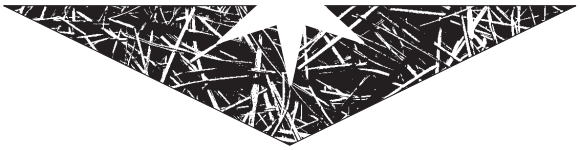
2014–2015 Alabama Pest Management Handbook



Volume 1

ANR-0500-A

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IPM

ANR-2096

Introduction

Alabama Pest Management Handbook for 2014–2015

The *Alabama Pest Management Handbook—Volume 1* contains recommendations for major row crops; small and stored grains; pastures and forage crops; commercial turfgrass; and noncropland. It was compiled by both current and former Extension entomologists, plant pathologists, weed scientists, and a pesticide education specialist and provides information on the selection, rates, application, and safe and proper use of pesticides. A directory of the specialists who authored sections in this notebook is included.

The 2014-2015 volume of this book includes revisions to the insect and disease and nematode control sections of the corn; grain sorghum; pastures and crops; soybean; and peanut IPMs and revisions or reviews to the insect, disease and nematode, and weed control sections of the small grains and cotton IPMs.

Since the status of pesticides is constantly changing, some that are currently listed in this volume of the *Alabama Pest Management Handbook* may no longer be legal. Also, some recently labeled pesticides may not yet be included in this volume. For these reasons, anyone preparing to use a pesticide should always consult the current pesticide label on the container before application.

Chemicals are listed both by common names (lowercase letters) and by trade names (all capital letters). Some chemicals are available only under trade names and, therefore, their common names may be omitted because of space restrictions. The presence or absence of any particular trade name in no way indicates endorsement or discrimination on the part of the Alabama Cooperative Extension System.

Recommended uses of pesticides are based on research, field trials, demonstrations, and experience. Because of variations in environmental conditions and methods of application, these recommendations do not assure that your results will always be the same as those obtained in research.

The label on every pesticide container presents information that is essential to safe and proper use, handling, and storage of the pesticide. Users are responsible for adhering to label information and should always review it thoroughly before applying the pesticide. Applying rates that exceed the recommendations or shortening the waiting period from application to harvest or grazing can cause excessive residues that are illegal according to state and federal regulations.

Contents

Directory of Contributors

The main contributors for each section of the handbook are listed below. If you have any comments or questions about any section, please contact the specialists responsible for that section.

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FOR MORE INFORMATION on pesticides, pesticide safety, or submitting samples for analysis, see the following publications in the IPM series:
IPM 1293, “Safety.” Safety contact information; worker protection standards; the safe use, handling, and storage of pesticides
IPM 1294, “Submitting Samples.” Procedures for submitting samples for diagnosis, analysis, and identification
IPM 1295, “General Pesticide Information.” Federal and state restricted use pesticide lists; pesticides and water quality
IPM 1317, “Appendix.” Pesticide guidelines for agronomic crops, including preharvest intervals; rain-free requirements; grazing restrictions; crop rotation guidelines; and the names, classifications, and toxicities of pesticides.

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For more information, contact your county Extension office. Visit www.aces.edu/counties or look in your telephone directory under your county’s name to find contact information.

Use pesticides **only** according to the directions on the label. Follow all directions, precautions, and restrictions that are listed. Do not use pesticides on plants that are not listed on the label

The pesticide rates in this publication are recommended **only** if they are registered with the Environmental Protection Agency or the Alabama Department of Agriculture and Industries. If a registration is changed or canceled, the rate listed here is no longer recommended. Before you apply **any** pesticide, check with your county Extension agent for the latest information.

Trade names are used **only** to give specific information. The Alabama Cooperative Extension System does not endorse or guarantee any product and does not recommend one product instead of another that might be similar.

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IPM

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SAFETY CONTACT INFORMATION

Sonja B. Thomas, Coordinator - Pesticide Safety Education Program

Table 1. Emergency Telephone Numbers

In an emergency dial 911, especially if the person is unconscious, has trouble breathing, or has convulsions.

Contact	Telephone number
Poison Control Centers (Human or Animal)	
National Poison Control Hotline (Spanish speakers available)	(800) 222-1222
Physician (See local phone directory; add number to list at right.)	
Ambulance (See local phone directory; add number to list at right.)	
Fires, Spills, Leaks, Etc.	
Chemtrec (technical assistance 24 hrs. a day for fires, spills, and medical emergency)	(800) 424-9300
Alabama Department of Environmental Management	(334) 271-7700
Alabama Emergency Management Agency	(205) 280-2200
Sheriff (See local phone directory; add number to list at right.)	
City Police (See local phone directory; add number to list at right.)	
Alabama Highway Patrol Post	*HP (*47) for mobile phones
Fire Department (See local phone directory; add number to list at right.)	
Endangerment of Game or Fish	
Alabama Department of Conservation and Natural Resources (Nongame endangered species)	(334) 242-3469
U.S. Fish and Wildlife Service	(800) 344-WILD (9453)

Table 2. Telephone Numbers for Pesticide Information

Contact	Telephone number
Nonemergency	
Alabama Cooperative Extension System	(334) 844-8832 (Sonja Thomas)
Regional Poison Control Center, Children's Hospital, Birmingham, AL, Non-emergencies and educational information	(800) 292-6678
Alabama Poison Center, Shelton State Community College, Tuscaloosa, AL, Non-emergencies and educational information	(800) 462-0800
National Pesticide Information Center (NPIC), Oregon State University, General information on toxicology, environmental hazard, etc. (M-F, 8:30 a.m.-6:30 p.m. CST)	(800) 858-7378
Pesticide Manufacturer	See pesticide label.

continued

Table 2. Telephone Numbers for Pesticide Information (cont.)

Contact	Telephone number
Nonemergency (cont.)	
CropLife America, General information about the pesticide industry (M-F, 9:00 a.m.-5:00 p.m. EST)	(202) 296-1585
Chemtrec Referral Center, Refers caller to the company responsible for the pesticide (M-F, 9:00 a.m.-6:00 p.m. EST)	(800) 262 8200
National Response Center, Refers caller to proper government agency for hazardous materials	(800) 424-8802 (Voice/TTY)
Pesticide Disposal	
Alabama Department of Agriculture & Industries	(334) 240-7242
Alabama Department of Environmental Management	(334) 271-7730
EPA Hazardous Waste Hotline (Superfund)	(800) 424-9346
Hazard Communication–Workplace Assistance	
OSHA	(800) 321-OSHA (6742) [TTY (877) 889-5627]
Regional IV OSHA Office Alliance in Atlanta	(404) 562-2277
Drinking Water	
EPA Safe Drinking Water Hotline Interprets residue data and gives EPA drinking water regulations	(800) 426-4791
Local Health Department or Sanitarian. County (See local phone directory; add number to list at right.) City (See local phone directory; add number to list at right.)	
Enforcement of Pesticide Laws	
Alabama Department of Agriculture & Industries, Pesticide Management Division	(334) 240-7242
EPA Region IV Pesticides Section	(404) 562-9038
Applicator certification to use restricted-use pesticides	(334) 240-7239
Structural pest control certification	(334) 240-7243
Safety/Training/Information	(334) 240-7239 or (334) 844-8832

Table 3. Websites with Pesticide Information

Contact	Website
The Alabama Cooperative Extension System Pesticide Information Home Page	www.aces.edu/anr/pesticidemgt/
Alabama Department of Agriculture & Industries, Pesticide Management Section	www.agi.alabama.gov/pesticide_management
Pesticide Action Network North America	www.panna.org
American Crop Protection Association	www.croplifeamerica.org
Extension Toxicology Network	extoxnet.orst.edu
U.S. Fish & Wildlife Service: Endangered Species	www.fws.gov
National Pesticide Information Center	npic.orst.edu
National IPM Network	www.ipmcenters.org
USDA National Organic Program	www.ams.usda.gov/nop
Pesticide labels/MSDS from a range of companies. Daily updates	
EPA Pesticide Product Information	ppis.ceris.purdue.edu
EPA List of Restricted-Use Pesticides	www.epa.gov/opprd001/rup/
EPA Pesticide Safety Programs/Worker Protection Standard	www.epa.gov/pesticides/safety/
EPA Office of Pesticide Programs	www.epa.gov/pesticides/

WORKER PROTECTION STANDARD

The U.S. EPA Worker Protection Standard (WPS) protects employees on farms, forests, nurseries, and greenhouses from occupational exposure to agricultural pesticides. The regulation covers two types of employees:

· **Pesticide handlers**—those who mix, load, or apply agricultural pesticides; clean or repair pesticide application equipment; or assist with the application of pesticides in any way.

· **Agricultural workers**—those who perform tasks related to the cultivation and harvesting of plants on farms or in greenhouses, nurseries, or forests. Workers include anyone employed for any type of compensation (included self-employed) doing tasks (such as carrying nursery stock, repotting plants, or watering) related to the production of agricultural plants on an agricultural establishment. Workers do not include such employes as office employees, truck drivers, mechanics, and any other worker not engaged in worker or handler activities.

In addition there are some WPS requirements that apply to all persons and some that apply to anyone who handles pesticide application equipment or cleans or launders pesticide-contaminated personal protective equipment.

The WPS requires agricultural employers to provide four basic protections for their employees.

1. Employees must receive pesticide safety training.

2. Information concerning pesticides applied in the work area must be posted in a central location.

3. Employees must be excluded from treated areas or provided proper training and safety equipment if they may be exposed to pesticides.

4. Employers must supply decontamination sites (soap, water, etc.) for workers. Emergency assistance must be available for any employee injured by pesticides.

Refer to the EPA *Worker Protection Standard for Agricultural Pesticides—How to Comply* for details. (This publication is available at the following website: www.epa.gov/pesticides/safety).

Additional information is available from the Alabama Department of Agriculture & Industries (334-240-7239) or Auburn University Cooperative Extension System (334-844-8832).

SAFE USE, HANDLING, AND STORAGE OF PESTICIDES

Most pesticides are synthesized chemicals which have proven effective, useful, and safe if used according to label instructions. Many pesticides, however, are poisonous and may be a hazard to humans, animals, plants, and the environment if they are not handled and used properly. Certain procedures are required when dealing with pesticides. They are:

- Identify the pest.
- Determine the correct pesticide.
- Apply the pesticide properly.
- Store the pesticide safely.
- Dispose of the empty containers safely.

The following suggestions for using, handling, and storing pesticides will minimize the likelihood of injury to man, animals, plants, and the environment.

General Precautions

1. Always read all precautionary labeling directions before using pesticides and follow them exactly. Notice warnings and cautions before opening the containers. Read them each time, no matter how often you use a pesticide or how familiar you are with the directions. Apply material only in the amounts and at the times specified.

2. Keep pesticides out of the reach of children, pets, irresponsible persons, and livestock. They should be stored outside the house, away from food and feed, and under lock and key.

3. Store pesticides in their original containers with a legible label intact. Keep the container tightly closed.

4. Never smoke or eat while applying pesticides.

5. Avoid inhaling sprays or dusts. When directed on the label, wear protective clothing and an approved mask.

6. Should pesticides be accidentally spilled on the skin or clothing, remove contaminated clothing immediately and thoroughly wash contaminated skin for at least 15 minutes.

7. Bathe and change to clean clothing after spraying or dusting. If it is not possible to bathe, wash your hands and face thoroughly and change clothes. Also, wear clean clothing each day.

8. Cover all food and water containers when treating around livestock or pet areas. Be careful not to contaminate fish ponds, streams, or lakes.

9. Never reuse pesticide containers.

10. Dispose of all empty containers after rendering them useless, so that they will not become a hazard to humans, animals, valuable plants, or wildlife. Disposal regulations need to be determined before carrying a load of containers to a landfill.

11. Observe directions and follow recommendations in order to keep the residue on edible portions of plants within the limits permitted by law.

12. If symptoms of illness occur during or shortly after dusting or spraying, call a physician or get the patient to a hospital immediately. Also, take a label from the pesticide container with you.

13. Do not use your mouth to siphon liquids from containers or to blow out clogged lines, nozzles, etc.

14. Do not spray with leaking hoses or connections.

15. Do not work in the drift of a spray or dust.

16. Confine a pesticide to the property being treated. Avoid drift to adjacent properties by stopping treatment if weather conditions become unfavorable.

17. Notify all nearby beekeepers before applying any insecticide.

18. If laborers are working in crops with heavy foliage, such as cotton, tomatoes, peaches, or tobacco, that has been treated with highly toxic compounds, be sure the restricted entry interval (REI) between treatment and entrance into the treated area is observed. REIs are listed on the pesticide label. Workers in such fields should follow the same precautions as given for the applicators in regard to changing clothes and wearing protective clothing, eating or smoking, and bathing. If workers become ill while working under these conditions, take them to the emergency room immediately. Be sure to take the pesticide label.

Precautions for Using Highly Toxic Chemicals

Use extreme caution when handling concentrates of any restricted use pesticides or other highly toxic pesticides. When using these materials, observe the following rules:

1. Wear liquid-proof gloves. The pesticide label will tell you what gloves to use. Remember, however, that some fumigants are readily absorbed by neoprene.

2. When mixing and applying these materials, wear a cartridge respirator approved for the specific pesticide and also wear protective clothing such as a long-sleeved shirt and a washable rain hat.

Specific types of cartridges and canisters protect against specific chemical gases and vapors. Be sure you choose one that is made for the pesticide you are using. Use only those that are approved by the National Institute for Occupational Safety and Health (NIOSH) or by the Mining Administration (MESA). This information can be found on the label.

The respirator must fit your face well. Read the manufacturer's instructions on the use and care of any respirator and its parts before you use it.

When applying pesticides, if you have trouble breathing or if you smell the pesticides, change the respirator's filters, cartridges, and canisters. Remove and discard the filters, cartridges, and canisters after use. Then wash the face piece with detergent and water, rinse it, and dry it with a clean cloth. Store it in a clean, dry place away from pesticides.

3. Start each day with clean clothing. Change garments when they become wet with spray. Bathe before returning to work. Take a thorough bath as soon as the work day is finished.

4. Have soap, clean water, and clean clothes on hand in the field in case of an accidental contamination.

5. Aircraft pilots should not assist in mixing or loading the chemicals into the plane.

6. Avoid overhead or into-the-wind application.

Precautions For Protecting Water Quality

Protecting the quality of our water is one of the Environmental Protection Agency's objectives for an overall cleaner environment. Pesticides have been identified as a potential source of water contamination. The EPA has begun a review of pesticide registrations to determine which pesticides pose undue risks to water supplies.

A nationwide water-well pesticide contamination survey is underway to identify potential problems. Users should be aware of the surface-loss and leaching potentials of pesticides and of practices that could contribute to ground water contamination. The following suggestions can help prevent water contamination.

1. Triple rinse your empty pesticide container and pour the rinse water into a spray tank. Then, apply it to the area or site being treated.

2. Prevent any back-siphoning of the chemical when filling a spray tank by leaving an air-gap between the high water level and the end of the water hose or by adding the pesticide after the desired water level has been reached in the spray tank.

3. Catch the rinse water from the spray tank instead of emptying it onto the ground in one area. Then, spray it over the area being treated.

4. Protect the well head from surface water entering the top of the well. Use a concrete apron around the well head with an appropriate cover.

5. Determine if the pesticide you are using may create a problem with leaching. Your county Extension agent can provide you with this information.

6. Calibrate your application equipment to ensure that the correct rate is being applied.

7. Do not fill spray tanks from streams, drinking water tanks, or farm ponds. Pesticide label directions may specify a distance from the well head to fill a spray tank or for handling rinsate.

Endangered Species

The Endangered Species Protection Act of 1973 requires all federal agencies to help protect the environment—specifically, the habitat and species of animals and plants that are almost extinct because of human encroachment or changes in the environment.

A specific pesticide label program was initiated by EPA to identify sites and chemicals that could endanger certain species and their habitat. The final federal regulations have been delayed, but interim county maps are available on the world-wide web (www.acesag.auburn.edu/department/ent/). These maps show areas where endangered species have been identified.

Chronic Toxicity

Toxic doses of chemicals can cause either chronic or acute health effects. An acute effect usually follows a large dose. However, if the chemical is highly toxic, a very small amount can cause symptoms of poisoning. Labels of highly and moderately toxic pesticides list poisoning symptoms.

Generally, chronic toxicity occurs periodically after long-term exposure. Symptoms are difficult to describe because specific data is often not available. Most long-term effect studies have failed to identify specific pesticides and their role in chronic toxic symptoms.

Pesticide users who experience unusual sinus problems, watery eyes, or some type of skin condition that does not clear up should seek medical attention.

Disposal

Excess Pesticides

The EPA recommends ways to dispose of excess pesticides. Consult local authorities for procedures in your area. If you have excess organic pesticides, use them as directed on the label or store the pesticides until you can use them. If you have

any questions concerning the disposal of excess pesticides, contact:

Mr. Gerald Hardy
Alabama Department of Environmental Management
Land Division Chief
1751 Congressman W. L. Dickinson Drive
Montgomery, AL 36130 Phone: 334-271-7730

Mr. Tony Cofer
Program Director–Pesticide Management
P.O. Box 3336
Montgomery, AL 36109-0336 Phone: 334-240-7242

Containers

To prepare a container for disposal:

1. Empty the container into the spray tank. Then, let it drain for an additional 30 seconds.

2. Fill it one-fourth full of water.

3. Replace the lid and gently shake the container. Turn the container upside-down to rinse all of the side surfaces.

4. Carefully drain the rinse water from the container into the tank. Let the container drain for 30 seconds.

5. Repeat steps 2 through 4 at least two or more times for a total of at least three rinses. Remember to empty all rinse solutions into the spray tank.

The EPA recommendations divide containers into three groups and tell you how to dispose of each kind.

Group I Containers. These are containers which will burn. They hold organic or metallic organic pesticides but not an organic mercury, lead, cadmium, or arsenic compound. Dispose of them in one of the following ways:

- Burn them in an approved pesticide incinerator.
- Bury them in a specially designated landfill.
- Burn small numbers of them as directed by state and local regulations.

Air pollution boards or other designated regulations control certain burning conditions.

Group II Containers. These are containers which will not burn. They hold organic or metallic organic pesticides but not organic mercury, lead, cadmium, or arsenic compounds. First, rinse the containers three times. Then, dispose of them in one of the following ways:

- Send or take the rinsed containers to a place that can recycle them as scrap metal or dispose of them for you.
- Many large containers in good shape can be reused by your supplier. Return them to the pesticide manufacturer, formulator, or drum reconditioner.
- All rinsed containers may be crushed and buried in a sanitary landfill. Follow state and local standards.
- Bury rinsed containers in a field or property that you own, if you have obtained a certificate of exception from your county or municipal health department. To get a certificate of exception, file an application and plan for disposal with your county health officer. The officer must investigate the plan and site before approval and certification.

If the containers have not been triple rinsed, they can be buried only in a specially designated landfill.

Group III Containers. These include containers which hold organic mercury, lead, cadmium, arsenic, or inorganic pesticides. Dispose of them in one of the following ways:

- Rinse them three times and dispose of them in a sanitary landfill.
- If they are not rinsed, bury them only in a specially designated landfill.

FOR MORE INFORMATION on pesticides, pesticide safety, or submitting samples for analysis, see the following publications in the IPM series:
IPM 1294, "Submitting Samples." Procedures for submitting samples for diagnosis, analysis, and identification
IPM 1295, "General Pesticide Information." Federal and state restricted use pesticide lists; pesticides and water quality
IPM 1317, "Appendix." Pesticide guidelines for agronomic crops, including preharvest intervals; rain-free requirements; grazing restrictions; crop rotation guidelines; and the names, classifications, and toxicities of pesticides.

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For more information, contact your county Extension office. Visit www.aces.edu/counties or look in your telephone directory under your county's name to find contact information.

Use pesticides **only** according to the directions on the label. Follow all directions, precautions, and restrictions that are listed. Do not use pesticides on plants that are not listed on the label

The pesticide rates in this publication are recommended **only** if they are registered with the Environmental Protection Agency or the Alabama Department of Agriculture and Industries. If a registration is changed or canceled, the rate listed here is no longer recommended. Before you apply **any** pesticide, check with your county Extension agent for the latest information.

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IPM-1294

Submitting Samples

Alabama Pest Management Handbook for 2014

SUBMITTING SAMPLES FOR DIAGNOSIS, ANALYSIS, AND IDENTIFICATION

The Alabama Cooperative Extension System supports two plant diagnostic laboratories. One is at Auburn University; the other is located in Birmingham at the Birmingham Botanical Gardens.

The Plant Diagnostic Laboratory at Auburn University provides three services: plant problem diagnosis, soil nematode analysis, and insect identification. Plant problems sent to the lab include diseases, nematode injury, insect damage, chemical damage, environmental stress, horticultural and agronomic problems, or wildlife damage.

Plant samples at the Auburn University Plant Diagnostic Lab are initially examined by a plant pathologist. Some samples may then be referred to Extension specialists in entomology, agronomy, horticulture, or wildlife.

In addition to plant problem diagnosis, soil nematode analysis, and insect identification, plants are also received for identification. These plants are referred to agronomists and horticulturists who typically respond to the inquiries.

Weeds for identification should be sent directly to Extension weed scientists. Label the package **WEED ID** and mail to Plant Diagnostic Lab, 961 South Donahue Drive, Auburn University, Auburn, AL 36849-5624. Give the name of the crop infested.

The Plant Diagnostic Laboratory at the C. Beaty Hanna Horticulture and Environmental Center at the Birmingham Botanical Gardens in Birmingham is available to provide plant disease diagnoses to residents of the greater Birmingham area, including Jefferson, Tuscaloosa, Walker, Blount, St. Clair, Shelby, and Bibb counties.

It is extremely important that samples and specimens be collected and packaged correctly for diagnosis and analysis. For example:

- Soil for nematode analysis must not be dried out or too wet.
- Nematodes that have been subjected to extreme temperatures or moisture will die and are not suitable for diagnosis.
- Dried or decayed samples are not satisfactory for diagnostic purposes.
- Plant, soil, and insect samples must be accompanied by the proper information for adequate diagnosis, analysis, and/or identification.

The information in this section explains the proper collecting and packaging techniques needed for an accurate diagnosis. Read it carefully. Then, mail or bring samples and specimens to:

Plant Diagnostic Lab
ALFA Agricultural Services & Research Building
961 South Donahue Drive
Auburn University, AL 36849-5624.

If you reside in Jefferson or adjoining counties, you may bring or mail samples to:

Plant Diagnostic Lab
C. Beaty Hanna Horticulture & Environmental Center
Birmingham Botanical Gardens
2612 Lane Park Road
Birmingham, AL 35223-1802.

If possible, mail plant and soil samples during the first part of the week. Samples mailed on Thursday or Friday usually remain in the post office during the weekend. By Monday morning, samples are often decayed or damaged and are not suitable for diagnosis or analysis.

Service charges at the Plant Diagnostic Labs are as follows:

- **Soil Nematode Analysis: $10**
- **Plant Problem/Disease Diagnosis: depends on work needed**
  - **Residential: usually $15**
  - **Commercial: usually $20**
- **Advanced Molecular Testing: $30 minimum; charge depends upon specific tests done as per discussion with the client.**
- **Insect Identification:**
  - **Commercial/Industrial: $20.**

The exact charge for plant problem or disease diagnosis depends on the type of diagnostic tests performed. Do not send a check or money with the plant sample; a billing statement will be mailed with the diagnostic report, which is usually sent by regular mail. When requested, the response is made by phone, fax, or e-mail.

PLANTS FOR DISEASE/PROBLEM DIAGNOSIS

James Jacobi, *Extension Plant Pathologist,* Department of Entomology and Plant Pathology, and
Kassie Conner, *Extension Plant Pathologist,* Department of Entomology and Plant Pathology

For an accurate diagnosis of a plant problem, the lab must receive the following:

1. Fresh plant material that is representative of the total problem.

2. Enough plant material for two to three specialists to examine and/or for two to three testing procedures.

3. Information that accurately describes the history of the plant and problem development.

Remember that diagnoses are often based on the visible plant symptoms, associated microscopic structures or other test results, and the information included. If the plant sample is not representative of the actual problem and the information is inaccurate or misleading, the conclusions and diagnoses made in the lab may not be appropriate for the actual problem. The diagnosis can be based only on the sample and information sent to the lab.

Collecting Plant Specimens

1. The specimen must be representative of the problem. If possible, collect the plants intact, including roots, because the above-ground plant symptoms could be caused by a root problem. Dig out—don't pull up—plants. Gently shake off soil but do not wash roots. Wrap roots in a plastic bag to prevent contact of soil with foliage. If you can't collect intact plants, include the plant parts that show damage. If possible, collect several plants or plant parts, such as fruits, nuts, twigs, and leaves, representing different stages of the disease or problem. Do not collect dead plants.

2. After collecting the sample, gently shake off or blot any water droplets that may be present. Wet samples will decay rapidly. Place the sample in a plastic bag immediately and close the bag securely. Do not include any wet or damp paper towels with the samples. If samples must be kept for a time before packaging and mailing, keep them cool.

3. If you suspect a soil problem, send 1 or 2 pints of soil from the affected area and 1 or 2 pints of soil from the non-affected healthy area so that pH, total soluble salt level, and the possibility of nematodes can be checked. Package the soil in a sealed plastic bag.

4. If you suspect a soil nutrition problem, you may send a soil sample directly to the Soil Test Lab. Collect 1 pint of soil from the suspect area. Directions, packages, and forms are available at your county Extension office. Package and mail samples to Soil Testing Laboratory, ALFA Agricultural Services and Research Building, 961 South Donahue Drive, Auburn University, AL 36849-5411. The current charge of $7 for a routine soil analysis is subject to change.

Call 334-844-3958 or check with the lab at http://www.aces.edu/anr/soillab/ for more information on soil testing.

5. Check with your county Extension office if you have questions, or check the Plant Diagnostic Laboratories' websites at http://www.aces.edu/dept/plantdiagnosticlab/ for the Auburn lab and http://www.aces.edu/plantlabbham/ for the Birmingham lab. Or, you may contact the labs by phone at 334-844-5507 or 5508 for the Auburn lab or 205-879-6964 (ext. 19) for the Birmingham lab.

Packaging and Mailing Plant Samples

1. Pack the sample well in a sturdy container to prevent crushing. Padded envelopes or boxes are best.

2. Provide as much information as possible. Use the diagnostic questionnaire, Form ANR-89 or Form ANR-89B. These forms (ANR-89 and ANR-89B) are available from the Auburn and Birmingham websites, respectively. They may also be obtained from your county Extension office. If more space is needed, use additional sheets of paper. The more information provided with the sample, the more accurate the diagnosis and control recommendations will be.

3. If samples must be held for a time before mailing, keep them cool.

4. When sending in a soil sample with the plant sample, always place the soil in a separate plastic bag. Always seal the soil sample bag.

5. The service charge for plant disease/problem diagnosis depends upon the diagnostic procedures needed. The charge is usually $15 for residential and $20 for commercial locations, and a minimum of $30 for advanced molecular testing. Advanced molecular testing is done only after specific discussion with the client. The diagnostic response, recommendations, and an invoice will be mailed directly to you, usually within 7 to 10 days from the time the sample is received. Checks or money orders should be made payable to the Plant Diagnostic Lab.

6. Samples sent from out of state must be double sealed in heavy plastic bags and placed in a sturdy container before shipping. The charge for out-of-state samples is $30 for residential and $40 for commercial, which is double instate fees.

Special Handling Techniques for Certain Types of Plant Samples

1. Lawn or Turf Specimens: Take the sample from the edge of the affected area. Provide both diseased and healthy plant material. Samples should be approximately 8 to 10 inches square by 3 inches deep. Package samples in a sealed plastic bag. Do not wrap sample in newspaper.

2. Fleshy Fruits and Vegetables (apples, peaches, grapes, tomatoes, cabbage, Brussels sprouts, broccoli, etc.): Wrap sample in several layers of dry newspaper. Do not place sample in a plastic bag. Do not include wet or damp towels or paper.

3. Woody Trees or Shrubs With Cankers or Galls: Cut three to five branches with cankers or galls. Make cuts several inches beyond the margin of the damage. Be sure to include some living wood.

4. Woody Shrubs or Small Trees With Wilted Foliage, Dieback, and/or Poor Growth: Include three to five branches (12 to 16 inches long) showing foliage symptoms, a root sample large enough to fill a quart- or half-gallon-size bag, including larger roots along with feeder roots, and 1 to 2 pints of soil. Package branches, roots, and soil in separate plastic bags. Also, include a soil sample from similar shrubs or trees that appear healthy.

5. Large Woody Trees With Wilted and/or Dying Foliage and Branches: Collect branch segments (12 to 16 inches long)

that have wilted, dying, or scorched foliage. Be sure the branch segments have some living wood. Look for branches that show any dark brown, black, tan, or greenish streaks just under the bark (in the vascular tissue). Branch segments should be 0.5 inch or more in diameter. Place four to five branch segments in a plastic bag. Be sure to keep the samples cool. A sample of roots and soil may be needed. See number 4 above for details

6. Small Herbaceous Garden Plants or Field Crops: Collect 10 to 12 whole plants (4 to 12 inches tall) that show symptoms. For plants less than 4 inches tall, collect approximately 20 plants. For seedlings, collect at least 20 to 30 plants. Carefully dig up whole plants and place them in a plastic bag. In a separate plastic bag, send 1 to 2 pints of soil.

7. Mature Herbaceous Garden Plants or Field Crops: Dig up two or more whole plants, including the root systems. If the plants are large, cut them into three or more sections so that they may be enclosed in a plastic bag. Also, send 1 to 2 pints of soil from the garden in a separate plastic bag.

8. Mushrooms: Collect several specimens if possible. Include mushrooms at different stages of growth. Wrap each specimen gently in waxed paper or several layers of newspaper. Package mushrooms in a crush-proof box with a lightweight filler material such as styrofoam chips to prevent damage during transit.

For submission forms, contact your county Extension office or http://www.aces.edu/dept/plantdiagnosticlab/ or http://www.aces.edu/plantlabbham/.

SOIL SAMPLES FOR NEMATODE ANALYSIS

Plant parasitic nematodes cause considerable damage each year to garden and field crops. Fruits, lawns, and landscape shrubs also may have nematode problems, but the occurrence is not common. It is a good idea to check gardens and fields for nematodes every 3 years.

Collecting Soil Samples

The best time of the year to test the soil is during late summer and early fall. Collect 1 pint of soil from the root zone area of the plants. Repeat this procedure in 20 or more places in the sampling area which should not exceed 10 acres in size. Divide larger fields into separate 10-acre sampling areas. Thoroughly mix the soil in a bucket and take 1 pint of the mixed soil.

If stunted, yellowed, and stressed plants lead you to suspect a nematode problem, take a soil sample from the area around some plants which are growing poorly. Do not take the sample from soil around dead plants. Always take several soil samples from the root area of affected plants. If sampling soil from one shrub, take the samples from three to five places around the plant. Mix the soil together and remove 1 pint of the sample for testing. Take samples when the soil is moist, but do not use extremely wet or dry soil because analysis from wet or dry soils may test deceptively low. Analyzing soil in winter is generally not recommended.

Packaging Soil Samples

After collecting the sample, immediately place 1 pint of the soil in a plastic bag and seal it. Do not expose it to extremely hot or cold temperatures, and do not allow it to become dry. Place the bag in a nematode soil carton, providing the information requested. Also, fill out Form ANR-F7, the nematode analysis questionnaire. Both are available from your Extension agent. Always indicate what crop will be grown. Control recommendations cannot be made without this information.

The service charge for nematode soil testing is $10 for each sample. Make a check or money order payable to Plant Diagnostic Laboratory. Enclose (1) the sample box or boxes, (2) the information sheet(s), and (3) a check or money order to cover the service charge in a nematode mailing carton available at your county Extension office. Analysis results and recommendations will be mailed 7 to 14 days from the time the soil sample is received. If you have questions, check the website at http://www.aces.edu/dept/plantdiagnosticlab/ or call 334-844-5506, 844-5507, or 844-5508.

INSECT SPECIMENS FOR IDENTIFICATION AND ANALYSIS

Charles Ray, Research Fellow, Department of Entomology and Plant Pathology

Collecting for Identification

The identification of an insect is the first step in determining whether it should be controlled and what control measures should be used. Auburn University provides identification assistance when it is needed. A good insect specimen and supporting information are essential for pests to be correctly identified. County Extension offices furnish specific information on what is necessary for collecting, preserving, and shipping specimens and the supporting information that should be included.

Preserving and Packaging

Most insects should be preserved immediately after collection. Include several specimens, if possible. Most can be killed and preserved in glass or plastic vials in 70 percent isopropyl (rubbing) alcohol. Do not send insects in water. Containers must be leak proof. It is advisable to wrap the cap with electrical tape to prevent any leakage.

Spiders and soft-bodied insects such as caterpillars, grubs, and maggots should be placed into hot (nearly boiling temperature) water for a minute and allowed to cool slightly before being placed in alcohol. This ensures that some important microscopic features remain visible. Even dead specimens should be so treated.

Large, fragile insects such as butterflies and moths should be killed in a kill jar or freezer and stored in a crush-proof container without alcohol. Tissue paper gently placed around the specimens will keep them from becoming damaged in the mail.

Very fragile insects, such as mites, thrips, aphids, and scales, should be packaged and sent in the same manner as diseased plants. These insects are easily damaged by removing

them from the plant; also, their appearance on the plant as well as damage symptoms may be important for identification.

If possible, send small caterpillars, grubs, and maggots alive in a plastic bag with some of the host material. It may be necessary to rear some of these to the adult stage for positive identification. Place the plastic bag in a container that will not be crushed in the mail.

Finally, if at all possible, ticks found on humans or pets should be sent in alive. Ticks can be kept alive for several days in a small, loosely capped container with a slightly moistened paper towel or a cotton swab moistened with one drop of water.

Include the following information for each sample:

1. Name of collector.

2. County and nearest town.

3. Date collected.

4. Where found, such as on a host plant, animal, or location in a building. If the host was a plant or animal, give its stage of growth. If the specimen was found on a person, provide the person's name and phone number.

5. Degree of infestation (heavy, medium, light) and type of damage.

6. Insecticide used for control and results, if known.

7. Service charges for insect identification:

• Commercial/Industrial: $20.

SAMPLE PLANTS FOR WEED IDENTIFICATION

John W. Everest, Professor Emeritus, and
Michael G. Patterson, Visiting Professor, Department of Crop, Soil and Environmental Sciences

To identify weeds, a complete plant or a specimen containing leaves, stem, roots, and flowers or fruit is absolutely necessary. The success of each identification depends to a large degree on the condition of the plant material at the time of identification. Decomposed, dry, or incomplete plant specimens make identification difficult, if not impossible. Adequate specimens with flowers or fruit usually produce positive results. The following points will help in the identification process and in making control recommendations.

Collecting Weed Specimens

1. Collect and submit intact plants with roots, if possible. If the weed is small, collect several plants.

2. If the weed has flowers and/or fruit present, collect plants which have these parts.

3. If the weed is too large to submit, send samples of the roots, stem, leaves, flowers, and fruit. Please indicate the size of the plant.

4. In some plants, especially grasses, it is necessary to have the flowers or seedheads. Otherwise, only a general identification can be made.

Packaging and Mailing Specimens

1. Do not let the plants lie around for several days before packaging.

2. Place the plant(s) or plant parts in a plastic bag. A dry paper towel may be placed in the bag to prevent crushing the sample. Do not add water.

3. Pack sealed plastic bag in a shipping container which is sturdy and large enough to prevent crushing the specimen during transit.

4. Label the package **WEED ID** and mail to Plant Diagnostic Lab, 961 South Donahue Drive, Auburn University, Auburn, AL 36849-5624.

Additional Information

The following should be included with each specimen:

1. Location or crop where weed was collected. For example: roadside, forest area, cotton field, edge of pond, St. Augustine lawn, fescue pasture, etc.

2. Any other pertinent information that might influence the control recommendation, such as location and proximity of desirable plants in the area; whether the pond is used for swimming, fishing, or irrigation; size and degree of weed problem; etc.

SAMPLES FOR PESTICIDE RESIDUE ANALYSIS

Sonja B. Thomas, Coordinator - Pesticide Safety Education Program

The Alabama Department of Agriculture and Industries operates a state laboratory for special pesticide residue problems related to raw agricultural products and the environment. Samples that originate because of a second party or conflict between landowners or between pesticide applicator and/or landowner(s) should be official samples taken by an Alabama Department of Agriculture and Industries inspector. Call 334-240-7239 with specific details about why an analysis is needed. Arrangements will be made concerning the taking of an official sample.

Water Samples

Private water wells which are contaminated and possibly endangering human health can be handled by the Alabama Department of Environmental Management, Groundwater Section, in Montgomery, Alabama; telephone 334-270-5655. The director of this section should be contacted because an inspector will be needed to obtain an official sample. **DO NOT** mail or transport samples to this laboratory.

When the owner of a private well suspects contamination by a commercial pest control company, he/she should contact Tony Cofer, 334-240-7237, for an official sample to be taken by a state agricultural inspector.

Private laboratories are also available for residue analysis. The cost varies depending on the product and tests needed. These labs are located in Alabama's larger cities.

Soil and Plant Samples

Pesticide residue analysis is difficult for several pesticides because of their chemical nature and the special equipment needed by the laboratory. An adequate sample is a must. For residue determination, contact Tony Cofer, 334-240-7237, for an official sample to be taken. All additional information will be collected by the state agricultural inspector.

FOR MORE INFORMATION on pesticides, pesticide safety, or submitting samples for analysis, see the following publications in the IPM series:
IPM 1293, “Safety.” Safety contact information; worker protection standards; the safe use, handling, and storage of pesticides
IPM 1295, “General Pesticide Information.” Federal and state restricted use pesticide lists; pesticides and water quality
IPM 1317, “Appendix.” Pesticide guidelines for agronomic crops, including preharvest intervals; rain-free requirements; grazing restrictions; crop rotation guidelines; and the names, classifications, and toxicities of pesticides.

2014 IPM-1294

For more information, contact your county Extension office. Visit www.aces.edu/counties or look in your telephone directory under your county’s name to find contact information.

Use pesticides **only** according to the directions on the label. Follow all directions, precautions, and restrictions that are listed. Do not use pesticides on plants that are not listed on the label

The pesticide rates in this publication are recommended **only** if they are registered with the Environmental Protection Agency or the Alabama Department of Agriculture and Industries. If a registration is changed or canceled, the rate listed here is no longer recommended. Before you apply **any** pesticide, check with your county Extension agent for the latest information.

Trade names are used **only** to give specific information. The Alabama Cooperative Extension System does not endorse or guarantee any product and does not recommend one product instead of another that might be similar.

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Extension
ALABAMA A&M & AUBURN UNIVERSITIES

IPM-1295

General Pesticide Information

IPM

Alabama Pest Management Handbook for 2014

FEDERAL RESTRICTED USE PESTICIDES

Sonja B. Thomas, Coordinator - Pesticide Safety Education Program

The EPA has updated their list of restricted use pesticides. The current updated copy can be found at the EPA Restricted Use Pesticide website: http://epa.gov/opprd001/rup. A condensed list will be included in the 2015 edition of the Alabama Pest Management Handbook.

ALABAMA 24(C) LABELS

A 24(C) registration is a federal registration that has been granted to the state of Alabama for a special local need. This registration is valid only in the state of Alabama; it is in effect through December 2013.

Alabama Registration Number	Product Name	Use	Company Name
AL 870002	Dimilin 25W	Use on pines to control insects	Chemtura Corp.
AL 880003	Furadan 4F	Controls chinch bugs on grain sorghum	FMC Corp.
AL 930004	Dimilin 25W	Controls mosquitoes and midges	Chemtura Corp.
AL 940002	Furadan 4F	Use on cucurbits	FMC Corp.
AL 980004	Envoy	Use on centipede sod to control bermudagrass	Valent USA Corp.
AL 000001	Penncap M	Controls white fringe beetle, cucmber beetle, and sweet potato weevil on sweet potatoes	United Phosphorus, Inc.
AL 030003	Reflex	Use in pine seedling nurseries	Syngenta Crop Protection
AL 040001	Curfew	Use on turf for nematode control	Dow AgroScience
AL 060002	Artic 3.2EC	Controls regeneration weevils in conifer nurseries	Agriliance LLC
AL 060006	Permethrin	Controls regeneration weevils in conifer nurseries	Loveland Products
AL 070001	Reward LA	Controls hydrilla	Syngenta Crop Protection
AL 070005	Zoro Miticide	Controls spider mites in cotton	Cheminova
AL 080001	Brigade EC	Use in conifer seed orchards	FMC Corp.
AL 090001	Reflex	Use early preplant on cotton	Syngenta Crop Protection
AL 100001	Arsenal Powerline	Cogongrass control on grazed and hayed sites	BASF
AL 100002	Valor SX	For burndown preplant cotton to control Palmer amaranth	Valent USA Corp.
AL 100003	Dual Magnum	Weed control in sesame	Syngenta Crop Protection
AL 110001	Gramoxone Inteon	Use in rope wick or carpet roller in peanuts for Palmer amaranth control	Syngenta Crop Protection
AL 110002	Heritage Fungicide	Controls downy mildew in basil	Syngenta Crop Protection
AL 110003	Subdue Maxx Fungicide	Controls downy mildew in basil	Syngenta Crop Protection
AL 120001	Avid 0.15 EC	Controls nematodes in golf course greens	Syngenta Crop Protection
AL 120002	Profume	Fumigation of non-edible commodities and quarantine/regulatory use	Dow AgroSciences
AL 120003	Gramoxone 2SL	Use on peanuts	Syngenta Crop Protection
AL 120004	Milestone	For control of wildling pines in forest site preparation areas	Dow AgroSciences
AL 120005	Avipel Liquid	For protection of field and sweet corn seed from black birds	Arkion Life Sciences
AL 120006	Avipel Hopper Box	Hopper box treatment of corn seed for protection from black birds	Arkion Life Sciences
AL 130002	Karmex DF	Control of algae in commercial catfish ponds	MANA, Inc.
AL 130003	Direx 4L	Control of algae in commercial catfish ponds	MANA, Inc.

MAINTAINING WATER QUALITY

Sonja B. Thomas, Coordinator - Pesticide Safety Education Program;
and John Everest, Professor Emeritus, Department of Crop, Soil and Environmental Sciences, Auburn University

Clean water is of great concern for all Americans. Almost all potable water supplies come from surface or ground water. Surface water is derived from above-ground sources such as lakes, streams, ponds, or other impounded bodies. Ground water is found in zones beneath the earth's surface, which are called aquifers. Aquifers are formations of rock, sand, or gravel in which all pore spaces are filled with water. Aquifers serve as the source of fresh water for wells and springs. Water originates as rain or melted snow, which either accumulates on the soil surface or percolates through the soil to the water table and into ground water.

Many human activities can have a detrimental effect on water quality. Contamination from industrial wastes, petroleum products, fertilizers, manures, and municipal sewage and septic tanks all affect the quality of our surface and ground water. Actions have been taken on a national scale to eliminate or to minimize the effects of these sources of possible contamination.

Agricultural pesticides may also contaminate aquifers or surface water sources. Pesticides enter surface and ground water because of the actions of the landowner. Pesticides can enter water directly through accidental spills, back siphoning, intentional excessive pesticide application, improper application, improper disposal of rinsates, improper container disposal, and through poorly constructed or maintained wells. These situations are all avoidable and can be prevented with greater attention to proper management practices and through upgrading application equipment.

Pesticides can enter water indirectly through normal leaching in the soil after application or through surface runoff (or surface-loss). Contamination due to surface-loss from agricultural fields can be reduced in part by modifying farming practices. Contour farming, no-till farming, and strip farming can reduce the movement and flow of water, thereby minimizing any soil erosion from sloped fields. In some cases, selecting the appropriate pesticide can reduce the potential for leaching and for surface-loss as well.

Each agricultural chemical or pesticide used today has different water solubility and other chemical characteristics that affect its behavior in and on soils. The solubility and behavior of a pesticide in the soil is dependent in part on the soil texture, soil type (morphology), and organic-matter content. These factors all affect the degree of soil absorption of a pesticide.

Soils with a high organic-matter content or with considerable amounts of clay in their structure tend to strongly adsorb pesticides, thus reducing leaching. However, coarse-textured sandy soils low in organic matter have low adsorption, which tends to permit downward leaching of pesticides. A knowledge of your particular soil type and soil texture will help in selecting pesticides which have limited potential for surface-loss or leaching.

In places where soils are very sandy or gravelly with little organic matter, a producer should select a pesticide that has only small or medium leaching potential. Use of a chemical with a large leaching potential in this situation could lead to contamination of ground water. In situations where fields have considerable slope or in areas where soil is permanently saturated with water, it is advisable to use a pesticide that has a small to medium potential for surface-loss.

In areas where ground water is quite shallow, there is a good possibility that pesticides can enter the ground water through leaching. In areas of limestone composition, it is possible that pesticides can enter ground water through developing sinkholes. In these situations, selection of pesticides used in agricultural production is critical to prevent possible contamination of surface and ground waters.

In the following table, water quality information is listed for insecticides and acaricides and for fungicides and nematicides, respectively. The pesticides are listed alphabetically by common name. The surface-loss potential indicates the tendency of the pesticide to move with sediment in run-off. The leaching potential indicates the tendency of the pesticide to move in solution with water and to leach below the root zone into deep percolation. Water quality information for herbicides is listed with the weed control recommendations in each section.

Properties of Pesticides That May Affect Water Quality

Common Name	Trade Names (not all listed)	Surface-Loss Potential	Leaching Potential
	INSECTICIDES AND ACARICIDES		
Abamectin	Affirm, Avid	NA	NA
Acephate	Orthene	Small	Small
Azinphosmethyl	Guthion	Large	Small
Bacillus thuringiensis	Dipel	***	***
Bendiocarb	Dycarb, Turcam	NA	NA
Bifenthrin	Capture, Talstar	NA	NA
Carbaryl	Ortho, Sevimol, Sevin	Medium	Small
Carbofuran	Furadan	Small	Large
Chinomethionate	Morestan	NA	NA
Chlorpyrifos	Dursban, Lorsban	Medium	Small
Cyfluthrin	Baythroid, Tempo	NA	NA
Cyhalothrin	Karate	NA	NA
Cypermethrin	Ammo, Cymbush, Demon	Large	Small
Demeton-S-Methyl	Metasystox	Medium	Large
Diazinon	Diazinon	Medium	Large
Dicofol	Kelthane	Large	Small
Dicrotophos	Bidrin	Small	Medium
Dienochlor	Pentac	NA	NA
Diethatyl-Ethyl	Andor	Medium	Small
Diflubenzuron	Dimilin	Large	***
Dimethoate	Cygon, Defend	Small	Medium
Disulfoton	Di-Syston	Medium	Small
Endosulfan	Thiodan	Large	Small
Esfenvalerate	Asana	Large	Small
Ethion	Ethion	Large	Small
Ethoprop (Ethoprophos)	Mocap	Medium	Large
Fenbutatin Oxide	Vendex	Large	Small
Fenitrothion	Sumithion	NA	NA
Fenoxycarb	Logic	Small	Small
Fensulfothion	Dasanit	NA	NA
Fenvalerate	Pydrin	Large	Small
Flucythrinate	Pay-Off	Large	Small
Fluvalinate	Mavrik	Large	Small
Fonofos	Dyfonate	Large	Medium
Formetanate Hydrochloride	Carzol	Large	Small
Hydramethylnon	Amdro, Combat	Large	***
Isazophos	Triumph	NA	NA
Isofenphos	Oftanol	NA	NA
Lindane	Isotox, Lindane	Large	Medium
Malathion	Cythion, Malathion	Small	Small
Metaldehyde	Metaldehyde	Large	Small
Methamidophos	Monitor	Medium	Small
Methidathion	Supracide	Medium	Small
Methiocarb	Mesurol	Medium	Medium
Methomyl	Lannate, Nudrin	Small	Medium
Methoxychlor	Marlate, Methoxychlor	NA	NA
Mevinphos	Phosdrin	Small	Medium

Properties of Pesticides That May Affect Water Quality (cont.)

Common Name	Trade Names (not all listed)	Surface-Loss Potential	Leaching Potential
	INSECTICIDES AND ACARICIDES (cont.)		
Oxydemeton-Methyl	Metasystox-R	Small	Large
Parathion	Parathion	Medium	Small
Permethrin	Ambush, Pounce, Pramex	Large	Small
Petroleum Oil	Volck Oils	Small	Medium
Phorate	Thimet	Large	Medium
Phosalone	Zolone	Small	Medium
Phosmet	Imidan	Medium	Small
Profenofos	Curacron	Large	Small
Propargite	Comite, Omite	Large	Small
Prosphamidon	Swat	Small	Large
Resmethrin	SBP-1382	NA	NA
Sulprofos	Bolstar	Medium	Small
Terbufos	Counter	Medium	Small
Thiodicarb	Larvin	Medium	Small
Tralomethrin	Scout	NA	NA
Trichlorfon	Dipterex, Dylox, Proxol	Small	Large
Trichloroethane	MC-96	NA	NA
Trimethacarb	Broot	Medium	Small
	FUNGICIDES AND NEMATICIDES		
Anilazine	Dyrene	Small	Small
Benomyl	Benlate, Tersan	Medium	Small
Captan	Captec, Orthocide	NA	NA
Carbofuran	Furadan	Small	Large
Carboxin	Vitavax, Enhance	Small	Small
Chloropicrin	Telone	Small	Small
Chlorothalonil	Bravo, Daconil	Medium	Small
DCNA	Botran	Large	Small
Dichloropropene	Telone, Vorlex	Small	Medium
Dinocap	Karathane, Crotothane	Small	Small
Dodine Acetate	Cyprex	Large	Small
Ethoprop	Mocap	Medium	Large
Etridiazole	Terrazole, Truban	Large	Small
Fenamiphos	Nemacur	Medium	Medium
Fenarimol	Rubigan	Medium	Small
Ferbam	Carbamate	Medium	Medium
Fonofos	Dyfonate	Large	Medium
Iprodion	Rovraol	Medium	Small
Mancozeb	Dithane, Manzate	Medium	Small
Maneb	Manex	Medium	Small
Metalaxyl	Apron, Ridomil, Subdue	Small	Medium
Metam Sodium Salt	Vapam	Small	Medium
Methyl Isothiocyanate	Vorlex	Small	Medium
Metiram	Polyram	Medium	Small
Oxamyl	Vydate	Small	Large
Oxycarboxin	Plantvax	Small	Large
PCNB	Terraclor, Turfcide	Large	Small
Phosethyl-Al	Aliette	Medium	Small
Piperalin	Pipron	Medium	Small
Propiconazole	Tilt, Orbit	Medium	Medium
Terbufos	Counter	Medium	Small

Properties of Pesticides That May Affect Water Quality (cont.)

Common Name	Trade Names (not all listed)	Surface-Loss Potential	Leaching Potential
	FUNGICIDES AND NEMATICIDES (cont.)		
Thiabendazole	Mertect 340F	NA	NA
Thiophanate-Methyl	Topsin, Fungo, Cleary's 3336	Small	Medium
Thiram	Thiram, Pro-Treat	Medium	Medium
Triadimefon	Bayleton	Medium	Medium
Triadimenol	Baytan	NA	NA
Triforine	Funginex, Ortho Triforine	Medium	Small
Vinclozolin	Ronilan, Vorlan	Medium	Medium
Ziram	Ziram	Medium	Small

NOTE: NA = Information not available. *** = Pesticide should not leach with percolating water.

FOR MORE INFORMATION on pesticides, pesticide safety, or submitting samples for analysis, see the following publications in the IPM series:
IPM 1293, “Safety.” Safety contact information; worker protection standards; the safe use, handling, and storage of pesticides
IPM 1294, “Submitting Samples.” Procedures for submitting samples for diagnosis, analysis, and identification
IPM 1317, “Appendix.” Pesticide guidelines for agronomic crops, including preharvest intervals; rain-free requirements; grazing restrictions; crop rotation guidelines; and the names, classifications, and toxicities of pesticides.

2014 IPM-1295

For more information, contact your county Extension office. Visit www.aces.edu/counties or look in your telephone directory under your county’s name to find contact information.

Use pesticides **only** according to the directions on the label. Follow all directions, precautions, and restrictions that are listed. Do not use pesticides on plants that are not listed on the label

The pesticide rates in this publication are recommended **only** if they are registered with the Environmental Protection Agency or the Alabama Department of Agriculture and Industries. If a registration is changed or canceled, the rate listed here is no longer recommended. Before you apply **any** pesticide, check with your county Extension agent for the latest information.

Trade names are used **only** to give specific information. The Alabama Cooperative Extension System does not endorse or guarantee any product and does not recommend one product instead of another that might be similar.

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Extension
ALABAMA A&M & AUBURN UNIVERSITIES

Noncropland

IPM

IPM-0223

Insect and Weed Control Recommendations for 2014

INSECT CONTROL

Table 1. Noncropland Insect Control

Insect	Insecticide and Formulation	Formulation per Acre	Lb. Active Ingredient per Acre	Comments
		GRASSHOPPERS		
General Comments: *Use the lower rates for young grasshoppers and the higher rates for adult grasshoppers.*				
acephate	ORTHENE 97 Other trade names include Acephate 75SP AG, Orthene75S, Orthene Turf, Tree, and Ornamental Spray 97	0.25 lb.	0.24	For early- to mid-season application. Use higher volume for dense vegetation. **DO NOT** graze or harvest vegetation.
carbaryl	SEVIN XLR PLUS Other trade names include Carbaryl 4L, Sevin 4F, Sevin 80 Solupak,	0.5-1.5 qt.	0.5-1.5	Use 0.5 to 0.75 quarts for nymphs on small vegetation. Use 1 to 1.5 quarts on mature insects or application to dense foliage.
diflubenzuron	DIMILIN 2L	2 fl.oz./A	0.032	Dimilin is a **RESTRICTED USE** pesticide. Apply to young instars when the majority are in the second through the fourth instar. Dimilin is an insect growth regulator that will not work on adult grasshoppers.
esfenvalerate	ASANA XL 0.66EC Other trade names include S-Fenvalostar	2.9-5.8 fl.oz.	0.015-0.03	Spray noncropland adjacent to tilled areas to control migrating insects which are a threat to the crop. Do not apply Asana to public lands. **DO NOT** graze. Asana is a **RESTRICTED USE** pesticide.
gamma-cyhalothrin	DECLARE Other trade names include Proaxis	—	—	For noncropland adjacent to cropped areas. Apply at rates appropriate to adjacent crop and the target pest. Proaxis is a **RESTRICTED USE** pesticide. Do not graze.
lambda-cyhalothrin	KARATE with ZEON TECHNOLOGY Other trade names include Grizzly Z, Lambda-Cy, Lamcap, Lambda-Cyhalothrin, Paradigm, Province, Silencer	—	—	For noncropland adjacent to cropped areas. Apply at rates appropriate to adjacent crop and the target pest. Karate is a **RESTRICTED USE** pesticide. Do not graze.
malathion	FYFANON Other trade names include Fyfanon ULV Ag, Malathion 5, Malathion 57EC	1.5-3 pt.	0.94-1.25	

Table 1. Noncropland Insect Control (cont)

Insect	Insecticide and Formulation	Formulation per Acre	Lb. Active Ingredient per Acre	Comments
IMPORTED FIRE ANTS				
Contact Insecticides for Individual Mound Treatment				
For more information, see "How to Kill Fire Ants," www.extension.org/pages/30628.				
acephate	ORTHENE TURF, TREE, & ORNAMENTAL SPRAY 97 Other trade names include Acephate 75SP AG	—	—	**DO NOT** treat mounds more than once per season. Mix 0.75 ounce in 5 gallons of water. Sprinkle 1 gallon of diluted solution over each mound and surrounding 4-foot-diameter circle (about 1.25 teaspoons per gallon.) Grass in treated areas may be injured. **DO NOT** treat more than once per season.
carbaryl	SEVIN XLR PLUS Other trade names include Carbaryl 4L [1], Sevin 4F	—	—	Mix 0.75 fluid ounces of Sevin 4F per gallon of water. Apply a total of 2 gallons of the diluted solution over each mound or at least 1 quart per 6 inches of mound diameter, using a bucket or watering can. Thoroughly wet mound and surrounding area to an area 4 feet in diameter. Do not disturb the mound prior to treatment. Pour solution from a height of about 3 feet to give sufficient force to break the mound open and flow into tunnels. For best results apply when temperature is between 65 and 80°F. Repeat application after 30 days if mound activity resumes. Pressurized sprays may reduce the effectiveness of the treatment by disturbing the ants and causing migration.
	SEVIN 80 SOLUPAK	—	—	Mix one pack per 67.6 gallons of water. Apply same as for diluted solution, above.
Baits for Broadcast or Individual Mound Treatment				
abamectin	OPTIGARD FIRE ANT BAIT Other trade names may be available	1 lb.	0.0001	Apply as a broadcast treatment when ants are actively foraging. Or, sprinkle 5 to 7 tablespoons of bait around each mound. Do not apply more than 1 pound bait per acre.
hydramethylnon	AMDRO FIRE ANT BAIT Other trade names include Amdro Pro, Probait	1-1.5 lb.	0.0075-0.011	Apply as a broadcast treatment when ants are actively foraging. Noticeable results may take several weeks. Or, treat the mound by applying 2 to 5 level tablespoons per mound, disturbing material 3 to 4 feet around the mound.
hydramethylnon + s-methoprene	EXTINGUISH PLUS FIRE ANT BAIT	1.5 lb.	0.055 + 0.0037	Apply as a broadcast treatment when ants are actively foraging. Noticeable results may take several weeks. Or, treat the mound by applying 2 to 5 level tablespoons uniformly around each mound.
indoxacarb	ADVION FIRE ANT BAIT	1.5 lb.	0.007	Retreat after 12 to 16 weeks if needed. Or treat the mound by applying 4 level tablespoons per mound, uniformly distributing the product 3 to 4 feet around the mound. Noticeable results will be seen within a few days.
pyriproxifen	DISTANCE FIRE ANT BAIT	1-1.5 lb.	0.005-0.007	Apply as a broadcast treatment when ants are actively foraging. Or, treat the mound by applying 1 to 4 level tablespoons per mound, distributing material 3 to 4 feet around the mound. Noticeable results may take 4 to 8 weeks.

[1] Not all brands with this name are registered for this use. Check the label to make sure fire ant control in noncropland or waste areas is on the label.

Table 1. Noncropland Insect Control (cont)

Insect	Insecticide and Formulation	Formulation per Acre	Lb. Active Ingredient per Acre	Comments
IMPORTED FIRE ANTS (cont.)				
Baits for Broadcast or Individual Mound Treatment (cont.)				
s-methoprene	EXTINGUISH PROFESSIONAL FIRE ANT BAIT	1-1.5 lb.	0.005-0.007	Apply as a broadcast treatment when ants are actively foraging. Or, apply as a mound treatment by sprinkling 3 to 5 tablespoons around each mound to a perimeter of 4 feet. Noticeable results may take several months.
hopper blend	EXTINGUISH PROFESSIONAL FIRE ANT BAIT plus other bait	0.75 lb. + 0.75 lb. other bait	—	Mix Extinguish Professional fire ant bait in a 50:50 mix with another fire ant bait that is labeled for the site. Or treat the mound by applying 3 to 5 tablespoons per mound, disturbing material 4 feet around the mound.
spinosad	FERTILOME COME AND GET IT FIRE ANT KILLER Other trade names include Southern Ag Pay-Back Fire Ant Bait,	2.5-5 lb.	0.0004-0.0008	Apply as a broadcast treatment when ants are actively foraging. Or, sprinkle 4 to 6 tablespoons around each mound, extending out to about 2 feet around the mound. Noticeable results may take several weeks.

NOTE: Read manufacturer's label carefully for specific information for all product use restrictions and safety.

Insect Control section prepared by Kathy Flanders, Extension Entomologist, Professor, Department of Entomology and Plant Pathology, Auburn University.

WEED CONTROL

Table 2. Noncropland Weed Control

Herbicide Trade Name (Rate/Acre)	Herbicide Common Name (Active Herbicide/Acre)	Comments
	SOIL TREATMENTS	
ENDURANCE 65 WG (1-2.3 lb.)	prodiamine (0.65-1.5 lb.)	Provides preemergence control of annual grasses and certain broadleaf species in industrial settings and rights-of-way. Requires 0.5 inch of rainfall/irrigation or shallow incorporation (1 to 2 inches) to be effective.
ESPLANADE (3.5-7 oz.)	indaziflam (0.045-0.09)	Broad-spectrum, preemergent herbicide that provides extended residual control. Has postemergent activity on cool-season grasses, and unacceptable injury can occur where these species are desirable.
HYVAR X (80WP) (3-15 lb.) or HYVAR X-L (2L) (0.75-6 gal.)	bromacil (2.4-12 lb.) (1.5-12 lb.)	Lower rates control annuals such as crabgrass, foxtail, ragweed, and lambsquarter. Higher rates control perennials such as bahiagrass, broomsedge, goldenrod, bermudagrass, johnsongrass, nutsedge, horseweed, and dogfennel. **NOTE:** For use on railroad, highway, and pipeline rights-of-way, tank farms, storage areas, and industrial plant sites. Higher rates will control woody brush. Refer to the label for species and use rates. Apply before or during period of active growth. Use sufficient water to assure thorough coverage. Can be used in combination with several other herbicides to increase control spectrum. **DO NOT USE ON LAWNS, WALKS, DRIVEWAYS, TENNIS COURTS, OR SIMILAR AREAS.**
KARMEX DF (5-15 lb.) or KARMEX IWC (5-15 lb.)	diuron (4-12 lb.)	Controls most annual weeds and perennial weeds at high rates. **NOTE:** Provides long-term weed control in areas such as highway rights-of-way, lumberyards, storage areas, and around farm buildings. Karmex may also be used to control annual and perennial weeds in irrigation and drainage ditches. See label for specifics. For best results, apply to the soil shortly before weed growth begins. Retreatment may be necessary to control deep-rooted perennials such as johnsongrass. Adding a surfactant increases contact activity on established weeds at 0.5% v/v.
KROVAR I DF (6-8 lb.) (8-12 lb.) (12-16 lb.) (19-30 lb.)	bromacil + diuron (2.4-3.2 lb.) + (2.4-3.2 lb.) (3.2-4.8 lb.) + (3.2-4.8 lb.) (4.8-6.4 lb.) + (4.8-6.4 lb.) (7.6-12 lb.) + (7.6-12 lb.)	Low rates provide short-term control of annual weeds and grasses. Medium rates provide extended control of annuals and partial control of perennials. Higher rates control perennials such as bermudagrass, johnsongrass, and nutsedge. **NOTE:** May be mixed with foliage-applied herbicides such as Gramoxone. For short-term and extended control of vegetation in areas such as roadsides, storage areas, plant sites, industrial and right-of-way sites. **DO NOT USE ON WALKS, LAWNS, DRIVEWAYS, OR TENNIS COURTS WHERE CHEMICAL MAY BE WASHED INTO CONTACT WITH ROOTS OF DESIRABLE PLANTS.**
PAYLOAD (8-12 oz.)	flumioxazin (0.25-0.38 lb.)	Provides preemergence and postemergence control of selected grass and broadleaf weeds. Postemergence control is optimal when applications are made to weeds 2 inches tall or less.
PENDULUM 2G (100-200 lb.) or PENDULUM 3.3EC (2.4-4.8 qt.) or PENDULUM 60 WDG (3.3-6.6 lb.)	pendimethalin (2-4 lb.)	Provides preemergence control of annual grasses and selected broadleaf weeds. Can be used to maintain bareground areas in industrial areas and rights-of-way. Requires 0.5 inch of rainfall of irrigation or shallow incorporation for optimal weed control. If not incorporated within 30 days, erratic weed control may result.

Table 2. Noncropland Weed Control (cont.)

Herbicide Trade Name (Rate/Acre)	Herbicide Common Name (Active Herbicide/Acre)	Comments
	SOIL TREATMENTS (cont.)	
PRAMITOL 25E (4-6 gal.) (7.5-10 gal.)	prometon (8-12 lb.) (15-20 lb.)	Lower rates control annuals and a few perennials such as goldenrod and plantain. Higher rates control perennials such as johnsongrass. **NOTE:** For complete control of vegetation in areas such as industrial sites, around farm buildings, and under asphalt pavement more than 2 inches thick, apply before weeds emerge or when they are actively growing. Use sufficient water to assure thorough coverage. Very dry soil conditions and lack of sufficient rainfall may result in poor weed control.
PRAMITOL 5PS (152-200 lb.) (304-400 lb.)	prometon + simazine + sodium chlorate + sodium metaborate	Lower rates control annual weeds. Higher rates control perennial weeds. **NOTE:** For complete control of all vegetation around buildings, fences, drainage ditch banks, recreational areas, airports, military installations, and similar areas. Apply herbicide pellets just before or soon after plant growth begins. Dry soil conditions and the lack of rainfall after treatment will result in poor weed control.
SPIKE 80DF (2-5 lb.) or SPIKE 20P (3.75-20 lb.)	tebuthiuron (1.6-4 lb.) (0.75-4 lb.)	Controls annual grasses and weeds, most perennials, and woody plants. See label for appropriate rate. Controls perennials such as bermudagrass and dallisgrass. See label for appropriate rate. **NOTE:** For total control of vegetation in such areas as airport runways, utility substations, under asphalt and concrete pavement. Apply shortly before or at the time plant growth begins. **DO NOT USE ON TENNIS COURTS, LAWNS, WALKS, DRIVEWAYS, OR SIMILAR AREAS WHERE CHEMICAL MAY BE WASHED INTO CONTACT WITH ROOTS OF DESIRABLE PLANTS.**
SPRAKIL SK-13 (4G) (150-400 lb.) or SPRAKIL SK-26 (8G) (150-300 lb.)	tebuthiuron + diuron (1.5-4 lb.) + (4.5-12 lb.) (3-6 lb.) + (9-18 lb.)	Controls a wide range of annual and perennial grass and broadleaf weeds. May be applied year-round. However, best results are achieved when application is made in spring to early summer. **NOTE:** For industrial use only. **DO NOT** apply near desirable trees or in areas where tree roots may extend into treated area. **DO NOT** use on cropland or on land to be used for subsequent cropping.
VELPAR ULW (75%) (2.33-10.67 lb.) or VELPAR L (1-4 gal.) or VELPAR DF (75%) (2.67-10.67 lb.)	hexazinone (1.75-8 lb.) (2-8 lb.) (2-8 lb.)	Lower rates control many annual, biennial, and perennial weeds including dogbane, nutsedge, and trumpet creeper. Higher rates give season-long control of many annual, biennial, and perennial weeds including honeysuckle, blackberry, and bermudagrass. **NOTE:** For use in complete vegetation control on railroad, highway, utility, and pipeland rights-of-way, storage areas, and similar sites. Higher rates will control woody brush. Refer to label for species controlled and use rates. Apply just before or soon after weed emergence. Use enough water to dissolve the herbicide and to give thorough coverage. **DO NOT USE ON TENNIS COURTS, LAWNS, WALKS, DRIVEWAYS, OR SIMILAR AREAS WHERE CHEMICAL MAY BE WASHED INTO CONTACT WITH ROOTS OF DESIRABLE PLANTS.**

Table 2. Noncropland Weed Control (cont.)

Herbicide Trade Name (Rate/Acre)	Herbicide Common Name (Active Herbicide/Acre)	Comments
	SOIL TREATMENTS (cont.)	
WEED BLAST 8-G (100-200 lb.)	bromacil + diuron (4-8 lb.) + (4-8 lb.)	Controls a wide range of annual and perennial broadleaf weeds and grasses. May be applied year-round, but best results are obtained when application is made early in the growing season. **NOTE:** For industrial use only. **DO NOT** apply on or near desirable woody or herbaceous plants or on areas where their roots may extend because of possible severe plant injury. **DO NOT** use on cropland or on land to be used for subsequent cropping.
	FOLIAR TREATMENTS	
2,4-D Numerous Trade Names and Formulations	2,4-D (1-1.5 lb.) (2-4 lb.)	Lower rates control annual broadleaf weeds. Higher rates control perennial broadleaf weeds. **NOTE:** For use in areas such as cemeteries, parks, roadsides, airfields, lawns, vacant lots, and drainage ditch banks. Apply when weeds are young and actively growing. Perennials may require repeated applications. See label concerning the addition of oil, wetting agent, or surfactant to spray mix.
ARSENAL ARSENAL POWERLINE ARSENAL RAILROAD (2 lb./gal.) (2-4 pt.) (4-6 pt.)	imazapyr (0.5-1 lb.) (1-1.5 lb.)	Lower rates control weeds such as lovegrass, cheat, fall panicum, clover, dogfennel, and wild turnip. Higher rates control weeds such as bahiagrass, dallisgrass, honey locust, wild rose, pokeweed, hickory, oak, privet, maple, sweet gum, and willow. **NOTE:** For use in areas such as highway and railroad rights-of-way, ditch banks, fence lines, tank farms, industrial sites, and similar areas. Liquid application provides both foliar and soil activity on many weeds. Add 1 quart of non-ionic surfactant per 100 gallons of spray mix with foliar applications, using 60 or more gallons of spray solution per acre.
CLEARCAST 16-64 fl.oz./A	imazamox 0.125-0.5 lb.	Clearcast is registered for use in aquatic and noncrop environments. See label for restrictions and spray adjuvant recommendations. Provides excellent Chinese tallowtree (popcorntree) control at 64 ounces per acre.
CROSSBOW (2 qt.) (1.5-4 gal.)	2,4-D ester + triclopyr (1 lb. + 0.5 lb.) (3-8 lb. + 1.5-4 lb.)	Lower rate controls annual and perennial broadleaf weeds such as dock, goldenrod, plantain, and ironweed. Higher rates control woody species such as blackberry, maple, multiflora rose, sumac, oak, sweetgum, and willow. **NOTE:** For use in areas such as fencerows, roadsides, industrial sites, and similar areas. Thorough coverage of weeds is essential. See label for application methods and appropriate use rates.
ESCORT XP (60%) PATRIOT (0.5-4 oz.) + Non-ionic Surfactant (1 qt./ 100 gal. spray mix)	metsulfuron methyl (0.3-2.4 oz.) + non-ionic surfactant	Rate selection is based on weed species, weed size, and soil texture. Generally, higher rates are used on established weeds and on finer-textured soils. See label for use rate on specific weeds. Use the high rate for kudzu control. **NOTE:** For use on noncrop and industrial sites, such as pipeline, utility, and roadside rights-of-way, fencerows, lumberyards, airports, military installations, petroleum tank farms, railroads, storage areas, and similar areas. **DO NOT** allow spray to drift to desirable plants. Sprayers used to apply this herbicide should be used ONLY for spraying noncrop areas.
FINALE (2-6 qt.) [1 lb./gal.]	gluflosinate (0.5-1.5 lb.)	Used for nonselective, postemergence weed control in noncrop areas. Provides effective control of seedling weeds. Older plants or perennial species may require repeat applications. Finale does not have soil activity.

Table 2. Noncropland Weed Control (cont.)

Herbicide Trade Name (Rate/Acre)	Herbicide Common Name (Active Herbicide/Acre)	Comments
	FOLIAR TREATMENTS (cont.)	
GARLON 4 (4EC) TAHOE 4E (1-8 qt.) or GARLON 3A (3L) TAHOE 3A (1-3 gal.)	triclopyr (1-8 lb.) (3-9 lb.)	Controls a wide range of broadleaf weeds, vines, brush, and trees. **DO NOT** allow spray to contact desirable vegetation. Application can be made to utility, roadside, and railroad rights-of-way, industrial storage areas, and fencerows. Add a non-ionic surfactant when using Garlon / Tahoe 3A formulation.
GRAMOXONE INTEON 2.0 (2.5-4 pt.) + Non-ionic Surfactant (1-2 pt./100 gal. spray mix)	paraquat (0.64-1 lb.) + non-ionic surfactant	Controls annual weeds and grasses; top kills or suppresses perennials. For use around commercial buildings, airports, storage yards, fence lines, parkways, and on rights-of-way. Apply when weeds are young and succulent. Apply in 50 to 100 gallons of water for thorough weed coverage. Gramoxone is a **RESTRICTED USE** pesticide.
KRENITE S (4L) (1.5-6 gal.)	fosamine (6-24 lb.)	Primarily for brush control; also controls field bindweed. For use on land adjacent to and surrounding water supply sites, industrial sites, rights-of-way, and storage areas. Apply in late summer or early fall. Response is usually not observed until following spring. A penetrating type oil-based adjuvant (surfactant or crop oil concentrate) should be added to the spray solution at a minimum rate of 1 quart per 100 gallons of spray mix. Only the plant parts contacted will be controlled. **DO NOT** apply more than 6 gallons of Krenite per acre per year.
MILESTONE VM (3-7 fl.oz./A)	aminopyralid 0.75-1.75 oz.	Provides excellent postemergent control of many broadleaf weeds (especially thistles and legumes) and some preemergent control of subsequent seedling flushes depending on the rate used. Add a non-ionic surfactant at 0.25 % v/v. Do not apply beneath desirable trees (especially legumes such as locust, mimosa, or redbud) unless injury can be tolerated.
MILESTONE VM PLUS CAPSTONE (4-9 pt./A)	aminopyralid 0.8-1.8 oz. + triclopyr 8-18 oz.	Provides excellent postemergent control of many broadleaf weeds (especially thistles and legumes) and some preemergent control of subsequent seedling flushes depending on the rate used. Also provides good control of some woody species and vines. Add a non-ionic surfactant at 0.25 % v/v. Do not apply beneath desirable trees (especially legumes such as locust, mimosa, or redbud) unless injury can be tolerated.
OUST XP (75DG) (3-5 oz.) (6-8 oz.)	sulfometuron (2.25-3.75 oz.) (4.5-6 oz.)	Lower rates provide preemergence or early postemergence control of annual grasses and weeds such as foxtail, dogfennel, mustard, ragweed, bahiagrass, and ryegrass. Higher rates provide early postemergence control of weeds such as curly dock, dewberry, honeysuckle, poison ivy, and johnsongrass. **NOTE:** For use in areas such as airports, fencerows, roadsides, utility rights-of-way, industrial sites, and similar areas. Oust has both foliar and soil activity on many weeds. Add 1 quart of surfactant per 100 gallons of spray mix with foliar applications. Refer to label for species controlled and use rates.
OVERDRIVE (4-8 oz.) + Non-ionic surfactant (1 qt. per 100 gal. spray mix)	diflufenzopyr (0.8-1.6 oz.) + dicamba (2-4 oz.) + non-ionic surfactant	Controls many annual and biennial broadleaf weeds and suppresses many perennial broadleaf weeds. For use in noncropland sites such as railroad, utility, pipeline, and highway rights-of-way. Apply no more than 10 ounces of Overdrive per acre per season.

Table 2. Noncropland Weed Control (cont.)

Herbicide Trade Name (Rate/Acre)	Herbicide Common Name (Active Herbicide/Acre)	Comments
	FOLIAR TREATMENTS (cont.)	
REWARD LA (2L) (1-2 pt.)	diquat dibromide (0.25-0.5 lb.)	Controls small herbaceous broadleaf weeds and grasses. Thoroughly cover small actively growing weeds with spray solution. Retreatment will be necessary to control grasses and established weeds. Add a non-ionic surfactant at the rate of 1 pint per 100 gallons of spray mix.
PERSPECTIVE (1.75-11 oz.)	aminocyclopyrachlor (0.69-4.3 oz.) + chlorsulfuron (0.27-1.7 oz.)	Controls many annual and perennial broadleaf weeds commonly found on right-of-ways, including buckhorn plantain. Provides suppression of cogongrass seedheads at lower rates; suppresses cogongrass growth at higher rates. Avoid treatment of areas where desirable plants, including trees, may be contacted by spray or taken up by roots as injury may occur.
PLATEAU (2-12 fl.oz.)	imazapic (0.031-0.19 lb.)	Provides selective weed control in established grasses, wildflower areas, and native prairiegrasses; also provides seedhead and growth suppression of select grass species. Selectivity is dependent on species present and rate. Use lower rates for seedhead and growth suppression and higher rates for weed control.
ROUNDUP ULTRA MAX (5.5 lb./gal.) (0.8 qt.) (1.75-4 qt.) or ACCORD (4 lb./gal.) Generic Products (2-5 qt.)	glyphosate (1.1 lb.) (2.4-5.5 lb.) (2-5 lb.)	Lower rate controls annual grasses and broadleaf weeds. Higher rates control perennial weeds and woody brush. When using Accord, always add a non-ionic surfactant to the spray mix at the rate of 2 quarts per 100 gallons of spray mix. **BEFORE** using a generic glyphosate product, check to determine need for the addition of a non-ionic surfactant to spray mix. **NOTE:** For use in industrial, recreational, and public areas and for farmstead weed control. For specific application rates and timing, refer to the label. Provides no residual control of weeds.
SAHARA 70DG (13-19 lb.)	imazapyr (1-1.48 lb.) + diuron (8.1-11.8 lb.)	Sahara will control most annual and perennial grasses and broadleaf weed species. Several brush and vine species are also controlled. May be applied pre- or postemergence although perennial weeds will not be controlled if Sahara is applied before emergence.
SCYTHE (2.25-20 gal.) [4.2 lb./gal.]	pelargonic acid (9.4-84 lb.)	Nonselective control of emerged herbaceous weed species. More effective against seedling weeds. Established weeds will need retreatment and higher rates. Scythe provides no residual activity.
STREAMLINE (1.75-11.5 oz.)	aminocyclopyrachlor (0.69-4.5 oz.) + metsulfuron (0.05-1.4 oz.)	Provides excellent control of many herbaceous and woody species, including kudzu and Chinese tallowtree. Also suppresses cogongrass at higher rates. This herbicide has considerable soil activity, which may result in non-target injury to many desirable species. Add adjuvants according to label recommendations.
TELAR XP (75DF) (0.25-3 oz.)	chlorsulfuron (0.18-2.25 oz.)	Controls many annual, biennial, and perennial broadleaf weeds. Application should be made when weeds are actively germinating or when they are small and actively growing. Add a non-ionic surfactant at a rate of 1 quart per 100 gallons of spray mix. **NOTE:** Use on noncropland areas such as utility, roadside, and railroad rights-of-way, fencerows, and industrial storage areas.
TRANSLINE (3L) (0.25-1.33 pt.)	clopyralid (0.09-0.5 lb.)	Controls a wide range of annual and perennial weeds. Grasses and members of the mustard family are tolerant of clopyralid. Legumes and composites are especially sensitive. **NOTE:** For use in areas such as industrial, manufacturing, and storage sites, equipment pathways, rights-of-way, and similar sites. Add 1 quart of a non-ionic surfactant per 100 gallons of spray mix with foliar applications.

Table 2. Noncropland Weed Control (cont.)

Herbicide Trade Name (Rate/Acre)	Herbicide Common Name (Active Herbicide/Acre)	Comments
FOLIAR TREATMENTS (cont.)		
VANQUISH 4L (0.5-2 pt.) (2-4 pt.)	dicamba (0.25-1 lb.) (1-2 lb.)	Lower rates control annual broadleaf weeds. Higher rates control perennial broadleaf weeds and some vines. A non-ionic surfactant may be added to spray mix. **NOTE:** For noncropland areas such as fencerows, roadways, and similar areas. Apply when weeds are actively growing. Also has some residual soil activity. Higher rates can be used for woody plants and brush. Refer to the label for species and use rates. Spray drift can damage nearby desirable plants.
VIEWPOINT (13-20 oz.)	imazapyr (4.1-6.3 oz.) + aminocyclopyrachor (3-4.6 oz.) + metsulfuron (0.9-1.5 oz.)	Provides pre- and postemergence of many broadleaf weeds, vines, and woody plants. (See label for species list.) Exercise caution near desirable plant species as injury may result.
VISTA (0.67-2.66 pt.) [1.5 lb./gal.]	fluroxypyr (0.125-0.5 lb.)	Vista provides control or suppression of broadleaf weeds only. It may enhance control of brush species when tank mixed with other brush control products. It does not have grass activity. Plant symptoms resemble those provided by 2,4-D.
CUT SURFACE TREAMENTS		
Hack and Squirt or Injection		
General Comments: *This is an individual plant treatment method that is very effective for controlling woody plants. It can be used for trees larger than 1 inch in diameter but is generally best suited for trees or shrubs greater than 6 inches in diameter. Use a hatcher or machete to make cuts around the trunk. Make the cuts at about a 45-degree angle downward through the cambium just into the white wood. Use a curved blade to create a cuplike cut that will hold the herbicide. Make evenly spaced cuts around the trunk as directed on the label and immediately apply the herbicide into each cut. A squirt bottle that applies approximately 1 milliliter per squirt is recommend. Cut surface treatment can be used any time after full leaf expansion in the spring but is often most effective in the late summer or fall. Do not apply in the spring during sap rise. This technique is often difficult to use in multi-stemmed clumps. Do not use this technique where dead standing trees may become a hazard. This technique is not recommended for home landscapes.*		
ACCORD CONCENTRATE (25-100% v/v)	glyphosate	Apply 1 ml per cut with cuts evenly spaced 2 inches apart around the trunk.
ARSENAL AC (undiluted)	imazapyr	Apply 1 ml per cut with cuts evenly space at a maximum of 3 inches apart around the trunk. Do not use in mixed stands where desirable hardwoods are present.
DMA 4 IVM (undiluted)	2,4-D amine	Apply 1 to 2 ml per inch of trunk diameter. Can be used for trees larger than 1 inch in diameter but is generally best suited for trees or shrubs greater than 6 inches in diameter. Make evenly spaced cuts around each stem as directed on the label. Do not apply in the spring during sap rise.
GARLON 3A (50% v/v)	triclopyr amine	Make overlapping cuts around the trunk and apply 1 ml per cut.
PATHWAY (undiluted)	picloram + 2,4-D	Apply 1 ml per cut with cuts evenly spaced 2 to 3 inches apart around the trunk. Make cuts as close to the ground as possible.

Table 2. Noncropland Weed Control (cont.)

Herbicide Trade Name (Rate/Acre)	Herbicide Common Name (Active Herbicide/Acre)	Comments
CUT SURFACE TREAMENTS (cont.)		
Cut Stump Treatment		
General Comments: *This is an individual plant treatment method that is very effective for controlling woody plants. It can generally be used for any trees larger than 1 inch in diameter. Use a chainsaw, handsaw, or pruning shears (for small stems) to cut the trunk as low as possible and leave a flat stump above the soil line. For water soluble herbicides, immediately apply the herbicide solution to the surface of the stump. For oil soluble herbicides, treat the stump top and the sides of the stump. For trees larger than 4 inches in diameter, treat the entire cambium around the outer 2 inches of the stump. For smaller stems, treat the entire stump top. Cut stump treatments can be used any time after full leaf expansion in the spring but is often most effective in the late summer or fall. Do not apply in the spring during sap rise. This technique is recommended within home landscaping situations only if glyphosate is used. Consult Alabama Cooperative Extension System publication ANR-1465 for more information on this method.*		
ACCORD CONCENTRATE Other glyphosate products (25-100% v/v)	glyphosate	Immediately apply the herbicide to the cut surface as soon as possible after cutting.
ARSENAL AC (5% v/v)	imazapyr	Do not use in mixed stands where desirable hardwoods are present.
ARSENAL (6-9% v/v)	imazapyr	Do not use in mixed stands where desirable hardwoods are present.
GARLON 3A (50% v/v)	triclopyr amine	Immediately apply the herbicide to the cut surface as soon as possible after cutting.
GARLON 4 (25% v/v)	triclopyr ester	Herbicide treatment can be delayed after cutting for a few weeks if necessary.
PATHFINDER II (undiluted)	triclopyr ester	Ready to use formulation. No mixing is required.
PATHWAY (undiluted)	picloram + 2,4-D	Do not use in mixed stands where desirable hardwoods are present.
BASAL BARK TREAMENT		
General Comments: *This is an individual plant treatment method that is very effective for controlling woody plants that are typically less than 6 inches in diameter. Use an oil soluble herbicide mixed with an oil carrier. While diesel fuel has been commonly used, forestry herbicide distributors now sell bark oils that are safer and more environmentally friendly. Apply the herbicide oil mixture in a narrow stream to the bottom 12 to 15 inches of each stem. Good coverage all the way around is important. Spray to wet but do not puddle the herbicide at the base. Basal bark treatments can be used almost any time of year but are most effective in the fall. Do not apply in the spring during sap rise. This technique can be used on single and multi-stemmed clumps. Do not use this technique where dead standing trees may become a hazard. This technique is not recommended in home landscapes. However a ready to use formulation (Pathfinder II) is available for use in natural areas found near homes and within urban forests. Please consult ACES publication ANR-1466 for more information on this application technique.*		
CHOPPER (6-9% v/v)	imazapyr	Do not use imazsapyr in mixed stands where desirable hardwoods are present.
GARLON 4 Other generic products (20% v/v)	triclopyr ester	Spray to wet the bottom 12 to 15 inches of each stem and any exposed lateral roots. Do not puddle the herbicide.
PATHFINDER II (undiluted)	triclopyr ester	Ready to use formulation. No mixing is required.

Weed Control section prepared by Stephen F. Enloe, Extension Specialist, Associate Professor, Department of Crop, Soil and Environmental Sciences, Auburn University; and John W. Everest, Professor Emeritus, Department of Crop, Soil and Environmental Sciences, Auburn University.

Table 3. Properties of Herbicides for Noncropland That May Affect Water Quality [1]

	HERBICIDES							
	2,4-D	Arsenal	Banvel	Crossbow	Escort	Gramoxone	Hyvar	Karmex
Surface-Loss Potential [2]	M	L	S	L	M	S	M	M
Leaching Potential[3]	M	L	L	M	M	S	L	M
	HERBICIDES							
	Krenite	Krovar	MSMA	Oust	Pramitol	Roundup	Spike	Velpar
Surface-Loss Potential[2]	M	M	S	M	M	S	L	S
Leaching Potentia [3]	S	L	S	M	M	S	L	L

[1] Leaching and surface-loss potential ratings are based in part on herbicide chemical characteristics and pesticide behavior models developed by USDA scientists as well as on field experience.

[2] The surface-loss potential indicates the tendency of the pesticide to move with sediment in runoff.

[3] The leaching potential indicates the tendency of the pesticide to move in solution with water and to leach below the root zone.

KEY TO RATINGS: S = Small potential; M = Medium potential; L = Large potential.

FOR MORE INFORMATION on pesticides, pesticide safety, or submitting samples for analysis, see the following publications in the IPM series:
IPM 1293, “Safety.” Safety contact information; worker protection standards; the safe use, handling, and storage of pesticides
IPM 1294, “Submitting Samples.” Procedures for submitting samples for diagnosis, analysis, and identification
IPM 1295, “General Pesticide Information.” Federal and state restricted use pesticide lists; pesticides and water quality
IPM 1317, “Appendix.” Pesticide guidelines for agronomic crops, including preharvest intervals; rain-free requirements; grazing restrictions; crop rotation guidelines; and the names, classifications, and toxicities of pesticides.

2014 IPM-0223

For more information, contact your county Extension office. Visit www.aces.edu/counties or look in your telephone directory under your county’s name to find contact information.

Use pesticides **only** according to the directions on the label. Follow all directions, precautions, and restrictions that are listed. Do not use pesticides on plants that are not listed on the label

The pesticide rates in this publication are recommended **only** if they are registered with the Environmental Protection Agency or the Alabama Department of Agriculture and Industries. If a registration is changed or canceled, the rate listed here is no longer recommended. Before you apply **any** pesticide, check with your county Extension agent for the latest information.

Trade names are used **only** to give specific information. The Alabama Cooperative Extension System does not endorse or guarantee any product and does not recommend one product instead of another that might be similar.

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ALABAMA A&M & AUBURN UNIVERSITIES

IPM-0978

Alfalfa

IPM

Insect and Weed Control Recommendations for 2014

INSECT PEST MANAGEMENT

Alfalfa is a superb forage, but it can be attacked by a complex of insect pests. In fact, the introduction of the alfalfa weevil about 50 years ago contributed to the decline of alfalfa acreage in Alabama. However, improved cultivars and management techniques have led to a renewed interest in alfalfa.

Alfalfa insect populations can vary greatly from field to field. Therefore, it is essential to check each alfalfa field frequently for the presence of insects or insect injury. Table 1 indicates when each insect pest is likely to be present. For optimum insect management alfalfa should be scouted weekly.

Action Thresholds for Alfalfa Pests

An action threshold is a decision-making tool that indicates when an insect population is high enough to cause significant yield loss. Listed below are the recommended action thresholds for the pests in the scouting guide.

Alfalfa Weevil. Treat when 50 percent of stems have injury and insects are present at the rate of 25 larvae per net sweep; or two larvae per stem when alfalfa is 16 inches tall; or one larva per stem when alfalfa is 10 inches tall. When the threshold is reached, harvest if alfalfa is within 10 days of normal harvest. Otherwise, treat with an insecticide. After harvest, check to see how many alfalfa weevil larvae are present on the stubble and new regrowth. If there are more than eight larvae per square foot, consider a stubble spray.

Pea Aphid. The action threshold depends on height of crop. When alfalfa is 15 inches tall, treat if there are 50 aphids per stem; when it is 25 inches tall, treat if there are 120 aphids per stem. Aphid populations frequently decline due to natural enemies. Do not treat for aphids unless aphid populations are high.

True Armyworm, other Caterpillars. Treat when there are two to three caterpillars per square foot.

Three-Cornered Alfalfa Hopper. Treat when the insect is girdling and killing 10 percent of the lateral stems in the field—probably about three hoppers per plant.

Blister Beetles. These beetles poison livestock, particularly horses, when they are eaten along with the hay. Blister beetles are often clumped in the weedy margins of a field; spot treatment may be possible.

Table 1. Alfalfa Insect Scouting Guide

Insects	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Alfalfa Weevil		////////////////////										
Pea Aphids		////////////////////////////										
True Armyworms			////////////////////									
Other Caterpillars*					----------	----------	----------	----------	----------			
Japanese Beetle					////////////////							
Three-Cornered Alfalfa Hopper						////////////////////////////////////						
Blister Beetles						//						
Leafhoppers				////////////////////////////								
Grasshoppers						----------	----------	----------				

* Corn earworm, webworms, alfalfa caterpillar, green cloverworm, yellow-striped armyworm, soybean looper, beet armyworm, fall armyworm.

KEY TO RATINGS: //////////// normal; ---------- may vary with season.

Grasshoppers. Treat when heavy populations are defoliating the alfalfa. This will probably be about 12 per square yard.

Potato Leafhopper. Potato leafhopper feeding causes abnormal plant response. Only a few are needed to cause injury. Recommended thresholds are based on sweep-net sampling. Threshold is one half per sweep when alfalfa is 3 to 7 inches tall, one per sweep when 8 to 10 inches tall, and two per sweep when it is 11 to 14 inches tall. When alfalfa is taller, the yield loss will probably not be observed if it is harvested at the usual time.

Webworms. Treat when the crop is more than 2 weeks from cutting and when 25 to 30 percent of plant terminals are infested.

Sampling Equipment

Equipment needed depends on the method of measuring thresholds. When insect thresholds are based on the number of pests per stem, gently cut the stem off at the base and shake it into a bucket. When thresholds are based on number per area, use a sampling hoop that can be tossed onto the alfalfa. To make a hoop, bend the body of a wire coat hanger until it is approximately round. This should make a circle about 11 inches in diameter, which is approximately two-thirds of a square foot in area. Alternatively pvc pipe can be used to make a square foot frame. A sweep net is useful for detecting pest populations before they cause injury. A 15-inch diameter sweep net with a muslin or sailcloth bag can be purchased from various IPM or forestry supply stores.

Organic Insecticides That Can be Applied to Alfalfa

Organic producers may want to consider the following insecticides, most if not all of which are OMRI approved. Be sure to read the insecticide label to make sure it meets your needs. The following products contain azadirachtin: Neemix 4.5 and Ecozin Plus. The following products contain *Bacillus thuringiensis*: Biobit HP (subsp. *kurstaki* strain ABTS-351), Dipel DF (subsp. *kurstaki* strain ABTS-351), Javelin WG (subsp. *kurstaki* strain SA-11), Agree WG (susp. *aizawai* strain), and Xentari (subsp. *aizawai* strain ABTS-1857). PyGanic Crop Protection EC 1.4_{II} and PyGanic Crop Protection EC 5.0_{II} insecticides are OMRI approved and contain natural pyrethrins. There are other insecticides that contain pyrethrins. Be sure to choose one that does not contain piperonyl butoxide, as that chemical is not considered organic. Pest Out contains cottonseed, clove, and garlic oils. M-Pede contains potassium salts of fatty acids. Ecotec contains rosemary and peppermint oils. Entrust and Entrust SC contain spinosad. Mycotrol O contains *Beauveria bassiana* strain GHA. Grandevo contains *Chromobacterium subtsugae* strain PRAA4-1.

Table 2. Alfalfa Control [1]

Insecticide and Formulation	Amount of Formulation per Acre	Lb. Active Ingredient per Acre	Minimum Days from Last Application to Harvest	Comments
Caution: *Most insecticides cannot be used when alfalfa is in bloom. Read labels for instructions.*				
ALFALFA WEBWORMS, GARDEN WEBWORMS				
alpha-cypermethrin FASTAC EC	2.2-3.8 fl.oz.	0.014-0.025	3 (cutting, grazing) 7 (seed)	Fastac is a **RESTRICTED USE** pesticide.
beta-cyfluthrin BAYTHROID XL	1.6-2.8 fl.oz.	0.0125-0.022	7	Baythroid XL is a **RESTRICTED USE** pesticide.
carbaryl SEVIN XLR PLUS Other trade names [2]	1-1.5 qt.	1-1.5	7	
chlorpyrifos LORSBAN ADVANCED Other trade names [2]	1.5 pt.	0.7	21	Lorsban Advanced is a **RESTRICTED USE** pesticide.
chlorpyrifos + gamma-cyhalothrin COBALT	13-26 fl.oz.	0.25-0.51 + 0.004-0.009	7-14 [1]	Cobalt is a **RESTRICTED USE** pesticide.
chlorpyrifos + lambda-cyhalothrin COBALT ADVANCED Other trade names [2]	11-26 fl.oz.	0.21-0.51 + 0.011-0.026	7-14 [1]	Cobalt Advanced is a **RESTRICTED USE** pesticide.
cyfluthrin TOMBSTONE Other trade names [2]	1.6-2.8 fl.oz.	0.025-0.04	7	Tombstone is a **RESTRICTED USE** pesticide.

[1] See Table 3 for a list of insecticides, formulations, restricted entry intervals, and days to grazing or harvest.

[2] See Table 3 for other trade names.

Table 2. Alfalfa Control (cont.)[1]

Insecticide and Formulation	Amount of Formulation per Acre	Lb. Active Ingredient per Acre	Minimum Days from Last Application to Harvest	Comments
Caution: *Most insecticides cannot be used when alfalfa is in bloom. Read labels for instructions.*				
ALFALFA WEBWORMS, GARDEN WEBWORMS (cont.)				
flubendiamide				
BELT SC	2-4 fl.oz.	0.062-0.125	0	
gamma-cyhalothrin				Declare is a **RESTRICTED USE** pesticide.
DECLARE	0.77-1.28 fl.oz.	0.0075-0.0125	7 (hay) 1 (forage)	
lambda-cyhalothrin[1]				Karate with Zeon Technology is a **RESTRICTED USE** pesticide.
KARATE with ZEON TECHNOLOGY	0.96-1.6 fl.oz.	0.015-0.025	7 (hay) 1 (forage)	
Other trade names [2]				
lambda-cyhalothrin + chlorantraniliprole				Besiege is a **RESTRICTED USE** pesticide.
BESIEGE	5-8 fl.oz.	0.016-0.026 + 0.03-0.05	7 (hay) 1 (forage)	
methoxyfenozide				Use higher rate for heavier infestations.
INTREPID 2F	4-8 fl.oz.	0.06-0.12	7 (hay) 0 (grazing)	
permethrin				All permethrin formulations are **RESTRICTED USE** pesticides.
POUNCE 25 WP	3.2-12.8 oz.	0.05-0.2	0-14[1]	
Other trade names [2]				
zeta-cypermethrin				Mustang Maxx is a **RESTRICTED USE** pesticide.
MUSTANG MAXX 0.8E	2.2-4 fl.oz.	0.014-0.025	3	
Other trade names [2]				
ALFALFA WEEVILS				
alpha-cypermethrin				Fastac is a **RESTRICTED USE** pesticide.
FASTAC EC	2.2-3.8 fl.oz.	0.014-0.025	3 (cutting, grazing) 7 (seed)	
beta-cyfluthrin				Baythroid XL is a **RESTRICTED USE** pesticide.
BAYTHROID XL	1.6-2.8 fl.oz	0.0125-0.022	7	
carbaryl				
SEVIN XLR PLUS	1.5 qt.	1.5	7	
Other trade names [2]				
chlorpyrifos				Use a minimum of 20 gallons per acre by ground. Lorsban Advanced is a **RESTRICTED USE** pesticide.
LORSBAN ADVANCED	1-2 pt.	0.47-0.93	14-21[1]	
Other trade names [2]				
chlorpyrifos + gamma-cyhalothrin				Cobalt is a **RESTRICTED USE** pesticide.
COBALT	19-38 fl.oz.	0.37-0.74 + 0.007-0.013	14-21[1]	
chlorpyrifos + lambda-cyhalothrin				Cobalt Advanced is a **RESTRICTED USE** pesticide.
COBALT ADVANCED	16-38 fl.oz.	0.31-0.74 + 0.016-0.038	14-21 [1]	
Other trade names [2]				
cyfluthrin				Tombstone is a **RESTRICTED USE** pesticide.
TOMBSTONE	1.6-2.8 fl.oz.	0.025-0.044	7	
Other trade names [2]				

[1] See Table 3 for a list of insecticides, formulations, restricted entry intervals, and days to grazing or harvest.

[2] See Table 3 for other trade names.

Table 2. Alfalfa Control (cont.)[1]

Insecticide and Formulation	Amount of Formulation per Acre	Lb. Active Ingredient per Acre	Minimum Days from Last Application to Harvest	Comments
Caution: *Most insecticides cannot be used when alfalfa is in bloom. Read labels for instructions.*				
ALFALFA WEEVILS (cont.)				
gamma-cyhalothrin DECLARE	1.02-1.54 fl.oz.	0.01-0.015	7 (hay) 1 (forage)	Declare is a **RESTRICTED USE** pesticide.
indoxacarb STEWARD EC	6.7-11.3 fl.oz.	0.065-0.11	7	Use 6.7 to 11.3 fluid ounces when longer residual control is needed.
lambda-cyhalothrin KARATE with ZEON TECHNOLOGY Other trade names [2]	1.28-1.92 fl.oz.	0.02-0.03	7 (hay) 1 (forage)	Karate is a **RESTRICTED USE** pesticide.
lambda-cyhalothrin + chlorantraniliprole BESIEGE	6-9 fl.oz.	0.02-0.03 + 0.04-0.06	7 (hay) 1 (forage)	Besiege is a **RESTRICTED USE** pesticide.
methomyl LANNATE 2.4LV Other trade names [2]	3 pt.	0.9	7	Lannate is a **RESTRICTED USE** pesticide.
permethrin POUNCE 25WP Other trade names [2]	6.4-12.8 oz.	0.1-0.2	0-14[1]	For Rotational Grazing: Use low rate for short-term weevil control when alfalfa is too short to graze. Graze as soon as possible for further weevil suppression. Pounce is a **RESTRICTED USE** pesticide.
phosmet IMIDAN 70-W	1.0-1.33 lb.	0.7-1.0	7	
zeta-cypermethrin MUSTANG MAXX 0.8E Other trade names [2]	2.2-4 fl.oz.	0.014-0.025	3	Mustang Maxx is a **RESTRICTED USE** pesticide.
APHIDS				
alpha-cypermethrin FASTAC EC	2.2-3.8 fl.oz.	0.014-0.025	3 (cutting, grazing) 7 (seed)	Fastac is a **RESTRICTED USE** pesticide.
chlorpyrifos LORSBAN ADVANCED Other trade names [2]	1-2 pt.	0.47-0.93	14-21[1]	Lorsban 4E is a **RESTRICTED USE** pesticide.
chlorpyrifos + gamma-cyhalothrin COBALT	13-26 fl.oz.	0.25-0.51 + 0.004-0.009	14[1]	Cobalt is a **RESTRICTED USE** pesticide.
chlorpyrifos + lambda-cyhalothrin COBALT ADVANCED Other trade names [2]	11-26 fl.oz.	0.21-0.51 + 0.011-0.026	7-14 [1]	Cobalt Advanced is a **RESTRICTED USE** pesticide.
dimethoate DIMETHOATE 4EC Other trade names [2]	0.5-1 pt.	0.25-0.5	10	**DO NOT** apply more than once per cutting.

[1] See Table 3 for a list of insecticides, formulations, restricted entry intervals, and days to grazing or harvest.
[2] See Table 3 for other trade names.

Table 2. Alfalfa Control (cont.)[1]

Insecticide and Formulation	Amount of Formulation per Acre	Lb. Active Ingredient per Acre	Minimum Days from Last Application to Harvest	Comments
Caution: *Most insecticides cannot be used when alfalfa is in bloom. Read labels for instructions.*				
APHIDS (cont.)				
gamma-cyhalothrin DECLARE	1.02-1.54 fl.oz.	0.01-0.015	7 (hay) 1 (forage)	Declare is a **RESTRICTED USE** pesticide.
lambda-cyhalothrin KARATE with ZEON TECHNOLOGY Other trade names [2]	1.28-1.92 fl.oz.	0.02-0.03	7 (hay) 1 (forage)	Karate is a **RESTRICTED USE** pesticide.
lambda-cyhalothrin + chlorantraniliprole BESIEGE	6-9 fl.oz.	0.02-0.03 + 0.04-0.06	7 (hay) 1 (forage)	Besiege is a **RESTRICTED USE** pesticide.
methomyl LANNATE LV	1.5-3 pt.	0.45-0.9	7	Lannate is a **RESTRICTED USE** pesticide.
permethrin POUNCE 25 WP Other trade names [2]	3.2-12.8 oz.	0.05-0.2	0-14[1]	Use higher rate for higher pest pressure or for longer residual. Pounce is a **RESTRICTED USE** pesticide.
ARMYWORMS, CORN EARWORMS, FALL ARMYWORMS, YELLOW-STRIPED ARMYWORMS, GREEN CLOVERWORMS				
alpha-cypermethrin FASTAC EC	2.2-3.8 fl.oz.	0.014-0.025	3 (cutting, grazing) 7 (seed)	Fastac is a **RESTRICTED USE** pesticide.
beta-cyfluthrin BAYTHROID XL	1.6-2.8 fl.oz.	0.0125-0.022	7	Baythroid XL is a **RESTRICTED USE** pesticide. Use on small larvae (1st-2nd instar).
chlorantraniliprole PREVATHON Other trade names [2]	14-20 fl.oz.	0.045-0.067	0	
chlorpyrifos + gamma-cyhalothrin COBALT	19-38 fl.oz.	0.37-0.74 + 0.007-0.013	14-21[1]	Cobalt is a **RESTRICTED USE** pesticide.
chlorpyrifos + lambda-cyhalothrin COBALT ADVANCED Other trade names [2]	16-38 fl.oz.	0.31-0.74 + 0.016-0.038	14-21[1]	Cobalt Advanced is a **RESTRICTED USE** pesticide.
cyfluthrin TOMBSTONE Other trade names [2]	1.6-2.8 fl.oz.	0.025-0.044	7	Tombstone is a **RESTRICTED USE** pesticide. Use on small larvae (1st-2nd instar).
flubendiamide BELT SC	2-4 fl.oz.	0.062-0.125	0	
gamma-cyhalothrin DECLARE	1.02-1.54 fl.oz.	0.01-0.015	7 (hay) 1 (forage)	Declare is a **RESTRICTED USE** pesticide. Use on small larvae (1st-2nd instar).
indoxacarb STEWARD	6.7-11.3 fl.oz.	0.065-0.11	7	Use intermediate to higher rate on later instar larvae. One application per cutting.

[1] See Table 3 for a list of insecticides, formulations, restricted entry intervals, and days to grazing or harvest.

[2] See Table 3 for other trade names.

Table 2. Alfalfa Control (cont.)[1]

Insecticide and Formulation	Amount of Formulation per Acre	Lb. Active Ingredient per Acre	Minimum Days from Last Application to Harvest	Comments
Caution: *Most insecticides cannot be used when alfalfa is in bloom. Read labels for instructions.*				
ARMYWORMS, CORN EARWORMS, FALL ARMYWORMS, YELLOW-STRIPED ARMYWORMS, GREEN CLOVERWORMS (cont.)				
lambda-cyhalothrin KARATE with ZEON TECHNOLOGY Other trade names [2]	1.28-1.92 fl.oz.	0.02-0.03	7 (hay) 1 (forage)	Karate is a **RESTRICTED USE** pesticide. Use the higher rate for large larvae.
lambda-cyhalothrin + chlorantraniliprole BESIEGE	6-9 fl.oz.	0.02-0.03 + 0.04-0.06	7 (hay) 1 (forage)	Besiege is a **RESTRICTED USE** pesticide.
methomyl LANNATE 2.4LV Other trade names [2]	1.5-3 pt.	0.45-0.9	7	Use higher rate for larger caterpillars. Lannate is a **RESTRICTED USE** pesticide.
methoxyfenozide INTREPID 2F	4-8 fl.oz.	0.06-0.12	7 (hay) 0 (grazing)	Use higher rater for heavier infestations.
spinosad ENTRUST SC	2-4 fl.oz.	0.03-0.06	3 (hay) 0 (grazing)	
zeta-cypermethrin MUSTANG MAXX 0.8E Other trade names [2]	2.8-4 fl.oz.	0.07-0.025	3	Mustang Maxx is a **RESTRICTED USE** pesticide.
BLISTER BEETLES				
carbaryl SEVIN XLR PLUS Other trade names [2]	0.5-1 qt.	0.5-1	7	
chlorpyrifos + gamma-cyhalothrin COBALT	19-38 fl.oz.	0.37-0.74 + 0.007-0.013	14-21[1]	Cobalt is a **RESTRICTED USE** pesticide.
chlorpyrifos + lambda-cyhalothrin COBALT ADVANCED Other trade names [2]	16-38 fl.oz.	0.31-0.74 + 0.016-0.038	14-21[1]	Cobalt Advanced is a **RESTRICTED USE** pesticide.
gamma-cyhalothrin DECLARE	1.02-1.54 fl.oz.	0.01-0.015	7 (hay) 1 (forage)	Declare is a **RESTRICTED USE** pesticide.
lambda-cyhalothrin KARATE with ZEON TECHNOLOGY Other trade names [2]	1.28-1.92 fl.oz.	0.02-0.03	7 (hay) 1 (forage)	Karate is a **RESTRICTED USE** pesticide.
lambda-cyhalothrin + chlorantraniliprole BESIEGE	6-9 fl.oz.	0.02-0.03 + 0.04-0.06	7 (hay) 1 (forage)	Besiege is a **RESTRICTED USE** pesticide.

[1] See Table 3 for a list of insecticides, formulations, restricted entry intervals, and days to grazing or harvest.

[2] See Table 3 for other trade names.

Table 2. Alfalfa Control (cont.)[1]

Insecticide and Formulation	Amount of Formulation per Acre	Lb. Active Ingredient per Acre	Minimum Days from Last Application to Harvest	Comments
Caution: *Most insecticides cannot be used when alfalfa is in bloom. Read labels for instructions.*				
GRASSHOPPERS				
alpha-cypermethrin FASTAC EC	2.8-3.8 fl.oz.	0.017-0.025	3 (cutting, grazing) 7 (seed)	Fastac is a **RESTRICTED USE** pesticide.
beta-cyfluthrin BAYTHROID XL	2.0-2.8 fl.oz	0.0155-0.022	7	Baythroid XL is a **RESTRICTED USE** pesticide.
carbaryl SEVIN XLR PLUS Other trade names [2]	0.5-1.5 qt.	0.5-1.5	7	Use 1.25 to 1.875 pounds for mature grasshoppers or applications to dense foliage.
chlorpyrifos LORSBAN ADVANCED Other trade names [2]	0.5-1 pt.	0.235-0.47	7-14[1]	Lorsban Advanced is a **RESTRICTED USE** pesticide.
chlorpyrifos + gamma-cyhalothrin COBALT	7-13 fl.oz.	0.14-0.25 + 0.002-0.004	7	Cobalt is a **RESTRICTED USE** pesticide.
chlorpyrifos + lambda-cyhalothrin COBALT ADVANCED Other trade names [2]	6-13 fl.oz.	0.12-0.25 + 0.006-0.013	7	Cobalt Advanced is a **RESTRICTED USE** pesticide.
cyfluthrin TOMBSTONE Other trade names [2]	2-2.8 fl.oz.	0.031-0.044	7	Tombstone is a **RESTRICTED USE** pesticide.
dimethoate DIMETHOATE 4EC Other trade names 2	0.5-1 pt.	0.25-0.5	10	
gamma-cyhalothrin DECLARE	1.02-1.54 fl.oz.	0.01-0.015	7 (hay) 1 (forage)	Declare is a **RESTRICTED USE** pesticide.
lambda-cyhalothrin KARATE with ZEON TECHNOLOGY Other trade names[2]	1.28-1.92 fl.oz.	0.02-0.03	7 (hay) 1 (forage)	Karate is a **RESTRICTED USE** pesticide.
lambda-cyhalothrin + chlorantraniliprole BESIEGE	6-9 fl.oz.	0.02-0.03 + 0.04-0.06	7 (hay) 1 (forage)	Besiege is a **RESTRICTED USE** pesticide.
phosmet IMIDAN 70-W	1.0-1.33 lb.	0.7-1.0	7	
zeta-cypermethrin MUSTANG MAXX Other trade names [2]	2.8-4 fl.oz.	0.018-0.025	3	Mustang Maxx is a **RESTRICTED USE** pesticide.

[1] See Table 3 for a list of insecticides, formulations, restricted entry intervals, and days to grazing or harvest.

[2] See Table 3 for other trade names.

Table 2. Alfalfa Control (cont.)[1]

Insecticide and Formulation	Amount of Formulation per Acre	Lb. Active Ingredient per Acre	Minimum Days from Last Application to Harvest	Comments
Caution: *Most insecticides cannot be used when alfalfa is in bloom. Read labels for instructions.*				
IMPORTED FIRE ANTS				
s-methoprene EXTINGUISH PROFESSIONAL ANT BAIT	1-1.5 lb.	0.005-0.0075	0	Broadcast the bait according to label directions.
JAPANESE BEETLE ADULTS				
beta-cyfluthrin BAYTHROID XL	1.6-2.8 fl.oz	0.0125-0.022	7	Baythroid XL is a **RESTRICTED USE** pesticide.
carbaryl SEVIN XLR PLUS Other trade names [2]	1 qt.	1	7	
chlorpyrifos + gamma-cyhalothrin COBALT	19-38 fl.oz.	0.25-0.51 + 0.004-0.009	14-21[1]	Cobalt is a **RESTRICTED USE** pesticide.
chlorpyrifos + lambda-cyhalothrin COBALT ADVANCED Other trade names [2]	16-38 fl.oz.	0.31-0.74 + 0.016-0.038	14-21[1]	Cobalt Advanced is a **RESTRICTED USE** pesticide.
cyfluthrin TOMBSTONE Other trade names [2]	1.6-2.8 fl.oz.	0.025-0.044	7	Tombstone is a **RESTRICTED USE** pesticide.
gamma-cyhalothrin DECLARE	1.02-1.54 fl.oz.	0.01-0.015	7 (hay) 1 (forage)	Declare is a **RESTRICTED USE** pesticide.
lambda-cyhalothrin KARATE with ZEON TECHNOLOGY Other trade names [2]	1.28-1.92 fl.oz.	0.02-0.03	7 (hay) 1 (forage)	Karate is a **RESTRICTED USE** pesticide.
lambda-cyhalothrin + chlorantraniliprole BESIEGE	6-9 fl.oz.	0.02-0.03 + 0.04-0.06	7 (hay) 1 (forage)	Besiege is a **RESTRICTED USE** pesticide.
POTATO LEAFHOPPERS				
alpha-cypermethrin FASTAC EC	2.2-3.8 fl.oz.	0.014-0.025	3 (cutting, grazing) 7 (seed)	Fastac is a **RESTRICTED USE** pesticide.
beta-cyfluthrin BAYTHROID XL	0.8-1.6 fl.oz.	0.0065-0.0125	7	Baythroid XL is a **RESTRICTED USE** pesticide.
carbaryl SEVIN XLR PLUS Other trade names [2]	1 qt.	1.0	7	Carbaryl may bleach tender foliage. **DO NOT** apply when crop is wet.
chlorpyrifos LORSBAN ADVANCED Other trade names [2]	0.5-1 pt.	0.235-0.47	7-14[1]	Some phytotoxic symptoms may be observed on young, tender growth. Lorsban Advanced is a **RESTRICTED USE** pesticide.

[1] See Table 3 for a list of insecticides, formulations, restricted entry intervals, and days to grazing or harvest.

[2] See Table 3 for other trade names.

Table 2. Alfalfa Control (cont.)[1]

Insecticide and Formulation	Amount of Formulation per Acre	Lb. Active Ingredient per Acre	Minimum Days from Last Application to Harvest	Comments
Caution: *Most insecticides cannot be used when alfalfa is in bloom. Read labels for instructions.*				
POTATO LEAFHOPPERS (cont.)				
chlorpyrifos + gamma-cyhalothrin COBALT	7-13 fl.oz.	0.14-0.25 + 0.002-0.004	7	Cobalt is a **RESTRICTED USE** pesticide.
chlorpyrifos + lambda-cyhalothrin COBALT ADVANCED Other trade names [2]	6-13 fl.oz.	0.12-0.25 + 0.006-0.013	7	Cobalt Advanced is a **RESTRICTED USE** pesticide.
cyfluthrin TOMBSTONE Other trade names [2]	0.8-1.6 fl.oz.	0.013-0.025	7	Tombstone is a **RESTRICTED USE** pesticide.
dimethoate DIMETHOATE 4EC Other trade names [2]	0.5-1 pt.	0.25-0.5	10	
gamma-cyhalothrin DECLARE	0.77-1.28 fl.oz.	0.0075-0.0125	7 (hay) 1 (forage)	Declare is a **RESTRICTED USE** pesticide.
lambda-cyhalothrin KARATE with ZEON TECHNOLOGY Other trade names [2]	0.96-1.60 fl.oz.	0.015-0.025	7 (hay) 1 (forage)	Karate is a **RESTRICTED USE** pesticide.
lambda-cyhalothrin + chlorantraniliprole BESIEGE	5-8 fl.oz.	0.016-0.026 + 0.03-0.065	7 (hay) 1 (forage)	Besiege is a **RESTRICTED USE** pesticide.
malathion MALATHION 5 Other trade names [2]	1.5-2 pt.	0.94-1.25	0	
permethrin POUNCE 25WP Other trade names [2] 2	6.4-12.8 oz.	0.1-0.2	0-14[1]	Pounce is a **RESTRICTED USE** pesticide.
zeta-cypermethrin MUSTANG MAXX 0.8E Other trade names [2]	2.2-4 fl.oz.	0.014-0.025	3	Mustang Maxx is a **RESTRICTED USE** pesticide.
THREE-CORNERED ALFALFA HOPPERS				
alpha-cypermethrin FASTAC EC	2.2-3.8 fl.oz.	0.014-0.025	3 (cutting, grazing) 7 (seed)	Fastac is a **RESTRICTED USE** pesticide.
beta-cyfluthrin BAYTHROID XL	1.6-2.8 fl.oz.	0.0125-0.022	7	Baythroid XL is a **RESTRICTED USE** pesticide.
carbaryl SEVIN XLR PLUS Other trade names [2]	1 qt.	1	7	

[1] See Table 3 for a list of insecticides, formulations, restricted entry intervals, and days to grazing or harvest.

[2] See Table 3 for other trade names.

Table 2. Alfalfa Control (cont.)[1]

Insecticide and Formulation	Amount of Formulation per Acre	Lb. Active Ingredient per Acre	Minimum Days from Last Application to Harvest	Comments
Caution: *Most insecticides cannot be used when alfalfa is in bloom. Read labels for instructions.*				
THREE-CORNERED ALFALFA HOPPERS (cont.)				
chlorpyrifos + gamma-cyhalothrin COBALT	19-38 fl.oz.	0.37-0.74 + 0.007-0.013	14-21[1]	Cobalt is a **RESTRICTED USE** pesticide.
chlorpyrifos + lambda-cyhalothrin COBALT ADVANCED Other trade names [2]	16-38 fl.oz.	0.31-0.74 + 0.016-0.038	14-21[1]	Cobalt Advanced is a **RESTRICTED USE** pesticide.
cyfluthrin TOMBSTONE	1.6-2.8 fl.oz.	0.025-0.044	7	Tombstone is a **RESTRICTED USE** pesticide.
gamma-cyhalothrin DECLARE	0.77-1.28 fl.oz.	0.0075-0.0125	7 (hay) 1 (forage)	Declare is a **RESTRICTED USE** pesticide.
lambda-cyhalothrin KARATE with ZEON TECHNOLOGY Other trade names [2]	0.96-1.60 fl.oz.	0.015-0.025	7 (hay) 1 (forage)	Karate is a **RESTRICTED USE** pesticide.
lambda-cyhalothrin + chlorantraniliprole BESIEGE	5-8 fl.oz.	0.016-0.026 + 0.03-0.05	7 (hay) 1 (forage)	Besiege is a **RESTRICTED USE** pesticide.
zeta-cypermethrin MUSTANG MAXX 0.8E Other trade names [2]	2.2-4 fl.oz.	0.014-0.025	3	Mustang Maxx is a **RESTRICTED USE** pesticide.

[1] See Table 3 for a list of insecticides, formulations, restricted entry intervals, and days to grazing or harvest.

[2] See Table 3 for other trade names.

Table 3. Insecticides Labeled for Use on Alfalfa

Insecticide and Trade Name	A.I./ Formulated Product	Formulation	Restricted Entry Interval (hr)	Minimum Days from Last Application to Harvest (h) or Grazing (g)
alpha-cypermethrin *MoA Group 3A				
FASTAC EC (Restricted Use)	0.83 lb./gal.	emulsifiable concentrate	12	3 (cutting or grazing) 7 (seed)
beta-cyfluthrin MoA Group 3A				
BAYTHROID XL (Restricted Use)	1 lb./gal.	emulsifiable concentrate	12	7
carbaryl MoA Group 1A				
SEVIN 4F	4 lb./gal.	liquid suspension	12	7
SEVIN XLR PLUS	4 lb./gal.	liquid suspension	12	7
CARBARYL 4L, others	4 lb./gal.	liquid suspension	12	7
SEVIN 80 SOLUPAK	12.8 oz./lb.	water soluble packet	12	7
chlorantraniliprole MoA Group 28				
DUPONT CORAGEN	1.67 lb./gal.	suspension concentrate	4	0
DUPONT PREVATHON	0.43 lb./gal.	suspension concentrate	4	0

*MoA = Mode of Action classification from the Insecticide Resistance Action Committee (www.irac-online.org).

Table 3. Insecticides Labeled for Use on Alfalfa (cont.)

Insecticide and Trade Name	A.I./ Formulated Product	Formulation	Restricted Entry Interval (hr)	Minimum Days from Last Application to Harvest (h) or Grazing (g)
chlorpyrifos MoA Group 1B				
LORSBAN 4E (Restricted Use)	4 lb./gal.	emulsifiable concentrate	24	7 (0.5 pt./A) 14 (1 pt./A) 21 (>1 pt./A)
LORSBAN ADVANCED (Restricted Use)	3.7 lb./gal.	water emulsion	24	Same as above
GOVERN (Restricted Use)	4 lb./gal.	emulsifiable concentrate	24	Same as above
HATCHET (Restricted Use)	4 lb./gal.	emulsifiable concentrate	24	Same as above
CHLORPYRIFOS 4E AG (Restricted Use)	4 lb./gal.	emulsifiable concentrate	24	Same as above
NUFOS 4E (Restricted Use)	4 lb./gal.	emulsifiable concentrate	24	Same as above
VULCAN (Restricted Use)	3.76 lb./gal.	emulsifiable concentrate	24	Same as above
WARHAWK (Restricted Use)	4 lb./gal.	emulsifiable concentrate	24	Same as above
WHIRLWIND (Restricted Use)	4 lb./gal.	emulsifiable concentrate	24	Same as above
YUMA 4E (Restricted Use)	4 lb./gal.	emulsifiable concentrate	24	Same as above
LORSBAN 75WG	12 oz./lb.	water dispersable granule	24	7 (0.33 lb./A) 14 (0.67 lb./A) 21 (>0.67 lb./A)
LORSBAN 15G or 15G SMART BOX	2.4 oz./lb.	granular	24	21
SAURUS	2.4 oz./lb.	granular	24	21
chlorpyrifos + gamma-cyhalothrin MoA Group 1B + MoA Group 3A				
COBALT (Restricted Use)	2.5 lb./gal. + 0.045 lb./gal	emulsifiable concentrate	24	7 (≤13 fl.oz./A) 14 (13-26 fl.oz./A) 21 (>26 fl.oz./A)
chlorpyrifos + lambda-cyhalothrin MoA Group 1B + MoA Group 3A				
BOLTON (Restricted Use)	2.5 lb./gal. + 0.083 lb./gal.	emulsifiable concentrate	24	7 (5-9 fl.oz./A) 14 (9-18 fl.oz./A) 21 (>18 fl.oz./A)
COBALT ADVANCED (Restricted Use)	2.5 lb./gal. + 0.129 lb./gal.	emulsifiable concentrate	24	7 (6-13 fl.oz./A) 14 (13-26 fl.oz./A) 21 (>26 fl.oz./A)
cyfluthrin MoA Group 3A				
RENOUNCE 20WP (Restricted Use)	3.2 oz./lb.	wettable powder	12	7
TOMBSTONE (Restricted Use)	2 lb./gal.	emulsifiable concentrate	12	7
TOMBSTONE HELIOS	2 lb./gal.	emulsifiable concentrate	12	7
dimethoate MoA Group 1B				
DIMETHOATE 4E	4 lb./gal.	emulsifiable concentrate	48	10
DIMATE 4E	4 lb./gal.	emulsifiable concentrate	48	10
DIMETHOATE 400	4 lb./gal.	emulsifiable concentrate	48	10
DIMETHOATE 4EC	4 lb./gal.	emulsifiable concentrate	48	10

Table 3. Insecticides Labeled for Use on Alfalfa (cont.)

Insecticide and Trade Name	A.I./ Formulated Product	Formulation	Restricted Entry Interval (hr)	Minimum Days from Last Application to Harvest (h) or Grazing (g)
flubendiamide				
BELT SC	4 lb./gal.	suspension concentrate	12	0
gamma-cyhalothrin MoA Group 3A				
DECLARE (Restricted Use)	1.25 lb./gal.	microencapsulated suspension	24	7 (h), 1 (g)
indoxacarb MoA Group 22A				
STEWARD EC	1.25 lb./gal.	emulsifiable concentrate	12	7
lambda-cyhalothrin MoA Group 3A				
GRIZZLY Z INSECTICIDE (Restricted Use)	1 lb./gal.	emulsifiable concentrate	24	7 (h), 1 (g)
KARATE with ZEON TECHNOLOGY (Restricted Use)	2.08 lb./gal.	capsule suspension	24	7 (h), 1 (g)
LAMBDA-CY, AG, EC, 1EC (Restricted Use)	1 lb./gal.	emulsifiable concentrate	24	7 (h), 1 (g)
LAMBDA-CYHALOTHRIN 1EC (Restricted Use)	1 lb./gal.	capsule suspension	24	7 (h), 1 (g)
LAMBDASTAR (Restricted Use)	1 lb./gal.	emulsifiable concentrate	24	7 (h), 1 (g)
LAMBDASTAR 1CS (Restricted Use)	1 lb./gal.	emulsifiable concentrate	24	7 (h), 1 (g)
LAMBDASTAR PLUS (Restricted Use)	2 lb./gal.	capsule suspension	24	7 (h), 1 (g)
LAMBDA-T (Restricted Use)	1 lb./gal.	capsule suspension	24	7 (h), 1 (g)
LAMCAP (Restricted Use)	1 lb./gal.	capsule suspension	24	7 (h), 1 (g)
PARADIGM INSECTICIDE (Restricted Use)	1 lb./gal.	capsule suspension	24	7 (h), 1 (g)
PROVINCE INSECTICIDE (Restricted Use)	1 lb./gal.	capsule suspension	24	7 (h), 1 (g)
SILENCER (Restricted Use)	1 lb./gal.	emulsifiable concentrate	24	7 (h), 1 (g)
lambda-cyhalothrin + chlorantraniliprole MoA Group 3A + MOA Group 28				
BESIEGE (Restricted Use)	0.42 + 0.83 lb./gal.	water suspension	24	7 (h), 1 (g)
malathion MoA Group 1B				
MALATHION 5, others	5 lb./gal.	emulsifiable concentrate	12	0
MALATHION 8, others	8 lb./gal.	emulsifiable concentrate	12	0 (< 2 pt.), 7 (2 pt. rate)
MALATHION 57EC	5 lb./gal.	emulsifiable concentrate	12	0
FYFANON	5 lb./gal.	emulsifiable concentrate	12	0
FYFANON ULV AG	9.9 lb./gal.	emulsifiable concentrate	12	0

Table 3. Insecticides Labeled for Use on Alfalfa (cont.)

Insecticide and Trade Name	A.I./ Formulated Product	Formulation	Restricted Entry Interval (hr)	Minimum Days from Last Application to Harvest (h) or Grazing (g)
methomyl MoA Group 1A				
LANNATE LV (Restricted Use)	2.4 lb./gal.	water soluble liquid	48	7
LANNATE SP (Restricted Use)	14.4 oz./lb.	water soluble bags	48	7
NUDRIN LV (Restricted Use)	2.4 lb./gal.	water soluble liquid	48	7
NUDRIN SP (Restricted Use)	14.4 oz./lb.	water soluble packet	48	7
methoxyfenozide MoA Group 18				
INTREPID 2F	2 lb./gal.	liquid	4	7 (h), 0 (g)
permethrin MoA Group 3A				
AMBUSH 25 WP (Restricted Use)	4 oz./lb.	wettable powder	12	0 (≤ 0.1 lb.a.i./A) 14 (> 0.1 lb.a.i./A)
ARCTIC 3.2EC (Restricted Use)	3.2 lb./gal.	emulsifiable concentrate	12	Same as above
PERMASTAR AG	3.2 lb./gal.	emulsifiable concentrate	12	Same as above
PERMETHRIN (Restricted Use)	3.2 lb./gal.	emulsifiable concentrate	12	Same as above
PERMETHRIN 3.2EC, others (Restricted Use)	3.2 lb./gal.	emulsifiable concentrate	12	Same as above
PERM-UP 3.2EC (Restricted Use)	3.2 lb./gal.	emulsifiable concentrate	12	Same as above
POUNCE 25 WP (Restricted Use)	4 oz./lb.	wettable powder	12	Same as above
phosmet MoA Group 1B				
IMIDAN 70-W	11.2 oz./lb.	water soluble bag	120	7
s-methoprene MoA Group 7A				
EXTINGUISH PROFESSIONAL FIRE ANT BAIT	0.08 oz./lb.	bait	4	0
spinosad MoA Group 5				
ENTRUST	12.8 oz./lb.	wettable powder	4	3 (hay, fodder) 0 (grazing)
ENTRUST SC	2 lb./gal.	soluble concentrate	4	3 (hay, fodder) 0 (grazing)
zeta-cypermethrin MoA Group 3A				
MUSTANG MAXX INSECTICIDE (Restricted Use)	0.8 lb./gal.	emulsifiable concentrate	12	3 (h,g) 7 (seed)
RESPECT (Restricted Use)	0.8 lb./gal.	emulsifiable concentrate	12	3 (h,g) 7 (seed)

Insect Pest Management section prepared by Kathy L. Flanders, Extension Entomologist, Professor, Department of Entomology and Plant Pathology, Auburn University.

WEED CONTROL

Table 4. Alfalfa Weed Control

Herbicide Trade Name (Rate/Acre Broadcast)	Herbicide Common Name (Active Herbicide/Acre)	Comments
	PREPLANT INCORPORATED	
BALAN 60DF (2 lb.)	benefin (1.2 lb.)	Controls many annual grasses and small-seeded broadleaf weeds such as pigweed and lambsquarter. Apply just prior to planting and incorporate thoroughly into the soil 2 to 3 inches deep within 8 hours of application. Usually less injurious on coarse soils.
EPTAM 7E (3.5 pt.)	EPTC (3 lb.)	Controls many annual grasses and small-seeded broadleaf weeds and suppresses nutsedge. Apply just prior to planting and incorporate 3 inches deep immediately after application (within 30 minutes). Some temporary injury to alfalfa seedlings should be expected if conditions for germination and growth are not optimum. Alfalfa is sensitive to soil residues of atrazine. **DO NOT** use EPTAM on alfalfa if atrazine was applied within the previous 12 months.
	POSTEMERGENCE (SEEDLING ALFALFA)	
BUTYRAC 200 2,4-DB 200 (1-3 qt.) or 2,4-DB 175 (4.33-6.5 pt.)	2,4-DB (0.5-1.5 lb.) (0.94-1.42 lb.)	Controls many annual and some perennial broadleaf weeds. Does not control chickweed. Apply after alfalfa has three or more true leaves. Apply when weeds are no more than 3 inches tall and when temperature is 60°F or above. **DO NOT** graze seedling alfalfa or cut for hay within 60 days of application.
KERB 3.3SC (1.25-2 pt.)	pronamide (0.5-0.82 lb.)	Controls chickweed, annual grasses, and other winter annuals. Apply to fall-seeded alfalfa when temperatures are less than 55°F after seedlings are beyond the first true leaf stage. **DO NOT** graze or harvest for forage within 120 days after application. Kerb is a **RESTRICTED USE** pesticide.
POAST 1.5 (1-1.5 pt.) or POAST PLUS 1.0 (1.5-2.25 pt.) + Crop Oil Concentrate (2 pt.)	sethoxydim (0.19-0.28 lb.) + crop oil concentrate	Apply over-the-top of alfalfa for control of annual and perennial grasses. Annual grasses should be treated when they are 4 to 8 inches tall except for crabgrass and goosegrass which should be treated before reaching 4 inches. Johnsongrass should be 15 to 20 inches for Poast application. Use the low rate for annual grass control and the high rate for johnsongrass control. A second application may be necessary if regrowth of perennial grasses occurs. Use a minimum of 10 gallons of spray mix per acre and 40-psi nozzle pressure to ensure thorough spray coverage. **DO NOT** apply with any other pesticide. **DO NOT** graze treated areas within 7 days of treatment and **DO NOT** harvest for hay within 14 days of treatment. **DO NOT** use more than 6.5 pints of Poast or 9.75 pints of Poast Plus per acre per season. Poast does not control sedges (nutgrass).
PROWL H_2O (1.1-2.1 pt.) [3.8 lb./gal.]	pendimethalin (0.5-1 lb.)	Apply to seedling alfalfa before annual weed emergence and after alfalfa has developed two trifoliate leaves. Application should be made before alfalfa exceeds 6 inches in height. **DO NOT** cut for hay or forage for 28 days after application. Provides good to excellent preemergence control of annual grasses and some annual broadleaf weeds.
PURSUIT 2EC (3-6 oz.) + Crop Oil Concentrate (1.25 gal./100 gal. spray mix) or Non-ionic Surfactant (2 pt./100 gal. spray mix)	imazethapyr (0.047-0.094 lb.) + crop oil concentrate or non-ionic surfactant	Apply when seedling alfalfa is in the second trifoliate leaf stage or larger when weeds are 1 to 3 inches tall. There may be temporary discoloration of seedling alfalfa. Add liquid fertilizer (28% N, 32% N, or 10-34-0) at 1.25 to 2.5 gallons per 100 gallons of spray mix or spray grade ammonium sulfate (AMS) at 12 to 16 pounds per 100 gallons of spray solution. **DO NOT** feed, graze, or harvest hay for 30 days after application. **DO NOT** apply more than 6 ounces of Pursuit per acre per year.

Table 4. Alfalfa Weed Control (cont.)

Herbicide Trade Name (Rate/Acre Broadcast)	Herbicide Common Name (Active Herbicide/Acre)	Comments
POSTEMERGENCE (SEEDLING ALFALFA) (cont.)		
RAPTOR (4-6 fl.oz.) [1 lb./gal.] + Non-ionic Surfactant (2 pt./100 gal. spray mix) or Crop Oil Concentrate (1 gal./100 gal. spray mix)	imazamox (0.031-0.047 lb.) + non-ionic surfactant or crop oil concentrate	Apply when seedling alfalfa is in the second trifoliate leaf stage or larger and when weeds are 1 to 3 inches tall. A temporary growth reduction may occur after application. A maximum total of 6 fluid ounces per acre may be applied per season. Always add a non-ionic surfactant or crop oil concentrate to the spray mix.
ROUNDUP WEATHERMAX (22-44 fl.oz.) [5.5 lb./gal.]	glyphosate (0.95-1.9 lb.)	**USE ONLY ON ALFALFA VARIETIES DESIGNATED AS CONTAINING A ROUNDUP READY (RR) GENE.** Apply from alfalfa emergence up to 5 days before cutting hay. May be applied at any growth stage of alfalfa. Due to alfalfa biology and breeding constraints, up to 10 percent of seedlings may not contain the Roundup Ready gene and will be killed by glyphosate. To eliminate undesirable stand gaps during seedling establishment, apply Roundup Weathermax at the low rate at or before the third- to fourth-trifoliate leaf stage of alfalfa. Sequential applications may be made as needed (allow a minimum of 7 days between applications), but do not exceed 4.1 quarts per acre per year. Wait 5 days after last application before grazing or harvesting for hay. See additional glyphosate statements under the ESTABLISHED ALFALFA heading.
SELECT 2EC ARROW (6-16 oz.) or SELECT MAX 0.97E (9-32 oz.)	clethodim (0.09-0.25 lb.) (0.07-0.24 lb.)	Apply over-the-top of seedling alfalfa to control many actively growing annual grasses. **DO NOT** apply within 15 days of grazing, feeding, or harvesting for hay. **DO NOT** plant rotational crops within 30 days of application. **DO NOT** apply 2,4-DB as a tank mix with Select unless a 60-day harvest restriction can be observed. Always add a crop oil concentrate (1 gallon per 100 gallons spray mix) to Arrow or Select 2EC spray. For Select Max, add either a crop oil concentrate or a non-ionic surfactant (1 quart per 100 gallons of Select Max spray mix) to spray mix. See label for addition of AMS for perennial grass conrol.
PREEMERGENCE (ESTABLISHED ALFALFA		
PROWL H_2O (1.1-4.2 qt.) [3.8 lb./gal.]	pendimethalin (1.05-4 lb.)	In established alfalfa (defined as alfalfa that was planted in the fall or spring and has gone through a first cutting/mowing), Prowl may be applied in the fall after last cutting during winter dormancy or in spring before alfalfa regrowth exceeds 6 inches. Provides good to excellent preemergence control of annual grasses and some annual broadleaf weeds. **DO NOT** harvest for hay or graze for 28 days after application of 2.1 quarts per acre or less. If Prowl is applied at more than 2.1 quarts per acre, the grazing and hay harvesting restriction is 50 days.
SOLICAM DF (1.25-2.5 lb.)	norflurazon (1-2 lb.)	Apply to established alfalfa in spring or early fall for the control of annual grasses and broadleaf weeds such as crabgrass, teaweed, and tropic croton. Apply to actively growing alfalfa following hay removal to ensure good spray coverage on soil surface. **DO NOT** apply to seedling alfalfa earlier than 5 months after emergence. **DO NOT** apply within 28 days of harvest. Use low rate on sandy-textured soils.

Table 4. Alfalfa Weed Control (cont.)

Herbicide Trade Name (Rate/Acre Broadcast)	Herbicide Common Name (Active Herbicide/Acre)	Comments
POSTEMERGENCE (ESTABLISHED ALFALFA)		
BUTYRAC 200 2,4-DB (2-3 qt.) or 2,4-DB 175 (4.5-6.5 pt.)	2,4-DB (1-1.5 lb.) (1-1.42 lb.)	Controls many annual and some perennial broadleaf weeds. Does not control chickweed. Apply when weeds are no more than 3 inches tall and when temperature is 60°F or above. **DO NOT** graze established alfalfa or hay from treated established alfalfa to livestock within 30 days of application.
FIRESTORM 3 (0.7 pt.) or GRAMOXONE INTEON 2 GRAMOXONE SL (1 pt.) + Non-ionic Surfactant (1-2 pt./100 gal. spray mix)	paraquat (0.25 lb.) (0.25 lb.) + non-ionic surfactant	Apply to established alfalfa stands at least 1 year old immediately after the alfalfa has been removed for hay or silage. **DO NOT** treat later than 5 days after cutting and **DO NOT** graze or cut within 30 days of application. Apply to small weeds using a minimum of 10 gallons of water per acre. Paraquat is a **RESTRICTED USE** pesticide.
KERB 3.3SC (1.25-2.5 pt.)	pronamide (0.5-1 lb.)	Controls chickweed, annual grasses, and other winter annuals. Make application in fall after last cutting when day temperatures are less than 55°F. **DO NOT** graze or harvest for forage within 120 days after application. **DO NOT** tank-mix with other herbicides. Kerb is a **RESTRICTED USE** pesticide.
POAST 1.5 (1-1.5 pt.) or POAST PLUS 1.0 (1.5-2.25 pt.) + Crop Oil Concentrate (2 pt.)	sethoxydim (0.19-0.28 lb.) + crop oil concentrate	Apply over-the-top of alfalfa for control of annual and perennial grasses. Annual grasses should be treated when they are 4 to 8 inches tall except for crabgrass and goosegrass which should be treated before reaching 4 inches. Johnsongrass should be 15 to 20 inches for Poast application. Use the low rate for annual grass control and the high rate for johnsongrass control. A second application may be necessary if regrowth of perennial grasses occurs. Use a minimum of 10 gallons of spray mix per acre and 40-psi nozzle pressure to ensure thorough spray coverage. **DO NOT** apply with any other pesticide. **DO NOT** graze treated areas within 7 days of treatment and **DO NOT** harvest for hay within 14 days of treatment. **DO NOT** use more than 6.5 pints of Poast or 9.75 pints of Poast Plus per acre per season. Poast does not control sedges (nutgrass).
PURSUIT 2EC (3-6 fl.oz.) + Crop Oil Concentrate (1.25 gal./100 gal. spray mix) or Non-ionic Surfactant (2 pt./100 gal. spray mix)	imazethapyr (0.047-0.094 lb.) + crop oil concentrate or non-ionic surfactant	Apply in the fall or spring to dormant or semi-dormant (less than 3 inches new growth) established alfalfa or between cuttings. Spray must contact target weeds. **DO NOT** apply more than 6 fluid ounces per acre per year. **DO NOT** replant alfalfa for 4 months after last application. See label for other recropping time intervals. **DO NOT** feed, graze, or harvest alfalfa for 30 days after application.
RAPTOR (4-6 fl.oz.) [1 lb./gal.] + Non-ionic Surfactant (2 pt./100 gal. spray mix) or Crop Oil Concentrate (1 gal./100 gal. spray mix)	imazamox (0.031-0.047 lb.) + non-ionic surfactant or crop oil concentrate	Apply to established alfalfa in the fall or in the spring to dormant or semi-dormant alfalfa or between cuttings. Spring treatment should be made when alfalfa has less than 3 inches of new growth. Apply when weeds are 1 to 3 inches tall. A temporary growth reduction may occur following application. **DO NOT** feed, graze, or harvest alfalfa for 20 days after application. **DO NOT** apply more than 6 fluid ounces of Raptor per season. Always add a non-ionic surfactant or crop oil concentrate to the spray mix.

Table 4. Alfalfa Weed Control (cont.)

Herbicide Trade Name (Rate/Acre Broadcast)	Herbicide Common Name (Active Herbicide/Acre)	Comments
POSTEMERGENCE (ESTABLISHED ALFALFA) (cont.)		
ROUNDUP WEATHERMAX (44 fl.oz.) [5.5 lb./gal.]	glyphosate (1.9 lb.)	**USE ONLY ON ALFALFA VARIETIES DESIGNATED AS CONTAINING A ROUNDUP READY (RR) GENE.** May be applied at any alfalfa growth stage. Sequential applications may be made at least 7 days apart. Each application should not exceed 44 fluid ounces per acre and total application should not exceed 4.1 quarts per acre per year. Wait 5 days after last application before grazing or cutting for hay. Glyphosate will control most weed species, including dodder. Weeds that are not effectively controlled by a single application of glyphosate include hemp sesbania, bermudagrass, yellow nutsedge, tropical spiderwort, greenbrier species, cutleaf eveningprimrose, Carolina geranium, maypop passionflower, and trumpetcreeper. Repeat applications or other appropriate herbicides will be needed to control this group of weeds. Not all formulations of glyphosate are labeled for this use. See specific product label for registered uses and the need for addition of a non-ionic surfactant.
SELECT 2EC ARROW (10-16 oz.) or SELECT MAX 0.97E (12-32 oz.)	clethodim (0.16-0.25 lb.) (0.09-0.24 lb.)	Apply over-the-top of established alfalfa to control actively growing annual grasses. Can be tank mixed with 2,4-DB to broaden spectrum of weeds controlled. See additional remarks for Select under Seedling Alfalfa section. **DO NOT** graze or harvest for hay for 15 days after treatment. Always add a crop oil concentrate (1 gallon per 100 gallons spray mix) to Arrow or Select 2EC spray. For Select Max, add either a crop oil concentrate or a non-ionic surfactant (1 quart per 100 gallons of Select Max spray mix) to spray mix.

Weed Control section prepared by John W. Everest, Professor Emeritus, Department of Crop, Soil and Environmental Sciences, Auburn University.

FOR MORE INFORMATION on pesticides, pesticide safety, or submitting samples for analysis, see the following publications in the IPM series:
IPM 1293, “Safety.” Safety contact information; worker protection standards; the safe use, handling, and storage of pesticides
IPM 1294, “Submitting Samples.” Procedures for submitting samples for diagnosis, analysis, and identification
IPM 1295, “General Pesticide Information.” Federal and state restricted use pesticide lists; pesticides and water quality
IPM 1317, “Appendix.” Pesticide guidelines for agronomic crops, including preharvest intervals; rain-free requirements; grazing restrictions; crop rotation guidelines; and the names, classifications, and toxicities of pesticides.

2014 IPM-0978

For more information, contact your county Extension office. Visit www.aces.edu/counties or look in your telephone directory under your county’s name to find contact information.

Use pesticides **only** according to the directions on the label. Follow all directions, precautions, and restrictions that are listed. Do not use pesticides on plants that are not listed on the label

The pesticide rates in this publication are recommended **only** if they are registered with the Environmental Protection Agency or the Alabama Department of Agriculture and Industries. If a registration is changed or canceled, the rate listed here is no longer recommended. Before you apply **any** pesticide, check with your county Extension agent for the latest information.

Trade names are used **only** to give specific information. The Alabama Cooperative Extension System does not endorse or guarantee any product and does not recommend one product instead of another that might be similar.

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ALABAMA A&M & AUBURN UNIVERSITIES

IPM-0428

Corn

IPM

Insect, Disease, Nematode, and Weed Control Recommendations for 2015

INSECT PEST MANAGEMENT

There are more than twenty common insect pests of field corn. The potential for at least one of them to cause problems makes it worthwhile to scout cornfields for insect damage to determine if control tactics are needed.

Scout cornfields weekly from seedling emergence until the corn is knee-high. Thereafter, scout fields periodically until pretasselling, at tasselling, and during ear formation.

How to Scout Corn for Insect Pests

To scout corn, walk across the field in a zigzag or a "U" pattern. Look for any areas where there has been poor emergence, where the seedlings appear to be unhealthy (yellowed, stunted, or deformed plants), where there is evidence of insect chewing, or where plants appear to have been cut off at ground level. Look for patterns in the field. For example, perhaps poor emergence occurs in a regular pattern, such as in low spots where growing conditions are poor, at the end of each row, or in every eighth row. Maybe the damage occurs only on the edges of the field.

Insect damage tends to occur in patches. Use a shovel or trowel to dig in the affected area and at the margins of the patch. Look for the insects themselves or for damaged plants. When the corn is small, insects cause injury by eating out seeds, pruning roots, and feeding on the growing point, causing plant death or deformation. As the plants grow, look for insects and insect damage in the leaf whorl, at the base of the leaf sheath, on the tassels, silks, and the developing ear, and in the stalk. "Identifying Caterpillars in Field, Forage, and Horticultural Crops," ANR-1121, at http://www.aces.edu/go/525 may be useful in identifying insect pests.

Insects to Look for

Corn insect pests can be divided into five categories related to the corn plant's growth stage:

- Insects that feed on seedlings, reducing plant stand and health in the first few weeks;
- Insects that feed in the whorl;
- Insects that feed on tassels and silks, interfering with pollination;
- Insects that feed on ears and individual kernels; and
- Insects that tunnel in the stalk, causing lodging and ear loss.

Insects That Feed on Seedlings

Seedlings are the most easily damaged corn plant stage. Protecting them from insect feeding is important because the farmer must achieve an adequate plant population during this stage to realize full yield potential. When damage has been caused by soil insects such as billbugs, wireworms, sugarcane beetles, or white grubs, there is little that can be done in the current year. For fields with a history of damage by these insects, plant seed treated with higher rates of insecticide seed treatment (Table 2) or apply a broad spectrum at-planting insecticide (Table 3). See *When to Use At-Planting Treatments* further in this discussion.

Billbugs are robust, reddish-brown or black weevils (beetles) with long, curved snouts. They are about 0.5 inch long and often covered with mud. They attack corn at the base of the stalk or just below the soil's surface. Billbugs feeding on unfurled leaves result in rows of circular to elliptical holes across the leaf when it expands. Billbugs are more numerous in no-till systems. They usually cause economic damage in corn following corn (not rotated), corn in fields adjacent to the past year's corn, or in fields seriously infested with nutsedges and crabgrass. Rotation is an effective management tool for billbugs because the insect has only one generation per year, moves by crawling, and has a limited host range. Rotation is particularly effective when large blocks are rotated, maximizing isolation. In no-till systems, subsoiling can help enhance the vigor of corn and increase tolerance for billbug infestations. Good fertilization and irrigation can increase the plant's tolerance to billbugs.

Wireworms are yellow-brown, wire-like beetle larvae. Their bodies are hard and feel slick. Wireworms vary in size from 0.5 to 2 inches long. They live in the larval stage for several years, depending on the species, and grow up to become click beetles. Wireworms prune roots and burrow in the base of seedlings, causing stunting or death of plants. They also will feed on germinating seed. Wireworms are more common in certain conservation tillage situations.

Wireworms are likely to occur where corn has been double cropped after grain, pasture, or clover, or when it has been planted after weedy fallow. Wireworms can inhabit the soil to a depth of up to 5 feet, and they are very difficult to find. They may be even worse in corn planted early in cold soil.

White grubs are occasional pests of corn. Plant damage is caused by the grubs' feeding on the roots of the plant. White grubs are the immature feeding stage (larva) of May beetles, Japanese beetles, masked chafers, and other scarab beetles. Most white grubs in Alabama complete their development within a year.

Green June beetle grubs may appear in fields where organic fertilizer, such as broiler litter, is used. See ANR-0991, "Biology and Control of Green June Beetle," http://www.aces.edu/go/526. In September, scout fields where broiler litter has been used and control grubworms in the fall to prevent damage to corn seedlings.

Sugarcane beetle adults are black and about 0.5 inch long; they gouge holes in stalks just below the ground's surface. Infestations are worse in reduced tillage systems following grass, fallow, or small grains. ***Corn planted into a field that has been in pasture for several years is at risk regardless of tillage practices.***

Sugarcane beetle adults are active at the time corn is planted. Certain seed treatments and at-planting insecticides may be useful in controlling this beetle. Foliar sprays are unlikely to provide control of the pest because it tends to feed and live just below the soil surface. Do not replant corn into an infested area while adult beetles are still present. In fields prone to sugarcane beetle, an additional at-planting application of a broad-spectrum insecticide is recommended. An in-furrow application is the most effective way to apply the supplemental insecticide.

Cutworms can actually cut small corn plants off at the base. Cutworm damage is largely confined to plants younger than the eight-leaf stage. Damage is most likely to occur when seedlings are growing slowly because of adverse environmental conditions. Cutworms can usually be monitored by the damage they do. "Window-pane" feeding is a sign of young cutworms. Larger worms cut plants off near the soil line. If cut plants are found, check the top 2 inches of soil extending 4 inches from both sides of the row where the plants have been cut. Cutworms normally spend the day just under the soil surface or under debris close to their feeding sites. There are several different kinds of cutworms. The mature larva is a plump, smooth, greasy-looking, dark gray, spotted or striped caterpillar. Consider control measures for cutworms if more than 10 percent of seedlings are cut and the worms are present.

Cutworms tend to be associated with no-till corn and/or with fields where there was a substantial cover of green weeds in the previous year or just prior to planting. Burn down cover crops and/or weeds four weeks before planting to reduce problems with cutworms. Otherwise, apply a broadcast spray at planting of an inexpensive pyrethroid that is labeled for use in corn to control cutworms in these situations.

Chinch bugs overwinter on the edges of fields in wild grasses like big bluestem and broom sedge. Weather conditions in the winter can cause many chinch bugs to die on the overwintering hosts. In spring, they move into transition hosts like wheat. Later, they may invade corn. Invasion can occur at any time, but corn is most susceptible when it is less than a foot tall.

Chinch bugs congregate at the base of plants and thrive in cracks and crevices that develop as the soil dries. Therefore, chinch bug injury is most common in Black Belt soils that are prone to cracking. They suck sap from roots, leaves, and stems of plants, causing stunting, deformation, wilting, and plant death. The plants may be purpled at the base. Chinch bug wounds may be invaded by soft rots, causing further damage. Plants with severely damaged roots may lodge.

The adult chinch bug is black with white wing covers. It is about 0.2 inch long. Immature chinch bugs are reddish brown with a white band running horizontally around their bodies. They can be hard to find because they hide in the leaf sheaths, under residue, or in cracks in the soil.

A plant damaged by chinch bugs is often brittle and will break off if it is moved from side to side. Vigorously growing corn can often outgrow potentially damaging insect situations. However, stresses such as cold temperatures, too much or too little water, and herbicide injury will cause the corn to grow less vigorously.

Chinch bugs almost always occur in patches, starting near the edges of a field. They usually congregate on isolated plants and then move outward. Chinch bugs tend to be worse in fields with the most surface residue. Therefore, corn in fields with reduced tillage or with grassy weeds is prone to chinch bug damage.

If infestations are detected early enough, a corrective insecticide treatment may be applied. At-planting insecticides or seed treatments can protect young plants from chinch bugs, up to about 25 days after emergence (V1-V3). Otherwise, use a directed spray of a foliar insecticide. Treat for chinch bugs when three to five bugs per plant are found in 20 percent of the corn in a field and when the plants are under water stress or are growing slowly due to herbicide stress or cool temperatures. It is important to aim the insecticide at the base of the plant where the bugs congregate. If the chinch bugs are still migrating into a field, a second application of insecticide may be necessary.

Flea beetles are shiny black bugs that jump instantly when they are disturbed. Look for their characteristic feeding "scratch marks" on the leaves. Flea beetles seldom cause economic damage to cornfields in Alabama. Plants are more susceptible when temperatures are cold, causing seedling growth to slow down. However, the growing point stays below ground level until about the time that the fifth leaf emerges, so plants are usually able to recover from flea beetle injury. Consider treatment only when 75 percent of plants are infested or when more than five beetles per plant are found. Beetles are more numerous during cold springs following mild winters.

Thrips are tiny, fast-crawling, yellow or black insects found in the young plant. They cause "sandblasting" on the leaves. The leaf mottling caused by thrips looks silvery in severely damaged plants. Thrips seldom cause economic damage to corn. Consider treatment only if more than 80 percent of the leaf area is affected or if the plants are severely deformed.

Leafhoppers are small, wedge-shaped, green or brownish bugs that suck sap from buds and leaves of corn. Damage by this insect is seldom great enough to justify control. However, two leafhopper species are responsible for spreading corn stunt virus disease. This disease can cause severe stunting and a subsequent reduction in yield. Try to plant virus-resistant corn to minimize the impact of this virus. If corn that is susceptible to corn stunt virus is to be planted, an at-planting insecticide or seed treatment will help control the leafhopper vectors and, hence, the disease.

Southern corn rootworms make a circular feeding tunnel through the young seedling, causing severe damage if the growing point is eaten. Damage from this pest is most likely when a legume cover crop has been planted. If such a cover crop is planted, be sure to kill it with herbicides four weeks before planting. Southern corn rootworms overwinter as adults. Eggs are laid in the spring and the larvae attack seedling corn.

Stink bugs are major pests of young corn, particularly in South Alabama. At least three species—southern green stink bug, brown stink bug, and green stink bug—occur in Alabama. Brown marmorated stink bug, an invasive species, has recently been found in Alabama. In 2014, higher than normal stink bug damage was found on corn kernels from field edges in the Tennessee Valley. This may have been

due to brown marmorated stink bug. The brown stink bug is generally hardest to control with insecticides. Stink bugs overwinter as adults under plant residue, tree bark, or culverts in drainage areas. At least two generations occur each year. Parasites and predators, including fire ants, contribute to stink bug control. Certain conditions predispose a cornfield to stink bug problems, including excessive weeds in winter or spring prior to planting, double cropping, and conservation tillage. Corn planted near wheat fields may also be more likely to have problems with stink bugs. Stink bugs have a wide host range, including wheat, corn, cotton, and soybeans. Stink bugs will move from one field to another during the season. Plants on field borders may be more severely affected than those further into the field. Stink bug infestations are very clumped and are hard to scout.

Stink bugs have sucking mouthparts, which they insert into the plant in order to feed. On young corn plants, stink bugs feed at the base of the plant and injure the growing point. Extreme feeding leads to the death of plants.

If the growing point is badly damaged, the plant may develop multiple stems. Moderate feeding results in a buggy whip symptom, where one side of the plant grows faster than the other and the tips of the leaves are entangled in the whorl. If more than 10 percent of plants show a buggy whip symptom, or if there are more than one or two stink bugs per plant, an insecticide treatment may be justified. As the corn gets older, stink bugs can damage the developing ears. See the stink bug section later in this publication for information on control at later corn growth stages..

Insects That Feed in the Whorl

Fall armyworms, corn earworms, European corn borers, southwestern corn borers, cereal leaf beetle adults, and grasshoppers can feed on corn leaves, particularly in the whorl stage. Use Table 1 to determine if the potential amount of damage from these leaf-feeding insects justifies using a corrective treatment.

Fall armyworms, corn earworms, southwestern corn borers, and European corn borers cause damage in more than one category. They are general feeders that feed in the whorl and attack the ear as well. Also, corn borers can cause plant lodging by boring into the cornstalks. Each of these insects has alternate hosts and each one has several generations per year. It may be economically feasible to use an insecticide to control these pests if they are causing excessive damage in the whorl stage. See Bt corn section and Table 3 for a discussion of this method for controlling whorl-feeding caterpillars. See *Insects That Attack the Stalk* for further discussion of corn borers.

Grasshopper outbreaks are likely to occur during a drought and for 1 to 2 years following the drought. There are numerous grasshopper species that attack corn. They overwinter as eggs in the soil. Best control is achieved when grasshoppers are still young. It is very difficult to kill nearly mature grasshoppers of most species and almost impossible to kill lubber grasshoppers (large black grasshoppers with yellow markings). Infestation of grasshoppers is highest in no-tillage situations, along field margins.

Cereal leaf beetles are pests of wheat, oats, and other small grains. Adults emerge as the grain crop is drying in May and migrate to other areas, including cornfields, in search of food. Cereal leaf beetles make long, narrow feeding scars between leaf veins. Leaf feeding by these beetles is usually cosmetic. They do not stay very long in cornfields. Therefore, damage is a single, short-term event that rapidly developing corn plants usually outgrow.

Table 1. Yield Loss Potential in Bushels per Acre

Stage of Growth	Percent Leaf Area Destroyed				
	20	40	60	80	100
7 leaf	0	1	4	6	9
9 leaf	0	2	6	9	13
11 leaf	1	5	9	14	22
13 leaf	1	6	13	22	34
15 leaf	2	9	20	34	51
17 leaf	4	12	27	45	69
Tassel	7	21	42	68	100
Silks Brown	6	18	38	60	90
Blister	5	16	30	50	73
Milk	3	12	24	41	59
Soft Dough	2	8	17	29	41
Dent	0	4	10	17	23

Source: John van Duyn, North Carolina State University.

Insects That Feed on Tassels and Silks

Japanese beetles, corn earworm larvae, corn rootworm adults, and grasshoppers may all clip corn silks. When these insects feed on the silks and clip them off, the result can be incomplete pollination. Silk clipping has to be severe to affect pollination. Therefore, it is very important to determine when silk clipping is occurring relative to the pollination process. Pollination occurs 3 to 8 days after full tasselling, and it takes 12 to 24 hours for a pollen grain to move down the silk. Poor pollination results in ears that are only partially filled, ears that are smaller than normal, and barren stalks. An insecticide treatment to protect the silks may be justified if (1) less than 75 percent of the ears have silks; AND (2) there are five or more rootworm beetles or two or more Japanese beetles on each ear, or there are corn earworm larvae on each ear; AND (3) silks are being clipped to within 0.5 inch of the ear tip.

Corn leaf aphids are small, blue-green, soft-bodied insects with dark blue "tail pipes." They usually colonize the upper leaves and tassels of corn plants. Numerous white cast skins are usually seen on the plant and on the ground around the plant. Aphids excrete a sticky substance that may coat nearby plant parts. Microorganisms use this "honeydew" as a food source, resulting in a blackened condition called "sooty mold." High populations on the tassels and silks can interfere with pollination. Treatment may be justified when there are 50 or more aphids on 50 percent or more of the plants when plants are tasselling.

Insects That Feed on Ears

Stink bugs feed on all plant parts but prefer the high liquid content in developing grain. Ears moderately damaged by stink bugs will typically crook away from the plant stem. Kernels are aborted at and near the feeding site.

Stink bug feeding on young ears, prior to pollination, often results in the destruction of those ears. Best results are obtained if corn is treated while the ear is forming (less than 1 inch long, just before tasseling around the V8-10 growth stage). At that time, two stink bugs per plant can reduce yields by 40 percent.

Therefore, at this stage, treat if 5 percent of plants have stink bugs. At kernel fill, treat if 10 percent of the plants have stink bugs. Continue to protect corn plants from stink bugs through the silking stage. After silking, losses due to stink bugs are usually not as significant. If brown marmorated stink bugs are present, damage will most likely be on the edge of the fields. A perimeter treatment one-boom-width wide may be all that is needed for infestations by this insect.

Corn earworm caterpillars feed on corn ears. Feeding is usually confined to the tip end of the ear. When corn earworms feed on kernels, they open the husks and provide an entry for disease and bird feeding. The female lays her eggs one at a time, usually on the developing silks. Small larvae feed on the silks and then enter the tip of the ear where they will feed on developing kernels. Corn earworm larvae will reach 1.5 inches in length in about 14 to 21 days. Because the larvae are cannibalistic, there will usually be only one earworm larva per ear.

Ear feeding is common in most cornfields, with 60 to 100 percent of the ears having a single caterpillar in years of high populations. Also, secondary ears may be infested. Yield loss in typical field corn, though, is usually not more than 3 percent. Since chemical control requires multiple applications, spraying to reduce ear infestation is seldom economically justified in field corn. Bt corn will reduce ear damage from corn earworms. See Table 3.

Fall armyworm larvae also feed on developing kernels. The caterpillar generally enters the ear from the sides as well as from the tip of the ear. When populations are heavy, it is not unusual to find several worms within a single ear. It is difficult to control the ear-attacking phase of the fall armyworm with insecticides. Certain types of Bt corn (see Table 3) will protect ears from this insect. Early-planted corn is less likely than late-planted corn to be damaged by fall armyworms.

Southwestern and European corn borer larvae (also see below) bore into kernels and cobs. If the corn borer damages the ear shank, the entire ear can fall to the ground. Early-planted, early- maturing corn is recommended in order to escape the heavier pest populations that occur as the weather becomes warmer. Chemical control is effective only when the timing of the application kills the larvae before they enter the ear. See Bt corn section for more information.

Insects That Attack the Stalk

Stalk borers, such as European corn borer and south-western corn borer, are best managed using Bt corn that is active on stalk borers. They tunnel in the stalks, reducing plant vigor and causing stalks to lodge. Refuge requirements prevent the use of this corn on all the acreage. To control stalk borers in the refuge corn, see the list of insecticides that can control stalk borers before they enter the corn plant in Table 6.

European corn borer is only a problem in the northern tier counties in Alabama. Southwestern corn borer is found in the northern half of Alabama.

Overall losses from serious infestation of southwestern corn borers can be considerable (i.e., 25 to 50 percent) if yield potential of the crop is high. They are difficult to manage in non-Bt corn because there are few cultural control options. It is hard to scout for. Insecticide treatments are effective only against small caterpillars before they bore into the stalk. Bt corn for corn borer is the most effective way to manage this pest. See Table 3. In fields where Bt corn for corn borer is not planted, pheromone traps can be used to help time the application of long residual foliar insecticides to prevent stalk borers from tunneling in the stalk.

Insects That Attack the Roots

Corn rootworms (several species). Southern corn rootworm is most likely to be a problem in fields that were weedy before spring planting. Adults are attracted to lay eggs in the weedy areas. Southern corn rootworm overwinters as adults, and the larvae attack corn early in the season, causing the young plants to die.

Western corn rootworms are now found in the northern part of Alabama. They are pests of second-year or longer continuous corn. Western corn rootworm larvae can destroy most of a plant's root system, causing the plant to fall over. The plant may straighten as it recovers, giving it a goosenecked appearance. Western corn rootworm larvae hatch in May and continue to occur through late June. Injury will not appear until mid to late season, if western corn rootworm is the problem.

In summer western corn rootworms lay their eggs in the soil of cornfields. The eggs overwinter and hatch the following May. Because the eggs overwinter in the soil and the larvae feed on corn but not other major crops, this pest can be controlled by rotation with soybeans or some other crop.

Rootworms can be controlled with insecticides. The insecticides must be applied in or incorporated into the soil at planting or shortly thereafter as a cultivation treatment. High rates of seed treatments may also be effective. See Table 2.

Bt corn is available for control of western corn rootworms but not for southern corn rootworms. Several brands of rootworm active Bt corn are available. See Table 3.

The adults of both species—southern corn rootworm and western corn rootworm—can feed on the silks and reduce pollination.

Effects of Weather on Corn Pest Incidence

Cool temperatures delay seed germination and early- season growth. This increases the risk of insect damage because the young corn plants are exposed to a longer feeding period by insects. Fall armyworms, chinch bugs, and lesser cornstalk borers are usually more abundant in dry years.

When to Use At-Planting Treatments

The advent of seed treatments containing clothianidin or thiamethoxam (Table 2) has changed the way we manage early-season insects. However, there is still a place for at-planting insecticides in fields that are at high risk from cutworms or soil insects such as sugarcane beetle. Table 4 lists choices for at-planting soil-applied insecticides.

Cutworms are a threat in conservation or no-till systems. A broadcast spray of an inexpensive pyrethroid labeled on corn is recommended to supplement insecticide seed treatment if weeds are not burned down 4 weeks prior to planting.

A field's history should help determine whether to use an at-planting insecticide or a high rate of insecticide seed treatment. Rotated, conventionally tilled corn has the least problems with early-season insects. Cornfields following pasture, non-rotated corn, and conservation tillage or no-till corn are at the greatest risk from early season soil insects.

Bt Corn for Corn Borers and Other Caterpillar Pests

Corn has been genetically engineered to produce Bt toxins that are effective against caterpillar insects such as European corn borer, Southwestern corn borer, and lesser cornstalk borer. Bt corn can also help protect corn against attack by corn earworm and fall armyworm. It is marketed under various names. See Table 3.

Some of the newer types of Bt corn are more effective against other caterpillars, such as fall armyworm and corn earworm. See Table 3 for more information and refuge requirements.

For more information on the different types of Bt corn and how they have performed in Alabama, see the following publications:

• Performance of Bt Corn in North Alabama in 2010 (revised) at www.aces.edu/timelyinfo/entomology/2011/January/corrected.pdf,

• Performance of Bt Corn in Central and South Alabama in 2010 (revised) at www.aces.edu/timelyinfo/entomology/2011/January/corrected2.pdf, and

• Performance of Bt corn in Alabama in 2011 at www.aces.edu/extcomm/timelyinfo/entomology/2012/February/2011_%20Bt_Corn_timely.pdf

• Performance of Bt field corn in Alabama in 2012 at http://sites.aces.edu/group/timelyinfo/Documents/2012%20Bt%20Corn.pdf

Bt corn cannot be planted on 100 percent of the corn acreage. A certain amount (20 to 50 percent) must be planted in non-Bt corn as a refuge. See Table 3 for more details.

Bt Corn for Rootworms

Corn has been genetically engineered to produce Bt toxins that are effective against the root-feeding larvae of certain beetles called corn rootworms, particularly the western corn rootworm. It is marketed under various trade names. See Table 3.

The genes in this genetically engineered corn are different from those conferring resistance to corn borers and other aboveground caterpillar pests. Sometimes the two types of genes are stacked in a hybrid—like in Herculex Xtra or Genuity VT Triple Pro—in order to give the plant resistance to rootworms and caterpillars such as corn borer.

Western corn rootworm is a pest of continuous corn in the northern half of Alabama. This is where planting a hybrid with a rootworm Bt gene will be most likely to pay off. Bt corn for rootworms is not effective against southern corn rootworm.

When to Plant or Replant Corn

When planting corn, follow the recommended planting dates for your area of the state. Planting date recommendations are available at the Alabama Cooperative Extension System office in your county.

Damage from early-season soil insect pests, cutworms, and armyworms may look drastic. However, if the cutting damage by these insects occurs above the growing point and there is no additional feeding by these insects, the plants should recover.

Recommended plant stands for Alabama are from 26,000 to 28,000 for dryland corn and 32,000 to 36,000 for irrigated corn.

Before replanting corn, consider the time the damage occurs. Oftentimes, insect damage occurs too late to replant. If 50 percent of a stand is lost during the first four weeks after the first recommended planting date in your area, immediate replanting should result in yields of 85 to 90 percent of the original estimates. However, if 50 percent or more of the stand is lost after the fourth week, replanting is not profitable. At this point, more is lost due to the late replanting date than because of the poor stand. However, a 50-percent stand reduction will usually result in severe yield reduction and is not likely to return production costs. Also, weed problems in the thinned stand will likely be severe.

Considerations for Late-Planted Corn

Certain pest insects and pathogens reach high levels in late July and August and may severely infest late-maturing corn. Late-planted corn is vulnerable to attack by the lesser cornstalk borers, fall armyworms, and southwestern and European corn borers. Also, late-planted corn is attractive to adult rootworm beetles and may have excessive silk clipping.

Organic Insecticides That Can be Applied to Field Corn

Organic producers may want to consider the following insecticides, most if not all of which are OMRI approved. Be sure to read the insecticide label to make sure it meets your needs. The following products contain azadirachtin: Azera, Neemix 4.5, and Ecozin Plus. The following products contain *Bacillus thuringiensis*: Biobit HP (subsp. *kurstaki* strain ABTS-351), Dipel DF (subsp. *kurstaki* strain ABTS-351), Javelin WG (subsp. *kurstaki* strain SA-11), Agree WG (subsp. *kurstaki* strain GC-91), and Xentari (subsp. *aizawai* strain ABTS-1857). Pest Out contains cottonseed, clove, and garlic oils. Ecotec contains rosemary and peppermint oils. Entrust and Entrust SC contain spinosad. Other formulations of spinosad can be found. Mycotrol O contains *Beauveria bassiana* strain GHA. Grandevo contains *Chromobacterium subtsugae* strain PRAA4-1. Be sure to check the labels to see if they meet the requirements for your cropping system. Other organic insecticides may be available. PyGanic Crop Protection EC 1.4_{II} and PyGanic Crop Protection EC 5.0_{II} insecticides are OMRI approved and contain natural pyrethrins. Other insecticides contain pyrethrins, but also contain piperonyl butoxide and are not considered organic.

Table 2. Corn Seed Treatments and Their Relative Efficacy for Control of Seedling Insect Pests in Field Corn, 2015

Insecticide		Relative Efficacy of the Seed Treatment[1]											
	Rate	Corn Billbug	White Grubs	Wire-worms	Seedcorn Maggot	Cutworm[2]	Sugar-cane Beetle	Southern Green Stink bug	Brown Stink bug	Chinch Bug	Southern Corn Rootworm[2]	Western Corn Rootworm	Lesser Cornstalk Borer
clothianidin													
PONCHO 250 or ACCELERON [3]	0.25 mg a.i./ kernel	NL	F	G	G	P-F	F	F	NL	G	E	NL	G, NL
PONCHO 500 or ACCELERON with PONCHO VOTiVO 500 [4]	0.50 mg a.i./ kernel	F	E	G	E	P-F	G	G	NL	G-E	E	P, NL	G, NL
PONCHO 1250 or ACCELERON with PONCHO VOTiVO 1250 or PPST+ PONCHO 1250/ VOTiVO	1.25 mg a.i./ kernel	G	E	E	E	F-G	G	G	G, NL	E	E	F-G	E, NL
thiamethoxam													
CRUISER MAXX 250 [3]	0.25 mg a.i./ kernel	NL	F	G	E	P	P	P	NL	F	G-E, NL	NL	G, NL
PPST 250 [6]	0.25 mg a.i./ kernel	NL,F	F	F[7]	F[7]	P	P	P	NL	F	G-E, NL	NL	G, NL
CRUISER MAXX 500 [3] or AVICTA COMPLETE CORN [4]	0.5 mg a.i./ kernel	NL	G	G	E	P	F	F	NL	F	E	NL	G, NL
CRUISER MAXX 1250 [3] or AVICTA COMPLETE CORN [4]	1.25 mg a.i./ kernel	G	E	E	E	F	F	G	NL	G	E	P	E, NL
thiamethoxam + chlorantraniliprole (Rynaxypyr)													
PPST 250 PLUS LUMIVIA [6]	0.25 mg a.i.+0.25 mg a.i./kernel	E	G [7]	G [7]	E	E[7]	P	P	NL	F	G-E, NL	NL	G, NL
imidacloprid													
IMIDA E-AG 5 FST, AXCESS, MACHO 600 ST, NITROSHIELD GAUCHO 600, IMIDACLOPRID 5, ATTENDANT 600	0.60 mg a.i./ kernel [5]	NL	G	G	E	P, NL	P, NL	P, NL	NL	F	G, NL	NL	NL
LATITUDE [5]	3.5 oz./ hundred-weight	NL	F, NL	G	G	NL	NL	NL	NL	F, NL	G, NL	NL	NL
CONCUR [3]	1.5 oz./ 42 lb. seed	NL	F	G	G	NL	NL	NL	NL	F, NL	G, NL	NL	NL

[1] E = highly effective, G = effective, F = inconsistent results, P = not effective, based on trials in the Southeastern U.S.; L = insect is on the label for this product; NL = insect is not on the label for this product. In this case it is best to assume that the product is ineffective against that particular pest, unless there is specific knowledge to the contrary about product efficacy in the Southeast.

[2] In the Southeast, several species of cutworms overwinter as medium to large-sized larvae. They may be capable of cutting considerable numbers of seedlings before they eat a lethal dose of the insecticide. Black cutworm, the cutworm that appears on the label of most of these products, has a different life cycle in which eggs are laid in the spring, so that black cutworm larvae will be small if they have hatched out by the time the corn is planted. Southern corn rootworm larvae are a seedling pest, not a mid-season pest like western corn rootworm larvae.

[3] Product name as marketed includes fungicides.

[4] Product name as marketed includes fungicides and a nematicide. AVICTA COMPLETE CORN contains abamectin; ACCELERON WITH PONCHO VOTiVO contains *Bacillus firmus* I-1582, PPST +PONCHO 1250/VOTiVO contains *B. firmus* I-1589 and a biological growth promoter, Biostacked.

[5] Other rates for this active ingredient are available. See label.

[6] Product name as marketed includes fungicides and a biological growth promoter, Biostacked.

[7] Efficacy determined by commercial seed company data.

Table 3. Bt Corn Products for the Southeastern U.S., 2015

		Amount of Insect Control [1]								
Product Trade Name (Abbreviation)	Bt protein(s)	Corn Earworm (ear)	Fall Armyworm (whorl)	Corn Borers[2] (stalk)	Black Cutworm (seedling)	LCB[3] (seedling)	CRW[4] (roots)	Herbicide Tolerance [5]	Refuge requirement in the South[6]	Event(s)
		Aboveground					In soil			
Agrisure Products										
Agrisure 3011	Cry1Ab mCry3A	F	F-G	E	P	G	F-G	GT LL	50%	Bt11, MIR604, GA21
Agrisure Viptera 3110	Vip3Aa20 Cry1Ab	E	E	E	G	G	—	GT LL	20%	MIR162, Bt11, GA21
Agrisure Viptera 3111	Vip3Aa20 Cry1Ab mCry3A	E	E	E	G	G	F-G	GT LL	20%	MIR162, Bt11, MIR604, GA21
Agrisure Viptera 3220	Vip3Aa20 Cry1Ab Cry1F	E	E	E	VG	VG	—	GT LL	20%	MIR162, Bt11, TC 1507, GA21
Herculex and Optimum Products										
Herculex I (HX1) or (HR)	Cry1F	P	G-VG	E	G	G	—	LL	50%	TC 1507
Optimum Intrasect (YHR)	Cry1F Cry1Ab	F-G	VG	E	VG	VG	—	LL RR2	20%	TC 1507, MON810
Optimum Intrasect XTRA (YXR)	Cry1F Cry1Ab Cry34Ab1/Cry35Ab1	F-G	VG	E	VG	VG	E	LL RR2	20%	TC 1507, MON810, DAS-59122-7
Optimum Leptra (VYHR)	Cry1F Cry1Ab Vip3A.20	E	E	E	VG	VG	—	LL RR2	20%	MIR162, MON810, TC1507
YieldGard Products										
YieldGard Corn Borer (YGCB)	Cry1Ab	F	F-G	E	P	G	—	—	50%	MON810
YieldGard VT Triple (VT3)	Cry1Ab Cry3Bb1	F	F-G	E	P	G	VG	RR2	50%	MON810, MON88017
Genuity/SmartStax /Powercore Products										
Genuity VT Double PRO (GENVT2P)	Cry1A.105 Cry2Ab2	G-VG	E	E	P	VG	—	RR2	20%	MON89034, NK603
Genuity VT Triple PRO (GENVT3P)	Cry1A.105 Cry2Ab2 Cry3Bb1	G-VG	E	E	P	VG	VG	RR2	20%	MON89034, MON88017
Powercore	Cry1A.105 Cry2Ab2 Cry1F	VG	E	E	G	VG	—	LL RR2	20%	MON89034, TC 1507, NK603
SmartStax (SSX, Dow) or Genuity SmartStax (GENSS, Monsanto)	Cry1A.105 Cry2Ab2 Cry1F Cry3Bb1 Cry34Ab1/Cry35Ab1	VG	E	E	G	VG	E	LL RR2	20%	MON89034, TC 1507, MON88017, DAS-59122-7

[1] E = excellent, VG = very good, G = good, F = fair, P = poor. Excellent usually means better than 95 percent control. Poor means less than about 30% control

[2] Southwestern corn borer, European corn borer, and sugarcane borer, and others.

[3] Lepidopteran Bt traits do not specifically list lesser cornstalk borer (LCB) as a target pest.

[4] Bt rootwom traits target western corn rootworm larvae (CRW), which occurs in areas such as north Alabama and north Georgia. These traits are not effective against southern corn rootworm.

[5] GT = Glyphosate tolerant; LL= Liberty Link (glufosinate tolerant); RR2= Roundup Ready 2 (glyphosate tolerant)

[6] See product Insect Resistance Management (IRM) documentation from the seed companies for more details.

[7] Resistance to Cry1F has been reported in some areas of the Southeast.

Adapted from D. Buntin and K. Flanders, 2014, Bt Corn Products for the Southeastern United States. Based on input from the Southern Corn Insect Working Group who meet at the Annual Meeting of the Southeastern Branch, Entomological Society of America.

Table 4. Examples of Broad-Spectrum At-Planting Insecticides for Insect Pests of Corn Seeds and Seedlings

Insecticide (Trade Names)	Rates of Formulated Product	Pests Controlled Include
chlorpyrifos (Lorsban 15G) [1,2]	8 oz./1000 row ft.	Seedcorn maggot, Southern corn rootworm, White grubs, Cutworm, Lesser cornstalk borer
terbufos (Counter Lock'n'Load 20G)[1,2]	4.5-6 oz./1000 row ft.	Seedcorn maggot, Southern corn rootworm, Wireworms, White grubs
bifenthrin (Capture LFR)[1,2,]	0.2-0.78 oz./1000 row ft.	Seedcorn maggots, Southern corn rootworm, Wireworms, White grubs, Cutworm, Lesser cornstalk borer, Sugarcane beetle (in furrow at planting)
bifenthrin + chlorethoxyfos (Smart Choice 5G Lock'n'Load)[1,2]	3-5 oz./1000 row ft.	Seedcorn maggots, Southern corn rootworm, Wireworms, White grubs, Cutworms

This table was adapted from a table prepared by Scott Stewart, University of Tennessee.

See the insecticide label for specific use instructions, including whether product is to be applied in-furrow, as a T-band, or broadcast.

[1] Other trade names available see Table 7.

[2] Other insecticides are labeled for at-planting control of cutworms or other pests. These include the pyrethroids beta-cyfluthrin (Baythroid XL), cyfluthrin (Tombstone), esfenvalerate (Asana XL, other trade names), gamma-cyhalothrin (Declare, other trade names), lambda-cyhalothrin (Karate with Zeon Technology, other trade names), permethrin (Pounce, other trade names), alpha-cypermethrin (Fastac), and zeta-cypermethrin (Mustang Maxx, other trade names). The insecticide mix chlorpyrifos+gamma-cyhalothrin (Cobalt, other trade names) also can be applied at-planting as can the insecticide mix chlorpyrifos + bifenthrin (Tundra Supreme), the insecticide mix chlorpyrifos and zeta-cypermethrin (Stallion), and the insecticide mix zeta-cypermethrin and bifenthrin (Hero, other trade names), phorate (Thimet 20), and chlorethoxyfos (Fortress 5G). Please see their labels for specific use instructions.

Table 5. Suggestions for Postemergence Corn Insect Control [1]

Insecticide and Formulation	Acres per Gallon	Amount of Formulation per Acre	Lb. Active Ingredient Per Acre	Minimum Days from Last Application to Harvest or Grazing	Comments
ARMYWORMS, FALL AND TRUE					
alpha-cypermethrin FASTAC EC	34-40	3.2-3.8 fl.oz.	0.02-0.025	30 (grain, stover) 60 (forage)	Fastac EC is a **RESTRICTED USE** pesticide.
beta-cyfluthrin BAYTHROID XL	46-80	1.6-2.8 fl.oz.	0.0113-0.022	21 (grain, fodder) 0 (green forage)	Baythroid XL is a **RESTRICTED USE** pesticide. Use highest rate for fall armyworms.
bifenthrin BRIGADE EC Other trade names [2]	20-61	2.1-6.4 fl.oz.	0.03-0.1	30	Brigade is a **RESTRICTED USE** pesticide. Do not use Brigade on corn in coastal counties.
bifenthrin + zeta-cypermethrin HERO Other trade names [2]	12-32	4.0-10.3 fl.oz.	0.04-0.1	30 (grain, fodder, grazing) 60 (harvest for forage)	Hero is a **RESTRICTED USE** pesticide.
carbaryl SEVIN XLR PLUS Other trade names [2]	2-4	1-2 qt.	1-2	14 (silage, green) 48 (fodder, grain)	
chlorantraniliprole PREVATHON Other trade names [2]	6-9	14-20 fl.oz.	0.04-0.06	14 (ears) 1 (forage, fodder, silage, stover)	

[1] See Table 6 for approximate relative efficacy of postemergence insecticides for control of corn insects. See Table 7 for a list of insecticides, formulations, restricted entry intervals, and days to grazing or harvest.

[2] See Table 7 for other trade names.

Table 5. Suggestions for Postemergence Corn Insect Control (cont.) [1]

Insecticide and Formulation	Acres per Gallon	Amount of Formulation per Acre	Lb. Active Ingredient Per Acre	Minimum Days from Last Application to Harvest or Grazing	Comments
ARMYWORMS, FALL AND TRUE (cont.)					
chlorpyrifos LORSBAN ADVANCED LORSBAN 75WG Other trade names [2]	4-8 —	1-2 pt. 0.67-1.33 lb.	0.47-0.93 0.5-1	21 21	Use on true armyworms only. See label for detailed instructions. Lorsban Advanced is a **RESTRICTED USE** pesticide. Lorsban 75WG is not.
chlorpyrifos + bifenthrin TUNDRA SUPREME	8-23	5.6-16.8 fl.oz.	0.1-0.32 + 0.03-0.1	30	Tundra Supreme is a **RESTRICTED USE** pesticide. Use of Tundra Supreme is prohibited on corn in coastal counties.
chlorpyrifos + gamma-cyhalothrin COBALT	5-10	13-26 fl.oz.	0.25-0.51 + 0.004-0.009	21 (grain, ears, forage, fodder) 1 (grazing)	Cobalt is a **RESTRICTED USE** pesticide.
chlorpyrifos + lambda-cyhalothrin COBALT ADVANCED	5-12	11-26 fl.oz.	0.21-0.51 + 0.011-0.026	21 (grain, ears, forage, fodder) 1 (grazing)	Cobalt Advanced is a **RESTRICTED USE** pesticide.
chlorpyrifos + zeta-cypermethrin STALLION	11-14	9.25-11.75 fl.oz.	0.2-0.25 + 0.02-0.025	30 (grain, stover) 60 (forage)	Stallion is a **RESTRICTED USE** pesticide.
cyfluthrin TOMBSTONE Other trade names [2]	46-80	1.6-2.8 fl.oz.	0.025-0.044	21 (grain, fodder) 0 (grazing)	Tombstone is a **RESTRICTED USE** pesticide. Use high rate for fall armyworm.
deltamethrin DELTA GOLD 1.5 EC	67-85	1.5-1.9 fl.oz.	0.018-0.022	21 (harvest, fodder) 12 (grazing)	Delta Gold is a **RESTRICTED USE** pesticide.
esfenvalerate ASANA XL Other trade names [2]	13-22	5.8-9.6 fl.oz.	0.03-0.05	21	Use on true armyworms. Asana is a **RESTRICTED USE** pesticide.
flubendiamide BELT SC	43-64	2-3 fl.oz.	0.063-0.094	28 (grain, stover) 1 (forage, silage)	
gamma-cyhalothrin DECLARE Other trade names [2]	83-125	1.02-1.54 fl.oz.	0.01-0.015	21 (grain, fodder, silage) 1 (grazing)	Declare is a **RESTRICTED USE** pesticide.
lambda-cyhalothrin KARATE with Zeon Technology Other trade names [2]	67-100	1.28-1.92 fl.oz.	0.02-0.03	21 (grain, fodder, silage) 1 (grazing)	Karate is a **RESTRICTED USE** pesticide.
lambda-cyhalothrin + chlorantraniliprole BESIEGE	13-21	6-10 fl.oz.	0.02-0.03 + 0.04-0.06	21 (grain, fodder, silage) 1 (grazing)	Besiege is a **RESTRICTED USE** pesticide.
methomyl LANNATE LV Other trade names [2]	5-11	0.75-1.5 pt.	0.22-0.45	21 (grain, fodder) 3 (grazing, silage)	Lannate is a **RESTRICTED USE** pesticide.
methoxyfenozide INTREPID 2F	8-32	4-16 fl.oz.	0.06-0.25	21	
permethrin POUNCE 25 WP Other trade names [2]	—	6.4-9.6 fl.oz.	0.1-0.15	30 (grain, fodder) 0 (forage)	Pounce is a **RESTRICTED USE** pesticide.
spinetoram RADIANT SC	21-43	3-6 fl.oz.	0.023-0.046	28 (grain) 3 (forage, fodder)	Use higher rate for heavier infestations or larger larvae.
spinosad TRACER Other trade names [2]	43-128	1-3 fl.oz.	0.031-0.094	28 (grain) 3 (forage, fodder)	Use higher rates for heavier infestations. Time applications to peak egg hatch.

Table 5. Suggestions for Postemergence Corn Insect Control (cont.) [1]					
Insecticide and Formulation	Acres Per Gallon	Amount of Formulation per Acre	Lb. Active Ingredient Per Acre	Minimum Days from Last Application to Harvest or Grazing	Comments
ARMYWORMS, FALL AND TRUE (cont.)					
spinosad + gamma-cyhalothrin CONSERO	42-64	1-1.5 fl.oz. of each product	0.03-0.046 + 0.01-0.015	28 (grain, fodder, silage) 1 (grazing)	Consero is a **RESTRICTED USE** pesticide. It is a co-pack of two insecticides that must be applied together.
zeta-cypermethrin MUSTANG MAXX EC INSECTICIDE	32-40	3.2-4 fl.oz.	0.02-0.025	30 (grain, stover) 60 (forage)	Control may be variable. Mustang Maxx is a **RESTRICTED USE** pesticide.
BILLBUGS					
General Comments: *Billbug damage often shows up after the insects are through feeding. See Table 2 for suggested seed treatments and Table 4 for at-planting insecticides for control of billbugs.*					
chlorpyrifos LORSBAN ADVANCED LORSBAN 75 WG Other trade names [2]	4 —	2 pt. 1.33 lb.	0.93 1	21 21	See label for detailed instructions. Lorsban Advanced is a **RESTRICTED USE** pesticide. Lorsban 75WG is not.
chlorpyrifos + bifenthrin TUNDRA SUPREME	8-23	5.6-16.8 fl.oz.	0.1-0.32 + 0.03-0.1	30	Tundra Supreme is a **RESTRICTED USE** pesticide.
chlorpyrifos + gamma-cyhalothrin COBALT	3	38-42 fl.oz.	0.74-0.82 + 0.013-0.015	21 (grain, ears, forage, fodder) 1 (grazing)	Cobalt is a **RESTRICTED USE** pesticide.
chlorpyrifos + lambda-cyhalothrin COBALT ADVANCED	3-4	32-42 fl.oz.	0.62-0.82 + 0.032-0.042	21 (grain, ears, forage, fodder) 1 (grazing)	Cobalt Advanced is a **RESTRICTED USE** pesticide.
terbufos COUNTER LOCK'N'LOAD 20G	4.5	6 oz./1000 row ft.	1.3 lb. a.i./A maximum	30 (grazing, forage)	Apply in a 7-inch band over the seedling corn plants and lightly incorporate into the soil when billbug damage is observed. Counter is a **RESTRICTED USE** pesticide.
CHINCH BUGS					
General Comments: *Apply insecticide as a directed spray to the base of plants in at least 15 to 20 gallons of water per acre. See Table 2 for suggested seed treatments and Table 4 for at-planting insecticides for control of chinch bugs.*					
alpha-cypermethrin FASTAC EC	34-40	3.2-3.8 fl.oz.	0.02-0.025	30 (grain, stover) 60 (forage)	Fastac EC is a **RESTRICTED USE** pesticide.
beta-cyfluthrin BAYTHROID XL	46-80	1.6-2.8 fl.oz.	0.013-0.022	21 (grain, fodder) 0 (green forage)	Baythroid XL is a **RESTRICTED USE** pesticide.
bifenthrin BRIGADE 2EC Other trade names [2]	20-61	2.1-6.4 fl.oz.	0.03-0.1	30	Brigade is a **RESTRICTED USE** pesticide. Do not use Brigade on corn in coastal counties.
bifenthrin + zeta-cypermethrin HERO Other trade names [2]	12-32	4.0-10.3 fl.oz.	0.04-0.1	30 (grain, fodder, grazing) 60 (harvest for forage)	Hero is a **RESTRICTED USE** pesticide.

Table 5. Suggestions for Postemergence Corn Insect Control (cont.) [1]

Insecticide and Formulation	Acres per Gallon	Amount of Formulation per Acre	Lb. Active Ingredient Per Acre	Minimum Days from Last Application to Harvest or Grazing	Comments
CHINCH BUGS (cont.)					
carbaryl SEVIN XLR PLUS Other trade names [2]	2-4	1-2 qt.	1-2	14 (silage, green) 48 (grain, fodder)	
chlorpyrifos LORSBAN ADVANCED LORSBAN 75 WG Other trade names [2]	4-8 —	1-2 pt. 0.67-1.33 pt.	0.47-0.93 0.5-1	21 21	See label for detailed instructions. Lorsban Advanced is a **RESTRICTED USE** pesticide. Lorsban 75WG is not.
chlorpyrifos + bifenthrin TUNDRA SUPREME	8-23	5.6-16.8 fl.oz.	0.1-0.32 + 0.03-0.1	30	Tundra Supreme is a **RESTRICTED USE** pesticide. Use of Tundra Supreme on corn is prohibited in coastal counties.
chlorpyrifos + gamma-cyhalothrin COBALT	3-7	19-38 fl.oz.	0.37-0.74 + 0.007-0.013	21 (grain, ears, forage, fodder) 1 (grazing)	Cobalt is a **RESTRICTED USE** pesticide.
chlorpyrifos + lambda-cyhalothrin COBALT ADVANCED	3-8	16-38 fl.oz.	0.31-0.74 + 0.016-0.038	21 (grain, ears, forage, fodder) 1 (grazing)	Cobalt Advanced is a **RESTRICTED USE** pesticide.
chlorpyrifos + zeta-cypermethrin STALLION	11-14	9.25-11.75 fl.oz.	0.2-0.25 + 0.02-0.025	30 (grain, stover) 60 (forage)	Stallion is a **RESTRICTED USE** pesticide
cyfluthrin TOMBSTONE Other trade names [2]	46-80	1.6-2.8 fl.oz.	0.025-0.044	21 (grain, fodder) 0 (grazing)	Tombstone is a **RESTRICTED USE** pesticide.
deltamethrin DELTA GOLD 1.5 EC	67-85	1.5-1.9 fl.oz.	0.018-0.022	21 (grain, fodder) 12 (green)	Delta Gold is a **RESTRICTED USE** pesticide.
esfenvalerate ASANA XL Other trade names [2]	13-22	5.8-9.6 fl.oz.	0.03-0.05	21 (harvest) —	Asana is a **RESTRICTED USE** pesticide.
gamma-cyhalothrin DECLARE Other trade names [2]	83	1.54 fl.oz.	0.015	21 (grain, fodder, silage) 1 (grazing)	Declare is a **RESTRICTED USE** pesticide.
lambda-cyhalothrin KARATE with Zeon Technology Other trade names [2]	67	1.92 fl.oz.	0.03	21 (grain, fodder, silage) 1 (grazing)	Karate is a **RESTRICTED USE** pesticide.
lambda-cyhalothrin + chlorantraniliprole BESIEGE	13	10 fl.oz.	0.03 + 0.06	21 (grain, fodder, silage) 1 (grazing)	Besiege is a **RESTRICTED USE** pesticide.
spinosad + gamma-cyhalothrin CONSERO	42-64	1-1.5 fl.oz. of each product	0.046 + 0.015	28 (grain, fodder, silage) 1 (grazing)	Consero is a **RESTRICTED USE** pesticide. It is a co-pack of two insecticides that must be applied together.
zeta-cypermethrin MUSTANG MAXX EC INSECTICIDE	32-40	3.2-4 fl.oz.	0.02-0.025	30 (grain, stover) 60 (forage)	Mustang Maxx is a **RESTRICTED USE** pesticide.

Table 5. Suggestions for Postemergence Corn Insect Control (cont.) [1]					
Insecticide and Formulation	Acers Per Gallon	Amount of Formulation per Acre	Lb. Active Ingredient Per Acre	Minimum Days from Last Application to Harvest or Grazing	Comments
CORN EARWORMS					
General Comments: *Using postemergent insecticides to prevent this insect from attacking ears is usually not practical. Insecticides listed here are for control of corn earworm in whorl-stage corn. Early planting may reduce damage from this pest. Corn earworm is also known as the bollworm. See Table 3 for suggested Bt corn for corn earworm control.*					
alpha-cypermethrin FASTAC EC	34-71	1.8-3.8 fl.oz.	0.011-0.025	30 (grain, stover) 60 (forage)	Fastac EC is a **RESTRICTED USE** pesticide.
beta-cyfluthrin BAYTHROID XL	46-80	1.6-2.8 fl.oz.	0.013-0.022	21 (grain, fodder) 0 (green forage)	Baythroid XL is a **RESTRICTED USE** pesticide.
bifenthrin BRIGADE 2EC Other trade names [2]	20-61	2.1-6.4 fl.oz.	0.03-0.1	30	Brigade is a **RESTRICTED USE** pesticide. Do not use Brigade in coastal counties.
bifenthrin + zeta-cypermethrin HERO Other trade names [2]	12-32	4.0-10.3 fl.oz.	0.04-0.1	30 (grain, fodder, grazing) 60 (harvest for forage)	Hero is a **RESTRICTED USE** pesticide.
carbaryl SEVIN XLR PLUS Other trade names [2]	2-4	1-2 qt.	1-2	14 (silage, green) 48 (grain, fodder)	Make applications directly onto the plant so that the spray will run onto the whorls.
chlorantraniliprole PREVATHON Other trade names [2]	6-9	14-20 fl.oz.	0.047-0.067	14 (ears) 1 (forage, fodder, silage, stover)	
chlorpyrifos LORSBAN ADVANCED LORSBAN 75 WG Other trade names [2]	4-5 —	1.5-2 pt. 1-1.33 pt.	0.7-0.93 0.75-1	21 21	See label for detailed instructions. Lorsban Advanced is a **RESTRICTED USE** pesticide. Lorsban 75WG is not.
chlorpyrifos + bifenthrin TUNDRA SUPREME	8-23	5.6-16.8 fl.oz.	0.1-0.32 + 0.03-0.1	30	Tundra Supreme is a **RESTRICTED USE** pesticide. Use of Tundra Supreme on corn is prohibited in coastal counties.
chlorpyrifos + gamma-cyhalothrin COBALT	3-7	19-38 fl.oz.	0.37-0.74 + 0.007-0.013	21 (grain, ears, forage, fodder) 1 (grazing)	Cobalt is a **RESTRICTED USE** pesticide.
chlorpyrifos + lambda-cyhalothrin COBALT ADVANCED	3-8	16-38 fl.oz.	0.31-0.74 + 0.016-0.038	21 (grain, forage, fodder) 1 (grazing)	Cobalt Advanced is a **RESTRICTED USE** pesticide.
chlorpyrifos + zeta-cypermethrin STALLION	11-14	9.25-11.75 fl.oz.	0.2-0.25 +0.02-0.025	30 (grain, stover) 60 (forage)	Stallion is a **RESTRICTED USE** pesticide.
cyfluthrin TOMBSTONE Other trade names [2]	46-80	1.6-2.8 fl.oz.	0.025-0.044	21 (grain, fodder) 0 (grazing)	Tombstone is a **RESTRICTED USE** pesticide.
deltamethrin DELTA GOLD 1.5 EC	67-85	1.5-1.9 fl.oz.	0.018-0.022	21 (harvest, fodder) 12 (green)	Delta Gold is a **RESTRICTED USE** pesticide.
esfenvalerate ASANA XL Other trade names [2]	13-22	5.8-9.6 fl.oz.	0.03-0.05	21 (harvest)	Use if excessively high numbers occur at silking. First application should be at or before silking. Subsequent applications should be made at 3- to 5-day intervals until silking is complete. Asana is a **RESTRICTED USE** pesticide.

Table 5. Suggestions for Postemergence Corn Insect Control (cont.) [1]					
Insecticide and Formulation	Acres Per Gallon	Amount of Formulation per Acre	Lb. Active Ingredient Per Acre	Minimum Days from Last Application to Harvest or Grazing	Comments
CORN EARWORMS (cont.)					
flubendiamide BELT SC	43-64	2-3 fl.oz.	0.063-0.094	21 (grain, stover) 1 (green, silage)	
gamma-cyhalothrin DECLARE Other trade names [2]	100-250	0.77-1.28 fl.oz.	0.0075-0.0125	21 (grain, fodder, silage) 1 (grazing)	Declare is a **RESTRICTED USE** pesticide.
lambda-cyhalothrin KARATE with Zeon Technology Other trade names [2]	80-133	0.96-1.6 fl.oz.	0.015-0.025	21 (grain, fodder, silage) 1 (grazing)	For control of corn earworm before it has entered the ear. Karate is a **RESTRICTED USE** pesticide.
lambda-cyhalothrin + chlorantraniliprole BESIEGE	13-26	5-10 fl.oz.	0.016-0.03 + 0.03-0.06	21 (grain, fodder, silage) 1 (grazing)	Besiege is a **RESTRICTED USE** pesticide.
methomyl LANNATE LV Other trade names [2]	5-11	0.75-1.5 pt.	0.22-0.45	21 (grain, fodder) 3 (grazing, silage)	Apply a minimum of 20 gallons water per acre for best results. Lannate is a **RESTRICTED USE** pesticide.
permethrin POUNCE 25 WP Other trade names [2]	—	6.4-9.6 oz.	0.1-0.15	30 (grain, fodder) 0 (forage)	Pounce is a **RESTRICTED USE** pesticide.
spinetoram RADIANT SC	—	3-6 fl.oz.	0.023-0.046	28 (grain) 3 (forage, fodder)	Use higher rate for heavier infestations or larger larvae.
spinosad TRACER Other trade names [2]	43-64	2-3 fl.oz.	0.062-0.094	28 (grain) 3 (forage, fodder)	Use higher rates for heavier infestations. Time applications to peak egg hatch.
spinosad + gamma-cyhalothrin CONSERO	42-64	1-1.5 fl.oz. of each product	0.03-0.046 + 0.01-0.015	28 (grain, fodder, silage) 1 (grazing)	Consero is a **RESTRICTED USE** pesticide. It is a co-pack of two insecticides that must be applied together.
zeta-cypermethrin MUSTANG MAXX EC INSECTICIDE	32-72	1.76-4 fl.oz.	0.011-0.025	30 (grain, stover) 60 (forage)	Mustang Maxx is a **RESTRICTED USE** pesticide.
CUTWORMS					
See Tables 2 and 4 for suggested seed treatments and broad-spectrum preplant and at-planting insecticides for control of cutworms; see Table 3 for transgenic corn that can control cutworms.					
alpha-cypermethrin FASTAC EC	46-98	1.3-2.8 fl.oz.	0.008-0.018	30 (grain, stover) 60 (forage)	Fastac EC is a **RESTRICTED USE** pesticide.
beta-cyfluthrin BAYTHROID XL	80-160	0.8-1.6 fl.oz.	0.007-0.013	21 (grain, fodder) 0 (green forage)	Baythroid XL is a **RESTRICTED USE** pesticide.
bifenthrin BRIGADE 2EC Other trade names [2]	20-61	2.1-6.4 fl.oz	0.033-0.10	30 (grain, stover, grazing) 60 (forage)	Brigade is a **RESTRICTED USE** pesticide. Do not use Brigade on corn in coastal counties.

Table 5. Suggestions for Postemergence Corn Insect Control (cont.) [1]					
Insecticide and Formulation	Acres Per Gallon	Amount of Formulation per Acre	Lb. Active Ingredient Per Acre	Minimum Days from Last Application to Harvest or Grazing	Comments
CUTWORMS (cont.)					
bifenthrin + zeta-cypermethrin HERO Other trade names [2]	21-49	2.6-6.1 fl. oz.	0.025-0.06 + 4.0-10.3 fl.oz.	30 (grain, stover, grazing) 60 (forage)	Hero is a **RESTRICTED USE** pesticide.
carbaryl SEVIN XLR PLUS Other trade names [2]	2	2 qt.	2	48 (grain, fodder) 14 (green)	Most effective when applied in a 12-inch band over the row.
chlorpyrifos LORSBAN ADVANCED LORSBAN 75 WG Other trade names [2]	4-8 —	1-2 pt. 0.67-1.33 lb.	0.47-0.93 0.5-1	21 21	See label for detailed instructions. Can be applied preplant, at plant, or preemergence. Lorsban Advanced is a **RESTRICTED USE** pesticide. Lorsban 75WG is not.
chlorpyrifos + bifenthrin TUNDRA SUPREME	8-23	5.6-16.8 fl.oz.	0.1-0.32 + 0.03-0.1	30	Tundra Supreme is a **RESTRICTED USE** pesticide. Use of Tundra Supreme is prohibited in coastal counties.
chlorpyrifos + gamma-cyhalothrin COBALT	5-10	13-26 fl.oz.	0.25-0.51 + 0.004-0.009	21 (grain, ears, forage, fodder) 1 (grazing)	Cobalt is a **RESTRICTED USE** pesticide. Can be applied preplant, at plant, or preemergence.
chlorpyrifos + lambda-cyhalothrin COBALT ADVANCED	5-12	11-26 fl.oz.	0.21-0.51 + 0.011-0.026	21 (grain, ears, forage, fodder) 1 (grazing)	Cobalt Advanced is a **RESTRICTED USE** pesticide.
chlorpyrifos + zeta-cypermethrin STALLION	11-34	3.75-11.75 fl.oz.	0.08-0.25 + 0.008-0.025	30 (grain, stover) 60 (forage)	Stallion is a **RESTRICTED USE** pesticide.
cyfluthrin TOMBSTONE Other trade names [2]	80-160	0.8-1.6 fl.oz.	0.013-0.025	21 (grain, fodder) 0 (grazing)	Tombstone is a **RESTRICTED USE** pesticide.
deltamethrin DELTA GOLD 1.5 EC	85-128	1-1.5	0.012-0.018	21 (grain, fodder) 12 (green)	Delta Gold is a **RESTRICTED USE** pesticide. Can be applied pre- or postemergence.
esfenvalerate ASANA XL Other trade names [2]	13-22	5.8-9.6 fl.oz.	0.03-0.05	21	Asana is a **RESTRICTED USE** pesticide. Can be applied at planting.
flubendiamide BELT SC	43-64	2-3 fl.oz.	0.063-0.094	28 (grain, stover) 1 (forage, silage)	
gamma-cyhalothrin DECLARE Other trade names [2]	166-250	0.51-0.77 fl.oz.	0.005-0.0075	21 (grain, fodder, silage) 1 (grazing)	Declare is a **RESTRICTED USE** pesticide. Can be applied at planting.
lambda-cyhalothrin KARATE with Zeon Technology Other trade names [2]	80-133	0.96-1.6 fl.oz.	0.015-0.025	21 (grain, fodder, silage) 1 (grazing)	Karate is a **RESTRICTED USE** pesticide. Can be applied at planting.
lambda-cyhalothrin + chlorantraniliprole BESIEGE	13-26	5-10 fl.oz.	0.016-0.03 + 0.03-0.06	21 (grain, fodder, silage) 1 (grazing)	Besiege is a **RESTRICTED USE** pesticide.
methomyl LANNATE LV Other trade names [2]	5	1.5 pt.	0.45	21 (grain, fodder) 3 (green)	Apply for variegated cutworms. Lannate is a **RESTRICTED USE** pesticide.

Table 5. Suggestions for Postemergence Corn Insect Control (cont.) [1]

Insecticide and Formulation	Acres Per Gallon	Amount of Formulation per Acre	Lb. Active Ingredient Per Acre	Minimum Days from Last Application to Harvest or Grazing	Comments
CUTWORMS (cont.)					
permethrin POUNCE 25 WP Other trade names [2]	—	6.4-9.6 oz.	0.1-0.15	30 (grain, fodder) 0 (forage)	Pounce is a **RESTRICTED USE** pesticide. Can be applied at planting.
spinosad + gamma-cyhalothrin CONSERO	42-64	1-1.5 fl.oz. of each product	0.03-0.046 + 0.01-0.015	28 (grain, fodder, silage) 1 (grazing)	Consero is a **RESTRICTED USE** pesticide. It is a co-pack of two insecticides that must be applied together.
zeta-cypermethrin MUSTANG MAXX EC INSECTICIDE	46-100	1.28-2.8 fl.oz.	0.008-0.0175	30 (grain, stover) 60 (forage)	Mustang Maxx is a **RESTRICTED USE** pesticide. Can be applied at planting or prior to planting.
EUROPEAN CORN BORERS, SOUTHWESTERN CORN BORERS					
See text at beginning for discussion of corn borers. See Table 3 for transgenic corn that can control corn borers. Insecticide applications must be made before the larvae bore into the plant.					
alpha-cypermethrin FASTAC EC	34-47	2.7-3.8 fl.oz.	0.017-0.025	30 (grain, stover) 60 (forage)	Fastac EC is a **RESTRICTED USE** pesticide.
beta-cyfluthrin BAYTHROID XL	46-80	1.6-2.8 fl.oz.	0.013-0.022	21 (grain, fodder) 0 (green forage)	Baythroid XL is a **RESTRICTED USE** pesticide.
bifenthrin BRIGADE 2EC Other trade names [2]	20-61	2.1-6.4 fl.oz.	0.03-0.1	30	Brigade is a **RESTRICTED USE** pesticide. Do not use Brigade on corn in coastal counties.
bifenthrin + zeta-cypermethrin HERO Other trade names [2]	12-32	4.0-10.3 fl.oz.	0.04-0.1	30 (grain, fodder, grazing) 60 (harvest for forage)	Hero is a **RESTRICTED USE** pesticide.
carbaryl SEVIN XLR PLUS Other trade names [2]	2-3	1.5-2 qt.	1.5-2	14 (silage, green) 48 (grain, fodder)	Apply in the whorls in 20 gallons of water per acre for best control.
chlorantraniliprole PREVATHON Other trade names [2]	6-9	14-20 fl.oz.	0.047-0.067	14 (grain, ears, forage, fodder) 1 (grazing)	
chlorpyrifos LORSBAN 75 WG Other trade names [2]	—	1-1.33 lb.	0.75-1	21	See label for detailed instructions.
LORSBAN 15G	—	5-6.5 lb.	—	21	See label for detailed instructions.
LORSBAN ADVANCED	4-5	1.5-2 pt.	0.71-0.93	21	See label for detailed instructions. Lorsban Advanced is a **RESTRICTED USE** pesticide.
chlorpyrifos + bifenthrin TUNDRA SUPREME	8-23	5.6-16.8 fl.oz.	0.1-0.32 + 0.03-0.1	30	Tundra Supreme is a **RESTRICTED USE** pesticide. Use of Tundra Supreme on corn is prohibited in coastal counties.
chlorpyrifos + gamma-cyhalothrin COBALT	3-7	19-38 fl.oz.	0.37-0.74 + 0.007-0.013	21 (grain, ears, forage, fodder) 1 (grazing)	Cobalt is a **RESTRICTED USE** pesticide.

Table 5. Suggestions for Postemergence Corn Insect Control (cont.) [1]					
Insecticide and Formulation	Acres Per Gallon	Amount of Formulation per Acre	Lb. Active Ingredient Per Acre	Minimum Days from Last Application to Harvest or Grazing	Comments
EUROPEAN CORN BORERS, SOUTHWESTERN CORN BORERS (cont.)					
chlorpyrifos + lambda-cyhalothrin COBALT ADVANCED	3-8	16-38 fl.oz.	0.31-0.74 + 0.016-0.038	21 (grain, ears, forage, fodder) 1 (grazing)	Cobalt Advanced is a **RESTRICTED USE** pesticide.
chlorpyrifos + zeta-cypermethrin STALLION	11-14	9.25-11.75 fl.oz.	0.2-0.25 + 0.02-0.025	30 (grain, stover) 60 (forage)	Stallion is a **RESTRICTED USE** pesticide.
cyfluthrin TOMBSTONE Other trade names [2]	46-80	1.6-2.8 fl.oz.	0.025-0.044	21 (grain, fodder) 0 (grazing)	Tombstone is a **RESTRICTED USE** pesticide.
deltamethrin DELTA GOLD 1.5 EC	67-85	1.5-1.9 fl.oz.	0.018-0.022	21 (grain, fodder) 12 (green)	Delta Gold is a **RESTRICTED USE** pesticide.
esfenvalerate ASANA XL Other trade names [2]	13-16	7.8-9.6 fl.oz.	0.04-0.05	21 (harvest)	Apply just before egg hatch (blackhead stage) or before larvae enter the whorls. Asana is a **RESTRICTED USE** pesticide.
flubendiamide BELT SC	43-64	2-3 fl.oz.	0.063-0.094	28 (grain, stover) 1 (forage, silage)	
gamma-cyhalothrin DECLARE Other trade names [2]	100-250	0.77-1.28 fl.oz.	0.0075-0.0125	21 (grain, fodder, silage) 1 (grazing)	Declare is a **RESTRICTED USE** pesticide.
lambda-cyhalothrin KARATE with Zeon Technology Other trade names [2]	67-100	1.28-1.92 fl.oz.	0.02-0.03	21 (grain, fodder, silage) 1 (grazing)	Apply in whorl before borers have entered stalk or ear. Karate is a **RESTRICTED USE** pesticide.
lambda-cyhalothrin + chlorantraniliprole BESIEGE	13-21	6-10 fl.oz.	0.02-0.03 + 0.04-0.06	21 (grain, fodder, silage) 1 (grazing)	Besiege is a **RESTRICTED USE** pesticide.
methomyl LANNATE LV Other trade names [2]	5-11	0.75-1.5 pt.	0.22-0.45	21 (grain, stover) 3 (grazing, silage)	Lannate LV is a **RESTRICTED USE** pesticide.
methoxyfenozide INTREPID 2F	8-32	4-16 fl.oz.	0.06-0.25	21	Apply at first sign of egg hatch or when infestation reaches threshold level.
permethrin POUNCE 25 WP Other trade names [2]	—	6.4-9.6 oz.	0.1-0.15	30 (grain, fodder) 0 (forage)	Pounce is a **RESTRICTED USE** pesticide.
spinetoram RADIANT SC	21-43	3-6 fl.oz.	0.023-0.046	28 (grain) 3 (forage, fodder)	Use higher rate for heavier infestations or larger larvae.
spinosad TRACER Other trade names [2]	43-128	1-3 fl.oz. (European corn borer)	0.031-0.094	28 (harvest) 3 (forage, fodder)	Use higher rates for heavier infestations. Time applications to peak egg hatch. Apply as a broadcast or a directed spray to whorl stage corn; otherwise, apply as a broadcast spray. Use 2-3 fl.oz. for southwestern corn borer.
spinosad + gamma-cyhalothrin CONSERO	42-64	1-1.5 fl.oz. of each product	0.03-0.046 + 0.01-0.015	28 (grain, fodder, silage) 1 (grazing)	Consero is a **RESTRICTED USE** pesticide. It is a co-pack of two insecticides that must be applied together.

Table 5. Suggestions for Postemergence Corn Insect Control (cont.) [1]					
Insecticide and Formulation	Acres Per Gallon	Amount of Formulation per Acre	Lb. Active Ingredient Per Acre	Minimum Days from Last Application to Harvest or Grazing	Comments
EUROPEAN CORN BORERS, SOUTHWESTERN CORN BORERS (cont.)					
zeta-cypermethrin MUSTANG MAXX EC INSECTICIDE	32-47	2.72-4 fl.oz.	0.017-0.025	30 (grain, stover) 60 (forage)	Mustang Maxx is a **RESTRICTED USE** pesticide.
GRASSHOPPERS					
alpha-cypermethrin FASTAC EC	34-47	2.7-3.8 fl.oz.	0.017-0.025	30 (grain, stover) 60 (forage)	Fastac EC is a **RESTRICTED USE** pesticide.
beta-cyfluthrin BAYTHROID XL	46-61	2.1-2.8 fl.oz.	0.017-0.022	21 (grain, fodder) 0 (green forage)	Baythroid XL is a **RESTRICTED USE** pesticide.
bifenthrin BRIGADE 2EC Other trade names [2]	20-61	2.1-6.4 fl.oz.	0.033-0.10	30	Brigade is a **RESTRICTED USE** pesticide. Do not use Brigade on corn in coastal counties.
bifenthrin + zeta-cypermethrin HERO Other trade names [2]	21-49	2.6-6.1 fl.oz.	0.025-0.06	30 (grain, fodder, grazing) 60 (harvest for forage)	Hero is a **RESTRICTED USE** pesticide.
carbaryl SEVIN XLR PLUS Other trade names [2]	3-8	0.5-1.5 qt.	0.5-1.5	14 (silage, green) 48 (grain, fodder)	Use lower rate of Sevin for young grasshoppers or sparse vegetation; use higher rate for larger grasshoppers or thicker vegetation.
chlorpyrifos LORSBAN ADVANCED LORSBAN 75 WG Other trade names [2]	8-16 —	0.5-1 pt. 0.33-0.67 lb.	0.23-0.47 0.25-0.5	21 21	See label for detailed instructions. Lorsban Advanced is a **RESTRICTED USE** pesticide. Lorsban 75WG is not.
chlorpyrifos + bifenthrin TUNDRA SUPREME	8-23	5.6-16.8 fl.oz.	0.1-0.32 + 0.03-0.1	30	Tundra Supreme is a **RESTRICTED USE** pesticide. Use of Tundra Supreme on corn is prohibited in coastal counties.
chlorpyrifos + gamma-cyhalothrin COBALT	10-18	7-13 fl.oz.	0.14-0.25 + 0.002-0.004	21 (grain, ears, forage, fodder) 1 (grazing)	Cobalt is a **RESTRICTED USE** pesticide.
chlorpyrifos + zeta-cypermethrin STALLION	11-14	9.25-11.75 fl.oz.	0.2-0.25 +0.02-0.025	30 (grain, stover) 60 (forage)	Stallion is a **RESTRICTED USE** pesticide.
chlorpyrifos + lambda-cyhalothrin COBALT ADVANCED	10-21	6-13 fl.oz.	0.12-0.25 + 0.006-0.013	21 (grain, ears, forage, fodder) 1 (grazing)	Cobalt Advanced is a **RESTRICTED USE** pesticide.
cyfluthrin TOMBSTONE Other trade names [2]	46-61	2.1-2.8 fl.oz.	0.033-0.044	21 (grain, fodder) 0 (grazing)	Tombstone is a **RESTRICTED USE** pesticide.
deltamethrin DELTA GOLD 1.5 EC Other trade names [2]	85-128	1.0-1.5 fl.oz.	0.012-0.018	21 (grain, fodder) 12 (green)	Delta Gold is a **RESTRICTED USE** pesticide.
dimethoate DIMETHOATE 4E Other trade names [2]	8	16 fl. oz.	0.5 lb.	28 (grain) 14 (forage)	

Table 5. Suggestions for Postemergence Corn Insect Control (cont.) [1]					
Insecticide and Formulation	Acres Per Gallon	Amount of Formulation per Acre	Lb. Active Ingredient Per Acre	Minimum Days from Last Application to Harvest or Grazing	Comments
GRASSHOPPERS (cont.)					
esfenvalerate ASANA XL Other trade names [2]	13-22	5.8-9.6 fl.oz.	0.03-0.05	21	Asana is a **RESTRICTED USE** pesticide.
gamma-cyhalothrin DECLARE Other trade names [2]	83-125	1.02-1.54 fl.oz.	0.01-0.015	21 (grain, fodder, silage) 1 (grazing)	Declare is a **RESTRICTED USE** pesticide.
lambda-cyhalothrin KARATE with Zeon Technology Other trade names [2]	67-100	1.28-1.92 fl.oz.	0.02-0.03	21 (grain, fodder, silage) 1 (grazing)	Karate is a **RESTRICTED USE** pesticide.
lambda-cyhalothrin + chlorantraniliprole BESIEGE	13-21	6-10 fl.oz.	0.02-0.03 + 0.04-0.06	21 (grain, fodder, silage) 1 (grazing)	Besiege is a **RESTRICTED USE** pesticide.
malathion CHEMINOVA MALATHION 57% Other trade names [2]	8	1 pt.	0.62 lb.	7	
spinosad + gamma-cyhalothrin CONSERO	42	1.5 fl.oz. of each product	0.046 + 0.015	28 (grain, fodder, silage) 1 (grazing)	Consero is a **RESTRICTED USE** pesticide. It is a co-pack of two insecticides that must be applied together.
zeta-cypermethrin MUSTANG MAXX EC INSECTICIDE	32-47	2.72-4 fl.oz.	0.017-0.025	30 (grain, stover) 60 (forage)	Mustang Maxx is a **RESTRICTED USE** pesticide.
GREEN JUNE BEETLE GRUBS (IN FIELDS WHERE BROILER LITTER HAS BEEN USED)					
carbaryl SEVIN XLR PLUS Other trade names [2]	—	1-1.5 qt.	1-1.5	14 (silage, green) 48 (grain, fodder)	Treat on the surface of the soil when there is more than one grub per square foot in the fall prior to planting. Spring treatment when soil temperature is cold is not as effective as an application made in the fall.
JAPANESE BEETLE ADULTS, CORN ROOTWORM ADULTS, OTHER SILK FEEDERS, AND FLEA BEETLES					
alpha-cypermethrin FASTAC EC	34-47	2.7-3.8 fl.oz.	0.017-0.025	30 (grain, stover) 60 (forage)	Fastac EC is a **RESTRICTED USE** pesticide.
beta-cyfluthrin BAYTHROID XL	46-80	1.6-2.8 fl.oz.	0.013-0.022	21 (grain, fodder) 0 (green forage)	Baythroid XL is a **RESTRICTED USE** pesticide.
bifenthrin BRIGADE 2EC Other trade names [2]	20-61	2.1-6.4 fl.oz.	0.03-0.1	30	Brigade is a **RESTRICTED USE** pesticide. Do not use Brigade in coastal counties.
bifenthrin + zeta-cypermethrin HERO Other trade names [2]	12-32	4.0-10.3 fl.oz.	0.04-0.1	30 (grain, fodder, grazing) 60 (harvest for forage)	Hero is a **RESTRICTED USE** pesticide.

Table 5. Suggestions for Postemergence Corn Insect Control (cont.) [1]					
Insecticide and Formulation	Acres Per Gallon	Amount of Formulation per Acre	Lb. Active Ingredient Per Acre	Minimum Days from Last Application to Harvest or Grazing	Comments
JAPANESE BEETLE ADULTS, CORN ROOTWORM ADULTS, OTHER SILK FEEDERS, AND FLEA BEETLES (cont.)					
carbaryl SEVIN XLR PLUS Other trade names [2]	2-4	1-2 qt.	1-2	14 (silage, green) 48 (grain, fodder)	Apply when silks first appear and continue until silks dry.
chlorpyrifos LORSBAN ADVANCED LORSBAN 75 WG Other trade names [2]	4-8 —	1-2 pt. 0.67-1.33 lb.	0.47-0.93 0.5-1	21 21	See label for detailed instructions. Lorsban Advanced is a **RESTRICTED USE** pesticide. Lorsban 75WG is not.
chlorpyrifos + bifenthrin TUNDRA SUPREME	8-23	5.6-16.8 fl.oz.	0.1-0.32 + 0.03-0.1	30	Tundra Supreme is a **RESTRICTED USE** pesticide. Use of Tundra Supreme is prohibited in coastal counties.
chlorpyrifos + gamma-cyhalothrin COBALT	3-10	13-42 fl.oz.	0.25-0.82 + 0.004-0.015	21 (grain, ears, forage, fodder) 1 (grazing)	Cobalt is a **RESTRICTED USE** pesticide. Use higher rate for Japanese beetle adults.
chlorpyrifos + lambda-cyhalothrin COBALT ADVANCED	3-12	11-42 fl.oz.	0.21-0.82 + 0.011-0.042	21 (grain, ears, forage, fodder) 1 (grazing)	Cobalt Advanced is a **RESTRICTED USE** pesticide. See label for specific insect to determine the correct rate.
chlorpyrifos + zeta-cypermethrin STALLION	11-14	9.25-11.75 fl.oz.	0.2-0.25 + 0.02-0.025	30 (grain, stover) 60 (forage)	Stallion is a **RESTRICTED USE** pesticide.
cyfluthrin TOMBSTONE Other trade names [2]	46-80	1.6-2.8 fl.oz.	0.025-0.044	21 (grain, fodder) 0 (grazing)	Tombstone is a **RESTRICTED USE** pesticide.
deltamethrin DELTA GOLD 1.5 EC	67-85	1.5-1.9 fl.oz.	0.018-0.022	21 (grain, fodder) 12 (green)	Delta Gold is a **RESTRICTED USE** pesticide.
esfenvalerate ASANA XL Other trade names [2]	13-22	5.8-9.6 fl.oz.	0.03-0.05	21	Asana is a **RESTRICTED USE** pesticide.
gamma-cyhalothrin DECLARE Other trade names [2]	83-125	1.02-1.54 fl.oz.	0.01-0.015	21 (grain, fodder, silage) 1 (grazing)	Declare is a **RESTRICTED USE** pesticide.
lambda-cyhalothrin KARATE with Zeon Technology Other trade names [2]	67-100	1.28-1.92 fl.oz.	0.02-0.03	21 (grain, fodder, silage) 1 (grazing)	Karate is a **RESTRICTED USE** pesticide.
lambda-cyhalothrin + chlorantraniliprole BESIEGE	13-21	6-10 fl.oz.	0.02-0.03 + 0.04-0.06	21 (grain, fodder, silage) 1 (grazing)	Besiege is a **RESTRICTED USE** pesticide.
methomyl LANNATE LV Other trade names [2]	5-11	0.75-1.5 pt.	0.22-0.45	21 (grain, fodder) 3 (green)	Lannate is a **RESTRICTED USE** pesticide.
permethrin POUNCE 25 WP Other trade names [2]	—	6.4-9.6 oz.	0.1-0.15	30 (grain, fodder) 0 (forage)	Pounce is a **RESTRICTED USE** pesticide. Not labeled for Japanese beetles.
spinosad + gamma-cyhalothrin CONSERO	42	1.5 fl.oz. of each product	0.046 + 0.015	28 (grain, fodder, silage) 1 (grazing)	Consero is a **RESTRICTED USE** pesticide. It is a co-pack of two insecticides that must be applied together.
zeta-cypermethrin MUSTANG MAXX EC INSECTICIDE	32-47	2.72-4 fl.oz.	0.017-0.025	30 (grain, stover) 60 (forage)	Mustang Maxx is a **RESTRICTED USE** pesticide.

Table 5. Suggestions for Postemergence Corn Insect Control (cont.) [1]					
Insecticide and Formulation	Acres Per Gallon	Amount of Formulation per Acre	Lb. Active Ingredient Per Acre	Minimum Days from Last Application to Harvest or Grazing	Comments
LEAFHOPPERS					
See Comments.					Leafhoppers are vectors of corn stunt and other plant viruses. Plant virus-resistant varieties, if possible. An at-planting soil systemic insecticide may be beneficial if a variety that is susceptible to corn stunt is planted.
LESSER CORNSTALK BORERS					
See Table 3 for transgenic corn that can control lesser cornstalk borers and Table 4 for at- planting insecticides for control of lesser cornstalk borers.					
chlorpyrifos LORSBAN ADVANCED LORSBAN 75WG Other trade names [2]	 4 —	 2 pt. 1.33 lb.	 0.93 1	 21 21	Apply as a broadcast spray. See label for detailed instructions. Lorsban Advanced is a **RESTRICTED USE** pesticide. Lorsban 75WG is not.
chlorpyrifos + bifenthrin TUNDRA SUPREME	8-23	5.6-16.8 fl.oz.	0.1-0.32 + 0.03-0.1	30	Tundra Supreme is a **RESTRICTED USE** pesticide. Use of Tundra Supreme on corn is prohibited in coastal counties.
chlorpyrifos + gamma-cyhalothrin COBALT	3	38-42 fl.oz.	0.74-0.82 + 0.013-0.015	21 (grain, ears, forage, fodder) 1 (grazing)	Cobalt is a **RESTRICTED USE** pesticide.
chlorpyrifos + lambda-cyhalothrin COBALT ADVANCED	3-4	32-42 fl.oz.	0.62-0.82 + 0.032-0.042	21 (grain, ears, forage, fodder) 1 (grazing)	Cobalt Advanced is a **RESTRICTED USE** pesticide.
gamma-cyhalothrin DECLARE Other trade names [2]	83-125	1.02-1.54 fl.oz.	0.01-0.015	21 (grain, fodder, silage) 1 (grazing)	Declare is a **RESTRICTED USE** pesticide.
lambda-cyhalothrin KARATE with Zeon Technology Other trade names [2]	67-100	1.28-1.92 fl.oz.	0.02-0.03	21 (grain, fodder, silage) 1 (grazing)	**DO NOT** apply more than 0.12 pound active ingredient per acre per season. Apply as soon as infestation is detected, before borers have entered the stalk. Karate is a **RESTRICTED USE** pesticide.
lambda-cyhalothrin + chlorantraniliprole BESIEGE	13-21	6-10 fl.oz.	0.02-0.03 + 0.04-0.06	21 (grain, fodder, silage) 1 (grazing)	Besiege is a **RESTRICTED USE** pesticide.
spinosad + gamma-cyhalothrin CONSERO	42	1.5 fl.oz. of each product	0.046 + 0.015	28 (grain, fodder, silage) 1 (grazing)	Consero is a **RESTRICTED USE** pesticide. It is a co-pack of two insecticides that must be applied together.
MITES					
bifenthrin BRIGADE 2EC Other trade names [2]	20-25	5.1-6.4 fl.oz.	0.08-0.10	30	Brigade is a **RESTRICTED USE INSECTICIDE**. Do not use in coastal counties.
bifenthrin + zeta-cypermethrin HERO Other trade names [2]	12	10.3 fl.oz.	0.10	30 (grain, fodder, grazing) 60 (harvest for forage)	Hero is a **RESTRICTED USE INSECTICIDE.**

Table 5. Suggestions for Postemergence Corn Insect Control (cont.) [1]					
Insecticide and Formulation	Acres Per Gallon	Amount of Formulation per Acre	Lb. Active Ingredient Per Acre	Minimum Days from Last Application to Harvest or Grazing	Comments
MITES (cont.)					
chlorpyrifos + bifenthrin TUNDRA SUPREME	7.6-9.5	13.5-16.8 fl.oz.	0.25-0.32 + 0.08-0.10	30	Tundra Supreme is a **RESTRICTED USE** pesticide.
dimethoate DIMETHOATE 4E Other trade names [2]	8-12	11-16 fl.oz.	0.33-0.5	28 (grain) 14 (forage)	
etoxazole ZEAL WDG	—	1-3 oz.	0.045-0.135	21	
hexythiazox ONAGER	5-13	10-24 fl.oz.	0.08-0.19	30	
propargite COMITE	2.4-3.5	36-54 fl.oz.	1.7-2.5	30	Comite is a **RESTRICTED USE** pesticide.
spiromesifen OBERON 2SC Other trade names [2]	—	5.7-16.0 fl.oz.	0.09-0.25	30 (grain, stover) 5 (forage, silage)	
SOUTHWESTERN CORN BORERS					
See European Corn Borers.					
STINK BUGS					
See discussion of stink bugs in introduction; see Table 2 for suggested seed treatments to control early season stink bugs.					
alpha-cypermethrin FASTAC EC	34-47	2.7-3.8 fl.oz.	0.017-0.025	30 (grain, stover) 60 (forage)	Fastac EC is a **RESTRICTED USE** pesticide.
beta-cyfluthrin BAYTHROID XL	46-80	1.6-2.8 fl.oz.	0.013-0.022	21 (grain, fodder) 0 (green forage)	Baythroid XL is a **RESTRICTED USE** pesticide.
bifenthrin BRIGADE 2EC Other trade names [2]	20-25	2.1-6.4 fl.oz.	0.033-0.1	30	Brigade is a **RESTRICTED USE** pesticide. Do not use Brigade on corn in coastal counties.
bifenthrin + zeta-cypermethrin HERO Other trade names [2]	12-32	4.0-10.3 fl.oz.	0.04-0.1	30 (grain, fodder, grazing) 60 (harvest for forage)	Hero is a **RESTRICTED USE** pesticide.
chlorpyrifos + bifenthrin TUNDRA SUPREME	8-23	5.6-16.8 fl.oz.	0.1-0.32 + 0.03-0.1	30	Tundra Supreme is a **RESTRICTED USE** pesticide.
chlorpyrifos + gamma-cyhalothrin COBALT	3-7	19-38 fl.oz.	0.37-0.74 + 0.007-0.013	21 (grain, ears, forage, fodder) 1 (grazing)	Cobalt is a **RESTRICTED USE** pesticide.
chlorpyrifos + lambda-cyhalothrin COBALT ADVANCED	3-8	16-38 fl.oz.	0.31-0.74 + 0.016-0.038	21 (grain, ears, forage, fodder) 1 (grazing)	Cobalt Advanced is a **RESTRICTED USE** pesticide.
chlorpyrifos + zeta-cypermethrin STALLION	11-14	9.25-11.75 fl.oz.	0.2-0.25 + 0.02-0.025	30 (grain, stover) 60 (forage)	Stallion is a **RESTRICTED USE** pesticide.
cyfluthrin TOMBSTONE Other trade names [2]	46-80	1.6-2.8 fl.oz.	0.025-0.044	21 (grain, fodder) 1 (grazing)	Tombstone is a **RESTRICTED USE** pesticide.
deltamethrin [2] DELTA GOLD 1.5 EC	67-85	1.5-1.9 fl.oz.	0.018-0.022	21 (grain, fodder) 12 (green)	Delta Gold is a **RESTRICTED USE** pesticide.

Table 5. Suggestions for Postemergence Corn Insect Control [1]					
Insecticide and Formulation	Acres Per Gallon	Amount of Formulation per Acre	Lb. Active Ingredient Per Acre	Minimum Days from Last Application to Harvest or Grazing	Comments
STINK BUGS (cont.)					
gamma-cyhalothrin DECLARE Other trade names [2]	83-125	1.02-1.54 fl.oz.	0.01-0.015	21 (grain, fodder, silage) 1 (grazing)	Declare is a **RESTRICTED USE** pesticide.
lambda-cyhalothrin KARATE with Zeon Technology Other trade names [2]	67-100	1.28-1.92 fl.oz.	0.02-0.03	21 (grain, fodder, silage) 1 (grazing)	Karate is a **RESTRICTED USE** pesticide.
lambda-cyhalothrin + chlorantraniliprole BESIEGE	13-21	6-10 fl.oz.	0.02-0.03 + 0.04-0.06	21 (grain, fodder, silage) 1 (grazing)	Besiege is a **RESTRICTED USE** pesticide.
spinosad + gamma-cyhalothrin CONSERO	42	1.5 fl.oz. of each product	0.046 + 0.015	28 (grain, fodder, silage) 1 (grazing)	Consero is a **RESTRICTED USE** pesticide. It is a co-pack of two insecticides that must be applied together.
zeta-cypermethrin MUSTANG MAXX EC INSECTICIDE	32-47	2.72-4 fl.oz.	0.017-0.025	30 (grain, stover) 60 (forage)	Mustang Maxx is a **RESTRICTED USE** pesticide.
SUGARCANE BEETLES					
See discussion of sugarcane beetles in introduction. See Tables 2 and 4 for suggested seed treatments and at-planting insecticides to control sugarcane beetles. No known rescue treatments have been found to be effective.					
WESTERN CORN ROOTWORM LARVAE					
See Tables 2 and 4 for suggested seed treatments or at-planting insecticides to control western corn rootworm larvae; see Table 3 for transgenic corn that can control western corn rootworm larvae.					
chlorpyrifos + gamma-cyhalothrin COBALT	3	38-42 fl.oz.	0.74-0.82 + 0.013-0.015	21 (grain, ears, forage, fodder) 1 (grazing)	Cobalt is a **RESTRICTED USE** pesticide. Apply as a cultivation treatment by directing spray to base of plant or use chemigation.
chlorpyrifos + lambda-cyhalothrin COBALT ADVANCED	3-4	32-42 fl.oz.	0.62-0.82 + 0.032-0.042	21 (grain, ears, forage, fodder) 1 (grazing)	Cobalt Advanced is a **RESTRICTED USE** pesticide. Apply as directed spray to base of plant at cultivaton or via chemigation.
chlorpyrifos LORSBAN 75 WG LORSBAN 15G LORSBAN ADVANCED Other trade names [2]	— — 4	1.33 lb. 8 oz./1000 row ft. 2 pt./A	1 — 0.93	21 21 21	Apply granules to base of plants at time of cultivation just ahead of cultivator shovel. Apply 75 WG as a water emulsion to base of plants on both sides of the row just ahead of cultivator shovel. See label for detailed instructions. Lorsban Advanced is a **RESTRICTED USE** pesticide.
phorate THIMET 20-G SMARTBOX Other trade names [2]	—	4.5-6 oz./ 1000 row ft.	no more than 1.3 lb. a.i./A	30	Apply granules at time of cultivation to base of plants just ahead of cultivator shovels. Phorate is a **RESTRICTED USE** pesticides.
terbufos COUNTER 20-G LOCK'N'LOAD	—	6 oz./1000 row ft.	1.3 lb. a.i./A maximum	30 (grazing, forage)	Apply to base of plants just ahead of cultivator shovels. Counter is a **RESTRICTED USE** pesticide.
WHITE GRUBS					
See Tables 2 and 4 for suggested seed treatments or at-planting insecticides for control of white grubs.					
WIREWORMS					
See Tables 2 and 4 for suggested seed treatments or at-planting insecticides for control of wireworms.					

Table 6. Relative Efficacy Ratings (1 to 5) of Postemergent Insecticides for Control of Aboveground (Seedling, Whorl, Stalk, Ear) Field Corn Insects. See Table 5 for Insecticide Rates

	INSECTS							
INSECTICIDES	Fall Armyworm (larvae)	True Armyworm (larvae)	Billlbug (adults)	Chinch Bug (adults, nymphs)	Corn Earworm (larvae)[1]	Cutworm (larvae)	European Corn Borer (larvae)[2]	Southwestern Corn Borer (larvae)[2]
Baythroid XL	3	1-2	NL	3	1-3	1	L	2
Tombstone	3	1-2	NL	2	1-3	1	L	2
Brigade	2	1-2	NL	1	1-2	1	L	2
Delta Gold	2	1-2	NL	L	1-2	1	L	2
Asana	3, NL	1-2	NL	4	1-3	1	L	2
Declare	2	1-2	NL	2-3	1-2	1	L	2
Karate	2	1-2	NL	3	1-3	1	L	2
Pounce	L	1-2	NL	NL	1-3	L	L	L
Mustang Maxx	2	1-2	NL	2-3	1-2	1	L	2
Fastac	2	1-2	NL	2-3	1-2	1	L	2
Hero	2	1-2	NL	L	1-2	NL	L	2
Sevin	4	1	NL	5	4	3-4	L	L
Lorsban	2	1	L	2	3	2-3	L	L
Lannate	2	1	NL	NL	2	NL	L	L
Intrepid	2, NL	L	NL	NL	3, NL	NL	1-2	1-2
Tracer	2	1	NL	NL	2-3	NL	3	3
Consero	2	1	NL		2	1-2	L	L
Radiant	L	L	NL	NL	L	NL	L	L
Cobalt	2	L	L	2	2	L	L	2
Cobalt Advanced	2	L	L	2	2	L	L	2
Belt	1	1	NL	NL	2	L	1	1-2
Prevathon	1	NL	NL	NL	1	1,NL	1	NL
Besiege	2	L	NL	L	1	1	1	1

continued

Ratings range from 1-5: 1 = very effective; 5 = not effective

"L" means that the insect is on the label for this product, but that the relative efficacy in the Southeast is not known.

"NL"means the insect is not on the label for this product. In this case it is best to assume that the product is ineffective against that particular pest, unless there is a specific knowledge to the contrary.

[1] Insecticide must be able to reach the target pests. Ratings related to applications made to the target pest before it enters the stalk or ear.

[2] Targeted for second generation larvae before they bore into the stalk or ear.

Table 6. Relative Efficacy Ratings (1 to 5) of Postemergent Insecticides for Control of Aboveground (Seedling, Whorl, Stalk, Ear) Field Corn Insects. See Table 5 for Insecticide Rates (cont.)

INSECTICIDES	INSECTS					
	Flea Beetle (adults)	Grass-hopper (nymphs)	Japanese Beetle, Rootworm (adults)	Lesser Cornstalk Borer (larvae)	Southern Green or Green Stink bug	Brown Stink bug
Baythroid XL	1-2	1-2	1-2	NL	1-2	3
Tombstone	1-2	1-2	1-2	NL	1-2	3
Brigade	1-2	1-2	1-2	NL	1	2
Delta Gold	1-2	1-2	L	NL	1-2	3
Asana	2	1-2	2	NL	NL	NL
Declare	1-2	1-2	1	NL	1-2	3
Karate	1-2	1-2	1-2	4-5	1-2	3
Pounce		NL		NL	NL	NL
Mustang Maxx	1-2	1-2	1	NL	1-2	3
Fastac	1-2	1-2	1	NL	1-2	3
Hero	1-2	L	1	NL	1-2	3
Sevin	1-2	L	1	NL	NL	NL
Lorsban	L	1-2	1-2	NL	4, NL	4, NL
Lannate	L	NL	1-2	NL	4, NL	4, NL
Intrepid	NL	NL	NL	NL	5, NL	5, NL
Tracer	NL	NL	NL	NL	NL	NL
Consero	L	1-2	L	L	2	3-4
Radiant	NL	NL	NL	NL	NL	NL
Cobalt	L	L	1-2	4-5	1-2	3
Cobalt Advanced	L	L	1-2	4-5	1-2	3
Belt	NL	NL	NL	NL	NL	NL
Prevathon	NL	NL	NL	NL	NL	NL
Besiege	L	L	L	L	1-2	3

Ratings range from 1-5: 1 = very effective; 5 = not effective

"L" means that the insect is on the label for this product, but that the relative efficacy in the Southeast is not known.

"NL"means the insect is not on the label for this product. In this case it is best to assume that the product is ineffective against that particular pest, unless there is a specific knowledge to the contrary.

[1] Insecticide must be able to reach the target pests. Ratings related to applications made to the target pest before it enters the stalk or ear.

[2] Targeted for second generation larvae before they bore into the stalk or ear.

Table 7. Insecticides Labeled for Use on Field Corn, Including Worker Protection and Harvest or Grazing Intervals

Insecticide and Trade Name	A.I./ Formulated Product	Formulation	Restricted Entry Interval (hr)	Minimum Days from Last Application to Harvest or Grazing	Bee Hazard Restriction
alpha-cypermethrin MoA Group 3A[2]					
FASTAC EC (Restricted Use)	0.83 lb./gal.	emulsifiable concentrate	12	30 (grain, stover) 60 (forage)	yes [1]
beta-cyfluthrin MoA Group 3A					
BAYTHROID XL (Restricted Use)	1 lb./gal.	emulsifiable concentrate	12	21 (grain, fodder) 0 (green forage)	yes [1]
bifenthrin MoA Group 3A (Most bifenthrin products prohibited in coastal counties)[3]					
BIFENTHRIN 2EC[3] (Restricted Use)	2 lb./gal.	emulsifiable concentrate	12	30	yes [1]
BIFENTURE LFC[4]	2 lb./gal.	emulsifiable concentrate	12	not specified	yes [1]
BIFEN 2 AG GOLD[3] (Restricted Use)	2 lb./gal.	emulsifiable concentrate	12	30	yes [1]
BIFENTURE EC (Restricted Use)	2 lb./gal.	emulsifiable concentrate	12	30	yes [1]
BRIGADE 2EC [3] (Restricted Use)	2 lb./gal.	emulsifiable concentrate	12	30	yes [1]
CAPTURE LFR [4] (Restricted Use)	1.5 lb./gal.	liquid fertilizer ready	12	Not specified	yes [1]
DISCIPLINE 2 EC[3] (Restricted Use)	2 lb./gal.	emulsifiable concentrate	12	30	yes [1]
FANFARE 2 EC[3] (Restricted Use)	2 lb./gal.	emulsifiable concentrate	12	30	yes [1]
FANFARE ES [3] (Restricted Use)	2 lb./gal.	water-based concentrate	12	30	yes [1]
SNIPER 2 EC (Restricted Use)	2 lb./gal.	emulsifiable concentrate	12	30	yes [1]
TAILGUNNER [3] (Restricted Use)	2 lb./gal.	emulsifiable concentrate	12	30	yes [1]
TUNDRA [3] (Restricted Use)	2 lb./gal.	emulsifiable concentrate	12	30	yes [1]
XPEDIENT[4] (Restricted use)	2 lb./gal.	emulsifiable concentrate	12	30	yes [1]
bifenthrin + chlorethoxyfos MoA Group 3A + MoA Group 1B (Prohibited in all coastal counties)					
SMARTCHOICE 5G LOCK'N'LOAD (Restricted Use)	0.1 oz.. + 0.7 oz./lb.	granular	48	Not specified	
SMARTCHOICE 5G SMARTBOX (Restricted Use)	0.1 oz.. + 0.7 oz./lb.	granular	48	Not specified	no
bifenthrin + indole-3-butyric acid MoA Group 3A (Prohibited in all coastal counties)					
EMPOWER [2,3]	0.18 oz. + 0.00016 oz./gal.	granular	24 [5]	30	yes [1]
bifenthrin + zeta-cypermethrin MoA Group 3A (Prohibited in all coastal counties)					
HERO (Restricted Use)	0.93 lb. + 0.31 lb./gal.	emulsifiable concentrate	12	30 (grain, fodder, grazing) 60 (harvest for forage)	yes [1]
STEED (Restricted Use)	0.8 lb. + 0.7 lb./gal.	emulsifiable concentrate	12	30 (grain, stover, grazing) 60 (harvest for forage)	yes [1]

[1] Do not apply this product or allow it to drift to blooming crops or weeds if bees are visiting the treatment area.

[2] MoA = Mode of Action classification from the Insecticide Resistance Action Committee (www.irac-online.org). Insecticides with different MoAs should be used for insecticide resistance management.

[3] Do not use on corn in coastal counties.

[4] Pre-plant incorporated at-plant, or pre-emergence applications only.

[5] REI for detasseling and roguing is 18 days.

Table 7. Insecticides Labeled for Use on Field Corn, Including Worker Protection and Harvest or Grazing Intervals (cont.)

Insecticide and Trade Name	A.I./ Formulated Product	Formulation	Restricted Entry Interval (hr)	Minimum Days from Last Application to Harvest or Grazing	Bee Hazard Restriction
carbaryl MoA Group 1A					
SEVIN 4F, others	4 lb./gal.	liquid suspension	12 [1]	48 (grain, fodder) 14 (grazing, silage)	yes[2]
SEVIN XLR PLUS, others	4 lb./gal.	liquid suspension	12 [1]	Same as above	yes[2]
CARBARYL 4L, others	4 lb./gal.	liquid suspension	12 [1]	Same as above	yes[2]
SEVIN 80 SOLUPAK	12.8 oz./lb.	water soluble packet	12	Same as above	yes[2]
chlorantraniliprole MoA Group 28					
DUPONT CORAGEN	1.67 lb./gal.	suspension concentrate	4	14	no
DUPONT PREVATHON	0.43 lb./gal.	suspension concentrate	4	14 (grain), 1 (forage, fodder, stover)	no
chlorethoxyfos MoA Group 1B					
FORTRESS 5G (Restricted Use)	0.8 oz./lb.	granular	48	Not specified	no
FORTRESS 2.5G (Restricted Use)	0.4 oz./lb.	granular	48	Not specified	no
chlorpyrifos MoA Group 1B					
LORSBAN 4E (Restricted Use)	4 lb./gal.	emulsifiable concentrate	24	21	yes[3]
LORSBAN ADVANCED (Restricted Use)	3.755 lb./gal.	water emulsion	24	21	yes[3]
GOVERN 4E (Restricted Use)	4 lb./gal.	emulsifiable concentrate	24	21	yes[3]
HATCHET (Restricted Use)	4 lb./gal.	emulsifiable concentrate	24	21	yes[3]
CHLORPYRIFOS 4E AG (Restricted Use)	4 lb./gal.	emulsifiable concentrate	24	21 (grain, ears) Not specified for grazing or silage	yes[3]
NUFOS 4E (Restricted Use)	4 lb./gal.	emulsifiable concentrate	24	21 (grain, ears) Not specified for grazing or silage	yes[3]
YUMA 4E (Restricted Use)	4 lb./gal.	emulsifiable concentrate	24	21	yes[3]
WARHAWK (Restricted Use)	4 lb./gal.	emulsifiable concentrate	24	21	yes[3]
WHIRLWIND (Restricted Use)	4 lb./gal.	emulsifiable concentrate	24	21	yes[3]
LORSBAN 75WG	12 oz./lb.	water dispersable granule	24	21	yes[3]
LORSBAN 15G	2.4 oz./lb.	granular	24	21	yes[3]
LORSBAN 15G SMARTBOX	2.4 oz./lb.	granular	24	35	yes[3]
SAURUS 15G	2.4 oz./lb.	granular	24	21 (grain, ears) Not specified for grazing or fodder	yes[3]

[1] REI for detasseling corn is 21 days.

[2] Notify beekeepers within 1 mile of treatment area at least 48 hours before application. Apply when bees are least active, e.g., within 2 hours of sunrise or sunset.

[3] Do not apply this product or allow it to drift to blooming crops or weeds if bees are visiting the treatment area.

Table 7. Insecticides Labeled for Use on Field Corn, Including Worker Protection and Harvest or Grazing Intervals (cont.)

Insecticide and Trade Name	A.I./ Formulated Product	Formulation	Restricted Entry Interval (hr)	Minimum Days from Last Application to Harvest or Grazing	Hazard Bee Restriction
chlorpyrifos + bifenthrin MoA Group 1B + MoA Group 3A (Prohibited in all coastal counties)					
TUNDRA SUPREME (Restricted Use)	2.41 + 0.076 lb./gal.	emulsifiable concentrate	24	30	yes [1]
chlorpyrifos + gamma-cyhalothrin MoA Group 1B + MoA Group 3A					
BOLTON (Restricted Use)	2.5 + 0.083 lb./gal.	emulsifiable concentrate	24	21 (grain or ears) 14 (grazing, silage)	yes [1]
COBALT (Restricted Use)	2.5 + 0.045 lb./gal.	emulsifiable concentrate	24	21 (grain, ears, forage, fodder) 1 (grazing)	yes [1]
chlorpyrifos + lambda-cyhalothrin MoA Group 1B + MoA Group 3A					
COBALT ADVANCED (Restricted Use)	2.5 + 0.13 lb./gal/	emulsifiable concentrate	24	21 (grain, ears, forage, fodder) 1 (grazing)	yes [1]
chlorpyrifos + zeta-cypermethrin					
STALLION	2.75 + 0.275 lb./gal.	emulsifiable concentrate	24	30 (grain, stover) 60 (forage)	yes [1]
clothianidin MoA Group 4A					
PONCHO 600	5 lb./gal.	seed treatment	Not specified	Not specified	minimize planter dust
ACCELERON IC-609	5 lb./gal.	seed treatment	Not specified	Not specified	
clothianidin + *Bacillus firmus* MoA Group 4A					
PONCHO VOTiVO	4.17 + 0.84 lb./gal.	seed treatment	Not specified	Not specified	minimize planter dust
cyfluthrin MoA Group 3A					
TOMBSTONE (Restricted Use)	2 lb./gal.	emulsifiable concentrate	12	21 (grain, fodder) 0 (grazing)	yes [1]
TOMBSTONE HELIOS (Restricted Use)	2 lb./gal.	emulsifiable concentrate	12	21 (grain, fodder) 0 (grazing)	yes [1]
deltamethrin MoA Group 3A					
DELTA GOLD 1.5 EC (Restricted Use)	1.5 lb./gal.	emulsifiable concentrate	12	21 (grain, fodder) 12 (forage, grazing)	yes [1]
dimethoate MoA Group 1B					
DIMETHOATE 4E	4 lb./gal.	emulsifiable concentrate	48	28 (grain) 14 (forage)	yes [1]
DIMATE 4E	4 lb./gal.	emulsifiable concentrate	48	28 (grain) 14 (forage)	yes [1]
DIMETHOATE 400	4 lb./gal.	emulsifiable concentrate	48	28 (grain) 14 (forage)	yes [1]
DIMETHOATE 4EC	4 lb./gal.	emulsifiable concentrate	48	28 (grain) 14 (forage)	yes [1]
esfenvalerate MoA Group 3A					
ASANA XL (Restricted Use)	0.66 lb./gal.	emulsifiable concentrate	12	21	yes [1]
S-FENVALOSTAR (Restricted Use)	0.66 lb./gal.	emulsifiable concentrate	12	21	yes [1]
etoxazole MoA Group 10B					
ZEAL WDG	11.5 oz./lb.	water dispersable granule	12	21	no
ZEAL MITICIDE	11.5 oz./lb.	water soluble packets	12	21	no
flubendiamide MoA Group 28					
BELT SC	4 lb./gal.	soluble concentrate	12	1 (forage, silage) 28 (grain, stover)	no

[1] Do not apply this product or allow it to drift to bloomimg crops or weeds if bees are visiting the treatment area.

Table 7. Insecticides Labeled for Use on Field Corn, Including Worker Protection and Harvest or Grazing Intervals (cont.)

Insecticide and Trade Name	A.I./ Formulated Product	Formulation	Restricted Entry Interval (hr)	Minimum Days from Last Application to Harvest or Grazing	Bee Hazard Restriction
gamma-cyhalothrin MoA Group 3A					
DECLARE (Restricted Use)	1.25 lb./gal.	microencapsulated suspension	24	21 (grain, fodder, silage) 1 (grazing)	yes [2]
PROAXIS (Restricted Use)	0.5 lb./gal.	microencapsulated suspension	24	21 (grain, fodder, silage) 1 (grazing)	yes [2]
hexythiazox MoA Group 10A					
ONAGER	1 lb./gal.	emulsifiable concentrate	12	30	no
imidacloprid MoA Group 4A					
NITRO SHIELD	5 lb./gal.	liquid used as seed treatment	12	Not specified	no
MACHO 600 ST	5 lb./gal.	liquid used as seed treatment	12	Not specified	yes[2]
GAUCHO 600	5 lb./gal.	liquid used as seed treatment	12	Not specified	no
AXCESS	5 lb./gal.	liquid used as seed treatment	12	Not specified	no
NITRO SHIELD IV	4 lb./gal.	liquid used as seed treatment	12	45	yes [1,2]
ATTENDANT 600	5 lb./gal.	liquid used as seed treatment	12	Not specified	yes[1]
DYNA-SHIELD IMIDACLOPRID 5	5 lb./gal.	liquid used as seed treatment	12	Not specified	yes[1]
SENATOR 600 FS	5 lb./gal.	liquid used as seed treatment	12	Not specified	no
imidacloprid + metalaxyl MoA Group 4A					
CONCUR SEED TREATMENT	4 oz./lb. + 0.16 oz./lb.	dust used as seed treatment	24	Not specified	no
imidacloprid + carboxin and metalaxyl MoA Group 4A					
LATITUDE	4 oz. + 2.2 oz. + 0.16 oz./lb.	dust used as seed treatment	24	45	no
l**ambda-cyhalothrin** MoA Group 3A					
GRIZZLY Z INSECTICIDE (Restricted Use)	1 lb./gal.	capsule suspension	24	21 (grain, fodder, silage) 1 (grazing, forage)	yes[2]
KARATE with ZEON TECHNOLOGY (Restricted Use)	2.08 lb./gal.	capsule suspension	24	Same as above	yes[2]
LAMBDA-CY 1EC (Restricted Use)	1 lb./gal.	emulsifiable concentrate	24	Same as above	no
LAMBDASTAR (Restricted Use)	1 lb./gal.	emulsifiable concentrate	24	Same as above	yes[2]
LAMBDASTAR 1CS (Restricted Use)	1 lb./gal.	capsule suspension	24	Same as above	yes[2]
LAMBDASTAR PLUS (Restricted Use)	2 lb./gal.	aqueous-based formulation	24	Same as above	yes[2]
LAMBDA-T (Restricted Use)	1 lb./gal.	capsule suspension	24	Same as above	yes[2]
LAMCAP	1 lb./gal.	capsule suspension	24	Same as above	yes[2]
PARADIGM (Restricted Use)	1 lb./gal.	capsule suspension	24	Same as above	yes[2]
PROVINCE (Restricted Use)	1 lb./gal.	capsule suspension	24	Same as above	yes[2]
SILENCER (Restricted Use)	1 lb./gal.	emulsifiable concentrate	24	Same as above	yes[2]

[1] Ensure that planting equipment is functioning properly in accordance with manufacturer specifications to minimize seed coat abrasion during planting to reduce dust, which can drift to blooming crops or weeds.

[2] Do not apply this product or allow it to drift to blooming crops or weeds if bees are visiting the treatment area.

Table 7. Insecticides Labeled for Use on Field Corn, Including Worker Protection and Harvest or Grazing Intervals (cont.)

Insecticide and Trade Name	A.I./ Formulated Product	Formulation	Restricted Entry Interval (hr)	Minimum Days from Last Application to Harvest or Grazing	Hazard Bee Restriction
LAMDA CY AG (Restricted Use)	1 lb./gal.	emulsifiable concentrate	24	21 (fodder, silage) 1 (grain, grazing)	yes[2]
LAMDA-CY EC (Restricted Use)	1 lb./gal.	emulsifiable concentrate	24	21 (grain, fodder, silage) 1 (grazing, forage)	yes[2]
NUFARM LAMBDA CYHALOTHRIN IEC (Restricted Use)	1 lb./gal.	emulsifiable concentrate	24	21 (grain, fodder, silage) 1 (grazing, forage)	yes[2]
KENDO (Restricted Use)	1 lb./gal.	emulsifiable concentrate	24	21 (grain, fodder, silage) 1 (grazing, forage)	yes[2]
lambda-cyhalothrin + chlorantraniliprole MoA Group 3A + MoA Group 28					
BESIEGE (Restricted Use)	0.417 lb. + 0.835 lb./ gal.	capsule suspension plus soluble concentrate	24	21 (grain, fodder, silage) 1 (grazing, forage)	yes[2]
malathion MoA Group 1B					
MALATHION 5, others	5 lb./gal.	emulsifiable concentrate	12[1]	7	yes[2]
GOWAN MALATHION 8, others	8 lb./gal.	emulsifiable concentrate	12[1]	7	yes[2]
CHEMINOVA MALATHION 57%	5 lb./gal.	emulsifiable concentrate	12[1]	7	yes[2]
FYFANON	5 lb./gal.	emulsifiable concentrate	12[1]	7	yes[2]
FYFANON ULV AG	9.9 lb./gal.	emulsifiable concentrate	12[1]	7	yes[2]
methomyl MoA Group 1A					
DUPONT LANNATE LV (Restricted Use)	2.4 lb./gal.	water soluble liquid	48	21 (grain, fodder) 3 (grazing, forage)	yes[2]
DUPONT LANNATE SP (Restricted Use)	14.4 oz./lb.	water soluble packet	48	Same as above	yes[2]
NUDRIN LV (Restricted Use)	2.4 lb./gal.	water soluble liquid	48	Same as above	yes[2]
NUDRIN SP (Restricted Use)	14.4 oz./lb.	water soluble packet	48	Same as above	yes[2]
methoxyfenozide MoA Group 18					
INTREPID 2F	2 lb./gal.	liquid	4	21	no
permethrin MoA Group 3A					
ARCTIC 3.2EC (Restricted Use)	3.2 lb./gal.	emulsifiable concentrate	12	30 (grain, fodder) 0 (forage)	yes[2]
PERMETHRIN (Restricted Use)	3.2 lb./gal.	emulsifiable concentrate	12	Same as above	yes[2]
PERMETHRIN 3.2EC, others (Restricted Use)	3.2 lb./gal.	emulsifiable concentrate	12	Same as above	yes[2]
PERMETHRIN 3.2 Ag (Restricted Use)	3.2 lb./gal.	emulsifiable concentrate	12	Same as above	yes[2]
STILETTO (Restricted Use)	0.08 oz./lb.	pellets	12	Same as above	yes[2]
PERMASTAR AG (Restricted Use)	3.2 lb./gal.	emulsifiable concentrate	12	Same as above	yes[2]
PERM-UP 3.2EC (Restricted Use)	3.2 lb./gal.	emulsifiable concentrate	12	Same as above	yes[2]
POUNCE 25 WP (Restricted Use)	4 oz./lb.	wettable powder	12	Same as above	yes[2]
POUNCE 1.5 G (Restricted Use)	0.24 oz./lb.	granular	12	Same as above	yes[2]
AMBUSH 25W (Restricted Use)	4 oz./lb.	wettable powder	12	Same as above	yes[2]

[1] 72 hours for detassling activities.

[2] Do not apply this product or allow it to drift to blooming crops or weeds while bees are actively visiting the treatment area.

Table 7. Insecticides Labeled for Use on Field Corn, Including Worker Protection and Harvest or Grazing Intervals (cont.)

Insecticide and Trade Name	A.I./ Formulated Product	Formulation	Restricted Entry Interval (hr)	Minimum Days from Last Application to Harvest or Grazing	Bee Hazard Restriction
phorate MoA Group 1B					
THIMET 20-G SMARTBOX OR LOCK'N'LOAD OR EZLOAD (Restricted Use)	3.2 oz./lb.	granular	48	30	no
propargite MoA Group 12C					
COMITE II (Restricted Use)	6 lb./gal.	emulsifiable concentrate	13 days	30	no
spinetoram MoA Group 5					
RADIANT SC	1 lb./gal.	suspension concentrate	4	28 (grain) 3 (forage, fodder)	yes[1]
spinosad MoA Group 5					
BLACKHAWK	5.8 oz./lb.	wettable powder	4	28 (grain, fodder) 7 (forage)	yes[1]
ENTRUST	12.8 oz./lb.	wettable powder	4	Same as above	yes[1]
ENTRUST SC	2 lb./gal.	soluble concentrate	4	Same as above	yes[1]
SPINTOR 2 SC	2 lb./gal.	soluble concentrate	4	Same as above	yes[1]
TRACER	4 lb./gal.	aqueous suspension	4	28 (grain) 3 (forage, fodder)	yes[1]
spinosad + gamma-cyhalothrin MoA Group 5 + MoA Group 3A					
CONSERO (Restricted Use)	4 lb./gal. + 1.25 lb./ gal.	co-pack containing 0.5 gallon of each insecticide	24	28 (grain, fodder, silage) 1 (grazing)	yes[2]
spiromesifen MoA Group 23					
OBERON 2SC	2 lb./gal.	suspension concentrate	12	30 (grain, stover) 5 (forage, silage)	no
OBERON 4SC	4 lb./gal.	suspension concentrate	12	30 (grain, stover) 5 (forage, silage)	no
terbufos MoA Group 1B					
COUNTER 15G LOCK'N'LOAD OR SMARTBOX (Restricted Use)	2.4 oz./lb.	granular	48	30	no
COUNTER 20G LOCK'N'LOAD OR SMARTBOX	3.2 oz./lb.	granular	48	30	no
thiamethoxam MoA Group 4A					
CRUISER 5FS	5 lb./gal.	seed treatment	12	Not specified	yes [3]
zeta-cypermethrin MoA Group 3A					
MUSTANG MAXX EC INSECTICIDE (Restricted Use)	0.8 lb./gal.	emulsifiable concentrate	12	30 (grain, stover) 60 (forage)	yes [2]

[1] This product is toxic to bees exposed to treatment during the 3 hours following treatment. Do not apply to blooming, pollen-shedding, or nectar-producing parts of plants if bees may forage on the plants during this time period.

[2] Do not apply this product or allow it to drift to blooming crops or weeds if bees are visiting the treatment area.

[3] Thiamethoxam is highly toxic to bees exposed to direct treatment and effects may be possible as a result of exposure to translocated residues in blooming

Other products may be available. Always read the label to make sure the specific crop is listed and to determine what rate to use.

Insect Pest Management section prepared by Kathy L. Flanders, Extension Entomologist, Professor, Department of Entomology and Plant Pathology, Auburn University.

DISEASE AND NEMATODE CONTROL

In general, diseases cause minimal damage to corn most years. Rusts, ear rots, and storage rots are the most widespread and important diseases of corn. Mycotoxin contamination, primarily aflatoxin on rotted grain, is of particular concern to farmers. Stalk rots and viruses may also cause significant losses on limited acreage across the state. Common smut, southern corn leaf blight, and crazy top are reported every year but are of little economic importance. For a more detailed description of corn diseases, see Extension Circular ANR-601, "Corn Diseases."

Most corn diseases can be controlled through the use of good management practices.

- Plant recommended varieties with resistance to viruses and diseases common to your region.
- Select high-quality seed treated with a fungicide.
- Plant only on well-drained and well-prepared seedbeds. Avoid arid or poorly drained soils.
- Maintain balanced fertility levels. Nitrogen and potassium imbalances can increase leaf diseases and stalk rot and cause lodging.
- Rotate corn with non-grass crops. Rotating crops will reduce diseases and nematodes that attack corn.
- Plant early to avoid buildup of aphids and other virus-transmitting insects as well as southern rust.
- Maintain plant populations at recommended levels to reduce stalk rots and lodging.

Fungicides (see Table 9) may partially control fungal leaf blights and rust, but in most cases they are not economical. Fungicide applications to field corn should only be considered when crop prices are good, yield potential is high (more than 120 bushels per acre), and weather conditions at tasseling favor rapid disease development. The need for protective fungicide treatments can often be avoided by planting disease resistant corn hybrids. Southern rust is the most destructive disease on corn. The later corn is planted, the higher the risk of a destructive rust outbreak.

Several species of plant-parasitic nematodes can reduce corn yields sufficiently to cause economic losses. Sting, stubby root, and lesion nematodes are known to be the most damaging species on corn. Southern or cotton root-knot nematodes also attack, damage, and reproduce on all field corn hybrids. Problems with root-knot nematodes occur where corn is rotated with cotton. Crop rotation with non-host crops will prevent the buildup of nematode populations to damaging levels. Corn is immune to the reniform nematode.

Although nematicides are effective against nematodes that attack corn, they are too expensive to use on field corn in most situations. Consequently, they are not recommended for general use in nematode-infested cornfields. Only in rare cases where soil insects and nematodes are a problem would nematicides/insecticides be cost effective.

Table 8. Properties of Nematicides Used on Corn That May Affect Water Quality

Common Name	Trade Name	Surface-Loss Potential[1]	Leaching Potential[2]
Ethoprop	Mocap	Medium	Large
Terbufos	Counter	Medium	Small

[1]The surface-loss potential indicates the tendency of the pesticide to move with sediment in runoff.

[2]The leaching potential indicates the tendency of the pesticide to move in solution with water and to leach below the root zone.

Table 9. Fungicides Labeled for Controlling Helminthosporium Leaf Spots, Gray Leaf Spot, and Rust

Chemical Name	Rate per Acre	Comments
Aspergillus flavus AFLA-GUARD GR	10-20 lb.	**Aflatoxin suppression** Apply by air or ground between growth stages V10 – V12 and R1 (silking) as an over-the-top broadcast treatment. Use higher rate if aflatoxin contamination has been historically high.
azoxystrobin QUADRIS FLOWABLE	6.2-15.5 fl.oz. 6-9 fl.oz.	For control of southern rust, northern corn leaf blight, southern corn leaf blight, gray leaf spot, and anthracnose on field corn. Apply when symptoms first appear on lower leaves and repeat after 7 to 14 days. Do not make more than two consecutive applications of Quadris or other Group 11 fungicide. For control of common rust. See above comments for application timing.
azoxystrobin + propiconzaole QUILT	7-14 fl.oz. 10.5-14 fl.oz.	For control of northern and southern corn leaf blight. Apply when disease first appears on leaves and make a second application 7 to 14 days later as needed to control disease. For control of eyespot, southern and common rust, anthracnose, and gray leaf spot in field corn. Apply when disease appears and repeat 7 to 14 days later if conditions favor disease development. **DO NOT** make more than two applications per year. **DO NOT** apply before tasseling or within 30 days of harvest to corn grown for fodder, grain, or stover. Add a crop oil concentrate or other adjuvant to increase the level of disease control. See label for other use restrictions.
QUILT XCEL	10.5-14 fl.oz.	For control of anthracnose leaf blight, eyespot, common and southern rust, northern and southern corn leaf blights, and gray leaf spot as well as suppression of Diplodia ear rot. Apply when disease first appears and repeat 7 to 14 days later. Do not make more than two applications per year. Do not apply before tasselling or 30 days before harvest for forage, grain, or stover. Add a crop oil concentrate or adjuvant to enhance coverage of the foliage. See label for other use restrictions.
azoxystrobin + tebuconazole Custodia	9-12.9 fl. oz.	For control of northern and southern corn blight, rusts, gray leaf spot, anthracnose, eyespot. Make first application before disease first appears and follow with a second application as needed 7 to 14 days later. Do not apply more than 51.7 fl. oz. /A/season to corn. Do not use on adjuvant or crop oil after GSV8 and prior to GSVT (tasseling).
fluoxastrobin EVITO 480SC	2-5.7 fl.oz.	For control of southern and common rust, anthracnose, gray leaf spot, Northern and Southern corn leaf blight, and eye spot in field, sweet, and seed corn. Apply at silking to milk stage and again 10 to 14 days later when conditions favor disease. Final application must be no later than the R4 (early soft dough) stage. See label for further use restrictions.
fluoxastrobin + flutriafol FORTIX	4-6 fl.oz.	For control of common and southern rust, anthracnose, gray leaf spot, northern and southern corn leaf blight, and eyespot on field corn. Make first application when disease first appears and follow with a second application no later than growth stage R4 after 7 to 10 days. **DO NOT** use adjuvant for applications made between growth stage V8 and VT (tasseling). See label for additional instructions and use restrictions.
fluoxastrobin + tebuconazole EVITO T	4-9 fl.oz.	For control of common and southern rust, northern and southern leaf blight, leaf anthracnose, gray leaf spot, eye spot, and northern corn leaf spot on field and seed corn. Apply up to two times preventively no later than growth stage R4 (early dough stage). Minimum retreatment interval is 7 days. See label for additional use guidelines and restrictions.
flutriafol TOPGUARD	7-14 fl.oz.	For control of anthracnose, common and southern rust, gray leaf spot, northern and southern corn leaf blight, and eyespot on field corn and popcorn. For optimal disease control, make first application before symptoms appear and repeat after 7 to 14 days. Use higher rate when disease pressure is high and conditions are favorable. **DO NOT** use a surfactant for applications made between growth stage V8 and VT (tasseling).
fluxapyroxad + pyraclostrobin PRIAXOR	4-8 fl.oz.	For control of anthracnose, common and southern rust, gray leaf spot, northern and southern corn leaf blight, and eyespot on field corn. For optimal disease control, make first application before symptoms appear and repeat after 7 to 14 days. **DO NOT** use adjuvant or crop oil for applications made between growth stage V8 and VT (tasseling) unless specified on label. See label for additional application and resistance management instructions
mancozeb DITHANE DF DITHANE F-45 DITHANE M-45 MANZATE PRO STICK PENNCOZEB 80W PENNCOZEB 4F	 1.2 qt. 1.2 qt. 1.5 lb. 1.5 lb. 1.5 lb. 0.8-1.2 qt.	For control of common rust, gray leaf spot, and leaf blight diseases of corn. Begin applications when disease first appears. Use with a spray adjuvant. DO NOT exceed 12 pounds active ingredient mancozeb or maneb-related product per acre per season.

Table 9. Fungicides Labeled for Controlling Helminthosporium Leaf Spots, Gray Leaf Spot, and Rust (cont.)

Chemical Name	Rate per Acre	Comments
picoxystrobin APROACH	 3-4 fl.oz. 6-12 fl.oz.	For control of anthracnose, common and southern rust, gray leaf spot, northern and southern corn leaf blight, and eyespot on field corn and popcorn. For early season disease suppression, apply between growth stage V4 and V7. For best results, apply between growth stage VT and R3, and make first application before disease onset. Reapply at 7- to 14-day intervals as needed. Use higher rate at shorter interval when disease pressure is high. **DO NOT** use an adjuvant or crop oil for applications made between growth stage V8 and VT (tasseling). **DO NOT** make more than two sequential applications of Aproach before switching to a fungicide with a different mode of action.
picoxystrobin + cyproconazole APROACH PRIMA	 3.4 fl.oz. 3.4-6.8 fl.oz.	For control of anthracnose, common and southern rust, gray leaf spot, northern and southern corn leaf blight, and eyespot on field corn and popcorn. For early season disease suppression, apply between growth stage V4 and V7. For best results, apply between growth stage VT and R3, and make first application before disease onset. Reapply at 7- to 14-day intervals as needed. Use higher rate at shorter interval when disease pressure is high. **DO NOT** apply with an adjuvant or crop oil when applying Aproach Prima between growth stage V8 and VT (tasseling). **DO NOT** make more than two sequential applications before switching to a fungicide with a different mode of action. **DO NOT** exceed 6.8 fluid ounces per acre per crop.
propiconazole BUMPER 41.8 EC PROPIMAX TILT 3.6E	 2-4 fl.oz. 2-4 fl.oz. 2-4 fl.oz. 4 fl.oz.	For control of northern and southern corn leaf blight. Apply when disease first appears and continue at 7- to 14-day intervals as needed to control the disease. Use higher rate when conditions favor disease development. **DO NOT** apply more than 16 fluid ounces per acre per year of any propiconazole formulation to corn grown for grain or within 30 days of harvest to corn grown for fodder, grain, or stover. See label for other use restrictions. For control of eyespot, southern and common rust, and gray leaf spot. Apply when disease first appears and repeat at 7- to 14-day intervals as needed to control disease. **DO NOT** apply more than 16 fluid ounces per acre per year of any propiconazole formulation to corn grown for grain or within 30 days of harvest to corn grown for fodder, grain, or stover. See label for other use restrictions.
prothioconazole + trifloxystrobin STRATEGO YLD	 4-5 fl.oz.	For control of northern and southern corn leaf blight, eyespot, southern and common rust, and gray leaf spot on field corn. Apply at silking or milk stage and repeat 7 to 14 days later when conditions favor further disease development. **DO NOT** apply more than 10 fluid ounces per acre per year. See label for further use restrictions.
pyraclostrobin HEADLINE 2.09SC	6-12 fl.oz.	For control of anthracnose, northern and southern corn leaf blight, yellow leaf spot, southern rust, and gray leaf spot, apply when conditions favor disease and repeat application 7 to14 days later as needed to control disease. Apply at higher rate and shorter intervals when weather patterns favor disease. Make no more than two consecutive applications of Headline or other Group 4 fungicide. See label for application and resistance management instructions.
pyraclostrobin + metconazole HEADLINE AMP	10-14.4 fl.oz.	For control of anthracnose, northern and southern corn leaf blight, Physoderma brown spot, southern and common rust, and gray leaf spot, apply prior to disease development and repeat at 7- to 14-day intervals as needed. Use higher rate at shorter interval when conditions favor disease. **DO NOT** make more than two consecutive applications of Headline AMP or other Group 4 fungicide. Maximum product per ace per season is 57.6 fluid ounces.
tebuconazole MONSOON ORIUS 3.6F TEBUZOL 3.6F TEBUSTAR 3.6F	4-6 fl.oz.	For control of rust, southern corn leaf blight, northern corn leaf blight, and gray leafspot. Apply as protective treatment when conditions favor disease or when symptoms first appear. Repeat applications at 7- to 14-day intervals. A maximum of 24 fluid ounces may be applied per year. See label for additional instructions.
tetraconazole DOMARK 230ME	4-6 fl.oz.	For control of common and southern rust, northern and southern corn leaf blight, gray leaf spot, and anthracnose leaf blight. Apply before disease appears but when conditions favor disease development. Do not apply more than 6 fluid ounces per acre or make more than one application per year. Do not apply between growth stage V8 and VT (tasselling) with an adjuvant.

Table 10. Corn Nematode Control

	Amount of Formulation		
Nematicide	Per 1000 Ft. Row	Per Acre	Comments
abamectin + thiamethoxam AVICTA DUO CORN	—	See label.	**Field, Popcorn, and Sweet Corn**: Apply with commercial seed treatment equipment. For early season suppression of nematodes.
clothianidin + *Bacillus firmus* I-1582 PONCHO/VOTiVO	—	See label.	**Field, Popcorn, and Sweet Corn**:Apply with commercial seed treatment equipment.
ethoprop MOCAP 15G LOCK'N'LOAD	12-16 oz.	See label.	**Field and Sweet Corn**: Apply at planting on 6- to 7-inch band *over seed furrow* and lightly incorporate. Rate depends on row spacing. See label for applicator settings and application instructions.
terbufos COUNTER LOCK'N'LOAD 15G	6-8 oz. 6-8 oz.	— —	**Field, Popcorn, and Sweet Corn**:Apply on 7-inch band directly behind planter shoe and in front of press wheel. Incorporate with drag chains or tines. See label for other use restrictions Do not exceed 6.5 lb. of Counter per acre. Place in seed furrow behind the planter shoe so granules are covered by soil..

Disease and Nematode Control section prepared by Austin K. Hagan, Extension Plant Pathologist, Professor, Department of Entomology and Plant Pathology, Auburn University; and Paul Mask, Extension Agronomist, Professor, Department of Crop, Soil and Environmental

WEED CONTROL

Table 11. Corn Weed Control

Herbicide Trade Name (Rate/Acre Broadcast)	Herbicide Common Name (Active Herbicide/Acre)	Comments
MINIMUM TILL, STRIP-TILL, AND NO-TILL BURNDOWN OPTIONS		
ROUNDUP (Various trade names) Generics (0.75-2.1 pt.) [5.5 lb./gal.) or (1-3 pt.) [4 lb./gal.]	glyphosate (0.5-1.5 lb.) (0.5-1.5 lb.)	Apply immediately before, during, or after planting but before crop emergence with 10 to 20 gallons of spray solution per acre. Use higher spray rate for heavier weed infestations and where crop residue or stubble is dense. See label for higher use rates needed to control perennial weeds. Glyphosate is labeled for use as a tank mixture with a number of herbicides. See label. Can be tank mixed with atrazine, 2,4-D, or Aim to improve burndown weed control If 2,4-D is used with glyphosate for improved wild radish and cutleaf eveningprimrose control, planting of corn must be delayed for 7 to 14 days. Refer to glyphosate label for the need for addition of a non-ionic surfactant to spray mix. *MOA–ESP synthesis inhibitor
GRAMOXONE INTEON/ GRAMOXONE SL (2-4 pt.) [2 lb./gal.] or FIRESTORM (1.25-2.5 pt.) [3 lb./gal.] + Non-ionic Surfactant (1 qt./100 gal. spray mix)	paraquat or paraquat + non-ionic surfactant	Use low rate for weeds less than 3 inches tall and high rate for weeds that are between 3 to 6 inches tall. Weeds more than 6 inches tall may not be adequately controlled. Paraquat will not control horseweed, swinecress, purslane speedwell, or curly dock. Use 20 to 60 gallons of spray solution per acre to assure good spray coverage. Use high rate for heavy weed infestations and where crop residue or stubble is dense. Some regrowth from rye, oats, and wheat may occur after treatment. This regrowth may vary with small grain species, variety, and stage of growth. For these reasons, apply herbicide 10 to 14 days prior to planting. If regrowth occurs, retreat at planting, Paraquat is registered for use as a tank mixture with a number of herbicide combinations. If 2,4-D is used with paraquat for improved wild radish and cutleaf eveningprimrose control, planting of corn must be delayed for 7 to 14 days. **DO NOT** make more than three applications of paraquat per year. Paraquat is a **RESTRICTED USE** pesticide. MOA–Photosystem I inhibitor
LIBERTY 280SL (29-36 oz.) [2.34 lb./gal.)	glufosinate (0.53-0.66 oz.)	Apply during or after planting but before crop emerges to kill emerged annual grasses and weeds. Thorough spray coverage is essential for optimum performance. Ground application requires a minimum of 15 gallons of water per acre. Dense weed canopies require 20 to 40 gallons per acre. Liberty will not provide adequate burndown control of small grains. Provides very effective burndown control of volunteer peanut. Can be tank mixed with glyphosate or 2,4-D. The use of a soil residual herbicide at planting is mandatory for optimum weed control and will help delay the development of herbicide resistance. If Liberty is applied as a burndown treatment, no addtional Liberty can be applied postemergence during the growing season. Rain-free period is 4 hours. MOA–Glutamine synthesis inhibitor
2,4-D (1-2 pt.) Various trade names [3.8 lb./gal.]	2, 4-D (0.48-0.96 lb.)	Can be applied prior to planting in combination with glyphosate, paraquat, or glufosinate for improved burndown of problem weeds, including herbicide-resistant horseweed and cutleaf eveningprimrose. Corn can be planted 7 to 14 days after application. MOA–Synthetic auxin
BANVEL CLARITY (8 oz.) [4 lb./gal.]	dicamba (0.25 lb.)	Apply prior to planting in combination with glufosinate, glyphosate, or paraquat to fields where horseweed is a problem. Wait 7 days before planting. Corn must be planted at least 1.5 inches deep. MOA–Synthetic auxin

*MOA=Mechanism of action. Herbicides with different MOAs should be used in weed resistance management. See Table 13.

Table 11. Corn Weed Control (cont.)		
Herbicide Trade Name (Rate/Acre Broadcast)	Herbicide Common Name (Active Herbicide/Acre)	Comments
PREPLANT INCORPORATED		
ERADICANE 6.7E (4.75 pt.)	EPTC (4 lb.) + safener + extender	Gives good control of annual grasses. It should be incorporated according to label directions immediately after application. Failure to do so will result in loss of the chemical by volatilization. Provides good control of annual grasses and nutsedge. It is weak on many broadleaf weeds. Risk of corn injury on coarse soils is greater where heavy rainfall and cold weather follow treatment. May be mixed with fertilizers (see label) for simultaneous application. **DO NOT** use on hybrid corn grown for seed. ***See johnsongrass control section for rates to control nutsedge, wild cane, Texas panicum (buffalograss), bermudagrass, and johnsongrass.*** MOA– Lipid synthesis inhibitor
PREEMERGENCE		
AATREX/ATRAZINE 4L (1.6-2 qt.) or AATREX/ATRAZINE 90WDG (1.8-2.2 lb.)	atrazine (1.6-2 lb.)	Controls many annual broadleaf weeds and few grasses. Atrazine does not provide adequate control of panicum, signalgrass, some species of crabgrass, and certain other annual grasses. It may be applied to the soil surface immediately after planting or delayed for up to 3 weeks after planting but before weeds are 1.5 inches tall. Corn has excellent tolerance to atrazine. It may be mixed with liquid fertilizer for simultaneous application. **DO NOT** apply atrazine combined with liquid fertilizer if corn has emerged. Use the low rate on highly erodible soils (as classed by NRCS) if conservation tillage is not utilized. Use the high rate on highly erodible soils where conservation tillage practices are utilized (more than 30-percent plant residue) or on soils that are not highly erodible. **DO NOT** exceed 2 pounds active ingredient per acre as a preemergence treatment. **DO NOT** apply within 50 feet of any well, pond, stream, or sinkhole. Wear protective clothing, boots, and rubber gloves when mixing or loading herbicide. Atrazine is a **RESTRICTED USE** pesticide. MOA–Photosystem II inhibitor
DUAL II MAGNUM 7.64E DUAL MAGNUM 7.62E CINCH 7.64E (1-1.67 pt.)	s-metolachlor (0.95-1.59 lb.)	Controls many annual grasses but is weak on broadleaf weeds. Herbicide is very similar to Micro-Tech for control of most weeds but is more effective on yellow nutsedge. Best results are obtained when rainfall occurs within 4 to 6 days after application. MOA–Mitosis inhibitor
HARNESS 7EC (1.5-3 pt.)	acetochlor (1.3-2.6 lb.) + safener	Controls most annual grasses and some broadleaf weeds in corn. It can be applied preplant incorporated or preemergence, but before corn emerges. Apply in a minimum of 10 gallons of spray mix per acre, using a spray pressure of 15 to 40 psi. Use the low rate on coarse-textured soils that are low in organic matter and the high rate on fine-textured soils with organic matter less than 3 percent. To control large-seeded broadleaf weeds such as sicklepod, morninglories, and cocklebur, atrazine should be added to the spray mix. See label for rotational crop restrictions. Harness is a **RESTRICTED USE** pesticide. MOA–Mitosis inhibitor
MICRO-TECH 4ME (2-2.75 qt.)	alachlor (2-2.75 lb.)	Controls most annual grasses including fall panicum and some small-seeded broadleaf weeds. It does not effectively control Texas panicum, common cocklebur, or morningglory. Apply to the soil surface during or immediately after planting. Best results are obtained when rainfall occurs within 7 days after application. Under dry conditions, shallow cultivation or rotary hoeing may improve control. Corn has good tolerance to alachlor. Use low rate on coarse soils and high rate on medium- to fine-textured soils. Micro-Tech is a **RESTRICTED USE** pesticide. MOA–Mitosis inhibitor

Table 11. Corn Weed Control (cont.)

Herbicide Trade Name (Rate/Acre Broadcast)	Herbicide Common Name (Active Herbicide/Acre)	Comments
PREEMERGENCE (cont.)		
OUTLOOK 6L (12-18 fl.oz.)	dimethenamid (0.56-0.84 lb.)	Controls most annual grasses and some broadleaf weeds in field corn. It can be applied preplant incorporated, preemergence, or early postemergence, but before weeds emerge. Incorporation should be in the top 1 to 2 inches of soil. Use lower rates on coarse-textured soils, the intermediate rate on medium soils, and higher rates on fine-textured (heavy) soils. See label for use rate for yellow nutsedge control. Can be tank mixed with other herbicides. **DO NOT** apply more than 21 fluid ounces per acre per season. MOA–Mitosis inhibitor
PRINCEP 4L SIMAZINE 4L (2 qt.) or PRINCEP CALIPER 90 SIMAZINE 90WDG (2.2 lb.)	simazine (2 lb.)	Controls some annual broadleaf weeds and grasses. It provides adequate control of signalgrass, some species of crabgrass, and certain other annual grasses. It must be applied to the soil surface immediately after planting before weeds emerge. Corn has excellent tolerance to simazine. **DO NOT** apply within 50 feet of any well, pond, stream, or sinkhole. Wear protective clothing, boots, and rubber gloves when mixing or loading herbicide. Simazine requires more rainfall than atrazine for activation. MOA–Photosystem II inhibitor
PYTHON 80 WG (0.8-1 oz.)	flumetsulam (0.04-0.05 lb.)	Controls a number of broadleaf weeds. Can be tank-mixed with atrazine and other labeled herbicides for use on field corn to increase spectrum of weed control. Due to crop injury, Python cannot be used when Counter or Thimet insecticides are used. All other insecticides should be applied in a T-band or band to avoid potential crop injury. Use on soils with less than 1.5 percent organic matter may result in crop injury. Has lengthy recropping restrictions for certain crops (canola–26 months, cotton–18 months, peanuts–4 months). See label. MOA–ALS inhibitor
SURPASS 6.4EC (1.5-2.75 pt.)	acetochlor (1.2-2.2 lb.) + safener	Controls most annual grasses and some broadleaf weeds in corn. It can be applied preplant, preplant incorporated, preemergence, or early postemergence, but before weeds emerge. Apply in a minimum of 10 gallons of spray mix per acre, using a spray pressure of 15 to 40 psi. Use the low rate on coarse-textured soils that are low in organic matter, the intermediate rate on medium soils, and the high rate on fine-textured soils with organic matter less than 3 percent. See label for higher permissible rates in reduced till or no-till corn. To control large-seeded broadleaf weeds such as sicklepod, morningglories, and cocklebur, atrazine should be added to the spray mix. See label for rotational crop restrictions. Surpass is a **RESTRICTED USE** pesticide. MOA–Mitosis inhibitor
ZIDUA (1.5-2.75 oz. of 85WG)	pyroxasulfone (0.079-0.146)	Can be applied preplant incorporated, preemergent, or early postemergence (growth stage V4) prior to weed seedlings emergence. Provides residual control of certain annual grasses and broadleaf weeds, including Palmer amaranth. Can be tank mixed with atrazine, glyphosate, and Liberty. Apply no more than 2.75 ounces per acre per year to coarse soils. See higher use rate for medium- and fine-textured soils. MOA–Very long chain fatty acid synthesis inhibitor

Table 11. Corn Weed Control (cont.)

Herbicide Trade Name (Rate/Acre Broadcast)	Herbicide Common Name (Active Herbicide/Acre)	Comments
POSTEMERGENCE		
2,4-D AMINE (0.5-1 pt.)	2,4-D amine (0.25-0.5 lb.)	Provides excellent control of most annual broadleaf weeds. Broadcast over-the-top when corn is 4 to 8 inches tall and weeds are small. Use the high rate when weeds are larger and weather is cool. After corn is more than 8 inches tall, apply 1 pint per acre on a broadcast basis using drop nozzles to direct spray to base of plants. Corn may be injured by over-the-top applications when it is silking or tasseling. Corn stalks often become brittle after application; therefore, cultivation should be delayed at least 1 week after application. Prevent spray drift from contacting susceptible crops during application. **CAUTION:** Use ester formulations carefully because vapors may rise in hot weather after application and may drift considerable distances. Certain corn hybrids may be more susceptible to injury than others. MOA–Synthetic auxin
AATREX/ATRAZINE 4L (2 qt.) or AATREX/ATRAZINE 90WDG (2.2 lb.)	atrazine (2 lb.)	Apply before weeds exceed 1.5 inches in height. **DO NOT** apply atrazine in combination with liquid fertilizer if corn has emerged. **DO NOT** apply more than 2.5 pounds active ingredient per acre total of Atrazine or AAtrex in one season. Can be applied to corn up to 12 inches tall. Atrazine is a **RESTRICTED USE** pesticide. MOA–Photosystem II inhibitor
AATREX/ATRAZINE 4L (1.25-2 qt.) or AATREX/ATRAZINE 90WDG (1.4-2.2 lb.) + Crop Oil Concentrate (2 pt.)	atrazine (1.25-2 lb.) + crop oil concentrate	Same as for atrazine, above. Addition of crop oil concentrate to postemergence sprays of atrazine speeds the activity and provides quicker kill of weeds; it also allows the use of lower atrazine rates. Use the low rate where broadleaf weeds are the only problem and high rate where broadleaf weeds and grasses are a problem. The addition of crop oil to atrazine sprays may result in crop damage. To minimize risk of injury, follow special precautions and application methods given on the product label. Atrazine is a **RESTRICTED USE** pesticide. MOA–Photosystem II inhibitor
ACCENT 75 WDG (0.67 oz.) or NIC-IT (2 fl.oz.) or ACCENT Q 54.5 WDG (0.9 oz.) + Non-ionic Surfactant (1 qt./100 gal. spray mix) or Crop Oil Concentrate (1 qt./25 gal. spray mix)	nicosulfuron (0.031 lb.) (0.031 lb.) (0.031 lb.) + non-ionic surfactant or crop oil concentrate	Provides postemergence control of some annual grasses, johnsongrass, and some broadleaf weeds. Apply over-the-top of field corn from the two-leaf (V2 stage) to 20 inches in height (but before V6 stage). Apply over-the-top of popcorn or field corn grown for seed up to 20 inches in height. Postemergence directed application can be made to field corn up to 36 inches tall (ten-leaf stage). Weeds should be small and actively growing at time of treatment. Apply in a minimum of 10 gallons of water per acre with a spray pressure of 25 to 40 psi. Avoid overlapping or doubling application at row ends or along field borders. Cultivation 10 to 14 days after application will improve control. **DO NOT** apply to sweet corn. A repeat treatment 14 to 28 days after treatment can be applied for hard-to-control grasses. **DO NOT** apply more than 1.3 ounces per acre per year. **DO NOT** apply to corn previously treated with Counter insecticide. Corn previously treated with a soil-applied organo-phosphate insecticide (Lorsban, Dyfonate, Thimet) may develop temporary corn injury. Severe corn injury may also occur if nicosulfuron application is made within 7 days of a foliar application of 2,4-D, Basagran, Lorsban, malathion, or parathion. There is a 10-month recropping restriction for most crops planted in treated soils with a pH less than 6.5; there is an 18-month restriction for most crops planted in treated soils with a pH greater than 6.5. In johnsongrass-infested fields, apply only to virus-tolerant hybrids. Nicosulfuron does not control crabgrass. Accent Q formulation contains a crop safener. MOA–ALS inhibitor

Table 11. Corn Weed Control (cont.)

Herbicide Trade Name (Rate/Acre Broadcast)	Herbicide Common Name (Active Herbicide/Acre)	Comments
POSTEMERGENCE (cont.)		
AIM 2 EC (0.5-1 fl.oz.) + Non-ionic Surfactant or Crop Oil Concentrate	carfentrazone (0.008-0.016 lb.) + non-ionic surfactant or crop oil concentrate	Controls several problem broadleaf weeds including tropical spiderwort. Can be applied over-the-top of corn until the V8 stage of growth. Use directed spray on larger corn up to the 14-leaf-collar growth stage. Apply with either a non-ionic surfactant (1 quart per 100 gallons of spray mix) or crop oil concentrate (1 gallon per 100 gallons of spray mix). Aim will cause injury in the form of leaf speckling or necrosis. Increased injury is observed when crop oil concentrate is used. See label for complete list of approved tank mixes. MOA–PPO inhibitor
ARMEZON/IMPACT 2.8SC (0.75 fl.oz.)	topramezone (0.016 lb.)	Apply postemergence over-the-top of corn. May be useful in areas where atrazine-resistant Palmer amaranth is a problem. May be tank mixed with atrazine, glyphosate (Roundup Ready corn), or Liberty (Liberty-Linked corn). Use in combination with crop oil concentrate (1 gallon per 100 gallons spray mix) and UAN (1.25 gallons per 100 gallon spray mix) or AMS (8.5 to 17 pounds per 100 gallons of spray mix). Can be applied postemergence up to 45 days before harvest. See label for replanting and crop rotation restrictions. MOA–Carotenoid biosysnthesis inhibitor
BANVEL 4 (0.5 pt.) or CLARITY 4 (0.5 pt.)	dicamba (0.25 lb.) (0.25 lb.)	Controls most annual broadleaf weeds, including some difficult to control with low rates of 2,4-D. It will not control mustards as well as 2,4-D. Banvel can be applied any time from the corn seedling stage until corn is 36 inches high. Over-the-top sprays are generally more effective when corn is small; drop-nozzle application is better when corn is taller than 8 inches. Clarity can only be used postemergence on corn less than 8 inches tall. **DO NOT** allow spray drift to contact susceptible plants during application; soybeans and most vegetables are very sensitive to minute amounts of dicamba. **DO NOT** apply when day temperatures exceed 85°F. **DO NOT** use crop or petroleum oils with dicamba. MOA–Synthetic auxin
BASAGRAN 4SC (1.5-2 pt.)	bentazon (0.75-1 lb.)	Apply early postemergence when corn has one to five leaves for control of certain broadleaf weeds and yellow nutsedge suppression. Corn is tolerant to Basagran at all stages, but larger weeds are not as easy to kill. **DO NOT** apply to corn which is showing stress from drought, cold weather, or other herbicide injury. A crop oil concentrate may be added to the spray mix at a rate of one quart per acre to control certain weeds. Two applications, 7 to 10 days apart, are required for yellow nutsedge control. MOA–Photosystem II inhibitor
BEACON 75 WDG (0.75 oz.) + Non-ionic Surfactant (1 qt./100 gal. spray mix) or Crop Oil Concentrate (1 qt./25 gal. spray mix)	primisulfuron (0.57 oz.) + non-ionic surfactant or crop oil concentrate	Provides postemergence control of johnsongrass and some broadleaf weeds. Apply Beacon over-the-top or semi-directed to corn when plants are 4 to 20 inches tall but before corn reaches 20 inches in height. **DO NOT** apply Beacon as a band application directly over the corn rows. If a second split application is made to corn, it can be applied up to the tassel emergence stage if the application is directed.**DO NOT** exceed 0.75 ounce per acre per year. Weeds must be small and actively growing at time of treatment. Application should be made with ground equipment using 10 to 20 gallons of water per acre at 40 psi spray pressure. Always use water as the carrier. **DO NOT** use a crop oil concentrate or nitrogen solution when applying Beacon with any other postemergence herbicide (such as dicamba or 2,4-D). **DO NOT** apply Beacon where Counter has been previously applied to corn. When other soil-applied insecticides have been applied to corn, delay Beacon application for 20 days to reduce possibility of corn injury. **DO NOT** apply Beacon within 10 days after an organo-phosphate insecticide application or with herbicides containing bentazon or 2,4-D. See label for recropping restrictions. Some corn hybrids are sensitive to Beacon; check with company representatives for current list. In johnsongrass-infested fields, apply only to virus-tolerant hybrids. MOA–ALS inhibitor

Table 11. Corn Weed Control (cont.)		
Herbicide Trade Name (Rate/Acre Broadcast)	Herbicide Common Name (Active Herbicide/Acre)	Comments
POSTEMERGENCE (cont.)		
BUCTRIL 2EC (1-1.5 pt.) or BUCTRIL 4EC (0.5-0.75 pt.)	bromoxynil (0.25-0.375 lb.)	A contact postemergence herbicide that is effective in controlling a number of seedling broadleaf weeds. Use the low rate on susceptible weeds. Apply in a minimum of 20 gallons water per acre and with a minimum spray pressure of 30 psi. Apply over-the-top, beginning when corn is in the four-leaf stage. When corn is 12 inches tall or more, use drop nozzles to direct the spray solution toward the base of the corn plant. **DO NOT** mix with liquid fertilizer, surfactants, or oils. Observe all precautions. MOA–Photosystem II inhibitor
CALLISTRO 4SC (3 fl.oz.) + Crop Oil Concentrate	mesotrione (0.094 lb.) + crop oil concentrate	Controls a number of broadleaf weeds, including small escaped palmer amaranth. Apply to small actively growing weeds and Palmer pigweed smaller than 5 inches in height. Apply with a crop oil concentrate at a rate of 1 gallon per 100 gallons of spray mix. Apply in combination with spray grade UAN (2.5 gallons per 100 gallons of spray mix) or AMS (8.5 pounds per 100 gallons of spray mix). **DO NOT** use if corn has been treated with soil application of Counter or Lorsban. Corn up to 30 inches tall or up to the eight-leaf growth stage can be treated. See label for possible tank-mix partners. MOA–Carontenoid biosynthesis inhibitor
CAPRENO 3.45SC (3 fl.oz.)	thiencarbazone + tembotrione + safener (0.013 + 0.0675 lb.)	Apply postemergence for control of Palmer amaranth and certain annual grasses such as crabgrass and Texas panicum. Can be applied over-the-top of corn from V1 to V6 stage of growth and post-directed from V6 to V7 stage of growth. Can be tank mixed with atrazine glyphosate (Roundup Ready corn), or Liberty (Liberty-Linked corn). Use in combination with crop oil concentrate (1 gallon per 100 gallons of spray mix) and 1.5 quarts UAN per acre or 1.5 pounds of AMS per acre. **DO NOT** use on field corn treated with organophosphate soil insecticides See label for replanting and crop rotation restrictions. MOA–Carotenoid biosynthesis inhibitor
DISTINCT 70WDG (4-6 oz.) + Non-ionic Surfactant	dicamba (0.125-0.189 lb.) + diflufenzopyr (0.05-0.075 lb) + non-ionic surfactant	Will control many annual broadleaf weeds and will suppress the growth of some annual grasses. Apply 6 ounces per acre when corn is 4 to 10 inches tall and 4 ounces per acre when corn is 10 to 24 inches tall. Must be applied with a non-ionic surfactant (1 quart per 100 gallons of spray mix) and a nitrogen source such as urea ammonium nitrate (UAN) or spray-grade ammonium sulfate (AMS). Use 5 quarts of UAN or 5 pounds of AMS per 100 gallons of spray mix. **DO NOT** use petroleum-based or methylated seed oils. **DO NOT** tank mix with Banvel, Clarity, 2,4-D, Poast, Poast Plus, Lorsban, Ambush, or Warrior. Any crop can be planted 120 days after application. **DO NOT** apply within 15 days of tassel emergence. **DO NOT** apply more than 10 ounces of Distinct per acre per season. MOA–Synthetic auxin and Auxin transport inhibitor
ET (0.4-0.75 fl.oz.) [0.208 lb./gal.]	pyraflufen (0.0007-0.0012 lb.)	Can be applied over-the-top of field corn up to V2 stage of growth. Can be tank mixed with glyphosate for use in Roundup Ready corn to improve the control of annual morningglories. **DO NOT** use with a crop oil concentrate. MOA–PPO inhibitor.
LAUDIS 3.5 SC (3 fl.oz.)	tembotrione (0.082 lb.)	May be useful for the postemergence control of escaped Palmer amaranth in situations where 2,4-D use would be undesirable or glyphosate-, ALS-, or triazine-resistance is suspected. Also provides residual control of several grasses. Tank mixes with Roundup to improve control of pigweeds, ragweed, and morningglory can be applied over-the-top of corn from emergence to V8 growth stage. Two applications can be made (14 days apart), but 6 ounces per acre is the maximum amount allowed per season. Should be applied with a crop oil or methylated seed oil at 1 percent v/v (1 gallon per 100 gallons spray mix). MOA–HPPD inhibitor

Table 11. Corn Weed Control (cont.)

Herbicide Trade Name (Rate/Acre Broadcast)	Herbicide Common Name (Active Herbicide/Acre)	Comments
POSTEMERGENCE (cont.)		
OPTION 35WDG (1.5-1.75 oz.)	foramsulfuron (0.033-0.038 lb.) + crop safener	Provides good to excellent control of many annual grasses and johnsongrass. Can be applied over-the-top of corn from emergence to 16 inches tall (V5 stage). Application can be made to corn 16 to 36 inches tall using drop nozzles. Option MUST be applied with a methylated or ethylated seed oil (1.5 pints per acre) and a nitrogen fertilizer (urea ammonium nitrate [UAN]—1.5-2 quarts per acre OR spray-grade ammonium sulfate [AMS]—1.5-3 pounds per acre). **DO NOT** apply in a nitrogen solution. See label for approved tank mixes. **DO NOT** use Option if soil insecticide (Counter, Dyfonate, or Thimet) was used previously. Any crop can be planted in treated area after 60 days. **DO NOT** apply more than 3.5 ounces per acre per year. MOA–ALS inhibitor
RESOURCE (2-4 fl.oz.)	flumiclorac (0.013-0.026 lb.)	Apply with Roundup for increase broadleaf control in Roundup Ready corn. Tall ivyleaf and entireleaf morningglory control is enhanced by adding Resource to glyphosate. **DO NOT** apply before the two-leaf or after the 10-leaf stage of corn development. Use rate is dependent on size of target weed. Use with a non-ionic surfactant (1 quart per 100 gallons of spray mix). MOA–PPO inhibitor
SANDEA 75DF (0.66-1.33 oz.) + Non-ionic Surfactant (1-2 qt./100 gal.) or Crop Oil Concentrate (1 gal./100 gal.)	halosulfuron (0.032-0.063 lb.) + non-ionic surfactant crop oil concentrate	Controls many annual broadleaf weeds and nutsedge. Use higher rates for nutsedge and larger weeds. Can be applied over-the-top of corn from spike to layby stages. Can be tank mixed with other postemergence herbicides. See label. **DO NOT** apply more than 2.67 ounces per acre per year. **DO NOT** plant wheat for 3 months or soybeans for 10 months following application. MOA–ALS inhibitor
STATUS 56WDG (5-10 oz.)	dicamba + diflufenzopyr + saftener (0.125-0.25 lb.) + (0.05-0.10 lb.)	Apply postemergence over-the-top of corn to control a number of broadleaf weeds. Can be applied from 4-inch tall (V2) corn to 36-inch tall (V10) corn. Use in combination with non-ionic surfactant (1 quart per 100 gallons of spray mix) and AMS (5 to 17 pounds per 100 gallons of spray mix). Status can also be tank mixed with glyphosate (Roundup Ready corn) or Liberty (Liberty-Linked corn hybrids). When tank mixed with these herbicides, the normal use rate of Status is 5 ounces per acre. Status should not be tank mixed with Dual, Magnum, Harness, Outlook, Surpass, Lorsban, 2,4-D, or Stinger. See label for replanting and crop rotation restrictions associated with use. MOA–Synthetic auxin and Auxin transport inhibitor

Table 11. Corn Weed Control (cont.)		
Herbicide Trade Name (Rate/Acre Broadcast)	Herbicide Common Name (Active Herbicide/Acre)	Comments
POSTEMERGENCE (HERBICIDE-TOLERANT VARIETIES)		
LIBERTY 280SL (22 fl.oz.) [2.34 lb./gal.]	glufosinate (0.4 lb.)	**USE ONLY ON "LIBERTY-LINK" OR "GLUFOSINATE-RESISTANT" CORN HYBRIDS. APPLYING TO NON-TOLERANT VARIETIES WILL RESULT IN SEVERE CROP INJURY OR CROP DEATH!** Can be applied from time of emergence until corn has reached 24 inches in height (V-7 with seven developed collars). For corn 24 to 36 inches tall, apply Liberty only with drop nozzles and avoid spraying directly into the whorl or leaf axils. A broad-spectrum material with limited systemic activity, it has no soil residual activity. Effective on a number of annual grasses and broadleaf weeds. Use rate is dependent on the weeds present and their size. Most annual grasses are controlled by the medium and high use rate. Thorough coverage is essential. **DO NOT** add a surfactant or crop oil concentrate. Can be tank mixed with atrazine. It is rainfast in 4 hours. Make only two applications per season at least 10 to 14 days apart and **DO NOT** apply more than 44 fluid ounces of Liberty per acre per season. No rotation restrictions exist. **DO NOT** apply within 70 days of harvesting corn grain or within 60 days of harvesting corn forage. Requires the use of spray grade ammonium sulfate (AMS) at 3 pounds per acre (17 pounds per 100 gallons of spray mix). When temperatures exceed 85°F, the rate of AMS can be reduced to 1.5 pounds per acre (8.5 pounds per gallon of spray mix). See label for crop rotation restrictions. MOA–Glutamine synthesis inhibitor
LIGHTNING 70DG (1.28 oz.) + Non-ionic Surfactant (1 pt./100 gal. spray mix)	imazethapyr (0.042 lb.) + imazapyr (0.014 lb.) + non-ionic surfactant	**USE ONLY ON "CLEARFIELD" HYBRIDS. APPLYING LIGHTNING TO NON-TOLERANT VARIETIES WILL RESULT IN SEVERE CROP INJURY AND/OR CROP DEATH!** Application requires adding a surfactant and liquid fertilizer solution to the spray mix. Liquid fertilizer solution (such as 28% N, 32% N, or 10-34-0) at the rate of 1 to 2 quarts per acre is recommended. Spray-grade ammonium sulfate may be used at the rate of 2.5 pounds per acre instead of the fertilizer solution. Make postemergence application from the spike stage until corn is 12 inches tall (when weeds are less than 3 to 4 inches tall). Can be tank mixed with other herbicides, but observe all size limitations. **DO NOT** use crop oil concentrates or seed oils with spray mix. Make only one application per season. Application is rainfast within 1 hour. **DO NOT** apply to "IMI-Corn" hybrids treated with Counter or Thimet insecticides due to severe crop injury or death. **DO NOT** tank mix with Accent or Beacon. **DO NOT** feed or harvest for grain for at least 45 days after application. Recropping restrictions can be significant. Consult label before use to determine compatibility with production plans. MOA–ALS inhibitor
ROUNDUP (Various trade names) Generics (22 oz.) [5.5 lb./gal.) or (2 pt.) [4 lb./gal.]	glyphosate (0.94 lb.) (1 lb.)	**FOR USE ONLY ON ROUNDUP READY (RR) CORN HYBRIDS. APPLICATION OF GLYPHOSATE TO NONTOLERANT HYBRIDS WILL RESULT IN SEVERE CROP INJURY AND/OR CROP DEATH.** Apply over-the-top of Roundup Ready corn up to V8 stage or until corn height reaches 30 inches, whichever comes first. Drop nozzles should be used in making application to corn between 30 and 48 inches in height, keeping the herbicide spray out of the leaf whorl. **DO NOT** exceed a total of 2 pounds active ingredient glyphosate per acre per season over-the-top. Not all formulations of glyphosate are labeled for use on Roundup Ready corn hybrids. See label for use rate and need for addition of a non-ionic surfactant. Sequence is a premix of glyphosate + s-metolachlor. Expert is a premix of glyphosate + s-metolachlor + atrazine. See label for other tank mixes. MOA–ESP synthesis inhibitor

Table 11. Corn Weed Control (cont.)

Herbicide Trade Name (Rate/Acre Broadcast)	Herbicide Common Name (Active Herbicide/Acre)	Comments
POSTEMERGENCE (HERBICIDE-TOLERANT VARIETIES) (cont.)		
TOUCHDOWN TOTAL (24-35 fl.oz.) [4.17 lb./gal.]	glyphosate (0.78-1.14 lb.)	Apply over-the-top of **Roundup Ready (RR) corn hybrids** up to V8 stage or until corn height reaches 30 inches, whichever comes first. Sequential applications can be made, but **DO NOT** exceed a total of 70 fluid ounces per acre per year over-the-top. See label use rate on annual grass control. There is no need for additional surfactant. Avoid application of spray into whorls of corn plants. Allow at least 50 days between treatments or before harvest. MOA–ESP synthesis inhibitor
POSTEMERGENCE DIRECTED		
EVIK 80DF (1.25-2.0 lb.) + Non-ionic Surfactant (1 pt./25 gal. spray mix)	ametryn (1-1.6 lb.) + non-ionic surfactant	Provides excellent control of annual grasses and broadleaf weeds. May temporarily burn back perennials. Evik **MUST** be applied as a directed spray after corn plants are at least 12 inches tall. **DO NOT** apply within 3 weeks of tasseling. CAUTION: Over-the-top sprays will kill corn. May be applied in water or liquid nitrogen solutions. Use low rates on small, easily killed weeds and higher rates on larger, hard-to-kill weeds as specified on the product label. Evik is particularly effective on Texas panicum and broadleaf signalgrass. The highest rate will control 6-inch-tall signalgrass. MOA–Photosystem II inhibitor
GRAMOXONE INTEON 2.0 (1-2 pt.) or FIRESTORM 3 (0.75-1.3 pt.) + Non-ionic Surfactant	paraquat (0.25-0.5 lb.) (0.25-0.5 lb.) + non-ionic surfactant	For use as a postemergence directed spray after corn is at least 12 inches tall. Spray no higher than the lower 3 inches on the corn stalk. For control of broadleaf weeds and some grasses less than 4 inches tall, a non-ionic surfactant should be added to the spray mixture at the rate of 1 quart per 100 gallons of spray mix. **DO NOT** mix with liquid fertilizer. **DO NOT** spray on windy days. Gramoxone and Firestorm are **RESTRICTED USE** pesticides. MOA–Photosystem I inhibitor
LINEX 4L (1.25-1.5 pt.) or LOROX 50DF (1.25-1.5 lb.) + Non-ionic Surfactant (1 pt./25 gal. spray mix)	linuron (0.6-0.75 lb.) (0.6-0.75 lb.) + non-ionic surfactant	Provides excellent control of annual grasses and broadleaf weeds. May temporarily burn back perennials. Lorox MUST be applied as a directed spray after corn plants are at least 15 inches tall. **CAUTION:** Over-the-top sprays will kill corn. May be applied in water or non-pressure nitrogen solution. Use low rate on weeds 2 inches or less and on coarse soils low in organic matter. Use high rate for weeds up to 5 inches and on fine-textured soils. MOA–Photosystem II inhibitor
PROWL 3.3EC (1.2-3.6 pt.) or PROWL H_2O (1.5-3 pt.) Others (See label.)	pendimethalin (0.5-1.5 lb.) (0.75-1.5 lb.)	Apply as a directed spray after corn is 12 inches tall. Cultivate first with sweep or rolling cultivators to throw at least 1 inch of soil over the base of the corn plants prior to application. Must be incorporated using cultivators or irrigation water. Set cultivators to provide maximum soil mixing; move treated soil into the crop rows. This herbicide is effective on late-emerging problem grasses such as fall panicum and Texas panicum. MOA–Mitosis inhibitor
TREFLAN HFP (1-2 pt.) Others (See label.)	trifluralin (0.5-1 lb.)	Apply as a directed spray after corn is 12 inches tall and incorporate with a sweep-type or rolling cultivator. Cultivate first to cover the base of the corn plants with soil prior to application. Apply herbicide and then set cultivators to provide maximum soil mixing, to move treated soil into the crop row, and to avoid exposing untreated soil. This herbicide is effective on late-emerging problem grasses such as fall panicum and Texas panicum. MOA–Mitosis inhibitor

Table 11. Corn Weed Control (cont.)

Herbicide Trade Name (Rate/Acre Broadcast)	Herbicide Common Name (Active Herbicide/Acre)	Comments
HARVEST AID		
2,4-D (1-2 pt.) [3.8 lb./gal.]	2,4-D (0.475-0.95 lb.)	Apply when corn has reached the hard dough stage to suppress or control weeds and vines, which interfere with harvesting. Observe drift precautions on label to prevent damage to non-target areas. Wait 5 to 7 days after application before harvesting. MOA–Synthetic auxin
AIM 2EC (1.9 fl.oz.) + Crop Oil Concentrate	carfentrazone-ethyl (0.031 lb.) + crop oil concentrate	Apply after corn is mature and the grain has begun to dry down. Apply as a broadcast spray in sufficient spray volume to give complete coverage of crop and weeds such as morningglories, pigweed, and velvetleaf. Use a crop oil concentrate at rate of 1 gallon per 100 gallons of spray solution. A minimum of 3 days must be allowed between Aim application and grain harvest. MOA–PPO inhibitor
GRAMOXONE INTEON2 (1.2-2 pt.) or FIRESTORM 3 (0.8-1.3 pt.) + Non-ionic Surfactant (1 qt./100 gal. spray mix)	paraquat (0.3-0.5 lb.) paraquat (0.3-0.5 lb.) + non-ionic surfactant	Applications must be made at least 7 days before harvest. Apply after corn is mature and black layer has formed at the base of the kernals. MOA–Photosystem I inhibitor
ROUNDUP (Various trade names) Generics (22 oz.) [5.5 lb./gal.) or (2 pt.) [4 lb./gal.]	glyphosate (0.94 lb.) (1 lb.)	Apply 7 days before harvest when kernal moisture is less than 35 percent and after black layer formation. Avoid drift onto sensitive crops or sites. **DO NOT** use on corn grown for seed if hybrid is not Roundup Ready Corn 2. Not all formulations of glyphosate may be labeled for use as a harvest aid. See product label. MOA–ESP synthesis inhibitor
SODIUM CHLORATE (2 gal. of 3-lb. material) or SODIUM CHLORATE (1 gal. of 6-lb. material)	sodium chlorate (6 lb.) sodium chlorate (6 lb.)	Apply after corn is in black layer stage. Apply at least 14 days before anticipated harvest date on a bright, sunny day when temperature is above 75°F. Apply in 5 to 7 gallons of water by air. Grasses (such as johnsongrass) will be desiccated. Broadleaf weeds will probably be only defoliated. MOA–N/A
JOHNSONGRASS CONTROL		
Johnsongrass causes yield reductions in corn by competing with the crop for plant nutrients. In addition, johnsongrass serves as an alternate host to virus diseases. The diseases are then transmitted to the corn by insects. Control of johnsongrass in fields and along field borders is essential for optimum production.		
ACCENT 75 WDG (0.67 oz.) or NIC-IT (2 fl.oz.) + Non-ionic Surfactant (1 qt./100 gal. spray mix) or Crop Oil Concentrate (1 qt./25 gal. spray mix)	nicosulfuron (0.031 lb.) (0.031 lb.) + non-ionic surfactant crop oil concentrate	Same as Comments for nicosulfuron in the Postemergence section. Apply over-the-top of corn when rhizome johnsongrass is 8 to 12 inches tall and seedling johnsongrass is 4 to 10 inches tall. A second application can be made 14 to 28 days later when johnsongrass regrowth is 8 to 10 inches tall. **DO NOT** apply later than the ten-leaf stage of corn. D**O NOT** apply more than 1.33 ounces of WDG or 4 fluid ounces of 2 pounds per gallon liquid per acre per year. MOA–ALS inhibitor

Table 11. Corn Weed Control (cont.)

Herbicide Trade Name (Rate/Acre Broadcast)	Herbicide Common Name (Active Herbicide/Acre)	Comments
JOHNSONGRASS CONTROL (cont.)		
BEACON 75 WDG (0.75 oz.) + Non-ionic Surfactant (1 qt./100 gal. spray mix) or Crop Oil Concentrate (1 qt./25 gal. spray mix)	primisulfuron (0.57 oz.) + non-ionic surfactant crop oil concentrate	Same as Comments for Beacon in the Postemergence section. Seedling johnsongrass should be 4 to 12 inches tall, and rhizome johnsongrass should be 8 to 16 inches tall at time of first application. Two applications at half the labeled rate are permitted to control johnsongrass and subsequent regrowth. The second application should be made 10 to 20 days after the first application. **DO NOT** apply more than 0.75 ounce of Beacon per acre per year. **DO NOT** use a crop oil concentrate or nitrogen solution when applying Beacon with any other postemergence herbicide (such as dicamba or 2,4-D). MOA–ALS inhibitor
ROUNDUP (Various trade names) (1.4-2 qt.) [5.5 lb./gal.]	glyphosate (1.9-2.75 lb.)	Apply as a foliar treatment after harvest while johnsongrass is still growing and has produced at least 12 inches of regrowth (after mowing or plowing). Apply in 10 to 30 gallons of water per acre. Allow at least 7 days after application before tillage. Additional fall tillage will increase control: it chops rhizomes into small pieces. Use preplant or preemergence herbicide application in following year's crop to control seedling johnsongrass. See label for non-ionic surfactant use rate. MOA–ESP synthesis inhibitor
TOUCHDOWN TOTAL (1.4-2.2 qt.) [4.17 lb./gal.]	glyphosate (1.46-2.3 lb.)	Apply as a foliar spray after harvest when johnsongrass is at boot to head stage and in the fall prior to harvest. There is no need for surfactant addition. See Powermax comments for further control strategies. **DO NOT** exceed total of 5.75 quarts of Touchdown Total from all applications per year. MOA–ESP synthesis inhibitor

Table 12. Estimated Effectiveness of Recommended Herbicide Treatments for Corn on Common Weeds in Alabama [1]

WEEDS	HERBICIDES							
	AAtrex, Atrazine (PRE)	Dual (PRE)	Micro-Tech (PRE)	Outlook (PRE)	Princep (PRE)	Surpass, Harness (PRE)	Python (PRE)	Zidua (PRE)
GRASSES								
Broadleaf signalgrass	2	8	8	8	6	8	2	7
Crabgrass	8	9	9	9	8	9	4	9
Crowfootgrass	7	9	9	9	8	9	2	8
Fall panicum	3	8	8	9	8	9	2	8
Goosegrass	8	9	9	9	8	9	2	9
Johnsongrass (rhizomes)	0	0	0	0	0	0	0	7
Johnsongrass (seedlings)	4	5	5	5	5	6	2	6
Texas panicum	0	4	4	5	2	4	2	7
SEDGES								
Purple nutsedge	0	1	1	0	0	1	0	0
Yellow nutsedge	0	7	5	7	0	7	0	0
BROADLEAF WEEDS								
Bristly starbur	7	0	0	0	8	0	8	—
Cocklebur	7	0	0	0	7	0	9	—
Florida beggarweed	8	6	6	5	9	5	7-8	—
Florida pusley	8	9	9	9	9	9	8	8
Morningglory	7	0	0	0	7	0	7-8	7
Pigweed	8	8	9	9	9	9	8	8
Prickly sida	9	6	6	4	9	7	9	7
Sicklepod	7	5	7	5	8-9	4	7	8

continued

[1] Effectiveness ratings are based on observations of research plots and field use under average weather conditions for several years by weed control workers in Alabama.

KEY TO CONTROL RATINGS AND ABBREVIATIONS

Ratings on a scale of 0 to 10: 0 = No control; 10 = 100% control.

PRE = Preemergence.

— = Information not available.

Table 12. Estimated Effectiveness of Recommended Herbicide Treatments for Corn on Common Weeds in Alabama [1] (cont.)

WEEDS	HERBICIDES							
	2,4-D amine (POST)	AAtrex, Atrazine (POST)	Aim (POST)	Armezan/ Impact (POST)	Banvel/ Clarity (POST)	Basagran (POST)	Beacon (POST)	Buctril (POST)
GRASSES								
Broadleaf signalgrass	0	2	0	7	0	0	0	0
Crabgrass	0	7	0	8	0	0	0	0
Crowfootgrass	0	6	0	—	0	0	0	0
Fall panicum	0	4	0	7	0	0	7	0
Goosegrass	0	5	0	8	0	0	0	0
Johnsongrass (rhizomes)	0	0	0	0	0	0	8	0
Johnsongrass (seedlings)	0	2	0	6	0	0	8	0
Texas panicum	0	0	0	7	0	0	0	0
SEDGES								
Purple nutsedge	0	0	0	0	0	0	0	0
Yellow nutsedge	0	0	0	0	0	7	0	0
BROADLEAF WEEDS								
Bristly starbur	7	7	0	—	8	9	0	7
Cocklebur	9	9	8	8	9	9-10	4	9
Florida beggarweed	7	7	7	—	8	0	8	7
Florida pusley	8	8	7	7	7	0	7	8
Morningglory	9	9	8-9	6	9	4	7	7
Pigweed	9	8	8	8	9	4	8	8
Prickly sida	7	7	7	7	8	7	6	4
Sicklepod	8	8	5	—	9	0	6	0

continued

[1] Effectiveness ratings are based on observations of research plots and field use under average weather conditions for several years by weed control workers in Alabama.

KEY TO CONTROL RATINGS AND ABBREVIATIONS

Ratings on a scale of 0 to 10: 0 = No control; 10 = 100% control.

POST = Postemergence Over-The-Top.

— = Information not available.

Table 12. Estimated Effectiveness of Recommended Herbicide Treatments for Corn on Common Weeds in Alabama [1] (cont.)

WEEDS	HERBICIDES							
	Callistro (POST)	Capreno (POST)	Distinct (POST)	Liberty (POST)	Lightning (POST)	NIC-IT Accent (POST)	Option ({POST)	Status (POST)
GRASSES								
Broadleaf signalgrass	0	8	0	8	7	8-9	8	0
Crabgrass	7	8	0	8	8	6	6	0
Crowfootgrass	0	—	—	8	—	8	0	0
Fall panicum	0	—	0	8	6	8	8	0
Goosegrass	0	—	0	5	3	9	8	0
Johnsongrass (rhizomes)	0	5	0	6	5	8	8	0
Johnsongrass (seedlings)	0	7	0	8	8	9	8	0
Texas panicum	0	8	0	8	6	7	7	0
SEDGES								
Purple nutsedge	6	0	3	7	5	0	0	0
Yellow nutsedge	6	0	3	7	5	0	0	0
BROADLEAF WEEDS								
Bristly starbur	0	—	8	8	—	0	0	8
Cocklebur	8-9	8	9	8	9	6	6	9
Florida beggarweed	0	—	8	9	—	7	0	8
Florida pusley	0	—	8	7	7	5	0	8
Morningglory	7-8	9	9	8	8	7	6	9
Pigweed	8	9	8	7	8	8	8	8
Prickly sida	5	9	9	7	—	0	0	9
Sicklepod	4	5	8	8	6	0	6	8

continued

[1] Effectiveness ratings are based on observations of research plots and field use under average weather conditions for several years by weed control workers in Alabama.

KEY TO CONTROL RATINGS AND ABBREVIATIONS

Ratings on a scale of 0 to 10: 0 = No control; 10 = 100% control.

POST = Postemergence Over-The-Top.

— = Information not available.

Table 12. Estimated Effectiveness of Recommended Herbicide Treatments for Corn on Common Weeds in Alabama [1] (cont.)

WEEDS	HERBICIDES				
	Sandea (POST)	Evik (PDS)	Firestorm Gramoxone (PDS)	Lorox (PDS)	Aim (HAR)
GRASSES					
Broadleaf signalgrass	0	8	8	7	0
Crabgrass	0	8	4	8	0
Crowfootgrass	0	8	8	8	0
Fall panicum	0	8	8	8	0
Goosegrass	0	8	8	8	0
Johnsongrass (rhizomes)	0	0	3	4	0
Johnsongrass (seedlings)	0	8	8	7	0
Texas panicum	0	7-8	8	7	0
SEDGES					
Purple nutsedge	7-8	7	4	4	0
Yellow nutsedge	7-8	7	4	4	0
BROADLEAF WEEDS					
Bristly starbur	8	8	7	8	0
Cocklebur	9	7	7	9	7
Florida beggarweed	4	9	8-9	8	6
Florida pusley	8	8	6	8	7
Morningglory	7	8	6-8	8	9
Pigweed	8	9	8-9	9	8
Prickly sida	3	9	6	8	6
Sicklepod	2	9	8-9	8	0

[1] Effectiveness ratings are based on observations of research plots and field use under average weather conditions for several years by weed control workers in Alabama.

KEY TO CONTROL RATINGS AND ABBREVIATIONS

Ratings on a scale of 0 to 10: 0 = No control; 10 = 100% control.

POST = Postemergence Over-The-Top; PDS = Postemergence Directed Spray; HAR = Harvest Aid.

— = Information not available.

Table 13. Herbicide Classification by Mechanism of Action

Mechanism of Action	Herbicides
ALS inhibitor	Python, Accent/Nic-It, Beacon, Option, Sandea, Lightning
Auxin transport inhibitor	Distinct, Status
Carotenoid biosynthesis inhibitor	Callistro, Impact/Armezon, Laudis, Capreno
ESP synthesis inhibitor	Roundup, Touchton
Glutamine synthesis inhibitor	Ignite
Lipid synthesis inhibitor	Eradicane
Mitosis inhibitor	Dual/Cinch, Harness, Micro-Tech, Outlook, Surpass, Prowl/Pendimax, Treflan
Photosystem I inhibitor	Gramoxone Inteon/Firestorm
Photosystem II inhibitor	Aatrex/Atrazine, Princep/Simazine, Basagran, Buctril. Lorox/Linex, Evik
PPO inhibitor	Aim, Resource, ET
Synthetic auxin	2,4-D, Banvel/Clarity, Distinct, Status

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FOR MORE INFORMATION on pesticides, pesticide safety, or submitting samples for analysis, see the following publications in the IPM series:
IPM 1293, “Safety.” Safety contact information; worker protection standards; the safe use, handling, and storage of pesticides
IPM 1294, “Submitting Samples.” Procedures for submitting samples for diagnosis, analysis, and identification
IPM 1295, “General Pesticide Information.” Federal and state restricted use pesticide lists; pesticides and water quality
IPM 1317, “Appendix.” Pesticide guidelines for agronomic crops, including preharvest intervals; rain-free requirements; grazing restrictions; crop rotation guidelines; and the names, classifications, and toxicities of pesticides.

2015 IPM-0428

For more information, contact your county Extension office. Visit www.aces.edu/counties or look in your telephone directory under your county’s name to find contact information.

Use pesticides **only** according to the directions on the label. Follow all directions, precautions, and restrictions that are listed. Do not use pesticides on plants that are not listed on the label

The pesticide rates in this publication are recommended **only** if they are registered with the Environmental Protection Agency or the Alabama Department of Agriculture and Industries. If a registration is changed or canceled, the rate listed here is no longer recommended. Before you apply **any** pesticide, check with your county Extension agent for the latest information.

Trade names are used **only** to give specific information. The Alabama Cooperative Extension System does not endorse or guarantee any product and does not recommend one product instead of another that might be similar.

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ALABAMA A&M & AUBURN UNIVERSITIES

IPM-0415

Cotton

IPM

Insect, Disease, Nematode, and Weed Control Recommendations for 2015

INSECT CONTROL

Maximum profits in cotton production depend on an effective and economical insect management program. To plan such a program, you must know what insects are present and the amount of damage they are doing. The "tools of technology" available in managing cotton insects are cultural practices, the selective use of insecticides, insect scouting, transgenic varieties, and beneficial arthropods. The effectiveness of these tools can be maximized when they are used by all growers over a large area. Insect management does not mean reduction of the insect population to zero but merely to below the level of economic damage.

Cultural Practices

Certain production practices can have a significant effect on insect management and thus should be evaluated by considering the overall effect of the practice. For example, cotton grown under various conservation tillage methods may increase the likelihood of cutworm problems but may reduce thrips infestations. Any practice that delays fruiting or extends the fruiting period will increase the potential for damage by a variety of insects. High plant populations, excessive nitrogen rates, late planting, and excessive or careless herbicide use can all delay or extend the fruiting period. Generally, cultural practices that promote the health, vigor, and normal maturation of the cotton crop will benefit insect management.

Beneficial Arthropods

Parasites and predators are the first line of defense against bollworms, beet armyworms, and tobacco budworms. Predators such as nabids, big-eyed bugs, spiders, insidious flower bugs, green lacewings, and lady beetles are important regulators of caterpillars, particularly in early and mid season. Parasitic flies and wasps are less noticeable than are the predators, but their importance should not be underestimated. Cotton insecticides vary widely as to their toxicity toward beneficial arthropods and those characteristics should always be considered when choosing a product.

Selective Use of Insecticides

Selection of insecticides should be based on several factors; effectiveness in controlling target insects should not be the only consideration. Insects' potential to develop resistance, effects on beneficial arthropods and on other nontarget organisms, ease of application, human safety hazards, availability, and economic considerations are also important.

Apply insecticides only when the economic threshold level of the pest is reached. This can be determined only by thorough and regular scouting of the fields to obtain population densities of both destructive and beneficial insects. The use of scouting and thresholds often reduces insecticide and application costs, lowers the amount of unnecessary insecticides in the environment, and helps maximize profits.

Insecticide Application

Proper timing and coverage of insecticide applications are extremely important. Only field scouting will enable you to time applications for best effectiveness. Good coverage using ground equipment usually involves applying 5 to 8 gallons of water per acre at 60 to 70 pounds per square inch. Keep nozzles clean and functioning correctly. Maintain appropriate boom height.

Fixed-wing aircraft used to apply insecticides should be equipped with standard nozzles or rotary atomizing devices that will deliver the majority of the insecticides in droplets within the range of 100 to 300 microns. Fly 5 to 10 feet above the crop for the most effective insecticide placement and least drift. Mix emulsifiable concentrates with water immediately before application and apply from 1 to 5 gallons of the insecticide-water mixture per acre. For mid- to late-season insect control, particularly "worms," apply 3 to 5 gallons of total mixture per acre. Fly proper swath widths to obtain complete coverage of the field. Correct swath widths depend on the type aircraft used, weather, number and kind of insects present, and other factors.

Insect Pests of Cotton

Boll Weevils. The boll weevil has now been eradicated from the state. Therefore, neither economic weevil numbers nor damage should exist in any fields this year. However, reinfestations may occur from non-eradicated areas of the country. If weevil infestations are observed, they should be reported immediately to the local Boll Weevil Eradication Program.

Bollworms. Both the cotton bollworm and tobacco budworm can be devastating pests of cotton. Widespread problems with insecticide resistance, especially with pyrethroids, have occurred in the state. Planting transgenic cotton or using alternative insecticides will be necessary to control high levels of budworms in most areas. Cotton bollworms are capable of damaging both trangenic and conventional cotton varieties. Caterpillars reaching 0.25 inch or longer often survive on transgenic cotton. Escaped bollworms are usually found in the blooming zone of the plant in Bollgard II cotton. Some caterpillars may also be found in the upper part of plants containing Widestrike technology.

During periods of moth activity, monitor fields twice weekly. In previously untreated fields, apply a recommended larvicide when you find ten small larvae per 100 plants. In previously

treated fields, apply a recommended larvicide when you find five small larvae per 100 plants.

Spider Mites. In some areas of Alabama, spider mites cause severe damage. Normally, they cause more trouble during hot, dry weather. Spider mites feed on plant juices and cause leaves to become discolored. A heavy infestation can cause complete defoliation of cotton.

Planting behind a winter cereal cover crop, as opposed to fallow ground, reduces the risk of early mite infestations. Conservation tillage acreage containing winter weeds should be burned down well in advance of planting.

If damaging populations develop, make foliar applications of a recommended miticide. Two-spotted spider mites are notorious for developing resistance, and lasting control with any product is seldom achieved before mid-July. Excellent coverage is critical to mite control.

Fall Armyworms. Fall armyworms may cause economic damage to cotton in Alabama. Fall armyworms feed on and inside squares, blooms, and bolls in a manner similar to bollworms. The eggs are laid in masses of 150 or more on the undersides of leaves that are on the lower parts of the plants. The larvae are light green or cream colored at hatching but turn darker shades of brown, black, or green as they mature. Small larvae may have a characteristic black dot above and behind the third pair of true legs. Fall armyworm larvae usually have a light colored inverted Y-shape on their heads. The fall armyworm that attacks pastures, lawns, etc. is a different strain and does not damage cotton.

Beet Armyworms. The beet armyworm is a sporadic pest of cotton. The eggs are deposited in a fuzzy mass, usually on the bottom of leaves, and are similar to the egg masses of the fall armyworm. The newly hatched larvae feed en masse, skeletonizing leaves near the old egg mass. As they mature, they disperse, eating the fruit and foliage as they do. The beet armyworm will damage blooms, squares, and small bolls and even bore into the stalk. Beet armyworm infestations often begin along field edges or in skippy stands.

The larvae vary from pale to dark olive green, have dark stripes down their backs and pale stripes down each side, and reach a maximum length of 1 inch. A characteristic black spot is located above the second pair of thoracic (true) legs. The spot is often obscured by a dark lateral line. Take care not to confuse the beet armyworm with other armyworms that often possess an evident spot on the side of the first abdominal segment.

Cabbage and Soybean Loopers. Loopers are small, greenish, looping worms with white stripes down their backs. These worms feed on leaves, causing a ragged appearance. Loopers that occur in late season in high numbers are most likely the soybean looper. Begin control when worms are small if the top bolls expected for harvest are not mature. Late-season looper infestations are seldom widespread but may defoliate all cotton in a community when they occur.

Cutworms. There are several species of cutworms that attack seedling cotton. Use control measures where cotton stands are threatened. Cotton planted into weedy fields, cotton produced under various conservation tillage systems, and cotton produced on cool soils are more susceptible to cutworm infestation.

Cotton Aphids. Aphids may be numerous in cotton fields at any time during the growing season. They are usually found on the underside of leaves, on stems, and on terminals. Curling and yellowing of leaves indicate infestation. At-planting insecticides may aid in controlling aphids early in the season. Apply additional control measures when honeydew production is heavy. Aphid populations normally crash in July due to a naturally occurring fungus.

G**rasshoppers.** Grasshoppers have emerged as a pest of seedling cotton in recent years, primarily in conservation tillage systems. They chew the main stem of young plants, causing a reduction in stands. Cotton is most susceptible to grasshopper injury from the time it begins to emerge in the "crook stage" until the plants have about six true leaves. Both the immature and the adult stages may cause injury. Controls are warranted when stands are threatened.

Thrips. Thrips feed on the young leaves and buds and stunt the growth of seedling cotton. A common sign of a heavy thrips infestation is distorted leaves that have turned brownish around the edges and cup upward. Control of thrips increases yields and generally results in earlier maturity.

Plant Bugs and Fleahoppers. Plant bugs and fleahoppers migrate to cotton from weeds and various legumes. In prebloom cotton, both adults and nymphs feed on tiny squares, causing them to turn black. These insects are usually found in terminals and move quickly about the plant or fly when disturbed. Make one or more applications when 100 adults and/or nymphs are found per 100 row feet. If early square set is less than 80 percent, make one or more applications when populations exceed 50 adults and/or nymphs per 100 row feet. Check plants by shaking terminals over a sweep net or drop cloth prior to first bloom. Sampling techniques are not adequate when the majority of the plant bug population is in the adult stage.

Plant bugs can also be a problem in blooming cotton (July-August). At this point of the season, a large portion of the plant bug population is nymphs, and large squares and young bolls are damaged in addition to the small squares. Plant bug damage to young bolls results in "hard-locking" of one or more locks per boll. Damage to large squares is revealed as "dirty blooms," which show necrotic flower parts and warty petals caused when the bugs feed on large squares.

Controlling plant bugs in blooming cotton generally is warranted when 15 to 20 percent of bolls the diameter of a quarter reveal internal plant bug damage.

Whiteflies. Whiteflies damage cotton by sucking sap from plants and by secreting honeydew on which sooty mold grows and stains the lint. Heavy whitefly feeding reduces plant vigor, causes premature defoliation, and reduces yield. All whitefly stages are found on the undersurface of cotton leaves. The tiny, white, gnat-like adults lay small eggs that hatch into immature whiteflies, which soon resemble scale insects.

Historically, the banded-wing whitefly is the species that has been present in Alabama. A new species, the silverleaf whitefly, has now been identified in Baldwin, Mobile, and Houston counties. It is much more difficult to control with insecticides. The adult banded-winged whitefly has faint but visible grayish zigzag bands on the wings; the silverleaf whitefly is solid white.

Stink Bugs (Various species). Three main species occur on cotton—the green stink bug, the southern green stink bug, and the brown stink bug. They are shield-shaped, about one-half inch long, and have sucking mouthparts.

The southern green stink bug adults are green, and the nymphal stage has white spots on the back or abdomen. The green stink bug is also green, but the nymphal stage has a striped abdomen. The brown stink bug closely resembles another predaceous stink bug, the spined soldier bug, but can be distinguished from it by the very sharply pointed "shoulders" on the spined soldier bug. Stink bug eggs are barrel-shaped and metallic-colored and are deposited in a regular cluster on foliage. The leaf footed bug may be a part of the boll feeding bug complex, especially in the southern part of Alabama.

Stink bugs overwinter as adults in a variety of habitats, such as leaf litter, tree holes, and fields. Their primary host crops in Alabama are corn, wheat, soybeans, and peanuts. Cotton grown near corn or peanuts may be at a greater risk for stink bug infestations and damage. The egg stage lasts about four days, the nymphs develop over 33 days, and the adults live up to 58 days.

Stink bugs damage cotton by feeding on developing seeds within the bolls. Damaged bolls may or may not have a small black spot on the outside. To be certain whether bolls are damaged or not requires an internal examination. Seeds usually turn brown from their feeding and a warty growth is often present where the carpel wall was penetrated.

Stink bug damage is generally warranted when 15 to 20 percent of the quarter-sized bolls reveal damage.

Precautions and General Restrictions.

Read the label before using any insecticide to prevent misuse. When applying insecticides, change clothes at least once a day. If spray concentrates come in contact with your skin or clothing, remove the clothing immediately and wash your skin with soap and water. For field re-entry intervals, refer to the insecticide label or consult your county agent.

Restricted Use Pesticides. Your county Extension office has the necessary forms and information concerning all Restricted Use pesticides. Permits to use Restricted Use insecticides will be issued only by the State Department of Agriculture and Industries, Montgomery, Alabama.

Premixes/Combination Packages

Multiple insecticide active ingredients are being combined into single products, presumably to increase the number of pest species controlled or to address resistance issues. (See Table 2.) Premixes may be useful to insect management programs, but also may encourage the unnecessary use of some ingredients or encourage their use at less than optimum rates. Unnecessary applications or applications of reduced rates may lead to the development of insecticide resistance and flare untargeted pest species. Be sure the use of all active ingredients is warranted and that proper rates are being delivered.

Effectiveness of Insecticides and Transgenic Cotton on Target Pests

The insecticide ratings found in Tables 4 and 5 are based on research across the Cotton Belt and in field experiences by entomologists. Ratings should be considered only general guidelines for comparison purposes. Insecticide ratings assume standard rates, good timing, thorough coverage, no wash off, etc.

Table 1. Cotton Insect Control

Insecticide and Formulation	Amount of Formulation per Acre	Lb. Active Ingredient per Acre	Minimum Days from Last Application to Harvest	Comments
BEET ARMYWORMS				
chlorantraniliprole				
CORAGEN 1.67 SC	5-7 oz.	0.065-0.09	21	
PREVATHON 0.43 SC	14-27 oz.	0.047-0.09	21	
emamectin benzoate				
DENIM 0.16EC	6-8 oz.	0.0075-0.01	21	
flubendiamide				
BELT 4SC	2-3 oz.	0.063-0.094	28	
indoxacarb				
STEWARD 1.25EC	9.2-11.3 oz.	0.09-0.11	14	
methoxyfenozide				
INTREPID 2F	4-10 oz.	0.06-0.16	14	
spinosad				
BLACKHAWK	2.4-3.2 oz.	0.054-0.072	28	
TRACER 4SC	2.14-2.9 oz.	0.067-0.089	14	

Table 1. Cotton Insect Control (cont.)

Insecticide and Formulation	Amount of Formulation per Acre	Lb. Active Ingredient per Acre	Minimum Days from Last Application to Harvest	Comments
BOLLWORMS/TOBACCO BUDWORMS				
Seed				
Bt transgenic cotton BOLLGARD II TWINLINK WIDESTRIKE WIDESTRICK 3				See Table 4 for activity against all caterpillar pests.
Bollworms: Larvicides				
alpha-cypermethrin FASTAC EC	2.6-3.6 oz.	0.017-0.023	14	In previously untreated fields where beneficials are present, apply when ten small larvae (0.25 inch) per 100 plants are found. In previously treated fields where beneficials are low or absent, apply when five small larvae per 100 plants are found. Isolated problems with pyrethroid resistance have been reported throughout the eastern United States.
beta-cyfluthrin BAYTHROID XL 1EC Other brand names (See label.)	1.6-2.6 oz.	0.0125-0.0205	0	
bifenthrin BRIGADE 2EC Other brand names (See label.)	4-6.4 oz.	0.06-0.08	14	
chlorantraniliprole CORAGEN 1.67SC	5-7 oz.	0.065-0.09	21	
PREVATHON 0.43SC	14-27 oz.	0.047-0.09	21	
cypermethrin AMMO 2.5EC Other brand names (See label.)	2-5 oz.	0.04-0.1	14	
esfenvalerate ASANA XL 0.66EC	5.8-9.6 oz.	0.03-0.05	21	
flubendiamide BELT 4SC	3 oz.	0.094	28	
gamma-cyhalothrin PROLEX 1.25EC Other brand names (See label.)	1.3-2.0 oz.	0.0125-0.02	21	
indoxacarb STEWARD 1.25EC	11.3 oz.	0.11	14	
lambda-cyhalothrin KARATE Z 2.08CS Other brand names (See label.)	1.6-2.56 oz.	0.025-0.04	21	
methomyl LANNATE 2.4 LV	1.5 -2 pt.	0.45	15	
spinosad BLACKHAWK	2.4-3.2 oz.	0.054-0.072	28	
TRACER 4SC	2.14-2.9 oz.	0.067-0.089	28	
zeta-cypermethrin MUSTANG MAX 0.8EC	2.64-3.6 oz.	0.017-0.022	14	

Table 1. Cotton Insect Control (cont.)

Insecticide and Formulation	Amount of Formulation per Acre	Lb. Active Ingredient per Acre	Minimum Days from Last Application to Harvest	Comments
BOLLWORMS/TOBACCO BUDWORMS (cont.)				
Tobacco Budworms: Larvicides				
chlorantraniliprole				***In previously untreated fields where beneficials are present,*** apply when ten small larvae (0.25 inch) per 100 plants are found. ***In previously treated fields where beneficials are absent,*** apply when five small larvae per 100 plants are found. Tobacco budworms have proven to be more difficult to control with most insecticides (see Table 4). Minimum rates of the recommended insecticides may not be effective against larger larvae or under high pressure. Rates should be adjusted according to the size of the larvae and the level of infestation. Methomyl may be used as an ovicide to control the egg stage at rates of 0.125 to 0.25 pound active ingredient per acre.
CORAGEN 1.67SC	5-7 oz.	0.065-0.09	21	
PREVATHON 0.43SC	14-27 oz.	0.047-0.09	21	
flubendiamide				
BELT 4SC	3 oz.	0.094	28	
indoxacarb				
STEWARD 1.25EC	11.3 oz.	0.11	14	
methomyl				
LANNATE 2.4 LV	1.5 pt.	0.45	15	
spinosad				
BLACKHAWK	1.6-3.2 oz.	0.036-0.072	28	
TRACER 4SC	1.4-2.9 oz.	0.045-0.089	28	
COTTON APHIDS				
acetamiprid				Apply when leaves appear sticky. Make one application; repeat when necessary. At-planting treatments may also give effective early-season control (see Seedling Thrips). Aphids are resistant to many insecticides. Control may vary with location and time of season. Additional applications of the same chemicals are usually ineffective.
INTRUDER 70WP	0.6-1.1 oz.	0.025-0.05	28	
flonicamid				
CARBINE 0WG	1.4-2.8 oz.	0.044-0.088	30	
imidacloprid				
TRIMAX PRO 4.4	0.9-1.37 oz.	0.03-0.047	14	
sulfoxaflor				
TRANSFORM WG	0.75 oz.	0.023	14	
thiamethoxam				
CENTRIC 40WG	2 oz.	0.05	21	
CUTWORMS				
alpha-cypermethrin				Apply when worms appear and stands are threatened; cover plants and surfaces of ground along rows with insecticide. Preplant or at-plant applications have been successful for high-risk fields.
FASTAC EC	1.3-1.9 oz.	0.008-0.012	14	
beta-cyfluthrin				
BAYTHROID XL 1EC	0.8-1.6 oz.	0.0065-0.125	0	
Other brand names (See label.)				
chlorpyrifos				
LORSBAN 4E	1 qt.	1	14	
Other brand names (See label.)				
cypermethrin				
AMMO 2.5EC	1.3-5 oz.	0.025-0.1	14	
Other brand names (See label.)				
esfenvalerate				
ASANA SL 0.66EC	5.8 oz.	0.03	21	
gamma-cyhalothrin				
PROLEX 1.25EC	0.77-1.0 oz.	0.0075-0.01	21	
lambda cyhalothrin				
KARATE Z 2.08CS	0.96-1.28 oz.	0.015-0.02	21	
Other brand names (See label.)				
zeta-cypermethrin				
MUSTANG MAX 0.8EC	1.3-2 oz.	0.008-0.012	14	

Table 1. Cotton Insect Control (cont.)

Insecticide and Formulation	Amount of Formulation per Acre	Lb. Active Ingredient per Acre	Minimum Days from Last Application to Harvest	Comments
FALL ARMYWORMS				
chlorantraniliprole				Apply when ten or more larvae per 100 plants are found.
CORAGEN 1.67SC	5-7 oz.	0.065-0.09	21	
PREVATHON 0.43SC	14-27 oz.	0.047-0.09	21	
flubendiamide				
BELT 4SC	2-3 oz.	0.063-0.094	28	
indoxacarb				
STEWARD 1.25EC	9.2-11.3 oz.	0.09-0.11	14	
novaluron				
DIAMOND 0.83EC	6-12 oz.	0.39-0.77	30	
spinosad				
BLACKHAWK	2.4-3.2 oz.	0.054-0.072	28	
TRACER 4SC	2.14-2.9 oz.	0.067-0.089	28	
GRASSHOPPERS				
chlorpyrifos				Lower rates may be used to control immature grasshoppers early in the spring (March, April). However, the highest suggested rates will be needed on the adult stage in May and June. Reinfestations may occur from field borders if the first application is made prior to planting. Under these conditions, a second application may be necessary if cotton is still younger than the sixth true leaf stage.
LORSBAN 4E	0.5-1.5 pt.	0.25-0.75	14	
Other brand names (See label.)				
dicrotophos				
BIDRIN 8EC	4-8 oz.	0.25-0.5	10	
diflubenzuron				
DIMILIN 2L	2 oz.	0.03	—	
pyrethroids	See label..	See Table 3.		
PLANT BUGS, FLEAHOPPERS				
acephate				Do not allow pinhead square retention to drop below 80 percent due to plant bug feeding. Prior to bloom, treat when sampling detects 8 plant bugs/100 sweeps. After first bloom, treat when sampling detects 15 plant bugs/100 sweeps or 3 plant bugs per 6 row feet ground cloth sample. No threshold exists for percent dirty blooms, but if you find 10 to 15 percent dirty blooms, intensify scouting plant for bugs. During peak bloom and beyond, applications should be made when 15 percent of the bolls have damage and plant bugs are present. Diamond is an insect growth regulator and is only active on the immature stage of plant bugs. Use of Bidrin between pinhead square and first bloom is prohibited.
ORTHENE 90SP	0.37-0.55 lb.	0.33-0.5	21	
ORTHENE 97	0.35-0.55 lb.	0.33-0.53	21	
Other brand names (See label.)				
acetamiprid				
INTRUDER 70WP	1.1 oz.	0.05	28	
chlorpyrifos				
LORSBAN 4E	16 oz.	0.5	14	
Other brand names (See label.)				
clothianidin				
BELAY	3-6 fl.oz.	0.05-0.1	21	
dicrotophos				
BIDRIN 8EC	3.2-5.3 oz.	0.2-0.33	10	
flonicamid				
CARBINE	2.8 oz.	0.088	30	
imidacloprid				
TRIMAX PRO 4.4	1.37 oz.	0.047	14	
Other brand names (See label.)				
methomyl				
LANNATE 2.4 LV	13 oz.	0.25	15	
novaluron				
DIAMOND 0.83EC	6-9 oz.	0.39-0.58	30	
oxamyl				
VYDATE C-LV 3.77	11.2-17 oz.	0.33-0.5	14	

Table 1. Cotton Insect Control (cont.)

Insecticide and Formulation	Amount of Formulation per Acre	Lb. Active Ingredient per Acre	Minimum Days from Last Application to Harvest	Comments
PLANT BUGS, FLEAHOPPERS (cont.)				
pyrethroids	See label.	See Table 3.		
sulfoxaflor				
TRANSFORM WG	1.5 oz.	0.047	**14**	
thiamethoxam				
CENTRIC 40WG	2 oz.	0.05	**21**	
SEEDLING THRIPS				
Foliar Treatment				
acephate				Make one or more applications to seedling cotton (one- to four-leaf stage) when damage is evident and early crop maturity is important. If western flower thrips are present, higher rates will be necessary for control. See recommendations listed under western flower thrips. Radiant provides suppression; it must be used with an adjuvant.
ORTHENE 90SP	3.2 oz.	0.18	21	
ORTHENE 97	3 oz.	0.18	21	
Other brand names (See label.)				
dicrotophos				
BIDRIN 8EC	3.2 oz.	0.2	10	
dimethoate 4E				
Other brand names (See label.)	6.4 oz.	0.2	14	
spinetoram				
RADIANT SC	1.5-3 oz.	0.012-0.023	28	
thiamethoxam				
CENTRIC 40WG	2 oz.	0.05	21	
In-Furrow Liquid Treatment				
acephate				Both Orthene and Admire in-furrow sprays may be applied with a liquid fungicide.
ORTHENE 90SP	1 lb.	0.9	21	
ORTHENE 97	1 lb.	0.97	21	
Other brand names (See label.)				
imidacloprid				
ADMIRE	17.9 oz.	0.28	21	
Seed Treatment				
imidacloprid	See label.			
GAUCHO 600				
AERIS				
thiamethoxam	See label.			
CRUISER				
AVICTA				
SOYBEAN LOOPERS				
chlorantraniliprole				Treat when four to five loopers per row foot are present and the top bolls expected for harvest are not mature. Populations of soybean loopers are now resistant to many cotton insecticides.
CORAGEN 1.67SC	5-7.5 oz.	0.065-0.098	21	
PREVATHON 0.43SC	20-29 oz.	0.067-0.097	21	
emamectin benzoate				
DENIM 0.16EC	2 oz.	0.063	21	
flubendiamide				
BELT 4SC	2-3 oz.	0.063-0.094	28	
indoxacarb				
STEWARD 1.25EC	6.7-9.2 oz.	0.065-0.09	14	
methoxyfenozide				
INTREPID 2F	4-10 oz.	0.06-0.16	14	
spinosad				
BLACKHAWK	2.4-3.2 oz.	0.054-0.072	28	
TRACER 4SC	2.14-2.9 oz.	0.067-0.089	28	

Table 1. Cotton Insect Control (cont.)

Insecticide and Formulation	Amount of Formulation per Acre	Lb. Active Ingredient per Acre	Minimum Days from Last Application to Harvest	Comments
SPIDER MITES				
abamectin AGRI-MEK 0.15EC Other brand names (See label.)	8-16 oz.	0.009-0.018	20	**Foliar Treatment:** Treat field when leaves begin to redden and mites are numerous. Resistance to most acaricides is common; therefore, results may vary. Control of spider mites on rapidly growing cotton is difficult. Bifenthrin may not control spider mite populations; it can be used for suppression.
bifenthrin BRIGADE 2EC Other brand names (See label.)	3.8-6.4 oz.	0.06-0.1	14	
chlorpyriphos LORSBAN 4E Other brand names (See label.)	1 pt.	0.5	14	
dicofol DICOFOL 4E Other brand names (See label.)	1.5-3 pt.	0.75-1.5	30	
dimethoate 4EC Other brand names (See label.)	1 pt.	0.5		
etoxazole ZEAL	0.66-1 oz.	0.03-0.45	28	
fenpyroximate PORTAL 0.4	12-16 oz. (early season) 24-32 oz. (mid-season)	0.0375-0.05	14	
propargite COMITE II 6	20-36 oz.	0.94-1.69	50	
spiromesifen OBERON 2SC	8-16 oz.	0.125-0.25	30	
BROWN STINK BUGS, LEAF FOOTED BUGS				
acephate ORTHENE 90S ORTHENE 97	0.8 lb. 0.75 lb.	0.72 0.72	21 21	The boll injury threshold should be adjusted up or down based on the number of susceptible bolls present. Use a 10 to 15 percent boll injury threshold during weeks 3 to 5 of bloom (numerous susceptible bolls present), 20 percent injury during weeks 2 and 6, and 30+ percent during weeks 7+ of bloom (fewer susceptible bolls present).
dicrotophos BIDRIN 8EC	6-8 oz.	0.375-0.5	10	
GREEN AND SOUTHERN GREEN STINK BUGS				
Organophosphates				
acephate ORTHENE 90S ORTHENE 97	0.8 lb. 0.75 lb.	0.72 0.72	21 21	Use same thresholds as for brown stink bugs.
dicrotophos BIDRIN 8EC	4-8 oz.	0.25-0.5	10	
Pyrethroids				
beta-cyfluthrin BAYTHROID XL1 Other brand names (See label.)	2.13-2.6 oz.	0.0166-0.0205	0	
bifenthrin BRIGADE 2EC Other brand names (See label.)	4-6.4 oz.	0.06-0.08		

Table 1. Cotton Insect Control (cont.)

Insecticide and Formulation	Amount of Formulation per Acre	Lb. Active Ingredient per Acre	Minimum Days from Last Application to Harvest	Comments
GREEN AND SOUTHERN GREEN STINK BUGS (cont.)				
Pyrethroids (cont.)				
cypermethrin				
AMMO 2.5EC	3.1-5 oz.	0.06-0.1	14	
Other brand names (See label.)				
esfenvalerate				
ASANA SL 0.66EC	7.5-9.6 oz.	0.04-0.05	21	
gamma-cyhalothrin				
PROLEX 1.25EC	1.3-2 oz.	0.0125-0.02	21	
lambda-cyhalothrin				
KARATE Z 2.08CS	1.8-2.56 oz.	0.03-0.04	21	
Other brand names (See label.)				
zeta-cypermethrin				
MUSTANG MAX 0.8EC	2.6-3.6 oz.	0.0165-0.022	14	
WESTERN FLOWER THRIPS				
acephate				Economic thresholds are not well defined. To suppress, make two applications at 5- to 7-day intervals.
ORTHENE 90SP	0.6-0.83 lb.	0.5-0.75	21	
ORTHENE 97	0.52-0.77 lb.	0.5-0.75	21	
Other brand names (See label.)				
spinetoram				Use of an adjuvant with Radiant is recommended.
RADIANT	3 oz.	0.023	28	
WHITEFLIES (BANDEDWING)				
acephate				For actively growing cotton, apply when 50 percent of plant terminals have adults clustering on them. It may be necessary to apply more than once to control infestation. For mature or stressed cotton or cotton not growing, apply when honeydew or sooty mold appears on leaves, usually in late season. Make two or three applications 5 days apart.
ORTHENE 90SP	0.6-1 lb.	0.5-1	21	
ORTHENE 97	0.52-1 lb.	0.5-1	21	
Other brand names (See label.)				
acetamiprid				
INTRUDER 70WP	1.7-2.3 oz.	0.075-0.1	28	
imidacloprid				
TRIMAX PRO 4.4	0.9-1.8 oz.	0.031-0.062	14	
thiamethoxam				
CENTRIC 40WG	2 oz.	0.05	21	
WHITEFLIES (SILVERLEAF)				
acetamiprid				The insect growth regulator Knack is the most consistent treatment for management of silverleaf whiteflies. Knack has a long residual (several weeks) and is generally slow acting. When females feed on foliage treated with Knack, eggs will be sterile. Knack will control the immature stage as they pupate into adults; therefore, established nymphs will continue feeding for several days. **Threshold:** When five immature whiteflies are found in an area the size of a nickle on the underside of the leaf surface.
INTRUDER 70WP	1.7-2.3 oz.	0.075-0.1	28	
buprofezin				
COURIER 40SC	9-12.5 oz.	0.25-0.35	14	
dinotefuran				
VENOM 70WDG	1-3 oz.	0.045-0.134		
pyriproxfen				
KNACK 0.86EC	8-10 oz.	0.054-0.067	28	

Table 2. Premix/Combination Packages

Premix/combination insecticide packages are available and include the following: (See page 3 for more detailed information about premix/combination insecticide packages.)	
avermectin B1 + bifenthrin (ATHENA)	flubendiamide + buprofexin (TOURISMO)
bifenthrin + zeta-cymethrin (HERO)	imidacloprid + bifenthrin (BRIGADIER)
chlorantraniliprole + lambda-cyhalothrin (BESIEGE)	imidacloprid + cyfluthrin (LEVERAGE 2.7)
chlorpyrifos + gamma-cyhalothrin (COBALT)	imidacloprid + beta-cyfluthrin (LEVERAGE 360)
chlorpyrofos + lambda-cyhalothrin (COBALT ADVANCED)	methoxyfenozide + spinetoram (Intrepid Edge)
dicrotophos + bifenthrin (BIDRIN XP II)	spinosad + gamma-cyhalothrin (CONSERO)
diflubenzuron + lambda-cyhalothrin (DoubleTake)	thiamethoxam + lambda-cyhalothrin (ENDIGO)

Table 3. Pyrethroid Rates for Cotton in Pounds Active per Acre, Acres per Gallon, and Ounces per Acre

Materials and Formulation	Pounds Active per Acre, (Acres per Gallon), [Ounces per Acre]		
	Low	Medium	High
Ambush 2	0.1 (20) [6.4]	0.15 (13) [9.6]	0.2 (10) [12.8]
Ammo 2.5	0.04 (63) [2] – 0.05 (50) [2.6]	0.06 (42) [3.1]	0.08 (31) [4]
Asana 0.66	0.02 (33) [3.9] – 0.03 (22) [5.8]	0.04 (17) [7.5]	0.05 (13) [9.7]
Baythroid XL	0.0125 (80) [1.6] – 0.014 (71) [1.8]	0.0166 (60) [2.13]	0.0205 (49) [2.6]
Brigade 2	0.04 (50) [2.6] – 0.05 (40) [3.2]	0.06 (33) [3.9]	0.08 (25) [5.1]
Decis 1.5	0.019 (79) [1.6]	0.025 (60) [2.1]	0.03 (50) [2.6]
Karate 2.08	0.015 (140) [1]	0.03 (69) [1.8]	0.04 (52) [2.6]
Mustang Max 0.8	0.008 (100) [1.3]	0.0165 (50) [2.6]	0.022 (36) [3.6]
Pounce 3.2	0.1 (32) [4]	0.15 (21) [6]	0.2 (16) [8]
Prolex 1.25	0.0075 (167)[0.77]	0.0125 (100) [1.3]	0.02 (62) [2.0]

Table 4. Transgenic Technology Ratings*

TRANSGENIC TECHNOLOGY	INSECTS							
	Beet Armyworm	Cotton Bollworm	Cutworm	European Corn Borer	Fall Armyworm	Loopers	Southern Armyworm	Tobacco Budworm
Bollgard**	3	2	5	1	4	5	5	1
Bollgard II	1	1	4	1	2	1-2	1	1
TwinLink	1	1	?	1	1	1	1	1
WideStrike	1	2	4	1	1-2	1	1	1
WideStrike3	1	1	?	1	1	1	1	1

* Ratings range from 1-5. 1 = Very Effective; 5 = Not Effective.

** Bollgard technology is no longer registered; it is listed as a reference only.

Some variation in the expression of Bt proteins can be caused by environmental conditions, time of season, and cultivar.

Table 5. Insecticide Effectiveness Ratings*

INSECTICIDES	INSECTS						
	Aphids	Beet Armyworms	Beneficial Insects**	Boll Weevils	Bollworms	Budworms	Fall Armyworms
Altacor	5	1	4	5	1	1	2
Ammo	4	5	1	1-2	1	3	3
Asana XL	4	5	1	2	1	3	3
Baythroid XL	4	5	1	1-2	1	3	3
Belay	—	5	—	—	5	5	5
Belt	5	1	4	5	2	1	2
Bidrin	3	5	1	3	5	5	5
Blackhawk	5	1	5	5	1-2	1	1-2
Brigade	3	5	1	1	1	3	2
Carbine	1-2	5	3	5	5	5	5
Centric	1-2	5	2	5	5	5	5
Decis	4	5	1	2	1	3	2
Denim	5	1	4	5	3	3	2
Diamond	5	2-3	3	4	4	4	2
Dimilin	5	3	5	4	5	5	3
Intrepid	5	1	5	5	3	3	2
Intruder	1	5	3	5	5	5	5
Karate	4	5	1	1-2	1	3	2
Knack	2	5	3	5	5	5	5
Lannate	4	3-4	3	5	2	2	2
Larvin	5	2	3	5	2	2	2
Lorsban	4	2	2-3	3	3	4	2
Malathion	5	5	1	1	5	5	5
Monitor	5	5	1	5	5	5	5
Mustang Max	4	5	1	1-2	1	3	2
Orthene	5	4-5	1	5	3	3-4	4
Penncap M	4	5	3	1	3	5	4
Prevathon	5	1	5	5	1	1	1
Prolex	4	5	1	1-2	1	3	2
Radiant	5	5	5	5	—	—	—
Steward	5	1	4	5	2	1	2
Tracer	5	1	4	5	2	1	2
Transform	1	5	5	5	5	5	5
Trimax Pro	1-2	5	3	5	5	5	5
Venom	—	5	—	5	5	5	5
Vydate	5	5	2	3	5	5	5

continued

*Ratings range from 1 - 5: 1 = Very Effective; 5 = Not Effective.

**A rating of 1 on beneficial insects means the chemical is very hard on beneficials; a rating of 5 indicates selectivity toward beneficials.

Table 5. Insecticide Effectiveness Ratings* (cont.)

INSECTICIDES	INSECTS						
	Plant Bugs	Seedling Thrips	Soybean Loopers	Spider Mites	Stink Bugs (Brown)	Stink Bugs (Green)	Whiteflies
Altacor	5	5	2	5	5	5	5
Ammo	2	1	3	5	4	2	4
Asana XL	3	1	4	5	4	2	4
Baythroid XL	3	1	4	5	4	2	4
Belay	2	—	4	—	3	3	—
Belt	5	5	1	5	5	5	5
Bidrin	1	1	5	4	1	1	4
Blackhawk	5	5	1	5	5	5	5
Brigade	1	1	4	3	3	2	4
Carbine	2-3	2-3	5	5	—	—	—
Centric	2	1	5	5	2-3	2-3	2
Curacron	3	3	3	2	3	3	4
Decis	3	1	3	5	4	2	4
Denim	4	5	1	3	5	5	5
Diamond	2	5	2	5	2-3	2-3	5
Dimilin	5	5	4	5	5	5	5
Intrepid	5	5	1	5	5	5	5
Intruder	2-3	1-2	5	—	3	3	1-2
Karate	1	1	4	5	4	2	4
Knack	4	3-4	5	3	4	4	1
Lannate	3	5	3	5	4	4	5
Lorsban	2	2	4	3	3	3	4
Malathion	1	4	5	5	1	1	5
Monitor	2	2	5	5	4	4	2
Mustang Max	2	1	3	5	4	2	4
Orthene	1	1-2	3	5	2	2	2
Penncap M	3	4	4	5	1	1	4
Prevathon	5	—	1	—	5	5	—
Prolex	2	1	3	5	4	2	4
Radiant	5	1	—	5	5	5	5
Steward	3	5	1	5	3	3	5
Tracer	5	5	1	5	5	5	5
Transform	1	?	5	5	5	4	3
Trimax Pro	2-3	2	5	5	4	4	2
Venom	—	—	5	—	5	5	1
Vydate	3	3	5	5	2	2-3	4

*Ratings range from 1 - 5: 1 = Very Effective; 5 = Not Effective.

Insect Control section prepared by Tim Reed, Extension Entomologist, Alabama Cooperative Extension System, Alabama A&M University and Auburn University; Ronald H. Smith, Professor Emeritus, Department of Entomology and Plant Pathology, Auburn University; and Barry Freeman, Associate Professor Emeritus, Department of Entomology and Plant Pathology, Auburn University.

DISEASE CONTROL

Control of Cotton Seedling Disease

Seedling disease is one of the major problems on cotton in Alabama. Losses range from less than 1 percent in some years up to 20 percent in others, depending on such factors as the condition of the soil at planting, seed quality, seed treatment, chemicals, nematode and insect populations, and climatic conditions. These adverse factors favor seedling disease by retarding seed germination and seedling growth and allowing fungal pathogens to overcome the plant's defenses. Vigorous, fast-growing seedlings can usually outgrow damage resulting from invasion by fungi. Planting too early in cold, wet soils is probably the one factor that is most responsible for making seedlings susceptible to seedling diseases.

In Alabama, the fungi most often implicated in seedling disease are *Rhizoctonia solani, Pythium* spp., *Fusarium* spp., and *Thielaviopsis basicola.* These fungi, along with several other pathogens of minor importance, usually attack cotton at any time during the first 6 to 8 weeks after planting.

For ease of identification, cotton seedling diseases are placed into the following three categories.

Seed Rot. Pythium and Fusarium attack cotton seed before or during germination, causing a soft, watery decay. These fungi spread rapidly from seed to seed.

Preemergence Damping-Off. This stage occurs between seed germination and emergence of seedlings from the soil. The newly formed root or stem may become infected, causing the seedlings to die before they emerge from the soil.

Seedling Root Rots and Postemergence Damping-Off. Symptoms occur on the root or hypocotyl after the seedlings have emerged from the soil. Plants may first appear stunted and light green, and as the disease progresses, plants will wilt and die. A close examination of the affected seedlings will reveal varying symptoms depending upon the organisms involved in the disease.

Fusarium and *Thielaviopsis* cause a dry, dark rot that progresses up the root into the stem. Pythium is characterized by a light, soft, watery decay of the tap root and is particularly severe in cool, wet weather. *Rhizoctonia* usually attacks the plant at soil level, causing reddish brown lesions (soreshin). It eventually moves into the stem tissue, giving the stem a "wirestem" appearance. In the advanced stage, stems fall over and die, leaving an uneven stand.

Seedling Disease Control Recommendations

The incidence of seedling disease can be reduced by the following practices.

Plant on Well-Prepared Seedbeds and in Well-Drained Soils. Wet soils favor the growth of many soil fungi and retard or slow the growth of cotton seedlings.

Plant in Warm Soil. Plant when the soil temperature at a 4-inch depth remains at least 65°F for three consecutive mornings. AVOID planting when soil temperatures are expected to drop below 50°F at anytime one week following planting. Germinating seed are extremely susceptible to chill injury, which occurs below 50°F, and may be killed outright or badly damaged. Remember, the warmer the soils, the less chance for seedling disease.

Lime Acid Soils. Apply lime as recommended by the Soil Testing Laboratory. Acid soil favors the development of seedling disease by restricting seedling growth and favoring the development of seedling disease-inciting fungi in the soil.

Avoid Chemical or Mechanical Injury. Excessive rates of herbicides, fertilizers, insecticides, or fungicides applied in the drill area can injure seedlings, making them more susceptible to seedling disease. Using high rates of dinitroanaline herbicides or incorporating them too deeply can inhibit root growth and increase seedling disease.

Plant High-Quality Seed. Poor-quality seed usually produces low-vigor seedlings which are more susceptible to attack by fungi that can cause seedling disease. Plant seed with a minimum of 80-percent germination.

Plant Only Treated Seed. Seed treatment will kill most fungal pathogens on the seed coat and protect the seed during germination (see Seed Treatment, below).

Use Soil Fungicides at Planting Time. These fungicides give added protection in areas where there is a history of seedling disease (see Soil Treatment, below).

Chemical Controls

Seed Treatment. Two or more fungicides must be applied to cotton seed in order to control the fungi species in the soil that cause seedling disease. For example, PCNB, Thiram, or Vitavax are active against Rhizoctonia solani and Fusarium spp. but not against Pythium spp., whereas Metalzxyl®, Anchor®, and Apron XL® are primarily active against Pythium spp., Acceleron®, and Dividend® are active against a wide range of soilborne diseases.

Soil Treatment. Soil treatment is not intended to replace seed treatment; it is used as a supplement.

In-the-furrow granules provide additional protection against pathogenic fungi in the soil as seedlings develop. They can be applied with granular applicators, thus eliminating the need for additional spray equipment and water. For the most effective control with granular fungicides, proper granule placement and soil incorporation at the correct rates are necessary. Granular formulations may also contain a systemic insecticide to provide control against many early-season insects.

In-the-furrow sprays provide excellent protection in the zone around seed. For best results, apply fungicide through two flat fan type nozzle tips adjusted parallel to rows.

A minimum spray volume of 5 gallons per acre is required to give adequate coverage in the furrow. Mount the nozzle just behind the seed-drop tube to treat the soil immediately surrounding the seed.

Table 6. In-Furrow Fungicide Treatments for Cotton Seedling Disease Control

Fungicide and Formulation	Rate Per 1000 Row Feet	Comments
Consult product guides and labels before applying fungicides and for plantback restrictions. Not all fungicides and formulations are listed due to space constraints.		
azoxystrobin QUADRIS FLOWABLE	0.4-0.8 fl.oz.	**At-plant in-furrow spray for control of** *Rhizoctonia* **and** *Pythium* **seedling blight.** Apply 3 to 7 gallons of water at planting and direct spray into the seed furrow before seed is covered. Use higher rate, particularly on early cotton when conditions favor disease.
etridiazole TERRAMASTER 4EC	4-8 fl.oz.	Apply over seed in open furrow at planting for control of *Pythium* seed rot and seedling blight. Listed rate is for 40-inch rows.
mefenoxam RIDOMIL GOLD GR	1.5-3 oz.	A**pply at-plant in-furrow for control of** *Pythium* **seedling blight.** Mount application tubes so the granules are mixed with the soil covering the seeds.
RIDOMIL GOLD SL	0.075-0.15 fl.oz.	**Apply at-plant in-furrow for control of** *Pythium* **seedling blight.** Apply in water or fertilizer at planting. Direct spray over the seed in open furrow before seed are covered.
pentachloronitrobenzene + mefenoxam RIDOMIL GOLD PC GR	8.6-12.3 oz.	Apply at-plant in-furrow to control seed rots and seedling diseases caused by *Pythium* and *Rhizoctonia*. Mount application tubes so that granules are mixed with soil covering the seeds. Use higher rate when soil conditions are unfavorable for rapid seed germination and seedling growth.
pyraclostrobin HEADLINE SC	0.1-0.8 fl.oz.	For control of *Rhizoctonia* and *Pythium* and seedling diseases. Apply at-plant by directing spray into the furrow before seed is covered. Use minimum of 2.5 gallons spray volume per acre. Refer to label for rates for specific row spacings.

Table 7. Fungicide Treatments for Leaf Spots and Boll Rots

Fungicide and Formulation	Rate Per Acre	Comments
Consult product guides and labels before applying fungicides and for plantback restrictions. Not all fungicides and formulations are listed due to space constraints.		
azoxystrobin QUADRIS FLOWABLE	6-9 fl.oz.	For control of *Anthracnose* and *Ascochyta* blight and boll rot, hard lock, and Target spot (*Corynespora* leaf spot). Apply before pin head square to early bloom or at early stages of disease development and repeat after 14 to 21 days as needed to control disease. Do not make more than two consecutive applications of Quadris flowable. See label for additional information concerning resistance management for strobilurin (Qol or Group 11) fungicides.
pyraclostrobin HEADLINE 2.09SC	6-12 fl.oz.	For control of leaf spot and boll rot disease caused by *Alternaria*, *Asochyta* (blight), *Cercospora*, *Corynespora*, *Fusarium* (hard lock), *Glomerella* (anthracnose), *Phoma*, and *Stemphyllum*. Begin applications prior to or at early stage of disease development and repeat after 7 to 14 days if conditions favor disease. Make no more than two consecutive applications of Headline 2.09SC. See label for additional information concerning resistance management with Qol fungicides.
pyraclostrobin + metconazole TWINLINE	7-8.5 fl.oz.	For control of leaf spot and boll rot disease caused by *Alternaria*, *Asochyta* (blight), *Cercospora*, *Corynespora*, *Fusarium* (hard lock), *Glomerella* (anthracnose), *Phoma*, and *Stemphyllum*. Apply before disease development and continue applications on a 7- to 14-day schedule as needed to control disease. Do not make more than two consecutive applications of Twinline before alternating to another fungicide with a different mode of action. A total of three Twinline applications may be made per year. See label for additional use restrictions.

NEMATODE CONTROL

Nematodes are microscopic worm-like animals that live in the soil. Most are harmless and feed only on dead organic matter, but a few feed on plant roots. Several of these plant parasitic nematodes attack cotton, causing serious yield reductions.

The cotton root-knot nematode (*Meliodogyne incognita*) and the reniform nematode (*Rotylenchulus reniformis*) are the most widespread and damaging nematodes on cotton.

Damage

Nematodes damage cotton by feeding on the roots and by breaking the cotton's resistance to Fusarium wilt. Nematodes feeding on the plant's roots impair its ability to take up water and nutrients from the soil. The plant becomes stunted and generally unthrifty. As a result of the nematodes' feeding activities, disease-causing bacteria and fungi enter through the wounds.

On cotton, seedling diseases, root rots, as well as Fusarium wilt are increased by nematode activity. Fusarium wilt, a soil-borne disease, can overcome Fusarium wilt-resistant cotton varieties by entering roots through nematode feeding wounds. Once the fungus is inside, it can rapidly plug the vascular system, stop the movement of water and, consequently, cause the plant to wilt and die.

Symptoms

Nematode symptoms can appear early in the season on young plants. Infected seedlings may be severely stunted and may occasionally die. Usually, symptoms do not appear until the middle of June or July as cotton begins to mature.

The first signs of root-knot or reniform nematode damage in newly infested fields appear as stunted cotton in localized spots in the field. These spots may comprise just a few plants or may cover an acre. In most fields with established reniform nematode populations, damage occurs generally throughout the field. As the season progresses, nematode-infested cotton will mature later than healthy cotton. If Fusarium wilt is in the field, cotton plants will turn yellow, wilt, and possibly die.

Roots of a nematode-infested plant are usually stubby and sparse and often rotted. If root-knot nematodes are present, small swellings or galls can be seen on the lateral roots.

A soil sample for nematode analysis should be taken from nematode-suspected fields for positive diagnosis. Take soil samples from around the plant's root zone, place in a plastic bag, and store in a cool place until they can be sent to the Auburn University Nematode Diagnostic Laboratory.

Control

Nematodes can be controlled most effectively by a combination of the following recommended control measures.

Rotate Crops. Crop rotation is a good cultural practice to follow, not only to control cotton diseases and nematodes but also to minimize weed problems and to avoid buildup of certain herbicides in the soil. Plant crops such as peanuts, small grains, millet, sudangrass, sorghum, pasture grasses, and some vetch varieties. The cotton root-knot nematode cannot reproduce on these crops, so its population can be effectively lowered.

Corn is an excellent host for cotton root-knot nematodes and should be avoided as a rotational crop in fields where root-knot is or could be a problem. Planting peanut, some soybean varieties, grasses, or grain sorghum or leaving the land fallow can effectively lower root-knot nematode populations.

In cotton fields where reniform nematodes are a problem, rotating with non-host crops such as grain sorghum, corn, small grains, and peanut will reduce populations.

Plant Resistant Varieties. Root-knot nematodes will predispose cotton to Fusarium wilt, so plant resistant varieties in fields that are known to be infested with root-knot nematodes or with a history of Fusarium wilt. Several commercial cotton varieties have acceptable tolerance to rootknot nematodes and are resistant to Fusarium wilt.

Plow up Cotton Stalks. Immediately after picking cotton, disk and plow the field. This practice reduces nematode populations by exposing them to the drying action of the sun and by depriving them of a food source. If erosion becomes a problem, plant a cover crop of rye. Avoid other legume-type crops because they will maintain the root-knot nematode populations.

Subsoil. Subsoiling under the row has been effective in reducing cotton damage caused by nematodes. It allows cotton roots to penetrate the subsoil more easily, thus compensating for much of the injury caused by nematodes.

Use Nematicides. Nematicides can be an effective way to reduce nematode damage to cotton when they are used with other recommended cultural practices.

Telone, a fumigant, must be injecteed 14 days prior to planting into well-prepared soils free of undecomposed organic matter and dirt clods. Aeris and Avicta are reported to be effective against low populations of reniform nematodes. Avicta and Aeris also have activity against early season insects while Telone II is only active against nematodes.

Table 8. Cotton Nematode Control		
Nematodes	Amount of Formulation per Acre (38-Inch Row)	Comments
ROOT-KNOT, RENIFORM		
1,3 dichloropropene TELONE II (Fumigant)	3-6 gal.	Preplant fumigation: Inject with one chisel per row to a final planting depth of at least 14 inches. Seal injection furrow with cultipaker or bedding equipment. Wait 7 days before planting. Rate based on 38-inch row spacing.
abamectin + thiamethoram AVICTA DUO COTTON	See label.	Available only in Avicta Complete Pak with Dynasty CST. Applied only by Delta and Pine Land, Monsanto, and selected retailers.
clothianidin + *Bacillus firmus* I-1582 PONCHO/VOTiVO	2.4 fl.oz.	Delinted cotton seed only. Available on DPL cotton seed.
imidaclorprid + thiocarb AERIS (Seed treatment)	25.6 fl.oz./100 lb. seed	Available through Stoneville, FiberMax, and Delta and Pine Land. Used in combination with Gaucho Grande.
oxamyl VYDATE C-LV	17 fl.oz. 8.5-11 fl.oz.	Apply after planting to suppress reniform, root knot, and lance nematodes following the planting of nematicide-treated cotton seed. Band or broadcast in the second through fifth true leaf stage. Reapply as needed 14 days after first application of Vydate C-LV. Apply following the application of a preplant fungicide or at-plant granular nematicide. Band or broadcast at the second to fifth true leaf stage and repeat 10 to 14 days later. Apply in sufficient water to cover foliage. Rates listed are for broadcast applications, so reduce rates accordingly for banded applications. See label for use restrictions and application guidelines.
VYDATE L	1 pt. 2 pt.	To suppress reniform, root knot, and lance nematodes: Apply at second to fifth true leaf stage and repeat 10 to 14 days later. Apply at first to seventh true leaf stage. See label for use restrictions and application guidelines. Treatment must follow application of a preplant fumigant or at-plant granular nematicide

Disease and Nematode Control section prepared by Austin Hagan, Extenson Plant Pathologist, Professor, Department of Entomology and Plant Pathology, Auburn University; Edward J. Sikora, Extension Plant Pathologist, Professor, Department of Entomology and Plant Pathology, Auburn University; Kathy S. Lawrence, Plant Pathologist, Associate Professor, Department of Entomology and Plant Pathology, Auburn University; Dale Monks, Extension Agronomist, Professor, Department of Crop, Soil and Environmental Sciences, Auburn University; and Charles Burmester, Extension Agronomist, Department of Crop, Soil and Environmental Sciences, Auburn University.

WEED CONTROL

Table 9. Cotton Weed Control

Herbicide Trade Name (Rate/Acre Broadcast)	Herbicide Common Name (Active Herbicide/Acre)	Comments
PREPLANT FOLIAR (BURNDOWN)		
AIM EC (2 oz.)	carfentrazone (0.031 lb.)	Apply prior to planting or within 24 hours after planting for burndown of several broadleaf weeds. May be mixed with glyphosate, glufosinate, 2,4-D, or dicamba to increase spectrum. Obey the most restrictive product label. Add non-ionic surfactant (1 quart per 100 gallons) or crop oil concentrate (1 gallon per 100 gallons of spray mix) to spray solution. *MOA–PPO inhibitor
CLARITY or VISION (8 fl. oz.)	dicamba (0.25 lb.)	Apply to cotton fields that will not be planted within 21 days. A minimum of 1 inch of rainfall or overhead irrigation is required within the 21-day interval. May be mixed with other herbicides. Consult label for tank-mix partners. MOA–Synthetic auxin
CAPAROL 4L or PROMETRYN 4L (1.5 pt.)	prometryn (0.75 lb.)	Apply to cotton fields that will not be planted within 14 days. Avoid use on sands and loamy sands. Add crop oil concentrate or surfactant if weeds have emerged. May be mixed with other herbicides. Consult label for tank-mix partners. MOA–Photosystem II inhibitor
ET Herbicide (0.5-2 fl.oz.)	pyraflufen (0.0008-0.003)	Apply prior to or immediately after planting for control of several broadleaf weeds including cutleaf evening primrose. May be mixed with other products to increase weed spectrum. See label. Add non-ionic surfactant at 2 pints or crop oil concentrate at 8 pints per 100 gallons of spray mix. MOA–PPO inhibitor
GRAMOXONE SL (1.25-2.5 pt.) or FIRESTORM (0.8-1.6 pt.) + Non-ionic Surfactant (1 pt./25 gal. spray mix)	paraquat (0.31-0.62 lb.) + non-ionic surfactant	Apply to emerged winter weeds and grasses prior to cotton planting or emergence. Adding Caparol (prometryn) to Gramoxone increases the effectiveness of this treatment. If Caparol is added, a restriction on planting date after treatment must be observed. See label. Add non-ionic surfactant at 2 pints per 100 gallons of spray solution. Paraquat is a **RESTRICTED USE** pesticide. MOA–Photosystem I inhibitor
HARMONY EXTRA (0.3-0.5 oz.) + Non-ionic Surfactant (1 pt./50 gal. spray mix)	thifensulfuron + tribenuron (0.23-0.38oz.) + non-ionic surfactant	Apply up to 14 days prior to planting for control of curly dock, henbit, wild radish, and several other winter weeds. Mix with glyphosate for added control. MOA–ALS inhibitor
LIBERTY (29 oz.)	glufosinate (0.53 lb.)	Apply prior to or immediately after planting but before emergence of cotton to control winter weeds. May be tank mixed with glyphosate, dicamba, or 2,4-D to increase weed spectrum. **DO NOT** apply within 30 days of planting if 2,4-D (at 1 pint per acre or less) is used or within 21 days if dicamba is used. MOA–Glutamine synthetase inhibitor
KARMEX or DIURON 4L (1.5 pt.)	diuron (0.75 lb.)	Apply to cotton fields that will not be planted within 14 days. Avoid use on sands and loamy sands. Add crop oil concentrate or surfactant if weeds have emerged. May be mixed with other herbicides. Consult label for tank-mix partners. MOA–Photosystem II inhibitor

*MOA = mechanism of action. Herbicides with different MOAs should be used in weed resistance management programs. See Table 11.

Table 9. Cotton Weed Control (cont.)		
Herbicide Trade Name (Rate/Acre Broadcast)	Herbicide Common Name (Active Herbicide/Acre)	Comments
PREPLANT FOLIAR (BURNDOWN) (cont.)		
RESOURCE (2-4 fl.oz.)	flumiclorac (0.013-0.027 lb.)	Use with glyphosate and other products labeled for burndown of winter weeds to increase activity on weeds such as cutleaf evening primrose. Consult label of tank-mix partner for planting restrictions. Add non-ionic surfactant (1 quart per 100 gallons) or crop oil concentrate (1 gallon per 100 gallons spray mix). MOA–PPO inhibitor
ROUNDUP or TOUCHDOWN or GLYPHOSATE + Non-ionic Surfactant (1 pt./25 gal. spray mix)	glyphosate (1-2 lb.) + non-ionic surfactant	Apply to emerged winter weeds and grasses prior to cotton planting or emergence. Effective on horseweed (marestail) and several other species. Consult label for tank-mix partners. MOA–EPSP inhibitor
VALOR HERBICIDE (1-2 oz.) + Non-ionic Surfactant (1 pt./25 gal. spray mix)	flumioxazin (0.03-0.06 lb.) + non-ionic surfactant	Apply with glyphosate or other labeled burndown herbicide for control of emerged winter weeds. May be applied 14 days prior to planting if 1 ounce rate is used or 21 days prior if 2 ounce rate is used. Field must contain stubble from the previous crop. Provides significant residual control at 2 ounce rate. MOA–PPO inhibitor
PREPLANT INCORPORATED		
PROWL 3.3EC (1.2-3.6 pt.) or PROWL H_20 (1-3 pt.) or TREFLAN TRILIN TRIFLURALIN EC	pendimethalin (0.5-1.5 lb.) trifluralin (0.5-1 lb.)	If a preemergence overlay is used, use the lowest labeled rate of these preplant incorporated herbicides. **DO NOT** incorporate deeper than 2 inches. Shallow incorporation is best achieved with a rolling cultivator or "do-all." If the soil is bedded, incorporate on top of bed after final knock-down of bed. Several trade names for trifluralin are available. See label of specific product for rate. MOA–Mitosis inhibitor
SOLICAM DF (1.25-2.5 lb.)	norflurazon (1-2 lb.)	Solicam may be applied as a split application with half the rate incorporated and half applied as an overlay alone or in combination with Cotoran. **DO NOT** incorporate deeper than 3 inches. **DO NOT** incorporate more than 1 pound per acre of Solicam 80 on Coastal Plains soils. Use lower rate on light soils. For 1 year following Solicam application, treated acreage may be rotated **ONLY** to cotton, soybeans, or peanuts. MOA–Carotenoid biosynthesis inhibitor
PREEMERGENCE		
CAPAROL 4L COTTON-PRO 4L PROMETRYN 4L (3.2-4.8 pt.)	prometryn (1.6-2.4 lb.)	Application to the soil surface at planting gives good control of many broadleaf weeds and grasses. Control tolerant weeds and weeds from deep-germinating seed that escape this treatment with timely post-directed sprays. Use low rate on sandy loam soil. **CAUTION: DO NOT** use on coarse sand and loamy sand soils. MOA–Photosystem II inhibitor

Table 9. Cotton Weed Control (cont.)		
Herbicide Trade Name (Rate/Acre Broadcast)	Herbicide Common Name (Active Herbicide/Acre)	Comments
PREEMERGENCE (cont.)		
COMMAND 3ME (1.33-3.33 pt.)	clomazone (0.5-1.25 lb.)	Apply as a broadcast or band treatment over the drill for control of many annual grasses and some broadleaf weeds. Velvetleaf and spurred anoda can generally be controlled using the lowest labeled rate. To avoid serious crop injury, Command must be used in conjunction with the in-furrow insecticides Disulfoton or Phorate. Command should be tank mixed with fluometuron (Cotoran, Meturon, etc.) for broad spectrum control. Off-site movement of spray drift or volatilization can cause highly visible injury (bleaching) to non-target plants. Wet soils and/or windy conditions contribute to problems with off-target injury. Consult the label for specific rotational intervals and replanting instructions. MOA–Carotenoid biosynthesis inhibitor
COTORAN 4L (3.2-4 pt.)	fluometuron (1.6-2 lb.)	Application to the soil surface at planting provides control of many broadleaf weeds and grasses. Control tolerant weeds and weeds from deep-germinating seed that escape this treatment with timely post-directed sprays. Use lower rate on medium soils and higher rate on fine-textured soils. **CAUTION**: May interact with organophosphate systemic insecticides to cause injury to young cotton seedlings. To minimize risk of injury, **DO NOT** exceed recommended rates for specific soil types. For coarse-textured soils low in organic matter, rates should be reduced to 1 to 1.75 pounds of Cotoran 85DF or to 2 to 3 pints of Cotoran 4L or Meturon 4L. MOA–Photosystem II inhibitor
COTORAN 4L (2-3 pt.) + SOLICAM DF (1.5-1.9 lb.)	fluometuron (1-1.5 lb.) + norflurazon (1.2-1.5 lb.)	See Comments for each herbicide, above and on the next page. MOA–Photosystem II inhibitor + carotenoid biosynthesis inhibitor
KARMEX DF or DIURON 80W (1-1.25 lb.) or DIREX 4L (1.5-2 pt.)	diuron (0.8-1 lb.)	Application to the soil surface at planting provides control of many broadleaf weeds and grasses. Control tolerant weeds and weeds from deep-germinating seed that escape this treatment with timely post-directed sprays. Use lower rate on medium soils and higher rate on fine-textured soils. **CAUTION:** May interact with organophosphate systemic insecticides to cause injury to young cotton seedlings. To minimize risk of injury, **DO NOT** exceed recommended rates for specific soil types. MOA–Photosystem II inhibitor
REFLEX (1 pt.)	fomesafen (0.25 lb.)	Apply to the soil surface immediately after planting **ONLY** to coarse-textured soils (sandy loam, loamy sand, sandy clay loam) for control of pigweed, nutsedge, and other weeds. May be applied to medium- and fine-textured soils up to 21 days ahead of planting. A minimum of 0.5 inch of rainfall or sprinkler irrigation must occur before planting cotton on these soils. (See 24C label.) MOA–PPO inhibitor

Table 9. Cotton Weed Control (cont.)		
Herbicide Trade Name (Rate/Acre Broadcast)	Herbicide Common Name (Active Herbicide/Acre)	Comments
PREEMERGENCE (cont.)		
STAPLE LX (1.3-2.1 fl.oz.)	pyrithiobac (0.032-0.043 lb.)	Provides soil-residual activity on sicklepod, morningglory, pigweed, and some other species. The addition of fluometuron (Cotoran, etc.) or diuron (Karmex, etc.) will broaden the spectrum of weeds controlled. MOA–ALS inhibitor
SOLICAM DF (1.25-2.5 lb.)	norflurazon (1-2 lb.)	Apply to soil surface ar planting for control of annual grasses and broadleaf weeds. Solicam also suppresses nutsedge. Solicam has given excellent control of spurred anoda. Soybeans may be planted as a replacement crop if a stand failure should occur. Peanuts may also be planted 30 days after Solicam application as a replacement crop. For 1 year following a Solicam application, treated acreage may be rotated **ONLY** to cotton, soybeans, or peanuts. MOA–Carotenoid biosynthesis inhibitor
WARRANT (2.5-4 pt.)	acetochlor (0.94-1.5 lb.)	Apply before or after planting but before cotton emerges. Provides residual control of several annual grasses and broadleaf weeds including pigweed. MOA–Mitosis inhibitor
POSTEMERGENCE OVER-THE-TOP		
ASSURE II (7-10 fl.oz.) + Crop Oil Concentrate (2 pt./25 gal. spray mix) or Non-ionic Surfactant (1 pt./25 gal. spray mix)	quizalofop (0.09-0.125 lb.) + crop oil concentrate or non-ionic surfactant	Apply postemergence to actively growing grasses. Use a minimum of 10 gallons spray solution per acre if applied with ground equipment. Use lower rates on annual grasses less than 6 inches tall and higher rates on perennial grasses such as bermudagrass and johnsongrass. A second application may be required with perennial grasses. Use crop oil concentrate with perennials. MOA–ACCase inhibitor
ENVOKE 75DF (0.1-0.15 oz.) + Non-ionic Surfactant (1 pt./50 gal. spray mix)	trifloxysulfuron (0.047-0.0118 lb.) + non-ionic surfactant	Apply as an over-the-top or post-directed treatment to cotton that has a minimum of six true leaves for control of several annual broadleaf weeds and sedges. **DO NOT** apply more than 0.15 ounce over-the-top. **DO NOT** apply to cotton under severe stress. May be applied over-the-top in mix with Staple for control of smallflower morningglory. May be tank mixed with Caparol, Dual Magnum, MSMA, etc., for post-directed application at rates up to 0.25 ounce. **DO NOT** apply within 60 days of harvest. MOA–ALS inhibitor
FUSILADE DX (0.75 pt.) + Crop Oil Concentrate (2 pt./25 gal. spray mix) or Non-ionic Surfactant (0.5 pt./25 gal. spray mix)	fluazifop-butyl (0.2 lb.) + crop oil concentrate or non-ionic surfactant	Apply over-the-top of cotton for control of annual and perennial grasses. Annual grasses should be treated when they are 2 to 4 inches tall. Johnsongrass should be 12 to 18 inches tall and bermudagrass 3 inches in height to 6 to 12 inches in stolen (runner) length. A second application may be necessary for complete control of johnsongrass and bermudagrass. Use a minimum of 10 gallons of solution per acre and 30 to 60 psi nozzle pressure to ensure complete coverage. Fusilade does not control sedges (nutgrass). MOA–ACCase inhibitor
FUSION 2.5E (6-10 fl.oz.) + Crop Oil Concentrate (2 pt./25 gal. spray mix) or Non-ionic Surfactant (0.5 pt./25 gal. spray mix)	fluazifop + fenoxaprop + crop oil concentrate or non-ionic surfactant	Apply postemergence to actively growing grasses. Annual grasses should be less than 6 inches tall when treated. Use 12-fluid-ounce rate for bermudagrass. A finished spray volume of 10 to 20 gallons per acre is sufficient. A second application may be needed for perennial grasses. MOA–ACCase inhibitor

Table 9. Cotton Weed Control (cont.)

Herbicide Trade Name (Rate/Acre Broadcast)	Herbicide Common Name (Active Herbicide/Acre)	Comments
POSTEMERGENCE OVER-THE-TOP (cont.)		
LIBERTY (1.8-2.7 pt.)	glufosinate (0.52-0.78 lb.)	Apply **ONLY** to Liberty-Link cotton that is tolerant to Ignite herbicide. May be applied to Liberty-Link cotton from emergence to 70 days prior to harvest. Provides broad-spectrum control of annual grasses and broadleaf weeds. Ignite has no soil residual activity. **DO NOT** apply more than 43 fluid ounces in a single application or more than 87 fluid ounces per acre per year. Consult label for tank mixes. MOA–Glutamine synthetase inhibitor
POAST PLUS (1.5-2.25 pt.) + Crop Oil Concentrate (2 pt.)	sethoxydim (0.2-0.3 lb.) + crop oil concentrate	Apply over-the-top of cotton for control of annual and perennial grasses. Annual grasses should be treated when they are 4 to 8 inches tall except crabgrass and goosegrass, which should be treated before reaching 4 inches in height. Johnsongrass should be 15 to 20 inches in height and bermudagrass should not exceed 6 inches in plant diameter for Poast application. A second application may be necessary for complete control of perennial grasses. Use a minimum of 10 gallons of solution per acre and 40 psi nozzle pressure to ensure thorough spray coverage of foliage. Poast does not control sedges (nutgrass). **DO NOT** mix with other herbicides. MOA–ACCase inhibitor
ROUNDUP or TOUCHDOWN or GLYPHOSATE + Non-ionic Surfactant (0.5 pt./25 gal. spray mix)	glyphosate (1-1.4 lb.) + non-ionic surfactant	**For Use Only on Roundup-Ready Flex Cotton.** A total of 128 fluid ounces of Roundup Weather Max or Original Max may be applied from emergence to 60 percent open bolls. Do not exceed 32 fluid ounces per application. There is no required waiting period or cotton growth stage between applications. Consult label for tank mixes. MOA–EPSP inhibitor
DUAL MAGNUM (1 pt.) or Generic Brand (1.3 pt.) + ROUNDUP or TOUCHDOWN	metolachor (0.95 lb.) + glyphosate	Apply over-the-top of Roundup-Ready or Roundup Ready Flex cotton in tank mixture with glyphosate prior to the four-leaf stage. Provides residual control of annual grass and pigweed. MOA–Mitosis inhibitor
SEQUENCE 5.25EC (2.5 pt.)	glyphosate (0.7 lb.) + metolachlor (0.95 lb.)	Apply to RR Flex cotton from 3-inch to four-leaf stage for foliar and residual control of several annual grasses and broadleaf weeds. Residual control is dependent on rainfall or sprinkler irrigation within 5 to 7 days after application. MOA–EPSP inhibitor + mitosis inhibitor
SELECT 2EC (6-16 fl.oz.) + Crop Oil Concentrate (2 pt./25 gal. spray mix) or Non-ionic Surfactant (1 pt./25 gal. spray mix)	clethodim (0.1-0.25 lb.) + crop oil concentrate or non-ionic surfactant	Apply postemergence to actively growing grasses. Annual grasses should be less than 6 inches tall when treated. A finished spray volume of 10 to 20 gallons per acre is sufficient. Use the higher rate on thick bermudagrass stands. A second application may be needed with perennial grasses. Use crop oil concentrate with perennials. MOA–ACCase inhibitor

Table 9. Cotton Weed Control (cont.)

Herbicide Trade Name (Rate/Acre Broadcast)	Herbicide Common Name (Active Herbicide/Acre)	Comments
POSTEMERGENCE OVER-THE-TOP (cont.)		
STAPLE LX (2.6-3.8 fl.oz.) + Non-ionic Surfactant (0.5 pt./25 gal. spray mix)	pyrithiobac (0.06-0.09 lb.) + non-ionic surfactant	Apply to weeds that are less than 3 inches tall. Provides control of several broadleaf weeds including annual morningglory, cocklebur, coffee senna, and pigweed. Add non-ionic surfactant at a rate of 1 pint per 50 gallons of spray mix. Staple alone may be used from first true leaf until 60 days prior to harvest. MSMA at 1 pint per acre (0.75 pound active) may be added to increase sicklepod control. May be used at rates of 1.3 to 3.8 fluid ounces per acre in combination with glyphosate on Roundup Ready Flex cotton or Liberty on Liberty Link cotton at rates up to 2.7 fluid ounces. **DO NOT** apply mixture after pinhead square. MOA–ALS inhibitor
WARRANT (3 pt.)	acetochlor (1.12 lb.)	Apply over-the-top of Roundup Ready Flex cotton from one- to four-leaf stage in tank mixture with glyphosate for residual control of annual grasses and small-seeded broadleaf weeds like pigweed. MOA–Mitosis inhibitor
POSTEMERGENCE DIRECTED		
CAPAROL 4L (1-1.5 pt.) + MSMA (several forms)	prometryn (0.5-0.75 lb.) + MSMA (2 lb.)	Apply as a postemergence directed spray after cotton is 10 inches high on medium and fine soils and after cotton is 12 inches high on coarse soils. As a postemergence spray, Caparol is effective on small annual morningglory, cocklebur, prickly sida, and pigweed. Higher rate of Caparol will provide better residual control of late germinating weeds. Use 1 pint of non-ionic surfactant per 50 gallons of spray mix. **DO NOT** apply over-the-top of cotton. MOA–Photosystem II inhibitor + unknown
COBRA 2E (0.75 pt.) + MSMA (several forms) + Crop Oil Concentrate	lactofen (0.2 lb.) + MSMA (2 lb.) + crop oil concentrate	Apply as a postemergence directed spray after cotton is at least 10 inches tall. Add 1 pint of crop oil concentrate per acre. Cobra is effective on common cocklebur, tropic croton, annual morningglory, and other broadleaf weeds. Weeds should be less than 4 inches tall. Cobra may also be tank mixed with Karmex. **DO NOT** apply later than 90 days before harvest. **DO NOT** apply over-the-top of cotton. MOA–PPO inhibitor
COTORAN 4L (2-4 pt.) + MSMA (several forms) + Non-ionic Surfactant	fluometuron (1-2 lb.) + MSMA (2 lb.) + non-ionic surfactant	Make one to two directed spray applications after cotton is 3 to 4 inches tall. Controls most small annual weeds. **DO NOT** apply after cotton starts blooming. **NOT** recommended as an over-the-top spray. Add 1 pint of non-ionic surfactant per 50 gallons of spray mix. MOA–Photosystem II inhibitor + unknown
ROUNDUP or GLYPHOSATE	glyphosate (0.9-1.4 lb.)	Use **ONLY** on varieties that contain a Roundup Ready Flex gene. May be combined with other labeled postemergence directed herbiciudes, using the most restrictive cautions on these labels. MOA–EPSP inhibitor
DUAL MAGNUM (1 pt.) or STALWART (1.33 pt.) + MSMA	metolachlor (0.95-1.25 lb.) + MSMA (1.5-2 lb.)	Apply as a directed spray for yellow nutsedge and annual grass control. Will not control Texas panicum or purple nutsedge. **DO NOT** apply with liquid fertilizer or make more than one application per growing season. **DO NOT** apply after first bloom. Rainfall or sprinkler irrigation is needed to activate Dual. MOA–Mitosis inhibitor + unknown

Table 9. Cotton Weed Control (cont.)

Herbicide Trade Name (Rate/Acre Broadcast)	Herbicide Common Name (Active Herbicide/Acre)	Comments
POSTEMERGENCE DIRECTED (cont.)		
GOAL 1.6E (1.25 pt.) + MSMA (several forms) + Non-ionic Surfactant	oxyfluorfen (0.25 lb.) + MSMA (2 lb.) + non-ionic surfactant	Apply as a postemergence directed spray to cotton at least 10 inches tall. **DO NOT** apply under windy or wet conditions. Add non-ionic surfactant at 1 pint per 50 gallons of final spray solution. Controls a variety of annual broadleaf weeds. **DO NOT** apply over-the-top of cotton. **DO NOT** apply within 90 days of harvest. MOA–PPO inhibitor
GRAMOXONE LS (1.2-2.4 pt.) or FIRESTORM (0.8-1.6 pt.) hooded + Non-ionic Surfactant	paraquat (0.3-0.6 lb.) + non-ionic surfactant	Apply with a hooded sprayer between rows to avoid contact with the crop. Add non-ionic surfactant at 2 pints per 100 gallons of spray mix. Paraquat is a **RESTRICTED USE** pesticide. MOA–Photosystem I inhibitor
KARMEX DF (0.5 lb.) or DIREX 4L (0.8 pt.) + Non-ionic Surfactant (0.5 pt./25 gal. spray mix)	diuron (0.4 lb.) + non-ionic surfactant	Apply as a directed spray to cotton at least 6 inches tall. Add DSMA (2 pounds active ingredient per acre) to increase overall weed control. MOA–Photosystem II inhibitor
LAYBY PRO (1 pt.)	linuron (0.25 lb.) + diuron (0.25 lb.)	Apply as a directed or hooded/shielded spray to cotton a minimum of 6 inches tall for control of weeds less than 2 inches tall. May be tank mixed with other herbicides; consult label for mixes. Apply in 10 to 30 gallons of spray solution per acre. MOA–Photosystem II inhibitors
LINEX 4L (1-3 pt.) + Non-ionic Surfactant	linuron (0.5-1.5 lb.) + non-ionic surfactant	Apply post-directed to cotton at least 8 inches tall and when weeds are 2 inches or less in size. MSMA may be added to increase weed spectrum. Use higher rates for layby applications. MOA–Photosystem II inhibitor
SUPREND (1-1.5 lb.) + Non-ionic Surfactant (1 pt./50 gal. spray mix)	prometryn (0.8-1.2 lb) + trifloxysulfuron (0.007-0.0105 lb.) + non-ionic surfactant	Apply as a directed spray to cotton 8 inches tall or taller. Provides foliar and residual control of several annual grasses and broadleaf weeds. May be tank mixed with other herbicides. Consult label. MOA–Photosystem II inhibitor + ALS inhibitor
LAYBY		
Layby treatments are recommended where late-season weeds are expected to be a problem or where stands are erratic. Read the label for maximum amount of a herbicide that can be used in any one year. **DO NOT** *exceed that amount.*		
AIM 2E (0.8-1.6 fl.oz.) + Crop Oil Concentrate (1 pt.)	carfentrazone (0.01-0.025 lb.) + crop oil concentrate (1 pt.)	Apply as a directed or hooded spray to the base of cotton plants at least 12 inches tall. Provides postemergence control of annual morninggloriy and other broadleaf weeds. May be mixed with other herbicides to obtain broad spectrum activity. Keep spray off green cotton tissue. MOA–PPO inhibitor

Table 9. Cotton Weed Control (cont.)		
Herbicide Trade Name (Rate/Acre Broadcast)	Herbicide Common Name (Active Herbicide/Acre)	Comments
LAYBY (cont.)		
COTORAN 4L (2 pt.)	fluometuron (1 lb.)	Apply after last cultivation, using flooding-type or other suitable nozzles mounted close to the ground to keep spray off cotton. If weeds have already emerged, add glyphosate for RF cotton or Liberty for LL cotton. MOA–Photosystem II inhibitor
COTTON-PRO 4L CAPAROL 4L or PROMETRYN 4L (2.5-3.5 pt.)	prometryn (1.25-1.75)	Apply after last cultivation, using flooding-type or other suitable nozzles mounted close to the ground to keep spray off cotton. If weeds have already emerged, add 1 pint of a non-ionic surfactant per 25 gallons of mix. MOA–Photosystem II inhibitor
ET 0.2E (1-2 oz.) + Crop Oil Concentrate (1 pt.)	pyraflufen (0.001-0.003 lb.) + crop oil concentrate	Apply using hooded spray equipment to the base of cotton a minimum of 12 inches tall. Provides control of annual morningglory and other broadleaf weeds. May be mixed with other herbicides to obtain broad spectrum activity. Keep spray off green cotton tissue. MOA–PPO inhibitor
KARMEX DF or DIURON 80 DF (1-1.5 lb.) or DIREX 4L (1.5-2.2 pt.)	diuron (0.8-1.25 lb.)	Apply after last cultivation, using flooding-type or other suitable nozzles mounted close to the ground to keep spray off cotton. If weeds have already emerged, add 1 pint of a non-ionic surfactant per 25 gallons of mix. MOA–Photosystem II inhibitor
LAYBY PRO (1.6-2.4 pt.)	linuron (0.4-0.6 lb.) + diuron (0.4-0.6 lb.)	Apply as a directed or hooded/shielded spray to cotton a minimum of 15 inches tall for control of weeds up to 4 inches tall. Provides residual control of germinating weeds following application if activated by rainfall or sprinkler irrigation. Apply in 10 to 30 gallons of spray solution per acre. MOA–Photosystem II inhibitors
VALOR HERBICIDE (1-2 oz.) + Non-ionic surfactant (1 pt./50 gal.)	flumioxazin (0.03-0.06 lb.) + non-ionic surfactant	Apply with glyphosate or MSMA as a hooded spray to cotton a minimum of 6 inches tall or as a layby to cotton at least 18 inches tall. **DO NOT** use crop oil concentrate. MOA–PPO inhibitor

NOTE: The crop oil concentrates listed in this table are defined as products that contain 80- to 85-percent petroleum oil plus 15- to 20-percent surfactants and emulsifiers. Non-ionic surfactant is defined as a product that contains at least 80-percent ingredients that act as surface-active agents, spreader stickers, or wetting agents.

Table 10. Estimated Effectiveness of Recommended Herbicide Treatments on Important Weeds Infesting Cotton in Alabama and Properties That May Affect Water Quality[1]

WEEDS	HERBICIDES							
	2,4-D (PPF)	Harmony Extra (PPF)	Prowl (PPI)	Treflan (PPI)	Caparol (PRE)	Command (PRE)	Cotoran (PRE)	Cotoran + Solicam (PRE)
GRASSES								
Bermudagrass	0	0	1	1	1	5	0	2
Crabgrass	0	0	9	9	7	8	8	8
Crowfootgrass	0	0	9	9	8	7	8	8
Fall panicum	0	0	8	8	6	6	7	8
Goosegrass	0	0	9	9	7	7	7	8
Johnsongrass (rhizomes)	0	0	2	3	0	3	0	0
Johnsongrass (seedlings)	0	0	8	8	6	6	6	7
Sedges (nutgrass)	0	5	0	0	0	2	0	5
BROADLEAF WEEDS								
Bristly starbur	6	—	1	1	7	3	8	8
Cocklebur	8	6	0	0	5	6	7	8
Coffee senna	7	6	0	0	5	6	5	6
Common groundsel	9	8	9	9	7	7	8	9
Common ragweed	8	6	3	3	8	6	9	9
Cutleaf eveningprimrose	9	4	9	9	8	5	8	9
Florida beggarweed	3	—	0	0	8	—	8	8
Florida pusley	7	—	9	9	8	4	9	9
Horseweed	9	2	8	8	7	7	8	9
Jimsonweed	8	—	3	3	7	6	7	8
Lambsquarter	6	—	7	7	8	8	9	9
Morningglory	7	—	4	4	6	5	7	8
Pigweed	8	2	8	8	8	3	9	7
Prickly sida	2	—	0	0	8	8	8	9
Sicklepod	7	—	0	0	8	2	8	8
Smartweed	5	—	2	2	6	6	6	6
Spotted spurge	3	—	2	2	6	5	5	8
Spurred anoda	6	—	0	0	3	8	4	7
Tropic croton	6	—	0	0	—	7	5	8
Velvetleaf	8	—	0	0	3	9-10	4	7
Wild garlic	5	8	0	0	4	4	4	5
Wild radish	6	7	0	0	8	6	8	9

continued

[1] Based on observations of research plots and field use of herbicides under average weather conditions for several years by weed control workers in Alabama. Control may vary depending on factors such as time and method of application, weather conditions, size of weeds, etc.

KEY TO CONTROL RATINGS AND ABBREVIATIONS

0 = No control; 10 = 100% control; — = Information not available.

PPF = Preplant Foliar; PPI = Preplant Incorporated; PRE = Preemergence.

Table 10. Estimated Effectiveness of Recommended Herbicide Treatments on Important Weeds Infesting Cotton in Alabama and Properties That May Affect Water Quality[1] (cont.)

WEEDS	HERBICIDES							
	Karmex (PRE)	Solicam (PRE)	Warrant (PRE)	Assure, Select (POST)	Gramoxone (POST)	Fusilade (POST)	Fusion (POST)	Poast (POST)
GRASSES								
Bermudagrass	0	3	1	8	2	8	7	6
Crabgrass	8	8	8	8	5	8	8	9
Crowfootgrass	8	8	8	9	8	9	9	9
Fall panicum	6	8	8	9	8	9	9	9
Goosegrass	8	8	8	8	8	8	8	8
Johnsongrass (rhizomes)	0	0	1	9	3	9	8	7
Johnsongrass (seedlings)	6	7	7	8	8	8	8	8
Sedges (nutgrass)	0	5	4	0	3	0	0	0
BROADLEAF WEEDS								
Bristly starbur	6	7	0	0	5	0	0	0
Cocklebur	6	5	0	0	5	0	0	0
Coffee senna	4	0	4	0	8	0	0	0
Common groundsel	8	5	—	0	5	0	0	0
Common ragweed	8	8	4	0	7	0	0	0
Cutleaf eveningprimrose	9	5	—	0	4	0	0	0
Florida beggarweed	8	7	5	0	9	0	0	0
Florida pusley	8	8	9	0	4	0	0	0
Horseweed	9	5	—	0	4	0	0	0
Jimsonweed	6	7	5	0	9	0	0	0
Lambsquarter	9	4	8	0	5	0	0	0
Morningglory	5	5	5	0	8	0	0	0
Pigweed	9	9	9	0	8	0	0	0
Prickly sida	4	9	4	0	4	0	0	0
Sicklepod	5	5	5	0	9	0	0	0
Smartweed	5	4	3	0	6	0	0	0
Spotted spurge	5	7	4	0	7	0	0	0
Spurred anoda	3	8	4	0	7	0	0	0
Tropic croton	5	4	2	0	5	0	0	0
Velvetleaf	4	7	—	0	7	0	0	0
Wild garlic	4	4	—	0	5	0	0	0
Wild radish	8	4	—	0	8	0	0	0

continued

[1] Based on observations of research plots and field use of herbicides under average weather conditions for several years by weed control workers in Alabama. Control may vary depending on factors such as time and method of application, weather conditions, size of weeds, etc.

KEY TO CONTROL RATINGS AND ABBREVIATIONS

0 = No control; 10 = 100% control; — = Information not available.

PRE = Preemergence; POST = Postemergence.

Table 10. Estimated Effectiveness of Recommended Herbicide Treatments on Important Weeds Infesting Cotton in Alabama and Properties That May Affect Water Quality[1] (cont.)

WEEDS	HERBICIDES							
	Envoke (OTT)	Ignite (OTT)	Roundup (OTT)	Staple (OTT)	Dual + Glyphosate (OTT)	Warrant + Glyphosate (OTT)	AIM (PDS)	Caparol +MSMA (PDS)
GRASSES								
Bermudagrass	0	2	8	0	3	3	0	0
Crabgrass	0	8	8	0	9	9	0	9
Crowfootgrass	0	8	8	0	9	9	0	8
Fall panicum	1	9	9	0	9	9	0	7
Goosegrass	0	9	9	0	8	8	0	8
Johnsongrass (rhizomes)	0	2	9	0	5	8	0	3
Johnsongrass (seedlings)	6	9	9	0	9	9	0	8
Sedges (nutgrass)	7	4	6	2	5	4	0	6
BROADLEAF WEEDS								
Bristly starbur	8	8	8	9	7	7	—	9
Cocklebur	8	9	9	9	8	8	7	9
Coffee senna	8	8	8	9	8	8	—	7
Common groundsel	5	7	5	3	7	7	7	8
Common ragweed	7	8	8	4	8	9	7	8
Cutleaf eveningprimrose	5	7	2	2	2	2	3	9
Florida beggarweed	7	8	8	9	8	8	—	8
Florida pusley	6	6	6	6	9	8	—	8
Horseweed	5	7	0	4	0	0	7	8
Jimsonweed	—	8	8	9	8	8	—	9
Lambsquarter	4	8	8	4	8	8	—	7
Morningglory	8	8	8	8	7	8	8	8
Pigweed	8	9	9	9	9	9	7	8
Prickly sida	2	8	8	7	7	7	—	8
Sicklepod	8	8	8	3	7	8	0	8
Smartweed	—	—	—	8	6	6	6	7
Spotted spurge	—	8	8	8	7	7	6	7
Spurred anoda	3	8	8	9	7	7	8	7
Tropic croton	—	8	8	5	6	6	—	8
Velvetleaf	8	8	8	9	6	6	9	5
Wild garlic	3	3	5	3	3	3	2	4
Wild radish	4	7	6	3	7	7	5	6

continued

[1] Based on observations of research plots and field use of herbicides under average weather conditions for several years by weed control workers in Alabama. Control may vary depending on factors such as time and method of application, weather conditions, size of weeds, etc.

KEY TO CONTROL RATINGS AND ABBREVIATIONS

0 = No control; 10 = 100% control; — = Information not available.

OTT = Over The Top; PDS = Postemergence Directed Spray.

Table 10. Estimated Effectiveness of Recommended Herbicide Treatments on Important Weeds Infesting Cotton in Alabama and Properties That May Affect Water Quality[1] (cont.)

WEEDS	HERBICIDES							
	Cobra + MSMA (PDS)	Cotoran +MSMA (PDS)	ET (PDS)	Goal + Surfactant (PDS)	Karmex + MSMA (PDS)	MSMA + Surfactant (PDS)	Layby Pro (Layby)	Valor + glyphosate (Layby)
GRASSES								
Bermudagrass	—	0	0	—	0	0	1	6
Crabgrass	6	9	0	—	9	7	7	8
Crowfootgrass	6	8	0	—	7	7	8	8
Fall panicum	8	8	0	—	8	8	7	8
Goosegrass	5	6	0	—	8	5	7	8
Johnsongrass (rhizomes)	5	7	0	—	3	5	1	6
Johnsongrass (seedlings)	5	8	0	—	8	6	7	8
Sedges (nutgrass)	6	6	0	—	6	7	2	6
BROADLEAF WEEDS								
Bristly starbur	7	9	—	7	9	8	9	8
Cocklebur	9	9	8	8	9	9	9	9
Coffee senna	5	5	—	8	5	2	8	8
Common groundsel	7	5	4	7	8	6	7	8
Common ragweed	8	8	8	7	8	6	8	9
Cutleaf eveningprimrose	8	7	8	6	8	3	6	9
Florida beggarweed	9	9	—	7	7	9	8	8
Florida pusley	9	7	—	8	8	3	7	7
Horseweed	8	7	7	7	8	3	6	8
Jimsonweed	6	9	—	8	8	6	8	9
Lambsquarter	6	6	8	8	7	4	8	9
Morningglory	8	7	8	9	8	6	9	9
Pigweed	9	7	8	9	8	4	8	9
Prickly sida	8	6	—	7	6	3	7	8
Sicklepod	7	6	0	3	8	5	8	9
Smartweed	4	6	7	7	6	2	7	8
Spotted spurge	7	4	—	6	4	1	7	8
Spurred anoda	5	4	6	6	5	1	7	8
Tropic croton	8	7	—	8	8	6	6	8
Velvetleaf	6	5	—	6	5	1	6	8
Wild garlic	4	3	3	2	2	1	2	3
Wild radish	7	5	7	6	6	2	4	7

[1] Based on observations of research plots and field use of herbicides under average weather conditions for several years by weed control workers in Alabama. Control may vary depending on factors such as time and method of application, weather conditions, size of weeds, etc.

KEY TO CONTROL RATINGS AND ABBREVIATIONS

0 = No control; 10 = 100% control; — = Information not available.

PDS = Postemergence Directed Spray.

Table 11. Herbicide Classified by Mechanism of Action

Mechanism of Action	Herbicide
Acetyl CoA Carboxylase (ACCase) inhibitor	Poast, Fusilade, Select, Assure
Acetolactase Synthase (ALS) inhibitors	Staple, Envoke, Harmony Extra
Carotenoid biosynthesis inhibitor	Command, Solicam
Enolpyruval shikimate-3-phospate (EPSP) inhibitor	Roundup, Touchdown
Glutamine synthesis inhibitor	Liberty
Mitosis inhibitor	Treflan, Prowl, Dual, Warrant
Photosystem I inhibitor	Gramoxone Interon, Firestorm
Photosystem II inhibitor	Cotoran, Caparol, Direx, Layby Pro, Linex
Protoporphyrinogen oxidase (PPO) inhibitor	Aim, ET, Reflex, Resource, Valor, Cobra, Goal
Synthetic auxin	2,4-D, Clarity

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COTTON DEFOLIATION GUIDE

The defoliation of cotton, under favorable circumstances, is a very desirable production practice. Defoliation can result in higher grades of cotton. It can reduce damage from boll rot by exposing greater portions of the plants to sunlight and air. Also, defoliation can facilitate the harvesting schedule. It tends to hasten the start of the picking season and allows picking to start earlier on mornings when the dew is heavy.

Is Defoliation Profitable?

Over several years and under favorable circumstances, defoliation is profitable. That is, the added returns from defoliation are greater than the added costs. However, results can vary considerably from year to year and from farm to farm, and even from field to field. As a consequence, the extra profits earned from defoliation are a reward for alert cotton producers who vary their use of the practice depending on the circumstance. This superior management involves combining close observation with a thorough knowledge of plant growth characteristics and the attributes of various defoliant materials.

A defoliant application will likely be profitable when:

- Plants are tall.
- Fruit set is heavy.
- Foliage is dense and succulent.
- Plants have cut-out but are not completely inactive.
- Secondary growth is not excessive.

A defoliant application will likely not be as profitable when:

- Plants are short.
- Leaves are sparse.
- Leaves are inactive due to drought, lack of plant food, complete maturity, etc.
- Boll set is light.
- Natural leaf drop is high.
- Plants are actively growing with no sign of cut-out.

Between these two extremes, the economic basis for defoliation is not so clear-cut. The advantages relate chiefly to creating a better environment for the opening bolls and facilitating the harvesting schedule as well as the mechanics of picker operation.

Timing of Application

The best time to defoliate varies with the weather, the condition of the crop, and the principal benefits expected. Often, something must be sacrificed to realize this benefit. Defoliating early to take advantage of higher temperatures and to permit earlier harvesting may result in sacrificing part of the top crop. Delaying defoliation of large, high-yielding plants until late-set bolls are fully mature may mean that lower temperatures will prevent good leaf drop and may result in excessive field deterioration of fiber and seed in the bolls that opened early.

In general, defoliation should be timed to permit the most efficient picking schedule with machines. If the application is delayed until 60 percent of the total crop to be harvested is open, 75 to 90 percent of the crop can likely beharvested within two weeks after the application, except when weather conditions are very favorable.

A defoliant should not be applied to the entire acreage at one time. The defoliation schedule should be coordinated with the harvest in such a way that harvest can follow defoliation within about two weeks. Defoliating too far ahead of picking can result in second growth problems, excessive field loss, and quality deterioration.

Materials

Aim, ET, Resource. These products provide good defoliation of mature cotton leaves but have minimal activity on juvenile growth. They may be mixed with ethephon and/or thidiazuron to speed boll opening and/or suppress regrowth. Adding crop oil concentrate at 1 to 2 pints per acre is needed for optimum activity.

CottonQuik, Finish. These “activated” ethephon products contain proprietary additives that increase the speed of boll opening and in some cases defoliation. Other harvest aides such as thidiazuron, Def, Harvade, Aim, ET, or Resource must often be added to increase overall defoliation.

Sodium Chlorate. Sodium chlorate is generally not used as a defoliant on spindle-picked cotton. Leaf sticking may occur with high application rates, and at normal rates it is usually not

as effective as other defoliants. It is not a strong inhibitor of terminal regrowth and is not very effective on young immature leaves. **DO NOT** mix sodium chlorate with surfactants, oils, insecticides, or other defoliants.

Def 6. This phosphate-type material has been a standard defoliant for several years in Alabama. Although this material does not strongly inhibit regrowth, it is effective on young immature leaves. A rain-free period of 2 hours is sufficient for phosphate-type defoliants. The use of surfactants and/or crop oil has enhanced the performance of this material under very adverse conditions.

Thidiazuron (Dropp, etc.). Thidiazuron provides defoliation essentially equal to the phosphate-type defoliants. However, thidiazuron is a strong inhibitor of terminal regrowth. Thidiazuron activity is relatively sensitive to cool weather. Tank mixing thidiazuron with DEF or ethephon (Prep, etc.) will enhance the activity of thidiazuron under cool conditions. Thidiazuron requires a 24-hour rain-free period. Make sure to follow the label instructions for tank cleanup when using thidiazuron. Failure to follow label tank-cleaning instructions may cause premature defoliation of cotton when the sprayer is used the following year.

Ethephon. Ethephon (Prep, etc.) has been shown to accelerate the opening of cotton bolls. Increasing the rate of boll opening has allowed harvest operations to begin several days earlier, increased the percentage of the crop harvested during the first picking, and eliminated the need for a second harvest in many fields. However, some quality reduction may occur if a large percentage of the total harvest is immature bolls, which will be opened and harvested. The crop should be well matured prior to the use of this material to avoid reductions in fiber quality.

Although ethephon is not labeled as a defoliant, it does have some defoliant activity. It has provided satisfactory defoliation at the higher rate of application (2 pounds active ingredient per acre) under optimum conditions on well-matured cotton. The addition of ethephon at lower rates with other defoliants has been reported to increase the degree of defoliation under adverse conditions. Ethephon is compatible with Def, Harvade, thidiazuron, Aim, ET, and Resource but should **NOT** be mixed with sodium chlorate.

Desiccants. Desiccants (sodium chlorate, paraquat) are generally not used as a harvest aid for cotton harvested with spindle-type pickers. If desiccation is necessary because of regrowth or weeds, it is best to apply a defoliant, wait until leaf drop occurs, and then apply the desiccant. Desiccants kill the entire plant and burn immature bolls. Therefore, 90 percent of the crop should be open before applying a desiccant.

Coverage

Adequate spray coverage is essential. Good defoliation requires that the chemical be sprayed on each leaf. Where cotton is tall and foliage is dense, failure to distribute the material over the entire plant is a frequent cause of poor results. Too often the application is concentrated on the upper leaves which may be "burned" too drastically and fail to drop while the lower foliage remains green and unaffected.

For plants up to 5 feet tall which are not densely over-lapped between the rows, satisfactory spray coverage can be obtained with 5 to 8 gallons of total spray per acre applied by airplane and 15 to 20 gallons by ground machine. It is not satisfactory to fly 3 to 4 gallons per acre twice or to overlap the swaths in order to apply 6 to 8 gallons. In these cases, the spray is concentrated on the upper leaves as described above.

With ground equipment, coverage of entire plants can be accomplished using three nozzles per row with one over-the-top and one on each side. This is particularly advantageous for cotton that has rank growth. With aerial applications to rank cotton, two applications about 1 week apart may be required to get spray on all the leaves.

Surfactants

Surfactants are used to obtain more thorough wetting and adsorption. Read the container label for surfactant-use requirements.

Evaluating Cotton for Maturity

Determining when to defoliate and terminate a crop is often difficult. Cotton requires approximately 40 to 50 days for an early-season white bloom to develop into a mature boll. That interval will increase to as many as 60 days later in the season. The cutoff dates for white blooms to develop into mature bolls are generally predicted to be August 15 for North Alabama and September 1 for South Alabama. These dates may be earlier or later, depending on the temperature, rainfall, and length of the fall season.

Several methods can be used to predict the number of mature bolls that will probably be harvested. One involves simply counting down four to five nodes from the top of the plant. All bolls below that point should mature in time for harvest. Another method, called Nodes Above Cracked Boll, involves locating the uppermost cracked boll (already cracked when found) on the first fruiting position. The bolls located four to five nodes above this point are generally considered mature, and defoliation at that time would not decrease yield or quality.

Traditionally, producers have used a method that involves cutting the bolls with a sharp knife. If the boll cannot be cut without stringing fiber and if the seed coats have begun to darken, the boll is considered mature.

COTTON GROWTH REGULATORS AND HARVEST AID PRODUCTS

Growth Regulation

Plant growth regulators (PGRs) have long been used for controlling cotton height and vegetative production to facilitate insecticide application, reduce boll rot, and improve picker efficiency. The products currently marketed for controlling excessive vegetative growth in actively grown, non-stressed cotton contain the following: mepiquat chloride, mepiquat pentaborate, or cyclanilide plus mepiquat chloride. Research conducted over many years and/or locations across the Cotton Belt has indicated that these products will consistently control cotton plant height and often result in increased earliness when compared to untreated cotton. PGRs will likely provide the greatest growth-regulating benefits in fields where excessive growth traditionally occurs; fields where excessive vegetative production can occur due to irrigation, high fertilization rates, or poor fruit set; and fields planted in varieties known to have excessive growth habits. Treatment strategies may change depending on the sensitivity of the variety to PGRs. In many cases PGRs for cotton can be tank-mixed with insecticides, miticides, and/or foliar fertilizer according to specific product label directions and precautions.

Boll Opening

It may be desirable to accelerate the opening of mature cotton bolls in order to harvest earlier or for a once-over harvest operation. Ethephon has been shown to accelerate the opening of bolls and to enhance defoliation. Immature bolls will also be affected and, depending on the stage of maturity, the fiber may be immature, quality of seed may be lowered, and yield may be reduced. Application should not be made until sufficient mature, unopened bolls have developed to produce the desired yield.

Cool, damp conditions occurring within 48 hours before or after treatment may severely inhibit the effectiveness of ethephon.

Defoliants and Boll-Opening Products

Several chemicals are labeled for use as defoliants (see table, below). They will defoliate cotton but will not kill the stalk under normal use. Some regrowth will occur with all of these products. For more information on cotton defoliation, see Circular ANR-715, "Cotton Defoliation."

Desiccants

A desiccant primarily dries plant tissue. These chemicals usually act so rapidly that leaves are killed and stick to the stalk and defoliation does not occur. Desiccants are generally recommended in areas where cotton is harvested by strippers. In Alabama, they should be used only as a last resort to eliminate second growth.

Additives

Additives are materials that are included in a tank mix with defoliants or boll openers to enhance the mixture's performance. Additives are often used to increase the speed of activity. They are also used when weather conditions are less than ideal. Before using an additive with harvest aides, carefully consider the crop condition and environmental conditions. Lush plants and hot (greater than 90°F) temperatures may be conducive to leaf sticking if additives are used.

Table 12. Rain-safe Period and Carrier Volume[1]

PRODUCT	————Rain-safe Period————		—Minimum Water Carrier Volume—	
	without surfactant [2]	with surfactant	aerial	ground
mepiquat chloride (Pix)	8 hours	4 hours	2 gpa	2 gpa
mepiquat pentaborate	2 hours	1 hour	2 gpa	10 gpa
cyclanilide + mepiquat chloride	4-8 hours	2 hours	2 gpa	10 gpa

[1] Specifications in this table are according to manufacturer's label directions.

[2] Rain-safe period may vary according to the product used, rain-fall duration, and the inclusion of a high-quality EPA-exempt surfactant.

Table 13. Plant Growth Regulators

Trade Name	Common Name	Application Instructions
PIX and various trade names and formulations	mepiquat chloride (MC)	Apply Pix (8 to 16 fluid ounces) when cotton is approximately 20 to 30 inches tall and is not more than 7 days beyond the early bloom stage (five to six blooms per 25 row feet) or when poorly fruited cotton is 24 inches tall. Subsequent applications can begin 2 to 3 weeks after the first one. MC products can also be applied in low-rate multiple treatments when cotton is at the match-head square stage with additional treatments made at 7- to 14-day intervals if re-growth occurs. Low rate multiple application rates may increase according to the vegetative vigor of the field. Do no apply more than 48 fluid ounces of standard Pix or its active ingredient equivalent (0.132 pound mepiquat chloride) per acre per season. Late-season applications can be made up to 30 days prior to harvest. Since there are many trade names and formulations of MC available, read and follow use directions for the specific product.
PENTIA (8-24 fl.oz.)	mepiquat pentaborate (0.026-0.154 lb.)	Make initial application after cotton has reached the pinhead square stage and is actively growing and the second application after 2 weeks on vigorously growing cotton that has greater than five NAWF. Subsequent applications can be made as needed. Pentia can also be applied late in the bloom cycle on cotton likely to experience additional vegetative growth or re-growth up to 30 days prior to harvest. Do not exceed 48 fluid ounces of Pentia per acre per season.
STANCE (2-4 fl.oz.)	cyclanilide + mepiquat chloride	Begin applications at match-head square when 50 percent of the cotton plants have one or more match-head squares or later. Sequential applications should begin 7 to 14 days later or when re-growth occurs with a minimum of 7 days between applications. Do not apply within 30 days of harvest. Rate is dependent upon field examination and vegetative vigor. Do not exceed 22 fluid ounces of Stance per acre per year.

Table 14. Boll Opening Products

Trade Name (Product/A)	Common Name (Rate a.i./A)	Application Instructions
BOLL'D* ETHEPHON PREP SUPER BOLL (1.33-2.67 pt.)	ethephon (1-2 lb.)	Apply in 5 to 50 gallons of water per acre when 40 to 60 percent of the bolls are open and when there are sufficient mature unopened bolls to produce the desired yield. Ethephon can be used 4 to 7 days prior to application of defoliants as a preconditioning agent, tank mixed with defoliants, or applied after defoliation. **DO NOT** harvest cotton sooner than 7 days after ethephon application. **DO NOT** mix ethephon with sodium chlorate products because toxic chlorine gas fumes will be produced.

* The addition of 5.33 fluid ounces of ethephon to Dropp or Folex is registered for use in Alabama. These mixtures have provided accelerated defoliation in some cases over the defoliant used alone, especially under less than ideal conditions.

Table 15. Defoliants

Trade Name (Product per Acre)	Common Name (Rate a.i. per Acre)	Application Instructions
SODIUM CHLORATE (several brands) Read label for rates.	sodium chlorate with fire suppressant (3-3.25 lb.)	Apply to mature cotton plants after the youngest bolls expected to make cotton are at least 30 days old. **DO NOT** apply later than 7 days before harvest. With ground equipment, use 10 to 20 gallons of spray solution per acre; by air, use 5 to 10 gallons per acre.

Table 15. Defoliants (cont.)

Trade Name (Product per Acre)	Common Name (Rate a.i. per Acre)	Application Instructions
AIM 2EC (1-1.6 fl.oz.) + Crop Oil Concentrate (1 pt.)	carfentrazone (0.01-0.025 lb.) + crop oil concentrate	Apply when 60- to 70-percent of the bolls are open or according to Cooperative Extension System recommendations. Aim may be applied as a tank mix with other cotton harvest aids or as a sequential treatment. When applied alone, Aim provides cotton defoliation and dessication of annual morningglory vines.
BLIZZARD EC (0.6 fl.oz.) + Crop Oil Concentrate (1 pt.)	fluthiacet (0.004 lb.) + crop oil concentrate	Apply when 60 percent or more of the bolls are open AND there are no more than four nodes between the highest first position cracked boll and the highest first position harvestable boll. May be mixed with other harvest aide products.
FIRSTPICK or COTTONQUIK (2-3.5 qt.)	ethephon plus tetraoxosulfate (4.8-8.4 lb.)	CottonQuik is a combination product designed to provide defoliation and open bolls. Dropp may be added to the tank mix to increase regrowth control.
DEF 6 (1-2 pt.)	phosphoro-trithioate (0.75-1.5 lb.)	Apply Def when 50 percent or more of the bolls are open and 7 to 10 days prior to anticipated picking. Use the low rate when the crop is mature and the weather is warm. When plants are still green and actively growing, when the temperature is cool, or when the weather is dry, use higher rates or a tank mix with another defoliant. Spray-mix of 5 to 25 gallons per acre should be applied.
DROPP SC or Generic Forms (3-6 fl.oz.)	thidiazuron (0.1-0.2 lb.)	Apply Dropp to plants **ONLY** when 60 to 70 percent of the bolls are open. Apply in 10 to 25 gallons of water per acre by ground equipment and 2 to 10 gallons per acre by air. Use higher rates during periods of low temperatures. Apply at least 5 days prior to picking. May be tank mixed with Def or Prep. Thidiazuron rates as low as 0.05 pound per acre (0.1 pound Dropp 50 WP or 1.5 fluid ounces Free Fall SC) may be used in tank mixes. Spray tanks should be cleaned immediately after using Dropp. To make cleanup easier, a non-ionic surfactant or compatibility agent is recommended when using tank mixes of Dropp plus Def. See label for more information.
ET 0.2E (1.5-2 oz.) + Crop Oil Concentrate (1 pt.)	pyraflufen (0.0015-0.003 lb.) + crop oil concentrate	Apply when 50 to 70 percent of bolls are open or according to label recommendations. ET provides cotton defoliation and dessication of annual morningglory vines when used alone.
FINISH 6 PRO (1.3-2 pt.)	ethephon + cyclanilide (1-1.5 lb.)	Finish is a combination product designed to provide defoliation, boll opening, and regrowth control in one product. May be mixed with Def, Dropp, or Harvade.
GINSTAR 1.5E (0.4-1 pt.)	thidiazuron + diuron	Ginstar provides defoliation and regrowth control in cooler weather than Dropp. Adjuvants (crop oil concentrates, non-ionic surfactants) are not required with Ginstar. May be mixed with Prep (ethephon) to provide boll opening.
RESOURCE (4-8 fl.oz.)	flumiclorac (0.027-0.054 lb.)	Apply with 1 to 2 pints crop oil concentrate per acre to cotton at least 60 percent open. Resource can be tank mixed with other harvest aides to increase boll opening or suppress regrowth. A sequential application may be made 7 days after the initial application at up to 6 fluid ounces per acre.
ROUNDUP or TOUCHDOWN or GLYPHOSATE (generic)	glyphosate (1-2 lb.)	For preharvest use to control weeds and to provide regrowth control on non-Roundup Ready cotton. Apply at least 7 days prior to harvest. May be applied when cotton is 20 percent open with no fruiting gaps. Roundup will not defoliate cotton; therefore, a defoliant must be used following a Roundup application. Or, a tank mix with defoliant can be applied at the proper timing for defoliant use.

Table 16. Desiccants

Trade Name (Product per Acre)	Common Name (Rate a.i. per Acre)	Application Instructions
GRAMOXONE LS (1-2 pt.) or FIRESTORM (0.67-1.33 pt.) + Non-ionic Surfactant (1 pt./100 gal. spray mix)	paraquat (0.25-0.5 lb.) + non-ionic surfactant	Apply as a desiccant when 80 percent or more of the bolls are open and the remaining bolls to be harvested are mature. **DO NOT** apply within 3 days before harvest. Low rates of paraquat may be used to speed boll opening when used with ethephon. Consult specific paraquat label for rate. Paraquat is a **RESTRICTED USE** pesticide.
SODIUM CHLORATE (several brands)	sodium chlorate (4 lb.)	Apply when cotton is fully mature and 70 percent or more of the bolls are open. **DO NOT** mix with other harvest aids. Picking should begin no later than 7 days after treatment.

Table 17. Additives

Trade Name (Product per Acre)	Common Name (Rate a.i. per Acre)	Application Instructions
AMS 99% Powder (2 lb.)	ammonium sulfate (2 lb.)	Research has shown a small quantity of ammonium sulfate added to the spray mixture can increase the amount of defoliant which penetrates the cotton leaf.
PREP (other trade names) (5-6 fl.oz.)	ethephon (0.25 lb.)	The addition of 5 to 6 fluid ounces of ethephon per acre to defoliants has increased leaf drop in some cases. This rate will not open bolls.
ADJUVANTS	crop oil concentrates non-ionic surfactants penetrants wetting agents spreader-stickers organo silicones	Adjuvants form a broad group of materials sold under a variety of trade names to be used with post-applied chemicals. Read the harvest aid label to determine if any adjuvant should or can be used.

WEED MAPS

Importance of Weed Maps

Maps showing locations of weed infestations in cotton fields are extremely helpful in planning and conducting weed control programs. Knowing the location of perennial weeds such as bermudagrass in fields helps in winter tillage programs and spot treatment with herbicides. The identification and location of weeds such as prickly sida (teaweed), spurred anoda, and velvetleaf should be extremely helpful in herbicide selection and rates needed.

Time of Year.

Weed maps should be made near the end of the growing season, with the ideal time being just before picking. Producers who employ scouts to check for insects could let the scouts make weed maps of the fields the last time they scout the cotton. It is important to be as accurate as possible so that weed maps will reflect the weed problems in the field.

How to Make a Weed Map

In an average field, make a minimum of one count per 10 acres at random in the field. If one weed dominates in an area of the field, note on the field diagram the area of high population. Step off 500 feet. Count and record the number of different weeds for two crop rows and one middle. Count all weeds no matter how small. As you are moving through the field, note and diagram weeds such as johnsongrass, bermudagrass, and nutsedge on the field outline. In skip row cotton, count the skip and the rows on each side.

Cotton Defoliation Guide and Cotton Growth Regulators and Harvest Aid Products prepared by Michael G. Patterson, *Visiting Professor*, Department of Crop, Soil and Environmental Sciences, Auburn University; Charles Burmester, *Extension Agronomist*, Department of Crop, Soil and Environmental Sciences, Auburn University; Dale Monks, *Extension Agronomist*, Professor, Department of Crop, Soil and Environmental Sciences, Auburn University; and John W. Everest, Professor Emeritus, Department of Crop, Soil and Environmental Sciences, Auburn University.

FOR MORE INFORMATION on pesticides, pesticide safety, or submitting samples for analysis, see the following publications in the IPM series:
IPM 1293, “Safety.” Safety contact information; worker protection standards; the safe use, handling, and storage of pesticides
IPM 1294, “Submitting Samples.” Procedures for submitting samples for diagnosis, analysis, and identification
IPM 1295, “General Pesticide Information.” Federal and state restricted use pesticide lists; pesticides and water quality
IPM 1317, “Appendix.” Pesticide guidelines for agronomic crops, including preharvest intervals; rain-free requirements; grazing restrictions; crop rotation guidelines; and the names, classifications, and toxicities of pesticides.

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For more information, contact your county Extension office. Visit www.aces.edu/counties or look in your telephone directory under your county’s name to find contact information.

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Grain Sorghum

Insect, Disease, and Weed Control Recommendations for 2015

INSECT CONTROL

Sugarcane aphid is a new pest of sweet, grain, and forage sorghums. In 2014, it caused economic losses to many sorghum fields in Alabama. Currently labeled insecticides are not effective against this pest. Several insecticides are in the process of getting full labels from the EPA. If these are not available by planting time, there will be at least one insecticide that can be used on sugarcane aphid in Alabama in 2015, via the Section 18 process. Check the alabamacrops.com website in spring 2015 for more information about which insecticides are available for use on various sorghum species in Alabama.

Meanwhile, plan to scout all sorghum for sugarcane aphid in 2015. Most fields will require an insecticide treatment for sugarcane aphid. Texas A&M presented a helpful webinar that explains how to manage this pest. See http://ccag.tamu.edu/sugarcane-aphid/. Texas A&M also has a publication that explains how to identify this pest: http://nueces.agrilife.org/files/2014/05/Sugarcane-Aphid-Publication.pdf.

IMPORTANT: The presence of sugarcane aphid will affect how we manage other pests of sorghum. If this aphid is present, do not spray the sorghum field with a pyrethroid.

The following publication provides information on the biology and management of sorghum pests in Georgia. Please refer to this publication "Sorghum Insects and Their Management" (http://www.caes.uga.edu/publications/pubDetail.cfm?pk_id=7797) by David Buntin, University of Georgia.

For specific insecticides that can be used on grain sorghum, refer to the Grain Sorghum Insect Control section (http://www.ent.uga.edu/pmh/Com_Grain_Sorghum.pdf) of the University of Georgia Pest Management Handbook (http://www.ent.uga.edu/pmh). Additional information on forage sorghum, millets, and sudangrass can be found in the Temporary Summer Grazing Insect Control section (http://www.ent.uga.edu/pmh/Com_Temp_Grazing.pdf) of the University of Georgia Pest Management Handbook (http://www.ent.uga.edu/pmh).

Insect Control section prepared by Kathy L. Flanders, Extension Entomologist, Professor, Department of Entomology and Plant Pathology, Auburn University.

DISEASE CONTROL

Diseases may have a significant impact on the yield and grain quality of sorghum. While the risk of yield loss is greatest with the leaf blight and stalk (peduncle) rot phases of anthracnose, other diseases that can impact sorghum yield include Fusarium stalk rot and gray leaf spot. Forage sorghum varieties are particularly susceptible to anthracnose. Anthracnose, rough leaf spot, and zonate leaf spot are common and sometimes damaging diseases on sweet sorghum. Other than frequent showers, factors that influence crop susceptibility to diseases include sorghum cropping frequency, tillage practices, and variety selection. During periods of extended drought stress, charcoal rot may reduce the yield and increase lodging in grain sorghum.

For a brief description of the diseases commonly found on sorghum in Alabama, see http://www.aces.edu/dept/grain/sorghumDIS.php.

Table 1. Grain Sorghum Disease Control

Chemical Name	Rate per 1,000 Row Ft.	Comments
SEED ROT AND SEEDLING DISEASE		
azoxystrobin QUADRIS FLOWABLE	0.4-0.8 fl.oz.	**At-Plant In-furrow Spray for control of Rhizoctonia and Pythium seedling blight:** Apply in 3 to 7 gallons of water at planting and direct spray into the seed furrow before seed is covered. Use higher rate when conditions favor disease. May help suppress charcoal rot.
LEAF SPOTS AND BLIGHTS		
azoxystrobin QUADRIS FLOWABLE	6.0-15.5 fl.oz.	**For Control of Anthracnose, Charcoal Rot, Gray Leaf Spot on Forage and Grain Sorghum.** Begin applications prior to disease development and repeat 14 to 21 days later as needed. Use higher rate when conditions are favorable for disease on susceptible host. Make no more than two consecutive applications of Quadris Flowable or other Group 11 fungicide (Qol). See label for additional information concerning resistance management with Qol fungicides. See label for additional instructions.
azoxystrobin + propiconazole QUILT	14 fl.oz.	**For Control of Anthracnose and Gray Leaf Spot on Forage And Grain Sorghum.** For anthracnose and gray leaf spot control, apply prior to disease development and repeat as needed. Make no more than two consecutive applications of Quilt or other Group 11 fungicide (Qol). See label for additional information concerning resistance management with Qol fungicides. See label for additional instructions.
QUILT XCEL	10.5-14 fl.oz.	**For Control of Anthracnose, Ergot, Gray Leaf Spot, Northern Corn Leaf Blight, Ladder Spot, and Zonate Leaf Spot on Sorghum.** Apply at first sign of disease and repeat after 14 days as needed. **DO NOT** apply more than 56 fluid ounces per acre of Quilt Xcel.
picoxystrobin APROACH	6-12 fl.oz.	**For Control of Anthracnose, Gray Leaf Spot, and Rust on Sorghum and Sorghum spp.** Apply prior to disease development and continue at 7- to 14- day intervals when disease pressure is high, **DO NOT** apply after flowering. **DO NOT** make more than two sequential applications before switching to a fungicide with a different mode of action.
pyraclostrobin HEADLINE SC	6-12 fl.oz.	**For Control of Anthracnose, Gray Leaf Spot, Northern Corn Leaf Blight, Southern Leaf Spot, and Rust on Sorghum.** Apply prior to disease development. **DO NOT** apply more than 12 fluid ounces per acre or make more than one application of Headline SC per year. See label for additional information concerning resistance management with Qol fungicides.

Disease Control section prepared by Austin K. Hagan, Extension Plant Pathologist, Professor, Department of Entomology and Plant Pathology, Auburn University.

WEED CONTROL

Table 2. Grain Sorghum Weed Control

Herbicide Trade Name (Rate/Acre Broadcast)	Herbicide Common Name (Active Herbicide/Acre)	Comments
PREEMERGENCE		
DUAL II MAGNUM CINCH 7.64EC (1-1.67 pt.) [7.64 lb./gal.]	metolachlor (0.96-1.6 lb.)	Apply preplant incorporated or preemergence. Grain sorghum seed should have been treated with Concep to prevent injury. If sorghum seed have not been properly treated, Dual will severely injure the crop. Several commercial companies have treated seed for sale in Alabama. Dual will provide effective control of many annual grasses and small-seeded broadleaf weeds. *MOA–Mitosis inhibitor
INTRRO 4EC MICRO-TECH (1.5-2.5 qt.) [4 lb./gal.]	alachlor (1.5-2.5 lb.)	Apply preemergence. Grain sorghum seed should have been treated Concep seed safener. If sorghum seed have not been properly treated, alachlor will severely injure the crop. Several commercial companies have treated seed for sale in Alabama. Alachlor will provide effective control of many annual grasses and small-seeded broadleaf weeds such as pigweed. Use low rate for coarse- and medium-textured soils. See label for use rate on fine-textured soils. Alachlor is a **RESTRICTED USE** pesticide. MOA–Mitosis inhibitor
OUTLOOK (12-21 fl.oz.) [6 lb./gal.]	dimethenamid (0.56-0.98 lb.)	Apply preemergence. Grain sorghum seed should have been treated with Concep seed safener. Use lower rates on coarse-textured soils and higher rates on medium- to fine-textured soils. Rate is also influenced by soil organic matter content. Under high soil moisture or cool conditions, application may cause temporary stunting or leaf wrapping of sorghum. MOA–Mitosis inhibitor
POSTEMERGENCE		
2,4-D AMINE (0.5-1 pt.) [3.8 lb./gal.]	2,4-D (0.24-0.48 lb.)	May be applied broadcast over-the-top when weeds are small and when crop plants are 6 to 8 inches tall. Use drop nozzles to direct spray as soon as possible to keep spray out of whorls. **DO NOT** spray over-the-top when crop plants are over 8 inches tall. If sorghum is 8 to 15 inches tall, apply as directed spray. **DO NOT** apply when sorghum is in bloom or early-dough stage. **DO NOT** apply with adjuvants. MOA–Synthetic auxin
AATREX/ATRAZINE 4L (4 pt.) or AATREX 90WDG (2.2 lb.)	atrazine (2 lb.)	Apply after sorghum completely emerges and weeds are no taller than 1.5 inches. Controls most annual broadleaf weeds and grasses. **DO NOT** use on coarse-textured soils (sand and loamy sand soils). **DO NOT** use on any soil with less than 1-percent organic matter. **DO NOT** apply with liquid fertilizers or nitrogen solutions. Atrazine is a **RESTRICTED USE** pesticide. MOA–Photosystem II inhibitor
AATREX/ATRAZINE 4L (2.4 pt.) or AATREX 90WDG (1.3 lb.) + Crop Oil Concentrate (1 qt.)	atrazine (1.2 lb.) + crop oil concentrate	Controls broadleaf weeds 2 to 4 inches tall and newly emerged annual grasses (one-leaf). To control broadleaf weeds less than 4 inches tall, apply as an over-the-top spray to sorghum that is at least in the three-leaf stage but before reaching 12 inches in height. **DO NOT** use oil if sorghum is in a stressed condition of any kind. **DO NOT** apply with liquid fertilizers or nitrogen solutions. Atrazine is a **RESTRICTED USE** pesticide. MOA–Photosystem II inhibitor
AIM 2EC (0.5-1 fl.oz.) + Non-ionic surfactant	carfentrazone (0.008-0.016 lb.) + non-ionic surfactant	May be applied postemergence to grain or forage sorghum after emergence to the six-leaf-collar growth stage. Directed application is recommended if rate higher than 0.5 fluid ounces per acre will be used. Addition of a non-ionic surfactant (1 quart per 100 gallons of spray mix) is required. Crop oil should not be used. Expect moderate leaf burning from low rate, over-the-top application. MOA–PPO inhibitor

*MOA=Mechanism of action. Herbicides with different MOAs should be used in weed resistance management. See Table 4.

Table 2. Grain Sorghum Weed Control (cont.)

Herbicide Trade Name (Rate/Acre Broadcast)	Herbicide Common Name (Active Herbicide/Acre)	Comments
POSTEMERGENCE (cont.)		
BANVEL 4 CLARITY (0.5 pt.) [4 lb./gal.]	dicamba (0.25 lb.)	Banvel/Clarity may be applied over-the-top of sorghum from the three-leaf stage until sorghum is 8 inches tall. If sorghum is 8 to 15 inches tall, herbicide should be applied as a directed spray. An application made later than 25 days after emergence and up through flowering will reduce yield. Make **ONLY** one application per season. **DO NOT** apply to sorghum grown for seed production. MOA–Synthetic auxin
BASAGRAN 4 (1.5-2 pt.) [4 lb./gal.]	bentazon (0.75-1 lb.)	Apply early postemergence when sorghum has one to five leaves to control certain broadleaf weeds. Sorghum is tolerant to Basagran up to the early boot stage. Weeds generally should be small and actively growing at time of treatment. **DO NOT** apply more than 2 pints of Basagran per acre per year on sorghum. Add a crop oil concentrate (2 pints per acre) according to label directions for specific weeds. MOA–Photosystem II inhibitor
BUCTRIL 2E (1-1.5 pt.)	bromoxynil (0.25-0.38 lb.)	Apply over-the-top when sorghum has three leaves (up to preboot stage). Controls labeled broadleaf weeds up to 3 inches tall. **DO NOT** add spray adjuvants or mix with liquid fertilizer. To minimize sorghum leaf burn, spray when sorghum foliage is dry. **DO NOT** cut for feed or graze treated sorghum within 30 days of treatment. MOA–Photosystem II inhibitor
PEAK 57WDG (0.75-1 oz.) + Non-ionic Surfactant or Crop Oil Concentrate	prosulfuron (0.027-0.036 lb.) + non-ionic surfactant or crop oil concentrate	Controls many annual broadleaf weeds. Apply over-the-top of grain sorghum when it is between 5 and 20 inches tall. Apply as a directed spray when crop is 20 to 30 inches tall. Add a non-ionic surfactant at a rate of 2 quarts per 100 gallons of spray mix or a crop oil concentrate at a rate of 1 quart per acre. Rate to use depends on the weed problem and size at treatment. **DO NOT** use on forage sorghum. See label for recropping restrictions. MOA–ALS inhibitor
PROWL 3.3EC (1.8-3.6 pt.) or PROWL H_2O (1.5-3 pt.) [3.8 lb./gal.]	pendimethalin (0.74-1.5 lb.) (0.71-1.42 lb.)	Cultivate with sweep or rolling cultivators to throw at least 1 inch of soil over the base of the sorghum plants prior to application. Apply as a **directed spray** after grain sorghum is 6 inches tall. Must be incorporated using cultivators or irrigation water. Set cultivators to provide maximum soil mixing, and move treated soil into the crop rows. Effective on late-emerging problem grasses such as fall panicum and Texas panicum. See label for specific instructions. MOA–Mitosis inhibitor
SANDEA 75DF (0.67-1 oz.) + Non-ionic Surfactant	halosulfuron (0.03-0.047 lb.) + non-ionic surfactant	Controls many annual broadleaf weeds and suppresses nutsedge. Apply when weeds are small after the two-leaf stage of sorghum growth but before grain head emergence. Add a non-ionic surfactant at the rate of 2 quarts of surfactant per 100 gallons of spray mix. Use rate depends on the weed problem and size at treatment. **DO NOT** apply more than 1 ounce of Sandea per acre per year. MOA–ALS inhibitor
POSTEMERGENCE (POST DIRECTED)		
GRAMOXONE INTEON GRAMOXONE SL (1-2 pt.) [2 lb./gal.] or FIRESTORM 3 (11-21 fl.oz.) [3 lb./gal.] + Non-ionic Surfactant	paraquat (0.25-0.5 lb.) (0.26-0.49 lb.) + non-ionic surfactant	For use as a **postemergence directed spray** when sorghum is at least 15 inches tall. Spray no higher than the lower 3 inches of the sorghum stalk. Paraquat will control many broadleaf weeds and grasses less than 3 inches tall. Add a non-ionic surfactant at the rate of 1 quart per 100 gallons of spray mixture. **DO NOT** spray on windy days. **DO NOT** breathe spray mist. Gramoxone and Firestorm are **RESTRICTED USE** pesticides. MOA–Photosystem I inhibitor

Table 2. Grain Sorghum Weed Control

Herbicide Trade Name (Rate/Acre Broadcast)	Herbicide Common Name (Active Herbicide/Acre)	Comments
POSTEMERGENCE (POST DIRECTED) (cont.)		
LOROX 50DF (1-2 lb.) + Non-ionic Surfactant	linuron (0.5-1 lb.) + non-ionic surfactant	For use as a **postemergence directed spray** when grain sorghum is at least 15 inches tall and weeds are 2 to 4 inches tall. Spray no higher than the lower 3 inches of the sorghum stalk. Add non-ionic surfactant at the rate of 2 quarts per 100 gallons of spray mixture. **DO NOT** graze or feed treated plants to livestock within 3 months of application. MOA–Photosystem II inhibitor
HARVEST AID		
AIM 2EC (1 fl.oz.) [2 lb./gal.]	carfentrazone (0.016 lb.)	For the preharvest dessication of weeds such as pigweed and morningglory. Apply at least three days before harvest. Use with a crop oil concentrate (1 gallon per 100 gallons spray mix) or a non-ionic surfactant (2 pints per 100 gallons spray mix). Use sufficient spray volume for adequate coverage. Coverage is essential for satisfactory performance. Can be tank mixed with glyphosate to improve spectrum of weed control. MOA–PPO inhibitor
SODIUM CHLORATE (2 gal.) [3 lb./gal.] or SODIUM CHLORATE (1 gal.) [6 lb./gal.]	sodium chlorate (6 lb.)	Apply from 7 to 10 days before harvest. Apply in 15 to 20 gallons of water with ground equipment or 5 to 10 gallons of water by air. Apply on a bright, sunny day when temperature is above 85°F and relative humidity is below 65 percent. Grasses will be desiccated, but broadleaf weeds may only be defoliated (little desiccation). MOA–N/A
ROUNDUP WEATHERMAX POWERMAX (22-44 fl.oz.) [5.5 lb./gal.]	glyphosate (0.94-1.9 lb.)	Apply when grain sorghum is less than 30 percent moisture. Allow a minimum of 7 days between application and harvest. **DO NOT** use on grain sorghum grown for seed production. Not all glyphosate formulations may be labeled for this use. Refer to specific product label for rate and the need for addition of non-ionic surfactant. MOA–ESP synthesis inhibitor

Rate of herbicides are given for broadcast application. Band application reduces the amount needed per acre of crop and can be determined by the formula:

$$\frac{\text{Band Width}}{\text{Row Width}} \times \text{Broadcast Rate} = \text{Band Rate.}$$

For example, the amount of AATrex 4L needed for a broadcast application to a light sandy soil is 2 quarts per acre. The amount needed to treat a 20-inch band on a 40-inch row would be:

$20/40 \times 2 \text{ qt./A} = 1 \text{ qt./A on 20-inch band}$

Weed Control section prepared by John W. Everest, Professor Emeritus, Department of Crop, Soil and Environmental Sciences, Auburn University; and Michael G. Patterson, Visiting Professor, Department of Crop, Soil and Environmental Sciences, Auburn University; in cooperation with Glenn Wehtje, Professor, Department of Crop, Soil and Environmental Sciences, Auburn University.

Table 3. Estimated Effectiveness of Herbicides Recommended for Grain Sorghum on Common Weeds in Alabama [1]

WEEDS	HERBICIDES					
	Cinch Dual (PRE)	Micro-Tech Intrro (PRE)	Outlook (PRE)	2,4-D amine (POST)	AAtrex/ Atrazine (POST)	Banvel Clarity (POST)
GRASSES						
Broadleaf signalgrass	8	8	7-8	0	2	0
Crabgrass	9	9	9	0	7	0
Crowfootgrass	9	9	9	0	6	0
Fall panicum	8	8	8	0	4	0
Goosegrass	9	9	9	0	5	0
Johnsongrass (rhizomes)	0	0	0	0	0	0
Johnsongrass (seedlings)	5	5	7	0	2	0
Texas panicum	4	4	4	0	0	0
SEDGES						
Purple nutsedge	1	1	0	0	0	0
Yellow nutsedge	7	5	7	0	0	0
BROADLEAF WEEDS						
Bristly starbur	0	0	0	7	9	8
Cocklebur	0	0	0	9	9	9
Florida beggarweed	6	6	6-7	7	8	8
Florida pusley	9	9	9	8	8	7
Morningglory	0	0	0	9	8	9
Pigweed	8	9	9	9	8	9
Prickly sida	6	6	6	7	8	8
Sicklepod	5	7	5	8	8	9

continued

[1] Effectiveness ratings are based on observations of research plots and field use under average weather conditions for several years by weed control workers in Alabama.

KEY TO CONTROL RATINGS AND ABBREVIATIONS

Ratings on a scale of 0 to 10: 0 = No control; 10 = 100% control.

PRE = Preemergence; POST = Postemergence.

Table 3. Estimated Effectiveness of Herbicides Recommended for Grain Sorghum on Common Weeds in Alabama [1] (cont.)

WEEDS	HERBICIDES						
	Basagran (POST)	Buctril (POST)	Peak (POST)	Sandea (POST)	Aim (POST,PDS)	Gramoxone/ Firestorm (PDS)	Lorox (PDS)
GRASSES							
Broadleaf signalgrass	0	0	0	0	0	8	7
Crabgrass	0	0	0	0	0	8	8
Crowfootgrass	0	0	0	0	0	8	8
Fall panicum	0	0	0	0	0	8	8
Goosegrass	0	0	0	0	0	8	8
Johnsongrass (rhizomes)	0	0	0	0	0	3	4
Johnsongrass (seedlings)	0	0	0	0	0	8	7
Texas panicum	0	0	0	0	0	8	7
SEDGES							
Purple nutsedge	0	0	0	7-8	0	4	4
Yellow nutsedge	7	0	0	7-8	0	4	4
BROADLEAF WEEDS							
Bristly starbur	9	8	0	8	—	6	8
Cocklebur	9-10	9	8-9	8	7	6	9
Florida beggarweed	0	8	4	4	—	8-9	8
Florida pusley	0	9	8	0	—	5	8
Morningglory	4	8	7	6	8	6-8	8
Pigweed	4	8	8	7-8	7-8	8	9
Prickly sida	7	8	3	6	—	6	8
Sicklepod	0	4	2	4	0	8-9	8

[1] Effectiveness ratings are based on observations of research plots and field use under average weather conditions for several years by weed control workers in Alabama.

KEY TO CONTROL RATINGS AND ABBREVIATIONS Ratings on a scale of 0 to 10: 0 = No control; 10 = 100% control.

POST = Postemergence; PDS = Postemergence Directed Spray.; — = Information not available

Table 4. Herbicide Classification by Mechanism of Action

Mechanism of Action	Herbicides
ALS inhibitor	Peak, Sandea
ESP synthesis inhibitor	Roundup
Mitosis inhibitor	Dual, Intrro/Micro-Tech, Prowl/Pendimax, Outlook
Photosystem I inhibitor	Gramoxone Inteon/Gramoxone SL/Firestorm
Photosystem II inhibitor	Atrazine, Basagran, Buctril, Lorox
PPO inhibitor	Aim
Synthetic auxin	2,4-D, Banvel/Clarity

GRAIN SORGHUM MANAGEMENT CHECKLIST

The grain sorghum producers who get maximum returns from their investments pay special attention to certain key management practices. This grain sorghum checklist will improve your sorghum management system. If you cannot mark off each of these points for your own farm, you may be missing out on potential income.

□ **Soil test for fertility and follow recommendations.** Sample each field in the fall for fertility and lime needs. Liming soils to a pH above 6.0 helps produce healthy, uniform crop stands and high yields. Apply phosphorus and potassium according to recommendations. Generally, apply about 80 pounds of nitrogen per acre either at planting or as a split application with the second application applied before sorghum is 8 inches tall.

□ **Use a preemergence herbicide to control grass weeds.** In fields with a history of grass weed problems, use a preemergence herbicide at the labeled rate for the soil type. This is the best opportunity to control grass weeds in this crop. You must use seed treated with herbicide "safeners" in areas where a preemergence herbicide is applied.

□ **Plant early when soil temperature is correct for optimum yields.** Planting as early as possible usually gives best yields. As a general rule, plant grain sorghum as soon as the soil temperature at 2 inches warms to 65°F. Early planting usually allows for better growing conditions and good moisture, and the crop usually escapes most insect pressure and can be harvested sooner.

□ **Plant adapted varieties.** Plant varieties that have characteristics for suitable growth and development in southern environments. Important factors to consider when selecting a hybrid are: yielding ability; susceptibility to lodging; maturity; head exsertion; head compactness; and damage from birds, insects, and diseases.

□ **Avoid high-density stands.** Many problems are associated with excessive plant populations, such as increased disease problems, reduced drought tolerance, and lower yields. A plant population of approximately 60,000 to 80,000 plants per acre is most desirable. This will usually require about 5 pounds of seed per acre, but the weight of seed planted is not a good measure of plant population because seed size varies considerably with various hybrids. Carefully calibrate your planter to deliver the correct number of seeds per foot of row. For 30-inch rows, four to six seeds per foot of row will be adequate.

□ **Use residual postemergence herbicides to control problem broadleaf weeds.** Apply postemergence residual herbicides over-the-top of grain sorghum when it is at least 3 inches tall and weeds are small. Weeds such as sicklepod, cocklebur, and morningglory can be controlled by the timely application of a herbicide such as atrazine. Follow label directions for the proper use rate based on soil type.

□ **Use post-directed herbicide if needed.** The herbicides available for post-directed spray application are more effective on a wide range of weeds and are relatively inexpensive. Grain sorghum must be at least 12 inches tall at time of treatment, and only the lower 3 inches of the sorghum stem should be contacted by the spray. Directed sprays can give good burndown of small weeds and some grasses.

□ **Base insect management decisions on thorough field scouting.** Scout fields and treat only where an economically damaging level of insects has been reached. General guides to economic treatment levels have been established for insects such as sorghum midge, corn earworms, and armyworms. Remember, good scouting is required in order to match the recommended insecticide to damaging insect(s).

□ **Apply insecticides, herbicides, and fungicides only as labeled and recommended.** Calibrate sprayers and follow recommended methods. Misapplication is costly; it results in waste of expensive chemicals and/or damage to the crop.

□ **Maintain a field-by-field record or map of weed problems.** In the late summer before harvest, prepare a field record or map of each field. Include a list of weeds present with their general location in the field, and estimate the size or magnitude of the different problem weeds present. Use these maps or records to plan for the next year's weed control program.

□ **Harvest when crop is ready.** Start harvesting grain sorghum when the heads are mature and seed approach an average of 20- to 22-percent moisture. Drying sorghum seed will be necessary to reach a moisture percentage of 12 to 14 percent. Field drying of grain sorghum often results in significant harvesting losses, crop shattering, and increased disease problems.

□ **Develop marketing strategies.** Consider contracts or other marketing methods for handling your crop well ahead of harvesttime. Don't get caught by the low cash prices available at harvesttime.

FOR MORE INFORMATION on pesticides, pesticide safety, or submitting samples for analysis, see the following publications in the IPM series:
IPM 1293, “Safety.” Safety contact information; worker protection standards; the safe use, handling, and storage of pesticides
IPM 1294, “Submitting Samples.” Procedures for submitting samples for diagnosis, analysis, and identification
IPM 1295, “General Pesticide Information.” Federal and state restricted use pesticide lists; pesticides and water quality
IPM 1317, “Appendix.” Pesticide guidelines for agronomic crops, including preharvest intervals; rain-free requirements; grazing restrictions; crop rotation guidelines; and the names, classifications, and toxicities of pesticides.

2015 IPM-0429

For more information, contact your county Extension office. Visit www.aces.edu/counties or look in your telephone directory under your county’s name to find contact information.

Use pesticides **only** according to the directions on the label. Follow all directions, precautions, and restrictions that are listed. Do not use pesticides on plants that are not listed on the label

The pesticide rates in this publication are recommended **only** if they are registered with the Environmental Protection Agency or the Alabama Department of Agriculture and Industries. If a registration is changed or canceled, the rate listed here is no longer recommended. Before you apply **any** pesticide, check with your county Extension agent for the latest information.

Trade names are used **only** to give specific information. The Alabama Cooperative Extension System does not endorse or guarantee any product and does not recommend one product instead of another that might be similar.

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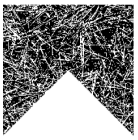
Pastures and Forage Crops

IPM



IPM-0028

Insect and Weed Control Recommendations for 2015

INSECT PEST MANAGEMENT

Check forages regularly to detect insect infestations. They should be checked frequently during the active growing season, particularly during periods of drought. Three to four locations in each field should be monitored. Symptoms of insect infestation may be early visible chewing, or it may be less obvious. Insects may be on the foliage, may hide in the crowns of the plants, or may feed on the plant roots. Look for yellowing plants and spots where the grass may be dead or thinning.

A sweep-net helps in detecting insect infestations, particularly those of grasshoppers, the various armyworms, spittlebugs, blister beetles, and leafhoppers. These nets, often made of tapered muslin bags mounted on a 12- to 15-inch rim, can be bought for $20 to $30. However, an old pillowcase mounted on a dip net makes a good substitute. If excessively large numbers of insects are detected in the sweep net, the area can then be examined more closely.

To find soil insects, check areas with poor growth or where soil surface has been disturbed. Use a shovel to dig or turn soil 8 inches deep. In late August, scout pastures where organic fertilizers have been used for green June beetles. Common insect pests of pastures are discussed below.

See Tables 1 through 4 for chemical control recommendations. Insecticides used on summer annual forages differ from those on legumes or on perennial grasses. For forage sorghum, sudangrass, and millet see www.ent.uga.edu/pmh/Com_Temp_Grazing.pdf.

Fall Armyworm

Fall armyworm caterpillars damage crops by chewing plant tissue. They prefer to feed on plants in the grass family, i.e., turf, corn, sorghum, and grass pastures. When hungry, however, they will also attack most field crops.

There are two strains of fall armyworm: one prefers to feed on rice and pasture grasses; the other prefers corn and sorghum. When fall armyworms eat all the available food in a field, they will migrate in large numbers to other fields.

The fall armyworm moths migrate north from southern Florida, the Caribbean, and Central America each year. By early summer, they are laying eggs in Alabama pastures. Reports of damaging populations usually come in late July and early August when later generations of the pest are present. However, damaging populations can occur in June. Hot, dry weather is favorable for fall armyworm outbreaks. This insect has several generations per year. There can be considerable overlap between generations later in the season.

Fall armyworms can be found feeding on foliage at any time of day but may be less likely to be found during the hottest hours. When fully grown, they are 1.5 inches long. Fall armyworms are always striped, but their coloring is not always the same. Their background color ranges from light green to almost black. Fall armyworm caterpillars can be identified by four black dots arranged in a square on the back of the tip of the abdomen, and three white lines on the back of the segment behind the head. Larger caterpillars typically have a light-colored, upside-down Y-shape on the head. More information on biology and habits of fall armyworms can be found in Alabama Cooperative Extension Circular ANR-1019, "Management of Fall Armyworms in Pastures and Hayfields," www.aces.edu/pubs/docs/A/ANR-1019/. The publication "Identifying Caterpillars of Field and Forage Crops," www.aces.edu/pubs/docs/A/ANR-1121/, may be used to distinguish fall armyworms from other common caterpillars.

Fall armyworms need to be treated when they are still small—less than 1 inch long. Detecting infestations when the caterpillars are small gives more time for control measures to be implemented. When armyworms are fully grown, they are less susceptible to insecticides and, therefore, are harder to kill. In addition, if most of the caterpillars are nearly grown, most of the damage will already have been done. Then, there will be little benefit from control.

Because of the need to detect infestations early, check perennial grass forages frequently to see if damaging numbers of fall armyworms or other pasture pests are present. Usually, late July through October is the recommended time for scouting. Scouting is particularly important when the weather has been hot and dry.

A sweep net is very useful in finding fall armyworms while they are still small. A video on how to use a sweep net to find fall armyworms can be found at http://youtu.be/71wdf8P33bQ. Most county offices of the Alabama Cooperative Extension System have a net that you can borrow. A map showing which Alabama cattlemen have a sweep net you can borrow can be found at this website: http://www.aces.edu/anr/forages/Management/documents/FallArmywormMap.php. This map will also show where fall armyworms have been detected.

Walk into the pasture from all four sides or walk in an X across the field to make sure you check a large enough area. If you find armyworms with the sweep net, then inspect the grass to see how many armyworms you have per square foot. Control of fall armyworms is justified when the population exceeds two to three 0.5-inch caterpillars per square foot.

Making Control Decisions. If damaging levels of fall armyworm are found and fields are almost ready to mow for hay, consider mowing earlier than usual. Insecticides are recommended if only part of a pasture is infested (treat the infested area only) or if the grass is too short to be cut for hay. If considerable defoliation has already occurred, consider grazing or mowing whatever forage is left. If rain is forecast and it is not too late in the season, bermudagrass pastures can be fertilized to encourage another hay crop. Each generation of fall armyworms takes about 1 month under Alabama conditions. If a hay crop is lost to the insect, the next hay crop should be checked frequently, particularly in the time frame of 2 to 5 weeks from the time injury was noticed.

Fall armyworms can destroy a hay crop in bermudagrass and bahiagrass pastures, but they will rarely cause plant death. However, defoliation by fall armyworm, particularly in drought-stressed conditions, can kill the fescue plants.

Chemical control recommendations for fall armyworm in grass pastures are included in this guide. Pay careful attention to the grazing interval—the time required from application until livestock can be put back in a pasture.

If the efficacy of a chemical is in doubt, treat a small test area. The next day, check for control percentage.

Green June Beetles (Grubworms) and Other White Grubs

Four types of grubs are common in grass pastures. They are the larval stages of green June beetles (Junebugs), May beetles in the genus *Phyllophaga,* southern masked chafers, and Japanese beetles. Grubs in the genus *Polyphylla* have also been found to damage pasture grasses.

The green June beetle is an increasing problem in Alabama. The grubs of this beetle rarely feed on grass roots, but their extensive burrowing activities disrupt the root-soil contact. Once the soil around the roots is loosened, grazing cattle can easily uproot the plants. When green June beetle grubs are present, the pasture will seem to have thinned out. There will be areas where the soil is pulverized, and you may see 0.5-inch-diameter tunnels that the grubs have made. The green June beetle grub is stout, it has short legs, and it crawls on its back. This distinguishes it from other white grubs which have longer legs and typically curl up into a C-shape when disturbed. Grubs typically come to the surface at night to feed on organic matter.

Green June beetles have one generation per year. The green and gold adults fly in the daytime and are a familiar sight in July and August. Eggs hatch in August and early September. Best time to spray is in September and early October. They grow to be 2 inches long by late fall or early spring.

Pastures in high-risk areas should be checked for green June beetle grubs. ***High-risk pastures are those in which broiler litter or manure has been applied as fertilizer.*** This is particularly important if winter forages will be interseeded. The tunneling activities can tear up young plants. Green June beetle grubs tend to move along a drill row, pushing out seedlings as they go. The best way to scout for green June beetles is to look for tunneling holes, pulverized soil, or thin areas in pastures. Then, use a shovel to carefully dig out a square-foot surface area to a depth of 8 to 10 inches. Sift the soil carefully, looking for the grubs. Check at least five samples per field. Treat fescue with an insecticide (see Table 1) if more than two to four grubs per square foot are found. Bermudagrass should be treated if four to six grubs per square foot are found. Fields where winter annuals are planted should be treated if more than one green June beetle grub per square foot is found. See Extension Circular ANR-991, "Biology and Control of the Green June Beetle," www.aces.edu/pubs/docs/A/ANR-0991, for more details on green June beetle biology.

The other white grubs feed on the roots of pasture grasses. They can prune the roots so intensively that the pasture sod can be rolled back like a carpet. In some years, pastures may not recover from this severe pruning.

Smaller populations of grubs can reduce plant stand, allowing invasion by broadleaf weeds. The broadleaf weeds, in turn, make it easier for the adult females to get down to the soil to lay eggs, causing further damage to sod.

White grubs occur in mixed populations. It is rare that an infestation consists of a single species. If all species had similar life cycles, feeding impact, and response to insecticides, management decisions could be made without identifying species. However, this is not the case. Currently, there are no insecticides registered on pastures that are effective against May beetles, Japanese beetles, and southern masked chafers. Cultural practices to promote vigorous growth can help the grass sod recover. Weed control may be necessary for 1 to 2 years after damage has occurred.

Japanese beetles, southern masked chafers, and green June beetles have a single-year life cycle and their larvae are most damaging in late summer and fall. May beetles have 1- to 3-year life cycles, and their larvae are actively feeding except during the coolest months of the year.

Sugarcane Beetles

Sugarcane beetle adults can also damage perennial grass forages. Damage from sugarcane beetle adults is most likely to occur in May and June. Sugarcane beetles tend to feed at the base of the stems, removing enough tissue to kill the stems. They may hide in the leaf litter during the heat of the day. High rates of a pyrethroid insecticide might provide helpful control, but research data are lacking. Grubs of this species live in the soil and feed predominantly on organic matter. Bahiagrass is most likely to be damaged, particularly if it is low in pH or in a low-lying area.

Billbugs

Billbugs, *Sphenophorus coesifrons,* can cause severe damage to bahiagrass stands. Young billbug larvae tunnel inside the rhizomes beginning in midsummer. Some time in late fall they leave the rhizome and enter the soil. There they overwinter and may also feed on the roots. In April the billbugs pupate. In May and June, adults emerge to cause a second round of damage. Adults gouge elongated holes in the base of the bahiagrass stems as they feed. They lay eggs in these holes; when the eggs hatch, the life cycle begins again. Plant death seems to occur at two times of year: during adult feeding in May and June and again in late summer and early fall as the larvae feed. Billbugs do not fly readily so the damage from this pest starts in spots that enlarge each year as the new adults emerge and crawl a short distance outward from the dead spot to feed and lay eggs on the healthy plants. It is easy to miss the first infestation and all too often billbugs are detected only when a stand of bahiagrass has disappeared.

Pitfall traps can be used to detect when adults begin to emerge. Traps should be placed in healthy bahiagrass near the

edges of a dead spot in the field. Traps should be put out in mid-May and checked weekly. Once the first adults are found, traps should be checked twice a week. After the first catches, there will be a sampling date when the number of billbugs in the traps suddenly increases. This is a signal that it is time to spray to kill the billbug adults. Experience by some Alabama cattlemen has shown carbaryl (Sevin) is effective. High rates of the pyrethroid insecticides may also be helpful.

Adult billbugs are about 1/4 inch long, dark gray to black in color with long snouts typical of the weevil family. Larvae are cream colored with a medium brown colored head. They have no legs so can be distinguished easily from white grubs.

More information on this billbug can be found in the Timely Information Sheet, Scouting for Billbug Adults in Bahiagrass, https://sites.aces.edu/group/timelyinfo/Lists/Posts/Post.aspx?ID=725.

Two-lined Spittlebugs

Two-lined spittlebugs can damage bermudagrass pastures. Spittlebugs have two generations per year in Alabama. Two-lined spittlebugs overwinter as eggs in sheltered places, such as in plant debris on the soil surface, in hollow stems, and behind leaf sheaths. Humid conditions are required for egg hatch and development of young spittlebugs.

The adult is dark brown, about 0.375-inch long, with two horizontal red lines on its back. Young spittlebugs hide inside foamy masses of saliva. Nymphs and adults feed by sucking juices from the roots, stems, and leaves of bermudagrass. In heavy infestations, injured grasses tend to yellow and dry out. Damage occurs most frequently in dense, overgrown stands of bermudagrass. Populations of more than one adult spittlebug per square foot could present a problem.

Recommended control measures are to burn the affected areas to destroy the spittlebugs and the accumulated thatch. If burning is not possible, mow the pastures and then rake to reduce the amount of the accumulated thatch.

In fields where spittlebugs are a chronic problem or in fields with a heavy thatch build-up, burning in February may be used as a preventive measure.

Chinch Bugs

Chinch bugs can be a severe pest of dallisgrass and summer grass forages. Problems are enhanced by minimum tillage rotations that plant summer annual grasses after a winter grain crop and by dry, hot weather. Chinch bugs suck plant juices out of the base of plants. Symptoms include brittle stems, reddening, or sudden wilting or browning.

Many times, chinch bugs cease to be a problem after a heavy rain. If drought conditions persist, apply insecticide in a spray directed at the base of the plants.

Fire Ants

The red imported fire ant, *Solenopsis invicta,* was accidentally introduced into Mobile sometime between 1933 and 1945 and is the predominant fire ant species. In northwest Alabama, the black imported fire ant, *Solenopsis richteri,* is also present. Part of the state is infested with a hybrid of the two species. Imported fire ants are predators and scavengers and feed on a wide variety of foods. Their mounds are a familiar sight in Alabama pastures.

The impact of fire ants in pastures is hard to document because they affect different areas of the livestock operation. They injure both cattle and humans, and they also damage haying equipment, electrical equipment, and livestock feed. Insecticide-based management strategies have been quite effective for home lawns, golf courses, and other public areas. Controlling fire ants in livestock pastures, however, is more difficult because of the extensive land area involved, the high cost of insecticides, and because of livestock safety considerations. The publication "Management of Imported Fire Ants in Cattle Production Systems" contains more information about fire ants. You can find this publication on the imported fire ant eXtension site www.extension.org/fire+ants.

Currently, management options for fire ants in pastures and hayfields are cultural and chemical control. In hayfields, frequent mowing discourages the building of large mounds even though fire ants will still be present. Disc mowers are more practical than conventional sickle-bar mowers because they are less likely to break.

Chemical treatment for fire ants is possible but may not be economical in pasture situations. It may be prudent to treat pastures in which heavy calving activity will occur between March and September when fire ants are most active. It may also be prudent to treat hayfields and areas around equipment sheds.

Fire ants are territorial, and defensive actions tend to limit the number of mounds per acre. Chemical treatment for fire ants has to be a continuous process. Treatments control what is already there but cannot prevent reinfestation by incoming flights of queens.

Currently, the most economical treatment for pastures is to broadcast an insecticide-laced bait that will be picked up by the foraging ants and carried back to each colony. Broadcast applications of baits are better than individual mound treatments for pastures because the visible mounds are only the tip of the iceberg. There are other colonies that have not yet built mounds. Mound treatments may be useful follow-ups a few weeks after bait has been applied.

When a bait is broadcast, it will be picked up and carried back to all of the colonies, no matter how large or how small they are. Because baits must be carried back to the nest, they must be applied when ants are actually foraging. Winter applications will not be effective. In warm weather, morning or late afternoon treatments (70° to 90°F) are best because of high foraging activity. Few ants forage during the noon heat of a summer day. Baits should be applied when the foliage is dry. Rain immediately following application will reduce efficacy. Baits are most effective when applied between May and September.

There are two kinds of fire ant baits in pastures and hayfields: fast-acting baits containing hydramethylnon or spinosad and slower-acting baits containing insect growth regulators such as methoprene, fenoxycarb, or pyriproxyfen. Fast-acting baits act within 2 to 4 weeks, but the effect wears off fairly quickly (3 to 8 months). Insect growth regulator baits take longer to work (4 to 8 weeks) but tend to give longer lasting control (8 to 12 months). Trials in Texas showed that mixing 0.75 pound of a metabolic inhibitor bait with 0.75 pound of an insect growth regulator bait worked faster than an insect growth regulator alone. It also lasted longer than a metabolic inhibitor alone. A commercially available product contains a mixture of the two baits (See Table 1).

Winter Grain Mites

Winter grain mites (*Penthaleus major*) are large, dark brown or black mites with red legs. They attack fall-seeded ryegrass planted into established bermudagrass or bahiagrass sod. Damage often appears between Thanksgiving and Christmas. See "Winter Grain Mite," http://pubs.ext.vt.edu/444/444-037/444-037.html.

Bermudagrass Stem Maggot

Bermudagrass stem maggot, *Atherigona reversura,* has recently invaded Alabama. This tiny fly attacks only bermudagrass. It was first discovered in Georgia in 2010. By late summer 2012 the fly was present throughout most of Alabama. The species is native to Asia. Adult flies lay eggs on bermudagrass stems. Larvae hatch and begin feeding at a node. The feeding activity kills the portion of the plant above the node. Therefore, from a distance the primary symptom of infestation is a silvery appearance or frosted look due to the discolored dead tips. Closer inspection will show the maggots. Adult flies may be very numerous, especially toward the end of the summer. Generation time is short, about 3 weeks, so there are multiple generations each year. Finer textured bermudagrass, such as 'Alicia' appears to have more damage than coarser textured varieties such as 'Tifton 85.'

Economic thresholds for this pest are yet to be determined. Bermudagrass fields in south Alabama will be at the greatest risk of having economic damage. If a field is severely damaged, the best recourse is to harvest the field to salvage what hay is present; then make two applications of a pyrethroid insecticide on the regrowth. For more information see Alabama Cooperative Extension Circular ANR-1462, "Biology and Management of Bermudagrass Stem Maggot," www.aces.edu/pubs/docs/A/ANR-1462/ANR-1462.pdf.

Striped Ground Crickets

Striped ground crickets attack clover planted into grass sod. See ACES Circular ANR-1133, "Controlling Insect Pests During Stand Establishment of Forage Legumes" www.aces.edu/pubs/docs/A/ANR-1133, for more information.

Clover Head Weevil

Clover head weevils are the most serious pests of crimson clover grown for seed. Larvae feed on developing seeds, destroying the germ. Controlling these pests is usually necessary to get acceptable seed yields.

One option is to scout fields for adult clover leaf beetles about two weeks before bloom. Applying a recommended pesticide at that time may reduce the number of eggs laid on the heads. Another strategy is to wait until 10- to 20-percent of the seed heads are infested. Insecticides effective on weevils are also highly toxic to pollinating insects; treat fields late in the evening after bees are less active.

Organic Insecticides That Can be Applied to Perennial Grasses and Clover

Organic producers may want to consider the following insecticides, most if not all of which are OMRI approved. Be sure to read the insecticide label to make sure it meets your needs. The following products contain azadirachtin: Azera, Neemix 4.5, and Ecozin Plus 1.2 ME. Grandevo contains *Chromobacterium subtsugae* strain PRAA4-1. The following products contain *Bacillus thuringiensis*: Biobit HP (subsp. *kurstaki* strain ABTS-351), Dipel DF (subsp. *kurstaki* strain ABTS-351), Javelin WG (subsp. *kurstaki* strain SA-11), Agree WG (susp. *aizawai* strain GC-91), and Xentari (subsp. aizawai strain ABTS-1857). PyGanic Crop Protection EC 1.4_{II} and PyGanic Crop Protection EC 5.0_{II} insecticides are OMRI approved and contain natural pyrethrins. There are other insecticides that contain pyrethrins. Be sure to choose one that does not contain piperonyl butoxide, as that chemical is not considered organic. Entrust and Entrust SC contain spinosad. Pest Out contains cottonseed, clove, and garlic oils. Other organic insecticides may be available.

Table 1. Forage Grass Insect Control [1,2]

Insecticide and Formulation	Acres per Gallon	Amount of Formulation per Acre	Lb. Active Ingredient per Acre	Minimum Days from Last Application to Harvest (h) or Grazing (g)	Comments
ARMYWORM, FALL ARMYWORM, STRIPED GRASS LOOPER					
beta-cyfluthrin BAYTHROID XL	46-80	1.6-2.8 fl.oz.	0.013-0.022	0	For first and second instar armyworms. Use higher rates (2.6 to 2.8 fluid ounces) for fall armyworms. Baythroid XL is a **RESTRICTED USE** pesticide.
carbaryl SEVIN XLR PLUS Other trade names [3]	3-4	1-1.5 qt.	1-1.5	14	Treat when there are three or more 0.5-inch-long worms per square foot.
chlorantraniliprole PREVATHON Other trade names [3]	6-9	14-20 fl.oz.	0.047-0.067	0	

[1] For forage sorghum, see www.ent.uga.edu/pmh/Com_Temp_Grazing.pdf.
[2] See Table 2 for a list of insecticides, formulations, restricted entry intervals, days to grazing or harvest, and maximum amount to apply.
[3] See Table 2 for other trade names. NOTE: Read manufacturer's label carefully for specific information on all product use restrictions and safety.

Table 1. Forage Grass Insect Control (cont.) [1,2]

Insecticide and Formulation	Acres per gallon	Amount of Formulation per Acre	Lb. Active Ingredient per Acre	Minimum Days from Last Application to Harvest (h) or Grazing (g)	Comments
ARMYWORM, FALL ARMYWORM, STRIPED GRASS LOOPER (cont.)					
cyfluthrin TOMBSTONE Other trade names [3]	46-80	1.6-2.8 fl.oz.	0.025-0.03	0	Tombstone is a **RESTRICTED USE** pesticide for first and second instar armyworms. Use 2.4 to 2.8 fluid ounces for fall armyworms.
diflubenzuron DIMILIN 2L	64	2 fl.oz.	0.03	1 (h), 0 (g)	Diflubenzuron is an insect growth regulator that interferes with the normal molting process. It must be eaten by the young caterpillar. Use at first sign of hatch out and before larvae are 0.5 inch long. Effects are seen when caterpillars have molted at least once. Caterpillars die when they try to molt to the next size. Dimilin is a **RESTRICTED USE** pesticide.
gamma-cyhalothrin DECLARE	83-125	1.02-1.54 fl.oz.	0.01-0.015	7 (hay), 0 (g)	Declare is a **RESTRICTED USE** pesticide.
lambda-cyhalothrin KARATE WITH ZEON TECHNOLOGY Other trade names [3]	67-100	1.28-1.92 fl.oz.	0.02-0.03	7 (hay), 0 (g)	Karate is a **RESTRICTED USE** pesticide.
lambda-cyhalothrin + chlorantraniliprole BESIEGE	13-21	6-10 fl.oz.	0.02-0.03 + 0.04-0.06	7 (hay), 0 (g)	Besiege is a **RESTRICTED USE** pesticide.
methomyl LANNATE LV 2.4 Other trade names [3]	3-11	0.75-3 pt.	0.22-0.9	3 (hay), 7 (g)	Use higher rate for heavy populations and larger larvae. Use lower rate for small larvae. FOR BERMUDAGRASS ONLY. Lannate is a **RESTRICTED USE** pesticide.
methoxyfenozide INTREPID 2F	8-32	4-12 fl.oz.	0.06-0.19	7 (hay), 0 (g)	Use a higher rate for heavier infestations or where thorough coverage is difficult.
spinosad TRACER Other trade names [3]	64-128	1-2 fl.oz.	0.03-0.062	3 (h), 0 (g)	Target small larvae or eggs at hatching. Do not allow cattle to graze until foliage has dried.
zeta-cypermethrin MUSTANG MAXX INSECTICIDE	32-46	2.8-4.0 fl.oz	0.017-0.025	0	Mustang Maxx is a **RESTRICTED USE** pesticide. Graze when spray is dry.

[1] For forage sorghum, see www.ent.uga.edu/pmh/Com_Temp_Grazing.pdf.
[2] See Table 2 for a list of insecticides, formulations, restricted entry intervals, days to grazing or harvest, and maximum amount to apply.
[3] See Table 2 for other trade names. NOTE: Read manufacturer's label carefully for specific information on all product use restrictions and safety.

Table 1. Forage Grass Insect Control (cont.) [1,2]

Insecticide and Formulation	Acres per gallom	Amount of Formulation per Acre	Lb. Active Ingredient per Acre	Minimum Days from Last Application to Harvest (h) or Grazing (g)	Comments
BERMUDAGRASS STEM MAGGOT					
beta-cyfluthrin BAYTHROID XL	46-80	1.6-2.8 fl.oz.	0.013-0.022	0	Baythroid XL is a **RESTRICTED USE** pesticide.
cyfluthrin TOMBSTONE Other trade names [3]	46-49	2.6-2.8 fl.oz.	0.041-0.044	0	Tombstone is a **RESTRICTED USE** pesticide.
gamma-cyhalothrin DECLARE	83-125	1.02-1.54 fl.oz.	0.01-0.015	7 (hay), 0 (g)	Declare is a **RESTRICTED USE** pesticide.
lambda-cyhalothrin KARATE WITH ZEON TECHNOLOGY Other trade names [3]	67-100	1.28-1.92 fl.oz.	0.02-0.03	7 (hay), 0 (g)	Karate is a **RESTRICTED USE** pesticide.
zeta-cypermethrin MUSTANG MAXX INSECTICIDE	32-46	2.8-4.0 fl.oz	0.017-0.025	0	Mustang Maxx is a **RESTRICTED USE** pesticide. Graze when spray is dry.
BILLBUGS					
See section in the text at the beginning of this IPM guide.					
CHINCH BUGS					
beta-cyfluthrin BAYTHROID XL	46-49	2.6-2.8 fl.oz.	0.02-0.022	0	Baythroid XL is a **RESTRICTED USE** pesticide.
carbaryl SEVIN XLR PLUS Other trade names [3]	3-4	1-1.5 qt.	1-1.5	14	Direct spray at base of plants. Use at least 20 to 30 gallons of water per acre.
gamma-cyhalothrin DECLARE	83-125	1.02-1.54 fl.oz.	0.01-0.015	7 (hay), 0 (g)	Declare is a **RESTRICTED USE** pesticide.
lambda-cyhalothrin KARATE WITH ZEON TECHNOLOGY Other trade names [3]	67-100	1.28-1.92 fl.oz.	0.02-0.03	7 (hay), 0 (g)	Under heavy population pressure and/or migration, Karate may provide suppression only. Karate is a **RESTRICTED USE** pesticide.
lambda-cyhalothrin + chlorantraniliprole BESIEGE	13-21	6-10 fl.oz.	0.02-0.03 + 0.04-0.06	7 (hay), 0 (g)	Besiege is a **RESTRICTED USE** pesticide.
zeta-cypermethrin MUSTANG MAXX INSECTICIDE	32-46	2.8-4.0 fl.oz	0.017-0.025	0	Mustang Maxx is a **RESTRICTED USE** pesticide. Graze when spray is dry.

[1] For forage sorghum, see www.ent.uga.edu/pmh/Com_Temp_Grazing.pdf.
[2] See Table 2 for a list of insecticides, formulations, restricted entry intervals, days to grazing or harvest, and maximum amount to apply.
[3] See Table 2 for other trade names. NOTE: Read manufacturer's label carefully for specific information on all product use restrictions and safety.

Table 1. Forage Grass Insect Control (cont.) [1,2]

Insecticide and Formulation	Acres per gallon	Amount of Formulation per Acre	Lb. Active Ingredient per Acre	Minimum Days from Last Application to Harvest (h) or Grazing (g)	Comments
GRASSHOPPERS .					
General Comments: *Apply pesticide when 50 percent or more foliage has been lost. It may be possible to spot-treat the edge of fields. Large, black and yellow lubber grasshoppers will probably not be controlled with any insecticide*					
beta-cyfluthrin BAYTHROID XL	46-49	2.6-2.8 fl.oz.	0.02-0.022	0	Baythroid XL is a **RESTRICTED USE** pesticide.
carbaryl SEVIN XLR PLUS Other trade names [3]	3-7	0.5-1.5 qt.	0.5-1.5	14	Apply 0.5 to 0.75 pounds active ingredient per acre for nymphs or small plants. Apply 1.0 to 1.5 active ingredient per acre for mature grasshoppers or application to dense foliage or if extended residual control is desired.
cyfluthrin TOMBSTONE Other trade names [3]	46-49	2.6-2.8 fl.oz.	0.041-0.044	0	Tombstone is a **RESTRICTED USE** pesticide.
diflubenzuron DIMILIN 2L	64-128	1-2 fl.oz.	0.015-0.03	1 (h), 0 (g)	Diflubenzuron is an insect growth regulator that interferes with the normal molting process. It must be eaten by the young grasshopper. Dimilin is a **RESTRICTED USE** pesticide.
gamma-cyhalothrin DECLARE	83-125	1.02-1.54 fl.oz.	0.01-0.015	7 (hay), 0 (g)	Declare is a **RESTRICTED USE** pesticide.
lambda-cyhalothrin KARATE WITH ZEON TECHNOLOGY Other trade names [3]	67-100	1.28-1.92 fl.oz.	0.02-0.03	7 (hay), 0 (g)	Karate is a **RESTRICTED USE** pesticide.
lambda-cyhalothrin + chlorantraniliprole BESIEGE	13-21	6-10 fl.oz.	0.02-0.03 + 0.04-0.06	7 (hay), 0 (g)	Besiege is a **RESTRICTED USE** pesticide.
malathion MALATHION 5 Other trade names [3]	4	2 pt.	1.25	0	Treat areas where young hoppers congregate before they reach the winged stage.
zeta-cypermethrin MUSTANG MAXX INSECTICIDE	32-46	2.8-4.0 fl.oz	0.017-0.025	0	Mustang Maxx is a **RESTRICTED USE** pesticide. Graze when spray is dry.
GREEN JUNE BEETLE GRUBS					
carbaryl SEVIN XLR PLUS Other trade names[3]	3-4	1-1.5 qt.	1-1.5	14	Good control for green June beetle grubs **ONLY**. Use in at least 25 gallons of water per acre. Mow or graze to reduce height of forage before application. Effectiveness depends on getting carbaryl on the soil, not the foliage.

[1] For forage sorghum, see www.ent.uga.edu/pmh/Com_Temp_Grazing.pdf.
[2] See Table 2 for a list of insecticides, formulations, restricted entry intervals, days to grazing or harvest, and maximum amount to apply.
[3] See Table 2 for other trade names. NOTE: Read manufacturer's label carefully for specific information on all product use restrictions and safety.

Table 1. Forage Grass Insect Control (cont.) [1,2]

Insecticide and Formulation	Acres per Gallon	Amount of Formulation per Acre	Lb. Active Ingredient per Acre	Minimum Days from Last Application to Harvest (h) or Grazing (g)	Comments
IMPORTED FIRE ANTS					
Baits on Active Pastures and Hayfields					
See discussion for mixing baits for fire ants, under "Chemical Control Options," to optimize speed and longevity of control.					
hydramethylnon AMDRO PRO FIRE ANT BAIT	—	1-1.5 lb.	0.12-0.18 oz.	7 (hay), 0 (g)	Broadcast bait uniformly. Treat when ants are foraging and when rain is not forecast for 24 hours. Or treat the mound by applying 2 to 5 level tablespoons per mound, distributing material 3 to 4 feet around the mound.
Baits on Active Pastures and Hayfields (cont.)					
pyriproxyfen ESTEEM ANT BAIT	—	1.5-2 lb.	0.12-0.16 oz.	0 (g)	Apply uniformly when ants are looking for food. Avoid application if rain is expected within 4 to 6 hours. Or apply as a mound treatment by sprinkling 2 to 4 level tablespoons around the mound. Noticeable results may take 4 to 8 weeks.
s-methoprene EXTINGUISH PROFESSIONAL FIRE ANT BAIT	—	1-1.5 lb.	0.08-0.12 oz.	0	Extinguish is labeled for use in all forages. Apply as a broadcast treatment when ants are foraging and when rain is not forecast for 24 hours. Or apply as a mound treatment by sprinkling 3 to 5 tablespoons around each mound, distributing material 4 feet around the mound. Extinguish is an insect growth regulator. It may take several months to see noticeable results.
s-methoprene + hydramethylnon EXTINGUISH PLUS FIRE ANT BAIT	—	1.5 lb.	0.06 oz. s-methoprene + 0.08 oz. hydramethylnon	7 (harvest), 0 (g)	Do not apply more than 8 pounds per acre per year. Allow at least 90 days between applications. Apply as a broadcast treatment when ants are foraging and when rain is not forecast for 24 hours, or apply as a mound treatment 2-5 tbsp./mound.
hopper blend EXTINGUISH PROFESSIONAL FIRE ANT BAIT + another bait	—	0.75 lb. + 0.75 lb. other bait	—		Mix Extinguish Professional fire ant bait in a 50:50 mix with a hydramethylnon ant bait. Broadcast or treat the mound by applying 3 to 5 tablespoons per mound, distributing material 4 feet around the mound.

[1] For forage sorghum, see www.ent.uga.edu/pmh/Com_Temp_Grazing.pdf.
[2] See Table 2 for a list of insecticides, formulations, restricted entry intervals, days to grazing or harvest, and maximum amount to apply.
[3] See Table 2 for other trade names. NOTE: Read manufacturer's label carefully for specific information on all product use restrictions and safety.

Table 1. Forage Grass Insect Control (cont.) [1,2]

Insecticide and Formulation	Acres per gallon	Amount of Formulation per Acre	Lb. Active Ingredient per Acre	Minimum Days from Last Application to Harvest (h) or Grazing (g)	Comments
IMPORTED FIRE ANTS (cont.)					
Contact Insecticide for Individual Mound Treatment					
carbaryl SEVIN XLR PLUS Other products: SEVIN 4F	—	—	—	14	Mix 0.75 fluid ounces per gallon of water. Apply a total of 2 gallons of the diluted solution over each mound or at least 1 quart per 6 inches of mound diameter, using a bucket or watering can. Thoroughly wet mound and surrounding area, distributing material 4 feet around the mound. Do not disturb the mound prior to treatment. Pour solution from a height of about 3 feet to give sufficient force to break the mound open and flow into tunnels. For best results apply when the temperature is between 65 and 80°F. Repeat application after 7 days if mound activity resumes. Pressurized sprays may reduce the effectivenss of the treatment by disturbing the ants and causing migration.
SEVIN 80 SOLUPAK	—	—	—	14	Mix one pack per 67.6 gallons of water. Apply same as for diluted solution, above.
STRIPED GROUND CRICKETS					
General Comments: *Apply an insecticide before overseeding clovers if excessive numbers of crickets (more than four or five crickets per square foot) are present.*					
beta-cyfluthrin BAYTHROID XL	46-49	2.6-2.8 fl.oz.	0.02-0.022	0	Baythroid XL is a **RESTRICTED USE** pesticide.
carbaryl SEVIN XLR PLUS Other trade names [3]	3-4	1-1.5 qt.	0.02-0.022	14	Karate Z is a **RESTRICTED USE** pesticide.
gamma-cyhalothrin DECLARE	83-125	1.02-1.54 fl.oz.	0.01-0.015	7 (hay), 0 (g)	Declare is a **RESTRICTED USE** pesticide.
lambda-cyhalothrin KARATE WITH ZEON TECHNOLOGY Other trade names [3]	67-100	1.28-1.92 fl.oz.	0.02-0.03	7 (hay), 0 (g)	Karate is a **RESTRICTED USE** pesticide.
lambda-cyhalothrin + chlorantraniliprole BESIEGE	13-21	6-10 fl.oz.	0.02-0.03 + 0.04-0.06	7 (hay), 0 (g)	Besiege is a **RESTRICTED USE** pesticide.
zeta-cypermethrin MUSTANG MAXX INSECTICIDE	32-46	2.8-4.0 fl.oz.	0.017-0.025	0	Mustang Maxx is a **RESTRICTED USE** pesticide. Graze when spray is dry.
SUGARCANE BEETLES					
See section in the text at the beginning of this IPM guide.					

[1] For forage sorghum, see www.ent.uga.edu/pmh/Com_Temp_Grazing.pdf.
[2] See Table 2 for a list of insecticides, formulations, restricted entry intervals, days to grazing or harvest, and maximum amount to apply.
[3] See Table 2 for other trade names. NOTE: Read manufacturer's label carefully for specific information on all product use restrictions and safety.

Table 1. Forage Grass Insect Control (cont.) [1,2]

Insecticide and Formulation	Acres per Gallon	Amount of Formulation per Acre	Lb. Active Ingredient per Acre	Minimum Days from Last Application to Harvest (h) or Grazing (g)	Comments
TWO-LINED SPITTLEBUGS (ON COASTAL BERMUDAGRASS)					
See section in the text at the beginning of this IPM guide.					No chemical control is recommended on coastal bermudagrass. Prevent a dense mat of grass from forming by grazing or by close mowing and raking. If spittlebugs should seriously damage a dense growth, the dead grass may be burned off immediately.
WHITE GRUBS (OTHER THAN GREEN JUNE BEETLE)					
See section in the text at the beginning of this IPM guide.					No effective insecticides are labeled for control of these insects. Rotate fields to crops where preplant or at-planting insecticides can be used to control these insects.
WINTER GRAIN MITES					
The following insecticides may provide helpful control.					
lambda-cyhalothrin KARATE WITH ZEON TECHNOLOGY Other trade names [3]	67-100	1.28-1.92 fl.oz.	0.02-0.03	7 (hay), 0 (g)	Karate is a **RESTRICTED USE** pesticide.
lambda-cyhalothrin + chlorantraniliprole BESIEGE	13-21	6-10 fl.oz.	0.02-0.03 + 0.04-0.06	7 (hay), 0 (g)	Besiege is a **RESTRICTED USE** pesticide.
zeta-cypermethrin MUSTANG MAXX Other trade names [3]	32-46	2.8-4.0 fl.oz.	0.017-0.025	0	Mustang Maxx is a **RESTRICTED USE** pesticide. Graze when spray is dry.

[1] For forage sorghum, see www.ent.uga.edu/pmh/Com_Temp_Grazing.pdf.
[2] See Table 2 for a list of insecticides, formulations, restricted entry intervals, days to grazing or harvest, and maximum amount to apply.
[3] See Table 2 for other trade names. NOTE: Read manufacturer's label carefully for specific information on all product use restrictions and safety.

Table 2. Insecticides Labeled for Use on Perennial Grass Pasture and Hayfields

Insecticide and Trade Name	A.I./ Formulated Product	Formulation	Restricted Entry Interval (hr)	Minimum Days from Last Application to Harvest (h) or Grazing (g)	Bee Hazard Restrictions
beta-cyfluthrin *MoA Group 3A					
BAYTHROID XL (Restricted Use)	1 lb./gal.	emulsifiable concentrate	12	0	yes[1]
carbaryl MoA Group 1A					
SEVIN 4F, others	4 lb./gal.	liquid suspension	12	14	yes[2]
SEVIN XLR PLUS, others	4 lb./gal.	liquid suspension	12	14	yes[2]
CARBARYL 4L, others	4 lb./gal.	liquid suspension	12	14	yes[2]
SEVIN 80 SOLUPAK	12.8 oz./lb.	water soluble packet	12	14	yes[2]
chlorantraniliprole MoA Group 28					
DUPONT CORAGEN	1.67 lb./gal.	suspension concentrate	4	0	no
DUPONT PREVATHON	0.43 lb./gal.	suspension concentrate	4	0	no
cyfluthrin MoA Group 3A					
RENOUNCE 20WP (Restricted Use)	3.2 oz./lb.	wettable powder	12	0	yes[1]
TOMBSTONE (Restricted Use)	2 lb./gal.	emulsifiable concentrate	12	0	yes[1]
TOMBSTONE HELIOS (Restricted Use)	2 lb./gal.	emulsifiable concentrate	12	0	yes[1]
diflubenzuron MoA Group 15					
DIMILIN 2L	2 lb./gal.	liquid	12	1 (h), 0 (g)	yes[3]
gamma-cyhalothrin MoA Group 3A					
DECLARE	1.25 lb./gal.	capsule suspension	24	7(h), 0(g)	yes[1]
hydramethylnon MoA Group 20A					
AMDRO PRO FIRE ANT BAIT	0.12 oz./lb	bait	12	7(h), 0(g)	no
hydramethylnon + s-methoprene MoA Group 20A + MoA Group 7A					
EXTINGUISH PLUS FIRE ANT BAIT	0.06 oz. + 0.04 oz./lb.	bait	12	7(h), 0(g)	no
lambda-cyhalothrin MoA Group 3A					
GRIZZLY Z INSECTICIDE (Restricted Use)	1 lb./gal.	capsule suspension	24	7(h), 0(g)	yes[1]

[1] Do not apply this product or allow it to drift to blooming crops or weeds if bees are visiting the treatment area.
[2] Notify beekeepers within 1 mile of treatment area at least 48 hours before application. Apply when bees are least active, e.g., within 2 hours of sunrise or sunset.
[3] Do not apply this product to target crops or weeds in bloom. Minimize exposure of this product to bees and other insect pollinators when they are foraging on pollinator attractive plants around the application site. Minimize drift of this product onto beehives or to off-site pollinator- attractive habitat. Drift of this product onto beehives or off-site to pollinator-attractive habitat can result in bee kills.

*MoA = Mode of Action classification from the Insecticide Resistance Action Committee (www.irac-online.org). Insecticides with different MoAs should be used for insecticide resistance management.

Table 2. Insecticides Labeled for Use on Perennial Grass Pasture and Hayfields

Insecticide and Trade Name	A.I./ Formulated Product	Formulation	Restricted Entry Interval (hr)	Minimum Days from Last Application to Harvest (h) or Grazing (g)	Bee Hazard Restrictions
lambda-cyhalothrin (cont.) MoA Group 3A					
KARATE WITH ZEON TECHNOLOGY (Restricted Use)	2.08 lb./gal.	capsule suspension	24	7(h), 0(g)	yes[1]
KENDO (Restricted Use)	1 lb./gal.	emulsifiable concentrate	24	7 (hay), 0 (grazing, forage)	yes[1]
LAMBDA-CY 1EC (Restricted Use)	1 lb./gal.	emulsifiable concentrate	24	7(h), 0(g)	no
LAMBDA-CY EC (Restricted Use)	1 lb./gal.	emulsifiable concentrate	24	7 (hay), 0 (grazing, forage)	yes[1]
LAMBDA-CY AG (Restricted Use)	1 lb./gal.	emulsifiable concentrate	24	7 (hay), 0 (grazing, forage)	yes[1]
LAMBDA-CY AG GOLD (Restricted Use)	1 lb./gal.	Aqueous suspension	24	7 (hay), 0 (grazing, forage)	yes[1]
NUFARM LAMBDA-CYHALOTHRIN 1EC (Restricted Use)	1 lb./gal.	capsule suspension	24	7(h), 0(g)	yes[1]
LAMBDASTAR (Restricted Use)	1 lb./gal.	emulsifiable concentrate	24	7(h), 0(g)	yes[1]
LAMBDASTAR 1CS (Restricted Use)	1 lb./gal.	capsule suspension	24	7(h), 0(g)	yes[1]
LAMBDASTAR PLUS (Restricted Use)	2 lb./gal.	capsule suspension	24	7(h), 0(g)	yes[1]
LAMBDA-T (Restricted Use)	1 lb./gal.	capsule suspension	24	7(h), 0(g)	yes[1]
LAMCAP (Restricted Use)	1 lb./gal.	capsule suspension	24	7(h), 0(g)	yes[1]
PARADIGM (Restricted Use)	1 lb./gal.	capsule suspension	24	7(h), 0(g)	yes[1]
PROVINCE (Restricted Use)	1 lb./gal.	capsule suspension	24	7(h), 0(g)	yes[1]
RAVAGE (Restricted Use)	1 lb./gal.	emulsifiable concentrate	24	7 (hay), 0 (grazing, forage)	no
SILENCER (Restricted Use)	1 lb./gal.	emulsifiable concentrate	24	7(h), 0(g)	yes[1]
lambda-cyhalothrin + chlorantraniliprole MoA Group 3A + MoA Group 28					
BESIEGE (Restricted Use)	0.42 lb./gal. + 0.83 lb./ gal.	capsule, suspension + soluble concentrate	24	7 (h), 0 (g)	yes[1]

[1] Do not apply this product or allow it to drift to blooming crops or weeds if bees are visiting the treatment area.

Insecticide and Trade Name	A.I./ Formulated Product	Formulation	Restricted Entry Interval (hr)	Minimum Days from Last Application to Harvest (h) or Grazing (g)	Bee Hazard Restrictions
malathion MoA Group 1B					
MALATHION 5, others	5 lb./gal.	emulsifiable concentrate	12	0	yes[1]
GOWAN MALATHION 8, others	8 lb./gal.	emulsifiable concentrate	12	0	yes[1]
CHEMINOVA MALATHION 57%	5 lb./gal.	emulsifiable concentrate	12	0	yes[1]
FYFANON	5 lb./gal.	emulsifiable concentrate	12	0	yes[1]
FYFANON ULV AG	9.9 lb./gal.	emulsifiable concentrate	12	0	yes[1]
methomyl (bermudagrass only) MoA Group 1A					
ANNIHILATE LV (methomyl) (Restricted Use)	2.4 lb./gal.	Water soluble liquid	48	7 (grazing), 3 (hay)	yes[1]
ANNIHILATE SP (methomyl) (Restricted Use)	14.4 oz./lb.	Water soluble powder	48	7 (grazing), 3 (hay)	yes[1]
CORRIDA 29 SL (Restricted Use)	2.4 lb./gal.	Water soluble liquid	48	7 (grazing), 3 (hay)	yes[1]
DUPONT LANNATE LV (Restricted Use)	2.4 lb./gal.	water soluble liquid	48	3(h), 7(g)	yes[1]
DUPONT LANNATE SP (Restricted Use)	14.4 oz./lb.	water soluble powder	48	3(h), 7(g)	yes[1]
NUDRIN LV (Restricted Use)	2.4 lb./gal.	water soluble liquid	48	3(h), 7(g)	yes[1]
NUDRIN SP (Restricted Use)	14.4 oz./lb.	water soluble packet	48	3(h), 7(g)	yes[1]
methoxyfenozide MoA Group 18					
INTREPID 2F	2 lb./gal.	flowable liquid	4	7(h), 0(g)	no
pyriproxyfen MoA Group 7D					
ESTEEM ANT BAIT	0.08 oz./lb.	bait	12	0 (g)	no
s-methoprene MoA Group 7A					
EXTINGUISH PROFES-SIONAL FIRE ANT BAIT	0.08 oz./lb.	bait	4	0	no
spinosad MoA Group 5					
BLACKHAWK	5.8 oz./lb.	wettable powder	4	3 (h), 0 (g)	yes[2]
ENTRUST	12.8 oz./lb.	wettable powder	4	Same as above	yes[2]
ENTRUST SC	2 lb./gal.	soluble concentrate	4	Same as above	yes[2]
TRACER	4 lb./gal.	aqueous suspension	4	3 (h), 0 (g) Graze when spray is dry.	yes[2]
zeta-cypermethrin MoA Group 3A					
MUSTANG MAXX INSECTICIDE	0.8 lb./gal.	emulsifiable concentrate	12	0 (forage, hay) Graze when spray is dry.	yes[1]

[1] Do not apply this product or allow it to drift to blooming crops or weeds if bees are visiting the treatment area.
[2] This product is toxic to bees exposed to treatment during the 3 hours following treatment. Do not apply to blooming, pollen-shedding, or nectar-producing parts of plants if bees may forage during this time period.

Table 3. Clover Insect Control [1,2]

Insecticide and Formulation	Acres per Gallon	Amount of Formulation per Acre	Lb. Active Ingredient per Acre	Minimum Days from Last Application to Harvest (h) or Grazing (g)	Comments
ALFALFA WEEVILS					
carbaryl SEVIN XLR PLUS Other trade names [3]	3	1.5 qt.	1.5	7	Observe bee caution. If pretreatment damage is extensive, cut clover and treat the stubble. To avoid plant injury to tender foliage.
zeta-cypermethrin MUSTANG MAXX INSECTICIDE Other trade names [3]	32-57	2.2-4.0 fl.oz.	0.014-0.025	3 (h,g) 7 (seed)	Mustang Maxx is a **RESTRICTED USE** pesticide.
APHIDS					
malathion MALATHION 5 Other trade names [3]	4-5	1.5-2 pt.	0.93-1.25	0	Treat when one aphid per plant is found on seedlings or when honeydew is found on older stands. Avoid treating crops grown for seed with these insecticides when pollinating insects are visiting blooms.
zeta-cypermethrin MUSTANG MAXX INSECTICIDE Other trade names [3]	32-57	2.2-4.0 fl.oz.	0.014-0.025	3 (h,g) 7 (seed)	Mustang Maxx is a **RESTRICTED USE** pesticide. Control may be variable depending on species of aphid.
ARMYWORMS					
carbaryl SEVIN XLR PLUS Other trade names [3]	3-4	1-1.5 qt.	1-1.5	7	
chlorantraniliprole PREVATHON Other trade names [3]	6-9	14-20 fl.oz.	0.047-0.007	0	
methoxyfenozide INTREPID 2F	16-32	4-8 fl.oz.	0.06-0.12	7 (h), 0 (g)	
spinosad ENTRUST SC	32-64	2-4 fl.oz.	0.03-0.06	3 (h), 0 (g)	
zeta-cypermethrin MUSTANG MAXX INSECTICIDE Other trade names [3]	32-46	2.8-4.0 fl.oz.	0.0175-0.025	3 (h,g) 7 (seed)	Mustang Maxx is a **RESTRICTED USE** pesticide.
BLISTER BEETLES					
carbaryl SEVIN XLR PLUS Other trade names [3]	4-8	0.5-1 qt.	0.5-1	7	
CLOVER HEAD WEEVILS					
carbaryl SEVIN XLR PLUS Other trade names [3]	3-4	1-1.5 qt.	1-1.5	7	Treat when 10 to 20 percent of seed heads are infested with larvae. Bee hazard; avoid treating crops when pollinating insects are active.

[1] See the Alfalfa IPM for insect control on alfalfa stands.
[2] See Table 4 for a list of insecticides, formulations, restricted entry intervals, days to grazing or harvest, and maximum amount to apply.
[3] See Table 4 for other trade names.

Table 3. Clover Insect Control (cont.) [1,2]

Insecticide and Formulation	Acres Per Gallon	Amount of Formulation per Acre	Lb. Active Ingredient per Acre	Minimum Days from Last Application to Harvest (h) or Grazing (g)	Comments
CLOVER LEAF WEEVILS, LESSER CLOVER LEAF WEEVILS					
carbaryl SEVIN XLR PLUS Other trade names [3]	3-4	1-1.5 qt.	1-1.5	7	Apply when foliage feeding becomes severe. Avoid treating crops when pollinating insects are active.
GREEN CLOVERWORMS					
carbaryl SEVIN XLR PLUS Other trade names [3]	4	1 qt.	1	7	Treat when worm population and foliage loss indicate control is needed.
methoxyfenozide INTREPID 2F	16-32	4-8 fl.oz.	0.06-0.12	7 (h), 0 (g)	
zeta-cypermethrin MUSTANG MAXX INSECTICIDE	32-57	2.2-4.0 fl.oz.	0.014-0.025	3 (h,g) 7 (seed)	Mustang Maxx is a **RESTRICTED USE** pesticide.
IMPORTED FIRE ANTS					
s-methoprene EXTINGUISH PROFESSIONAL FIRE ANT BAIT	—	1-1.5 lb.	0.08-0.12	0	Apply uniformly when ants are looking for food. Avoid application if rain is expected within 4 to 6 hours. Or apply as a mound treatment by sprinkling 2 to 4 tablespoons around the mound.
PLANT BUGS (LYGUS SPECIES)					
carbaryl SEVIN XLR PLUS Other trade names [3]	3-4	1-1.5 qt.	1-1.5	7	Apply insecticide as soon as buds appear or in early bloom if seed yield is important and if plant bugs appear in large numbers. **DO NOT** apply insecticide when honey bees are present.
malathion MALATHION 5 Other trade names [3]	4-5	1.5-2 pt.	0.93-1.25	0	Apply insecticide as soon as buds appear or in early bloom if seed yield is important and if plant bugs appear in large numbers. **DO NOT** apply insecticide when honey bees are present.
zeta-cypermethrin MUSTANG MAXX INSECTICIDE	32-46	2.8-4.0 fl.oz.	0.0175-0.025	3 (h,g) 7 (seed)	Mustang Maxx is a **RESTRICTED USE** pesticide.
STRIPED GROUND CRICKETS					
General Comments: *Apply an insecticide before overseeding clovers if excessive numbers of crickets (more than four or five crickets per square foot) are present.*					
carbaryl SEVIN XLR PLUS Other trade names [3]	3-4	1-1.5 qt.	1-1.5	14	Bee hazard; avoid treating crops when pollinating insects are active.
zeta-cypermethrin MUSTANG MAXX INSECTICIDE	32-46	2.8-4.0 fl.oz.	0.0175-0.025	3 (h,g) 7 (seed)	Mustang Maxx is a **RESTRICTED USE** pesticide.

[1] See the Alfalfa IPM for insect control on alfalfa stands.
[2] See Table 4 for a list of insecticides, formulations, restricted entry intervals, days to grazing or harvest, and maximum amount to apply.
[3] See Table 4 for other trade names.

Table 3. Clover Insect Control (cont.) [1,2]

Insecticide and Formulation	Acres Per Gallon	Amount of Formulation per Acre	Lb. Active Ingredient per Acre	Minimum Days from Last Application to Harvest (h) or Grazing (g)	Comments
THREE-CORNERED ALFALFA HOPPERS					
carbaryl SEVIN XLR PLUS	4	1 qt.	1	7	May cause injury to clovers that persist in the summer. Apply when insects become abundant.
zeta-cypermethrin MUSTANG MAXX INSECTICIDE	32-46	2.2-4.0 fl.oz.	0.014-0.025	3 (h,g) 7 (seed)	Mustang Maxx is a **RESTRICTED USE** pesticide.

[1] See the Alfalfa IPM for insect control on alfalfa stands.
[2] See Table 4 for a list of insecticides, formulations, restricted entry intervals, days to grazing or harvest, and maximum amount to apply.

Table 4. Insecticides Labeled for Use on Clover

Insecticide and Trade Name	A.I./ Formulated Product	Formulation	Restricted Entry Interval (hr)	Minimum Days from Last Application to Harvest or Grazing	Bee Hazard Restriction
carbaryl *MoA Group 1A					
SEVIN 4F, others	4 lb./gal.	liquid suspension	12	7	yes[1]
SEVIN XLR PLUS, others	4 lb./gal.	liquid suspension	12	7	yes[1]
CARBARYL 4L, others	4 lb./gal.	liquid suspension	12	7	yes[1]
SEVIN 80 SOLUPAK	12.8 oz./lb.	water soluble packet	12	7	yes[1]
chlorantraniliprole MoA Group 28					
CORAGEN	1.67 lb./gal.	suspension concentrate	4	0	no
PREVATHON	0.43 lb./gal	suspension concentrate	4	0	no
malathion MoA Group 1B					
MALATHION 5, others	5 lb./gal.	emulsifiable concentrate	12	0	yes[2]
MALATHION 8, others	8 lb./gal.	emulsifiable concentrate	12	0	yes[2]
CHEMINOVA MALATHION 57%	5 lb./gal.	emulsifiable concentrate	12	0	yes[2]
FYFANON	5 lb./gal.	emulsifiable concentrate	12	0	yes[2]
FYFANON ULV AG	9.9 lb./gal.	emulsifiable concentrate	12	0	yes[2]
s-methoprene MoA Group 7A					
EXTINGUISH PROFESSIONAL FIRE ANT BAIT	0.08 oz./lb.	bait	4	0	no
methoxyfenozide MoA Group 18					
INTREPID 2F	2 lb./gal.	liquid suspension	4	7 (h), 0 (g)	no
spinosad MoA Group 5					
ENTRUST SC	2 lb./gal.	soluble concentrate	4	3 (h), 0 (g)	yes[3]
zeta-cypermethrin MoA Group 3A					
MUSTANG MAXX INSECTICIDE (Restricted Use)	0.8 lb./gal.	emulsifiable concentrate	12	3 (h,g) 7 (seed)	yes[2]

*MoA = Mode of Action classification from the Insecticide Resistance Action Committee. Insecticides with different MoAs should be used for insect resistance management.

Other products may be available. Always read the label to make sure the specific crop is listed and to determine what rate to use. Insect

[1] Notify beekeepers within 1 mile of treatment area at least 48 hours before application. Apply when bees are least active, e.g., within 2 hours of sunrise or sunset.
[2] Do not apply this product or allow it to drift to blooming crops or weeds if bees are visiting the treatment area.
[3] This product is toxic to bees exposed to treatment during the 3 hours following treatment. Do not apply to blooming, pollen-shedding, or nectar-producing parts of plants if bees may forage during this time period.

Pest Management section prepared by Kathy L. Flanders, Extension Entomologist, Professor, Department of Entomology and Plant Pathology, Auburn University.

WEED CONTROL

Weed control is frequently a necessary component of hay and pasture management. Most hay and pasture forages are generally very competitve with proper soil pH, fertility, moisture, and grazing management. However, weeds can still be a problem even in the best managed pasture. Weeds tend to reduce forage production and are generally lower in quality than most forage species, especially as they mature. Some weeds may also be poisonous to livestock and should be controlled when found. Other spiny or thorny weeds deter animals from grazing and result in decreased forage utilization. Finally, other very aggressive weeds known as invasive plants may completely overrun and replace desirable pasture species, resulting in tremendous losses in forage productivity.

The first thing to remember when considering pasture weed management is the following: there are no silver bullets that will solve pasture weed problems with a single shot. Pasture and hay weed management is generally needed on an annual basis. Weed generally have soil seedbanks that persist for several years. With long-lived seedbanks, eradication is very unlikely, except for very small infestations of new weeds. An old but true saying about many weeds is "One year of seed equals seven years of weeds."

Mowing for Weed Control

Mowing as a stand alone management tool has an important role in pasture weed management. Mowing is often used to clean up pastures from an aesthetic perspective. Mowing can also stimulate grasses to produce new shoots that are higher in quality than older rank growth. However, do not expect too much as mowing may only suppress many weed species.

The timing of mowing is critical for maximum effect. When targeting herbaceous weeds, mowing is often most effective either at or just prior to early flowering. This timing is when annuals and biennials have fully shifted into reproductive mode and are most susceptible to defoliation. For herbaceous perennials, this timing is generally when root energy reserves are at their lowest and plants are most susceptible to defoliation. While most herbaceous weeds will recover from growing points below the mowing height, this timing appears to slow recovery more than earlier timings. Mowing after flowering, however, generally serves to spread weed seed and provides little control especially for annuals and biennials. For woody weeds, annual mowing makes things look better, but in the long run it only serves to create dense woody thickets and stobby stumps that damage tractor tires.

With these timing issues in mind, it may be necessary to pick your battles in mixed stands of weeds. Target specific weed species at the optimal timing and recognize that other species in the fields may not be controlled as well. Either way, mowing will open up the canopy and stimulate new forage growth. This is often greatly needed under dense stands of weeds where shading suppresses forage growth.

Integrating Mowing and Herbicides

Mowing integrated with herbicide treatment is a tricky business. It is often species specific. For example, after mowing blackberries, do not spray until the following growing season. For most annual weeds, do not mow for two weeks either before or after spraying. This ensures enough regrowth after mowing but before spraying for the weed to be able to absorb sufficient herbicides. After spraying, this no-mow window allows the herbicide time to translocate to the roots before mowing removes the top growth. For herbaceous perennials, spraying should be delayed after mowing until flowering or when there is 12 to 24 inches of regrowth. For woody plants, wait to spray after mowing until there are 3 to 4 feet of regrowth and do not mow for at least 2 months after treatment or until woody stems are dead.

For hayfields on a 28-day cutting schedule, herbicide treatment of herbaceous perennials and woody plants may be less effective. To counter this, aggressively treat hard to control perennials and woody plants approximately 1 month after the last cutting if possible. This may or may not be possible since September and October are often very dry and early frost may prevent treatment. Another option would be to avoid cutting heavily infested areas to allow for a longer window for better herbicide performance.

Herbicide Use

When using herbicides, always read and follow label directions. Most pasture herbicides now have fewer restrictions on grazing or hay harvest than they previously did only a few years ago. However, there are still critical issues for many herbicides with regards to injury of certain grasses and legumes, plantback restrictions for small grains for winter grazing, and allowable uses of hay and manure where treatments have previously been applied

Additionally, herbicide use should be carefully considered in pastures near broadleaf crops or vegetables. Herbicide drift or volatilization may become serious issues in these situations. Herbicide efficacy is often reduced if applications are made during droughts or if very cold conditions persist in the winter or spring. Most herbicides that are applied to the foliage tend to work better when a surfactant is added to the spray tank. For pasture herbicides a non-ionic surfactant is often the best choice, but be sure to read the label for surfactant directions. Finally herbicide resistance has rarely been an issue in pastures, but the best approach is to rotate herbicides with different modes of action when possible.

Table 5. Forage Crops Weed Control

Herbicide Trade Name (Rate/Acre Broadcast)	Herbicide Common Name (Active Herbicide/Acre)	Comments
BERMUDAGRASS PASTURES AND HAYFIELDS DURING ESTABLISHMENT		
	Preemergence	
DIURON 4L (1.5-4.5 pt.) DIREX 4L (1.6-4.8 pt.)	diuron (0.75-2.3) (0.8-2.4 lb.)	Controls annual grasses and broadleaf weeds. Apply only during establishment after sprigs are planted but before emergence of bermudagrass or weeds. Plant sprigs 2 inches deep in a well-prepared seedbed. Do not treat areas where sprigs are planted less than 2 inches deep as crop injury may result. Do not graze or cut for hay within 70 days after treatment.
2,4-D AMINE 4 (2-4 pt.)	2,4-D amine (1-2 lb.)	Controls dogfennel (summer cedar), pokeweed, common mullein, jimsonweed, and horseweed (marestail). Apply from April to late June. These rates may kill legumes. Allow legumes to reseed before treating. Dogfennel should be 12 to 24 inches when treated. If taller, mow and spray regrowth at 12 to 24 inches. Apply when daytime temperature is 75°F or above.
OUTRIDER (1.33 fl.oz.)	sulfosulfuron 0.062 lb.	Can be used in newly sprigged bermudagrass 4 weeks or more after emergence from sprigs. Do not mow 2 weeks before or after treatment. Effective on Johnsongrass and nutsedge. Add a non-ionic surfactant at 0.25 percent v/v.
	Postemergence	
WEEDMASTER (2-4 pt.)	dicamba (0.25-0.5 lb.) + 2,4-D (0.7-1.4 lb.)	Controls seedling broadleaf weeds with limited suppression of certain germinating annual grasses. Apply after bermudagrass is planted but before germinating weeds reach 1 inch in height. Do not allow grazing within 30 days of slaughter and do not graze lactating dairy animals within 7 days of treatment. Do not harvest hay within 37 days of treatment.
ESTABLISHED WARM-SEASON GRASS PASTURES AND HAYFIELDS		
	Preemergence	
PROWL H_2O (1.1-4.2 qt.)	pendimethalin (1-4 lb.)	For control of most annual grasses and some broadleaf weeds in **ESTABLISHED, DORMANT** warm-season forage grasses in hayfields and pastures. This includes bermudagrass, bahiagrass, switchgrass, and others. Treatment must be applied BEFORE target weed germination to be effective. Do not harvest hay for 60 days following treatment. Do not allow livestock grazing for 45 days after treatment. Not labeled for use in cool season grasses such as tall fescue.
ESTABLISHED PERENNIAL GRASS PASTURES AND HAYFIELDS		
	Postemergence	
2,4-D AMINE 4 or 2,4-D LV 4 (2-4 pt.)	2,4-D (1-2 lb.)	Apply to weeds 2 to 6 inches tall. Use low rate for small weeds and high rate for larger or perennial weeds. Apply low volatile esters from October through March. Apply only non-volatile amine forms from April through late June. Herbicide will severely injure all legume species except established white clover and sericea lespedeza at the low rate. Treat thistles before flower stalk elongation and buttercups before bloom in late winter. Prevent drift.
2,4-D LV 4 (2 qt.)	2,4-D LV ester (2 lb.)	Controls wild onion, wild garlic, and other winter perennial weeds. Apply in November or December and repeat in late February or March. Apply when temperature is 65°F or above. This rate may kill all legumes. It may not kill all onion or garlic plants.
AIM EC (0.5-1.5 oz.)	carfentrazone-ethyl (0.008-0.023)	Controls certain annual weeds such as bitter sneezeweed and spiny pigweed up to 4 inches tall. Can be used on all pasture grasses. Add a non-ionic surfactant at 0.25 percent v/v and ammonium sulfate (AMS) at 2.5 pounds per acre. Do not apply more than 5.9 ounces per acre per season. There are no grazing or haying restrictions when Aim EC is applied alone.
ARSENAL POWERLINE (48 oz. or 1% v/v)	imazapyr (0.75 lb.)	Nonselective treatment for removal of cogongrass patches in areas grazed or cut for hay. Optimal timing is late summer. Do not apply within the root zone of any desirable trees or shrubs. Do not graze or cut for hay for 30 days after treatment.

Table 5. Forage Crops Weed Control (cont.)

Herbicide Trade Name (Rate/Acre Broadcast)	Herbicide Common Name (Active Herbicide/Acre)	Comments
ESTABLISHED PERENNIAL GRASS PASTURES AND HAYFIELDS (cont.)		
Postemergence (cont.)		
BANVEL 4L (1-3 pt.) VANQUISH 4L (1-3 pt.)	dicamba (0.5-1.5 lb.)	Controls giant ragweed, dogfennel, smartweed, red sorrel, and most weeds listed for 2,4-D alone. Apply in South Alabama from mid March to late May and in North Alabama from mid April to late June. Will kill all legumes. Soybeans are particularly susceptible to drift injury.
CHAPARRAL (1.5-3.3 oz.)	aminopyralid (0.05-0.11 lb.) + metsulfuron methyl (0.009-0.02 lb.)	Controls Pensacola bahaigrass and many broadleaf weeds. Add a non-ionic surfactant to the spray mix at the rate of 1 quart per 100 gallons of spray mix. May cause some yellowing and stunting of fescue. This product will provide poor control of common and Argentine bahiagrass. Consult supplemental label for restrictions on off-site hay sale or distribution.
CIMARRON MAX CIMARRON [PART A] (0.1-0.3 oz.) + 2,4-D + DICAMBA [PART B] (1-4 pt.)	metsulfuron methyl (0.004-0.012 lb.) + 2,4-D + dicamba (0.36-1.4 lb.) + (0.125-0.5 lb.)	Controls a number of broadleaf weeds and Pensacola bahiagrass in established bermudagrass. Add 1 quart of non-ionic surfactant per 100 gallons of spray mix. **DO NOT** apply more than 0.15 ounce of metsulfuron to tall fescue. **DO NOT** add more than 1 pint of surfactant per 100 gallons of spray mix that will be applied to fescue. This product will provide poor control of common and Argentine bahiagrass.
CIMMARON PLUS (0.125-1.25 oz.)	metsulfuron methyl (0.004-0.04 lb.) + chlorsulfuron (0.001-0.01 lb.)	Controls Pensacola bahiagrass and many other broadleaf weeds less than 4 inches tall. Do not apply to bermudagrass established less than 2 months or fescue established less than 24 months. May cause some yellowing and stunting of fescue. Do not apply with liquid fertilizer when controlling bahiagrass. Do not apply to ryegrass.
CROSSBOW (1-4 qt.)	2,4-D ester (0.5-2 lb.) + triclopyr (0.25-1 lb.)	Controls several annual and biennial broadleaf weeds and a few perennials when applied in the spring or early summer to actively growing weeds. See label for specific use rate. Woody weeds such as green ash, blackberry, willow, wild rose, and alder can be controlled by spot treatment of Crossbow using a 1.5-percent solution (1.5 gallons in 100 gallons of spray solution). See label for hay and grazing restrictions.
FOREFRONT R+P GRAZON NEXT (1.5-2.6 pt.)	aminopyralid (0.06-0.11 lb.) + 2,4-D (0.5-0.87 lb.)	Controls a number of annual and perennial broadleaf weeds in perennial grass pastures and hayfields. **DO NOT** apply in areas with desirable legumes. Delay hay harvest for 7 days and do not make a second application within 30 days of first application. **DO NOT** apply more than 42 fluid ounces (2.6 pints) per acre per year. Add a non-ionic surfactant to the spray mix at the rate of 1 to 2 quarts per 100 gallons of spray mix. See label for appropriate use rate for target weeds. Consult supplemental label for restrictions on off-site hay sale or distribution.
FOREFRONT HL GRAZON NEXT HL (1.2-2.1 pt.)	aminopyralid (0.06-0.11 lb.) + 2,4-D (0.5-0.87 lb.)	Controls a number of annual and perennial broadleaf weeds in permanent grass pastures and hayfields. **DO NOT** apply in areas with desirable legumes. Delay hay harvest for 7 days and do not make a second application within 30 days of the first application. **DO NOT** apply more than 2.1 pints per acre per year. Add a non-ionic surfactant to the spray mix at a rate of 1 to 2 quarts per 100 gallons of spray mix. Residues in hay and manure can cause off-site problems. Consult supplemental label for restrictions on off-site hay sale or redistribution.

Table 5. Forage Crops Weed Control (cont.)

Herbicide Trade Name (Rate/Acre Broadcast)	Herbicide Common Name (Active Herbicide/Acre)	Comments
ESTABLISHED PERENNIAL GRASS PASTURES AND HAYFIELDS (cont.)		
Postemergence (cont.)		
GRAZON P+D (1-8 pt.)	picloram (0.067-0.54 lb.) + 2,4-D (0.25-2 lb.)	Make application only to permanent grass pastures and hayfields. Provides broad spectrum postemergence control of broadleaf weeds and residual activity on late-germinating weeds. Use 1 to 2 pints per acre to control small annual weeds in March or April. When application is made later or when weeds are taller than 3 inches, use 3 to 4 pints per acre. A rate of 4 pints per acre should be applied on perennial weeds taller than 4 inches. Apply in 10 to 15 gallons of spray mix per acre at a spray pressure of 20 to 25 psi. Add a non-ionic surfactant to the spray mix at the rate of 1 to 2 quarts per 100 gallons of spray mix. See label for higher use rates for control of wild rose and prickly pear cactus. Grazon provides poor control of blackberry and dewberry briars. Read and observe all replanting and grazing restrictions on label. **DO NOT** plant any other crop on treated land for 2 years after treatment. Grazon P+D is a **RESTRICTED USE** pesticide. Residues in hay and manure can cause off-site problems. See label for use restrictions.
IMPOSE PANORAMIC 2 SL (4-8 fl.oz.)	imazapic (0.063-0.125 lb.)	Apply only to established bermudagrass pastures and hayfields. **DO NOT** apply to tall fescue or bahiagrass. Provides postemergence control of crabgrass, sandbur, broadleaf signalgrass, johnsongrass, nutsedge, and some broadleaf weeds. Apply in late spring to mid-summer after bermudagrass has reached the 100-percent green-up growth stage and moisture is available for active growth. Add one quart of a non-ionic surfactant per 100 gallons of spray mix. **DO NOT** spray during spring transition. Herbicide will cause yellowing of bermudagrass and will suppress bermudagrass growth for 30 to 45 days. Hay yields may be reduced by 50 percent in the first cutting. Higher labeled rates will cause lengthy growth suppression during growing season. **DO NOT** apply to World Feeder or Jiggs bermudagrass.
MAVERICK OUTRIDER (1.33-2 oz.)	sulfosulfuron (0.062-0.094 lb.)	Controls some annual and perennial grasses and broadleaf weeds, including johnsongrass, yellow and purple nutsedge, and green kyllinga. Can be applied to established bermudagrass and bahiagrass pastures and hay fields. Use higher rate to control larger, established weeds. A second application can be made no sooner than 40 days after initial application. **DO NOT** exceed 2.66 ounces of herbicide per acre per year. Apply with a non-ionic surfactant at a rate of 2 pints per 100 gallons of spray mix. Grass my be grazed immediately after treatment. **DO NOT** harvest for hay within 14 days of treatment.
METSULFURON 60EG PATRIOT 60DF (0.1-0.4 oz.)	metsulfuron (0.004-0.015 lb.)	For control of Pensacola bahiagrass in established bermudagrass and some broadleaf weeds; provides spot treatment of blackberry and multiflora rose. Not effective on common and Argentine bahiagrass. May cause yellowing, stunting, and seedhead suppression of tall fescue. Will injure or kill legumes.
MILESTONE (3-7 fl.oz.)	aminopyralid (0.05-0.11 lb.)	Controls annual and perennial broadleaf weeds in perennial grass pastures and hayfields. **DO NOT** apply in areas with desirable legumes. Add a non-ionic surfactant to the spray mix at the rate of 1 to 2 quarts per 100 gallons of spray mix. See label for appropriate use rate for target weeds. **DO NOT** use treated hay or manures off-site.
OVERDRIVE (4-8 oz.)	diflufenzopyr (0.05-0.1 lb.) + dicamba (0.013-0.025 lb.)	Controls annual and perennial broadleaf weeds. Use low rate for annuals and high rate for biennials and perennials. Add a non-ionic surfactant to spray mix at the rate of 1 quart per 100 gallons of spray mix. May be tank mixed with other herbicides to increase spectrum of weeds controlled. Overdrive is rainfast within 4 hours of application.

Table 5. Forage Crops Weed Control (cont.)

Herbicide Trade Name (Rate/Acre Broadcast)	Herbicide Common Name (Active Herbicide/Acre)	Comments
ESTABLISHED PERENNIAL GRASS PASTURES AND HAYFIELDS (cont.)		
Postemergence (cont.)		
PASTORA (1-1.5 oz.)	nicosulfuron (0.035-0.053 lb.) + metsulfuron (0.009-0.014 lb.)	For use in established bermudagrass hay and pastures only. **DO NOT** apply to tall fescue or bahiagrass pastures. Controls many broadleaf and grass weeds. Optimal timings to minimize crop injury are during bermudagrass dormancy (for winter weeds) and within 7 days following hay cutting. A non- ionic surfactant at 0.25% v/v is the preferred adjuvant. Treat when broadleaf weeds are less than 4 inches in height and when grasses are less than 2 inches in height. There are no grazing or haying restrictions.
PASTUREGARD (3-8 pt.)	triclopyr (0.56-1.5 lb.) + fluroxypyr (0.19-0.5 lb.)	Controls a number of broadleaf weeds and woody plants such as dogfennel, camphorweed, maypop, honeylocust, locust, and blackberries in permanent grass pastures and hayfields. Apply when weeds are small and actively growing. For woody plants, make applications when new leaves are fully expanded and terminal growth has slowed. After mowing, allow at least 9 to 12 months of regrowth before herbicide application. Add a non-ionic surfactant to the spray mix at the rate of 1 to 2 quarts per 100 gallons of spray mix. See label for weeds controlled and specific herbicide use rates.
PASTUREGARD HL (1-4 pt.)	triclopyr (0.41-1.7 lb.) + fluroxypyr (0.12-0.5 lb.)	Controls a number of broadleaf weeds and woody plants in permanent grass pastures and hayfields. Apply when weeds are small and actively growing. For woody plants, make applications when new leaves are fully expanded and terminal growth has slowed. After mowing, allow at least 9 to 12 months of regrowth before application. Add a non-ionic surfactant to the spray mix at a rate of 1 to 2 quarts per 100 gallons of spray mix.
REMEDY ULTRA (2-4 pt.)	triclopyr (1-2 lb.)	Provides control of many woody plants, such as blackberry and multiflora rose, as well as herbaceous broadleaf weeds. Make application using more than 10 gallons of spray solution per acre when target weeds are actively growing. Remedy may be mixed with certain other pasture herbicides for control of difficult weeds. See label for hay and grazing restrictions.
ROUNDUP POWERMAX (10 fl.oz.) (5.5 lb./gal.)	glyphosate (0.43 lb.)	Apply immediately after the first bermudagrass hay cutting when bermudagrass has not yet initiated new growth. Controls crabgrass, sandbur, and seedling johnsongrass. **DO NOT** graze or cut for hay for 28 days after application. Make only one application per year. **DO NOT** apply after the first cutting if field previously received a glyphosate application during the winter months.
SURMOUNT (1.5-6 pt.)	picloram (0.13-0.89 lb.) + fluroxypyr (0.13-0.87 lb.)	Controls a number of woody plants and broadleaf weeds, such as prickly pear, milkweed, horsenettle, tallowtree, wild rose, and osage orange in permanent grass pastures and hayfields. For woody plants, make application to new growth at least 4 feet tall and when new leaves are fully expanded and terminal growth has slowed. After mowing, allow at least 9 to 12 months of regrowth before herbicides application. On broadleaf weeds, apply when weeds are small and actively growing using the lower use rates. Add a non-ionic surfactant to spray mix at the rate of 1 to 2 quarts per 100 gallons of spray mix. See label for weeds controlled and specific herbicide use rates and directions. Surmount is a **RESTRICTED USE** pesticide. Will kill all legumes.

Table 5. Forage Crops Weed Control (cont.)

Herbicide Trade Name (Rate/Acre Broadcast)	Herbicide Common Name (Active Herbicide/Acre)	Comments
ESTABLISHED PERENNIAL GRASS PASTURES AND HAYFIELDS (cont.)		
Postemergence (cont.)		
VELPAR DF (0.9-1.5 lb.) or VELPAR L (2.75-4.5 pt.)	hexazinone (0.67-1.12 lb.)	Controls smutgrass in established bermudagrass and bahiagrass pastures and hayfields. Use low rate on coarse, sandy soils and high rate on heavy, clay soils. Make **ONLY** one application per year using a ground-driven boom sprayer calibrated to deliver a minimum of 25 gallons per acre. Avoid excessive application rates or overlapping of spray swath. Make application when soil moisture is good, humidity is high, and when air temperature is above 80°F. Smutgrass should be treated in the spring or early summer when the new growth is 2 inches tall. Treated forage grasses should recover from the temporary burn or yellowing in 2 to 3 weeks. Fertilization soon after herbicide application helps pasture species recover. Treated forage grasses may not be fed for hay until 38 days after application. There are no other grazing restrictions.
WEEDMASTER BRASH (2-4 pt.)	2,4-D (0.75-1.5 lb.) + dicamba (0.25-0.5 lb.)	Controls dogfennel, smartweed, pigweed, and all weeds listed for 2,4-D alone. Use high rate for horsenettle suppression and when other weeds are 12 to 24 inches tall. Apply in South Alabama from mid March to late May and in North Alabama from mid April to late June. Will kill all legumes.
DORMANT BERMUDAGRASS PASTURES		
GRAMOXONE INTEON 2 (16 fl.oz.) or FIRESTORM 3 (11 fl.oz.)	paraquat (0.25 lb.)	Controls little barley and other annual grasses and broadleaf weeds. Apply during late winter or early spring (February to March) but before green-up. Bermudagrass must be dormant. Add 2 pints of non-ionic surfactant per 100 gallons of spray solution. For control of little barley, apply before seed heads emerge. **DO NOT** spray where winter annual forages or clovers are present in the pasture. **DO NOT** graze or cut hay until 40 days after treatment. Gramoxone and Firestorm are **RESTRICTED USE** pesticides.
ROUNDUP POWERMAX (10 fl.oz.) (5.5 lb./gal.)	glyphosate (0.43 lb.)	Apply in mid to late winter to dormant bermudagrass pastures and hayfields to control little barley, cheat, henbit, and Italian ryegrass (suppression). Bermudagrass not dormant at time of treatment will be injured, and green-up may be delayed up to 4 weeks. **DO NOT** graze or cut for hay for 60 days after application.
FORAGE SORGHUMS		
Postemergence		
2,4-D AMINE (0.5-1 pt.) (4 lb./gal.)	2,4-D amine (0.25-0.5 lb.)	Controls annual broadleaf weeds. May be applied over-the-top when weeds are small and when sorghum plants are 4 to 6 inches tall. **DO NOT** spray over-the-top when sorghum plants are less than 4 inches tall or more than 10 inches tall.
ATRAZINE 90WDG AATREX 90WDG (2.2 lb.) or ATRAZINE 4L AATREX 4L (2 qt.)	atrazine (2 lb.)	Controls annual broadleaf weeds and grasses. Apply atrazine after sorghum has emerged but before weeds are 1.5 inches tall. **DO NOT** use on sandy loam or coarser soil textures. **DO NOT** graze or feed forage within 21 days after treatment. Atrazine is a **RESTRICTED USE** pesticide.

Table 5. Forage Crops Weed Control (cont.)

Herbicide Trade Name (Rate/Acre Broadcast)	Herbicide Common Name (Active Herbicide/Acre)	Comments
FESCUE CONVERSION*		
GRAMOXONE INTEON 2 (1-2 pt.) or FIRESTORM 3 (11-21 fl.oz.)	paraquat (0.25-0.5 lb.)	Controls or kills endophyte-infected fescue. Fall Application: Gramoxone: Apply 1 to 2 pints per acre followed by a second application of 1 to 2 pints per acre in 10 to 21 days, if necessary. Firestorm: Apply 11 to 21 fluid ounces per acre followed by a second application of 11 to 21 fluid ounces per acre in 10 to 21 days, if necessary. Spring Application: Gramoxone: Apply 2 pints per acre followed by a second application of 1 to 2 pints per acre in 10 to 21 days, if necessary. Firestorm: Apply 21 fluid ounces per acre followed by a second application of 11 to 21 fluid ounces per acre in 10 to 21 days, if necessary. Add a non-ionic surfactant to each spray solution at the rate of 1 quart per 100 gallons. In all cases, apply prior to planting endophyte-free fescue seed. **DO NOT** graze new planting for 60 days after last application or until new growth is at least 6 inches tall. Gramoxone and Firestorm are **RESTRICTED USE** pesticides.
ROUNDUP WEATHERMAX (22 fl.oz.) (5.5 lb./gal.)	glyphosate (0.9 lb.)	Apply Roundup in the fall to endophyte-infected fescue 3 to 4 weeks prior to planting fungus-free fescue. Apply Roundup at 11 fluid ounces per acre at planting to control escaped seedling fescue and weeds. New growth 6 to 12 inches tall should be treated with 3 to 10 gallons of spray solution per acre.
PASTURE RENOVATION		
GRAMOXONE INTEON 2 (16 fl.oz.) or FIRESTORM 3 (11 fl.oz.)	paraquat (0.25 lb.)	Provides chemical frost of bermudagrass sod. Apply in late summer or early fall to suppress bermudagrass sod that does not exceed 3 inches in height. Apply prior to or at time of seeding winter annuals. Apply 20 to 30 gallons of water per acre. **DO NOT** graze area until 60 days after treatment or until winter annual seedlings are 9 inches tall. Add 1 quart of non-ionic surfactant per 100 gallons of spray solution. Gramoxone Inteon and Firestorm are **RESTRICTED USE** pesticides.
WINTER GRAZING/GRAIN PRODUCTION (WHEAT, BARLEY, RYE, OATS, RYEGRASS)		
2,4-D AMINE (0.5-2 pt.) (4 lb./gal.)	2,4-D amine (0.25-1 lb.)	Controls winter broadleaf weeds such as wild mustard. Apply from late October to early March. Apply after grains are tillered with five or more leaves and are 5 to 8 inches tall. **DO NOT** exceed 1 pint per acre on oats. **DO NOT** apply before the fully tillered stage or from early boot through the milk stage. Treatment can be applied when the grain is in the dough stage to control weeds that will interfere with harvest. Use the high rate **ONLY** where some crop injury can be tolerated.
SERICEA LESPEDEZA		
Preplant Incorporated		
EPTAM 7E (3.5 pt.)	EPTC (3 lb.)	Controls annual grasses and small-seeded broadleaf weeds and provides nutsedge suppression. Apply just prior to planting. Thoroughly incorporate into upper 3 inches of soil (disk 4 to 6 inches deep) immediately after application (within 30 minutes). Some temporary injury to Sericea seedlings may occur if conditions for germination and growth are not optimum.

* NOTE: Endophyte-infected fescue should not be allowed to make seed during the calendar year when non-infected seed is to be planted. Otherwise, the new non-infected fescue field will contain volunteer infected plants.

Table 5. Forage Crops Weed Control (cont)

Herbicide Trade Name (Rate/Acre Broadcast)	Herbicide Common Name (Active Herbicide/Acre)	Comments
RED CLOVER AND LADINO CLOVER		
Preplant Incorporated		
EPTAM 7E (3.5 pt.)	EPTC (3 lb.)	Controls annual grasses and small-seeded broadleaf weeds and provides nutsedge suppression. Apply just prior to planting. Thoroughly incorporate into upper 3 inches of soil (disk 4 to 6 inches deep) immediately after application (within 30 minutes). **DO NOT** use if grass nurse crop is to be planted. **DO NOT** use on white Dutch clover. Some temporary injury to alfalfa and clover seedlings should be expected if conditions for germination and growth are not optimum.
SEEDLING RED CLOVER AND LADINO CLOVER		
Postemergence		
KERB 50W (1-3 lb.)	pronamide (0.5-1.5 lb.)	Controls winter grasses and broadleaf weeds. Apply from November through February. Use ONLY on established legume plantings or on new plantings after the legume has reached the trifoliolate stage. **DO NOT** use preplant or preemergence or before the trifoliolate leaf stage because injury to the legume will result. **DO NOT** graze or harvest for forage within 120 days after application. Kerb is a **RESTRICTED USE** pesticide.
CLOVER		
Postemergence		
PURSUIT (3-6 oz.)	imazethapyr (0.05-0.09 lb.)	Can be applied to established legumes or seedling legumes with at least two fully expanded trifoliate leaves. Do not apply during the last year of the stand. This treatment may suppress many cool season grasses. Controls hairy buttercup and some other weeds.

Table 6. Estimated Effectiveness of Herbicides for Forage Crops on Selected Weeds [1]

WEEDS	NEW SEEDLINGS	ESTABLISHED FORAGE STANDS	FORAGE SORGHUMS	
	Legume Only	Legume Only		
	Eptam (PPI)	Kerb (POST)	2,4-D amine (POST)	Atrazine (POST)
GRASSES				
Crabgrass	E	F	P	F
Fall panicum	E	P	P	F
Foxtails	E	P	P	G
Signalgrass	F	P	P	P
Texas panicum	F	P	P	P
SEDGES				
Nutsedge	G	P	P	P
BROADLEAVES				
Bitterweed	P	P	G	P
Curly dock	P	P	F	P
Dogfennel	P	P	G	P
Field buttercup	P	P	G	P
Field dodder	P	G	P	P
Goldenrod	P	P	F	P
Horsenettle	P	P	F	P
Horseweed	F	P	E	E
Musk thistle	P	P	E	P
Plantains	P	P	E	E
Pokeberry	P	P	F	P
Redroot pigweed	G	P	E	E
Shepherdspurse	P	G	E	E
Smartweed	P	P	F	E
Wild garlic	P	P	F	F
Wild mustard	F	P	E	E
Surface-Loss Potential[2]	M	L	M	M
Leaching Potential[3]	M	S	M	M

continued

[1]Ratings are based on observations of research plots and field use under average weather conditions for several years by weed control workers in Alabama and the South. .

KEY TO CONTROL RATINGS AND ABBREVIATIONS

E = Excellent control; G = Good control; F = Fair control; P = Poor control; — = Information not available.

S = Small; M = Medium; L = Large. POST = Postemergence.

Table 6. Estimated Effectiveness of Postemergence Herbicides for Forage Crops on Selected Grasses and Grasslike Weeds [1] (cont.)

TARGET GRASSES AND WEEDS	ESTABLISHED FORAGE STANDS											
	2, 4-D	Banvel	Chaparral	Cimmaron Max	Cimmarron Plus	Cross-bow	Grazon-Next	Grazon P+D	Impose/ Panoramic	Maverick/ Outrider	Metsul-furon	Mile-stone
Barnyardgrass	P	P	P	P	P	P	P	P	—	P	P	P
Bahiagrass, Pensacola	P	P	G	G	G	P	P	P	G-E	P	E	P
Crabgrass	P	P	P	P	P	P	P	P	G	P	P	P
Dallisgrass	P	P	P	P	P	P	P	P	F	P	P	P
Foxtails, Annual	P	P	P	P	P	P	P	P	G	P	P	P
Foxtail, Knotroot	P	P	P	P	P	P	P	P	F	P	P	P
Goosegrass	P	P	P	P	P	P	P	P	F	P	P	P
Johnsongrass, Rhizome	P	P	P	P	P	P	P	P	G	E	P	P
Johnsongrass, Seedling	P	P	P	P	P	P	P	P	E	E	P	P
Nutsedge	P	P	P	P	P	P	P	P	G	G	P	P
Panicum, Fall	P	P	P	P	P	P	P	P	G	P	P	P
Panicum, Texas	P	P	P	P	P	P	P	P	F-G	P	P	P
Ryegrass, Italian	P	P	P	P	P	P	P	P	G	P	F	P
Sandbur	P	P	P	P	P	P	P	P	G	P	P	P
Signalgrass	P	P	P	P	P	P	P	P	G	P	P	P
Smutgrass	P	P	P	P	P	P	P	P	P	P	P	P
Vaseygrass	P	P	P	P	P	P	P	P	G	P	P	P

continued

[1]Ratings are based on observations of research plots and field use under average weather conditions for several years by weed control workers in Alabama and the South. .
KEY TO CONTROL RATINGS AND ABBREVIATIONS
E = Excellent control; G = Good control; F = Fair control; P = Poor control; — = Information not available.
POST = Postemergence.

Table 6. Estimated Effectiveness of Postemergence Herbicides for Forage Crops on Target Grass and Grasslike Weeds [1] (cont.)

TARGET GRASSES AND WEEDS	ESTABLISHED FORAGE STANDS									
	Overdrive	Pastora	Pasture-Gard	Prowl H_2O	Redeem R+P	Remedy	Roundup Powermax	Surmount	Velpar	Weedmaster
Barnyardgrass	P	E	P	G	P	P	G	P	P	P
Bahiagrass, Pensacola	P	G	P	P	P	P	F	P	P	P
Crabgrass	P	F	P	G	P	P	G	P	P	P
Dallisgrass	P	F	P	P	P	P	F	P	P	P
Foxtails, Annual	P	G	P	G	P	P	G	P	P	P
Foxtail, Knotroot	P	F	P	P	P	P	G	P	P	P
Goosegrass	P	F	P	G	P	P	G	P	P	P
Johnsongrass, Rhizome	P	G	P	P	P	P	G	P	P	P
Johnsongrass, Seedling	P	E	P	G	P	P	E	P	P	P
Nutsedge	P	P	P	P	P	P	F	P	P	P
Panicum, Fall	P	G	P	G	P	P	G	P	P	P
Panicum, Texas	P	G	P	G	P	P	G	P	P	P
Ryegrass, Italian	P	G	P	F-G	P	P	P	P	P	P
Sandbur	P	F	P	G	P	P	G	P	P	P
Signalgrass	P	G	P	F	P	P	G	P	P	P
Smutgrass	P	P	P	P	P	P	G	P	P	P
Vaseygrass	P	G	P	P	P	P	F	P	P	P

[1]Ratings are based on observations of research plots and field use under average weather conditions for several years by weed control workers in Alabama and the South. .
KEY TO CONTROL RATINGS AND ABBREVIATIONS
E = Excellent control; G = Good control; F = Fair control; P = Poor control; — = Information not available.

Table 7. Estimated Effectiveness of Postemergence Herbicides for Forage Crops on Selected Broadleaf Weeds

WEEDS	ESTABLISHED FORAGE STANDS						
	2,4-D	Banvel	Chaparral	Cimarron Max	Crossbow	Grazon Next	Grazon P+D
Amaranth, Spiny	F	G	G-E	G	G-E	G	F-G
Bitterweed	F	E	—	E	—	E	E
Blackberry	P	P	G	F	G	P	P-F
Buttercup	E	G	G	E	G-E	G	E
Cherokee and Macartney Rose	—	—	F	—	—	F	F
Crotolaria, Showy	G	G	—	—	—	E	E
Croton, Wooly	G	E	E	E	E	E	E
Curly Dock	F	E	E	E	E	E	G
Dewberry	—	—	—	—	—	P	P-F
Dogfennel	F	G	P	E	F-G	F	E
Goldenrod	F	G	—	E	F-G	F	G
Ground cherry	—	—	E	—	—	E	—
Henbit	F	G	E	E	F-G	G	F
Horsenettle	F	F	E	G	F	G	G
Horseweed	G	E	E	E	F-G	G	E
Ironweed	F	G	G	P	F	F	P
Jimsonweed	—	—	G	F	G-E	E	F
Lambsquarters	—	G	E	E	E	E	E
Milkweed	—	—	P	P	P-F	P	P
Perilla Mint	F	F	—	—	—	G	G
Pigweed	F	E	G	G	E	G	E
Plantain	G	P	E	E	G-E	E	E
Poison Ivy	—	—	—	P	G-E	—	G-E
Pricklypear	—	—	P	—	—	P	G
Ragweed	E	E	E	G	E	G	E
Red Sorrel	P	G	G	G	F-G	—	E
Rose, Multiflora	G	G	G	F	F-G	P-F	F-G
Prickly Sida	F	—	G	—	—	F	P
Smartweed	F	G	E	E	G-E	E	E
Stinging Nettle	P	P	G	F	—	E	E
Thistle, Musk, Bull, Yellow, Milk	G	G	E	E	F-G	E	E
Tropical Soda Apple	P	F	G	P	—	E	E
Vervain, Blue	G	—	—	—	—	G-E	G-E
Wild Garlic	G	G	F-G	G	—	—	F-G
Wild Mustard	G	—	—	—	—	G	E

continued

KEY TO CONTROL RATINGS AND ABBREVIATIONS
E = Excellent control; G = Good control; F = Fair control; P = Poor control; — = Information not available.

Table 7. Estimated Effectiveness of Postemergence Herbicides for Forage Crops on Selected Broadleaf Weeds (cont.)

WEEDS	ESTABLISHED FORAGE STANDS						
	Impose/ Panoramic	Milestone	Pasture -Gard	Redeem R+P	Remedy	Surmount	Weed -master
Amaranth, Spiny	P	F-G	F-G	F-G	G	E	G-E
Bitterweed							
Bitter Sneezeweed	—	F	E	E	G	E	E
Blackberry	P	P	P	P-F	E	F-G	—
Buttercup	F	G	F	G	G	G	E
Cherokee and Macartney Rose	—	—	—	—	F	F	—
Crotolaria, Showy	—	—	E	—	—	—	G
Croton, Wooly	E	E	E	E	E	E	E
Curly Dock	P	E	F	G	E	E	E
Dewberry	P	P	F-G	P	F-G	F	—
Dogfennel	P	—	E	G	F	G	G
Goldenrod	P	P	G	F-G	G	F-G	G
Ground cherry	—	E	—	—	—	—	—
Henbit	P	G	E	E	G	E	P
Horsenettle	P	G-E	F	F	P	E	F
Horseweed	P	E	G	G	G	E	E
Ironweed	P	G	G	G	F	G	—
Jimsonweed	P	G	—	G	G	F-G	—
Lambsquarters	F	—	E	E	E	E	—
Milkweed	P	P	P	F	F	F-G	—
Perilla Mint	—	P	—	—	—	F	F-G
Pigweed	F	G	P	E	G	E	E
Plantain	P	P	G	G	E	G	G
Poison Ivy	—	—	P	G	G-E	G	—
Pricklypear	P-F	—	P	—	P	G	P
Ragweed	P	E	G	G	G	E	E
Red Sorrel	P	—	P	F-G	—	G	F
Rose, Multiflora	P	F	F	P	F-G	F-G	F
Prickly Sida	P	F-G	P	—	—	P	E
Smartweed	G	E	F	—	G	E	E
Stinging Nettle	—	E	E	E	E	E	P
Thistle, Musk, Bull, Yellow, Milk	P	E	G	G	G	E	G
Tropical Soda Apple	P	E	P	—	G	E	F
Vervain, Blue	P	F	—	—	—	E	—
Wild Garlic	P	P	P	—	—	P	G
Wild Mustard	G-E	—	G	—	—	E	—

KEY TO CONTROL RATINGS AND ABBREVIATIONS
E = Excellent control; G = Good control; F = Fair control; P = Poor control; — = Information not available.

Table 8. Hay and Grazing Restrictions

HERBICIDE	WAITING PERIOD, IN DAYS			
	Grazing Beef/Non-Dairy Animals	Grazing Dairy Animals	Delay in Hay Cutting	Removal Ahead of Slaughter
2,4-D [1]	0-7	7-14	30	7
Atrazine	21	21	21	—
Banvel [2]	0	7-40	37-70	30
Chaparral	0	0	14	—
Cimarron Max	0	0	0	0
Cimaron Plus	0	0	0	—
Crossbow [3]	0	14	7	3
Diuron	70	70	70	—
Eptam	45	45	45	—
Forefront	0	0	7	0
Gramoxone/Firestorm	—	—	40	—
GrazonNext	0	0	7	—
Grazon P+D	0	7	30	3
Impose/Panoramic	0	0	7	0
Kerb	120	120	120	120
Maverick	0	0	14	—
Metsulfuron	0	0	0	0
Milestone	0	0	0	0
Outrider	0	0	14	—
Overdrive	0	0	0	0
Pastora	0	0	0	0
PasturAll	0	0	7	0
Pasturegard	0	next season	14	3
Prowl H_2O	45	45	60	0
Redeem	0	14	75	3
Remedy [3]	0	14	7	3
Roundup Powermax [4]	56	56	56	—
Surmount	0	14	7-14	3
Velpar	0	0	38	—
Weedmaster/Brash	0	7	37	30

[1] Refer to product label for exact use restrictions.

[2] For use rates of 1 to 4 pints per acre. See label for more lengthy time restrictions associated with higher use rates.

[3] For use rates higher than 2 gallons per acre of Crossbow or 2 quarts per acre of Remedy. See label for more lengthy time restrictions.

[4] The waiting period is rate dependent. For rates greater than 2 quarts per acre, the 56-day period apples. For rates less than 2 quarts per acre, the waiting period is 0 days.

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FOR MORE INFORMATION on pesticides, pesticide safety, or submitting samples for analysis, see the following publications in the IPM series:
IPM 1293, “Safety.” Safety contact information; worker protection standards; the safe use, handling, and storage of pesticides
IPM 1294, “Submitting Samples.” Procedures for submitting samples for diagnosis, analysis, and identification
IPM 1295, “General Pesticide Information.” Federal and state restricted use pesticide lists; pesticides and water quality
IPM 1317, “Appendix.” Pesticide guidelines for agronomic crops, including preharvest intervals; rain-free requirements; grazing restrictions; crop rotation guidelines; and the names, classifications, and toxicities of pesticides.

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For more information, contact your county Extension office. Visit www.aces.edu/counties or look in your telephone directory under your county’s name to find contact information.

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ALABAMA A&M & AUBURN UNIVERSITIES

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Peanut

IPM

Insect, Disease, Nematode, and Weed Control Recommendations for 2015

INSECT CONTROL

Thrips Management

Several species of thrips found in Alabama can infect peanut plants with tomato spotted wilt (TSW) virus. Good thrips control requires preventive treatment. You can use either (1) an in-furrow systemic insecticide like phorate (Thimet); (2) a foliar application of synthetic pyrethroids or spinetoram (Radiant); or (3) a hopper-box seed treatment with acephate. If foliar sprays are used, make the first application when the first true leaf is present and a second application 7 to 10 days later. If using synthetic pyrethroids early in season, stop spraying when thrips are under control to prevent excessive loss of natural enemies.

Using an in-furrow systemic insecticide at planting is usually the most effective method for thrips control and the least detrimental to beneficial insects. As the effect of systemic insecticide wears off, producers may start noticing increased thrips activity and disfigured terminal leaves with some virus pressure (depending on variety). Use of spinetoram (Radiant) before outbreak can effectively reduce thrips with minimum need for additional sprays and protect the natural enemies. Radiant will not flare up spider mites, which is an added benefit.

Cowpea Aphid Alert

In 2012 several acres of peanuts in the sandy soil regions of Florida were found to be infested with cowpea aphids *(Aphis craccivora*). Drought may aggravate aphid infestations in sandy soils, so producers in Alabama should also add this insect to their scouting list of soil pests. Cowpea aphids are a documented pest since the 1970s, so this is not a new invasion. In 2012 cowpea aphids were found feeding in masses of 25 to 30 adults and nymphs clustered on the developing peg, resulting in loss of growing point and poor pod formation.

Adult aphids are large shiny black insects with white legs; they also have a pair of dark cornicles protruding from the abdomen. Nymphs are grayish. Infested pegs may have numerous white molted skin (exuviae) attached to them, indicating prior infestation. Cowpea aphids inject a powerful toxin through their piercing-sucking mouthparts, causing darkening and deformation of the pegs.

At present there is no economic threshold for aphids on peanut pegs. Constant monitoring of peanut pegs is the only way to detect aphid infestation early. Once detected, it is advisable to check fields randomly twice every week since populations can increase rapidly in certain weather conditions. Insecticides containing imidacloprid (Sherpa) are effective against many sucking insect pests like aphids and leafhoppers. In 2012, peanut fields treated with Sherpa insecticide (17 percent imidacloprid at 3.5 ounces per acre) directed at the plant base provided excellent control of cowpea aphids. Two insecticide applications five days apart may be necessary to get proper aphid control. Scout peanut fields three to four days after the first treatment to assess the need for a second application. Note the 14-day preharvest interval on the label. If you are in doubt regarding insect identification, please send a sample of the insect along with the affected peg to your nearest agricultural Extension agent and treat fields only after proper identification. A new peanut IPM picture guide (car magnet) is now available from ACES to help you correctly identify soil insect pests of peanuts.

Burrower Bug Alert

Reports regarding burrower bug damage increased in dry years (2010 and 2011), so producers should pay special attention to the description of the insect, injury symptoms, and scouting methods.

Burrower bugs are small (1/3 to 1/4 inch) black, oval-shaped insects that feed on peanut pods. They are closely related to stinkbugs and produce a musky smell. They feed underground when peanut seeds begin to form in the pod. Excessive pod damage is usually associated with strip-tilled peanut or peanuts planted into soil with high organic residue. Feeding injury on kernel is known as "pitting" and is seen as yellow to dark brown spots. Numerous outbreaks of burrower bugs were noted in southwest and southeast Alabama peanut fields in 2010 and 2011 along with reports of outbreaks from Georgia. Movement of some burrower bug species is known to be affected by soil moisture. For detecting activity of burrower bugs, pit-fall traps can be used to collect insects.

There are several species of burrower bugs, but based on published literature, only one species appears to be associated with injury to the peanut crop. Please seek help from a regional Extension agent to correctly identify the pest before taking any control measures. Remember that burrower bugs may not be controlled with late season insecticide applications; cultural control tactics are the best way to manage them.

Lesser Cornstalk Borer Alert

In the 2014 growing season, lesser cornstalk borer was noted early in the season in certain dry and sandy regions. Mid-season drought can increase the activity of lesser cornstalk borers. Caterpillars live inside sand tunnels that stick to peanut stems, pegs, and pods. Use the monitoring procedure for adult moths described in Table 1 and consult a regional Extension agent before using insecticides. Remember that lesser cornstalk borers may not be consistently controlled with late season insecticide applications.

Insect growth regulator products (Table 2) are effective on larval stages of this borer after thorough application. Follow all label instructions for use of these reduced-risk insecticides.

IPM Insect Control in Peanuts

Always follow integrated pest management (IPM) tactics for insect management. Apply insecticides only if needed after scouting for pests and confirming economic damage to crops. Remember that doing nothing when insects are present below the economic threshold level is considered a sound IPM approach. Use pheromone-based insect monitoring systems for estimating popuation pressure of soil insects like the lesser cornstalk borer.

Familiarize yourself with insect pests (Table 1) as well as beneficial arthropods (Table 4). Use insecticides (Table 2) with low environmental impact in order to conserve natural enemies. Use broad-spectrum insecticides such as pyrethroids in a manner consistent with the insecticide label. Refer to the full insecticide label for identifying use restrictions before applying the product. Rotate insecticides with different modes of action to avoid insecticide resistance and/or resurgence.

Monitoring and Scouting Techniques for Foliar and Soil Insect Pests (Caterpillars and Grubs)

Use of multiple monitoring and scouting techniques can increase the chance of encountering insect pests in any habitat. When preparing soil before planting peanuts, check for below-ground insect infestations by spade sampling or by using germinating seed bait. Germinating-seed baits can also be deployed postemergence by placing them within planted peanut rows. Use a shovel to dig soil at several locations to sample pests within crop rows. Increase sampling accuracy by drawing samples from several locations in an unbiased manner. Late-season scouting may require digging beyond 6 inch depth since insect larvae in soil may be moving away from the root zone for overwintering. Peanut vines could be pulled back to reveal some pegs and pods for direct examination. As the vines are folded back, some pods and pegs will be pulled out of the soil. Examine these for damage. If you find larvae or fresh damage from either of these soil insects at three or more of the ten locations, apply a recommended insecticide.

If white grubs, wireworms, whitefringed beetle larvae, or bahiagrass borer larvae are expected to be a problem, they may be present before planting. These insects are much more likely to cause problems where peanuts follow sod crops. For these insect pests, crop rotation and other cultural practices should be used to prevent pest buildup.

In areas with a history of whitefringed beetle damage to the crop, check soil closely for active larvae in soil up to a depth of 4 to 8 inches. Control measures for these soil pests must be applied and incorporated into the soil before the crop is planted. This is because eggs are laid when adults feed, and the small larvae will be present when land is prepared.

After peanut seedlings have emerged from the ground, check fields at least once a week to estimate the level of pest and predatory insect populations before making treatment decisions. At ten locations in each field, carefully examine 3 feet of row by walking diagonally across and around the field, including border rows. Sketch a layout of the field and establish a scouting pattern; then record on paper the number of insects encountered to determine their spatial distribution. Insect populations are generally clumped or non-uniform, so spot treatment could be effective in some cases.

In each 3-foot section, shake the vines thoroughly and fold them back to count any foliage-feeding pests falling on the surface of the soil. Insects can also be collected in a plastic pan or other containers for counting. Identify and record numbers of insects of each kind seen during scouting. Look for any abnormal plants or plant parts, and if any are found, try to determine the cause. Also, look for any discolored leaves and examine the underside closely to determine if spider mites are present. Carefully examine the undersides of the plants for signs of lesser cornstalk borer damage. Silken tunnels at the base of plants or pegs or around peanut pods are the most visible sign of lesser cornstalk borer.

To detect soil insects, you may have to uproot a few plants and dig around the base to find the larvae.

Monitoring Activity of Winged Insect Pests (Moths)

IPM pheromone traps are modern insect detection devices that can provide early warning about pest presence and activity. The Alabama Cooperative Extension System (ACES) has maintained a statewide insect monitoring program since 2009 that uses commercial insect pheromone traps with two objectives: developing a database of insect species distribution and encouraging growers to use traps correctly. Growers can use pheromone traps in conjunction with actual crop scouting since traps alone cannot indicate level of economic damage to the crop. Results from past insect monitoring and IPM studies have been reported in the Alabama IPM Communcator newsletter, which can be found at www.aces.edu/go/128.

Insects that have been monitored with pheromone traps in commercial peanut fields include the lesser cornstalk borer, corn earworm, tobacco budworm, armyworms (three species), loopers (two species), and cutworms. Two major advantages of pheromone traps that justify the small added investment include detection of first pest activity and identification of closely related species. Commercially available pheromone traps (Table 3) are a good scouting tool for pesticide applicators and consultants.

Spotted Wilt Virus Management

Selection of a TSW-resistant cultivar should be a major component of a management program. Georgia Green peanut cultivar is moderately susceptible to TSW compared to the older varieties like Florunner. Recently released peanut cultivars offer significant improvements for TSW management. These include Tifguard, FL07, AP-3, Ga03L, Ga02C, etc. With any of these new peanut varieties, follow the agronomist's recommendations abour seeding rates and planting time. The goal is to have a uniform plant stand with minimum stress. Twin-row planting and strip-tilled planting are production practices that have also been shown to reduce incidence of TSW.

Spider Mite Management

Spider mites should be controlled as soon as they are detected. If they are confined to small areas within a field (hot spots), acceptable control can be obtained by treating only the infested areas or hot spots. Carefully examine the infested areas for the presence of live mites at least 3 to 4 days following the first treatment. If any live mites are found, make a second application of a recommended miticide. Let no more than 5 days elapse between the two treatments. Spidermites and lesser cornstalk borer activities can increase in hot, dry years as seen in 2010 and 2011 across Alabama. Carefully plan

insecticide rotations to reduce spider mite buildup in crops and reduce number of synthetic pyrethrid sprays. Provide irrigation to crops when feasible to reduce moisture stress on plants. As a general cultural practice, reduce number of spray passes and tractor movement across the fields in hot, dry years. Excessive field passes with equipment and mowing close to the field edges can lead to spider mite hot spots.

Foliar Insect Pest Management

Foliage-feeding caterpillars should be controlled when an average of four or more per foot of row are found in a field. Broad-spectrum insecticides used in early or mid-season may cause resurgence (sudden increase) of foliage-feeding caterpillars later in the season due to removal of natural predators.

Some selective and reduced-risk insecticides are available to manage caterpillar pests in peanuts. These include flubendiamide (Belt), spinetoram (Radiant, also controls thrips), and diflubenzuron (Dimilin). These are excellent for including in IPM programs to minimize nontarget effects.

Leafhoppers are small insects that suck plant juices by feeding on the mid-vein of the peanut leaflet. Their feeding produces a toxic reaction in the leaflet, causing it to turn yellow. This damage is referred to as "hopper burn." Leafhoppers often move into peanut fields from grassy or weedy field borders. If more than 20 percent of foliage in a field has hopper burn and adults or nymphs are found when scouting, a recommended insecticide should be applied.

Three-cornered alfalfa hoppers (TCAH) are small, green rectangular insects that girdle the main stem, lateral stems, and even the leaf stems. Their damage is most obvious when the foliage above the girdled stem turns yellow and the stem turns a purplish color. This girdled area is usually a thickened calloused ring around the damaged area. In recent years, the damage to Alabama peanuts caused by TCAH has increased considerably. In 2009 and 2010, several scouted peanut fields in southwestern counties of Alabama were treated with synthetic pyrethroid insecticides to control rapidly rising popuations of TCAH. Excessive girdling by adults or feeding on the crowns (terminal leaves) by nymphs can severely stress the plants and affect yields. Unusually high populations of TCAH or early detection of girdling might warrant an insecticide treatment.

Improving Insect Pest Management

Common reasons for failure of insecticides include delayed application of insecticide, wrong insecticide choice, inappropriate delivery of formulation to the target pest, and poor timing of insecticide applications. Growers can improve insect control by the following techniques:

1. Scout fields early to record pest occurrences and crop injury.

2. Adopt IPM tactics: Use economic threshold to determine need for insecticide application. Use selective or reduced-risk insecticides in order to minimize nontarget effects. Apply onlylabeled rate of insecticides. Rotate insecticides to avoid development of resistance.

3. Know the beneficial insects and monitor their activity. Learn to identify beneficial insect predators and parasitoids (Table 4) and use environmentally friendly products for pest management.

Extension Resources for Peanut Producers

Note that a new peanut IPM scouting guide (car magnet) is now available to all peanut producers free of charge along with a bookmark that highlights Extension resources. Please contact an ACES regional Extension agent to receive these publications.

Table 1 of this publication provides insecticide recommendations for peanut insect management. A full list of registered peanut insecticides in Alabama is provided in Table 2. Table 3 is a compilation of common insect pests that can be monitored with IPM pheromone traps along with contact phone number of some manufacturers. Growers can also refer to Extension publication ANR-0598, "Peanut Pest Management Scout Manual," for complete recommendations and techniques for scouting peanuts. Publications ANR-0990, "Sucking Pests of Peanuts"; ANR-0752, "Foliage Feeders on Alabama Peanuts"; and ANR-1351, "Soil Insect Pests of Peanuts in Alabama" provide additional information to aid in the identification of peanut insect pests. Contact the nearest county Extension office to get a copy of IPM Extension publications or to schedule more training on crop scouting and integrated pest management.

Want to Know More about Integrated Pest Management?

For more information about IPM projects or updates, subscribe to the IPM Communicator newsletter by visiting the www.aces.edu/ipmcommunicator. Readers can also subscribe to the Facebook page called "Alabama Peanut IPM" and receive live updates about pest detection and movement. The Facebook page has a handy insect identification photo album that can be accessed via smartphones.

Table 1. Peanut Insect Control

Insecticide and Formulation	Amount of Formulation per Acre	Lb. Active Ingredient per Acre	Minimum Days/Hours[1] from Last Application to: Harvest	Reentry	Comments
BEET ARMYWORMS					
Caterpillar appearance: *Many thin, white wavy lines on back and a broad greenish-white line on each side of body; a dark spot on each side above the second pair of legs behind the head; larval head is not dark.* ***Economic threshold:*** *Apply foliar insecticide when infestations of four or more caterpillars per foot of row are present.* ***Monitoring technique:*** *Commercial pheromone traps are available from various companies (Table 3); traps are useful in distinguishing among various armyworm species.*					
diflubenzuron DIMILIN 2L	4-8 fl.oz.	0.25-0.50	28	12	**DO NOT** make more than three applications per season. **DO NOT** exceed 24 fluid ounces per acre per season. The minimum application interval is 14 days. Apply when larvae are small. Since Dimilin is an insect growth regulator, larvae must ingest treated peanut foliage. Control of larvae may not be seen for 5 to 7 days after application.
flubendiamide BELT SC	2-4 fl.oz.	0.062-0.125	3	12	**DO NOT** apply more than 4 fluid ounces per acre per 7-day interval and 12 fluid ounces total per season. This is a new insecticide with a unique mode of action.
indoxacarb STEWARD EC	9.2-11.3 oz.	0.09-0.11	14	12	**DO NOT** apply more than 45 fluid ounces per acre per season.
methomyl LANNATE 2.4LV	1.5-3 pt.	0.45-0.9	21	48	**DO NOT** make more than eight applications per crop per season or exceed 12 pints per acre per season. **DO NOT** feed treated vines.
methoxyfenozide INTREPID 2F	6-10 oz.	0.09-0.16	7	4	**DO NOT** apply more than 64 fluid ounces per acre per year. **DO NOT** make mor than three applications per acre per year.
novaluron DIAMOND 0.83EC	6-12 fl.oz.	0.049-0.099	28	12	Diamond is an insect growth regulator and effective on small caterpillars. **DO NOT** use Diamond in rotation with other GR15 insecticides. **DO NOT** feed treated peanut hay or vines to livestock**.**
spinosad BLACKHAWK TRACER 4SC	1.7-3.3 oz. 2-3 oz.	0.062-0.094	3	4	**Grazing Restrictions: DO NOT** feed hay until 14 days after last application. **DO NOT** make more than three applications per season. **DO NOT** apply more than a total of 9 fluid ounces per season.
spinetoram RADIANT SC	3-8 oz.	0.188 lb. (max)	3	24	**DO NOT** exceed 24 fluid ounces of Radiant SC per acre per year. Do not allow grazing of peanut hay.
BURROWER BUGS					
Identification: *Black body; oval shaped with spiny legs; looks similar to stink bugs but much smaller (less than 0.3 inch).* ***Economic threshold:*** *Apply soil insecticide when infestation level is two bugs per 3 feet of row at pod stage.* ***Monitoring technique:*** *Pheromone traps are not available; bugs are attracted to light traps or insects may be collected in pit-fall traps (ground traps placed within planted row early in the season).*					
chlorpyrifos LORSBAN 15G Other trade names [2]	13.3 lb. See label.	2 See label.	21 See label.	24 See label.	Band over the row when more than two bugs per 3 row feet are found on or in the soil during early pod fill. **DO NOT** feed peanut forage or hay to meat or dairy animals. Do not exceed 4 pounds active ingredient per acre of clorpyrifos per season. Do not apply by air.

[1] Days refers to minimum time from last application to harvest; hours refers to minimum time from last application to reentry.

Table 1. Peanut Insect Control (cont.)

Insecticide and Formulation	Amount of Formulation per Acre	Lb. Active Ingredient per Acre	Minimum Days/Hours[1] from Last Application to: Harvest	Reentry	Comments
CORN EARWORM					
Identification: *Caterpillars vary in color, have light and dark stripes on top and a number of black spots or warts that bear a spine; head capsule is light brown with a dark area behind the head. See ANR-752, "Foliage Feeders on Alabama Peanuts," for more information.* ***Economic threshold:*** *Apply foliar insecticide when infestations of four or more caterpillars per foot of row are present.* ***Monitoring technique:*** *Pheromone traps are available from many vendors (Table 3) and are very effective in identifying corn earworm and tobacco budworm moths.*					
acephate					**DO NOT** feed forage or hay treated with acephate to livestock or graze treated areas.
ORTHENE 75S	1-1.33 lb.	0.75-1	14	24	
ORTHENE 97AG	12-16 oz.	0.75-1	14	24	
Other trade names [2]	See label.	See label.	See label.	See label.	
bifenthrin					This product is extremely toxic to fish and aquatic invertebrates, so growers in coastal areas should not use this product if chances of runoff are high. This product is highly toxic to bees. Do not apply more than 0.5 lb ai per acre per season. **DO NOT** feed green immature plants and peanut hay to livestock.
BRIGADE 2EC	2.1-6.4 oz.	0.033-0.1	14	12	
carbaryl					**DO NOT** apply more than 8 quarts or pounds of carbaryl per acre per season.
SEVIN 4F, XLR	3 pt.	1.5	14	12	
SEVIN 80S	1.88 lb.	1.5	14	12	
Other trade names [2]	See label.	See label.	See label.	See label.	
cyfluthrin					**DO NOT** make more than three applications of cyfluthrin and/or beta-cyfluthrin per season.
TOMBSTONE	1.8-2.4 fl.oz.	0.028-0.038	14	12	
Other trade names [2]	See label.	See label.	See label.	See label.	
beta-cyfluthrin					
BAYTHROID XL	1.8-2.4 fl.oz.	0.014-0.019	14	12	
esfenvalerate					**DO NOT** feed or graze livestock on vines treated with enfenvalerate. **DO NOT** exceed 0.15 pound active ingredient of esfenvalerate per season.
ASANA XL	2.9-5.8 oz.	0.01-0.03	21	12	
fenpropathrin					
DANITOL 2.4 EC	10.66-16 fl.oz.	0.2-0.3	14	24	
flubendiamide					**DO NOT** apply more than 4 fluid ounces per acre per 7-day interval and 12 fluid ounces total per season. This is a new insecticide with a unique mode of action.
BELT SC	2-4 fl.oz.	0.062-0.125	3	12	
gamma-cyhalothrin					**DO NOT** apply more than 0.06 pound active ingredient of gamma-cyhalothrin per acre per season.
PROLEX 1.25	1-1.5 fl.oz.	0.01-0.015	14	24	
Other trade names [2]	See label.	See label.	See label.	See label.	
lambda-cyhalothrin					**DO NOT** apply more than 0.12 pound active ingredient of lambda-cyhalothrin per acre per season.
KARATE Z	1.28-1.92 oz.	0.02-0.03	14	24	
Other trade names [2]	See label.	See label.	See label.	See label.	

[1] Days refers to minimum time from last application to harvest; hours refers to minimum time from last application to reentry

[2] See Table 2 for a list of other trade names.

Table 1. Peanut Insect Control (cont.)

Insecticide and Formulation	Amount of Formulation per Acre	Lb. Active Ingredient per Acre	Minimum Days/Hours[1] from Last Application to: Harvest	Reentry	Comments
CORN EARWORM (cont.)					
methomyl LANNATE 2.4LV	0.75-1.5 pt.	0.23-0.45	21	48	**DO NOT** feed vines treated with methomyl. **DO NOT** make more than eight applications of methomyl per season or exceed 12 pints per acre.
spinosad BLACKHAWK TRACER 4SC	1.7-3.3 oz. 1.5-3 fl.oz.	0.047-0.094	3	4	**DO NOT** feed hay until 14 days after last application. **DO NOT** make more than three applications or apply more than a total of 9 fluid ounces per season.
spinetoram RADIANT SC	3-8 oz.	0.188 lb. (max)	3	24	**DO NOT** exceed 24 fluid ounces of Radiant SC per acre per year. Do not allow grazing of peanut hay.
zeta-cypermethrin MUSTANG MAX EC or EW	3.2-4 fl.oz.	0.02-0.025	7	12	**DO NOT** apply more than 0.15 pound active ingredient per acre per year. **DO NOT** graze livestock in treated area. **DO NOT** use treated vines or hay for animal feed.
COWPEA APHID					
Identification: *This insect was detected on large peanut acres in 2012. Adults are shiny black with white legs. Nymphs are smaller than adults and grayish. Adults and nypmhs have a pair of cornicles (tail-pipes) protruding from the abdomen. A good hand lens should be used to look for aphids. All life stages feed on peanut pegs and can cause deformations along with blackening of the growing point.* ***Economic threshold:*** *There is no economic threshold for cowpea aphids on peanuts.* ***Monitoring technique:*** *Aphids may be problematic during drought in sandy areas. During peg formation, check the pegs every week, If aphids are detected, scout twice every week to monitor population growth and assess the need for insecticide treatments.*					
imidacloprid SHERPA	3.5 fl.oz.	0.04	14	24	Treatments should be directed toward the plant base. There should be a mimimum of 5 days between applications. The maximum insecticide allowed on peanuts is 10.5 fluid ounces per acre per season. Consult the insecticide label for other restrictions.
CUTWORMS (MANY SPECIES)					
Identification: *Caterpillars are greasy, plump, and shiny in appearance; they curl into a 'C' when disturbed. Caterpillars hide in soil during the day and feed on crop at night; they overwinter as larvae in soil near weedy host plants. Variegated cutworm climbs and feeds on soft plant stem.* ***Economic threshold:*** *Apply foliar insecticide when infestations of four or more caterpillars per foot of row are present.* ***Monitoring technique:*** *Commercial pheromone traps are available from various companies (Table 3); traps are useful in identifying various cutworm species.*					
bifenthrin BRIGADE 2EC	2.1-6.4 oz.	0.033-0.1	14	12	This product is extremely toxic to fish and aquatic invertebrates, so ***growers in coastal areas should not use this product if chances of runoff are high.*** This product is highly toxic to bees. Do not apply more than 0.5 lb ai per acre per season. **DO NOT** feed green immature plants and peanut hay to livestock.
cyfluthrin TOMBSTONE Other trade names [2] beta-cyfluthrin BAYTHROID XL	1-1.8 fl.oz. See label. 1.0-1.8 fl.oz.	0.016-0.028 See label. 0.008-0.014	14 See label. 14	12 See label. 12	**DO NOT** make more than three applications of cyfluthrin or beta-byfluthrin per season.

[1] Days refers to minimum time from last application to harvest; hours refers to minimum time from last application to reentry

[2] See Table 2 for a list of other trade names.

Table 1. Peanut Insect Control (cont.)

Insecticide and Formulation	Amount of Formulation per Acre	Lb. Active Ingredient per Acre	Minimum Days/Hours[1] from Last Application to: Harvest	Reentry	Comments
CUTWORMS (MANY SPECIES) (cont.)					
flubendiamide BELT SC	2-4 fl.oz.	0.062-0.125	3	12	**DO NOT** apply more than 4 fluid ounces per acre per 7-day interval and 12 fluid ounces total per season. This is a new insecticide with a unique mode of action.
gamma-cyhalothrin PROLEX 1.25 Other trade names [2]	0.75-1.25 fl.oz. See label.	0.0075-0.0125 See label.	14 See label.	24 See label.	**DO NOT** apply more than 0.06 pounds active ingredient of gamma-cyhalothrin per acre per season.
indoxacarb STEWARD EC	9.2-11.3 oz.	0.09-0.11	14	12	**DO NOT** apply more than 45 fluid ounces per acre per season.
lambda-cyhalothrin KARATE Z 2.08 Other trade names [2]	1.28-1.92 fl.oz. See label.	0.015-0.025 See label.	14 See label.	24 See label.	**DO NOT** apply more than 0.12 pounds active ingredient of lambda-cyhalothrin per acre per season.
methomyl LANNATE 2.4 LV	1.5-3 pt.	0.45-0.9	21	48	**DO NOT** feed vines treated with methomyl. **DO NOT** make more than eight applications per crop per season or exceed 12 pints per acre per season.
zeta-cypermethrin MUSTANG MAX EC or EW	1.28-4 fl.oz.	0.008-0.025	7	12	**DO NOT** apply more than 0.15 pound active ingredient per acre per year. **DO NOT** graze livestock in treated area. **DO NOT** use treated vines or hay for animal feed.
FALL ARMYWORMS					
Identification: *Caterpillars may be green to nearly black with several bright lines on their back; a pale inverted 'Y' mark is present on the dark head capsule. Larvae overwinter as pupae in soil at shallow depths.* ***Economic threshold:*** *Apply foliar insecticide when infestations of four or more caterpillars per foot of row are present. Karate, Prolex, and Baythroid are effective on first and second instar larvae only.* ***Monitoring technique:*** *Commercial pheromone traps are available from various companies (Table 3); traps are useful in identifying various armyworm species.*					
acephate ORTHENE 75S ORTHENE 97AG Other trade names[2]	 1-1.3 lb. 12-16 oz. See label.	 0.75-1 0.75-1 See label.	 14 14 See label.	 24 24 See label.	**DO NOT** graze or feed vines treated with acephate.
cyfluthrin TOMBSTONE Other trade names[2] beta-cyfluthrin BAYTHROID XL	 2.4-2.8 fl.oz. See label. 2.4-2.8 fl.oz.	 0.038-0.44 See label. 0.019-0.022 fl.oz.	 14 See label. 14	 12 See label. 12	**DO NOT** make more than three applications of cyfluthrin and/or beta-cyfluthrin per season.
diflubenzuron DIMILIN 2L	4-8 fl.oz.	0.25-0.50	28	12	**DO NOT** make more than three applications per season. Do not exceed 24 fluid ounces per acre per season. The minimum application interval is 14 days. Apply when larvae are small. Since Dimilin is an insect growth regulator, larvae must ingest treated peanut foliage. Control of larvae may not be seen for 5 to 7 days after application.

[1] Days refers to minimum time from last application to harvest; hours refers to minimum time from last application to reentry

[2] See Table 2 for a list of other trade names.

Table 1. Peanut Insect Control (cont.)

Insecticide and Formulation	Amount of Formulation per Acre	Lb. Active Ingredient per Acre	Minimum Days/Hours[1] from Last Application to: Harvest	Reentry	Comments
FALL ARMYWORMS (cont.)					
fenpropathrin DANITOL 2.4 EC	10.66-16 oz.	0.2-0.3	14	24	
flubendiamide BELT SC	2-4 fl.oz.	0.062-0.125	3	12	**DO NOT** apply more than 4 fluid ounces per acre per 7-day interval and 12 fluid ounces total per season. This is a new insecticide with a unique mode of action.
gamma-cyhalothrin PROLEX 1.25 Other trade names[2]	1-1.5 fl.oz. See label.	0.01-0.015 See label.	14 See label.	24 See label.	**DO NOT** apply more than 0.06 pound active ingredient of gamma-cyhalothrin per acre per season.
indoxacarb STEWARD EC	9.2-11.3 fl.oz.	0.09-0.11	14	12	**DO NOT** apply more than 45 fluid ounces of indoxacarb per acre per season.
lambda-cyhalothrin KARATE Z Other trade names[2]	1.28-1.96 oz. See label.	0.02-0.03 See label.	14 See label.	12 See label.	**DO NOT** apply more than 0.12 pound active ingredient of lambda-cyhalothrin per acre per season.
methomyl LANNATE 2.4LV	0.75-1.5 pt.	0.23-0.45	21	48	**DO NOT** feed vines treated with methomyl. **DO NOT** make more than eight applications of methomyl per season or exceed 12 pints per acre per season.
spinosad BLACKHAWK TRACER 4 SC	1.7-3.3 oz. 2-3 fl.oz.	0.062-0.094	3	4	**DO NOT** feed hay until 14 days after last application of spinosad. **DO NOT** make more than three applications nor apply more than 9 fluid ounces of spinosad per season.
spinetoram RADIANT SC	3-8 oz.	0.188 lb. (max)	3	24	**DO NOT** exceed 24 fluid ounces of Radiant SC per acre per year. Do not allow grazing of peanut hay.
GRASSHOPPERS (MANY SPECIES)					

Identification: *Nymphs do not have wings; adults fly readily and can be quite large. They are generalist feeders.*
Economic threshold: *Apply foliar insecticide when defoliation exceeds 25 percent.*
Monitoring technique: *Pheromone traps unavailable for this pest; simply use a sweep net to sample insects directly from foliage.*

acephate ORTHENE 75 S ORTHENE 97 Other trade names [2]	0.33-0.67 lb. 0.25-0.5 lb. See label.	0.25-0.5 0.24-0.49 See label.	14 14 See label.	24 24 See label.	**DO NOT** feed forage or hay treated with acephate to livestock or graze treated areas.
cyfluthrin TOMBSTONE Other trade names [2] beta-cyfluthrin BAYTHROID XL	1.8-2.4 fl.oz. See label. 1.8-2.4 fl.oz.	0.028-0.38 See label. 0.014-0.019	14 See label. 14	12 See label. 12	**DO NOT** make more than three applications of cyfluthrin and/or beta-cyfluthrin per season.
gamma-cyhalothrin PROLEX 1.25 Other trade names [2]	1-1.5 fl.oz. See label.	0.01-0.015 See label.	14 See label.	24 See label.	**DO NOT** apply more than 0.06 pound active ingredient of gamma-cyhalothrin per acre per season.
lambda-cyhalothrin KARATE Z Other trade names [2]	1.28-1.92 fl.oz. See label.	0.02-0.03 See label.	14 See label.	24 See label.	**DO NOT** apply more than 0.12 pound active ingredient of lambda-cyhalothrin per acre per season.
zeta-cypermethrin MUSTANG MAX EC or EW	3.2-4 fl.oz.	0.02-0.025	7	12	**DO NOT** apply more than 0.15 pound active ingredient per acre per year. **DO NOT** graze livestock in treated area. **DO NOT** use treated vines or hay for animal feed.

[1] Days refers to minimum time from last application to harvest; hours refers to minimum time from last application to reentry
[2] See Table 2 for a list of other trade names.

Table 1. Peanut Insect Control (cont.)

Insecticide and Formulation	Amount of Formulation per Acre	Lb. Active Ingredient per Acre	Minimum Days/Hours[1] from Last Application to: Harvest	Reentry	Comments
LEAFHOPPERS					
Identification: *Small wedge-shaped body, pale green, about 0.1 inch long; head is broad and mouthparts are sucking type. They hide underneath leaves.* ***Economic threshold:*** *Apply as a foliar spray when damage (hopper burn) is evident on 20 percent or more of plants and insects are present.* ***Monitoring technique:*** *Pheromone traps unavailable for this pest; simply use a sweep net to sample insects directly from foliage.*					
acephate					**DO NOT** graze or feed vines treated with acephate.
ORTHENE 75S	1-1.3 lb.	0.75-1	14	24	
ORTHENE 97AG	12-16 oz.	0.75-1	14	24	
Other trade names[2]	See label.	See label.	See label.	See label.	
carbaryl					**DO NOT** apply more than 8 quarts or pounds of cabaryl per acre per season.
SEVIN 4F, XLR	1 qt.	1	14	12	
SEVIN 80S	1.25 lb.	1	14	12	
Other trade names [2]	See label.	See label.	See label.	See label.	
cyfluthrin					**DO NOT** make more than three applications of cyfluthrin and/or beta-cyfluthrin per season.
TOMBSTONE	1-1.8 fl.oz.	0.016-0.028	14	12	
Other trade names [2]	See label.	See label.	See label.	See label.	
beta-cyfluthrin					
BAYTHROID XL	1-1.8 fl.oz.	0.008-0.014	14	12	
gamma-cyhalothrin					**DO NOT** apply more than 0.06 pound active ingredient of gamma-cyhalothrin per acre per season.
PROLEX 1.25	0.75-1.25 fl.oz.	0.0075-0.0125	14	24	
Other trade names [2]	See label.	See label.	See label.	See label.	
lambda-cyhalothrin					**DO NOT** apply more than 0.12 pound active ingredient of lambda-cyhalothrin per acre per season.
KARATE Z	0.96-1.6 fl.oz. See label.	0.015-0.025	14	24	
Other trade names [2]		See label.	See label.	See label.	
zeta-cypermethrin					**DO NOT** apply more than 0.15 pound active ingredient per acre per year. **DO NOT** graze livestock in treated area. **DO NOT** use treated vines or hay for animal feed.
MUSTANG MAX EC or EW	1.76-4 fl.oz.	0.011-0.025	7	12	
LESSER CORNSTALK BORERS					
Identification: *Very active larva that wriggles when touched; larvae have alternate brown and purple bands. They construct sand tunnels that become attached to plant structures like roots, pegs, and pods.* ***Economic threshold:*** *Apply soil insecticide when fresh damage or borers are found at 30 percent of sites scouted in a field.* ***Monitoring technique:*** *Growers can use the Aflatoxin Risk Index model on the Alabama Weather Information System website for updated information on lesser cornstalk borer and the risk of contamination due to pathogens. Pheromone traps are available from various companies (Table 3). They are a very effective monitoring technique for estimating moth activity even when the larvae are difficult to locate in soil.*					
chlorpyrifos					Apply granules in a band over the row and pegging zone. **DO NOT** feed forage or hay to meat or dairy animals.
LORSBAN 15G	13.3 lb.	2	21	12	
Other trade names [2]	See label.	See label.	See label.	See label.	
diflubenzuron					Make applications when larvae are small, and target the spray to the base of the plant. Dimilin is an insect growth regulator, so it only acts on larval stages of insects and takes up to 7 days to show effects.
DIMILIN 2L	4-8 fl.oz. See label.	0.25-0.50	28	12	
novaluron					Diamond is an insect growth regulator and effective on small caterpillars. **DO NOT** use in conjunction with another GR15 insecticide.
DIAMOND 0.83 EC	6-12 fl.oz.	0.049-0.099	28	12	

[1] Days refers to minimum time from last application to harvest; hours refers to minimum time from last application to reentry

[2] See Table 2 for a list of other trade names.

Table 1. Peanut Insect Control (cont.)

Insecticide and Formulation	Amount of Formulation per Acre	Lb. Active Ingredient per Acre	Minimum Days/Hours[1] from Last Application to: Harvest	Reentry	Comments
LOOPERS (TWO SPECIES)					
Identification: *Caterpillars of cabbage and soybean loopers are bright green and have two pairs of abdominal prolegs; they move by looping and may drop off plants when disturbed.* ***Economic threshold:*** *Apply foliar insecticides when infestations of four or more caterpillars per foot of row are present.* ***Monitoring technque:*** *Pheromone traps are available from various companies (Table 3); moth identification is easy with traps, but always scout the crop directly.*					
flubendiamide BELT SC	2-4 fl.oz.	0.062-0.125	3	12	**DO NOT** apply more than 4 fluid ounces per acre per 7-day interval and 12 fluid ounces total per season. This is a new insecticide with a unique mode of action.
indoxacarb STEWARD EC	9.2-11.3 fl.oz.	0.09-0.11	14	12	**DO NOT** apply more than 45 fluid ounces per acre per season.
methomyl LANNATE LV	1.5-3 pt.	0.45-0.9	21	48	**DO NOT** make more than eight applications per crop per season or exceed 12 pints per acre per season. **DO NOT** feed treated vines.
novaluron DIAMOND 0.83EC	6-12 fl.oz.	0.049-0.099	28	12	For **suppression** only. **DO NOT** feed treated vines or peanut hay to livestock.
spinosad BLACKHAWK TRACER 4SC	1.7-3.3 oz. 1.5-3 oz.	0.047-0.094	3	4	**DO NOT** feed hay nor graze for 14 days after application. **DO NOT** make more than three applications nor apply more than 9 fluid ounces total per season.
REDNECKED PEANUT WORM					
Identification: *Caterpillars are pale green with dark brown head and a red band behind the head. Larvae are active when disturbed.* ***Economic threshold:*** *Apply foliar insecticide when terminal damage is excessive.* ***Monitoring technique:*** *Pheromone traps are not available for this insect; use a sweep net to estimate infestation level.*					
cyfluthrin TOMBSTONE Other trade names[2] beta-cyfluthrin BAYTHROID XL	 1-1.8 fl.oz. See label. 1.8-2.4 fl.oz.	 0.016-0.028 See label. 0.008-0.014	 14 See label. 14	 12 See label. 12	**DO NOT** make more than three applications of cyfluthrin and/or beta-cyfluthrin per season.
esfenvalerate ASANA XL	2.9-5.8 oz.	0.015-0.03	21	12	**DO NOT** feed or graze livestock on vines treated with enfenvalerate. **DO NOT** exceed 0.15 pound active ingredient of esfenvalerate per season.
flubendiamide BELT SC	2-4 fl.oz.	0.062-0.125	3	12	**DO NOT** apply more than 4 fluid ounces per acre per 7-day interval and 12 fluid ounces total per season. This is a new insecticide with a unique mode of action.
gamma-cyhalothrin PROLEX 1.25 Other trade names [2]	 0.75-1.25 fl.oz. See label.	 0.0075-0.0125 See label.	 14 See label.	 24 See label.	**DO NOT** apply more than 0.06 pound active ingredient of gamma-cyhalothrin per acre per season.
lambda-cyhalothrin KARATE Z Other trade names [2]	 0.96-1.6 oz. See label.	 0.015-0.025 See label.	 14 See label.	 24 See label.	**DO NOT** apply more than 0.12 pound active ingredient of lambda-cyhalothrin per acre per season.

[1] Days refers to minimum time from last application to harvest; hours refers to minimum time from last application to reentry

[2] See Table 2 for a list of other trade names.

Table 1. Peanut Insect Control (cont.)

Insecticide and Formulation	Amount of Formulation per Acre	Lb. Active Ingredient per Acre	Minimum Days/Hours[1] from Last Application to: Harvest	Reentry	Comments
REDNECKED PEANUT WORM (cont.)					
spinosad BLACKHAWK TRACER 4SC	1.7-3.3 oz. 1.5-3 oz.	0.047-0.094	3	4	**DO NOT** feed hay nor graze for 14 days after application. **DO NOT** make more than three applications nor apply more than 9 fluid ounces total per season.
spinetoram RADIANT SC	3-8 oz.	0.188 lb. (max)	3	24	**DO NOT** exceed 24 fluid ounces of Radiant SC per acre per year. Do not allow grazing of peanut hay.
zeta-cypermethrin MUSTANG MAX EC or EW	1.28-4 fl.oz.	0.008-0.025	7	12	**DO NOT** apply more than 0.15 pound active ingredient per acre per year. **DO NOT** graze livestock in treated area. **DO NOT** use treated vines or hay for animal feed.
SOUTHERN CORN ROOTWORM					
Identification: *Immature stages are creamish white, slender insects that are difficult to locate in soil. Heavy, poorly drained soils are favorable to rootworm infestation.* ***Economic threshold:*** *Apply soil insecticide when fresh damage or borers are found at 30 percent of sites scouted in a field.* ***Monitoring technique:*** *Traps are available from many vendors (Table 3) but monitoring kits can be expensive. The trap design is excellent and traps are reusable. Adult beetles can be sampled by sweep netting from foliage.*					
chlorpyrifos LORSBAN 15G Other trade names [2]	13.3 lb. See label.	2 See label.	21 See label.	12 See label.	Apply as a banded application over the row at early pegging through pod fill. **DO NOT** feed forage or hay to beef or dairy animals.
SPIDER MITES (MANY SPECIES)					
Identification: *Spider mites have four pair of legs and are actually closely related to ticks. Mites are microscopic arthropods (less than 1/20 inch). Species may have to be identified by Extension specialists. Two-spotted spider mites are effectively controlled with insecticides listed below.* ***Economic threshold:*** *Extensive bronzing of leaves indicates an outbreak of mites since they live in dense colonies on the undersurface of leaves.* ***Monitoring technique:*** *Look on the underside of leaves with a hand-held magnifying glass for tiny moving specks or tap the leaves on white paper and record number of mites.*					
fenpropathrin DANITOL 2.4 EC	10.67-16 oz.	0.2-0.3	14	24	**DO NOT** apply more than 2.67 pints per season. **DO NOT** graze or feed treated peanut forage or hay within 14 days of last application.
propargite COMITE 6	2 pt.	1.64	14	7 days 48 hr., if protective equipment is used	**DO NOT** apply more than twice per season. **DO NOT** graze or feed livestock on treated areas or cut treated forage for hay. May cause foliar burn, especially if temperature is greater than 90°F.
COMITE II	2.25 pt.	1.6	14	7 days 48 hr., if protective equipment is used	**DO NOT** apply more than once per season. May cause foliar burn, especially if air temperature is greater than 90°F. **DO NOT** graze or feed livestock on treated areas or cut treated forage for hay.
OMITE 30WS	3-5 lb.	0.9-1.5	14	48 hr., if protective equipment is used	**DO NOT** apply more than twice per season. **DO NOT** graze or feed livestock on treated areas or cut treated forage for hay. **DO NOT** plant unregistered crops within 6 months of last application.

[1] Days refers to minimum time from last application to harvest; hours refers to minimum time from last application to reentry.

[2] See Table 2 for a list of other trade names.

Table 1. Peanut Insect Control (cont.)

Insecticide and Formulation	Amount of Formulation per Acre	Lb. Active Ingredient per Acre	Minimum Days/Hours[1] from Last Application to: Harvest	Reentry	Comments
THREE-CORNERED ALFALFA HOPPER					
Identification: *Adult hoppers are wedge-shaped, ¼ inch long and green with broad head and tapering abdomen.* ***Economic threshold:*** *One adult per 6 foot row with more than 75 days to digging OR one adult per 3 feet of row within 25 to 75 days to digging (suggested by University of Georgia).* ***Monitoring technique:*** *No pheromone traps are available; use a sweep net for detection and monitoring.*					
carbaryl					**DO NOT** apply more than 8 quarts or pounds of carbaryl per acre per season.
SEVIN 4F, XLR	1 qt.	1	14	12	
SEVIN 80S	1.25 lb.	1	14	12	
Other trade names [2]	See label.	See label.	See label.	See label.	
cyfluthrin					**DO NOT** make more than three applications of cyfluthrin and/or beta-cyfluthrin per season.
TOMBSTONE	1.8-2.4 fl.oz.	0.028-0.38	14	12	
Other trade names [2]	See label.	See label.	See label.	See label.	
beta-cyfluthrin					
BAYTHROID XL	1.8-2.4 fl.oz.	0.014-0.019	14	12	
gamma-cyhalothrin					**DO NOT** apply more than 0.06 pound active ingredient of gamma-cyhalothrin per acre per season.
PROLEX 1.25	0.75-1.25 fl.oz.	0.075-0.0125	14	24	
Other trade names [2]	See label.	See label.	See label.	See label.	
lambda-cyhalothrin					**DO NOT** apply more than 0.12 pound active ingredient of lambda-cyhalothrin per acre per season.
KARATE Z	0.96-1.6 fl.oz.	0.015-0.025	14	12	
Other trade names [2]	See label.	See label.	See label.	See label.	
THRIPS (MANY SPECIES)					
Identification: *Submicroscopic insects less than 1/20 inch long, adult have wings that are narrow and hairy. Tobacco thrips and western flower thrips are two common species.* ***Economic threshold:*** *No action threshold for insect management. Use spotted-wilt-tolerant varieties to reduce crop losses in endemic areas.* ***Monitoring technique:*** *Pheromone traps are not available; yellow or blue sticky cards may be used but require high maintenance. Use a sheet of white paper or cardboard and tap terminal leaves or flowers to dislodge insects and estimate numbers. Place small plants in Ziploc bags and shake vigorously for 10 seconds to dislodge; then count thrips inside bag.*					
acephate					Apply as a foliar spray in seedling stage. **DO NOT** feed forage or hay to livestock or graze treated areas.
ORTHENE 75S	0.5-1 lb.	0.38-0.75	14	24	
ORTHENE 97AG	0.4-0.75 lb.	0.38-0.75	14	24	
Other trade names[2]	See label.	See label.	See label.	See label.	
ORTHENE 75S	4 oz./100 lb. seed	0.19/100 lb. seed	14	—	Apply seed treatment as a dry powder to peanut seed in the planter box. Layer in powder in thirds as seed hopper box is filled. NOTE: Germination of treated seed that become wet or moist due to rain or heavy dew may decrease.
Other trade names [2]	See label.	See label.	See label.	See label.	
gamma-cyhalothrin					Apply as a foliar spray in seedling stage. **DO NOT** apply more than 0.06 pound active ingredient of gamma-cyhalothrin per acre per season.
PROLEX 1.25	1-1.5 fl.oz.	0.01-0.015	14	24	
Other trade names [2]	See label.	See label.	See label.	See label.	
lambda-cyhalothrin					Apply as a foliar spray in seedling stage. **DO NOT** apply more than 0.12 pound active ingredient of lambda-cyhalothrin per acre per season.
KARATE Z	1.28-1.96 fl.oz.	0.02-0.03	14	24	
Other trade names [2]	See label.	See label.	See label.	See label.	

[1] Days refers to minimum time from last application to harvest; hours refers to minimum time from last application to reentry.

[2] See Table 2 for a list of other trade names.

Table 1. Peanut Insect Control (cont.)

Insecticide and Formulation	Amount of Formulation per Acre	Lb. Active Ingredient per Acre	Minimum Days/Hours[1] from Last Application to: Harvest	Reentry	Comments
THRIPS (MANY SPECIES) (cont.)					
phorate THIMET 20G Other trade names [2]	3.85 lb. (36-in. rows) See label.	0.77 See label.	90 See label.	48 See label.	Apply granules in seed furrow at planting. **DO NOT** graze or feed treated hay or forage to livestock. Available only in closed handling systems (lock 'n load). Do not apply more than 5.8 total pounds per acre on twin rows.
spinetoram RADIANT SC	3-8 oz.	0.188 lb. (max)	3	24	**DO NOT** exceed 24 fluid ounces of Radiant SC per acre per year. Do not allow grazing of peanut hay.
TOBACCO BUDWORM					
Identification: *This is a native insect whose immature stages look identical to corn earworm caterpillars; microscopic examination is needed to confirm species (budworm larvae have numerous microspines on tubercles or warts). See ANR-752, "Foliage Feeders on Alabama Peanuts," for more information.* ***Economic threshold:*** *Apply foliar insecticide when infestations of four or more caterpillars per foot of row are present.* ***Monitoring technique:*** *Pheromone traps are available from many vendors (Table 3) and are very effective in separating corn earworm and tobacco budworm moths.*					
indoxacarb STEWARD EC	9.2-11.3 oz.	0.09-0.11	14	12	**DO NOT** apply more than 45 fluid ounces per acre per season.
methomyl LANNATE 2.4LV	0.75-1.5 pt.	0.23-0.45	21	48	**DO NOT** exceed 12 pints per acre per season. **DO NOT** feed treated vines.
spinosad BLACKHAWK TRACER 4SC	1.7-3.3 oz. 1.5-3 fl.oz.	0.047-0.094	3	4	**DO NOT** feed hay until 14 days after last application. **DO NOT** make more than three applications per season. **DO NOT** apply more than a total of 9 fluid ounces per acre per season.
VELVETBEAN CATERPILLARS (VBC), GREEN CLOVERWORMS (GCW)					
Identification: *VBC are active or wiggly when disturbed; larvae are green or black with seven white longitudinal stripes and four pairs of abdominal prolegs. GCW are green larvae with three pairs of abdominal prolegs. See ANR-752, "Foliage Feeders on Alabama Peanuts," for more information.* ***Economic threshold:*** *Apply foliar insecticide when caterpillar infestations exceed four or more per row foot.* ***Monitoring technique:*** *Pheromone traps are not available for moths; larvae are easily collected in sweep nets or beat sheet.*					
Bacillus thuringiensis AGREE WG BIOBIT HP DIPEL DF JAVELIN WG XENTARI DF	 1.2 lb. 0.5-1 lb. 0.5-1 lb. 0.25-0.5 lb. 0.5-1.5 lb.	 — — — — —	 — — — — —	 4 4 4 4 4	A delay in larval mortality may occur. Use on small to medium-size larvae. At high population levels, a contact insecticide should be added or used instead.
carbaryl SEVIN 4F, XLR SEVIN 80S Other trade names[2]	 2 pt. 1.25 lb. See label.	 1 1 See label.	 14 14 See label.	 12 12 See label.	**DO NOT** apply more than 8 quarts or pounds of carbaryl per acre per season.
beta-cyfluthrin BAYTHROID XL	1-1.8 fl.oz.	0.008-0.014	14	12	**DO NOT** make more than three applications of cyfluthrin and/or beta-cyfluthrin per season.
cyfluthrin TOMBSTONE Other trade names [2]	 1-1.8 fl.oz. See label.	 0.016-0.028 See label.	 14 See label.	 12 See label.	**DO NOT** make more than three applications of cyfluthrin and/or beta-cyfluthrin per season.

[1] Days refers to minimum time from last application to harvest; hours refers to minimum time from last application to reentry.

[2] See Table 2 for a list of other trade names.

Table 1. Peanut Insect Control (cont.)

Insecticide and Formulation	Amount of Formulation per Acre	Lb. Active Ingredient per Acre	Minimum Days/Hours[1] from Last Application to: Harvest	Reentry	Comments
VELVETBEAN CATERPILLARS (VBC), GREEN CLOVERWORMS (GCW) (cont.)					
diflubenzuron DIMILIN 2L	2-4 fl.oz.	0.125-0.250	28	12	**DO NOT** make more than three applications per season. Do not exceed 24 fluid ounces per acre per season. The minimum application interval is 14 days. Apply when larvae are small. Since Dimilin is an insect growth regulator, larvae must ingest treated peanut foliage. Control of larvae may not be seen for 5 to 7 days after application. Dimilin is slightly slow in VBC control but provides great control of GCW and armyworms.
esfenvalerate ASANA XL	2.9-5.8 oz.	0.015-0.03	21	12	**DO NOT** exceed 0.15 pound active ingredient of Asana per season. **DO NOT** graze livestock in treated areas or use treated vines or hay for animal feed.
flubendiamide BELT SC	2-4 fl.oz.	0.062-0.125	3	12	**DO NOT** apply more than 4 fluid ounces per acre per 7-day interval and 12 fluid ounces total per season. This is a new insecticide with a unique mode of action.
gamma-cyhalothrin PROLEX 1.25 Other trade names [2]	0.75-1.25 fl.oz. See label.	0.075-0.0125 See label.	14 See label.	24 See label.	**DO NOT** apply more than 0.06 pound active ingredient of gamma-cyhalothrin per acre per season.
lambda-cyhalothrin KARATE Z Other trade names [2]	0.96-1.6 fl.oz. See label.	0.015-0.025 See label.	14 See label.	24 See label.	**DO NOT** apply more than 0.12 pound active ingredient of lambda-cyhalothrin per acre per season.
methomyl LANNATE 2.4LV	1.5 pt.	0.45	21	48	**DO NOT** feed vines treated with methomyl. **DO NOT** make more than eight applications per crop per season or exceed 12 pints per acre per season
novaluron DIAMOND 0.83EC	6-8 fl.oz.	0.049-0.066	28	12	Diamond is an insect growth regulator and effective on small caterpillars. **DO NOT** use Diamond in rotation with other GR15 insecticides. **DO NOT FEED** treated vines or peanut hay to livestock.
spinosad BLACKHAWK TRACER 4SC	1.7-3.3 oz. 1.5-3 fl.oz.	0.047-0.094	3	4	**DO NOT** feed hay until 14 days after last application. **DO NOT** make more than three applications per season. **DO NOT** apply more than a total of 9 fluid ounces per acre per season.
spinetoram RADIANT SC	3-8 oz.	0.188 lb. (max)	3	24	**DO NOT** exceed 24 fluid ounces of Radiant SC per acre per year. Do not allow grazing of peanut hay.
zeta-cypermethrin MUSTANG MAX EC or EW	1.28-4 fl.oz.	0.008-0.025	7	12	**DO NOT** apply more than 0.15 pound active ingredient per acre per year. **DO NOT** graze livestock in treated area. **DO NOT** use treated vines or hay for animal feed.

[1] Days refers to minimum time from last application to harvest; hours refers to minimum time from last application to reentry.

[2] See Table 2 for a list of other trade names.

Table 1. Peanut Insect Control (cont.)

Insecticide and Formulation	Amount of Formulation per Acre	Lb. Active Ingredient per Acre	Minimum Days/Hours[1] from Last Application to: Harvest	Reentry	Comments
WIREWORMS					
Identification: *Caterpillars resemble southern corn rootworm larvae; they have a long tubular body with three pairs of legs behind the head; head and mouthparts are dark. Lifecycle ranges from 3 months to 2 years.* ***Economic threshold:*** *Use bait stations or shovel for estimating infestation. More than two wireworms per sampling location indicates threat to the main crop.* ***Monitoring technique:*** *Pheromone traps are unavailable. Use wheat and corn based bait stations in ground (at several locations within field and weedy borders) up to a depth of 6 inches. Allow 7 days for bait to work and then uncover to count wireworms.*					
chlorpyrifos					***Apply as a preplant broadcast spray to soil surface. Incorporate immediately*** to a depth of 3 to 4 inches. **DO NOT** make more than one application per season. **DO NOT** feed treated forage or hay to meat or dairy animals. The total amount of chlorpyrifos applied per season must not exceed 4 pounds active ingredient per acre.
LORSBAN 4E	4 pt.	2	21	24	
LORSBAN 75WG	2.67 lb.	2	21	24	
Other trade names [2]	See label.	See label.	See label.	See label.	
chlorpyrifos					**For Suppression Only.** Apply as a banded application over the row when scouting reveals greater than 30 percent pod damage.
LORSBAN 15G	13.3 lb.	2	21	24	
Other trade names [2]	See label.	See label.	See label.	See label.	

[1] Days refers to minimum time from last application to harvest; hours refers to minimum time from last application to reentry.

[2] See Table 2 for a list of other trade names.

Table 2. Peanut Insecticide Common Chemical Names and Classes, Trade Names, and Formulations

Insecticide Common Name	IRAC Chemical Class *	Trade Name and Formulation
acephate**	1B	Orthene 75S, Orthene 97AG, Acephate 75S, Acephate 90S
Bacillus thuringiensis (Bt, OMRI listed***)	11	Subspecies aizawai: Agree WG (50% Bt), Xentari DF (54%) Subspecies kurstaki: BioBit HP (58% Bt), Dipel DF (54% Bt), Dipel ES (24% Bt), Javelin WG (85% Bt)
bifenthrin	3A	Brigade 2EC
carbaryl	1A	Sevin XLR, Sevin 80S, Sevin 4F, Carbaryl 4L
chlorpyrifos	1B	Lorsban Advanced, Lorsban 4E, Lorsban 15G, Lorsban 75WG, Nufos 4E, Chlorpyrifos 4E, Smartbox
cyfluthrin	3A	Tombstone, Tombstone Helios
beta-cyfluthrin	3A	Baythroid XL
diflubenzuron +	15	Dimilin 2L
esfenvalerate	3A	Asana XL
fenpropathrin	3A	Danitol 2.4EC
flubendiamide		Belt SC
gamma-cyhalothrin	3A	Prolex 1.25, Proaxis, Declare
indoxacarb	22	Steward EC
imidacloprid	4	Sherpa
lambda-cyhalothrin	3A	Grizzly Z, Karate with Zeon Technology, Warrior with Zeon Technology, Lambda, Lambda T, Silencer
methomyl	1A	Lannate LV
methoxyfenozide	18	Intrepid 2F
novaluron	15	Diamond 0.83EC
phorate**	1B	Thimet 20G, Phorate 20G
propargite	—	Omite 30WS, Comite, Comite II
spinetoram	5	Radiant
spinosad	5	Blackhawk, Tracer 4SC
zeta-cypermethrin	3A	Mustang Max EC, Mustang Max EW

*Recommended by the Insecticide Resistance Action Committee

**Systemic insecticide—read insecticide label carefully before use.

***OMRI = Organic Materials Review Institute approved for organic peanut production

+ Insect growth regulators are effective only against larval or immature stages.

Table 3. Some Commercial Insect Pheromone Lures and Traps That May Be Used Around Peanut Fields to Detect Early Insect Pest Infestations

	MANUFACTURERS			
INSECT	Scentry Biologicals [1]	Pherocon Traps Trece, Inc.) [2]	Great Lakes IPM [3]	Arbico Organics [4]
Army Cutworms	•			•
Armyworm, True	•	•	•	•
Armyworm, Beet	•		•	•
Armyworm, Fall	•		•	•
Armyworm, Southern	•			
Armyworm, Yellow-striped		•		
Black Cutworm	•		•	•
Glassy Cutworm		•		
Alfalfa Looper		•		
Cabbage Looper	•	•	•	•
Soybean Looper	•			•
Corn Earworm	•		•	•
Tobacco Budworm	•	•	•	•
Variegated Cutworm	•	•		
Lesser Cornstalk Borer		•	•	
Corm Rootworm	•	•	•	
Stinkbugs (complex)		•		

[1] Scentry Biologicals, Montana (1-800-735-5323)

[2] Pherocon Traps (Trece, Inc.), Oklahoma (1-866-785-1313)

[3] Great Lakes IPM, wholesale IPM suppliers located in Michigan (1-800-235-0285)

[4] Arbico Organics, suppliers of mini-kits located in Arizona (1-800-827-2847)

Disclaimer: The above list of products may change over time. Please inquire directly with the company about available products and package units. Mention of company name and products does not mean endorsement of those products.

Table 4. Common Beneficial Insects Occurring in Peanut Fields

Predatory Insects	Activity
Flower Bugs	Feed on thrips, spider mites, aphids, small caterpillars
Big-Eyed Bugs	Feed on variety of small insects, including caterpillars
Spined Soldier Bugs	Found on weedy field borders mid-season. Generalist predator of many insects.
Lady Beetles, Lacewings	Actively devour small caterpillars and thrips. Immature forms of lady beetle and lacewing look very different from adult insect.
Predacious Mites	Feed on pest mites.
Parasitic Wasps	**Activity**
Ichnuemonid Wasps	Feed on small caterpillars. Parasitic wasps may be difficult to see in field but can get accidentally captured in sticky traps.
Encyrtid Wasps	Feed on small caterpillars of the cabbage looper
Scelionid Wasps	Destroy egg masses of stink bugs

Insect Control section prepared by Ayanava Majumdar, Extension Entomologist, Alabama Cooperative Extension System, Alabama A&M University and Auburn University.

DISEASE AND NEMATODE CONTROL

Peanut diseases significantly reduce yield and nut quality. Poor peanut stands are often the result of seed rot or seedling disease. Control of early and late leaf spot requires a program of regular fungicide sprays to avoid defoliation of peanuts before harvest. Several soilborne fungi and nematodes damage stems, crowns, roots, and pods of peanut plants. A combination of chemical and management practices is usually necessary to control diseases and nematodes on peanuts.

Management Practices for Disease Control

Management practices are an important part of a peanut disease control program. Such practices alone cannot prevent outbreaks of disease or nematodes on peanuts. However, they are a good method of reducing losses and, thus, reducing the need for expensive chemical treatments.

Rotating peanuts with pasture grasses, cotton, grain sorghum, and corn for two to three growing seasons can reduce the incidence of leaf spot diseases and white mold as well as root-knot nematodes. Avoid peanut-soybean rotations because both crops are susceptible to white mold and peanut root-knot.

See Extension Circulars ANR-368, "Soilborne Diseases of Peanuts," ANR-393, "Nematode Pests of Peanuts," and ANR-856, "Nematode Suppressive Crops," for more information on using crop rotation to control diseases and nematode pests on peanuts.

Deep plowing of the previous season's peanut crop residue can be an effective method of reducing leaf spot and white mold pressure. Turning crop residues 6 inches below the soil surface should slow the movement of pathogenic fungi onto young peanut plants. Planting into corn or cotton crop debris using reduced tillage practices will not increase the risk of leaf spot diseases, white mold, or Cylindrocladium black root rot (CBR).

Using recommended herbicides minimizes the need for cultivation which can encourage disease. Mechanical cultivation between rows for weed control may move soil over the runners or main stem, making the plants more susceptible to white mold. If cultivation is needed, use flat sweeps or other equipment designed to minimize soil movement.

Table 5. Peanut Disease Control

Fungicide and Formulation	Amount of Formulation Per 100 lb. Seed	Comments
SEED ROT AND SEEDLING DISEASES		
azoxystrobin + fludioxonil + mefenoxam DYNASTY PD	3.4 oz.	Combining products is **NOT RECOMMENDED**. Follow manufacturer's directions for treating seed. **DO NOT** use treated seed for food, feed, or oil. Dynasty PD is active against fungi such as *Rhizoctonia solani* and Cylindrocladium and will suppress seed rot and seedling disease caused by *Aspergillus* niger.
carboxin + PCNB + captan + metalaxyl PREVAIL	4-8 oz.	
thiamethoxam + azoxystrobin + fludioxonil + mefanoxam CRUISER MAXX	3-4 oz.	
SEED AND ROOT ROT		
Bacillus subtilis KODIAK HB	2-4 oz.	**Hopper Box Treatment:** Use is recommended for peanuts planted before April 25 to suppress seed rot and seedling disease caused by *Rhizoctonia, Fusarium*, and *Aspergillus*, and to improve *Rhizobium* nodulation.
ASPERGILLUS AND PYTHIUM SEED ROT, DAMPING-OFF, AND EARLY WHITE MOLD SUPPRESSION		
azoxystrobin ABOUND 2SC AZAKA	0.4-0.8 fl.oz./ 1000 row ft.	**In-Furrow Spray:** Mount the nozzle so that the spray mixture is applied into the open seed furrow just in front of the press wheel. May also be applied on a 4- to 6-inch band in 20 gallons per acre per treated acre at 100 percent emergence. Use higher rate when weather is cool and wet. Use for the control of *Aspergillus-, Pythium-,* and *Rhizoctonia*-incited seed rots and seedling damping-off, as well as suppression of white mold. See label for additional information.
AFLATOXIN AND A. FLAVUS		
AFLA-GUARD GR	20 lb.	Apply on a band over the row middle approximately 60 days after planting (full canopy) when there is enough soil moisture for plant growth.
RHIZOCTONIA SEED ROT AND DAMPING-OFF		
flutolanil CONVOY	1.68 fl.oz./1000 row ft. (25 fl.oz./A)	I**n-Furrow Spray:** Apply as a directed spray on a 4- to 8-inch band into the seed furrow over the seed and then cover. Apply in a minimum of 3 gallons of spray volume per acre. Application rate will vary by row spacing. See label for additional application information.

Table 5. Peanut Disease Control (cont.)

Fungicide and Formulation	Amount of Formulation Per 100 lb. Seed	Comments
EARLY AND LATE LEAF SPOT, WEB BLOTCH		
Leaf Spot Advisory: *Absolute, Bravo Weather Stik, Bravo Ultrex, Orius, Propimax, Provost, and Tilt may be applied according to the rules of a leaf spot forecasting advisory such as AU-Pnut* and Peanut Risk Index. Refer to the product label for specific guidelines concerning the use of any of the above fungicides in a disease forecasting or advisory program.* ***If white mold and limb rot control is desired, do not use a leaf spot advisory to schedule tebuconozole applications.***		
dodine ELAST 400 FLOWABLE	0.9-1.5 pt.	Begin sprays 35 to 40 days after planting and repeat at 10- to 14-day intervals. Under heavy pressure of early leaf spot, use higher rate. For control of both early and late leaf spot, apply propiconazole at a rate of 4 ounces per acre. Apply a propiconazole + chlorothalonil fungicide tank mixture in any field that will be treated later in the season with generic tebuconazole formulation. All applications of propiconazole made after July 15 ***must*** be tank mixed with chlorothalonil. Propiconazole does not control peanut rust, white mold, or *Rhizoctonia* limb rot. Tilt, Bumper, and Propimax are triazole fungicides. See Extension Circular ANR-369, "Foliar Disease of Peanut," for additional information on triazole-resistance management strategies. Apply no more than 1.5 pounds per acre per year of T-Methyl 70WSB. Do not make more than three applications of Elast Flowable at the rate of 1.5 pints per acre per year. See Elast 400 Flowable label for additional use guidelines.
propiconazole BUMPER ES TILT 3.6E PROPIMAX	2.5-4 fl.oz. 2.5-4 fl.oz. 2.5-4 fl.oz.	
propiconazole TILT 3.6E or BUMPER ES or PROPIMAX + chlorothalonil BRAVO WEATHER STIK or ECHO 720 6F	2 fl.oz. 2 fl.oz. 2 fl.oz. 1 pt. 1 pt.	
propiconazole/chlorothalonil TILT BRAVO SE ECHO PROPIMAX CO-PACK	1.5-2.25 pt. See label.	
thiophanate-methyl T-METHYL 70WSB or TOPSIN 4.5FL or T-METHYL 4.5AG or TOPSIN M 70 WDG + chlorothalonil BRAVO WEATHER STIK or ECHO 720 6F or CHLOROTHALONIL 720F	0.5 lb. 10 fl.oz. 10 fl.oz. 0.5 lb. 1 pt. 1 pt. 1 pt.	
EARLY AND LATE LEAF SPOT, PEANUT RUST		
azoxystrobin ABOUND 2SC	6.2-18.3 fl.oz.	For control of foliar diseases only. Make no more than two applications 10 to 14 days apart as part of a recommended seven-application calendar disease control program.
azoxystrobin + cyproconazole ABOUND 2SC + ALTO 100SL	12.24 fl.oz.+ 5.5 fl.oz.	

* See 2014 AU-Pnut Rules for Peanut Leaf Spot Control, page 215.

Table 5. Peanut Disease Control (cont.)

Fungicide and Formulation	Amount of Formulation Per 100 lb. Seed	Comments
EARLY AND LATE LEAF SPOT, PEANUT RUST, WEB BLOTCH		
chlorothalonil		**General Leaf Spot Spray Program Guidelines.** Begin sprays no later than 40 days after planting or by June 1. Using the AU-Pnut* leaf spot advisory, start sprays after the fifth shower of more than 0.1 inch but no later than 40 days after planting. Start sprays within 30 days of planting on late May- and June-planted peanuts. If needed, chlorothalonil fungicides may be tank mixed with cracking or early postemergence herbicide sprays. Repeat sprays every 10 to 14 days up to 2 weeks before harvest. During periods of frequent rain showers, shorten spray intervals to 7 to 10 days. Adjust spray intervals to account for changes in weather conditions and rotation practices. For peanut rust and web blotch control, apply high rate at 7- to 10-day intervals. Scout fields weekly for both diseases, starting in early August. Rust can cause significant damage in Baldwin, Escambia, and Mobile Counties. The first and possibly the second leaf spot sprays of the year can be banded over the row middle, particularly in a well-rotated field or when May and June weather is relatively dry. Absolute may be used in approved disease forecasting or risk index programs.
BRAVO ULTREX	0.9-1.36 lb.	
BRAVO WEATHER STIK	1-1.5 pt.	
CHLORONIL 720	1-1.5 pt.	
CHLOROTHALONIL 720	1-1.5 pt.	
ECHO 90DF	1-1.25 lb.	
ECHO 720 6F	1-1.5 pt.	
EQUUS 720 SST	1-1.5 pt.	
EQUUS DF	0.9-1.36 lb.	
chlorothalonil + tetraconazole		
ECHO EMINENT CO-PACK	1 pt. + 0.45 pt.	
copper hydroxide		
KOCIDE 3000	0.75-1.25 lb.	
+		
chlorothalonil		
BRAVO ULTREX	1 lb.	
BRAVO WEATHER STIK	1 pt.	
tebuconozole + trifloxystrobihn		
ABSOLUTE 500SC	3.5 fl.oz.	
EARLY AND LATE LEAF SPOT, PEANUT RUST, WEB BLOTCH, WHITE MOLD SUPPRESSION		
flutriafol		Can be integrated into the standard calendar spray schedule with other fungicides such as chlorothalonil with Topguard being applied beginning mid-block (applications 3 to 6) for a total of up to four applications. Apply chlorothalonil before and following the Topguard application block. Use higher rate in fields with a history of disease. May be tank mixed with chlorothalonil for resistance management purposes. Irrigation after Topguard applications will enhance soil activity. May be tank mixed with other fungicides to enhance soil disease control.
TOPGUARD	7-14 fl.oz.	
EARLY AND LATE LEAF SPOT; PEANUT RUST; WEB BLOTCH; RHIZOCTONIA LIMB, PEG, AND POD ROT; WHITE MOLD; SUPPRESSION OF CBR		
fluxapyroxad + pyraclostrobin		For leaf spot, rust, and web blotch control begin applications prior to disease development and repeat at 14- to 21-day intervals for a total of three Priazor applications as part of a recommended 14-day calendar leaf spot spray program. For Rhizoctonia diseases and white mold, apply at 8 fl. oz. per acre before disease development and repeat at 14- to 28-day intervals. Apply no more than 24 fluid ounce per acre of Priaxor per year. Use higher rate at shorter interval when disease pressure is high or if field has a history of disease. Do not make more than two consecutive applications of Priaxor before switching to a fungicide with a different mode of action. Maximum number of Priaxor applications per season is three.
PRIAXOR	4-8 fl.oz.	

Table 5. Peanut Disease Control (cont.)

Fungicide and Formulation	Amount of Formulation Per 100 lb. Seed	Comments
EARLY AND LATE LEAF SPOT; PEANUT RUST; WEB BLOTCH; RHIZOCTONIA LIMB, PEG, POD, AND STEM ROT; WHITE MOLD; SUPPRESSION OF CBR		
penthiopyrad FONTELIS	12-24 fl.oz.	Integrate into the standard seven-application calendar spray schedule with other fungicides such as chlorothalonil. Begin applications before symptoms appear and repeat applications at 14- to 21-day intervals. Use higher rate at shorter intervals when disease pressure is high and when white mold control is needed. Make no more than three consecutive applications of Fontelis fungicide before switching to another fungicide with a different mode of action. Use the higher rate in fields where the risk of damaging stem rot outbreaks is high.
	16-24 fl.oz.	For the control of white mold and suppression of CBR in peanut. Begin applications before symptoms appear and repeat applications at 14- to 21-day intervals. Use higher rate at shorter intervals when disease pressure is high.
EARLY AND LATE LEAF SPOT, PEANUT RUST, WHITE MOLD		
metconazole QUASH 50WDG QUASH 50WDG + chlorothalonil (as needed) BRAVO WEATHER STIK or BRAVO ULTREX or ECHO 720 6F	 2.5-4 oz. 2.5-4 oz. 0.75-1 pt. 0.7-0.9 lb. 0.75-1 pt.	Make four consecutive sprays (block) at 14-day intervals beginning about 60 days after planting or no earlier than mid-July (applications 3, 4, 5, and 6 in a 7-spray calendar program). Applications should target control of leaf spot with chlorothalonil. As areas where reduced tebuconazole performance are seen, tank mix Quash 50WDG with chlorothalonil. To control white mold, use highest rate of Quash. See comments concerning Triazole Fungicide Resistance Management under tebuconazole.
EARLY AND LATE LEAF SPOT, PEANUT RUST, RHIZOCTONIA LIMB ROT, WHITE MOLD		
fluoxastrobin EVITO fluoxastrobin + tebuconazole EVITO T	 5.7 fl.oz. 6-11.2 fl.oz.	Make no more than two consecutive applications of Evito or Evito T at 14-day intervals in a seven-application fungicide treatment program. For season-long leaf spot and rust control, apply the recommended rate of a non-strobilurin fungicide before and after applications of Evito or Evito T for a total of approximately seven fungicide applications a year. Use higher rate of Evito T to insure effective control of white mold or *Rhizoctonia* limb rot. See label for additional information concerning application rates. Make no more than four applications of Evito or Evito T per year. Evito and Evito T are Group 11 (strobilurin) fungicides. See guidelines for Strobilurin Fungicide Resistance Management under azoxystrobin.
EARLY AND LATE LEAF SPOT, PEANUT RUST, RHIZOCTONIA LIMB ROT, WEB BLOTCH, WHITE MOLD		
pyraclostrobin HEADLINE 2.09SC	6-15 fl.oz.	Make no more than two applications of Headline as part of a standard calendar spray program. Applications may be made at 14- to 21-day intervals. Do not make more than two consecutive applications of Headline. At application intervals longer than 14 days, apply 9 to 15 fluid ounces per acre. Shorten intervals and increase rates when weather patterns favor rapid disease spread or when heavy leaf shed and spotting have been seen. Also use the 9-to-15-fluid-ounces-per-acre rule for while mold control. Headline may be included in a fungicide program with Bravo Ultrex/ Echo/Equus, Tilt, Propimax, Artisan, and Convoy. To enhance activity against leaf spot diseases at extended treatment intervals, add a low rate of a non-ionic surfactant such as Induce to Headline tank mixtures.
	9-15 fl.oz.	**For White Mold and Rhizoctonia Limb Rot Control:** See above paragraph for application instructions. Best results against while mold are often seen with night applications programs
	12-15 fl.oz.	**For CBR Suppression:** See above paragraph for application direction and intervals.

Table 5. Peanut Disease Control (cont.)

Fungicide and Formulation	Amount of Formulation Per 100 lb. Seed	Comments
EARLY AND LATE LEAF SPOT, PEANUT RUST, RHIZOCTONIA LIMB ROT, SUPPRESSION OF CBR, WHITE MOLD		
tebuconazole MUSCLE 3.6F ORIUS 3.6F TRISUM 3.6 F TEBUSTAR 3.6 L	 7.2 fl.oz 7.2 fl.oz. 7.2 fl.oz 7.2 fl.oz	Make four consecutive sprays (block) at 12- to 14-day intervals, beginning no earlier than 45 days and preferably about 60 days after planting or no later than early July. Apply a recommended rate of a chlorothalonil fungicide before and, if needed, after the block of four Folicur sprays. ***For leaf spot control with tebuconazole***, tank mix with a chlorothalonil fungicide, particularly in Covington, Escambia, Geneva, Houston, Baldwin and Mobile Counties. ***Tank mix*** with a chlorothalonil fungicide at a rate listed under Triazole Fungicide Resistance Management (see below) in any field that has been sprayed earlier with Tilt, Bumper, or Propimax + chlorothalonil only. When applied alone, add the lowest recommended rate of a ***non-ionic surfactant*** to tebuconazole fungicides. ***No surfactant*** is needed when a tebuconazole fungicide is mixed with a chlorothalonil fungicide. During periods of frequent rain showers, tank mixing a tebuconazole fungicide with a chlorothalonil fungicide is **STRONGLY RECOMMENDED**. Never apply reduced rates of a triazole fungicide. **Note:** Overuse of stickers and other spray adjuvants may reduce fungicide effectiveness against white mold, particularly on dryland peanuts. In irrigated fields, water peanuts 24 to 48 hours after fungicide application. If rain occurs within 24 hours of an application of a tebuconazole fungicide, apply a chlorothalonil fungicide within 7 days. During drought conditions, try to apply tebuconazole fungicides to dryland peanuts a day or two before rain is forecast. See Extension Circular ANR-368, "Soilborne Diseases of Peanuts," for additional information on resistance management strategies. **Triazole Fungicide Resistance Management:** Continued use of triazole fungicides (Artisan, Bumper, Muscle, Orius, Propimax, Quash, Tebustar, Trisum, Tebuzol, and Tilt 3.6E) in the same field year after year will cause leaf spot control failures due to resistance or increased tolerance to these fungicides in target fungi. If ***four or more*** applications of one or more triazole fungicides are planned, tank mix Bravo, Echo. Chloronil 720, Chlorothalonil 720, or Equus at specified rates with ***all*** triazole fungicide sprays applied in the field in the current year. **Note:** Under drought conditions, tank mixing chlorothalonil with tebuconazole may decrease this fungicide's effectiveness against white mold and limb rot on dryland peanuts but not on irrigated peanuts. If tebuconazole has been applied to peanuts in the same field for 3 consecutive years, consider applying Abound 2SC, Convoy + Bravo, or Headline instead of tebuconazole for control of soilborne and foliar diseases of peanuts. **Comments:** Tebustar, Trisum, Tebuzole, Orius, Propimax, and Tilt have both protective and curative activity against leaf spot fungi while chlorothalonil fungicides are only protective. If sprays are delayed by rain, use Tebustar, Trisum, Tebuzole,, Orius, Propimax, or Tilt to knock out new leaf spot infections. When using ground equipment, apply in 10 to 20 gallons of spray mixture per acre at 60 to 80 psi and a minimum of 5 gallons of spray mixture per acre by air. Replace worn nozzles and recalibrate spray equipment. **DO NOT** feed peanut hay treated with any of the above fungicides to livestock.
tebuconazole ORIUS 3.6F + chlorothalonil BRAVO WEATHER STIK or BRAVO ULTREX or ECHO 6F	 7.2 fl.oz 0.75-1 pt. 0.7-0.9 lb. 0.75-1 pt.	
tebuconazole + chlorothalonil ECHO WITH MUSCLE 3.6F CO-PACK MUSCLE ADV	 1 pt. + 7.2 fl.oz. 2 pt.	

Table 5. Peanut Disease Control (cont.)

Fungicide and Formulation	Amount of Formulation Per 100 lb. Seed	Comments
EARLY AND LATE LEAF SPOT, PEANUT RUST, WEB BLOTCH, WHITE MOLD, CBR, RHIZOCTONIA LIMB ROT		
prothioconazole + tebuconazole PROVOST 433SC	7-8 fl.oz.	**For control of leaf spot diseases, rust, web blotch, white mold, *Rhizoctonia* limb rot:** Make four consecutive sprays (block) beginning about 60 days after planting or starting no later than mid-July and repeat at approximately 14-day intervals. Apply a recommended rate of a chlorothalonil fungicide before and as needed after the four-spray Provost block. Prothioconazole and tebuconazole are both triazole (sterol) fungicides. See comments under Triazole Fungicide Resistance Management. May be used in approved disease forecasting or risk index programs. See label for additional instructions concerning advisory spray programs. Avoid use of silicon-based surfactants and multiple tank-mix partners with Provost.
	10.7 fl.oz.	**For CBR Suppression:** See above application guidelines for CBR suppression. **Resistance Management:** Make no more than four applications of a triazole fungicide(s) per season. Apply fungicides with a different mode of action before and after applications of Provost 433SC to discourage the development of resistant strains.
EARLY AND LATE LEAF SPOT, RHIZOCTONIA LIMB ROT, SUPPRESSION OF CBR, WHITE MOLD		
azoxystrobin ABOUND 2SC AZAKA azoxystrobin + cyproconazole ABOUND 2SC + ALTO 100SL	12.0-24.5 fl.oz. 12.0-24.5 fl.oz. + 5.5 fl.oz.	Make broadcast foliar applications approximately 60 and 90 days after planting. Use higher rate in fields where heavy soilborne disease pressure is expected and serious disease-related losses have occurred in past years. Applications may be made earlier if weather conditions favor disease development. For season-long control of early and late leaf spot, apply the recommended fungicide at 10- to 14-day intervals, before and after applying Abound, for a total of approximately seven fungicide applications per year. Abound will give 10 to 14 days of protection from early and late leaf spot. Under heavy disease pressure or fields with a history of peanut production, use at least 18.5 fluid ounces per acre. Rates below 18.5 fluid ounces per acre may be used in nonirrigated fields under dry environmental conditions. Use the 18.5 to 24.5 fluid ounce rate for CBR suppression. **DO NOT** apply Abound within 14 days of digging and **DO NOT** make more than two applications per year. Abound may be applied with ground equipment or by air. Early and late leafspot, Rust, Rhizoctonia limb and pod rot, white mold.
EARLY AND LATE LEAF SPOT, RUST, RHIZOCTONIA LIMB AND POD ROT, WHITE MOLD		
azoxystrobin + tebuconazole CUSTODIA	15.5 fl. oz	For leaf spot control, apply 30 to 40 days after planting and continue at 14-day intervals. For Rhizoctonia limb and pod rot and white mold, apply 60 and 90 days after planting. Apply a chlorothalonil fungicide as needed before and after Custodia applications for a total of 7 fungicide applications. Do not apply more than 61 fl. oz. of Custodia per season (4 applications).
		Strobilurin Fungicide Resistance Management: Continued use of strobilurin fungicides in the same field year after year may eventually result in leaf spot control failures due to increasing tolerance. Abound 2SC, Evito, and Headline 2.09E are strobilurin fungicides that have a similar mode of action against target fungi. One of the components of Absolute is also a strobilurin fungicide. Avoid applying Abound, Evito, Headline, and/or Absolute to the same peanuts in the same growing season. FRAC guidelines specify that no more than two applications of any strobilurin fungicide may be made per year to the same field of peanuts without a broad-spectrum fungicide tank-mix partner. If more than two strobilurin fungicide applications are planned, add a recommended rate of Bravo Ultrex/Echo/Chloronil 720/Equus to all tank-mix strobilurin combinations. See Triazole Fungicide Resistance Management.

Table 5. Peanut Disease Control (cont.)

Fungicide and Formulation	Amount of Formulation Per 100 lb. Seed	Comments
EARLY AND LATE LEAF SPOT, RHIZOCTONIA LIMB ROT, WHITE MOLD		
propiconazole + flutolanil ARTISAN 3.6E + chlorothalonil BRAVO WEATHER STIK ECHO 720 6F EQUUS 720 SSF	13-21 fl.oz. 1 pt. 1 pt. 1 pt.	**Four-Application Block Application Program:** Tank mix with 1 pint per acre of a chlorothalonil fungicide to ensure good late leaf spot or rust control. Make first application approximately 60 days after planting and repeat at 10- to 14-day intervals until four consectutive applications of Artisan 3.6E are made. Apply a recommended fungicide(s) before and after the four applications of Artisan. See guidelines for Triazole Resistance Management under tebuconazole. Artisan maximum use is 84.5 fluid ounces per acre.
ARTISAN 3.6.E	26-32 fl.oz.	Use higher rate in fields with history of severe white mold. Make first spray 45 to 60 days after planting, depending on weather patterns and disease pressure or at first sign of disease. Apply the second spray approximately 21 to 30 days later. When using the low rate (26 fluid ounces) of Artisan, a third spray may be made as needed. Make scheduled leaf spot sprays in between each application of Artisan 3.6E. In areas where late leaf spot or peanut rust is common or triazole-resistant strains of the early and late leaf spot fungus occur, tank mix Artisan 3.6E with a chlorothalonil fungicide. A regularly scheduled leaf spot program should precede and follow Artisan applications.
CBR AND WHITE MOLD SUPPRESSION		
prothioconazole PROLINE 480SC	0.4 fl.oz./1000 row ft. (5.7 fl.oz./A)	**In-furrow and Banded Application for CBR and White Mold Suppression:** Apply in seed furrow or in a 4- to 6-inch band over the row prior to seedling emergence. May also be applied on a 4- to 6-inch band over the row at 100 percent seedling emergence (true ground cracking) in fields with a history of severe white mold. See label for additional instructions and use restrictions. For best results, use in conjunction with four-block spray program of Provost 433SC. Minimum application volume for in-furrow or banded application is 20 gallons per acre.
RHIZOCTONIA LIMB ROT		
tebuconazole + trifloxystrobin ABSOLUTE 500SC	7 fl.oz.	Apply 90 and 104 days after planting for Rhizoctonia limb rot control. See label for additional instructions and use restrictions.
RHIZOCTONIA LIMB ROT, WHITE MOLD		
pyraclostrobin HEADLINE 2.09E	9-15 fl.oz.	Make two or three applications approximately 60 to 100 days after planting. At treatment intervals longer than 14 days, apply Headline at 15 fluid ounces per acre. Where severe yield losses to white mold have previously occurred, Headline may be alternated with Artisan 3.6F, or Convoy + Bravo Ultrex/Echo/Equus. Best results with Headline against white mold have been obtained with night applications. See label for more information on application guidelines.
RHIZOCTONIA POD AND LIMB ROT, WHITE MOLD		
flutolanil CONVOY	20-32 fl.oz. 10-20 fl.oz.	For a two-application program, make the first application 45 to 60 days after planting or at first sign of disease and follow with a second application 21 to 30 days later. Use higher rate in fields with a history of disease. Convoy will not control leaf spot diseases, peanut rust, or web blotch. Apply a recommended leaf spot fungicide for their control. See chlorothalonil for leaf spot control guidelines. May be used with an approved disease risk index program. For a four-application block treatment program, tank mix Convoy with scheduled leaf spot fungicide beginning 45 to 60 days after planting or at first sign of disease. Repeat applications of Convoy + chlorothalonil tank mixture at 10- to 14-day intervals for a total of four applications. See chlorothalonil for leaf spot control guidelines.

Table 5. Peanut Disease Control (cont.)		
Fungicide and Formulation	Amount of Formulation Per 100 lb. Seed	Comments
NEMATODES (PEANUT ROOT-KNOT, RING, LESION)		
General Comments on Nematode Control: *In root-knot infested fields, consider planting an early-maturing runner-peanut cultivar, such as Andru II, on recommended planting dates in combination with a recommended nematicide to reduce the impact of nematodes on peanut yield and grade. To avoid some nematode damage, plant heavily root-knot infested fields in mid to late April. Avoid planting the Southern Runner peanut cultivar in root-knot infested fields. See Extension Circular ANR-393, "Nematode Pests of Peanuts," for more information on nematode control.*		
	Preplant	
1-3D TELONE II	4.5-6 gal. (row) 6-9 gal. (broadcast)	Apply as a broadcast plow sole treatment in fall or early spring for suppression of light to moderate nematode infestations. Treat 7 to 10 days before planting peanuts or a cover crop. For best results, apply with mold board plow to a depth of 10 inches below final planting surface. Seal furrow or drag immediately after application. Soil should remain undisturbed for at least 1 week prior to planting. Rates up to 9 gallons per acre may be required to control heavy root-knot nematode infestations. Refer to product label for additional application information. Under heavy nematode pressure, a supplemental application of Temik 15G at-plant or early postplant is suggested. Will not provide any thrips control.
NEMATODES (ROOT-KNOT, RING, LESION, STING) AND THRIPS		
oxamyl VYDATE C-LV	17 fl.oz.	Foliar applications are to be used only following preplant fumigant or at-planting contact nematicides. Band or broadcast beginning 14 to 28 days following peanut emergence. Make second application 14 days later. For band applications, use proportionally less material based on row spacing and band width.

Table 6. Properties of Fungicides and Nematicides Used on Peanuts That May Affect Water Quality

Common Name	Trade Name	Surface-Loss Potential[1]	Leaching Potential[2]
Chlorothalonil	Bravo, Echo	Medium	Small
Propiconazole	Propimax, Tilt	Medium	Medium
Tebuconazole	Orius	NA	NA

[1] The surface-loss potential indicates the tendency of the pesticide to move with sediment in runoff.

[2] The leaching potential indicates the tendency of the pesticide to move in solution with water and to leach below the root zone.

NA = Information not available.

SCOUTING TIPS

Leaf Spot

The effectiveness of your peanut leaf spot spray program should be periodically evaluated. If disease control is not adequate, adjustments can be made to prevent serious yield losses. If leaf spot control is fair to poor, shorten the interval between fungicide applications or increase the application rate to the highest amount on the label. Disease development will continue 14 days or more before any improvement in leaf spot control will be seen following this change in your spray program. See ANR-598, "Peanut Pest Management Scout Manual," for a complete description of peanut scouting procedures. Disease management programs are described in detail in ANR-369, "Foliar Diseases of Peanut."

White Mold

Unlike scouting for leaf spot and insects, fields should be checked once a year for white mold just before or after digging. Simply count the number of white mold hits in 100 feet of row. Sample plants at several locations in a field. A hit is considered a dead plant or group of plants no more than 1 row foot in length. As a rule of thumb, an average of three to four hits per 100 row feet indicates that a fungicide treatment would be justified in the following season. If the hit count is extremely high, rotation to a non-host crop is recommended. White mold control procedures are described in detail in ANR-368, "Soilborne Diseases of Peanut."

Cylindiocladium Black Root Rot (CBR)

Check peanuts for CBR just before harvest. Symptoms can be confused with those of TSWV (tomato spotted wilt virus), white mold, or peanut root-knot nematode. Typically, the tap root of CBR-damaged peanuts appears shredded. The brick-red fruiting bodies of the causal fungus usually appear on the rotted crown or pegs. Use the same scouting procedures that are described for white mold. See ANR-368, "Soilborne Diseases of Peanut," for more information on CBR.

Tomato Spotted Wilt Virus (TSWV)

TSWV can have a sizable impact on the yield of susceptible peanut cultivars. Fields should be checked for TSWV levels in August or September when moisture levels are good for plant growth. A rough estimate of the incidence of this disease can be made by counting the number of TSWV hits of diseased plants in 1 foot of row down 100 feet of row. Yield loss to TSWV really becomes noticeable when hit counts over four or five locations in a field exceed 20 percent.

Nematodes

Collection of soil samples for nematode assay is recommended in every field going into peanuts no matter what its previous crop history. Particular attention should be paid to fields in continuous peanuts, summer fallow behind peanuts, soybeans, or soybean-peanut rotations due to the high risk of nematode problems associated with poor rotation practices. See ANR-393, "Nematode Pests of Peanuts," for more information on nematode control procedures.

Samples for nematode assay must be collected in late summer through fall when nematode populations in the soil are greatest. Do not sample for nematodes in the spring. Nematode populations are usually so low at this time of the year that it is impossible to make accurate control recommendations. See ANR-114, "Collecting Soil and Root Samples for Nematode Analysis," for additional information on collecting and handling soil samples.

2015 AU-PNUT RULES FOR PEANUT LEAF SPOT CONTROL

In order to use this method for controlling leaf spot on peanuts, you need to know the following.

1. A "rain event" is any day (a 24-hour period) with more than 0.1 inch of rain and/or irrigation or it is fog that begins before 8:00 p.m.

2. The AU-Pnut Weather Forecast provides you:

a) the 5-day average forecast for rain;

b) the rain forecast (percent chance of rain) for each day within that 5-day average.

You will use the 5-day average forecast until you plan to irrigate. Then, you will use the forecast for each day.

3. The day you irrigate, the forecast automatically becomes 100 percent, and it becomes your fifth day. So, to figure your 5-day forecast, substitute 100 percent for the forecast on the planned irrigation day. Then, add the forecasts for each day and divide by five.

Timing for the First Spray of The Season

From true cracking, count the number of rain events.

Spray if:

• You have counted four rain events since cracking and the 5-day forecast calls for a 50-percent or greater chance of rain. Or,

• You have counted five rain events since cracking and the 5-day forecast calls for a 40-percent or greater chance of rain. Or,

• There have been six rain events; spray immediately.

If leaf spot is seen (two or more spots per plant) in the lower leaves of the plant, spray immediately.

Timing for All Other Sprays

Ten days after your last leaf-spot spray, begin counting rain events and check the 5-day average forecast daily. To accurately determine days since application, count the day you sprayed as Day 0; the day after will be Day 1, and so on. When you reach Day 10, start counting rain events again and checking the 5-day average forecast.

Spray if:

• No rain event has been recorded and the average chance of rain for the next 5 days is 50 percent or greater. Or,

• One rain event has been recorded and the average chance of rain for the next 5 days is 40 percent or greater. Or,

• Two rain events have been recorded and the average chance of rain for the next 5 days is 20 percent or greater. Or,

• There have been three rain events; spray immediately.

If you are within 14 days of harvest, stop fungicide applications.

Weather Forecast

The AU weather forecast for each day is available on the Internet 24 hours a day at the Agricultural Weather Information Service Website: www.awis.com. To access this information, click on peanut weather, then Alabama, and finally AU-Pnut Leaf Spot. On-line information includes both the precipitation forecasts for each of the next 5 days and also the 5-day average precipitation forecast. Check the forecast each morning as you plan that day's activities.

On-line Registration

To get the on-line rain events needed to run AU-Pnut in each of your peanut fields, you must register each of them with AWIS, using the on-line registration form found on the AWIS Peanut Weather Website. To locate your field(s) within the Doppler Radar output grid, the longitude and latitude for each peanut field must be provided to AWIS. A hand-held GPS unit can be used to generate the necessary coordinates. To get the full benefit from AU-Pnut, be sure to register your field(s) with AWIS before true ground cracking occurs. Beginning on that day, start totaling up the number of rain events needed to trigger the first fungicide application.

You may also use the AU-Pnut advisory without the Doppler Radar-generated precipitation data. Place a tapered rain guage, which should read to 0.10 inch, in the middle or end of a minimum of one field within a continuous 640-acre block of land. Since true ground cracking is used to start the AU-Pnut advisory, you will have to separately monitor rainfall totals where peanuts have been planted on different days within each 640-acre block. This situation is most likely to occur where peanut planting is delayed or separated by four or more days.

If numerous showers occur after true ground cracking, the AU-Pnut advisory may trigger the first fungicide spray earlier than the standard 14-day calendar program. If the peanuts are relatively young, the first and, sometimes, the second fungicide application may be banded directly over the middle of the peanut canopy.

See the website http://www.aces.edu/anr/ipm/fieldcrops/peanuts.php for internet access to peanut IPM publications and www.awis.com for access to the AU-PNUT Leaf Spot Advisory.

All peanut disease and nematode management circulars are distributed by Alabama Cooperative Extension System.

The recommendations in this section are based primarily on the research of Rodrigo Rodriguez-Kabana and Kira Bowen, Professors, Department of Entomology and Plant Pathology, Auburn University.

Disease and Nematode Control section prepared by Austin K. Hagan, Extension Plant Pathologist, Professor, Department of Entomology and Plant Pathology, Auburn University.

WEED CONTROL

Herbicides used for weed control in peanuts can generally be classified according to method of application.

Preplant. Applied and incorporated before planting. These are generally effective on grasses and small-seeded broadleaf weeds.

Preemergence. Applied on soil surface either broadcast or banded at or shortly after planting.

Postemergence. Applied after peanuts have emerged as an over-the-top application.

In this section, herbicides are grouped under these three headings. Rates are given in the amount per acre of material in the can or bag on a broadcast basis. The second column gives the pounds of active ingredient applied per acre on a broadcast basis. For band application, reduce the amount by using the following formula: Band width ÷ row width x broadcast rate per acre = rate per acre for band application.

Table 7. Peanut Weed Control

Herbicide Trade Name (Rate/Acre Broadcast)	Herbicide Common Name (Active Herbicide/Acre)	Comments
PREPLANT BURNDOWN (SMALL ANNUAL WEEDS)		
ROUNDUP Various trade names Generics (11-32 fl.oz.) [5.5 lb./gal.] or (16-48 fl.oz.) [4 lb./gal.]	glyphosate (0.47-1.375 lb.) (0.5-1.5 lb.)	Apply any time prior to planting to control emerged weeds. Refer to specific label for weeds controlled, application rates, need for non-ionic surfactant, and application precautions. Glyphosate does not adequately control cutleaf eveningprimrose, Carolina geranium, and wild radish. Application to wheat or rye should be made before the boot stage or after the wheat is fully headed. Glyphosate can be mixed with Valor to improve the spectrum of weeds controlled and to provide residual weed control. Refer to Valor label for the need to add an additional non-ionic surfactant and a spray grade nitrogen source such as AMS or a nitrogen solution. **DO NOT** apply more than 3 ounces of Valor per acre per year. *MOA–ESP synthesis inhibitor
GRAMOXONE INTEON 2 (2.5-3.75 pt.) or FIRESTORM 3 (1.7-2.5 pt.) + Non-ionic Surfactant	paraquat (0.63-0.94 lb.) or paraquat (0.63-0.94 lb.) + non-ionic surfactant	Apply any time prior to planting to control small emerged weeds. Add a non-ionic surfactant at the rate of 1 quart per 100 gallons of spray mix. Paraquat does not adequately control horseweed, curly dock, cutleaf eveningprimrose, and large wild radish. Cover crops must be mature with seedheads for adequate control. MOA–Photosystem I inhibitor
PREPLANT INCORPORATED		
DUAL II MAGNUM 7.64SC DUAL MAGNUM 7.62EC CINCH 7.64 EC (1-1.33 pt.)	s-metolachlor (0.96-1.27 lb.)	Apply at planting and shallowly incorporate into soil (no more than 2 inches). For better yellow nutsedge control on coarse-textured soils, apply 2 pints per acre and incorporate. Non-uniform incorporation may result in crop injury expressed as reduced crop emergence and stunted growth of emerged plants. Generic formulations are available but may require a higher application rate to give comparable control. Read the label carefully and use the appropriate rate. MOA–Mitosis inhibitor
OUTLOOK 6.0 (16-21 fl.oz.)	dimethenamid (0.75-0.98 lb.)	Outlook may be applied preplant incorporated, preemergence, or postemergence. **DO NOT** preplant incorporate Outlook on coarse-textured soils containing less than 1.5 percent organic matter. **DO NOT** apply within 80 days of harvest. A single or split application may be used. Provides control of hophornbean copperleaf and eclipta and suppresses Florida beggarweed, yellow nutsedge, and sicklepod. **DO NOT** apply more than 21 fluid ounces of Outlook per acre per year. Rainfall, irrigation, or soil incorporation into the top 2 inches of soil is needed for consistent control. MOA–Mitosis inhibitor

*MOA=mechanism of action. Herbicides with different MOAs should be used in weed resistance management programs. See Table 10.

Table 7. Peanut Weed Control (cont.)

Herbicide Trade Name (Rate/Acre Broadcast)	Herbicide Common Name (Active Herbicide/Acre)	Comments
PREPLANT INCORPORATED (cont.)		
PROWL 3.3 (1.8-2.4 pt.) or PROWL H_2O (2 pt.)	pendimethalin (0.75-1 lb.) or pendimethalin (0.95 lb.)	Apply before planting and incorporate thoroughly into the top 2 inches of soil within 7 days of application. Provides good control of Texas panicum, pigweeds, and Florida pusley. May be applied with liquid fertilizer for simultaneous application. May be tank mixed with Dual, Outlook, or Pursuit. MOA–Mitosis inhibitor
PURSUIT 2L (4 fl.oz.)	imazethapyr (0.063 lb.)	Pursuit may be applied preplant incorporated, preemergence, or early postemergence. **DO NOT** apply more than 4 fluid ounces total per acre per growing season. When applied as a preplant incorporated treatment, it should be shallowly and uniformly incorporated into soil. **DO NOT** apply to dry soil, especially if significant rain is expected after planting. It may be tank mixed with Prowl or Sonalan. See label for recropping restrictions. MOA–ALS inhibitor
SONALAN HFP (1.5-2.5 pt.)	ethalfluralin (0.6-0.94 lb.)	Apply just before planting and thoroughly incorporate into the top 2 to 3 inches of soil within 2 days of application. May be applied simultaneously with liquid fertilizer. May be tank mixed with Dual, Outlook, or Pursuit. MOA–Mitosis inhibitor
STRONGARM 84WDG (0.45 oz.)	diclosulam (0.024 lb.)	Strongarm may be applied preplant incorporated or preemergence to the soil surface. Incorporation through tillage, irrigation, or timely rainfall is needed to provide optimal weed control. Can be tank mixed with grass herbicide such as Prowl, Sonalan, Dual, or Outlook. Timely application of postemergence herbicides timed 14 to 17 days after peanut emergence can improve overall control, especially on escaped weeds such as sicklepod, Florida beggarweed, and Texas panicum. See label for recropping restrictions. MOA–ALS inhibitor
PREEMERGENCE		
DUAL II MAGNUM 7.64 DUAL MAGNUM 7.62 CINCH 7.64 EC (1.33-2 pt.)	s-metolachlor (1.27-1.9 lb.)	Apply as a band or broadcast treatment to the soil surface during or after planting but before crop or weeds emerge. Use 2 pints per acre for partial control of Florida beggarweed. Failure to calibrate properly may result in excessive herbicide rate. See label for correct calibration procedure. **DO NOT** use Dual/Cinch as a preemergence treatment following the use of Dual/Cinch as a preplant soil incorporated treatment. MOA–Mitosis inhibitor
VALOR SX 51WDG (3 oz.)	flumioxazin (0.096 lb.)	Apply only as a preemergence surface application. Apply to peanuts planted at least 1.5 inches deep. Application must be made within 2 days after planting and before peanut emergence. Applications made later or when peanuts have begun to crack or are emerged will result in severe crop injury. **DO NOT** irrigate when peanuts are cracking. May be tank mixed with Dual or Outlook. Timely application of postemergence herbicides after peanut emergence can improve overall control, especially on escaped weeds such as sicklepod, yellow nutsedge, and cocklebur. **DO NOT** apply more than 3 ounces of Valor per acre per year. Completely clean spray equipment **THE SAME DAY OF USE** as directed by herbicide label. MOA–PPO inhibitor

Table 7. Peanut Weed Control (cont.)

Herbicide Trade Name (Rate/Acre Broadcast)	Herbicide Common Name (Active Herbicide/Acre)	Comments
POSTEMERGENCE		
BASAGRAN 4 (1.5-2 pt.)	bentazon (0.75-1 lb.)	Apply over-the-top of peanuts for control of bristly starbur and common cocklebur. Use 1.5 pints per acre when bristly starbur has up to four leaves and is no taller than 6 inches. Use 2 pints per acre when bristly starbur is no taller than 3 inches and common cocklebur is no taller than 10 inches. Good spray coverage is essential for effective weed control. Use no more than 4 pints per acre per season. Will not control Florida beggarweed or sicklepod. Peanuts often exhibit chlorotic mottling after application but recover in 7 to 10 days. The addition of a crop oil concentrate at the rate of 1 quart per acre will improve the control of yellow nutsedge. Early season application of bentazon at high rates following in-furrow application of Di-Syston may infrequently result in **SEVERE** peanut injury. Rain-free period is 4 hours. MOA–Photosystem II inhibitor
2,4-DB 175 (0.9-1.1 pt.) or 2,4-DB 200 (0.8-1 pt.)	2,4-DB (0.2-0.24 lb.) or 2,4-DB (0.2-0.25 lb.)	Apply over-the-top of peanuts 2 to 12 weeks after planting to control common cocklebur, morningglory, and other broadleaf weeds. A second application may be made 3 weeks after the first, if needed. Gives poor control of Florida beggarweed and large sicklepod. **DO NOT** apply more than twice per season. Rain-free period is 1 hour. **DO NOT** tank mix with postemergence grass herbicides. **DO NOT** apply if peanuts are under drought stress. MOA–Synthetic auxin
CADRE 2AS IMPOSE 2AS (4 fl.oz.) + Non-ionic Surfactant (1 qt./100 gal. spray mix) or Crop Oil Concentrate (1 qt.)	imazapic (0.063 lb.) + non-ionic surfactant or crop oil concentrate	Apply over-the-top of peanuts when problem broadleaf weeds are less than 2 inches tall and nutsedges are less than 4 inches tall. This usually occurs about 10 to 14 days after peanut emergence. Controls problem weeds such as bristly starbur, wild poinsettia, morningglory, and Florida beggarweed. If Florida beggarweed is taller than 2 inches at time of treatment, weed regrowth will occur. If conditions remain dry after application, a shallow cultivation 14 days after treatment will enhance control. See label for recropping restrictions. Under adverse application conditions (dry weather, large weeds), the use of a crop oil concentrate and fertilizer (spray grade ammonium sulfate at 2.5 pounds per acre or liquid fertilizer at 1 to 2 quarts per acre) is recommended. **DO NOT** apply within 90 days of harvest. Rain-free period is 3 hours. MOA–ALS inhibitor
COBRA 2EC (12.5 oz.) + Non-ionic Surfactant (1 qt./100 gal. spray mix) or Crop Oil Concentrate (1-2 pt.)	lactofen (0.2 lb.) + non-ionic surfactant or crop oil concentrate	Apply over-the-top of peanuts when peanuts have at least six true leaves to control small, actively growing weeds. Treated peanuts will exhibit leaf crinkling, brown leaf speckling, and bronzing. Applications made earlier will result in growth suppression, which may be prolonged by poor growing conditions. Add a non-ionic surfactant to spray mix when weeds are small and growing. Add a crop oil concentrate to spray mix when weeds approach maximum label size. **DO NOT** make more than two applications of Cobra per season. A second application must be made at least 14 days after the first application. See label for weed size and appropriate adjuvant use. **DO NOT** apply within 90 days of harvest. Rain-free period is 1 hour. MOA–PPO inhibitor
FUSILADE DX (8-24 fl.oz.) [2 lb./gal.] + Crop Oil Concentrate (1 qt.) or Non-ionic Surfactant (2 pt./100 gal./spray mix)	fluazifop (0.125-0.375 lb.) + crop oil concentrate or non-ionic surfactant	Apply over-the-top of actively growing peanuts to control annual and perennial grasses. Use rate depends on weed and weed size. See label for specific rate and timing. **DO NOT** apply more than 24 ounces per acre per application. Allow a minimum of 14 days between applications. **DO NOT** harvest within 40 days of last application. MOA–ACCase inhibitor

Table 7. Peanut Weed Control (cont.)

Herbicide Trade Name (Rate/Acre Broadcast)	Herbicide Common Name (Active Herbicide/Acre)	Comments
POSTEMERGENCE (cont.)		
GRAMOXONE INTEON 2 (8 fl.oz.) or FIRESTORM 3 (5.5 fl.oz.) + Non-ionic Surfactant	paraquat (0.125 lb.) or (0.125 lb.) + non-ionic surfactant	Apply postemergence to peanuts when weeds are small, using ground equipment. Apply in 20 or more gallons of water per acre and add 1 pint of a non-ionic surfactant per 100 gallons of spray mix. A second application can be made but not later than 28 days after ground cracking. **DO NOT** make a second application if peanuts show injury from previous treatment. May be tank mixed with Storm, Pursuit, Basagran, or 2,4-DB to improve control of some weeds. See label for appropriate use rates. The addition of Basagran to the spray mix reduces peanut injury compared to other paraquat treatments. Basagran at 0.5 pint per acre is usually sufficient to reduce foliar burn and to provide control of smallflower morningglory. However, Basagran at 1 pint per acre is needed to control weeds such as small bristly starbur and prickly sida. Gramoxone and Firestorm are **RESTRICTED USE** pesticides. Rain-free period is 1 hour. MOA–Photosystem I inhibitor
POAST PLUS 1E (1.5 pt.) or POAST 1.5 (1 pt.) + Crop Oil Concentrate (2 pt.)	sethoxydim (0.188 lb.) or sethoxydim (0.188 lb.) + crop oil concentrate	Apply over-the-top of actively growing peanuts to control small annual grasses, including Texas panicum. A crop oil concentrate must be added to the spray mix for good grass control. **DO NOT** mix Poast with any other pesticide, additive, or fertilizer. Poast does not control broadleaf weeds or sedges (nutgrass). Apply in a final spray volume of 20 gallons per acre. **DO NOT** apply more than 0.47 pound active ingredient per acre per year. Higher use rates are needed to control perennial grasses such as bermudagrass and Johnsongrass. **DO NOT** apply within 40 days of harvest. Rain-free period is 1 hour. MOA–ACCase inhibitor
PURSUIT 2L (4 fl.oz.) + Non-ionic Surfactant	imazethapyr (0.063 lb.) + non-ionic surfactant	Apply over-the-top of peanuts for control of problem weeds such as nutsedge, morningglory, and wild poinsettia. Application should be made to small, actively growing weeds. This usually corresponds to the time interval from 7 to 14 days after planting (at cracking) until 14 days after crop emergence. The most consistent control has occurred when application is made during the at-cracking stage of growth. Use a non-ionic surfactant at the rate of 1 quart per 100 gallons of spray mix. Pursuit can be tank mixed with Starfire, Basagran, or 2,4-DB. **DO NOT** apply more than 4 fluid ounces total per acre per growing season. **DO NOT** apply within 85 days of harvest. See label for recropping restrictions. Rain-free period is 1 hour. MOA–ALS inhibitor
SELECT 2EC ARROW 2EC (6-8 fl.oz.) or SELECT MAX (12-16 fl.oz.) [0.97 lb./gal.] + Crop Oil Concentrate (1 qt.)	clethodim (0.09-0.125 lb.) or clethodim (0.09-0.125 lb.) + crop oil concentrate	Apply over-the-top of actively growing peanuts to control small annual grasses. Use low rate on small grasses and high rate on weeds of maximum label size and under conditions of heavy annual grass pressure. Select/Arrow does not control broadleaf weeds or sedges (nutgrass). A non-ionic surfactant can be used with Select Max at a rate of 1 quart per 100 gallons of spray mix to reduce crop injury potential. **DO NOT** apply within 40 days of peanut harvest. See label for higher use rates for perennial grass control. **DO NOT** tank mix with chlorothalonil products because reduced grass control will result. Rain-free period is 1 hour. MOA–ACCase inhibito

Table 7. Peanut Weed Control (cont.)

Herbicide Trade Name (Rate/Acre Broadcast)	Herbicide Common Name (Active Herbicide/Acre)	Comments
POSTEMERGENCE (cont.)		
STORM 4L (1.5 pt.) + Crop Oil Concentrate (2 pt.) or Non-ionic Surfactant (2 pt./100 gal. spray mix)	bentazon (0.5 lb.) + aciflurofen (0.25 lb.) + crop oil concentrate or non-ionic surfactant	Apply over-the-top of peanuts from ground cracking through the full expansion of the second compound leaf. Timing is critical to control small weeds such as morningglory, cocklebur, pigweed, prickly sida, and ragweed. Add a non-ionic surfactant or crop oil concentrate to the spray mix. May be mixed with 2,4-DB to control larger weeds, including sicklepod. **DO NOT** apply within 75 days of harvest. Rain-free period is 4 hours. MOA–PPO inhibitor + Photosystem II inhibitor
ULTRA BLAZER 2L (1.5 pt.) + Non-ionic Surfactant	aciflurofen (0.38 lb.) + non-ionic surfactant	Apply over-the-top of actively growing peanuts not under stress. For best results, apply when weeds are in the two- to four-leaf stage and actively growing. Controls a number of broadleaf weeds, including morningglory and wild citron. Apply with flat fan nozzles calibrated to deliver at least 20 gallons of spray mix per acre at 40 to 60 psi. Use 80-percent active non-ionic surfactant at the rate of 1 pint per 100 gallons of spray mix. Additional surfactant is required for maximum control of certain weeds. Refer to label for specific directions. Peanuts may exhibit leaf burning, crinkling, or bronzing. Under adequate growing conditions, they will outgrow this condition and continue to develop normally. **DO NOT** apply more than 2 pints Ultra Blazer per acre per growing season. **DO NOT** apply within 75 days of harvest. Rain-free period is 4 hours. Reduced rates will control showy crotolaria and hemp sesbania. MOA–PPO inhibitor
LAYBY		
CLASSIC 25DF (0.5 oz.) + Non-ionic Surfactant (2 pt./100 gal. spray mix)	chlorimuron (0.125 oz.) + non-ionic surfactant	Apply over-the-top of peanuts from 60 days after crop emergence to within 45 days of harvest. Application should be made to Florida beggarweeds that are less than 10 inches tall and are actively growing. Make ONLY one application per season. Classic will not effectively control regrowth of Florida beggarweed following a previous application of Cadre. Addition of ammonium sulfate (at a rate of 2 pounds per acre) or feed grade urea (at a rate of 2 gallons per acre) improves activity on bristly starbur. **DO NOT** use on sensitive varieties such as Georgia 06G. **DO NOT** use on Spanish peanuts. **DO NOT** use on Tifguard later than 80 days after emergence. Prior to use, consider the rotation instruction on the label. Classic may be mixed with Bravo or 2,4-DB. Combinations of Classic plus 2,4-DB result in significantly more foliar crop injury compared to Classic applied alone. Applications of Classic from 60 days after crop emergence to 45 days before harvest on current tomato spotted wilt-tolerant peanut varieties may result in increased tomato spotted wilt symptoms which may impact peanut yield. Rain-free period is 1 hour. MOA–ALS inhibitor
DUAL MAGNUM 7.62EC (1-1.33 pt.)	s-metolachlor (0.95-1.27 lb.)	Apply to the soil immediately after the last cultivation but not within 90 days of harvest. **DO NOT** apply more than 2.67 pounds active ingredient of Dual during any one year. Use this treatment when late germinating weeds are expected as a problem. Provides partial preemergence control of Florida beggarweed when activated by rain or irrigation. MOA–Mitosis inhibitor

Table 7. Peanut Weed Control (cont.)

Herbicide Trade Name (Rate/Acre Broadcast)	Herbicide Common Name (Active Herbicide/Acre)	Comments
HARVEST AID		
AIM 2EC (1-2 fl.oz.) + Non-ionic Surfactant or Crop Oil Concentrate	carfentrazone (0.0156-0.031 lb.) + non-ionic surfactant or crop oil concentrate	Useful for late season dessication/defoliation of annual morninglories. Apply 7 days before harvest. Apply with either a non-ionic surfactant (1 quart per 100 gallons spray mix) or a crop oil concentrate (2 pints per acre). Aim may cause leaf spotting or burning. Use at least 15 gallons of spray solution per acre. The high rate (2 ounces per acre) may be needed if smallflower morningglory is present. Make only one application per season. **DO NOT** feed or graze peanut hay treated with Aim. Rain-free period is 6 to 8 hours. MOA–PPO inhibitor

Table 8. Estimated Effectiveness of Recommended Preplant Incorporated and Preemergence Herbicide Treatments on Important Weeds Infesting Peanuts in Alabama [1]

WEEDS	HERBICIDES							
	Cinch/ Dual (PPI)	Outlook (PPI)	Prowl (PPI)	Sonalan (PPI)	Strongarm (PPI)	Pursuit (PPI, EPOT)	Cinch/ Dual (PRE)	Valor (PRE)
GRASSES								
Bermudagrass	0	0	4	4	0	0	0	0
Broadleaf signalgrass	7	9	8	9	0	6	7	6
Crabgrass	9	9	9	9	0	6	9	6
Crowfootgrass	9	9	9	9	0	4	9	--
Fall panicum	7	8	8	8	0	6	7	6
Goosegrass	9	9	9	9	0	6	9	6
Texas panicum	5	4	8	8	0	4	5	6
SEDGES								
Purple nutsedge	1	0	0	0	7	8	1	2
Yellow nutsedge	8	8	0	0	7	7	5	2
BROADLEAVES								
Bristly starbur	0	0	0	0	9+	6	3	6
Burgherkin	0	0	0	0	—	8	0	8
Carpetweed	7	8	8	8	8	0	6	0
Citronmelon	0	0	0	0	8	—	0	8
Cocklebur	0	0	0	0	9+	7-8	0	3
Common ragweed	0	7	0	0	8	5	0	7
Cowpea	0	0	0	0	0	0	0	6
Crotolaria	0	0	0	0	—	3	0	8
Eclipta	0	6	0	0	8	0	0	8
Florida beggarweed	6	6	1	1	7-8	3	6	9
Florida pusley	9	8	9	9	8	6	8	9
Groundcherry	8	8	0	0	0	0	7-8	0
Horsenettle	0	0	0	0	—	0	0	0
Hophornbean copperleaf	5	7	0	0	8-9	0	5	8-9
Jimsonweed	0	0	0	0	8	8	0	8
Lambsquarters	6	0	9	9	8	6	6	9
Morningglory	0	0	2	2	8+	7	0	8
Morningglory, smallflower	0	0	2	2	8	9	0	9
Pigweed	9	9	8	8	8	9	9	8-9
Prickly sida	6	7	0	0	8	8	3	8
Purslane	8	8	8-9	8-9	0	0	8	8-9
Redweed	0	0	0	0	—	—	0	8
Sicklepod	4	4	1	1	6	0	6	0
Spurge	6	7	0	0	0	7	4	0
Tropic croton	0	0	0	0	6	0	0	7
Tropical spiderwort	8-9	7	0	0	8	0	8-9	6
Wild poinsettia	0	0	0	0	9	9	0	8
Wild radish	0	0	0	0	9	9	0	7
Wooly croton	0	0	0	0	5	0	0	5

[1] Effectiveness ratings are based on observations of research plots and field use under average weather conditions for several years by weed control workers in Alabama.

KEY TO EFFECTIVENESS RATINGS AND ABBREVIATIONS:

9 = 90% to 100% effective; 0 = Not effective; — = Information not available. PPI = Preplant Incorporated; EPOT = Early Postemergence; PRE = Preemergence; POST = Postemergence.

Table 9. Estimated Effectiveness of Recommended Postemergence Herbicide Treatments on Important Weeds Infesting Peanuts in Alabama [1]

WEEDS	HERBICIDES										
	Basagran (POST)	2,4-DB (POST)	Impose Cadre (POST)	Classic (POST)	Cobra (POST)	Firestorm Gramoxone (POST)	Fusilade (POST)	Poast Plus Select (POST)	Storm (POST)	Ultra Blazer (POST)	Dual Magnum (LAYBY)
GRASSES											
Bermudagrass	0	0	0	0	0	0	8	6-8	0	0	0
Broadleaf signalgrass	0	1	7	0	1	8	8	8	0	1	4
Crabgrass	0	1	8	0	2	4	8	8	0	2	9
Crowfootgrass	0	1	7	0	2	8	7-8	8	0	2	9
Fall panicum	0	1	7	0	1	8	8	8	0	1	3
Goosegrass	0	1	6	0	2	8	8	8	0	2	9
Texas panicum	0	0	7	0	0	8	8	8	0	0	4
SEDGES											
Purple nutsedge	0	0	9	4	0	4	0	0	0	0	0
Yellow nutsedge	7	2	8	5	2	5	0	0	4	2	4
BROADLEAVES											
Bristly starbur	8	6	7	7	8	3	0	0	8	7	0
Burgherkin	6[2]	6[2]	8	4	7	5	0	0	6	8	3
Carpetweed	0	0	6	0	8	0	0	0	8	8-9	0
Citronmelon	0	7	8	0	8	6	0	0	8	7	0
Cocklebur	9	8	9+	8	9	4	0	0	9	8	0
Common ragweed	6	7	5	7	9	6	0	0	8	8	0
Cowpea	2	6	6	7	6	7	0	0	7	4	0
Crotolaria	3	6	—	—	9	4	0	0	9	9	0
Eclipta	7	4	—	4	8	4	0	0	8	8	0
Florida beggarweed	0	1	7-8	8	7-8	7-8	0	0	0	1	6
Florida pusley	0	3	3	3	8	5	0	0	9	9	8
Groundcherry	6	0	0	0	8	7	0	0	8	9	0
Horsenettle	0	0	7	0	5	2	0	0	0	0	0
Hophornbean copperleaf	0	0	5	0	8	0	0	0	7	8-9	0
Jimsonweed	9	3	9	—	9	9	0	0	9	9	0
Lambsquarters	6	6	—	4	7	3	0	0	6	6	4
Morningglory	4	8	8	5	8	7	0	0	8	8	0
Morningglory, smallflower	9	7	9	3	8	3	0	0	7	8	0

continued

Table 9. Estimated Effectiveness of Recommended Postemergence Herbicide Treatments on Important Weeds Infesting Peanuts in Alabama [1] (cont.)

WEEDS	HERBICIDES										
	Basagran (POST)	Butoxone (POST)	Impose Cadre (POST)	Classic (POST)	Cobra (POST)	Firestorm Gramoxone (POST)	Fusilade (POST)	Poast Plus Select (POST)	Storm (POST)	Ultra Blazer (POST)	Dual Magnum (LAYBY)
BROADLEAVES (cont.)											
Pigweed	4	5	9	4	9	5	0	0	9	9	9
Prickly sida	8	2	7-8	5	8	2	0	0	8	4	0
Purslane	7	3	0	5	8	5	0	0	8	9	0
Redweed	8	5	8	3	—	7	0	0	7	5	0
Sicklepod	0	7	8	7	6	7	0	0	0	3	4
Spurge	0	0	0	5	6-7	4	0	0	6	6	0
Tropic croton	7	3	0	4	9	4	0	0	8	8	0
Tropical spiderwort	8	0	6	0	—	8	0	0	6	3	0
Wild poinsettia	0	3	8-9	4	8	8	0	0	7	8-9	0
Wild radish	6	0	9	0	7	6	0	0	8	9	0
Wooly croton	4	2	0	0	8	0	0	0	6	8	0

[1] Effectiveness ratings are based on observations of research plots and field use under average weather conditions for several years by weed control workers in Alabama.

KEY TO EFFECTIVENESS RATINGS AND ABBREVIATIONS:

9 = 90% to 100% effective; 0 = Not effective; — = Information not available. PPI = Preplant Incorporated; EPOT = Early Postemergence; PRE = Preemergence; POST = Postemergence.

PEANUT MANAGEMENT CHECKLIST

Each year, the farmers who get maximum returns from the dollars they invest in peanut production are those who carry out certain key management practices. Use this checklist to check up on your peanut management system. If you can't check off each of these points for your own farm, you may be missing out on maximum returns.

□ **Use a crop rotation system.** For best results, grow a grass crop for at least 2 years before planting peanuts. Rotation helps you cut down on disease and nematode problems and contributes to better weed control. Avoid soybeans in the rotation—both soybeans and peanuts are susceptible to the same major diseases, nematodes, and weeds.

□ **Soil test every year and follow the recommendations.** Test each field in the fall for fertility level and lime needs. Peanuts respond best to residual fertility, so it is better to build up soil fertility as you grow other crops. But, peanuts will respond to direct fertilization when soil fertility levels are low.

□ **Plant between April 28 and May 25.** For optimum yield, plant according to the Tomato Spotted Wilt Index.

□ **Check fields regularly for virus problems.** Send a properly trained person—yourself, a consultant, or a scout—into your fields at least weekly during the growing season. Scouting enables you to identify pest problems and time control measures for best results. It also gives you the records you need for planning peanut production in the same field in future years.

□ **Irrigate if it is economically feasible.** Timely irrigation will increase yield and quality in most years. It also gives you a measure of insurance against loss during dry years. In the future, irrigation may be a major method of applying agricultural chemicals.

□ **Use the hull scrape or the shellout method to time your harvest.** You'll get better yields and higher quality using one of these methods.

□ **Use pesticides only as needed.** Except for leaf spot fungicides, chemicals applied to peanuts automatically or on a fixed schedule are usually a poor investment. For maximum returns, select and apply pesticides based on the specific problem identified in the field.

□ **Maintain records on white mold.** Control white mold only in fields where this disease has caused major problems before. Three to four dead spots in 100 feet of row is justification for treatment. White mold is more likely to cause losses if you don't follow a 3-year rotation or if you include soybeans in your rotation program. The highest white mold loss is usually seen in fields cropped every second year in peanuts. Two or more years of corn, cotton, or a pasture grass will greatly reduce the risk of serious disease loss.

□ **Control leaf spot with a regular spray program.** Begin 30 to 40 days after planting or by June 1. Maintain a 10- to 14-day schedule until July 15 and a 7- to 10-day schedule after July 15 during periods of frequent rain showers. Otherwise, continue sprays every 10 to 14 days until 2 weeks before harvest. Use recommended rate and an adequate spray volume for good coverage. Don't allow a canopy of broadleaf weeds to develop and interfere with your coverage. Evaluate your control program in each field every few weeks.

□ **Use nematicides only when needed.** Take a soil sample for nematode analysis in August or September from all fields you will plant to peanuts the following year. Treat for nematodes only in those fields where you know a problem exists. Apply a recommended nematicide at planting time in those fields. During your weekly inspections, check plants not growing normally for nematode damage. Nematodes are most destructive in fields in continuous peanut production.

□ **Maintain a field-by-field record or map of weed problems.** Choose the proper herbicides to control the weeds you have. Remember that the first 6 weeks of the growing season is the critical period for weed control. Don't use the "shotgun" approach: using different herbicides at different times without regard to the particular weed problems that are in the field. Most herbicides have some undesirable effects on the peanut plants themselves; the more herbicides you use, the more the peanut plants will be hurt.

□ **Control early-season sucking insects.** Use one of the insecticides recommended for thrips. If acephate or cyhalothrin is used as a foliar spray, make the first application when the second true leaf develops and make another application 5 to 7 days later.

□ **Use foliar insect sprays only when needed, based on your weekly inspection program.** Remember that uncontrolled low levels of damaging foliage-feeding insects early in the season will help to build up a beneficial insect population. Beneficials can help keep large infestations of damaging insects in check later in the season. Foliage-feeding caterpillars are more often a major problem in July and August.

□ **Control important peg- and pod-feeding pests.** The lesser cornstalk borer and southern corn rootworm are primarily peg- and pod-feeding pests. Check carefully for these pests and the feeding damage they cause from the time pegging begins until the crop is mature.

□ C**hoose and use insecticides as recommended.** Apply recommended insecticides at correct rates to control the insect pests that have reached or exceeded the "threshold" level. For example, only granular formulations are recommended for lesser cornstalk borer and southern rootworm control because granules will sift through the vines to the soil surface. No single insecticide will control all peanut insects.

For more information and specific recommendations, ask your county Extension agent for detailed information applicable to conditions in your county. You can also get cost and return budgets and up-to-date publications on peanut production.

Table 10. Herbicide Classified by Mechanism of Action

Mechanism of Action	Herbicide
Acetolactate Synthase (ALS) inhibitor	Pursuit, Strongarm, Cadre, Classic
Acetyl CoA Carboxylase (ACCase) inhibitor	Fusilade, Poast, Select/Arrow
EPSP inhibitor	Roundup
Mitosis inhibitor	Dual/Cinch, Outlook, Prowl, Sonalan
Photosystem I inhibitor	Gramoxone Inteon/Firestorm
Photosystem II inhibitor	Basagran, Storm
Protoporphyrinogen oxidase (PPO) inhibitor	Valor, Cobra, Storm, Ultra Blazer, Aim
Synthetic auxin	2,4-DB

Weed Control section prepared by John W. Everest, Professor Emeritus, Department of Crop, Soil and Environmental Sciences, Auburn University, in cooperation with Glenn Wehtje, Professor, Department of Crop, Soil and Environmental Sciences, Auburn University.

FOR MORE INFORMATION on pesticides, pesticide safety, or submitting samples for analysis, see the following publications in the IPM series:
IPM 1293, “Safety.” Safety contact information; worker protection standards; the safe use, handling, and storage of pesticides
IPM 1294, “Submitting Samples.” Procedures for submitting samples for diagnosis, analysis, and identification
IPM 1295, “General Pesticide Information.” Federal and state restricted use pesticide lists; pesticides and water quality
IPM 1317, “Appendix.” Pesticide guidelines for agronomic crops, including preharvest intervals; rain-free requirements; grazing restrictions; crop rotation guidelines; and the names, classifications, and toxicities of pesticides.

2015 IPM-0360

For more information, contact your county Extension office. Visit www.aces.edu/counties or look in your telephone directory under your county’s name to find contact information.

Use pesticides **only** according to the directions on the label. Follow all directions, precautions, and restrictions that are listed. Do not use pesticides on plants that are not listed on the label

The pesticide rates in this publication are recommended **only** if they are registered with the Environmental Protection Agency or the Alabama Department of Agriculture and Industries. If a registration is changed or canceled, the rate listed here is no longer recommended. Before you apply **any** pesticide, check with your county Extension agent for the latest information.

Trade names are used **only** to give specific information. The Alabama Cooperative Extension System does not endorse or guarantee any product and does not recommend one product instead of another that might be similar.

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ALABAMA A&M & AUBURN UNIVERSITIES

IPM-0458

Small Grains

Insect, Disease, and Weed Control Recommendations for 2015

IPM

INSECT PEST MANAGEMENT

Small grain fields provide an ideal habitat for many beneficial as well as harmful insect species. Some closely resemble each other, so accurate identification is important. Insects can be identified by visual appearance, location in the field, and seasonal occurrence. After identification, it is important to determine if the insect population level has increased to the point of economic damage. This level is called the *economic threshold* and refers to the projected loss of crop that is equivalent to the cost of treatment. Many factors influence the amount of damage that occurs. Determining when an insect infestation causes economic damage is the basis of pest management. Most insect pests including aphids can be controlled by applying foliar insecticides when population numbers exceed economic thresholds. Economic thresholds presented here apply to wheat unless otherwise indicated. Pest impact on other small grains has not been well studied in the Southeast.

The primary insect pests of wheat and triticale in the Southeast are aphids and the Hessian fly. Aphids are important because they transmit barley yellow dwarf virus. Cereal leaf beetle occurs in the northern two-thirds of the state. A number of other insects also attack small grains, but these pests occur sporadically. Insect pests of oats are similar to those of wheat, except that oats are not attacked by Hessian fly. Rye is frequently interplanted and/or planted early as a forage crop. As such, it is often prone to damage from fall armyworms, winter grain mites, and green June beetle grubs. Cereal leaf beetle, Hessian fly, and chinch bug are also pests of rye. The major insect pests of barley are aphids and occasionally Hessian fly.

See the Alabama Small Grain Production Guide at www.alabamacrops.com for more information on best management practices for wheat in Alabama.

General Insect Pest Management Recommendations for Wheat

- Avoid continuous planting of wheat in the same field.
- Select a Hessian fly resistant variety.
- Control volunteer wheat.
- If possible, chisel plow and disk harrow fields to bury wheat debris.
- Do not plant wheat for grain before the recommended planting date for your area.
- Consider planting oats or ryegrass instead of wheat for grazing.
- Scout fields (sample 5 to 10 sites per field) for insect pests and control with foliar-applied insecticides when numbers exceed treatment thresholds.

General Scouting Procedure

It is a good management practice to scout fields for damaging infestations of insects. At a minimum, check grain fields in the fall, in late winter before applying nitrogen, and during the boot and heading stages. Scouting during the first 20 to 50 days after planting is especially critical, because this is when insect control with a foliar spray can provide greatest economic returns. Check fields as often as possible after this time, particularly before applying fertilizer, herbicides, or fungicides. If insect populations exceed thresholds, it may be possible to apply an insecticide as a tank mix with another chemical.

Check five to 10 spots in the field, examining at least 1 row-foot at each location. Be sure to include at least two samples near the field edges. Check closely because insects, particularly aphids and pupae of the Hessian fly, can sometimes be found at the base of the plant below ground level. It may be necessary to pull some plants out of the ground in order to sample for insect infestations. For larger plants, slap the plants to jar insects to the ground for counting or use a sweep net.

Aphids

Wheat in the Southeast is attacked by a number of species of aphids. These include the greenbug, *Schizaphis graminum*; English grain aphid, *Sitobion avenae*; yellow sugarcane aphid, *Sipha flava*; bird cherry-oat aphid, *Rhopalosiphum padi*; rice-root aphid, *Rhopalosiphum rufiabdominale*; and corn leaf aphid, *Rhopalosiphum maidis*. All of these species attack a wide range of grass hosts including all of the small grain crops. Aphids have become the number one insect pest of wheat in the Southeast.

Aphids cause two types of damage. They directly damage plants by sucking sap and, in the case of the greenbug, by injecting a toxin while feeding. In general, the greenbug and English grain aphid cause more severe direct damage than the other species. Yellow sugar cane aphid can also cause direct damage. It is less common than the other aphids, and is more likely to be found in southwest Alabama than in other parts of the state. The greenbug is particularly prevalent in the fall, and it can cause economic losses due to direct feeding on the young plants. Feeding by the greenbug causes the wheat plant to turn yellow, and heavy feeding will cause it to die. Heavy feeding also causes typical "greenbug spots" in a field. The centers of the spots are made of dead plants with visible skins of greenbugs, surrounded by living plants that are heavily infested and beginning to turn yellow. English grain aphid, more common in the spring, can cause reduction in yield during heading. Mild, dry winters and cool, dry springs often favor aphid outbreaks.

Indirect damage from aphids is more important than the direct damage, because aphids transmit plant disease viruses of which barley yellow dwarf is the most devastating. The bird cherry-oat and other *Rhopalosiphum* spp. aphids are the most important vectors in our area. Infection of seedling and vegetative stage plants in the fall and winter is much more damaging than infection during the spring. Fall infection stunts plants, increases susceptibility to cold injury, and reduces grain yield of infected plants by about 50 percent. Early planting enhances fall aphid infestations and infection of barley yellow dwarf virus. For more detailed information and photographs, please see Circular ANR-1082, "Barley Yellow Dwarf in Small Grains in the Southeast." (www.aces.edu/pubs/docs/A/ANR-1082).

Description and Life Cycle. Aphids are small, soft-bodied insects. They are about 1/8 inch long when fully grown. Most species have a pair of cornicles, which extend like exhaust tailpipes from the hind end of the aphid. Some aphids have wings; some do not.

Aphids do not have distinct generations, but population numbers are greatest in the fall and spring. Winged adults move from summer grass crops, weeds, and volunteer small grain plants to newly sown fields in the fall.

The winged adult produces wingless forms that feed in clusters on all vegetative parts of the plants and on the grain heads. In the Southeast, aphids overwinter in wheat fields as nymphs and wingless adults. Several aphid species often occur together in the same field. Aphid populations are predominantly greenbug, bird cherry-oat, and rice root aphids in the fall and winter, whereas English grain aphid becomes predominant in the spring.

Aphids are born pregnant; consequently, populations can increase and reach economic levels rapidly. Dry, warm (but not hot) weather promotes rapid population increase. Heavy and violent rainstorms can reduce populations considerably during the spring when aphids are exposed on grain heads. Aphids also are attacked and killed by parasitic wasps, which cause aphids to become light brown "mummies." Several species of ladybird beetle adults and larvae are important predators of aphids. Ladybird beetle adults move into wheat fields from overwintering sites usually in March or early April where they feed voraciously on aphids and often control aphid infestations. This is too late to prevent transmission of barley yellow dwarf virus but may prevent direct aphid injury to developing grain. Hover fly larvae also can be found eating aphids in wheat fields.

Scouting Procedure. Follow the General Scouting Procedure (above) to scout for aphids.

Threshold Level and Management. The incidence of barley yellow dwarf may be reduced by controlling aphids in the fall and late winter using foliar insecticides or by using an insecticide seed treatment at planting. The cost of these treatments should be weighed against the historic or expected loss from aphid infestation and barley yellow dwarf infection. Insecticide seed treatments for control of aphid vectors are more likely to pay off in north Alabama than in south Alabama. Insecticides to control aphids are most likely to reduce barley yellow dwarf when applied in the fall in North Alabama and when applied in early spring (at the time of nitrogen-topdress application) in the Coastal Plain. Setting threshold levels for aphids is difficult because of the influence of factors other than the number of aphids per foot of row. The planting date, temperature, time of year, moisture conditions, stage of growth, presence of parasites and predators, and the number of virus sources all need to be taken into consideration in deciding whether to apply insecticides. Yield-limiting infections of barley yellow dwarf occur before heading. Do not treat to control barley yellow dwarf at or after heading.

Threshold levels in Table 1 are based on research conducted in South Carolina and Georgia.

Table 1. Aphid Thresholds in Wheat

Growth Stage	Treat if there are more than:
Seedling (0-30 days after planting)	1-2 bird cherry-oat aphids per foot of row (North Ala.) or 10+ greenbugs or sugarcane aphids per foot of row
6- to 10-Inch Tall Plants	6 aphids per foot of row
Stem Elongation	2 aphids per stem
Boot/Flag Leaf Stage	5 aphids per stem
Head Emergence	10 aphids per head
Soft/Hard Dough	Do Not Treat

Hessian Fly

Hessian fly, *Mayetiola destructor*, populations were high in Alabama in 2012 and 2013. Changes in the biotype of the Hessian fly, combined with increased wheat acreage and increased areas planted to continuous wheat, contributed to the problem. In outbreak years this insect is a major factor limiting wheat production throughout the southern United States. In 1989, the Hessian fly destroyed many fields and caused losses of $28 million in Georgia alone. Wheat is the primary host of the Hessian fly, but the insect also will infest barley, triticale, and rye. Hessian fly does not attack oats or ryegrass.

Description and Life Cycle. The adult fly is dark with long legs and is the size of a small mosquito. Adult females live for 2 to 3 days during which they mate. Females lay about 200 eggs in the grooves of the upperside of the wheat leaves. Eggs are orange-red, 1/32 inch long and hatch in 3 to 5 days. Young reddish larvae move along a leaf groove to the leaf sheath and then move between the leaf sheath and stem where they begin to feed on the stem above the crown or joints along the stem. Maggots become white after molting and appear greenish white when full grown. These white maggots discharge a toxic salivary secretion which stunts plant growth. Feeding by a single larva for several days will completely stunt the growth of a vegetative tiller. Maggots molt into a resting stage (puparia) which is often referred to as the "flaxseed" stage because the puparia resemble seeds of flax. The entire life cycle requires about 35 days at 70°F. Newly hatched larvae are prone to drying while they are exposed on the leaf surface, but once larvae move to the stem base, they are protected from weather extremes. Plants infested in the fall may die, and spring-infested wheat often lodges or has smaller heads.

The Hessian fly is a cool season insect and is active during the fall, winter, and spring. The insect oversummers as puparia in wheat stubble. The number of generations during the year is governed largely by temperature. Generally, three to four generations occur in the Piedmont region of the Southeast, and four to five generations occur in the Coastal Plain. Adults emerge from oversummered pupae in wheat stubble about

September 1. Because wheat has not yet been planted, the first generation develops entirely in volunteer wheat and weed hosts. Little barley is the only important non-crop host in our area. A second and sometimes a third generation occur in late fall and winter. One generation usually occurs in the spring. The fall and first spring generations stunt and kill seedling plants and vegetative tillers. The spring generation infests jointed stems during stem elongation with larvae feeding between the stem and leaf sheath above a joint (node).

Management Strategies for Hessian Fly. Host plant resistance is the most economical means of Hessian fly control. However, use of resistant plant varieties has resulted in the development of numerous Hessian fly biotypes. Biotypes are identical to each other and to the parental type, except each biotype contains the ability to overcome a specific set of wheat genes for resistance to the pest.

Laboratory studies and field surveys of the Hessian fly in Alabama have shown that wheat varieties with the H13 gene (so-called Biotype L resistant varieties) provide the most protection from Hessian fly in Alabama. However, varieties with very good H7H8 resistance are still more helpful than varieties that are known to be susceptible to Hessian fly. See the latest version of the Alabama wheat production guide for more information on specific varieties. This guide can be found at www.alabamacrops.com.

Generally, insect damage is more severe in early wheat plantings. Early plantings allow insects to become established and increase before freezing temperatures limit activity. Damage by many insects can be minimized or avoided by not planting before the recommended planting date in your area. Growers who plant fly-susceptible varieties should plant near the end of the recommended planting dates for their area (see Table 2). Planting after the recommended planting date usually results in a loss of yield potential. For more information, see ANR-1442, "Planting Date and Variety Selection and Effects on Wheat Yield" (www.aces.edu/pubs/docs/A/ANR-1442/).

Table 2. Recommended Planting Dates for Wheat in Alabama

	Grain	Forage Plus Grain	Forage Only
North	Oct. 15-Nov. 10	Sept. 15 - Nov. 1	Aug. 25-Sept. 10
Central	Oct. 15-Nov. 15	Sept. 15-Nov. 1	Sept. 1-Sept. 15
South	Nov. 15-Dec. 1	Oct. 1-Nov. 15	Sept. 15-Sept. 30

The average Hessian fly-free date in North Alabama is around November 1. South Alabama is similar to Georgia's coastal plain region and does not have a fly-free date.

The effect of planting date on Hessian fly populations in wheat is shown in Table 3. Fall infestations decline in later planting dates. Therefore, damage by the Hessian fly may be minimized by timely planting, but fall damage probably will not be eliminated, particularly in the coastal plain region where activity can occur throughout the winter. Several other cultural practices can aid in the management of Hessian fly in wheat. Most insect pests, including the Hessian fly, aphids, fall armyworms, and others can become established in a field on volunteer wheat growing in the summer annual crop before wheat planting. Therefore, control of volunteer wheat by reducing combine losses of grain at wheat harvest and effective subsequent weed control will help in reducing early pest buildup on volunteer wheat. Tillage can have a large impact on fall populations of insects in wheat. Insect populations and damage generally are greater under no tillage than under conventional tillage systems. Table 4 shows the effect of moldboard plowing on fall Hessian fly infestations in wheat. Fall infestations were almost three times greater in the no-till than the plow tillage systems. Plowing buries wheat stubble where Hessian flies oversummer and suppresses volunteer wheat.

Table 3. Effect of Planting Date on Hessian Fly Infestation in Susceptible Winter Wheat at Plains, Georgia

Planting Date	% Infested Tillers		
	Dec. 5	Feb. 9	May 12
Oct. 23	42	24	65
Nov. 5	16	23	70
Nov. 20	0	20	77
Dec. 5	—	2	70

SOURCE: David Buntin, University of Georgia, Field trials from Plains and Griffin, Georgia.

Table 4. Effect of Moldboard Plowing on Hessian Fly Infestation in the Fall and Spring

Tillage Treatment	% Infested Tillers	
	Fall	Spring
Plowing (fall and spring)	8	40
Plowing (fall only)	7	44
No-tillage	23	43

SOURCE: David Buntin, University of Georgia,

Using a seed treatment will provide some control of Hessian fly. Growers who plant fly-susceptible wheat in high-risk situations may benefit from high rates of seed treatments such as clothianidin, thiomethoxam, and imidacloprid. Seed treatments will not prevent reinfestation by subsequent generations during the winter and spring. Foliar application of insecticide at or before the second to third leaf stage may protect the young wheat plants from attack by Hessian fly. See the North Carolina small grain production guide for more information (www.smallgrains.ncsu.edu/NCSmallGrains/ProductionGuide.html). Foliar applications of insecticides in the spring for Hessian fly control are highly variable in effectiveness. Apply when adults are actively laying eggs. More information on the proper timing of foliar applications can be found at www.ces.ncsu.edu/plymouth/pubs/ent/HFLYupdate03.html.

Several non-stinging, parasitic wasps attack and kill Hessian fly larvae. *Platygaster hiemalis* attacks Hessian fly larvae in the fall and winter, and several other parasitic wasps attack the spring generation. Because of the number of generations, parasites cannot control the Hessian fly during an outbreak year, but natural enemies probably provide long-term regulation of Hessian fly populations.

For more information, see ANR-1069, "Biology and Management of Hessian Fly in Wheat" (www.aces.edu/pubs/docs/A/ANR-1069/). Information on varietal selection and

Hessian fly resistance is provided by the annual Small Grain Performance Tests (Univ. of Georgia), and the Performance of Small Grain Varieties for Grain in Alabama (www.alabamavarietytesting.com) (Auburn University).

Scouting Procedure. Hessiam fly-stunted vegetative tillers usually have a bottom leaf which is greener and wider than the leaf of a non-infested plant. The infested tillers do not elongate or produce new leaves, and die after the maggots pupate. Separating the leaf sheath from the stem reveals the white maggots or brown flaxseed stage. Infested jointed stems are short, and the stem is weakened at the joint where feeding occurs. Grain filling of infested stems is reduced and damaged stems often lodge before harvest. For more information, see "Hessian Fly Scouting Guide," www.aces.edu/dept/grain/documents/HessianFlyScoutingGuide.pdf.

Threshold Level. Yield loss usually becomes significant when fall infestations exceed 5 to 8 percent infested tillers or spring infestations exceed 20 percent infested stems. Growers who plant fly-susceptible varieties should inspect the wheat prior to making their customary nitrogen application between Feb. 15 and March 15. If 20 percent of the tillers are infested with Hessian fly maggots or pupae at this time, significant yield losses can be expected and the money spent for nitrogen may not produce the desired yield response.

Fall Armyworm and Its Relatives

The fall armyworm, *Spodoptera frugiperda*; beet armyworm, *S. exigua*; and yellowstriped armyworm, *S. ornithogalli*, can move into wheat in the autumn as summer crops mature. Damage usually is limited to early plantings for forage production. There is the potential for armyworm damage until the first heavy frost. Small larvae often produce clear windowpane-like areas on leaves which normally does not reduce grain yield. Older, larger larvae can destroy seedling plants, but most years they do not occur in sufficient numbers to cause damage. Fall armyworm damage is likely after a dry summer.

Description and Life Cycle. The full-grown caterpillar is from 1 to 1.5 inches long. Within a species, larvae (caterpillars) of these moths are highly variable in size and color. The circular ANR-1121, "Identifying Caterpillars in Field, Forage, and Horticultural Crops" (www.aces.edu/pubs/docs/A/ANR-1121) has a key that can be used to separate the three species of caterpillars. Beet armyworm larvae generally have a spot on the side of the second segment behind the head. Fall armyworms and yellow-striped armyworms have an inverted, light colored, Y-shaped line on the front of the head. Fall armyworms have four black spots on the back of each segment behind the legs, and three white lines on the back on the first segment just behind the head. Yellow-striped armyworms do not have these markings. Eggs are laid in clusters at night on grasses or other plants. Eggs hatch in a few days, and the larvae mature in about 3 weeks. A complete cycle requires as little as 30 days. There are several generations each year.

Scouting Procedure. Record the number of caterpillars per linear foot of drill row, or square foot of broadcast wheat. Include the small larvae. Be sure to take samples from the edge as well as the interior of the field because this pest is often heaviest near the field margins. Sometimes, only the field margins require treatment.

Threshold Level. These armyworms attack grain in the fall in the seedling stage; therefore, a relatively small number of larvae per foot of row can do heavy damage. The threshold level is from two to three larvae per linear row foot (three per square foot) for seedling wheat. For older plants, three to four larvae and obvious foliage loss justify control measures.

"True" Armyworm

The armyworm, *Mythimna unipuncta,* typically attacks wheat during the stem-elongation and heading stages during the spring. It is often called "true armyworm" to separate it from the fall armyworm and various cutworms. True armyworms can be hard to detect because they hide on or in the soil during the daytime. At night, larvae climb stalks to chew holes in leaves, eat spike glumes and kernels, and sometimes cut seed heads. The most severe damage to wheat is caused by cutting through the stem below the head and separating it from the plant. Heavy populations may destroy the leaves and beards in only a few nights of feeding.

Description and Life Cycle. Mature larvae are about 1.5 inches long, smooth-bodied, and dark gray to greenish-black. The chief distinguishing feature is five stripes extending lengthwise on the body, three on the back and one on each side. The true armyworm adult is a moth. For egg deposition, the moth is especially attracted to thick-growing grains in low areas. The destructive period of the armyworm's life cycle lasts about 10 days. At the end of this time, the worms may disappear as suddenly as they came. In most years, armyworms are attacked by numerous parasites and several diseases, which prevent them from causing economic damage. *Damage usually occurs during cool, wet springs.*

Scouting Procedure. The heaviest infestations of true armyworms are generally found near field margins and in low-lying areas of thick-growing grain, especially where it has lodged. Check for this pest in and under debris at the base of the plants, as well as in the heads. The presence of frass (feces) and dropped plant material can be an indication that worms were or are present. Shake or beat the heads and straw to dislodge the larvae. Check several locations in the field and average the counts for each. A sweep net can be a useful tool to find armyworms before they cause damage.

Threshold Level. Three to four armyworms per linear row foot is a commonly accepted economic threshold. However, if the crop is nearly mature and there is no evidence of head clipping, control may not be necessary. If the larvae are all mature, insecticidal control is not advised because these larvae will soon drop to the soil and pupate.

Cereal Leaf Beetle

The cereal leaf beetle, *Oulema melanopus,* was introduced from Europe into Michigan in the 1950s and is slowly spreading southward. It is now found as far south as central Alabama and Georgia. The immature stage (larva) of cereal leaf beetle feeds on the leaves of wheat, oats, and certain other grasses; it prefers oats but also readily accepts winter wheat.

Feeding activity by cereal leaf beetle larvae results in long, window-like slits in the leaves. Feeding occurs in the spring usually from the boot stage through early heading.

Description and Life Cycle. Cereal leaf beetle adults are about 3/16 inch long and 1/16 inch wide. The adults have dark, metallic blue wing covers, orange legs, and an orange collar. The head and the rest of the body are black. Eggs are cylindrical with rounded edges. They are light orange when laid and darken gradually over time to brown. Eggs are usually

deposited singly or in rows of two to four on the top side of the leaves. Each female lays from 12 to 50 eggs. Larvae are pale yellow with a brown head and legs. In the field, they look mostly black because they smear excrement over their bodies. People walking through a field infested with cereal leaf beetle larvae may emerge with black-stained pants legs because this black coating easily rubs off the larvae. The larvae are about 1/16 inch long just after hatching and 1/3 inch long when fully grown.

Cereal leaf beetle has one generation per year. Adult beetles spend the winter in the woods and field borders. During the first warm days of spring, the beetles fly into small grain fields, mate, and begin to lay eggs in mid to late March. Eggs hatch in about seven days, and larvae begin to feed on the cereal leaves. The larvae feed for about 3 to 4 weeks, then leave the plant, and move into the soil. The adults of the new generation come out in late May and early June, feed briefly, then move out of the fields, and remain inactive until the following spring. New generation adults may feed on corn leaves but seldom cause serious damage.

Scouting Procedure. Start checking for cereal leaf beetle eggs, larvae, and adults in early March in the vicinity of Talladega County and in mid-March in the Tennessee Valley region. Check fields weekly for about a month. Look for feeding damage, adult beetles, eggs, and larvae. Stop in five to ten areas in each field, and count the eggs and larvae on the top two leaves of five stems at each location. Sample the middle of the fields as well as the edges.

Threshold Level and Management. If cereal leaf beetle larvae have begun to hatch and there is more than one cereal leaf beetle egg or larva per two stems, treat with one of the suggested insecticides. All suggested insecticides provide good control of cereal leaf beetle larvae, but best yield response occurred when a long-residual insecticide, such as lambda-cyhalothrin, was applied at or before 30 percent egg hatch. Because dying larvae are hard to distinguish from living ones, wait 2 to 3 days after treatment before checking to make sure the treatment was successful. Heavy rains can kill larvae, so if heavy rains occur between the time a field is checked and insecticides are to be applied, wait for the foliage to dry and recheck the fields. Cereal leaf beetle has few natural enemies in the southern United States, but exotic parasites of the egg and larval stages are being released throughout the region.

See "Management of Cereal Leaf Beetles, Pests of Small Grains," ANR-984 (www.aces.edu/pubs/docs/A/ANR-0984), for more information.

Chinch Bugs

Adult chinch bugs, *Blissus leucopterus,* are 1/6 to 1/5 inch long and are black with white wings that are marked with a triangular black patch on the outer margins. The white wings give the insect a spotted appearance. Nymphs are brown to reddish with a transverse pale colored band. Both nymph and adult chinch bugs feed on grasses, including all the small grain crops, by sucking sap. Feeding can discolor and stunt plants, but populations usually are not large enough to cause economic damage on small grains. The insect overwinters as an adult and the entire life cycle takes about 40 days. Chinch bugs avoid damp, shaded areas; therefore, they are usually found along field edges and in thinner stands where sunlight reaches the soil. Chinch bugs are mainly a problem in dry years. They also may increase in small grain crops in the spring and move, as the wheat matures, to summer annual grass crops such as corn, sorghum, and millet in adjacent fields or to double-cropped plants in the same field. Chinch bugs can be very damaging to double cropped corn, sorghum and millet seedlings, especially under dry conditions. Economic thresholds have been estimated as one to two adults per five seedling plants. In spring, the economic threshold is one adult per stem.

Pathogenic fungi are especially important in suppressing populations of chinch bugs. These fungi require wet, humid conditions to develop; consequently, ***populations of these pests typically are worse in dry than wet years.***

Grasshoppers

Grasshoppers destroy leaves of seedlings during fall and occasionally during the spring. The damage is usually along field margins. The economic threshold is three to five per square yard within the field.

Lesser Cornstalk Borer

The lesser cornstalk borer, *Elasmopalpus lignosellus,* is a moth whose larvae bore into the stem base at or below the soil surface and kill seedling plants in the fall. This insect feeds on many host plants and often moves from weeds and stubble of the previous crop to newly planted small grain plants in the same field. Damage by lesser cornstalk borers usually is restricted to small grains that are planted early for grazing.

Stink Bugs

Large numbers of brown, *Euschistus* spp., or Southern green, *Nezara viridula,* stink bugs sometimes infest wheat in the coastal plain region during grain filling to harvest. Stink bugs feed by sucking fluid from developing grain, causing grain to be shriveled. The impact of stink bug feeding injury on wheat has not been determined, but most likely infestations rarely cause economically important damage. Instead, stink bugs disperse from wheat fields at harvest to infest adjacent summer crops where they may cause significant damage.

Thrips

Thrips are very small (3 inches or less in length) slender-bodied insects either wingless or winged with two pairs of very slender wings fringed with long hairs. Studies in Georgia and Florida found that the predominant species attacking small grains in the Southeast are the tobacco thrips, *Frankliniella fusca*, and cereal thrips, *Limothrips cerealium*. Nymphs are variously colored but adults are typically black. Thrips feed between the leaf sheath and stem where they suck plant fluids. Although thrips may become very abundant, they do not cause significant damage in small grains and do not require control in wheat. Wheat is not a host for tomato spotted wilt virus, which can be transmitted by tobacco thrips. However, as wheat matures, thrips may disperse to new plantings of adjacent summer crops where they can cause direct feeding damage.

Winter Grain Mites

Winter grain mites (*Penthaleus major*) are large, dark brown or black mites with red legs. They attack wheat, barley, and oats, particularly when these grains are over-seeded into perennial grass sod. Damage often appears between Thanksgiving and Christmas. See "Winter Grain Mite": http://pubs.ext.vt.edu/444/444-037/444-037.html.

Organic Insecticides That Can be Applied to Small Grains

Organic producers may want to consider the following insecticides, most if not all of which are OMRI approved. Be

sure to read the insecticide label to make sure it meets your needs. The following products contain azadirachtin: Neemix 4.5, Azera, and Ecozin Plus. The following products contain *Bacillus thuringiensis*: Biobit HP (subsp. *kurstaki* strain ABTS-351), Dipel DF (subsp. *kurstaki* strain ABTS-351), Javelin WG (subsp. *kurstaki* strain SA-11), and Xentari (subsp. *aizawai* strain ABTS-1857). M-Pede contains potassium salts of fatty acids. Entrust and Entrust SC contain spinosad. Other formulations of spinosad can be found. Be sure to check the labels to see if they meet the requirements for your cropping system. Grandevo contains *Chromobacterium subtsugae* strain PRA4-1. Mycotrol O contains *Beauveria bassiana* strain GHA. Other organic insecticides may be available. PyGanic Crop Protection EC 1.4$_{II}$ and PyGanic Crop Protection EC 5.0$_{II}$ insecticides are OMRI approved and contain natural pyrethrins. There are other insecticides that contain pyrethrins. Be sure to choose one that does not contain piperonyl butoxide, as that chemical is not considered organic.

Table 5. Small Grains (Barley, Oats, Rye, Triticale, and Wheat) Insect Control [1]

Insecticide and Formulation	Acres per Gallon	Amount of Formulation per Acre	Lb. Active Ingredient per Acre	Minimum Days from Last Application to Harvest (h) or Grazing (g)	Comments
APHIDS–SEED TREATMENT					
clothianidin NIPSIT INSIDE	—	0.75-1.79 fl.oz./ 100 lb. seed	0.03-0.07 lb./100 lb. seed	Not specified	For commercial seed treatment only.
imidacloprid GAUCHO 600 Other trade names [2]	—	0.8-2.4 fl.oz./ 100 lb. seed	0.03-0.09 lb./100 lb. seed	45	Use as a seed treatment. Apply as a slurry either on-farm or as a commercial seed treatment. Ensure thorough coverage. See label for plantback restrictions.
imidacloprid + captan + carboxin ENHANCE AW	—	4 oz/ 100 lb. seed	0.07 lb. imidaclo-prid/100 lb. seed	45	For oats, barley, and wheat. See label for plantback restrictions. Apply as a planter box treatment.
imidacloprid + ipoconazole + metalaxyl WARDEN CEREALS HR	—	5-8 fl.oz./ 100 lb. seed	0.05-.08 lb. imidaclo-prid/100 lb. seed	45	For wheat, barley, oats, rye, or triticale on-farm or commercial seed treatment.
imidacloprid + metalaxyl + tebuconazole GAUCHO XT	—	3.4-4.5 fl.oz./ 100 lb. seed	0.03 lb. imidaclo-prid/100 lb. seed	45	For barley, oats, rye, and wheat. See label for plantback restrictions.
imidacloprid + metalaxyl + tebuconazole + fludioxonil SATIVA IMF MAX	—	3.4-5 fl.oz/ 100 lb. seed	0.026-0.04 lb. imidaclo-prid/100 lb. seed	45	For barley and wheat. See label for plantback restrictions. Commercial seed treatment only. Not for planter boxes.
imidacloprid + metalaxyl + tebuconazole + fludioxonil SATIVA IMF RTU	—	5 fl. oz./ 100 lb. seed	0.005 lb. imidacloprid/ 100 lb. seed	45	Apply additional imidacloprid seed treatment to bring total amount of imidacloprid to 0.03-0.09 lb. ai/100 lb. seed. Not for use in planter boxes.
thiamethoxam CRUISER 5FS	—	0.75-1.33 fl.oz./100 lb. seed	0.03-0.07 lb./ 100 lb. seed	Do not graze.	Apply as a water-based slurry for seed treatment. See label for plantback restrictions. For on-farm or commercial use.
thiamethoxam + mefenoxam + difenoconazole CRUISER MAXX cereals	—	5 fl.oz./ 100 lb. seed	0.01 lb./ 100 lb. seed	Not specified	**Add an additional amount of Cruiser 5FS (0.48 to 1 fluid ounces of Cruiser 5FS).** For on-farm or commercial use.

[1] See Table 6 for a list of insecticides, formulations, restricted entry intervals, days to grazing or harvest, and maximum amount to apply.
[2] See Table 6 for other trade names.
[3] Use higher rate and increased water after insects are present or after boot stage. After boot stage control may be limited to suppression only.

Table 5. Small Grains (Barley, Oats, Rye, Triticale, and Wheat) Insect Control (cont.)[1]

Insecticide and Formulation	Acres Per Gallon	Amount of Formulation per Acre	Lb. Active Ingredient per Acre	Minimum Days from Last Application to Harvest (h) or Grazing (g)	Comments
thiamethoxam + sedaxane + mefenoxam + difenoconazole CRUISERMAXX VIBRANCE		5-10 fl. oz./100 lb. seed	0.01-0.02 lb. thiamethoxam/ cwt	45	Apply additional Cruiser 5 FS (0.5 – 1 fl. oz/ 100 lb. seed) to provide a sufficient dose of thiamethoxam. For on-farm or commercial use.
APHIDS–FOLIAR TREATMENT					
alpha-cypermethrin FASTAC EC	33-40	3.2-3.9 fl.oz.	0.02-0.025	14	For wheat and triticale only. Fastac EC is a **RESTRICTED USE** pesticide.
beta-cyfluthrin BAYTHROID XL [3]	53-71	1.8-2.4 fl.oz.	0.014-0.019	30 (h), 3 (g)	Baythroid XL is a **RESTRICTED USE** pesticide.
cyfluthrin TOMBSTONE [3] Other trade names [2]	53-71	1.8-2.4 fl.oz.	0.028-0.038	30 (h), 3 (g)	For wheat only. Tombstone is a **RESTRICTED USE** pesticide.
dimethoate CHEMINOVA DIMETHOATE 4EC Other trade names [2]	12-16	0.5-0.75 pt.	0.25-0.375	35 (h)	For wheat only. Other formulations are registered on triticale.
gamma-cyhalothrin DECLARE [3]	83-125	1.02-1.54 fl.oz.	0.01-0.015	30 (h), 7 (g)	Declare is a **RESTRICTED USE** pesticide. Use maximum rate for greenbug. Best control is achieved before the boot stage.
lambda-cyhalothrin KARATE with Zeon Technology [3] Other trade names [2]	67-100	1.28-1.92 fl.oz.	0.02-0.03	30 (h), 7 (g)	Use higher rate for greenbugs. Best control is achieved before boot stage. Karate is a **RESTRICTED USE** pesticide.
sulfoxaflor TRANSFORM WG	—	0.75 oz.	0.023 lb.	14 (grain, straw) 7 (grazing, fodder, hay)	For barley, triticale, wheat
zeta-cypermethrin MUSTANG MAXX INSECTICIDE	32-40	3.2-4 fl.oz.	0.02-0.025 lb. a.i./A	14	Mustang Maxx is a **RESTRICTED USE** pesticide. Aphid control may be variable depending on species present. Use on wheat and triticale only.
ARMYWORMS (FALL AND TRUE)					
alpha-cypermethrin FASTAC EC	33-71	1.8-3.9 fl.oz.	0.012-0.025	14	For wheat and triticale only. Fastac EC is a **RESTRICTED USE** pesticide. Use higher rate for fall armyworms.
beta-cyfluthrin BAYTHROID XL	53-71	1.8-2.4 fl.oz.	0.014-0.019	30 (h), 3 (g)	For first and second instar armyworm. Baythroid XL is a **RESTRICTED USE** pesticide.
chlorantraniliprole PREVATHON	6-9	14-20 fl. oz.	0.047-0.067	14	
cyfluthrin TOMBSTONE Other trade names [2]	53-71	1.8-2.4 fl.oz.	0.028-0.038	30 (h), 3 (g)	For wheat only. For true armyworm or first and second instar fall armyworm. Tombstone is a **RESTRICTED USE** pesticide.
gamma-cyhalothrin DECLARE	83-125	1.02-1.54 fl.oz.	0.01-0.015	30 (h), 7 (g)	Declare is a **RESTRICTED USE** pesticide.
lambda-cyhalothrin KARATE with Zeon Technology Other trade names [2]	67-100	1.28-1.92 fl.oz.	0.02-0.03	30 (h), 7 (g)	Apply when worms are small. Karate is a **RESTRICTED USE** pesticide.
malathion CHEMINOVA MALATHION 57% Other trade names [2]	5	1.6 pt.	1.0 lb.	7	For true armyworm only. For wheat, oats, rye, and barley.

[2] See Table 6 for other trade names.
[3] For suppression after boot stage.

Table 5. Small Grains (Barley, Oats, Rye, Triticale, and Wheat) Insect Control (cont.) [1]

Insecticide and Formulation	Acres per Gallon	Amount of Formulation per Acre	Lb. Active Ingredient per Acre	Minimum Days from Last Application to Harvest (h) or Grazing (g)	Comments
ARMYWORMS (FALL AND TRUE) (cont.)					
methomyl LANNATE LV Other trade names [2]	5-11	0.75-1.5 pt.	0.225-0.45	7 (h)	For wheat, oats, rye, and barley. Apply when worms are small. **DO NOT** apply more than 1.8 pounds active ingredient per acre per crop. Lannate is a **RESTRICTED USE** pesticide.
spinosad TRACER Other trade names [2]	43-85	1.5-3 fl.oz.	0.047-0.094	21 (grain, straw) 3 (forage, fodder, hay)	Most effective when timed to coincide with peak egg hatch.
spinetoram RADIANT SC	21-43	3-6 fl.oz.	0.023-0.046	21 (grain, straw) 3 (forage, fodder, hay)	Apply during peak egg hatch and/or small larval stage of each generation.
zeta-cypermethrin MUSTANG MAXX INSECTICIDE	32-72	1.76-4 fl.oz.	0.011-0.025	14	Use 3.2 to 4 fluid ounces per acre for fall armyworm. Mustang Maxx is a **RESTRICTED USE** pesticide. Use on wheat and triticale **ONLY**.
CEREAL LEAF BEETLES					
General Comments: *See the scouting section for information on action thresholds and timing of application.*					
alpha-cypermethrin FASTAC EC	34-71	1.8-3.8 fl.oz.	0.012-0.025	14	For wheat and triticale only. Fastac EC is a **RESTRICTED USE** pesticide.
beta-cyfluthrin BAYTHROID XL	71-128	1.0-1.8 fl.oz.	0.008-0.014	30 (h), 3 (g)	Baythroid XL is a **RESTRICTED USE** pesticide.
cyfluthrin TOMBSTONE Other trade names [2]	71-128	1.0-1.8 fl.oz.	0.016-0.028	30 (h), 3 (g)	For wheat only. Tombstone is a **RESTRICTED USE** pesticide.
gamma-cyhalothrin DECLARE	83-125	1.02-1.54 fl.oz.	0.01-0.015	30 (h), 7 (g)	Declare is a **RESTRICTED USE** pesticide.
lambda-cyhalothrin KARATE with Zeon Technology Other trade names [2]	67-100	1.28-1.92 fl.oz.	0.02-0.03	30 (h), 7 (g)	Karate is a **RESTRICTED USE** pesticide.
methomyl LANNATE LV Other trade names [2]	5-11	0.75-1.5 pt.	0.225-0.45	7 (h)	Lannate is a **RESTRICTED USE** pesticide. For wheat, barley, oats, and rye.
spinosad TRACER Other trade names [2]	43-128	1-3 fl.oz.	0.03-0.09	21 (grain, straw) 3 (forage, fodder, hay)	
spinetoram RADIANT SC	21-64	2-6 fl.oz.	0.016-0.046	21 (grain, straw) 3 (forage, fodder, hay)	
zeta-cypermethrin MUSTANG MAXX INSECTICIDE	32-72	1.76-4 fl.oz.	0.011-0.025	14	Mustang Maxx is a **RESTRICTED USE** pesticide. For wheat and triticale **ONLY**.
CHINCH BUGS					
alpha-cypermethrin FASTAC EC	33-40	3.2-3.9 fl.oz.	0.012-0.025	14	For wheat and triticale only. Fastac EC is a **RESTRICTED USE** pesticide.
beta-cyfluthrin BAYTHROID XL	53	2.4 fl.oz.	0.019	30 (h), 3 (g)	Baythroid XL is a **RESTRICTED USE** pesticide.

[2] See Table 6 for other trade names.

Table 5. Small Grains (Barley, Oats, Rye, Triticale, and Wheat) Insect Control (cont.) [1]					
Insecticide and Formulation	Acres per Gallon	Amount of Formulation per Acre	Lb. Active Ingredient per Acre	Minimum Days from Last Application to Harvest (h) or Grazing (g)	Comments
CHINCH BUGS (cont.)					
cyfluthrin TOMBSTONE Other trade names [2]	53	2.4 fl.oz.	0.038	30 (h), 3 (g)	For wheat only. Tombstone is a **RESTRICTED USE** pesticide.
gamma-cyhalothrin DECLARE	83	1.54 fl.oz.	0.015	30 (h), 7 (g)	Declare is a **RESTRICTED USE** pesticide.
lambda-cyhalothrin KARATE with Zeon Technology Other trade names [2]	67	1.92 fl.oz.	0.03	30 (h), 7 (g)	Karate is a **RESTRICTED USE** pesticide.
zeta-cypermethrin MUSTANG MAXX INSECTICIDE Other trade names [2]	32-40	3.2-4 fl.oz.	0.02-0.025	14	Mustang Maxx is a **RESTRICTED USE** pesticide. For wheat and triticale only.
GRASSHOPPERS					
General Comments: *Apply pesticide when 50 percent or more foliage has been lost. It may be possible to spot treat the edge of fields. Large, black and yellow lubber grasshoppers will probably not be controlled with any insecticide.*					
alpha-cypermethrin FASTAC EC	33-40	3.2-3.9 fl.oz.	0.012-0.025	14	For wheat and triticale only. Fastac EC is a **RESTRICTED USE** pesticide.
beta-cyfluthrin BAYTHROID XL	53-71	1.8-2.4 fl.oz.	0.014-0.019	30 (h), 3 (g)	Baythroid XL is a **RESTRICTED USE** pesticide.
cyfluthrin TOMBSTONE Other trade names [2]	53-71	1.8-2.4 fl.oz.	0.028-0.038	30 (h), 3 (g)	For wheat only. Tombstone is a **RESTRICTED USE** pesticide.
dimethoate CHEMINOVA DIMETHOATE 4EC Other trade names [2]	12	0.75 pt.	0.375	35 (h)	For wheat. Some formulations are also registered on triticale.
gamma-cyhalothrin DECLARE	83-125	1.02-1.54 fl.oz.	0.01-0.015	30 (h), 7 (g)	Declare is a **RESTRICTED USE** pesticide.
lambda-cyhalothrin KARATE with Zeon Technology Other trade names [2]	67-100	1.28-1.92 fl.oz.	0.02-0.03	30 (h), 7 (g)	See General Comments, above. Karate is a **RESTRICTED USE**E pesticide.
malathion CHEMINOVA MALATHION 57% Other trade names [2]	5	1.6 pt.	1.0	7	For wheat, oats, rye, and barley. Apply when nymphs are young.
zeta-cypermethrin MUSTANG MAXX INSECTICIDE	32-40	3.2-4 fl.oz.	0.02-0.025	14	Mustang Maxx is a **RESTRICTED USE** pesticide. For wheat and triticale only.

[2] See Table 6 for other trade names.
[4] Suppression.

Table 5. Small Grains (Barley, Oats, Rye, Triticale, and Wheat) Insect Control (cont.) [1]

Insecticide and Formulation	Acres per Gallon	Amount of Formulation per Acre	Lb. Active Ingredient per Acre	Minimum Days from Last Application to Harvest (h) or Grazing (g)	Comments
HESSIAN FLIES					
Seed Treatment					
General Comments: *Plant resistant or tolerant varieties. Avoid planting wheat in consecutive years.*					
clothianidin NIPSIT INSIDE	—	1.79 fl.oz./ 100 lb. seed	0.07 lb./ 100 lb. seed	Not specified	Suppression of early season Hession fly. For commercial seed treatment only.
imidacloprid GAUCHO 600 Other trade names [2]	—	1.6-2.4 fl.oz./ 100 lb. seed	0.06-0.09 lb./100 lb. seed	45	Use as a seed treatment. Apply as a slurry either on-farm or as a commercial seed treatment. Ensure thorough coverage. See label for plantback restrictions.
imidacloprid + carboxin + captan ENHANCE AW	—-	4 oz./100 lb. seed	0.07 lb. imidacloprid/ 100 lb. seed idacloprid/100 lb. seed	45	For on-farm use.
imidacloprid + metalaxyl + tebuconazole GAUCHO XT	—	4.5 fl. oz./ 100 lb. seed	0.04 lb. imidacloprid/ 100 lb. seed	45	Apply additional imidacloprid seed treatment to bring total amount of imidacloprid to 0.06-0.09 lb. ai/100 lb. seed.
imidacloprid + metalaxyl + tebuconazole + fludioxonil SATIVA IMF MAX		3.4-5.0 fl. oz./100 lb. seed	0.025-0.04 lb. imidacloprid/ 100 lb. seed	45	Apply additional imidacloprid seed treatment to bring total amount of imidacloprid to 0.06-0.09 lb. ai/100 lb. seed. Not for use in planter boxes.
SATIVA IMF RTU	—	5 fl. oz./100 lb. seed	0.005 lb. imidacloprid/ 100 lb. seed	45	Apply additional imidacloprid seed treatment to bring total amount of imidacloprid to 0.06-0.09 lb. ai/100 lb. seed. Not for use in planter boxes.
imidacloprid + ipoconazole + metalaxyl WARDEN CEREALS HR	—	8 fl.oz./ 100 lb. seed	0.08 lb. imidaclo-prid/100 lb. seed.	45	Suppression of early season Hessian fly. On-farm or commercial seed treatment.
thiomethoxam CRUISER 5FS	—	1.33 fl.oz./ 100 lb. seed	0.06 lb./ 100 lb. seed	—	Use as a seed treatment. Apply as a slurry either on-farm or as a commercial seed treatment. Ensure thorough coverage. See label for plantback restrictions.
thiamethoxam + mefenoxam + difenoconazole CRUISER MAXX cereals	—	5 fl.oz./ 100 lb. seed	0.01 lb./ 100 lb. seed	Not specified	Add an additional amount of Cruiser 5FS (0.48 to 1 fluid ounces of Cruiser 5FS). For on-farm or as a commercial seed treatment.
Foliar Treatment					
General Comments: *Foliar application of insecticide at the 2 to 3 leaf stage may protect young when plants from attack by Hessian fly. Foliar application at the time Hessian fly adults are laying eggs in winter to early spring may reduce further damage in fields where moderate to heavy Hessian fly infestations have been found. See "Hessian Fly Scouting Guide," www.aces. edu/dept/grain/documents/ HessianFlyScoutingGuide.pdf and North Carolina small grains production guide www.smallgrains.ncsu.edu/NCSmallGrains/ ProductionGuide.html.*					
gamma-cyhalothrin DECLARE	83-125	1.02-1.54 fl.oz.	0.01-0.015	30 (h), 7 (g)	Declare is a **RESTRICTED USE** pesticide. Apply when adults emerge.

lambda-cyhalothrin KARATE with Zeon Technology	67-100	1.28-1.92 fl.oz.	0.02-0.03	30 (h), 7 (g)	Timing is critical in the effectiveness of this treatment. Apply when adult Hessian flies emerge. Karate is a **RESTRICTED USE** pesticide.
WINTER GRAIN MITES					
The following insecticides may provide helpful control.					
alpha-cypermethrin FASTAC EC	33	3.9 fl.oz.	0.025	14	For wheat and triticale only. Fastac EC is a **RESTRICTED USE** pesticide.
gamma-cyhalothrin DECLARE	83	1.54 fl.oz.	0.015	30 (h), 7 (g)	For wheat, wheat hay, and triticale **ONLY**.
lambda-cyhalothrin KARATE WITH ZEON TECHNOLOGY Other trade names [2]	67	1.92 fl.oz.	0.03	30 (h), 7 (g)	Karate is a **RESTRICTED USE** pesticide.
zeta-cypermethrin MUSTANG MAXX Other trade names [2]	32-40	3.2-4 fl.oz.	0.02-0.025	14	Mustang Maxx is a **RESTRICTED USE** pesticide.

[2] See Table 6 for other trade names.

*MoA = Mode of Action classification from the Insecticide Resistance Action Committee (www.irac-online.org). Insecticides with different MoAs should be used for insecticide resistance management.

Table 6. Insecticides Labeled for Use on Small Grains

Insecticide and Trade Name	A.I./ Formulated Product	Formulation	Restricted Entry Interval (hr)	Minimum Days from Last Application to Harvest (h) or Grazing (g)	Bee Hazard Restriction
alpha-cypermethrin (triticale, wheat) *MoA Group 3A					
FASTAC EC (Restricted Use)	0.83 lb./gal.	emulsifiable concentrate	12	14	yes[1]
beta-cyfluthrin (barley, buckwheat, millet, oat, rye, triticale, wheat) MoA Group 3A					
BAYTHROID XL (Restricted Use)	1 lb./gal.	emulsifiable concentrate	12	30 (h), 3 (g)	yes[1]
chlorantraniliprole (barley, buckwheat, pearl and proso millet, oats, rye, triticale, and wheat) MoA Group 28					
DUPONT CORAGEN	1.67 lb./gal.	suspension concentrate	4	14	no
DUPONT PREVATHON	0.43 lb./gal.	suspension concentrate	4	14	no
clothianidin (wheat, oats, trittical, barley, rye, buckwheat, proso and pearl millet) MoA Group 4A					
NIPSIT INSIDE	5 lb./gal.	seed treatment	Not specified	Not specified	yes[2]
cyfluthrin (wheat) MoA Group 3A					
TOMBSTONE (Restricted Use)	2 lb./gal.	emulsifiable concentrate	12	30 (h), 3 (g)	yes[1]
TOMBSTONE HELIOS (Restricted Use)	2 lb./gal.	emulsifiable concentrate	12	30 (h), 3 (g)	yes[1]
dimethoate (wheat) MoA Group 1B					
CHEMINOVA DIMETHOATE 4E	4 lb./gal.	emulsifiable concentrate	48	35 (h)	yes[1]
DIMETHOATE 400	4 lb./gal.	emulsifiable concentrate	48	35 (h)	yes[1]
DIMETHOATE 4EC (also triticale)	4 lb./gal.	emulsifiable concentrate	48	35 (h), 14 (g)	yes[1]
DIMATE 4E	4 lb./gal.	emulsifiable concentrate	48	35 (h), 14 (g)	yes[1]
gamma-cyhalothrin (wheat, oats, triticale, barley, rye, and buckwheat) MoA Group 3A					
DECLARE (Restricted Use)	1.25 lb./gal.	microencapsulated suspension	24	30 (h, straw), 7 (g)	yes[1]
PROAXIS (wheat and triticale only) (Restricted Use)	0.5 lb./gal.	aqueous based concentrate	24	30 (h, straw), 7 (g)	yes[1]
imidacloprid (wheat, oats, rye, barley, triticale) MoA Group 4A					
AXCESS	5 lb./gal.	seed treatment	12	45	no
ATTENDANT 480 FS	4 lb./gal.	seed treatment	12	45	yes[2]
DYNA-SHIELD IMIDACLOPRID 5	5 lb./gal.	seed treatment	12	45	yes[2]
MACHO 600 ST	5 lb./gal.	seed treatment	12	45	yes[1]
NITRO SHIELD IV	4 lb./gal.	seed treatment	12	45	yes[1,2]
NITRO SHIELD	5 lb./gal.	seed treatment	12	45	no
SENATOR 600 FS	5 lb./gal.	seed treatment	12	45	no
GAUCHO 600	5 lb./gal.	seed treatment	12	45	no
ATTENDANT 600	5 lb./gal.	seed treatment	12	45	yes[2]
imidacloprid + captan + carboxin (oats, wheat, barley) MoA Group 4A					
ENHANCE AW	Per lb: 3.2 oz. + 3.1 oz. + 3.2 oz.	seed treatment	12	45	no

[1] Do not apply this product or allow it to drift to blooming crops or weeds if bees are visiting the treatment area.

[2] Ensure that planting equipment is functioning properly in accordance with manufacturing specifications to minimize seed coat abrasion during planting to reduce dust that can drift to blooming crops or weeds.

Table 6. Insecticides Labeled for Use on Small Grains (cont.)

Insecticide and Trade Name	A.I./ Formulated Product	Formulation	Restricted Entry Interval (hr)	Minimum Days from Last Application to Harvest (h) or Grazing (g)	Bee Hazard Restriction
imidacloprid + ipoconazole + metalaxyl (oats, wheat, barley, rye, triticale) MoA Group 4A					
WARDEN CEREALS HR	Per gal: 1.28 lb. + 0.038 lb. + 0.051 lb	seed treatment	24	45	no
imidacloprid + metalaxyl + tebuconazole (oats, wheat, barley) MoA Group 4A					
GAUCHO XT	Per gal: 1.16 lb. + 0.056 lb. + 0.075	seed treatment	24	45	no
imidacloprid + metalaxyl + tebuconazole + fludioxonil (wheat, barley) MoA Group 4A					
SATIVA IMF MAX	Per gal: 1.00 lb. + 0.05 lb. + 0.04 lb + 0.03 lb.	seed treatment	24	45	yes[2]
SATIVA IMF RTU	Per gal: 0.13 lb + 0.05 lb + 0.04 lb. + 0.03 lb.	seed treatment	24	45	yes[2]
DYNA-SHIELD FOOTHOLD VIROCK	Per gal: 1.0 lb + 0.05 lb + 0.04 lb. + 0.03 lb.	seed treatment	24	45	yes[2]
lambda-cyhalothrin (barley, oats, rye, buckwheat, wheat, triticale) MoA Group 3A					
GRIZZLY Z INSECTICIDE (Restricted Use)	1 lb./gal.	capsule suspension	24	30 (grain, straw), 7 (g)	yes[1]
KARATE with ZEON TECHNOLOGY (Restricted Use)	2.08 lb./gal.	capsule suspension	24	30 (grain, straw), 7 (g)	yes[1]
KENDO (Restricted Use)	1 lb./gal.	emulsifiable concentrate	24	30 (grain, straw), 7 (g)	yes[1]
LAMBDA-CY AG (Restricted Use)	1 lb./gal.	emulsifiable concentrate	24	30 (grain, straw), 7 (g)	yes[1]
LAMBDA-CY EC (Restricted Use)	1 lb./gal.	emulsifiable concentrate	24	30 (grain, straw), 7 (g)	no
NUFARM LAMBDA CYHALOTHRIN 1EC (Restricted Use)	1 lb./gal.	capsule suspension	24	30 (grain, straw), 7 (g)	yes[1]
LAMBDASTAR (Restricted Use)	1 lb./gal.	emulsifiable concentrate	24	30 (grain, straw), 7 (g)	yes[1]
LAMBDASTAR 1CS (Restricted Use)	1 lb./gal.	capsule suspension	24	30 (grain, straw), 7 (g)	yes[1]
LAMBDASTAR PLUS (Restricted Use)	2 lb./gal.	aqueous-based formulation	24	30 (grain, straw), 7 (g)	yes[1]
LAMBDA-T (Restricted Use)	1 lb./gal.	capsule suspension	24	30 (grain, straw), 7 (g)	yes[1]
LAMCAP (Restricted Use)	1 lb./gal.	capsule suspension	24	30 (grain, straw), 7 (g)	yes[1]
PARADIGM (Restricted Use)	1 lb./gal.	capsule suspension	24	30 (grain, straw), 7 (g)	yes[1]
PROVINCE (Restricted Use)	1 lb./gal.	capsule suspension	24	30 (grain, straw), 7 (g)	yes[1]

[1] Do not apply this product or allow it to drift to blooming crops or weeds if bees are visiting the treatment area.

[2] Ensure that planting equipment is functioning properly in accordance with manufacturing specifications to minimize seed coat abrasion during planting to reduce dust that can drift to blooming crops or weeds.

Insecticide and Trade Name	A.I./ Formulated Product	Formulation	Restricted Entry Interval (hr)	Minimum Days from Last Application to Harvest (h) or Grazing (g)	Bee Hazard Restriction
SILENCER (Restricted Use)	1 lb./gal.	emulsifiable concentrate	24	30 (grain, straw), 7 (g)	yes[1]
malathion (barley, oats, rye, wheat) MoA Group 1B					
FYFANON ULV AG	9.9 lb./gal.	emulsifiable concentrate	12	7	yes[1]
FYFANON	5 lb./gal.	emulsifiable concentrate	12	7	yes[1]
CHEMINOVA MALATHION 57% (rye, oats, barley)	5 lb./gal.	emulsifiable concentrate	12	7	yes[1] yes[1]
MALATHION 5, others	5 lb./gal.	emulsifiable concentrate	12	7	yes[1]
GOWAN MALATHION 8, others	8 lb./gal.	emulsifiable concentrate	12	7	yes[1]
methomyl (barley, oats, rye, wheat) MoA Group 1A					
DUPONT LANNATE LV (Restricted Use)	2.4 lb./gal.	water soluble liquid	48	7	yes[1]
DUPONT LANNATE SP (Restricted Use)	14.4 oz./lb.	water soluble bags	48	7	yes[1]
NUDRIN LV (Restricted Use)	2.4 lb./gal.	water soluble liquid	48	7	yes[1]
NUDRIN SP (Restricted Use)	14.4 oz./lb.	water soluble bags	48	7	yes[1]
spinetoram MoA Group 5 (barley, buckwheat, oats, triticale, wheat)					
RADIANT SC	1 lb./gal.	suspension concentrate	4	21 (grain, straw) 3 (forage, fodder, hay)	yes[3]
spinosad (barley, buckwheat, oats, rye, triticale, wheat) MoA Group 5					
BLACKHAWK	5.8 oz./lb.	water dispersable granule	4	21 (grain, straw) 3 (forage, fodder, hay) Graze when hay is dry.	yes [3]
ENTRUST	12.8 oz./lb.	wettable powder	4	same as above	yes [3]
ENTRUST SC	2 lb./gal.	soluble concentrate	4	same as above	yes [3]
SPINTOR 2SC	2 lb./gal	soluble concentrate	4	same as above	yes [3]
TRACER	4 lb./gal.	aqueous suspension	4	same as above	yes [3]
sulfoxaflor (barley, triticale, wheat) MoA Group 4C					
TRANSFORM WG	8 oz./lb.	Water dispersable granule	24	14 (grain, straw) 7 (grazing, forage, fodder, hay)	yes [3]
thiamethoxam (barley, buckwheat, oats, rye, triticale, wheat) MoA Group 4A					
CRUISER 5FS	5 lb./gal.	seed treatment	12	not specified	yes[4]
thiamethoxam + mefenoxam + difenoconzaole (barley, wheat, triticale) MoA Group 4A					
CRUISER MAXX CEREALS	0.26 lb. + 0.05 lb. + 0.31 lb./gal.	seed treatment	48	not specified	yes[4]
thiamethoxam + sedaxane + difenoconazole + mefenoxam (barley, triticale, wheat) MoA Group 4A					
CRUISERMAXX VIBRANCE CEREALS	Per gal: 0.26 lb + 0.07 lb + 0.31 lb. + 0.08 lb.	water dispersable granule	24	not specified	no
zeta-cypermethrin (triticale, buckwheat, wheat, barley, oats, rye) MoA Group 3A					
MUSTANG MAXX INSECTICIDE (Restricted Use)	0.8 lb./gal.	emulsifiable concentrate	12	14	yes[1]

[1] Do not apply this product or allow it to drift to blooming crops or weeds if bees are visiting the treatment area.
[3] This product is toxic to bees exposed to treatment during the 3 hours following treatment. Do not apply to blooming, pollen-shedding, or nectar producing parts of plants if bees may forage during this time period.
[4] Thiamethoxam is highly toxic to bees exposed to direct treatment and effects may be possible as a result of exposure to translocated residues in blooming crops.

Other products may be available. Always read the label to make sure the specific crop is listed and to determine what rate to use. Insect Pest Management section prepared by Kathy L. Flanders, Extension Entomologist, Professor, Department of Entomology and Plant Pathology, Auburn University. Portions of the introduction were adapted from Hudson, R., G. D. Buntin, and K. Flanders. Wheat Insects. In Southern Small Grains Resource Management Handbook. University of Georgia Cooperative Extension Service Bulletin 1190.

DISEASE CONTROL

Small grain production in Alabama can be critically limited by diseases. They are important factors in lowering both the yield and the quality of grain. Diseases must be managed effectively to achieve optimum yields of quality grains.

Many diseases can be managed without applying fungicides. Maintaining soil fertility, planting resistant varieties, rotating with nonhost crops, and following other good management practices are essential. These other practices include tilling, seedbed preparation, delayed planting, weed control, and using treated seed. However, foliar-applied fungicides may still sometimes be required to control stem and foliage disease outbreaks.

Most disease management decisions are made prior to planting! Variety selection, the type of tillage, crop rotation, planting dates, and the fertility of the soil will greatly influence diseases in small grains. The only decisions that may be required for disease control after planting will concern foliar pesticide applications needed to control leaf and head diseases and aphid outbreaks which can result in barley yellow dwarf.

Variety Selection

Selecting varieties is a very important disease control consideration. There are commercial varieties available that are tolerant and some that are resistant to many of the common diseases in Alabama. Selecting the varieties that are resistant to the prevailing diseases in a particular area can make the difference between the crop's success or failure. Also, it is important to plant more than one variety with resistance to the commonly occurring diseases to prevent the disease from overcoming the resistance of a single variety. Other factors such as the varieties' maturity dates, their ability to withstand any inclement environmental conditions, and other pests that may reduce grain production must be considered in selecting varieties.

Tillage

Destroying small grain stubble by disking grain fields speeds up the decomposition of stalks that can host diseases such as take-all, Septoria glume blotch, and scab.

Crop Rotation

Rotating crops prevents the buildup of certain small grain diseases and insect pests and improves weed control and soil fertility. Rotation is especially important in preventing take-all outbreaks in wheat. Also, rotation with nonhost crops causes a decline of foliage and stem fungal diseases such as rust, scab, septoria leaf and glume blotch, and smut by removing the hosts needed to maintain the disease-causing organisms.

Soil Fertility

High nitrogen rates can produce excessive vegetative growth in the fall, increasing the incidence of foliage diseases and barley yellow dwarf. Excessive growth and dense stands increase humidity in the canopy, which favors the development of powdery mildew, septoria leaf blotch, and leaf rust. Also, excessive vegetation prolongs the feeding activity of aphids, which transmit the barley yellow dwarf virus.

Planting Date

The development of barley yellow dwarf is greatly influenced by planting dates. Delaying the planting date to miss aphid migrations can reduce barley yellow dwarf incidence. Be careful, however, not to delay the planting date too long because planting too late can reduce small grain yields in Alabama.

Quality Seed

Selecting good seed is essential for good stands in the fall. Fungicide seed treatment provides added protection against seed- and soilborne seedling disease fungi. Though expensive, the newer sterol inhibitor class of seed treatment fungicides provides good systemic protection against loose smut, common bunt, and fall infection of powdery mildew.

Seed treatment is more effective when the fungicide covers the entire seed surface. Poor coverage of the seed will result in poor performance. Seed treatments applied at the factory are superior to on-farm treatments. However, on-farm or on-site treatments provide better coverage than hopperbox treatments.

Table 7. Small Grains Seed Treatments

Fungicide and Formulation	Rate/Cwt	Crops [1]	Comments
carboxin + captan + imidacloprin ENHANCE AW	4.0 oz.	B,O,W	Hopper box treatment for control of loose smut bunts, seed rots, and seedling diseases of small grains.
carboxin + metalaxyl + PCNB PREVAIL	2.5- 5 oz. 1.6-3.3 oz.	W O	Hopper box treatment for control of loose smut bunts, seed rots, and seedling diseases. Hopper box treatment for control of loose smut, seed rots, and seedling disease in oats.
difenoconazole DIVIDEND	0.5-1.0 fl.oz.	W	Good to excellent fall-season control of powdery mildew, rust, and Septoria leaf blotch. Controls loose smut and bunt disease of wheat.

Fungicide and Formulation	Rate/Cwt	Crops [1]	Comments
difenoconazole + metalaxyl DIVIDEND EXTREME DIVIDEND XL RTA (for on-farm use)	 1-4 fl.oz. 2.5-10 fl.oz.	 B,W B,W	Good to excellent fall-season control of powdery mildew, leaf rust, and Septoria leaf blotch when applied at highest rate. Excellent loose smut and bunt control. Low rate controls only loose smut and common bunt. Gives good Pythium damping off control; partial control of Fusarium root rot, crown rot, and take-all.
imidacloprid + metalaxyl + tebuconazole GAUCHO XT	3-4 fl.oz.	B, W	Suppresses barley yellow dwarf by controlling aphids. Also controls Pythium seed rot and seedling damping off, loose smut, covered bunt, and suppresses early season Septoria disease complex, powdery mildew, leaf rust, and root rot. See comments for imidacloprid in Table 5.
ipconazole RANCONA APEX MD	5-8.33 fl.oz.	B,O,R,W	For protection against seed decay, damping-off, and seedling blight as well as bunts and smuts.
metalaxyl APRON-FL ALLEGIANCE-FL	 0.75-1.5 fl.oz. 0.75 fl.oz.	 B, O, R, W	Add if Pythium seedling disease is a problem.
penflufen EVERGOL PRIME	0.32 fl.oz.	B, O, R, W	For control of seed rots and seedling damping-off caused by *Rhizoctonia*, common bunt, and smut diseases.
prothioconazole + penflufen + metalaxyl EVERGOL ENERGY	1 fl.oz.	B,W	For control of seed rots and seedling damping-off caused by *Rhizoctonia*, *Fusarium*, *Cochliobolus*, and *Pythium*, common bunt and smut diseases, and early season suppression of common foot rot, powdery mildew, and rust and Septoria diseases.
sedaxane + difconazole + mefenoxam + thiamethoxam CRUISERMAXX VIBRANCE CEREALS	5-10 fl.oz.	B, O, R, W	For control of seed rots and seedling damping-off caused by *Rhizoctonia*; *Fusarium*; *Pythium*; common, karnal, and dwarf bunt; flag; and loose smut as well as early suppression of take-all, common root (foot rot), Fusarium and Rhizoctonia root rot, powdery mildew, Fusarium scab, Fusarium foot rot, and rust and Septoria diseases.
tebuconazole + metalaxyl RAXIL MD	5-6 fl.oz.	B, O, R, W	For suppression or control of seed, seedling, and soilborne diseases. Includes early season control of powdery mildew and rust.
tebuconazole + thiram RAXIL-THIRAM	3.5-4.6 fl.oz.	B, O, W	Excellent loose smut and common bunt control. Good seedborne scab control and early season powdery mildew and rust control.
thiamethoxam + mefenoxam + difenconazole CRUISERMAXX FOR CEREALS	5 fl.oz.	B, W	For control of seed rots and damping-off by *Fusarium* and *Pythium*, common and dwarf bunt, loose smut as well as suppression of take-all, and early season common root rot, Fusarium root rot, and Rhizoctonia root rot along with early season control of aphids that transmit barley yellow dwarf virus on wheat, triticale, and barley. Custom machine-applied seed dressing.
triticonazole CHARTER	3.1 fl.oz.	B,O, R, W	For control of seed rots and damping-off caused by Fusarium bunt and smut diseases as well as early season suppression of common root (foot rot), Fusarium and Rhizoctonia root rot, and Fusarium foot rot. **DOES NOT** control Pythium seed rot and seedling diseases.
triticonazole + metalaxyl CHARTER F[2]	5.4 fl.oz.	B,O, R, W	For control of seed rots and damping-off caused by *Fusarium*, *Pythium*, and bunt and smut diseases as well as early season suppression of common root (foot rot), Fusarium and Rhizoctonia root rot, and Fusarium foot rot.

[1] B = Barley, O = Oats, R = Rye, W = Wheat.

[1] Apply fungicides in a minimum of 5 gallons per acre for aerial applications and 5 to 15 gallons per acre for ground applications. Thorough coverage of the lower and upper leaf surface is essential for optimum disease control.

Table 8. Foliar Fungicides Recommended for Control of Leaf, Stem, and Head Diseases

Fungicide	Formulation Rate/ Acre[1]	Comments
azoxystrobin QUADRIS FLOWABLE	4-12 fl.oz.	For control of leaf rust, tan spot, Septoria glume, and leaf blotch on barley, wheat, and triticale. Apply just before or during early stage of disease development and at any growth stage between jointing (Feeke's Growth Stage 6) and flowering (Feeke's Growth Stage 10.5). Add a crop oil concentrate at 1% v/v. **DO NOT** make more than two applications of Quadris per year. See label for application rates on barley.
	7.5-11 fl.oz.	For control of powdery mildew on wheat. Apply just before or when disease first appears and at any growth stage between jointing (Feeke's Growth Stage 6) and flowering (Feeke's Growth Stage 10.5). Add crop oil concentrate at 1% v/v. **DO NOT** make more than two applications of Quadris per year.
fluoxastrobin EVITO 480SC	2-4 fl.oz.	For control of leaf stripe, stem rust, tan spot, and Septoria leaf and glume blotch on wheat. For optimum control, apply preventively and repeat as needed 14 to 21 days later. Do not apply after 50 percent head emergence (Feeke's Growth State 10.5) or make more than two sequential applications.
	2.5-4 fl.oz.	For control of powdery mildew on wheat. See above for application timing.
fluoxastrobin + tebuconazole EVITO T	4-6 fl.oz.	For control of leaf stripe, stem rust, tan spot, and Septoria leaf and glume blotch. For best results, apply at Feeke's Growth Stage 5 followed by a second application no later than 50 percent head emergence (Feeke's Growth Stage 10.5).
fluxapyroxad + pyraclostrobin PRIAXOR	2-4 fl.oz.	For early season (spring) suppression on barley, triticale, and wheat for Septoria diseases, leaf and net blotch, powdery mildew, scald, spot blotch, and tan spot prior to flag leaf emergence. Apply when symptoms appear and repeat no later than flag leaf emergence for full season control. May be tank mixed with herbicide.
	4-8 fl.oz.	For control of powdery mildew, rust diseases, Septoria leaf and glume blotch, spot blotch, tan spot, and scald on barley, oat, rye, triticale, and wheat. See label for disease listing for each small grain. Apply at full flag leaf extension and again 10 to 14 days later at beginning of flowering (Feeke's Growth Stage 10.5) as needed. Does not suppress Fusarium head blight/scab on wheat and barley.
metaconazole CARAMBA	5-8.3 fl.oz	For early season (spring) suppression on barley, triticale, and wheat for Septoria diseases, leaf and net blotch, powdery mildew, scald, spot blotch, and tan spot prior to flag leaf emergence. Apply when symptoms appear and repeat no later than flag leaf emergence for full season control. May be tank mixed with herbicide. Early season application will not control Fusarium head scab.
	13-17 fl.oz.	For optimum suppression of Fusarium scab on wheat and barley. Apply at early flowering (Feek's Growth Stage 10.51). Do not make more than two applications of Caramba or other triazole (group 3) fungicides per year to wheat.
	10-14 fl.oz.	For control of powdery mildew, rust diseases, leaf and glume blotch, spot and rust blotch, tan spot, and scald on wheat, barley, oats, and triticale. Apply at full flag leaf extension and again 10 to 14 days later if conditions favor disease. Make no more than two applications of Caramba per crop.

[1] Apply fungicides in a minimum of 5 gallons per acre for aerial applications and 5 to 15 gallons per acre for ground applications. Thorough coverage of the lower and upper leaf surface is essential for optimum disease control.

Table 8. Foliar Fungicides Recommended for Control of Leaf, Stem, and Head Diseases (cont.)

Fungicide	Formulation Rate/ Acre[1]	Comments
picoxystrobin APROACH	3-4 fl.oz.	Apply between jointing and flag leaf emergence for early season control of Septoria disease, powdery mildew, and tan spot. Follow with a second application at flag leaf emergence for full season disease control.
	6-12 fl.oz.	For control of rust diseases, powdery mildew, Septoria leaf and glum blotch, black point, spot blotch, and tan spot as well as Fusarium head scab suppression on triticale and wheat. For best results, apply at flag leaf emerence (Feeke's growth stage 9.0) and 14 days later. Use higher rate when disease pressure is high and for Fusarium scab suppression **DO NOT** apply after Feeke's growth stage 10.5 Make no more than two applications per year.
picoxystrobin + cyproconazole APROACH PRIMA	3.4 fl.oz.	For early season (spring) suppression on triticale and wheat for Septoria diseases, powdery mildew, and tan spot prior to flag leaf emergence. Follow with a second application at flag leaf emergence for full season disease control.
	3.4-6.8 fl.oz.	For control of rust diseases, powdery mildew, Septoria leaf and glume blotch, black point, spot blotch, and tan spot on triticale and wheat. For best results, apply at flag leaf emergence (Feeke's growth stage 9.0) and 14 days later. Use higher rate when disease pressure is high. Also suppresses Fusarium head scab when applied at high rate. **DO NOT** apply after Feeke's growth stage 10.5. Make no more than two applications per year.
propiconazole TILT 3.6E PROPIMAX EC BUMPER 41.8EC	2-4 fl.oz.	For early season disease suppression on wheat (Tilt only). Apply when powdery mildew or leaf blotch is seen. Make a second application no later than flowering.
	4 fl.oz.	Fusarium head mold (scab) suppression in wheat. Apply at 50 percent flowering. Do not apply more than 8 fluid ounces for wheat harvested as grain.
	4 fl.oz.	For control of leaf rust, Septoria glume blotch, leaf blotch, powdery mildew, and Fusarium head blight on wheat and triticale as well as for control of crown rust and leaf blotch on oats. Apply up to flowering (Feeke's Growth Stage 10.5). Make up to two applications per year. Add a spreader for good leaf coverage.
propiconazole + azoxystrobin QUILT	7-14 fl.oz.	For early season suppression of leaf and glume blotch, Helminthosporium leaf spot, barley scald, barley stripe, and net blotch in barley, triticale, and wheat. Follow up with second application of Quilt for full season disease control.
	10.5-14 fl.oz.	For control of above diseases. Apply when flag leaf is 50 percent to fully emerged. A second application can be made at 14 days or later. May be applied through full head extension. Make no more than two applications at 14-day intervals.
QUILT XCEL	7-14 fl.oz.	For early season suppression of leaf and glume blotch, Helminthosporium leaf spot, barley scald, barley stripe, and net blotch in barley, triticale, and wheat. Follow up with second application of Quilt Xcel for full season disease control.
	10.5-14 fl.oz.	For control of above diseases. Apply when flag leaf is 50 percent to fully emerged. A second application can be made at 14 days or later. May be applied through full head extension. Apply no more than 28 fluid ounces per acre per year.

Table 8. Foliar Fungicides Recommended for Control of Leaf, Stem, and Head Diseases (cont.)

Fungicide	Formulation Rate/ Acre[1]	Comments
prothioconazole + trifloxystrobin STRATEGO YLD	4 fl.oz.	For control of leaf and glume blotch, powdery mildew, tan spot, and rust diseases on wheat.
	2.3 fl.oz.	For control of glume and leaf blotch, net and spot blotch, powdery mildew, rust, and scald on barley. Make first preventive spray when conditions favor disease and repeat after 14 days as needed. Do not apply after full head emergence (Feeke's Growth Stage 10.51) on wheat or flag leaf emercenge (Feeke's Growth Stage 8) on barley. Do not make more than two applications of Stratego YLD.
pyraclostrobin + metaconazole TWINLINE	7-9 fl.oz.	For control of all rust diseases, powdery mildew, glume and leaf blotch, and tan spot on wheat; rust diseases, net and spot blotch, and scald on barley and triticale; and crown rust and spot blotch on oats. For optimum control of above diseases, apply when flag leaf is 50 percent to fully emerged. A second application can be made at 14 days or later, preferably at full head extension. Use higher rate at shorter interval when disease is severe. Make no more than two applications or apply more than 18 fluid ounces per acre per season.
tebuconazole ORIUS 3.6F TEBUSTAR 3.6F TEBUZOL 3.6F MONSOON MUSCLE 3.6F	4.0 fl.oz. 4.0 fl.oz.	For control of leaf, stem, and stripe rust on wheat and leaf rust on barley. For rust control, apply at earliest sign of pustules on leaves. For Fusarium scab suppression on wheat and barley. Apply at early flowering (Feek's Growth Stage 10.51). Make only one application for a total of 4 fluid ounces per acre per year.
tebuconazole + prothioconazole PROSARO 421SC	6.5-8.2 fl.oz.	For control of all rust diseases, powdery mildew, glume and leaf blotch, and tan spot on wheat as well as rust diseases, net and spot blotch, and scald on barley.
	6.5-8.2 fl.oz.	Apply at early flowering (Feek's Growth Stage 10.51) for Fusarium scab control on wheat and barley. Spray equipment must be set to obtain good coverage of the heads. Make only one application for a total of 8.2 fluid ounces per acre per year. Apply a minimum of 5 gallons of spray volume per acre.
pyraclostrobin HEADLINE 2.09 SC	3-6 fl.oz.	For early season control of Septoria glume and leaf blotch, apply with postemergent herbicide in February. A second application may be needed to protect the flag leaf.
	6-9 fl.oz.	For control of leaf and glume blotch, rust diseases, tan spot, and powdery mildew in barley, oats, rye, triticale, and wheat. Apply immediately after flag leaf emergence and repeat if conditions favor disease spread 10 to 14 days later. Apply no later than flowering (Feeke's Growth Stage 10.5) on oat, triticale, and wheat. Apply no more than twice or 18 fluid ounces per acre per year. See label for resistance management instructions.

[1] Apply fungicides in a minimum of 5 gallons per acre for aerial applications and 5 to 15 gallons per acre for ground applications. Thorough coverage of the lower and upper leaf surface is essential for optimum disease control.

Table 9. Comparative Performance of Foliar-Applied Fungicides

Trade Name	Fungicide	Powdery Mildew	Leaf Rust	Leaf and Glume Blotch
HEADLINE	trifloxystrobin	Excellent	Excellent	Excellent
QUADRIS	azoxystrobin	Excellent	Excellent	Excellent
QUILT	propiconazole + azoxystrobin	Excellent	Excellent	Excellent
STRATEGO	propiconazole + trifloxystrobin	Excellent	Excellent	Excellent
TILT	propiconazole	Good	Excellent	Excellent

SOURCE: Table was compiled by Dr. Donald Hershman, University of Kentucky.

Disease Control section prepared by Austin K. Hagan, Extension Plant Pathologist, Professor, Department of Entomology and Plant Pathology, Auburn University.

WEED CONTROL

Several weed species are of concern in the production of small grains in Alabama. Weeds such as wild garlic, mustards, and annual ryegrass are widespread and persistent problems. The use of recommended mechanical and cultural weed control practices can minimize the effect of weeds in small grain production. A shallow tillage during seedbed preparation will kill many germinating weed seeds and existing plants. If weed problems develop later, the use of herbicides should be considered.

Winter annual weeds germinate in the fall or early winter. It is important to control these weeds while they are small to prevent them from competing with the grain crop. Although most grasses that germinate after planting and emerge with the crop plants cannot be controlled effectively, many of the broadleaf weeds can be controlled with the timely use of herbicides.

It is important to select the right herbicide for the specific weed problem and to apply it at the proper time in the development of the crop plants and weeds. Through the timely use of herbicides, it is possible to obtain good weed control without injuring the grain crop.

Herbicides that can be used to control troublesome weeds in small grains are listed in the following table. The most widely used herbicide in small grains is 2,4-D. Small grains vary in their tolerance to 2,4-D, depending upon the growth stage when the herbicide is applied and the particular crop planted. Generally, wheat varieties are the most tolerant to 2,4-D, barley is intermediate, and oats are least tolerant. Rye is intermediate between wheat and barley. The least injury to the grain crop from the use of herbicides can be expected when the herbicides are applied from full tiller to just before jointing (glyphosate and paraquat are the exceptions).

The following growth stages of small grains are ranked in order from the most tolerant stages to the most susceptible stages.

1. Soft dough to maturity.
2. Fully tillered to jointing (five or more leaves per plant; each plant 5 to 8 inches tall).
3. Jointing through flowering.
4. Germination to the four-leaf stage.

Final Remarks about Herbicide Use

If herbicides are used properly, they will effectively control most weeds in small grains. If they are used incorrectly, they will injure small grains. Herbicides should be used along with good tillage practices for best weed control. The following precautions should be observed when using any herbicide:

1. Choose the right herbicide for the specific weed problem that exists in the small grain crop.
2. Read the label and follow the directions. The label specifies the correct use rate of the herbicide for maximum benefit and minimum injury.
3. If winter grazing is planned, be sure to note the grazing restrictions given for the herbicide selected.
4. Be sure that the growth stage of the small grain is right for the use of the herbicide.
5. Pick a warm day, if possible, to apply the herbicide. Weeds are easier to kill when the temperature is 60°F or above.
6. Use enough carrier with the herbicide to get good coverage and spray when the wind is low for proper herbicide placement.
7. Calibrate the equipment carefully to apply the herbicides accurately.

Table 10. Small Grains Weed Control

Herbicide Trade Name (Rate/Acre Broadcast)	Herbicide Common Name (Active Herbicide/Acre)	Comments
PREPLANT FOLIAR (BURN DOWN)		
FIRST SHOT (0.5-0.8 oz.) + Non-ionic Surfactant	thifensulfuron + tribenuron (0.25-0.4 oz.) + non-ionic surfactant	Provides control of selected annula weeds prior to planting. May be mixed with other burndown herbcides for increased control. Wheat may be planted immediately after application unless dicamba or 2,4-D is included. *MOA–PPO inhibitor
SHARPEN (1-2 oz.) + Methylated Seed Oil (MSO) or Crop Oil Concentrate (COC) (1 gal./100 gal. spray mix) + Ammonium Sulfate (AMS) (10 lb./100 gal. spray mix)	saflufenacil (0.022-0.044 lb.)	Provides foliar and residual control of selected annual weeds, including horseweed, prior to planting wheat, oats, and barley. May be mixed with glyphosate for added foliar control. MOA–PPO inhibitor
BARRAGE HF (0.5 pt.)	2,4-D (0.28 lb.)	Apply a minimum of 29 days before planting wheat, oats, or rye. Will help with glyphosate-resistant horseweed control. *MOA–Synthetic auxin

*MOA=Mechanism of action. Herbicides with different MOAs should be used in weed resistance management programs. See Table 12 for classifications of mechanisms of action.

Table 10. Small Grains Weed Control (cont.)		
Herbicide Trade Name (Rate/Acre Broadcast)	Herbicide Common Name (Active Herbicide/Acre)	Comments
ET HERBICIDE (1-2 fl.oz.)	pyraflufen (0.0016-0.0032 lb.)	Apply prior to planting for control of small broadleaf weeds. May be mixed with glyphosate. Add 1 pint crop oil concentrate per acre when used alone. MOA–PPO inhibitor
GRAMOXONE SL (1-4 pt.) or FIRESTORM (0.6-2.5 pt.) + Non-ionic Surfactant (2 pt./100 gal.) spray solution	paraquat (0.25-1 lb.) + non-ionic surfactant	For control of emerged weeds. Apply prior to, during, or after planting but before emergence of the crop. Apply in 20 to 30 gallons of water per acre. **DO NOT** graze treated areas. Paraquat is a **RESTRICTED USE** pesticide. MOA–Photosystem I inhibitor
ROUNDUP or TOUCHDOWN or GLYPHOSATE (generic formulations)	glyphosate (See label.)	For control of emerged weeds. Apply any time prior to crop emergence. Application after crop emergence **WILL KILL CROP. DO NOT** plant subsequent crops, other than those on the label, for 30 days after application. Follow label directions carefully and note all precautionary statements. Some formulations may require additional surfactants. MOA–EPSP synthase inhibitor
POSTEMERGENCE		
AIM 2E (0.5-2 fl.oz.) + Non-ionic Surfactant (2 pt./100 gal. spray solution)	carfentrazone (0.008-0.031 lb.) + non-ionic surfactant	Provides foliar control of selected annual broadleaf weeds in **wheat**, **oats**, and **rye**. May be applied from preplant foliar until the joint stage. May be mixed with glyphosate, Liberty, or paraquat in burndown or with 2,4-D or MCPA after wheat is full tillered. MOA–PPO inhibitor
AXIAL (0.5 pt.)	pinoxaden (0.052)	Provides postemergence control of grass weeds in **wheat** and **barley** from two-leaf to boot stage. Tank mix with MCPA to increase broadleaf weed control after tiller. The label specifies the use of Adigor adjuvant at 9.6 fluid ounces per acres with Axial. MOA–ACCase inhibitor
POSTEMERGENCE (cont.)		
AXIOM DF (4-10 oz.)	flufenacet + metribuzin (0.17-0.43 lb.)	Apply early postemergence to **wheat** until the two-leaf stage.**DO NOT** apply before wheat emerges. Axiom provides control of wild radish, henbit, and bluegrass and suppresses annual ryegrass if activated prior to weed emergence. **Check label for use on cultivars NOT tolerant to Axiom.** MOA–Mitosis inhibitor + photosystem II inhibitor
CLARITY or VISION (0.25 pt.)	dicamba (0.125 lb.)	Controls most broadleaf weeds in **wheat**, **oats**, **barley**, and **rye**. Apply immediately after winter dormancy and before grain begins to joint. **DO NOT** graze treated areas or harvest for dairy feed prior to crop maturity. Proper timing and calibration are necessary to prevent delayed crop maturity and crop stunting. **YIELD REDUCTION** will occur when treatment is applied to jointing wheat. MOA–Synthetic auxin
ET HERBICIDE (0.5-1 fl.oz.)	pyraflufen (0.008-0.0016 lb.)	Apply to **wheat** from emergence to flag leaf for control of several annual broadleaf weeds including wild radish. Add 1 pint crop oil concentrate per acre. MOA–PPO inhibitor
EXPRESS 75DF (0.167-0.33 oz.) + Non-ionic Surfactant (2 pt./100 gal.) spray solution	tribenuron (0.125-0.25 oz.) + non-ionic surfactant	For control of broadleaf weeds in **wheat** and **barley**. Apply after the crop is in the two-leaf stage but before the flag leaf is visible. Apply in fall for wild mustard and wild radish. Application made later should include MCPA (see label). **DO NOT** harvest sooner than 45 days after treatment. MOA–ALS inhibitor
HARMONY SG (0.45-0.9 oz.) + Non-ionic Surfactant	thifensulfuron (0.22-0.45 oz.) + non-ionic surfactant	For control of wild garlic and other broadleaf weeds in **wheat**, **oats**, and **barley**. Apply from two-leaf to pre-flag leaf. Add a non-ionic surfactant at 2 pints per 100 gallons of spray mix. MOA–ALS inhibitor

Table 10. Small Grains Weed Control (cont.)		
Herbicide Trade Name (Rate/Acre Broadcast)	Herbicide Common Name (Active Herbicide/Acre)	Comments
HARMONY EXTRA SG (0.45-0.9 oz.) + Non-ionic Surfactant (2 pt./100 gal.) spray solution	thifensulfuron + tribenuron (0.22-0.45 oz.) + non-ionic surfactant	For wild garlic and wild radish control in **wheat**, **barley**, and **oats**. Apply after wheat is in the two-leaf stage but before flag leaf is visible. Use **LOW RATE** on **OATS**. Add non-ionic surfactant at 2 pints per 100 gallons of water. Wild garlic should be less than 12 inches tall. See label for wild radish control. Herbicidal action requires 2 to 5 weeks. Any crop may be planted 60 days after treatment. Temporary crop injury may occur if applied with liquid nitrogen fertilizer. MOA–ALS inhibitor
HOELON 3EC (1.33-2.67 pt.)	diclofop (0.5-1 lb.)	For control of annual ryegrass in **wheat** and **barley**. Apply postemergence in wheat when annual ryegrass is in the one- to four-leaf stage. Use low rate when weed is in the one- or two-leaf stage and high rate when weed is in the four-leaf stage. Ryegrass larger than the four-leaf stage is not effectively controlled. Make application with at least 10 gallons of water per acre at a spray pressure of at least 40 psi with ground equipment. Use a minimum of 5 gallons of water per acre by aerial application. Hoelon does not control broadleaf weeds or perennial grasses. **DO NOT** graze treated fields. **DO NOT** mix Hoelon with 2,4-D, Banvel, or Harmony Extra. Hoelon is a **RESTRICTED USE** pesticide. MOA–ACCase inhibitor
MCPA AMINE (0.5-1 pt.)	MCPA (0.25-0.5 lb.)	Controls broadleaf weeds in **wheat**, **oats**, **barley**, and **rye**. Apply after grain is tillered but before jointing. Small grains, especially oats, are more tolerant of MCPA than of 2,4-D. MOA–Synthetic auxin
POSTEMERGENCE (cont.)		
OSPREY (4.75 oz.) + Non-ionic Surfactant (2 pt./100 gal.) spray solution	mesosulfuron-methyl (0.013 lb.) + non-ionic surfactant	Apply postemergence to **wheat** from emergence to the joint stage. Controls annual ryegrass in the one-leaf to two-tiller stage. Suppresses the growth of several Brome species at the same growth stage. Osprey will only control 1 to 2 inch tall wild mustard. Apply in a minimum of 10 gallons of spray solution per acre with ground equipment. Make only one application per season. See label for recropping restrictions. MOA–ALS inhibitor
PEAK 57 WDG (0.38-0.5 oz.) + Non-ionic Surfactant (2 pt./100 gal.) spray solution	prosulfuron (0.2-0.3 oz.) + non-ionic surfactant	Apply postemergence to **wheat**, **barley**, **rye**, or **oats** from the three-leaf stage until the second node is detectable in stem elongation. Controls several winter annual weeds including wild garlic and wild mustard. A crop oil concentrate may be used under dry conditions. See label for rotational restrictions (10 months for cotton, peanuts, and soybean). MOA–ALS inhibitor
POWER FLEX (3.5 oz.) + Non-ionic Surfactant (2 pt./100 gal.) spray solution	pyroxsulam (0.016 lb.) + non-ionic surfactant	Apply postemergence to **wheat** from three-leaf to joint stage. Controls several annual grasses, including ryegrass, and broadleaf weeds. **DO NOT** mix with dicamba or amine formuations of 2,4-D or MCPA. See label for rotational restrictions. MOA–ALS inhibitor
PROWL H_2O (1.5-3 pt.)	pendimethalin (0.7-1.4 lb.)	Apply postemergence to **wheat** that is in the first leaf to flag leaf stage for preemergence control of annual grasses and small-seeded broadleaf weeds. Prowl will not control emerged weeds but may be mixed with any postemergence herbicide registered for use in wheat. Plant wheat at least 0.5 to 1 inch deep to avoid crop injury. MOA–Mitosis inhibitor
2,4-D AMINE or ESTER (1-1.5 pt.)	2,4-D (0.5-0.75 lb.)	Controls many winter annual broadleaf weeds such as mustards, buttercups, dock, and plantains in **wheat**, **barley**, and **rye**. Apply during warm (60°F), sunny weather in early spring when grain is fully tillered (5 to 8 inches tall) and has five or more leaves, but before jointing. Usually this occurs in February. **DO NOT** use this rate on oats (see 2,4-D Amine, below). **DO NOT** forage or graze treated fields for 2 weeks after treatment. See label for use rate of product selected. MOA–Auxin inhibitor
2,4-D AMINE (0.5-1 pt.)	2,4-D (0.25-0.5 lb.)	Use this rate on **oats**. Oats are more sensitive to 2,4-D than other grains. Make application in spring when oats are well established and fully tillered but before jointing. Some yield reduction may occur. Note weather conditions and grazing restrictions for 2,4-D Amine, above.
2,4-D ESTER (1.5-2 pt.) or 2,4-D AMINE (2-3 pt.)	2,4-D (0.75-1 lb.) 2,4-D (1-1.5 lb.)	For wild garlic and wild onion control. Will not control wild garlic completely but will reduce the production of aerial bulblets. Apply in early spring during warm (60°F), sunny weather when grain is fully tillered and has five or more leaves, but before jointing. Usually this occurs in February. These rates of 2,4-D **WILL INJURE OATS**. Amine formulation is not as effective as ester.

Table 10. Small Grains Weed Control (cont.)		
Herbicide Trade Name (Rate/Acre Broadcast)	Herbicide Common Name (Active Herbicide/Acre)	Comments
HARVEST AID		
2,4-D AMINE (1-2 pt.)	2,4-D (0.5-1 lb.)	Apply when small grains are in hard-dough stage to suppress large weeds that may interfere with harvest. Best results will be obtained when soil moisture is adequate for plant growth and weeds are growing well. **DO NOT** feed treated straw. Read label carefully.
ROUNDUP or TOUCHDOWN or glyphosate (generic)	22-33 oz. (See label for specific product.)	Apply when grains are in hard-dough stage to suppress large weeds that may interfere with harvest. Best results will be obtained when soil moisture is adequarte for plant growth and weeds are growing well. **DO NOT** feed treated straw. Read label carefully.

Table 11. Estimated Effectiveness of Recommended Herbicide Treatments on Important Weeds Infesting Small Grains in Alabama and Properties That May Affect Water Quality[1]

WEEDS	HERBICIDES						
	Barrage (PPF)	Gramoxone SL (PPF)	Glyphosate Roundup Touchdown (PPF)	2,4-D Ester (POST)	2,4-D, MCPA Amine (POST)	Aim (PPF, POST)	Axiom (POST)
Annual ryegrass	0	7	9	0	0	0	4
Buttercup	7	7	9	8	7	1	—
Chickweed	7	8	9	8	7	3	8
Common ragweed	8	6	9	8	8	—	—
Eveningprimrose	9	3	7	7	7	1	5
Pepperweed	7	6	8	7	7	1	—
Shepherdspurse	7	7	9	8	7	9	—
Wild garlic	5	6	8	8	6	—	0
Wild mustard	7	5	9	8	7	—	6
Wild radish	7	5	9	8	6	—	8

continued

[1]Ratings are based on observations of research plots and field use under average weather conditions for several years by weed control workers in Alabama and the South. Leaching and surface-loss potentials are based in part on herbicide chemical characteristics and pesticide behavior models developed by USDA scientists as well as on field experience.

KEY TO CONTROL RATINGS AND ABBREVIATIONS

Ratings range from 0 to 10: 0 = No control; 10 = 100% control.

PPF= Preplant Foliar.

POST = Postemergence: Applied to weeds and crop after crop emergence.

— = Information not available.

Table 11. Estimated Effectiveness of Recommended Herbicide Treatments on Important Weeds Infesting Small Grains in Alabama and Properties That May Affect Water Quality[1] (cont.)

WEEDS	HERBICIDES						
	Axial (POST)	Bucril (POST)	Clarity, Vision (POST)	ET (PPF, POST)	Express (POST)	Firstshot (PPF)	Harmony SG (POST)
Annual ryegrass	9	0	0	0	0	0	0
Buttercup	0	—	6	—	6	7	1
Chickweed	0	—	7	9	8	7	5
Common ragweed	0	6	8	8	—	4	1
Eveningprimrose	0	—	7	8	3	2	5
Pepperweed	0	8	7	—	—	—	1
Shepherdspurse	0	8	5	8	—	8	8
Wild garlic	0	2	4	0	6	7	6
Wild mustard	0	8	5	5	8	8	8
Wild radish	0	8	5	7	8	8	8

continued

[1]Ratings are based on observations of research plots and field use under average weather conditions for several years by weed control workers in Alabama and the South. Leaching and surface-loss potentials are based in part on herbicide chemical characteristics and pesticide behavior models developed by USDA scientists as well as on field experience.

KEY TO CONTROL RATINGS AND ABBREVIATIONS

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— = Information not available.

Table 11. Estimated Effectiveness of Recommended Herbicide Treatments on Important Weeds Infesting Small Grains in Alabama and Properties That May Affect Water Quality[1] (cont.)

WEEDS	HERBICIDES						
	Harmony Extra (POST)	Hoelon (POST)	Osprey (POST)	Peak (POST)	Power Flex (POST)	Prowl (POST)	Sharpen (PPF)
Annual ryegrass	0	9	9	0	8	8	0
Buttercup	7	0	0	—	—	—	—
Chickweed	8	0	5	8	9	8	8
Common ragweed	1	0	0	8	2	4	9
Eveningprimrose	6	0	0	8	2	2	8
Pepperweed	2	0	0	—	8	1	1
Shepherdspurse	8	0	0	—	9	4	8
Wild garlic	8	0	0	8	0	1	—
Wild mustard	8	0	8	8	8	5	8
Wild radish	8	0	7	8	8	5	—

[1]Ratings are based on observations of research plots and field use under average weather conditions for several years by weed control workers in Alabama and the South. Leaching and surface-loss potentials are based in part on herbicide chemical characteristics and pesticide behavior models developed by USDA scientists as well as on field experience.

KEY TO CONTROL RATINGS AND ABBREVIATIONS

Ratings range from 0 to 10: 0 = No control; 10 = 100% control.

PPF= Preplant Foliar.

POST = Postemergence: Applied to weeds and crop after crop emergence.

— = Information not available.

Table 12. Herbicide Classified by Mechanism of Action

Mechanism of Action	Herbicide
Acetyl CoA Carboxylase (ACCase) inhibitor	Axial, Hoelon
Acetolactase Synthase ALS inhibitors	Express, Firstshot, Harmony, Peak, Osprey
Enolpyruval shikimate-3-phosphase (EPSP) inhibitor	Roundup, Touchdown
Mitosis inhibitor	Prowl, Axiom
Photosystem I inhibitor	Gramoxone, Firestorm
Photosystem II inhibitor	Axiom
Protoporphyrinogen osidase (PPO) inhibitor	Aim, ET, Sharpen
Synthetic auxin	2,4-D, Clarity MCPA

Weed Control section prepared by Michael G. Patterson, Visiting Professor, Department of Crop, Soil and Environmental Sciences, Auburn University; and Brenda V. Ortiz, Extension Agronomist, Assistant Professor, Department of Crop, Soil and Environmental Sciences, Auburn University.

FOR MORE INFORMATION on pesticides, pesticide safety, or submitting samples for analysis, see the following publications in the IPM series:
IPM 1293, “Safety.” Safety contact information; worker protection standards; the safe use, handling, and storage of pesticides
IPM 1294, “Submitting Samples.” Procedures for submitting samples for diagnosis, analysis, and identification
IPM 1295, “General Pesticide Information.” Federal and state restricted use pesticide lists; pesticides and water quality
IPM 1317, “Appendix.” Pesticide guidelines for agronomic crops, including preharvest intervals; rain-free requirements; grazing restrictions; crop rotation guidelines; and the names, classifications, and toxicities of pesticides.

2015 IPM-0458

For more information, contact your county Extension office. Visit www.aces.edu/counties or look in your telephone directory under your county’s name to find contact information.

Use pesticides **only** according to the directions on the label. Follow all directions, precautions, and restrictions that are listed. Do not use pesticides on plants that are not listed on the label

The pesticide rates in this publication are recommended **only** if they are registered with the Environmental Protection Agency or the Alabama Department of Agriculture and Industries. If a registration is changed or canceled, the rate listed here is no longer recommended. Before you apply **any** pesticide, check with your county Extension agent for the latest information.

Trade names are used **only** to give specific information. The Alabama Cooperative Extension System does not endorse or guarantee any product and does not recommend one product instead of another that might be similar.

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Extension
ALABAMA A&M & AUBURN UNIVERSITIES

IPM-0413

Soybean

IPM

Insect, Disease, Nematode, and Weed Control Recommendations for 2015

INSECT CONTROL

For effective and economical insect control on soybeans, check beans periodically for the presence of insects. Scouting is especially important from the time of blooming until the beans are mature in the pods. Examine both foliage and pods to determine the number and kinds of insects present. The count will enable you to decide when sufficient numbers are present to justify control. The kinds of insects present will indicate which insecticide to use.

Seedling- and Stem-Feeding Insects

Cutworms are the larvae of night-flying moths. When fully grown, they are nearly 2 inches long. Several species attack soybeans. Larvae are fat, greasy, and dark-colored. They hide beneath the soil's surface during the day and then emerge at night to feed. Cutworms usually feed on portions of the stem rather than the foliage. Feeding results in leaves being clipped or plants being cut.

Three-cornered alfalfa hoppers are green, triangular insects that jump when disturbed. Both nymphs and adults suck juice from plants and can occur in damaging numbers on soybeans. The nymphs are particularly damaging because they gradually work their way around the stems as they feed. Their feeding girdles the plants and either kills them outright or weakens them so that they later fall over and die. The girdling takes place near ground level. Cruiser Maxx and Gaucho 600 insecticide seed treatments provide early season control. Once beans are 10 inches tall, feeding can occur on petioles of leaves, stems, and pods.

Lesser cornstalk borers are the slender, brownish-green, cross-striped, active larvae of small, brownish-gray moths. The eggs are laid on the stems of seedling plants. After hatching, the larvae bore into the young stems and burrow up and down inside the stems. The burrowing weakens the stems and causes the plants to fall over and die. The larvae construct tubes of sand, silk, and excrement which lie horizontally in the soil and are attached to the stems at the worms' entrance holes. The larvae leave the plants through these tubes when the plants die.

Grasshoppers have emerged as a pest of soybeans in recent years, primarily in conservation tillage systems. They chew the main stems of young plants, causing a reduction in stands. Soybeans are most susceptible to grasshopper injury from the time they emerge until the plants have about six leaves. Both the immature and the adult stage may cause injury. Controls are warranted when stands are threatened or more than one-third of the leaves are lost.

Kudzu bug is a new pest of soybeans that has been found in every county in Alabama. This insect is about 0.25 inch long. It is light brown in color with an olive green hue and dark specks. Its life cycle takes 6 to 8 weeks, depending on the temperature. This insect overwinters as an adult and can survive very cold winters. Kudzu appears to be an important early season reproductive host, but it is not required for a soybean field to be infested. Kudzu bug numbers tend to be much higher on full-season soybeans than on later planted fields. Immatures normally appear in full-season soybeans in early to mid July. Kudzu bug adults and nymphs feed on the main stem and leaf petioles with sucking mouthparts. Kudzu bug's feeding can reduce the number of pods per plant, number of seeds per pod, and seed size. Kudzu bug has been found to cause significant yield losses in soybeans.

Foliage-Feeding Insects

Velvetbean caterpillars are the larvae of small night-flying moths which overwinter in the tropics and in southern Florida. Adults migrate into Alabama in June and begin laying eggs on soybeans. The larvae are slender and multicolored with faint white stripes down the sides. They wiggle freely when disturbed. They are serious foliage feeders.

Fall armyworms are similar in appearance to corn earworms and are the larvae of small, night-flying moths. The larva has a prominent white inverted Y-shape on its head. Fall armyworms generally eat foliage and are easily seen and collected. They occur sporadically. Also, they are voracious feeders and can strip off leaves and tender stems very rapidly.

Soybean loopers (cabbage loopers) are serious defoliators of soybeans in Alabama. They are the larvae of small, dark-gray, night-flying moths. The larva is a slender, "cabbage green" worm that forms loops or humps as it crawls. When fully grown, it is 1 to 1.5 inches long. It feeds on foliage and is most often a pest from late August through September. However, it may occur earlier in the season.

Green cloverworms are semi-loopers. The worm is green with three pairs of prolegs. It has two narrow, white stripes down the side. It is about 1.25 inches long when fully grown. The worm is very active when disturbed.

Blister beetles are elongated, soft-winged beetles about 0.5 to 0.75 inch long. They are usually black and yellow striped but may be black or gray. They are generally foliage feeders that occur occasionally. Large populations may occur in isolated parts of a soybean field. These beetles feed gregariously and are easily seen.

Mexican bean beetles are reddish to yellow with sixteen black spots on the back and are about 0.25 inch long. Both the adult beetle and the spiny, orange or yellow larva skeletonize soybean leaves and sometimes feed on the pods. Mexican bean beetles are larger than the beneficial ladybug beetle, which they resemble. High populations are a serious pest.

Bean leaf beetles are reddish to yellow, usually with three or four black spots on each wing cover and a black border on the outside edge. They feed on soybean leaves and also on small pods.

Beet armyworms, close relatives of fall armyworms, are general feeders that attack soybean foliage and stems. The beet armyworm overwinters as a pupa in most of Alabama. In warmer areas, such as Baldwin County, it may overwinter as the adult moth. It has a wingspread of about 1.25 inches. The forewings are grayish brown with a pale spot in the mid-front margin. The hind wings are white with a dark front margin. The female begins to lay eggs in early spring. She deposits them in masses of about 80 eggs covered with hairs and scales from her body. She may lay as many as 500 to 600 eggs over a 4- to 10-day period. The eggs hatch in 2 to 5 days, and the larvae feed for about 3 weeks, spinning light webs over the foliage and passing through five stages.

The mature larva, about 1.25 inches long, is green with dark lateral stripes and a black dot above the second pair of legs behind the head. It usually pupates in the upper 0.25 inch of the soil in a cell made by putting soil particles and trash together with a sticky solution. The entire life cycle from egg to adult is about 36 days at 80°F. There usually are three to four generations each year in Alabama. They are extremely difficult to control with insecticides.

Pod-Feeding Insects

Podworms and stink bugs are perhaps the most important insects that attack soybeans. They may attack the beans from bloom (pod set) to pod maturity.

Podworms (bollworms, corn earworms) are probably the most destructive soybean insects because their feeding directly reduces yields. They usually occur from late July until mid September after the adults (small brown moths) have left corn fields. The small worms usually start feeding on the blooms and then eat into immature pods and destroy many beans. One worm can attack many pods. Podworms vary from green to brown and are about 1.25 inches long when fully grown. They roll up, drop to the soil, and play dead when touched.

Stink bugs include several shield-shaped bugs that may be brown or green, depending on the species. Both nymphs and adults suck juice from soybean pods, causing discoloration of the beans and subsequent reduction in grade. Heavy populations of stink bugs may occur in isolated parts of a soybean field; unless fields are closely examined, such infestations may go unnoticed. Beans are susceptible to stink bug damage up to maturity.

How to Identify Worms in Soybeans

You can distinguish the more important species of worms that attack soybeans by looking at their prolegs. Most caterpillars have four pairs. Green cloverworms have only three pairs and loopers have two pairs.

Table 1. When to Treat for Soybean Insects

Insects	When to Treat
Seedling- and Stem-Feeders ***Three Corner Alfalfa Hopper***	When pests or damage is noted and stands are threatened. Once soybeans become 10 inches tall, treat three-cornered alfalfa hoppers when you catch an average of two hoppers per sweep across two rows with a 15-inch diameter sweep net.
Kudzu Bugs	Prior to first bloom, treat when there is an average of five kudzu bugs per plant for the whole field. After first bloom through R6, apply insecticide when sweep-net sampling catches either (1) 10 adults per sweep or (2) one nymph per sweep. If immature kudzu bugs are easily and repeatedly found on petioles and main stems during visual inspections of the canopy, treatment is likely warranted. Do not bias all sampling to border rows where populations build initially. Border treatments in some cases have slowed movement of adults across fields. Retreatment may be necessary when a treatment is applied before migration into soybeans stops. (During 2013 kudzu bugs continued to migrate into soybean plots at Prattville through the third week of July.) Be aware that spraying for kudzu bugs will significantly reduce beneficial insects, which could result in economic infestations of caterpillars.
Foliage-Feeders	**During Pre-Bloom:** Prevent greater than 35-percent leaf loss. **From Pod Set To Maturity:** Prevent greater than 20-percent leaf loss. Treat prior to 20-percent leaf loss when five to eight soybean loopers or velvetbean caterpillars, 0.25 inch long or longer, are present per foot of row. Treat when you catch an average of 1.5 worms per sweep. Soybean loopers are harder to dislodge with a sweep net and each looper should be counted twice. Each larva eats a high percentage of the total amount of foliage it consumes during the last 4 to 5 days of the larval cycle.
Pod-Feeders ***Podworms***	**Between Blooming and Pod Maturity:** When they average one per row foot or three per 15 sweeps.
Stink Bugs	**Bloom to Mid-Pod Fill:** When they average one per 3 row feet or two per 15 sweeps. **After Mid-Pod Fill:** When they average one per row foot or three per 15 sweeps.

Table 2. Soybean Insect Control

Insecticide and Formulation	Amount of Formulation per Acre	Lb. Active Ingredient per Acre	Minimum Days from Last Application to Harvest	Comments
BEET ARMYWORMS				
chlorantraniliprole				**Treatment:**
PREVATHON 0.43	14-20 oz.	0.047-0.067	1	***Pre-Bloom***–Prevent greater than 35-percent leaf loss.
flubendiamide				***Pod Set to Maturity***–Prevent greater than 20-percent leaf loss.
BELT 4SC	2-3 oz.	0.625-0.094	14	
indoxacarb				
STEWARD 1.25 SC	9.2 oz.	0.09	14	
methomyl				
LANNATE 2.4LV	1.5 pt.	0.45	14	
LANNATE 90SP	0.5 lb.	0.45	14	
methoxyfenozide				
INTREPID 2F	4-8 oz.	0.06-0.12	14	
spinosad				
BLACKHAWK	1.7-2.2 oz.	0.038-0.0495	28	
TRACER 4SC	1.5-2 oz.	0.047-0.062	28	
thiodicarb				
LARVIN 3.2F	1.5 pt.	0.6	28	
BLISTER BEETLES				
beta-cyfluthrin				**Treatment:**
BAYTHROID XL 1EC	1.6-2.8 oz.	0.0125-0.02	45	***Pre-Bloom***–Prevent greater than 35-percent leaf loss.
carbaryl				***Pod Set to Maturity***–Prevent greater than 20-percent leaf loss.
SEVIN 80S	0.625-1.25 lb.	0.5-1.0	21	
SEVIN 4F	1-2 pt.	0.5-1.0	21	
gamma-cyhalthrin				
PROLEX	1.28-1.54 fl.oz.	0.0125-0.015	30	
lambda-cyhalothrin				
KARATE Z 2.08 CS	1.6-1.92 oz.	0.025-0.03	45	
zeta-cypermethrin				
MUSTANG MAX 0.8EC	2.8-4 oz.	0.0175-0.025	21	
CUTWORMS				
alpha-cypermethrin				Treat when pests or damage is noted and stands are threatened
FASTAC 0.83	1.3-3.8 oz.	0.008-0.025	21	
beta-cyfluthrin				
BAYTHROID XL 1EC	0.8-1.6 oz.	0.007-0.013	45	
bifenthrin				
BRIGADE 2EC	2.1-6.4 oz.	0.033-0.1	18	
DISCIPLINE 2EC	2.1-6.4 oz.	0.033-0.1	18	
chlorpyrifos				
LORSBAN 4EC	1 qt.	1	28	

Table 2. Soybean Insect Control (cont.)

Insecticide and Formulation	Amount of Formulation per Acre	Lb. Active Ingredient per Acre	Minimum Days from Last Application to Harvest	Comments
CUTWORMS (cont.)				
esfenvalerate ASANA 0.66EC	5.8 oz.	0.03	21	
gamma-cyhalothrin PROLEX	0.77-1.28 fl.oz.	0.0075-0.0125	30	
lambda-cyhalothrin KARATE Z 2.08 CS	0.96-1.6 oz.	0.015-0.025	30	
permethrin AMBUSH 2EC POUNCE 3.2EC	 3.2-6.4 oz. 2-4 oz.	 0.05-0.1 0.05-0.1	 60 60	
thiodicarb LARVIN 3.2F	1.2-1.9 pt.	0.5-0.75	28	
zeta-cypermethrin MUSTANG MAX 0.8EC	1.28-4 oz.	0.008-0.025	21	
FALL ARMYWORMS				
alpha-cypermethrin FASTAC 0.83EC	3.2-3.8 oz.	0.018-0.025	21	**Treatment:** ***Pre-Bloom***–Prevent greater than 35-percent leaf loss. ***Pod Set to Maturity***–Prevent greater than 20-percent leaf loss.
bifenthrin BRIGADE 2EC DISCIPLINE 2EC	 2.1-6.4 oz. 2.1-6.4 oz.	 0.033-0.1 0.033-0.1	 18 18	
chlorantraniliprole PREVATHON 0.43	14-20 oz.	0.047-0.067	1	
chlorpyrifos LORSBAN 4EC	1-1.5 pt.	0.5-0.75	28	
flubendiamide BELT 4SC	2-3 oz.	0.625-0.094	14	
indoxacarb STEWARD 1.25 SC	9.2 oz.	0.09	14	
gamma-cyhalothrin PROLEX lambda-cyhalothrin KARATE Z 2.08CS methomyl LANNATE 2.4LV LANNATE 90SP methoxyfenozide INTREPID 2F	 1.28-1.54 fl.oz. 1.6-1.92 oz. 1.5 pt. 0.5 lb. 4-6 oz.	 0.0125-0.015 0.025-0.03 0.45 0.45 0.06-0.12	 30 30 14 14 14	For control of first and second instars only.
spinosad BLACKHAWK TRACER 4SC	 1.7-2.2 oz. 1.5-2 oz.	 0.038-0.0495 0.047-0.062	 28 28	

Table 2. Soybean Insect Control (cont.)

Insecticide and Formulation	Amount of Formulation per Acre	Lb. Active Ingredient per Acre	Minimum Days from Last Application to Harvest	Comments
FALL ARMYWORMS (cont.)				
thiodicarb LARVIN 3.2F	1 pt.	0.4	28	
zeta-cypermethrin MUSTANG MAX 0.8EC	3.2-4 oz.	0.02-0.025	21	
GRASSHOPPERS				
acephate ORTHENE 90S ORTHENE 97 Other brand names (See label.)	 0.56 0.5 lb.	 0.5 0.485	 14 14	**Treatment:** ***Seedling*–**Treat when stands are threatened. ***Pre-Bloom*–**Prevent greater than 35-percent leaf loss. ***Pod Set to Maturity*–**Prevent greater than 20-percent leaf loss.
alpha-cypermethrin FASTAC 0.83	3.2-3.8 oz.	0.018-0.025	21	
beta-cyfluthrin BAYTHROID XL 1EC	2.0-2.8 oz.	0.017-0.02	45	
bifenthrin BRIGADE 2EC	2.1-6.4 oz.	0.033-0.1	18	
DISCIPLINE 2EC	2.1-6.4 oz.	0.033-0.1	18	
carbaryl SEVIN 4F, XLR SEVIN 80S	 1 qt. 0.63 lb.	 1 1	 21 21	
diflubenzuron DIMILIN 2L	2 oz.	0.03	21	Dimilin and Diamond are both insect growth regulators and are only effective against immature grasshoppers.
gamma-cyhalothrin PROLEX 1.25 lambda-cyhalothrin KARATE Z 2.08 CS	1.28-1.54 fl.oz. 1.6-1.92 oz.	0.0125-0.015 0.025-0.03	30 30	
novaluron DIAMOND 0.83 EC	9-12 oz.	0.058-0.078	30	
zeta-cypermethrin MUSTANG MAX 0.8EC	3.2-4 oz.	0.02-0.025	21	

Table 2. Soybean Insect Control (cont.)

Insecticide and Formulation	Amount of Formulation per Acre	Lb. Active Ingredient per Acre	Minimum Days from Last Application to Harvest	Comments
KUDZU BUG				
acephate				**Treatment:**
ORTHENE 97	0.75-1 lb.	0.73-0.97	14	***Prior to First Bloom***–Five kudzu bugs per plant across entire field. Do not bias all sampling to border rows where populations build initially.
bifenthrin				
BRIGADE 2EC	5.12-6.4 fl.oz.	0.08-0.1	18	***First Bloom through R6***–Ten adults per sweep or one nymph per sweep. Also treat when immature kudzu bugs are easily and repeatedly found on petioles and main stems during visual inspections of the canopy.
DISCIPLINE 2EC	6.4 fl.oz.	0.1	18	
FANFARE 2EC	6.4 fl.oz.	0.1	18	
clothianidin				
BELAY 2.13	3-4 fl.oz.	0.05-0.067	21	See Table 1 for more information.
gamma-cyhalothrin				
DECLARE 1.25	1.28-1.54 fl.oz.	0.0125-0.015	30	
lambda-cyhalothrin	1.92 fl.oz.			
KARATE ZEON 2.08	3.2 fl.oz.	0.03	45	
SILENCER 1EC		0.025	30	
zeta-cypermethrin	4 fl.oz.			
MUSTANG MAX 0.8EC		0.025	21	
LESSER CORNSTALK BORERS				
chlorpyrifos				Treat when pests or damage is noted and stands are threatened.
LORSBAN 4EC	1-4 pt.	0.5-2	28	
MEXICAN BEAN BEETLES, BEAN LEAF BEETLES				
acephate				**Treatment:**
ORTHENE 97	0.75-1 lb.	0.73-0.97	14	***Pre-Bloom***–Prevent greater than 35-percent leaf loss.
alpha-cypermethrin				***Pod Set to Maturity***–Prevent greater than 20-percent leaf loss.
FASTAC 0.83EC	2.8-3.8 oz.	0.018-0.025	21	
beta-cyfluthrin				
BAYTHROID XL 1EC	1.6-2.8 oz.	0.013-0.02	45	
bifenthrin				
BRIGADE 2EC	2.1-6.4 oz.	0.033-0.1	18	
DISCIPLINE 2EC	2.1-6.4 oz.	0.033-0.1	18	
carbaryl				
SEVIN 4F, XLR	1-2 pt.	0.5-1.0	21	
SEVIN 80S	0.63-1.25 lb.	0.5-1.0	21	
chlorpyrifos				
LORSBAN 4EC	1-1.5 pt.	0.5-0.75	28	
esfenvalerate				
ASANA 0.66EC	5.8-9.6 fl.oz.	0.03-0.05	21	
gamma-cyhalothrin				
PROLEX	0.77-1.28 fl.oz.	0.0075-0.0125	45	

Table 2. Soybean Insect Control (cont.)

Insecticide and Formulation	Amount of Formulation per Acre	Lb. Active Ingredient per Acre	Minimum Days from Last Application to Harvest	Comments
MEXICAN BEAN BEETLES, BEAN LEAF BEETLES (cont.)				
lambda-cyhalothrin KARATE Z 2.08 CS	0.96-1.6 oz.	0.015-0.025	30	
methomyl LANNATE 2.4LV LANNATE 90SP	0.75 pt. 0.25 lb.	0.22 0.22	14 14	**Treatment:** ***Pre-Bloom***–Prevent greater than 35-percent leaf loss. ***Pod Set to Maturity***–Prevent greater than 20-percent leaf loss.
permethrin AMBUSH 2EC POUNCE 3.2EC	3.2-6.4 oz. 2-4 oz.	0.05-0.1 0.05-0.1	60 60	
zeta-cypermethrin MUSTANG MAX 0.8EC	2.8-4 oz.	0.0175-0.025	21	
PODWORMS (BOLLWORMS, CORN EARWORMS)				
alpha-cypermethrin FASTAC 0.83EC	2.8-3.8 oz.	0.018-0.025	21	
beta-cyfluthrin BAYTHROID XL 1EC	1.6-2.8 oz.	0.013-0.02	45	
bifenthrin BRIGADE 2EC	2.1-6.4 oz.	0.033-0.1	18	
DISCIPLINE 2EC	2.1-6.4 oz.	0.033-0.1	18	
carbaryl SEVIN 4F, XLR SEVIN 80S	1-1.5 qt. 1.25-1.88 lb.	1-1.5 1-1.5	0 0	
chlorantraniliprole PREVATHON 0.43	14-20 oz.	0.047-0.067	1	
esfenvalerate ASANA 0.66EC	5.8 oz.	0.03	21	
flubendiamide BELT 4SC	2-3 oz.	0.625-0.094	14	
gamma-cyhalothrin PROLEX	0.77-1.28 fl.oz.	0.0075-0.0125	45	
indoxacarb STEWARD 1.25SC	9.2 oz.	0.09	14	
lambda-cyhalothrin KARATE Z 2.08 CS	0.96-1.6 oz.	0.015-0.025	30	
methomyl LANNATE 2.4LV LANNATE 90SP	1.5 pt. 0.5 lb.	0.45 0.45	14 14	

Table 2. Soybean Insect Control (cont.)

Insecticide and Formulation	Amount of Formulation per Acre	Lb. Active Ingredient per Acre	Minimum Days from Last Application to Harvest	Comments
PODWORMS (BOLLWORMS, CORN EARWORMS) (cont.)				
permethrin				
AMBUSH 2EC	6.4 oz.	0.1	60	
POUNCE 3.2EC	4 oz.	0.1	60	
spinosad				
BLACKHAWK	1.7-2.2 oz.	0.038-0.0495	28	
TRACER 4SC	1.5-2 oz.	0.047-0.062	28	
thiodicarb				
LARVIN 3.2F	10-24 oz.	0.25-0.6	28	
zeta-cypermethrin				
MUSTANG MAX 0.8EC	2.8-4 oz.	0.0175-0.025	21	
SOYBEAN LOOPERS				
chlorantraniliprole				
PREVATHON 0.43	14-20 oz.	0.047-0.067	1	
flubendiamide				
BELT 4SC	2-3 oz.	0.625-0.094	14	
indoxacarb				
STEWARD 1.25 SC	6.7 oz.	0.065	14	
methoxyfenozide				
INTREPID 2F	4-8 oz.	0.06-0.12	14	
spinosad				
BLACKHAWK	1.1-2.2 oz.	0.025-0.0495	28	
TRACER 4SC	1-2 oz.	0.031-0.062	28	
STINK BUGS				
acephate				Treat between bloom and mid-podfill when stink bugs average one per three feet of row. After mid-podfill until pod maturity, treat when stink bugs average one per one foot of row.
ORTHENE 90S	0.8-1.1 lb.	0.72-1.0	14	
ORTHENE 97	0.75-1 lb.	0.73-0.97	14	
Other brand names (See label.)				
alpha-cypermethrin				
FASTAC 0.83	3.2-3.8 oz.	0.018-0.025	21	
beta-cyfluthrin				
BAYTHROID XL 1EC	1.6-2.8 oz.	0.013-0.02	45	
bifenthrin				
BRIGADE 2EC	2.1-6.4 oz.	0.033-0.1	18	
DISCIPLINE 2EC	2.1-6.4 oz.	0.033-0.1	18	
carbaryl				
SEVIN 4F, XLR	1-1.5 qt.	1-1.5	0	
SEVIN 80S	1.25-1.88 lb.	1-1.5	0	
clothianidin				
BELAY 23.6% SC	3-4 oz.	0.05-0.067	21	
gamma-cyhalothrin				
PROLEX	1.28-1.54 fl.oz..	0.0125-0.015	45	

Table 2. Soybean Insect Control (cont.)

Insecticide and Formulation	Amount of Formulation per Acre	Lb. Active Ingredient per Acre	Minimum Days from Last Application to Harvest	Comments
STINK BUGS (cont.)				
lambda-cyhalothrin KARATE Z 2.08 CS	.6-1.92 oz.	0.025-0.03	30	
zeta-cypermethrin MUSTANG MAX 0.8EC	3.2-4 oz.	0.02-0.025	21	
THREE-CORNERED ALFALFA HOPPERS				
acephate ORTHENE 97 Other brand names (See label.)	0.75-1 lb.	0.73-0.97	14	For soybeans less than 10 inches tall, treat when pests or damage is noted and stands are threatened. Once soybeans become 10 inches tall, treat three-corner alfalfa hoppers when you catch an average of two hoppers per sweep.
alpha-cypermethrin FASTAC 0.83	2.8-3.8 oz.	0.018-0.025	21	
beta-cyfluthrin BAYTHROID XL 1EC	1.6-2.8 oz.	0.013-0.02	45	
carbaryl SEVIN 4F, XLR SEVIN 80S	1 qt. 1.25 lb.	1 1	21 21	
gamma-cyhalothrin PROLEX	0.77-1.28 oz.	0.0075-0.0125	45	
lambda-cyhalothrin KARATE Z 2.08 CS	0.96-1.6 oz.	0.015-0.025	30	
zeta-cypermethrin MUSTANG MAX 0.8EC	2.8-4 oz.	0.0175-0.025	21	
VELVETBEAN CATERPILLARS, GREEN CLOVERWORMS				
acephate ORTHENE 97	0.75-1 lb.	0.73-0.97	14	**Treatment:** ***Pre-Bloom***–Prevent greater than 35-percent leaf loss. ***Pod Set to Maturity***–Prevent greater than 20-percent leaf loss by treating when five to eight soybean loopers or velvetbean caterpillar larvae, 0.25 inch or larger, are present per foot of row. Each larva consumes a high percentage of its total foliage during the last 4 to 5 days of its larval cycle.
alpha-cypermethrin FASTAC 0.83	2.8-3.8 oz.	0.018-0.025	21	
*Bacillus thuringiensis** DIPEL ES KETCH DF	Use label rates.		0	
beta-cyfluthrin BAYTHROID XL 1EC	1.6-2.8 oz.	0.013-0.02	45	
carbaryl SEVIN 4F, XLR SEVIN 80S	1 pt. 0.63 lb.	0.5 0.5	21 21	

* A delay in larval mortality may be expected.

Table 2. Soybean Insect Control (cont.)

Insecticide and Formulation	Amount of Formulation per Acre	Lb. Active Ingredient per Acre	Minimum Days from Last Application to Harvest	Comments
VELVETBEAN CATERPILLARS, GREEN CLOVERWORMS (cont.)				
chlorantraniliprole PREVATHON 0.43	14-20 oz.	0.047-0.067	1	
chlorpyrifos LORSBAN 4EC	0.5-1 lb.	0.3-0.5	28	
diflubenzuron DIMILIN, 2L	2-4 oz.	0.03-0.06	21	
esfenvalerate ASANA 0.66EC	0.85 oz.	0.0125	21	
flubendiamide BELT 4SC	2-3 oz.	0.625-0.094	14	
gamma-cyhalothrin PROLEX lambda-cyhalothrin KARATE Z 2.08 CS	0.77-1.28 fl.oz. 0.96-1.6 oz.	0.0075-0.0125 0.015-0.025	45 30	
methomyl LANNATE 2.4LV LANNATE 90SP	0.75 pt. 0.2 lb.	0.22 0.22	14 14	
methoxyfenozide INTREPID 2F	4-8 oz.	0.06-0.12	14	
novaluron DIAMOND 0.83 EC	6-10 oz.	0.039-0.065	30	
permethrin AMBUSH 2EC POUNCE 3.2EC	3.2 oz. 2 oz.	0.5 0.5	60 60	
spinosad BLACKHAWK TRACER 4SC	1.1-2.2 oz. 1-2 oz.	0.025-0.0495 0.031-0.062	28 28	
thiodicarb LARVIN 3.2F	10 oz.	0.25	28	
zeta-cypermethrin MUSTANG MAX 0.8EC	2.8-4 oz.	0.0175-0.025	21	

Table 3. Multiple Soybean Pests—Premixed, or Copackaged Products

Product	Product/acre[1]	Lb. Active Ingredient per Acre	PHI	Comment
imidacloprid/beta-cyfluthrin (R) LEVERAGE 360	2.8	0.065	14 d	Premixed
thiamethoxam/lambda-cyhalothrin (R) ENDIGO 2.06 ZC	2.5-4.5 oz.	0.04-0.072	30 d	Premixed
imidacloprid/bifenthrin (R) BRIGADIER 2 SC	5.1-6.1 oz.	0.08-0.095	18 or 45 d	Premixed
spinosad/gamma-cyhalothrin (R) CONSERO	1 unit per 32- 64 acres	0.164-0.328	45 d	Copack
chlorantraniliprole/lambda-cyhalothrin (R) BESIEGE 1.25 ZC	5.0-10.0 oz.	0.049-0.098	30 d	Premixed
chlorpyrifos/gamma- cyhalothrin (R) COBALT 2.55	7.0-38.0 oz.	0.139- 0.757	30 d	Premixed
chlorpyrifos/lambda- cyhalothrin (R) COBALT ADVANCED 2.63	6.0-38.0 oz.	0.123-0.78	30 d	Premixed
diflubenzuron/lambda- cyhalothrin (R) DOUBLE TAKE 3	2.0-4.0 oz.	0.047-0.0938	30 d	Premixed
methoxyfenozide/spinetoram (R) INTREPID EDGE	4.0-6.4	0.094-0.15	28 d	Premixed

ai = active ingredient; (R) = restricted use; PHI = preharvest interval

[1] Rate varies with different pests.

Table 4. Properties of Insecticides and Acaricides Used on Soybeans That May Affect Water Quality

Common Name	Trade Name	Surface-Loss Potential[1]	Leaching Potential[2]
Bacillus thuringiensis	Dipel, Ketch	*	*
beta-cyfluthrin	Baythroid XL	Large	Small
bifenthrin	Brigade, Discipline, Fanfare	Large	Small
carbaryl	Ortho, Sevimol, Sevin	Medium	Small
chlorpyrifos	Dursban, Lorsban	Medium	Small
dicrotophos	Bidrin	Small	Medium
diflubenzuron	Dimilin	Large	*
esfenvalerate	Asana	Large	Small
indoxacarb	Steward	Small	Small
gamma-cyhalothrin	Declare, Prolex	Large	Small
lambda-cyhalothrin	Karate Z, Silencer	Large	Small
malathion	Cythion, Malathion	Small	Small
methomyl	Lannate	Small	Medium
methoxyfenozide	Intrepid	Large	Medium
permethrin	Ambush, Pounce	Large	Small
spinosad	Blackhawk, Tracer	Small	Small
thiodicarb	Larvin	Medium	NA
zeta-cypermethrin	Mustang Max	Large	Small

[1] The surface-loss potential indicates the tendency of the pesticide to move with sediment in runoff.

[2] The leaching potential indicates the tendency of the pesticide to move in solution with water and to leach below the root zone.

NA = Information not available. * = Pesticide should not leach with percolating water.

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DISEASE AND NEMATODE CONTROL

Seed and Seedling Diseases

Seed and seedling diseases are caused by pathogenic fungi, but the extent of the damage is determined by seed quality and soil conditions. To reduce the risk of these diseases this spring, follow these suggestions.

• **Use "Certified Seed" or high quality, vigorous seed** sold by a reliable dealer. This is one of the most important factors in obtaining good stands.

• **Plant on a good seedbed.** A well-prepared seedbed is important for good germination and seedling emergence.

• **Avoid planting on low, poorly drained soils.** These soils slow seed germination and seedling growth, making them more susceptible to attack by seed and soil-borne fungi.

• **Avoid planting too deep.** Optimum planting depth for soybeans in Alabama is 1 to 1.5 inches.

• **Rotate soybeans with non-leguminous crops** such as cotton, corn, sorghum, and small grains to avoid buildup of soil-borne fungi, nematodes, insects, and weeds, which can reduce yields.

• **Treat seed with a fungicide.** Seed treatment is beneficial in controlling seedling diseases and is especially effective in improving seed germination and seedling vigor in seeds of poor quality. Since complete seed coverage is necessary for best results, commercially applied seed treatments are preferred. Hopper-box treatments are generally not as effective because the fungicide is poorly distributed. However, farmers who take extra precautions to see that the fungicide is evenly distributed in hopper boxes can benefit from the treatment. Remember, no fungicide is effective unless it comes in contact with the disease organism. (Table 4).

Fungicide Resistance Management in Soybean*

Development of resistance in fungi to fungicides is a concern for the worldwide agricultural industry. Fungicide resistance can occur when a selection pressure is placed on the fungal pathogen population. Fungicides that have a single site of action tend to be more at risk for developing resistance compared to those that have multi-site activity. For example in recent years the fungal pathogen that causes frog-eye leaf spot of soybean has been shown to be resistant to the Qol strobilurin (FRAC group 11) class of fungicides in some counties in Alabama.

An organization known as the Fungicide Resistance Action Committee (FRAC) was developed to address the issue of fungicide resistance. This organization developed a code of numbers and letters that can be used to distinguish the different fungicide groups based on their mode of action (Table 5). This code is know as the FRAC Code and is now included on fungicide labels. A fungus that becomes resistant to a specific fungicide may be resistant to many or all of the fungicides within that fungicide's FRAC Code, a phenomenon referred to as *cross-resistance*. More information is available at the FRAC website: www.frac.info

Fungicide resistance management is important in the production of soybean and all crops. You will reduce the risk of a fungal pathogen developing resistance to a fungicide by taking the following steps:

• Apply a fungicide only when it is necessary.

• Alternate fungicides that have different modes of action.

• Apply mixtures of fungicides with different modes of action.

• Follow the directions on the label. Use recommended rates and obey restrictions.

• Monitor for reduced fungicide efficiency in your field.

*The majority of this information was obtained from the *Fungicide Manual for Soybean Rust*, Dorance, Draper and Hershman, 2007.

Table 4. Soybean Seedling Disease Control

Common name	Formulation per 100 Lb. of Seed	Comments
CAUSAL AGENTS: SEED ROT, SEEDLING DISEASE, DAMPING OFF, PHYTOPHTHORA ROOT ROT		
azoxystrobin		
DYNASTY 0.8F	0.15-0.46 fl.oz.	Slurry or mist type treatment
Bacillus subtilis		
KODIAK HB 0.3D	4-8 oz.	Biological treatment that can be used in combination with a fungicide treatment. Planter box treatment. Slurry or mist type treatment
mefenoxam + fludioxonil		
APRONMAXX RFC 0.52F	1.5 fl.oz.	Slurry or mist type treatment
APRONMAXX RTA	5 fl.oz.	Slurry or mist type treatment
WARDEN RTA	5 fl.oz.	Slurry or mist type treatment

Table 5. Fungicide Groups That Can be Applied on Soybean in the United States

FRAC Code	Chemical Group	Example	Risk of Fungicide Resistance
1	methyl benzimidazole carbamates (MBC)	Topsin M	High
3	demethylation inhibitors (DMI, includes triazoles)	Folicur	Medium
7	carboximides (i.e. fluxapyroxad in Priaxor)	Priaxor	Medium
11	quinone outside inhibitors (Qol, included strobilurins)	Headline	High
M	chloronitriles, inorganics	Bravo	Low

SOYBEAN RUST

Soybean rust is a disease caused by the fungus *Phakospora pachyrhiza*. The disease was first identified the continental United States in 2004. Soybean rust produces lesions on infected plants that can lead to premature defoliation and reduced yields. Early diagnosis and treatment for the disease is crucial.

Symptoms begin on the lower leaves as small lesions that increase in size and change in color from gray to tan or reddish brown on the underside of the leaves. Under close examination, tiny bumps can be seen within the lesions. The bumps are spore-producing structions called *uredinia* that give the leaf a rusty appearance. The uredinia are primarily found on the underside of the leaf, though smaller uredinia may be found on the upper side. Once pod set begins, infection can spread rapidly to the middle and upper leaves of the plant. The spores of the fungus are called *urediniospores* and are transported by air currents to other soybean plants. Rust-infected leaves eventually turn yellow and fall off the plant. Premature defoliation and a reduction in the number of days to maturity will cause infected plants to have lower seed weight and fewer pods and seeds.

All commercial varieties of soybeans currently available are highly susceptible to soybean rust. Management of soybean rust will depend on early detection of the disease. Monitoring soybean fields is recommended throughout the growing season. Fungicides may reduce yield losses depending on the plant developmental stage, time when soybean rust is detected, and timing of fungicide applications.

Fungicide Use Guidelines for Soybean Rust

Several fungicides are available for use against soybean rust (see Table 6). These can be divided into three groups: strobilurins, triazoles, and premixes (or tank mixes).

Strobilurins should be used as protectants and must be applied prior to infection to be effective. The products ***Quadris*** and ***Headline*** are strobilurins. Triazoles have protectant and curative activity and include the products ***Alto, Domark, Folicur, Laredo, Orius, Proline, Tilt, TebuStar*** and ***Topguard***. Premixes of strobilurin and triazole materials include ***Quilt, Quilt Xcel, Stratego YLD,*** and ***Quadris Xtra.*** Growers also have the option of tank mixing a strobilurin with a triazole on their own. ***Priaxor*** is a premix but should only be used as a protectant similar to the strobilurins.

When to spray. Your first spray should not be applied prior to bloom. Data suggest that applications prior to bloom are not economical. Make your first application when there is a risk of rust in your region. This disease can spread rapidly so growers need to be aware of new rust outbreaks in the southeastern United States. If growers wait for the disease to show up in their fields before applying a fungicide, chances are their fungicide program will not be as effective.

Growers can keep informed of rust movement by visiting the soybean rust ipmPIPE Website at http://sbr.ipmpipe.org. Growers can also call the Auburn University Soybean Rust Hotline at 1-800-446-0388 for updates on the disease and control recommendations.

Growers who follow rust movement closely could initially use a strobilurin fungicide such as Headline or Quadris in a protectant program (before the disease arrives in their area), then follow up with a triazole or a premix or a tank mix (triazole plus strobilurin) 21 days later if a second application is needed. In situations where the risk from soybean rust is relatively low, delaying your initial fungicide application until the R3-R4 growth stage may be most effective in managing other foliar diseases as well as protecting against rust infection later in the season.

If there is a likelihood that rust has moved into your field prior to your first fungicide application, applying a triazole fungicide would be the most effective option available. A second application of a premix may be needed in 14 to 21 days. Consecutive applications of either a triazole or strobilurin should be avoided due to resistance concerns. Refer to fungicide labels for specific directions and restrictions.

Spraying ***after*** the R5 growth stage is not recommended due to lack of yield response. In addition, many fungicides have preharvest intervals or growth stage restrictions. Refer to fungicide labels for specific directions and restrictions.

Fungicide Use Strategies for Soybean Rust*

Fungicide use strategy 1: low rust risk:

• No disease detected in immediate area or in sentinel plots; no rust forecasting alerts.

• Crop between R1 and R6.

• DO NOT SPRAY.

• Reevaluate at regular intervals through R6.

Fungicide use strategy 2: high rust risk, preventive program:

• High rust risk based on observations from regional sentinel plots and rust forecasting.

• Rust not detected in local soybean crop.

• Crop between R1 and R6.

• *Fungicide applications:*

1) Premix (tank mix) or strobilurin or triazole.

2) Premix (tank mix) or strobilurin[1] or triazole[2].

Fungicide use strategy 3: rust detected, curative program:

• Rust detected at low levels (1 to 10 percent of leaves in lower crop canopy) in your field or your neighbor's field.

• Crop between R1 and R6.

• *Fungicide applications*:

1) Premix (tank mix) or strobilurin + triazole or triazole.

2) Premix (tank mix) or triazole[2].

Fungicide use strategy 4: rust detected in mid-canopy:

• Crop between R1 and R6.

• Weather favorable for rust development.

• Crop may not respond to treatment; fungicide application may not be economical.

• Triazoles may provide some level of control.

• DO NOT apply a strobilurin.

*Information obtained from the *Fungicide Manual for Soybean Rust,* Dorance, Draper, and Hershman, 2007.

[1] If the first application was not a strobilurin

[2] If the first application was not a triazole

Table 6. Soybean Rust Fungicides

Fungicides	Active Ingredient	Rate/Acre	Chemical Class	FRAC Code	Spray Interval (days)	Preharvest Interval (days)
Alto	cyproconazole	4 fl.oz.	Triazole	3	14-28	30
Bravo WeatherStik	chlorothalonil	16-36 fl.oz.	Benzonitrile	M	14	42
Bumper	propiconazole	4-6 fl.oz.	Triazole	3	14	Not after R5 growth stage
Domark 230ME	tetraconazole	4-6 fl.oz.	Triazole	3	14-21	Not after R5 growth stage
Echo 720	chlorothalonil	16-40 fl.oz.	Benzonitrile	M	14	42
Equus 720 SST	chlorothalonil	1-2.5 pt.	Benzonitrile	M	14	42
Folicur	tebuconazole	3-4 fl.oz.	Triazole	3	14	21
Headline EC	pyraclostrobin	6-12 fl.oz.	Strobilurin	11	7-21	21
Headline SC	pyraclostrobin	6-12 fl.oz.	Strobilurin	11	7-21	21
Laredo EC	myclobutanil	4-8 fl.oz.	Triazole	3	10-14	28
Monsoon	tebuconazole	3-4 oz.	Triazole	3	14	21
Priaxor	fluxapyroxad + pyraclostrobin	4-8 fl.oz.	(SDH) inhibitor + Strobilurin	7 + 11	7-14	21
Proline	prothioconazole	2.5-3 fl.oz.	Triazole	3	10-21	30
Orius	tebuconazole	3-4 fl.oz.	Triazole	3	10-14	21
Quadris	azoxystrobin	6.2-15.4 fl.oz.	Strobilurin	11	7-21	14
Quadris Xtra	azoxystrobin + cyproconazole	4 fl.oz.	Strobilurin + Triazole	11 + 3	14-28	30
Quilt	azoxystrobin + propiconazole	14-20 fl.oz.	Triazole + Strobilurin	11 + 3	14-21	21
Quilt Xcel	propiconazole + azoxystrobin	14-21 fl.ox.	Triazole + Strobilurin	11 + 3	14-21	up to R6
Stratego	propiconazole + trifloxystrobin	5.5-10 fl.oz.	Triazole + Strobilurin	11 + 3	10-21	21
Stratego YLD	prothioconazole + trifloxystrobin	4-4.6 fl.oz.	Triazole + Strobilurin	11 + 3	10-21	21
TebuStar	tebuconazole	3-4 fl.oz.	Triazole	3	14	21
Tilt	propiconazole	4-8 fl.oz.	Triazole	3	14	Not after R5 growth stage
Topguard	flutriafol	7 fl.oz.	Triazole	3	21-35	21
Topsin XTR	thiophanate-methyl + tebuconazole	16-20 oz.	Benzimidazole + Triazole	M	14	See comments in Table 6

OTHER MAJOR POD AND STEM DISEASES

Other major pod and stem diseases that attack soybeans in Alabama include brown spot (*Septoria glycines*), pod and stem blight (*Diaporthe phaseolorum*), frogeye leaf spot (*Cercospora sojina*), anthracnose (*Collectotrichum dematium* var. *truncata*), downy mildew (*Peronospora manshurica*), purple stain (*Cercospora kukuchii*), and aerial blight (*Rhizoctonia solani*).

Control measures, including disease-free seed treated with a fungicide and a 2- to 3-year crop rotation with non-leguminous crops, will help reduce pod and stem diseases.

Foliar fungicides can produce a profitable yield increase in soybean fields that have a good yield potential and are subjected to conditions favoring disease development. Soybeans exposed to periods of rainy weather or heavy dews during bloom to early pod set have the highest incidence of foliar, pod, and stem diseases. Fungicides applied to soybeans during this developmental stage or just after the occurrence of these wet periods produce the best results.

Current Recommendations for Foliar Fungicides

1. Apply fungicides only to soybean fields that have a potential yield exceeding 25 bushels per acre or to fields where seed beans are produced.

2. Make first application to soybeans that are in mid-bloom to early-pod-set stages and that have been exposed to 2 to 3 days of rain or heavy dew. Do not apply less than 5 gallons of water per acre for aerial applications and no less than 20 gallons of water per acre for ground applications. Make a second application 2 weeks later. However, if dry weather prevails during the 2-week period following the first application, omit the second application.

Stem canker (*Diaporthe phaseolorum* f. sp. *meridionalis*) is a destructive fungal disease of soybeans that has become widespread throughout most of the state. The degree of damage depends on the stage of plant growth when infection occurs, the soybean cultivar, crop stress, and the climatic conditions.

Severely infected fields may be completely wiped out. Slightly infected fields, on the other hand, may suffer little or no yield loss.

Stem canker is believed to spread from one region to another by means of infected seeds or contaminated equipment. Once the disease is introduced into an area, it spreads from field to field on farm equipment and windblown rain.

The first noticeable signs of stem canker occur on soybeans during pod fill. At this stage, many of the plants may be dead but still erect with dead leaves attached.

The main stem of the infected plant usually has large, reddish brown lesions located at the base of a petiole or on the lower node. Each lesion is surrounded by green tissue. The pith or the central portion of the main stem tissue is brown or dead several inches above and below the lesion. The leaves on a recently infected plant exhibit a distinctive yellowing and, later, browning between the veins.

Suggested practices to help control stem canker are:

1. Avoid replanting soybeans in fields infested with stem canker whenever possible. Plant a non-host crop (any non-leguminous crop) for at least 2 years.

2. Do not use soybeans for seed which have been harvested from stem-canker infested fields.

3. Treat seeds with Vitavax or a similar fungicide that contains carboxin and thiram.

4. Delay planting date until the end of the recommended planting period. Research indicates that later-maturing cultivars suffer less from stem canker injury when planted late. According to research at Auburn University, late-maturing cultivars suffered little injury when planted on or after June 15 in fields infested with stem canker in Central Alabama; however, late planting can result in yield losses due to dry weather and heat stress.

5. If stem-canker fields must be replanted in soybeans the following year, plant a cultivar that has shown some tolerance to the disease. Most seed companies have literature ranking tolerance of their varieties.

Table 7. Soybean Pod and Stem Disease Control

Disease	Fungicide and Formulation	Amount of Formulation per 100 Lb. of Seed	Comments
AERIAL BLIGHT, ALTERNARIA LEAF SPOT, BROWN SPOT, CERCOSPORA BLIGHT AND LEAF SPOT, FROGEYE LEAF SPOT, RUST, SOUTHERN BLIGHT			
azoxystrobin			Applications should begin prior to disease development. Use higher rates under conditions favorable for severe disease development. A non-ionic surfactant is recommended with lower use rates with Quadris. **DO NOT** make more than one application before alternating to a fungicide with a different mode of action.
	QUADRIS 2.08F	6.2-15.4 oz.	
	HEADLINE EC	6-12 oz.	
	HEADLINE SC	6-12 oz.	
AERIAL BLIGHT, ANTHRACNOSE, BROWN SPOT, FROGEYE LEAF SPOT, PURPLE SEED STAIN (CERCOSPORA), POD AND STEM BLIGHT (DIAPORTHE, PHOMOPSIS)			
thiophanate-methyl			Apply from full bloom to when pods are 0.125- to 0.25-inch long. Make a second application 14- to 21-days later. **DO NOT** make the second application later than 14 days after pods average 0.25 inch in length or when beans form in pods. Use the high rate under severe disease pressure. **DO NOT** make more than two applications per year.
	TOPSIN M 70WP	0.5-1 lb.	
	TOPSIN M WSB	0.5-1 lb.	
	TOPSIN XTR	16-20 oz.	
ANTHRACNOSE, CERCOSPORA LEAF BLIGHT, FROGEYE LEAF SPOT, POD AND STEM BLIGHT (DIAPORTHE, PHOMOPSIS), PURPLE SEED STAIN, RUST			
chlorothalonil			Apply in sufficient water to obtain full coverage, using at least 5 gallons of water per acre for aerial application. Use the three-application program in areas having a history of moderate to severe disease intensity. **DO NOT** exceed three applications per season. **DO NOT** apply within 6 weeks of harvest.
	BRAVO ULTREX		
		Two-Application Program: 1.4-2.2 lb.	***Two-Application Program:*** Make first application when a majority of pods are 0.125 to 0.75 inch in length and the second at the beginning of seed formation (about 14 days later).
		Three-Application Program: 0.9-1.4 lb	***Three-Application Program:*** Make first application at the beginning of flowering, the second when the majority of pods are 0.125 to 0.75 inch in length, and the third at the beginning of seed formation.
	ECHO 720	See label.	
	EQUUS 720 SST	See label.	

NEMATODES

The most important nematode species that attack soybeans in Alabama are soybean cyst, root-knot, lance, reniform, and lesion. Fields should be sampled for nematodes every 2 to 3 years unless problem areas develop. Recommended sampling period is from August through October. Contact your county

Extension System office for information sheets and shipping cartons. Mail samples to Plant Diagnostic Laboratory, ALFA Services Building, 961 South Donahue Drive, Auburn University, AL 36849-5624. A $10.00 fee is required for each sample.

Chemical Control

Nematicides are NOT generally recommended because, in most instances, they are too expensive to use in soybeans.

Cultural Control: Soybean Cyst Nematode (SCN)

Control SCN by using non-host crops and resistant soybean cultivars. SCN will attack and multiply on relatively few plant species (Table 8).

Several non-host crops can be used in a rotation system to control SCN (Table 8). In fields with moderate to high cyst populations, follow a 3- or 4-year rotation using non-host crops and resistant cultivars.

At the end of this period, a nematode analysis should be made. If the SCN population is low, plant a susceptible cultivar for 1 year; then, repeat the rotation. When rotating with non-host crops or resistant soybean cultivars, an effective weed control program is necessary because SCN can survive and multiply on several weed species (Table 8).

Cultural Control: Root-Knot Nematodes

Crop Rotation with Non-Host Crops. Several root-knot (*Meloidogyne*) species attack and severely damage soybeans in Alabama. Southern root-knot (*M. incognita*) and peanut root-knot (*M. arenaria*) are the two most common and are responsible for most nematode damage on soybeans.

Root-knot species have a wide host range, but some non-host crops can be used effectively in a crop rotation scheme to reduce populations. Grain sorghum, coastal bermuda, and some cultivars of pearl millet are considered good rotation crops. Cotton, although susceptible to southern root-knot races three and four, is an effective rotation crop in fields with southern root-knot races one and two or in fields with peanut root-knot.

Since root-knot species and race determinations cannot be made in the state nematology laboratory, growers will have to determine by trial and error which non-host crops are best suited for their root-knot infested fields.

Root-Knot Resistant Cultivars. Several soybean cultivars have claimed root-knot resistance. However, some appear to be losing this resistance in certain areas of the state, particularly in South Alabama. Growers should, therefore, carefully observe the performance of these root-knot resistant cultivars if they are grown in fields with severe root-knot infestations.

Soybean Cyst Nematode (SCN) Resistant Varieties. Using resistant varieties is very effective for managing SCN. The most important characteristic of SCN-resistant varieties is yield potential in SCN-infested fields. Yield performance of these varieties in non-infested fields can vary greatly. SCN races 2, 4, 5, 6, and 14 have been identified in Alabama.

Table 8. Soybean Cyst Nematode *(Heterodera glycines)* Hosts

Host Crops*	Weed Hosts	Non-Host Crops
Soybeans, Snap Beans, Lima Beans	Chickweed, Coffee Bean	Corn, Cotton, Peanuts, Grain Sorghum
Crimson Clover, Cowpeas	Hemp Sesbania, Henbit Deadnettle	Oats, Wheat, Fescue, Rye
Common Lespedeza, Hairy Lespedeza	Lowhop Clover, Mullein	
Korean Lespedeza , Sericea Lespedeza	Pokeweed, Sicklepod	
Common Vetch, Hairy Vetch		

* List prepared by Dr. Ralph Motsinger, Georgia Cooperative Extension Service.

Table 9. Properties of Fungicides and Nematicides Used on Soybeans That May Affect Water Quality

Common Name	Trade Name	Surface-Loss Potential[1]	Leaching Potential[2]
captan	Captan	NA	NA
carboxin	Vitavax	Small	Small
metalaxyl	Apron	Small	Medium
PCNB	Terraclor	Large	Small
thiobendazole	Mertect	NA	NA
thiophanate-methyl	Topsin	Small	Medium
thiram	Thiram	Medium	Medium

[1]The surface-loss potential indicates the tendency of the pesticide to move with sediment in runoff.

[2]The leaching potential indicates the tendency of the pesticide to move in solution with water and to leach below the root zone.

NA = Information not available.

Disease and Nematode Control section prepared by Edward J. Sikora, Extension Plant Pathologist, Professor, Department of Entomology and Plant Pathology, Auburn University; Kathy S. Lawrence, Plant Pathologist, Associate Professor, Department of Entomology and Plant Pathology, Auburn University; and Dennis Delaney, Extension Specialist, Alabama Cooperative Extension System, Alabama A&M University and Auburn University. Some recommendations are based on research conducted in other states.

WEED CONTROL

Table 10. Soybean Weed Control

Herbicide Trade Name (Rate/Acre Broadcast)	Herbicide Common Name (Active Herbicide/Acre)	Comments
MINIMUM TILL, STRIP-TILL, OR NO-TILL BURNDOWN OPTIONS		
ROUNDUP (Various trade names) (22-32 oz.) [5.5 lb./gal.] or (32-64 oz.) [4 lb/.gal.] Generics	glyphosate (0.94-1.37 lb.) (1-2 lb.)	Controls most emerged annual grass and broadleaf weeds. Glyphosate rates vary according to weed species, weed size, and spray volume. Apply in 10 to 20 gallons of water per acre. Refer to the individual product labels for additional information. Use of tank mixes with glyphosate for bermudagrass or johnsongrass control in minimum tillage systems is not recommended. The higher rates are suggested for johnsongrass and bermudagrass control. The use of ammonium sulfate (AMS) is only recommended where hard water is a concern. Additional non-ionic surfactant may be required in the use of some generic formulations. *MOA–EPSP inhibitor
GRAMOXONE INTEON 2 GRAMOXONE SL 2.0 (2-4 pt.) [2 lb.gal.] or FIRESTORM 3 (1.3-2.6 pt.) [3 lb./gal.]	paraquat (0.5-1 lb.) (0.5-1 lb.)	Apply during or after planting but before crop emerges to kill emerged annual grasses and weeds. Add a nonionic surfactant at 0.25 percent (1 quart per 100 gallons spray) on a volume basis. Apply 20 to 60 gallons spray volume per acre. Refer to label for specific cautions and restrictions. Numerous tank mixes are allowed. Use the high rate when weeds approach 6 inches in size. Weeds taller than 6 inches may not be adequately controlled. Rain free period is 30 minutes. MOA–Photosystem I inhibitor
LIBERTY 280SL (29-36 oz.) [2.34 lb./gal.]	glufosinate (0.53-0.66 oz.)	Apply during or after planting but before crop emerges to kill emerged annual grasses and weeds. Liberty will not provide adequate burndown control of small grains. Very effective for burndown contol of volunteer peanuts. Can be tank mixed with glyphosate or 2,4-D. Rain-free period is 4 hours. The use of a soil residual herbicide at planting is mandatory for optimum weed control and will help delay the development of herbicide resistance.MOA–Glutamine synthase inhibitor
TOUCHDOWN TOTAL (1.5-4.4 pt.) [4.17 lb./gal.]	glyphosate (0.78-2.3 lb.)	For control of most annual and perennial weeds. Apply as a broadcast application before, during, or after planting, but prior to soybean emergence. Make applications in 10 to 30 gallons of water per acre. Can be mixed with other pesticides. Refer to label for specific instructions. See label for necessary surfactant. MOA–EPSP inhibitor
2,4-D (Various trade names) See label. [3.8 lb./gal.]	2,4-D (0.475 lb.)	Very effective for cutleaf evening primrose control. Can be tank mixed with glyphosate or paraquat to provide broad-spectrum burndown control. Soybeans can be planted in 7 (ester) or 15 (amine) days after application depending upon the formulations used.** MOA–Synthetic auxins
PREPLANT INCORPORATED		
PROWL 3.3EC (1.2-2.4 pt.) or PROWL H_2O (1.5-2 pt.) [3.8 lb./gal.]	pendimethalin (0.5-1 lb.) (0.7-1 lb.)	Controls annual grasses and some small-seeded broadleaf weeds. Use low rate on coarse soils, intermediate rate on medium soils, and high rate on fine-textured clay soils. Prowl should not be incorporated deeper than 2 inches. MOA–Mitosis inhibitor

PREPLANT INCORPORATED (cont.)		
PURSUIT 2L (4 fl.oz.)	imazethapyr (0.063 lb.)	Pursuit may be applied preplant incorporated, preemergence, or postemergence. When applied as a preplant incorporated treatment, it should be shallowly and uniformly incorporated into soil. **DO NOT** apply to dry soil, especially if significant rain is expected after planting. It may be tank mixed with Prowl or Treflan. **DO NOT** use more than 4 ounces per acre per growing season. Pursuit-treated areas should not be treated with products containing Classic or Scepter during the same growing season. Since Pursuit can injure sensitive crops, see label for recropping restrictions. MOA–ALS inhibitor
PURSUIT PLUS EC (2.5 pt.) [2.9 lb./gal.]	pendimethalin (0.84 lb.) + imazethapyr (0.063 lb.)	Apply and incorporate Pursuit Plus in the top 2 inches of soil within 45 days of planting, or apply as a preemergence treatment within 45 days of planting. This product controls most annual grasses and several annual broadleaf weeds, and it suppresses nutsedge. **DO NOT** apply Classic, Scepter, Scepter OT, or Pursuit postemergence to fields previously treated with Pursuit Plus. See label for recropping restrictions. MOA–Mitosis inhibitor + ALS inhibitor
SCEPTER 70DG (2.8 oz.)	imazaquin (0.125 lb.)	Controls many annual broadleaf weeds. Incorporate uniformly into the top 1 to 2 inches of soil prior to planting. Apply 10 or more gallons of water per acre with a spray pressure of 20 to 40 psi with ground equipment or in 5 or more gallons of water per acre with aerial equipment. Scepter applied in this manner provides more consistent annual morningglory control than when applied preemergence. This herbicide applied preplant incorporated or preemergence followed by an additional postemergence treatment of Classic provides consistent control of sicklepod. Before using the product, read and note the recropping restrictions on the label. Make only one application of Scepter per year. MOA–ALS inhibitor
TREFLAN 4HLP TRIFLUREX HFP TRIFLURALIN 4EC (1-2 pt.)	trifluralin (0.5-1 lb.)	Controls annual grasses and some small-seeded broadleaf weeds. Use low rate on coarse soils, intermediate rate on medium soils, and high rate on fine-textured clay soils. Herbicide should not be incorporated deeper than 3 inches. MOA–Mitosis inhibitor
PREEMERGENCE		
BOUNDARY 6.5EC (1.2-2.1 pt.)	s-metolachlor (0.78-1.38 lb.) + metribuzin (0.19-0.33)	For control of many annual grasses and broadleaf weeds. Apply as a preplant incorporated or preemergence treatment. Soybeans should be planted at least 1.5 inches deep. Application to sandy soils, low in organic matter, or to soils with pH of 7.5 or higher will result in soybean injury. Consult label for soybean varieties known to be highly sensitive to Boundary. Soil moisture is needed for herbicide activation. Use low rate on sandy loam soils and high rate on heavy acid soils. See label for additional precautionary statements. MOA–Mitosis inhibitor + Photosystem II inhibitor
CANOPY 75DG (6-10 oz.)	metribuzin (0.24-0.4 lb.) + chlorimuron (0.04-0.07 lb.)	Canopy may be soil incorporated or applied preemergence for control of broadleaf weeds. The use rate varies with soil type. **DO NOT** use on sands. Canopy can be mixed with dinitroaniline herbicide and incorporated. Some soybean varieties are highly sensitive to metribuzin. Consult seed suppliers for tolerance ratings. See label for additional precautionary statements. MOA–ALS inhibitor + Photosystem II inhibitor

* MOA=mechanism of action. Herbicides with different MOAs should be used in weed resistance management programs. See Table 11.
** See label for appropriate use and rate.

Table 10. Soybean Weed Control

Herbicide Trade Name (Rate/Acre Broadcast)	Herbicide Common Name (Active Herbicide/Acre)	Comments
PREEMERGENCE (cont.)		
DUAL II MAGNUM 7.64 DUAL MAGNUM 7.62 CINCH (1-1.67 pt.)	s-metolachlor (0.95-1.6 lb.)	Provides good to excellent control of many annual grasses and some small-seeded broadleaf weeds. Yellow nutsedge control has been acceptable when applied at the higher rate and preplant incorporated. Not effective on broadleaves such as cocklebur and morningglory. Best results are obtained when rainfall occurs within 7 days after application. If rainfall does not occur, shallow incorporation may improve control and remove existing weeds. Use low rate on coarse soils, intermediate rate on medium soils, and high rate on fine-textured (clay) soils. Failure to calibrate properly may result in excessive herbicide rate. MOA–Mitosis inhibitor
OUTLOOK 6 (10-18 fl.oz.)	dimethenamid (0.47-0.84 lb.)	Provides good to excellent control of many annual grasses, some small-seeded broadleaf weeds, and yellow nutsedge suppression. Can be applied preplant incorporated up to 2 weeks before planting to medium- to heavy-textured soils. Rainfall, irrigation, or shallow incorporation into the top 2 inches of soil is needed for consistent control. **DO NOT** apply more than 21 fluid ounces per acre per year. MOA–Mitosis inhibitor
INTRRO 4EC (2-3 qt.) or MICRO-TECH (2.5-3 qt.) [4 lb./gal.]	alachlor (2-3 lb.) (2.5-3 lb.)	Gives good to excellent control of many annual grasses and some small-seeded broadleaf weeds. It is not effective on broadleaves such as cocklebur and morningglory. Best results are obtained when rainfall occurs within 7 days after application. If rainfall does not occur, shallow incorporation may improve control. Soybeans have good tolerance. Use low rate on coarse soils, intermediate rate on medium soils, and high rate on fine-textured soils. Alachlor is a **RESTRICTED USE** pesticide. MOA–Mitosis inhibitor
LOROX 50DF (1-2 lb.) or LINEX 4L (1-2 pt.)	linuron (0.5-1 lb.)	Controls many annual grasses and common ragweed, pigweed, and teaweed. Common cocklebur, morningglory, and sicklepod control is poor. Rain is needed after application to move into the soil. Some stunting and stand reduction may occur if heavy rains closely follow treatment. **DO NOT** use on extremely sandy soils or soils with less than 1 percent organic matter. Use lower rates on medium soils low in organic matter and higher rates on medium- to fine-textured soils. MOA–Photosystem II inhibitor
PREFIX 5.29EC (2 pt.)	s-metolachlor (1.09 lb.) + fomesafen (0.24 lb.)	Can be applied preemergence in reduced tillage systems or can be shallowly incorporated. Useful in control of glyphosate and ALS-resistant Palmer amaranth as well as yellow nutsedge. See label for recropping restrictions. MOA–Mitosis inhibitor + PPO inhibitor
PYTHON 80WDG (0.8-1.33 oz.)	flumetsulam (0.04-0.06 lb.)	Can be applied preplant incorporated or preemergence. Controls many broadleaf weeds. Can be tank mixed with other herbicides to control additional broadleaf weeds and annual grasses. See label for recropping restrictions. MOA–PPO inhibitor

Table 10. Soybean Weed Control

Herbicide Trade Name (Rate/Acre Broadcast)	Herbicide Common Name (Active Herbicide/Acre)	Comments
SCEPTER 70DG (2.8 oz.)	imazaquin (0.125 lb.)	Controls many annual broadleaf weeds. Apply in 10 or more gallons of water per acre with a spray pressure of 20 to 40 psi with ground equipment or in 5 or more gallons of water per acre with aerial equipment. Rainfall of 1 to 2 inches after application is required for activation. This herbicide applied preplant incorporated or preemergence followed by an additional postemergence treatment of Classic provides consistent control of sicklepod. Before using the product, read and note the recropping restrictions on the label. Make only one appliation of Scepter per year. MOA–ALS inhibitor
PREEMERGENCE (cont.)		
METRIBUZIN 75DF (0.5-0.67 lb.) or METRI 4F (0.75-1 pt.)	metribuzin (0.37-0.5 lb.) (0.37-0.5 lb.)	Provides early-season control of sicklepod, coffee senna, Florida beggarweed, teaweed, and sesbania. Control of common cocklebur is erratic. Heavy rainfall shortly after application may cause leaching and increase soybean injury. Potential for injury is greater when used on soils having pH of 7.5 or higher or if used with soil-applied organophosphate pesticides. **DO NOT** use on sandy loam and loamy sand soils that contain less than 2 percent organic matter. Closely follow instructions and restrictions on herbicide label. Some soybean varieties are highly sensitive to metribuzin. Consult seed supplier for tolerance ratings. MOA–Photosystem II inhibitor
VALOR SX (51WDG) (2.5 oz.)	flumioxazin (0.08 lb.)	Provides good to excellent control of broadleaf weeds. Use rate is dependent on target weeds. Valor will not control sicklepod, nutsedge, or grasses. Apply as a preemergence treatment only. **DO NOT** incorporate Valor. **DO NOT** tank mix with Intrro, Dual, or Outlook herbicides or severe injury will occur. Application must be made within 3 days after planting. Delay in application, splashing, or heavy rain at cracking may result in severe crop injury. See label for recropping restrictions. MOA–PPO inhibitor
VALOR XLT (3-4 oz.) [40.3 WDG]	flumioxazin (0.056-0.075 lb.) + chlorimurion (0.019-0.026 lb.)	Provides better sicklepod and cocklebur control than Valor alone. Plant soybeans at least 1.5 inches deep and cover seed completely with soil. **DO NOT** apply later than 3 days after planting. **DO NOT** incorporate. **DO NOT** tank mix with Dual, Outlook, or Intrro. See label for tank-mix partners and recropping restrictions. MOA–PPO inhibitor + ALS inhibitor
PREEMERGENCE OR PREPLANT INCORPORATED TANK-MIX COMBINATIONS		
The following herbicide combinations, listed by trade name, are labeled for preemergence (PRE) or preplant incorporated (PPI) application as tank mixtures. Tank mixtures may be justified in specific instances in order to obtain broader spectrum weed control, to decrease risk of crop injury, or to simplify application. Should you have a situation where a tank mix would be advisable, follow closely the instructions on the product labels. The following are tank-mix combinations that have performed well in Alabama.		
Prowl + Scepter (PPI)		Dual + Lorox/Linex (PRE)
Prowl + Metribuzin/Metri (PPI)		Dual + Metribuzin/Metri (PRE)
Treflan + Dual (PPI)		Intrro + Lorox/Linex (PRE)
Treflan + Scepter (PPI)		Intrro + Metribuzin/Metri (PRE)
Treflan + Metribuzin/Metri (PPI)		Prowl + Metribuzin/Metri (PRE)
Note Metribuzin/Metri applied preemergence rather than preplant incorporated has given more consistent sicklepod weed control and less injury.		

Table 10. Soybean Weed Control

Herbicide Trade Name (Rate/Acre Broadcast)	Herbicide Common Name (Active Herbicide/Acre)	Comments
POSTEMERGENCE		
ASSURE II 0.88EC (7-10 oz.) + Crop Oil Concentrate (4 qt./100 gal. spray mix) or Non-ionic Surfactant (1 qt./100 gal. spray mix)	quizalofop (0.05-0.07 lb.) + crop oil concentrate or non-ionic surfactant	Apply postemergence to actively growing grasses. Apply in a minimum of 10 gallons of water per acre with ground equipment using flat fan nozzle tips. Use the lower rates for annual grasses and the high rate for perennial grasses such as bermudagrass and johnsongrass. May be applied by air. See label for instructions. If regrowth of perennial grasses occurs, a second application can be made at the low rate when the grass reaches the appropriate size. **DO NOT** apply after pod set or within 80 days of harvest. **DO NOT** rotate to crops other than cotton or soybeans within 120 days of last application. MOA–ACCase inhibitor
BASAGRAN 4 (1.5-2 pt.)	bentazon (0.75-1 lb.)	For best results, apply over-the-top when weeds are small and actively growing. Such weed growth stages generally correspond to soybean growth stages of two to four trifoliolate leaves. Gives excellent control of cocklebur. Early application and control provide the most beneficial effect on crop yields. Allow adequate spray coverage. For best results, treat before weeds reach the size limits listed on the label. Delayed applications may allow weeds and crop to become too large for adequate spray coverage, and unsatisfactory control may result. Best results are obtained with three nozzles per row (one over-the-top and one directed on each side of the row). Refer to label for correct rate to use. **DO NOT** apply more than 4 pints per acre in one season. A non-phytotoxic crop oil concentrate (1 quart per acre) should be added, depending on the weed species as specified on the label (yellow nutsedge). MOA–Photosystem II inhibitor
CLASSIC 25DF (0.5-0.75 oz.) + Non-ionic Surfactant (1 qt./100 gal. spray mix) or Crop Oil Concentrate (1 qt./25 gal. spray mix)	chlorimuron (0.008-0.012 lb.) + non-ionic surfactant or crop oil concentrate	Apply over-the-top after soybeans have their first trifoliolate leaf. For best results, apply when weeds are actively growing and at the appropriate growth stage listed on the label. Apply in a minimum of 10 gallons of water per acre with a spray pressure of 25 to 40 psi. A second application at 0.5 ounce per acre may be made 2 to 3 weeks after the first, if needed. **DO NOT** apply more than 1 ounce per acre of Classic per season. Consistent sicklepod control is obtained when Metribuzin is applied preplant incorporated or preemergence before the postemergence Classic treatment. Classic (0.25 to 0.33 ounces per acre) can be tank mixed with glyphosate (equivalent to 1 quart of a 4 pounds per gallon formulation). See label for the need of an additional non-ionic surfactant and ammonium sulfate. **DO NOT** apply Classic to soybeans growing in soil with a pH greater than 7.0. Before using this product, read and note the recropping restrictions on the label. **DO NOT** apply within 60 days of maturity. MOA–ALS inhibitor
COBRA 2EC (12.5 oz.) + Crop Oil Concentrate (1-2 pt./100 gal. spray mix) or Non-ionic Surfactant (2 pt./100 gal. spray mix)	lactofen (0.2 lb.) + crop oil concentrate or non-ionic surfactant	Apply over-the-top of soybeans in the first or second trifoliolate leaf stage to control small actively growing weeds. Application made while soybeans are under stress may result in leaf burn or crop growth suppression. This injury or growth suppression may be excessive if application is made to late-planted soybeans and a drought period follows application. **DO NOT** apply after R6 (full seed) stage or within 45 days of harvest. Apply in 20 to 30 gallons of water per acre at 40 to 60 psi spray pressure. See label concerning instructions for aerial application. MOA–PPO inhibitor
FIRSTRATE 84WDG (0.3 oz.) + Non-ionic Surfactant (1 qt./100 gal. spray mix) or Crop Oil Concentrate (1.25 gal./100 gal. spray mix)	cloransulam (0.016 lb.) + non-ionic surfactant or crop oil concentrate	Apply over-the-top of soybeans after crop reaches the first trifoliolate leaf stage but before flowering. Apply in a minimum of 15 gallons of water per acre with ground equipment at 20 to 40 psi of spray pressure. See label for possible tank-mix partners. Make only one FirstRate application per season. **DO NOT** apply in areas where soil pH is greater than 7.8 or in areas where iron chlorosis is a problem for soybeans. See label for recropping restrictions. MOA–ALS inhibitor

Table 10. Soybean Weed Control

Herbicide Trade Name (Rate/Acre Broadcast)	Herbicide Common Name (Active Herbicide/Acre)	Comments
POSTEMERGENCE (cont.)		
FLEXSTAR 1.88L (1-1.5 pt.) + Non-ionic Surfactant (1 qt./100 gal. spray mix) or Crop Oil Concentrate (4 qt./100 gal. spray mix)	fomesafen (0.24-0.35 lb.) + non-ionic surfactant or crop oil concentrate	Contains same active ingredient as Reflex. Apply to actively growing weeds usually 14 to 28 days after planting. Addition of crop oil concentrate will increase activity on large weeds or under dry conditions but will cause foliar burn of soybeans. See label. MOA–PPO inhibitor
FUSILADE DX (0.75 pt.) [2 lb./gal.] + Crop Oil Concentrate (2 pt./25 gal. spray mix) or Non-ionic Surfactant (2 pt./100 gal. spray mix)	fluazifop-butyl (0.18 lb.) + crop oil concentrate or non-ionic surfactant	Apply over-the-top of soybeans for control of annual and perennial grasses. Annual grasses should be treated when they are 2 to 4 inches tall. Johnsongrass should be 12 to 18 inches tall; bermudagrass should be no taller than 3 inches and its runners no longer than 4 to 8 inches. A second application may be necessary if regrowth of perennial grasses occurs. Use a minimum of 10 gallons of spray mix per acre and 40 to 60 psi pressure to ensure complete coverage. Mixing Fusilade with other herbicides will reduce the weed control effectiveness of Fusilade. See label for additional information on crop oils and surfactants. Fusilade does not control sedges (nutgrass). MOA–ACCase inhibitor
FUSION 2.56E (8-10 fl.oz.) + Crop Oil Concentrate (4 qt./100 gal. spray mix) or Non-ionic Surfactant (1 qt./100 gal. spray mix)	fluazifop (0.125-0.156 lb.) + fenoxyprop (0.035-0.044 lb.) + crop oil concentrate or non-ionic surfactant	Apply over-the-top of soybeans for control of annual and perennial grasses. Most annual grasses should be treated when they are 2 to 4 inches tall. Mixing Fusion with other herbicides will reduce herbicide effectiveness. Fusion does not control sedges (nutgrass). MOA–ACCase inhibitors
LIBERTY 280SL (22-36 fl.oz.) [2.34 lb./gal.]	glufosinate (0.4-0.66 lb.)	**APPLY OVER-THE-TOP OF SOYBEAN VARIETIES THAT ARE DESIGNATED AS LIBERTY-LINK SOYBEAN CULTIVARS.** Severe injury or death of soybeans will occur if Liberty is applied to non-Liberty-Link cultivars. Apply to actively growing weeds from time of crop emergence to just before bloom. A single application use rate can be as high as 36 fluid ounces per acre. Do not apply more than 44 fluid ounces of Ignite to soybean in a single season. Sequential application (22-fluid-ounces-per-acre use rate) should be made at least 10 to 14 days apart. MOA–Glutamine synthetase inhibitor
POAST PLUS 1E (1.5-2.25 pt.) or POAST 1.5E (1-1.5 pt.) + Crop Oil Concentrate (2 pt.)	sethoxydim (0.2-0.28 lb.) (0.19-0.28 lb.) + crop oil concentrate	Apply over-the-top of soybeans for control of annual and perennial grasses. Annual grasses should be treated when they are 4 to 8 inches tall, except crabgrass and goosegrass which should be treated before reaching 4 inches tall. Johnsongrass should be 15 to 20 inches and bermudagrass runners should not exceed 6 inches in length for Poast application. Use the low rate for annual grass control and the high rate for bermudagrass and johnsongrass control. A second application may be necessary if regrowth of perennial grasses occurs. Use a minimum of 10 gallons of spray mix per acre and 40 psi pressure at the nozzle to ensure thorough spray coverage of foliage. Mixing with other herbicides will reduce weed control effectiveness. Does not control sedges (nutgrass). MOA–ACCase inhibitor

Table 10. Soybean Weed Control

Herbicide Trade Name (Rate/Acre Broadcast)	Herbicide Common Name (Active Herbicide/Acre)	Comments
POSTEMERGENCE (cont.)		
PURSUIT 2SL (4 fl.oz.) + Non-ionic Surfactant	imazethapyr (0.0625 lb.) + non-ionic surfactant	Apply over-the-top of soybeans to control small, actively growing broadleaf weeds and a few grasses. Except in a few cases, sensitive weeds should be less than 3 inches tall at time of treatment. Pursuit does not control sicklepod or Florida beggarweed. Use a non-ionic surfactant at a rate of 1 quart per 100 gallons of spray mix. **DO NOT** apply within 85 days of harvest. **DO NOT** apply more than a total of 4 fluid ounces per acre per growing season. Pursuit-treated areas should not be treated with products containing either Scepter or Classic during the same growing season. Before using this product, read and note the recropping restrictions on the label. MOA–ALS inhibitor
REFLEX 2LC (1.5 pt.) + Non-ionic Surfactant (1 qt./100 gal. spray mix) or Crop Oil Concentrate (4 qt./100 gal. spray mix)	fomesafen (0.375 lb.) + non-ionic surfactant or crop oil concentrate	Apply over-the-top of soybeans until bloom to control many small actively growing broadleaf weeds. Make application in a minimum of 10 gallons of spray per acre at 40 to 60 psi. In heavy weed growth, apply in a minimum of 20 gallons of spray per acre at 60 psi spray pressure. Timely cultivation 2 to 3 weeks after application will improve overall weed control. **DO NOT** graze small grain or forage planted in Reflex-treated fields. Prior to use, read and note all recropping restrictions on the label. DO NOT apply more than 1.5 pints per acre per year. MOA–PPO inhibitor
ROUNDUP (Various trade names) (22-44 fl.oz.) [5.5 lb./gal.] or (32-64 fl.oz.) [4 lb/.gal.] Generics	glyphosate (0.95-1.9 lb.) (1-2 lb.)	**APPLY OVER-THE-TOP OF SOYBEAN VARIETIES THAT ARE DESIGNATED AS SOYBEANS WITH ROUNDUP READY GENE.** Severe injury or death of soybeans will result if soybeans without the Roundup Ready gene are sprayed. Controls a wide range of grasses and broadleaf weeds. May be applied from soybean emergence through flowering (R2 growth stage). R2 stage ends when a pod about 3/16 inch long appears at one of the four uppermost nodes on the main stem with a fully developed trifoliate. Use low rate on annual weeds 2 to 8 inches tall. Use higher rate when application is delayed and weeds are taller or more dense. Apply herbicides to morningglories when they are less than 3 inches tall. Sequential applications can be used, but total in-crop rate should not exceed 64 fluid ounces per acre (5.5 pounds per gallon) or 96 fluid ounces per acre (4 pounds per gallon). Some formulations require a non-ionic surfactant at a rate of 2 quarts surfactant per 100 gallons of spray mix.. MOA–EPSP inhibitor
TOUCHDOWN TOTAL (24-48 fl.oz.) [4 lb./gal.]	glyphosate (0.75-1.5 lb.)	**APPLY OVER-THE-TOP OF SOYBEAN VARIETIES THAT ARE DESIGNATED AS SOYBEANS WITH ROUNDUP READY GENE.** See remarks for Roundup above for timing, weed size, and use rate. Sequential treatments can be made but a total rate of 2.2 quarts per acre should not be exceeded in-crop per season. Do not graze or harvest for forage or hay. MOA–EPSP inhibitor
RESOURCE EC (2-4 fl.oz.) [0.86 lb./gal.] + Non-ionic Surfactant	flumiclorac (0.013-0.027 lb.) + non-ionic surfactant	Apply as a tank mix with glyphosate for improved control of tall, ivyleaf, and entireleaf morningglory in ROUNDUP READY soybeans. Rate of Resource depends on the size of the morningglory. Must be applied with a non-ionic surfactant (1 quart per 100 gallons of spray mix). Apply to actively growing weeds. Do not apply more than a total of 16 fluid ounces of Resource per acre per growing season. Do not make application within 60 days of harvest. MOA–PPO inhibitor
SCEPTER 70DG (2.8 oz.) + Non-ionic Surfactant (2 pt./100 gal. spray mix)	imazaquin (0.125 lb.) + non-ionic surfactant	Apply over-the-top of soybeans before actively growing cocklebur and pigweeds exceed 12 inches in height. **DO NOT** apply within 90 days of soybean harvest. Before using this product, read and note the recropping restrictions on the label. Make only one application of Scepter to soybeans per year. MOA–ALS inhibitor

Table 10. Soybean Weed Control

Herbicide Trade Name (Rate/Acre Broadcast)	Herbicide Common Name (Active Herbicide/Acre)	Comments
POSTEMERGENCE (cont.)		
SELECT 2EC ARROW (6-8 oz.) or SELECT MAX (12-16 fl.oz.) [0.97 lb./gal.] + Crop Oil Concentrate (2 pt.)	clethodim (0.09-0.125 lb.) (0.09-0.12 lb.) + crop oil concentrate	Apply over-the-top of actively growing soybeans to control small annual grasses and perennial grasses such as johnsongrass and bermudagrass. Use low rate on small annual grasses and medium rate in areas with heavy annual grass pressure. Use high rate on perennial grasses in the labeled size range. See label for higher use rates for controlling heavy infestations of perennial grasses. A second application may be necessary if regrowth occurs. For ground application, apply in a minimum of 10 gallons of spray per acre and a maximum of 40 gallons of spray mix per acre using a spray pressure in the 20- to 60-psi range. Select Max may be applied with a non-ionic surfactant at a rate of 1 quart per 100 gallons of spray mix. May be tank mixed with Basagran, Ultra Blazer, Classic, and Reflex. MOA–ACCase inhibitor
SEQUENCE (3-3.5 pt./A) [5.25 lb./gal.]	s-metolachlor (1.13-1.31 lb.) + glyphosate (0.84-0.98 lb.)	**APPLY SEQUENCE TO ROUNDUP READY SOYBEANS.** Make application to soybeans from cracking through the third trifoliate leaf stage. Do not apply more than 3.5 pints per acre as a single application or exceed 3.5 pints per acre total during season. Apply no later than 90 days before harvest. MOA–Mitosis inhibitor + EPSP inhibitor
STORM (1.5 pt.) + Crop Oil Concentrate	bentazon (0.5 lb.) + aciflurofen (0.25 lb.) + crop oil concentrate	Storm is a prepackaged mixture of Basagran and Blazer. Apply over-the-top of soybeans to small weeds that are actively growing. Soybeans should be in the unifoliate leaf stage at time of application. A crop oil concentrate should be added to the spray mix at a rate not to exceed 1 pint per acre. Use a spray volume of 5 to 20 gallons per acre. See Comments for Basagran and for Ultra Blazer alone for additional instructions. MOA–Photosystem II inhibitor + PPO inhibitor
ULTRA BLAZER 2L (0.5-1.5 pt.) + Non-ionic Surfactant (1 pt./100 gal. spray mix)	aciflurofen (0.125-0.375 lb.) + non-ionic surfactant	Apply over-the-top after soybeans have their second trifoliolate leaf. For best results, apply when weeds are in the two- to four-leaf stage and actively growing. An application made during a period of dry weather when soybeans and weeds are stressed and not actively growing can result in poor weed control. Apply the high rate for broad spectrum weeds, including morningglory and cocklebur. Use hollow cone or flat fan nozzles calibrated to deliver a minimum of 20 gallons of spray mix per acre at a spray pressure of 40 psi. Use an 80-percent active non-ionic surfactant. Additional surfactant is required for the control of certain weeds. Refer to the label for specific use directions. In large beans under poor growing conditions, apply in a semi-directed or directed manner to keep the spray off the top of soybean plants and to ensure good coverage of weeds. **DO NOT** apply more than 2 pints of Ultra Blazer per acre per year. MOA–PPO inhibitor
BUTYRAC 200 (0.7-0.9 pt.) [2 lb./gal.] or BUTYRAC 175 (0.8-1 pt.) [1.75 lb./gal.] or 2,4-DB 175 (1 pt.) [1.75 lb./gal.]	2,4-DB (0.175-0.22 lb.) (0.175-0.22 lb.) (0.22 lb.)	Apply as a postemergence directed spray to soybeans at least 12 inches tall for common cocklebur and morningglory control. Allow spray to contact no more than the bottom one-third of soybean plants. Repeat in 7 to 10 days for effective morningglory control. Plants infected with root rot disease or growing under poor conditions may show injury following treatment. **DO NOT** apply to drought-stressed soybeans. **DO NOT** harvest beans within 60 days after application. MOA–Synthetic auxin

Table 10. Soybean Weed Control

Herbicide Trade Name (Rate/Acre Broadcast)	Herbicide Common Name (Active Herbicide/Acre)	Comments
POSTEMERGENCE (cont.)		
GRAMOXONE INTEON 2 GRAMOXONE SL (8 fl.oz.) [2 lb./gal.] or FIRESTORM 3 (5.3 fl.oz.) + Non-ionic Surfactant	paraquat (0.124 lb.) (0.124 lb.) + non-ionic surfactant	Apply as a postemergence directed spray after soybeans are at least 15 inches tall. Spray no higher than the lower 3 inches of the soybean plant. **DO NOT** spray over-the-top of beans. Use low pressure (30 psi or less). CAUTION: **DO NOT** exceed recommended rate. Gramoxone and Firestorm are **RESTRICTED USE** pesticides. MOA–Photosystem I inhibitor
METRIBUZIN 75DF (0.33-0.5 lb.) or METRI 4F (0.5-0.75 pt.) + Non-ionic Surfactant (1 pt./25 gal. spray mix)	metribuzin (0.25-0.375 lb.) (0.25-0.375 lb.) + non-ionic surfactant	Apply as a postemergence directed spray after soybean plants are at least 12 inches tall and when weeds do not exceed 3 inches in height. Spray no higher than the lower 3 inches of the soybean plant. Provides contact kill of small weeds and residual control of weeds like sicklepod. May cause temporary discoloration to soybeans, but it is not reflected in a reduction in yield. MOA–Photosystem II inhibitor
HARVEST AID		
AIM 2EC (1.5 fl.oz.) + Crop Oil Concentrate	carfentrazone-ethyl (0.023 lb.) + crop oil concentrate	Apply after soybeans are fully developed and leaves are dropping. Apply as a broadcast spray in sufficient spray volume to give complete coverage of crop and weeds such as morninglories, pigweed, and velvetleaf. Use a crop oil concentrate at rate of 1 gallon per 100 gallons of spray solution. A minimum of 3 days must be allowed between Aim application and crop harvest. Control of sicklepod is poor. MOA–PPO inhibitor
GRAMOXONE INTEON 2 GRAMOXONE SL (16 fl.oz.) [2 lb./gal.] or FIRESTORM 3 (11 fl.oz.) + Non-ionic Surfactant (1 pt./25 gal. spray mix)	paraquat (0.25 lb.) (0.25 lb.) + non-ionic surfactant	**Indeterminate varieties:** Apply when at least 65 percent of the seed pods have reached a mature brown color or when seed moisture is 30 percent or less. **Determinate varieties:** Apply when plants are mature, beans are fully developed, and 50 percent of the leaves have dropped and the remaining leaves are yellowing. Mature cocklebur are tolerant of herbicide, and desiccation will not be complete. **DO NOT** apply within 15 days of harvest. **DO NOT** graze or harvest treated area for forage or hay. Gramoxone and Firestorm are **RESTRICTED USE** pesticides. MOA–Photosystem I inhibitor
TOUCHDOWN TOTAL (1.5 pt.) [4 lb./gal.]	glyphosate (0.75 lb.)	Apply at least 14 days prior to harvest. Apply to mature soybeans when pods have lost their color. **DO NOT** graze or harvest treated foliage for 14 days after treatment. This application is not recommended for use on soybeans grown for seed since reduction in germination and/or vigor may occur. MOA–EPSP inhibitor
ROUNDUP WEATHERMAX (22 fl.oz.) [5.5 lb./gal.] or Generics (See label.)	glyphosate (0.95 lb.)	Apply after soybean pods have set and lost all green color. Allow a minimum of 14 days between application and harvest. This application is not recommended for use on soybeans grown for seed since reduction in germination and/or vigor may occur. **DO NOT** graze or harvest treated forage for livestock feed within 14 days of preharvest application. For aerial application, see label for rate of herbicide needed. MOA–EPSP inhibitor

Table 10. Soybean Weed Control continued

Herbicide Trade Name (Rate/Acre Broadcast)	Herbicide Common Name (Active Herbicide/Acre)	Comments
HARVEST AID (cont.)		
SODIUM CHLORATE 3.0 (2 gal.) or SODIUM CHLORATE 6.0 (1 gal.)	sodium chlorate (6 lb.) sodium chlorate (6 lb.)	Apply as a harvest aid to dry down weeds in early-maturing soybeans. Make application 7 to 10 days before anticipated harvesting date when beans are mature and ready for harvest. **DO NOT** graze treated fields or treated soybean foliage. See label for additional precautions and restrictions. MOA–N/A
PERENNIAL GRASS CONTROL		
ASSURE II 0.88 EC (10-12 oz.) + Non-ionic Surfactant or Crop Oil Concentrate	quizalofop (0.07-0.08 lb.) + non-ionic surfactant or crop oil concentrate	Apply postemergence to actively growing grasses. Apply in a minimum of 10 gallons of water per acre with ground equipment using flat fan nozzle tips. Use the lower rates for annual grasses and the high rate for perennial grasses such as bermudagrass and johnsongrass. May be applied by air. See label for instructions. If new plants or regrowth of perennial grasses occurs, a second application can be made at the low rate when the grass reaches the appropriate size. **DO NOT** apply within 80 days of harvest. **DO NOT** rotate to crops other than soybeans within 120 days of last application. MOA–ACCase inhibitor
FUSILADE DX (0.75 pt.) [2 lb./gal.] + Crop Oil Concentrate (2 pt./25 gal. spray mix)	fluazifop-butyl (0.18 lb.) + crop oil concentrate	Apply over-the-top of soybeans for control of annual and perennial grasses. Annual grasses should be treated when they are 2 to 4 inches tall. Johnsongrass should be 12 to 18 inches tall; bermudagrass should be no taller than 3 inches and its runners no longer than 4 to 8 inches. A second application may be necessary if new plants or regrowth of perennial grasses occurs. Use a minimum of 10 gallons of spray mix per acre and 40 to 60 psi pressure to ensure complete coverage. Mixing Fusilade with other herbicides will reduce the weed control effectiveness of Fusilade. See label for additional information on crop oils and surfactants. Fusilade does not control sedges (nutgrass). MOA–ACCase inhibitor
FUSION 2.56E (10-12 fl.oz.) + Non-ionic Surfactant (2 qt./100 gal. mix) or Crop Oil Concentrate (1 gal./100 gal. mix)	fluazifop (0.156-0.187 lb.) + fenoxaprop (0.04-0.052 lb.) + non-ionic surfactant or crop oil concentrate	Apply over-the-top of soybeans to control small rhizome johnsongrass and bermudagrass. Use the low rate on rhizome johnsongrass less than 10 inches tall. Use the high rate on johnsongrass 10 to 18 inches tall. Bermudagrass should be treated with the high rate when runners are 4 to 8 inches long. A second application can be made at 8 fluid ounces per acre when johnsongrass regrowth is 6 to 12 inches tall or bermudagrass runner regrowth is 4 to 8 inches long. MOA–ACCase inhibitors
POAST PLUS 1E (2.25 pt.) or POAST 1.5E (1.5 pt.) + Crop Oil Concentrate (2 pt.)	sethoxydim (0.28 lb.) (0.28 lb.) + crop oil concentrate	Apply over-the-top of soybeans for control of annual and perennial grasses. Annual grasses should be treated when they are 4 to 8 inches tall, except crabgrass and goosegrass which should be treated before reaching 4 inches tall. Johnsongrass should be 15 to 20 inches and bermudagrass runners should not exceed 6 inches in length for Poast application. Use the low rate for annual grass control and the high rate for bermudagrass and johnsongrass control. A second application may be necessary if new plants or regrowth of perennial grasses occurs. Use a minimum of 10 gallons of spray mix per acre and 40 psi pressure at the nozzle to ensure thorough spray coverage of foliage. Mixing with other herbicides will reduce weed control effectiveness. Does not control sedges (nutgrass). MOA–ACCase inhibitor
ROUNDUP WEATHERMAX (33% solution)	glyphosate (wipe on)	Roundup may be used in a ROPE-WICK OR WIPER APPLICATOR to control isolated stands of johnsongrass. The recommended mixture ratio is 2 gallons of water to 1 gallon of Roundup (2:1 mixture). Best results have been obtained when application is made at 3 mph with two trips in opposite directions. Roundup may be applied with a recirculating sprayer in a carrier volume of 20 to 30 gallons per acre. Defoamers may be necessary to reduce foam and possible crop injury. Weeds must be a minimum of 6 inches taller than the soybeans. MOA–EPSP inhibitor

Table 10. Soybean Weed Control

Herbicide Trade Name (Rate/Acre Broadcast)	Herbicide Common Name (Active Herbicide/Acre)	Comments
PERENNIAL GRASS CONTROL (cont.)		
ROUNDUP WEATHERMAX (0.8-4 pt.) [5.5 lb./gal.]	glyphosate (0.55-2.75 lb.)	Apply preplant to foliage of perennial weeds such as rhizome johnsongrass, bermudagrass, and nutsedge. Use lower rate for rhizome johnsongrass and higher rate for bermudagrass and nutsedge. Apply in 20 or more gallons of water per acre. Allow at least 7 days after application before tillage. Johnsongrass must be at least 12 inches tall at time of application. Much better results are obtained if treatment can be delayed until early-head stage of johnsongrass, bermudagrass, and nutsedge. MOA–EPSP inhibitor
SELECT 2EC ARROW (0.5-1 pt.) or SELECT MAX (1-2 pt.) [0.97 lb./gal.] + Crop Oil Concentrate (2 pt.)	clethodim (0.125-0.25 lb.) (0.12-0.24 lb.) + crop oil concentrate	Apply over-the-top of actively growing soybeans to control small annual and perennial grasses, such as bermuda and johnsongrass. Use low rate on small annual grasses; medium rate in areas with heavy annual grass pressure; and high rate on perennial grasses in the labeled size range. See label for higher use rates to control heavy infestations. For ground application, apply in a minimum of 10 and a maximum of 40 gallons of spray mix per acre, using a spray pressure in the 20- to 60-psi range. May be tank mixed with Basagran, Ultra Blazer, Classic, and Reflex. A second application may be needed if new plants or regrowth occurs. MOA–ACCase inhibitor

Table 11. Herbicide Classification by Mechanism of Action

Mechanism of Action	Herbicide	
Acetolactase Synthase (ALS) inhibitor	Classic, FirstRate, Pursuit, Scepter	
Acetyl CoA Carboxylase (ACCase) inhibitor	Arrow, Assure, Fusilade, Poast/Poast Plus, Select	
EPSP inhibitor	Roundup, Touchdown	
Glutamine synthetase inhibitor	Liberty	
Mitosis inhibitor	Dual II, Intrro, Micro-Tech, Outlook, Prowl, Trefllan	
Photosystem I inhibitor	Gramoxone Inteon/Gramoxone SL/Firestorm	
Photosystem II inhibitor	Basagran, Lorox/Linex, Metribuzin/Metri, Storm	
Protoporphyrinogen oxidase (PPO) inhibitor	Aim, Cobra, Flexstar, Python, Reflex, Resource, Ultra Blazer, Valor	

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Table 12. Estimated Effectiveness of Recommended Preplant Incorporated and Preemergence Herbicide Treatments on Important Weeds in Alabama Soybeans [1]

WEEDS	HERBICIDES						
	Prowl, Treflan (PPI)	Scepter (PPI)	Outlook (PPI/PRE)	Pursuit (PPI/PRE)	Python (PPI/PRE)	Canopy (PRE)	Dual (PRE)
GRASSES							
Crabgrass	9+	5	9	8	0	6	9+
Crowfootgrass	9	3	9	—	0	7	8
Fall panicum	8-9	2	8	4	0	7	8
Goosegrass	9	5	9	5	0	7	9
Johnsongrass (rhizomes)	3	2	0	2	0	0	0
Johnsongrass (seedlings)	9	6-7	5	—	0	7	6
Junglerice	9	4	5	6	0	—	8
Texas panicum	8-9	3	5	6	0	—	4
SEDGES							
Purple nutsedge	0	5	1	8	0	5	2
Yellow nutsedge	1	7	7	7-8	0	7	8
BROADLEAF WEEDS							
Balloonvine	0	—	0	—	0	7-8	0
Bristly starbur	0	7	0	7	8	8-9	0
Cocklebur	0	9	0	7-8	8	9	0
Coffee senna	0	7	0	6	6	8	0
Common ragweed	2	8	0	4	8	8	6
Crotalaria	0	6	0	3	0	7-8	0
Florida beggarweed	1	5	4	3	7	8	6
Florida pusley	9+	8	9	8	8	7-8	9
Hemp sesbania	0	4	0	0	0	8	0
Morningglory	3	7-8	0	8	7	7-8	0
Pigweed	9	8	9	8	9	6	8-9
Prickly sida	0	7	4	8	8	7-8	6
Purslane	9	—	8	—	—	9	8
Sicklepod	0	7	5	0	7	8	3
Smartweed	3	8	0	—	8	8	3
Tropic croton	0	—	4	4	—	8	3

continued

[1] Effectiveness ratings are based on observations of research plot and field use under average weather conditions for several years by weed control workers in Alabama.

KEY TO CONTROL RATINGS AND ABBREVIATIONS 0 = No control; 10 = 100% control; — = Information not available.
PPI = Preplant Incorporated; PRE = Preemergence.

Table 12. Estimated Effectiveness of Recommended Preplant Incorporated and Preemergence Herbicide Treatments on Important Weeds in Alabama Soybeans[1] (cont.)

WEEDS	HERBICIDES					
	Intrro (PRE)	Lorox (PRE)	Prefix (PRE)	Scepter (PRE)	Metribuzin (PRE)	Valor XLT (PRE)
GRASSES						
Crabgrass	9+	8	9	0	7	0
Crowfootgrass	9	8	8	0	7	0
Fall panicum	8	8	8	0	6	0
Goosegrass	9	8	9	0	7	0
Johnsongrass (rhizomes)	0	0	0	0	0	0
Johnsongrass (seedlings)	6	4	0	6-7	5	0
Junglerice	8	7	—	0	7	0
Texas panicum	4	1	6	0	1	0
SEDGES						
Purple nutsedge	0	0	4	2	6	0
Yellow nutsedge	6	0	8-9	5	7	7-8
BROADLEAF WEEDS						
Balloonvine	0	6	—	—	7-8	—
Bristly starbur	0	7	—	—	7	7-8
Cocklebur	0	3	8	9	9	7-8
Coffee senna	5	6	5	7	7	8
Common ragweed	3	8	8	8	8	8-9
Crotalaria	0	0	—	—	2	8
Florida beggarweed	7	7	6	4	8	8-9
Florida pusley	9	8	8	7-8	8	8-9
Hemp sesbania	0	6	4	4	8	8
Morningglory	0	7	6-7	6-8	4	7-8
Pigweed	8	8	8	8	7	8-9
Prickly sida	8	7	—	8	8-9	8-9
Purslane	8	8	8	—	8-9	8-9
Sicklepod	4	3	—	7	8	7
Smartweed	4	6	—	8	8	—
Tropic croton	3	—	7	—	8	8

[1] Effectiveness ratings are based on observations of research plot and field use under average weather conditions for several years by weed control workers in Alabama.

KEY TO CONTROL RATINGS AND ABBREVIATIONS 0 = No control; 10 = 100% control;
-- = Information not available. PPI = Preplant Incorporated; PRE = Preemergence.

Table 13. Estimated Effectiveness of Recommended Postemergence and Postdirected Herbicide Treatments on Important Weeds in Alabama Soybeans [1]

WEEDS	HERBICIDES							
	Arrow, Assure, Select (POST)	Basagran (POST)	Classic (POST)	Cobra (POST)	First-Rate (POST)	Flexstar, Reflex (POST)	Fusilade, Poast (POST)	Fusion (POST)
GRASSES								
Crabgrass	8	0	0	0	0	0	8	8
Crowfootgrass	9	0	0	0	0	0	8	8
Fall panicum	8	0	0	0	0	0	9	8
Goosegrass	8	0	0	0	0	0	8	8
Johnsongrass (rhizomes)	8-9	0	0	0	0	0	8	0
Johnsongrass (seedlings)	9	0	0	0	0	0	8	8
Junglerice	8	0	0	0	0	0	8	7
Texas panicum	7-8	7	0	0	0	0	9	8
SEDGES								
Purple nutsedge	0	0	5	2	6	4	0	0
Yellow nutsedge	0	7	7	2	6	6	0	0
BROADLEAF WEEDS								
Balloonvine	0	1	6	9	—	7	0	0
Bristly starbur	0	9	8	8	9	4	0	0
Cocklebur	0	9+	9	8-9	9	7-8	0	0
Coffee senna	0	8	2	4	—	3	0	0
Common ragweed	0	7	8	8	9	8	0	0
Crotalaria	0	4	—	9	—	8	0	0
Florida beggarweed	0	0	8	6	7	4	0	0
Florida pusley	0	5	5	7	7	8	0	0
Hemp sesbania	0	5	8	9	5	8	0	0
Morningglory	0	5-8	4-9	7-9	8	8-9	0	0
Pigweed	0	7	6	9	4	9	0	0
Prickly sida	0	8	2	8	4	2	0	0
Purslane	0	8	—	9	—	—	0	0
Sicklepod	0	0	7-8	5	7	4	0	0
Smartweed	0	7	7	6	7	—	0	0
Tropic croton	0	0	4	8	—	—	0	0

continued

[1] Effectiveness ratings are based on observations of research plot and field use under average weather conditions for several years by weed control workers in Alabama.

KEY TO CONTROL RATINGS AND ABBREVIATIONS

0 = No control; 10 = 100% control; — = Information not available. POST = Postemergence Over-the-top.

Table 13. Estimated Effectiveness of Recommended Postemergence and Postdirected Herbicide Treatments on Important Weeds in Alabama Soybeans [1] (cont.)

WEEDS	HERBICIDES						
	Ignite (POST)	Scepter (POST)	Sequence (POST)	Ultra Blazer (POST)	Firestorm Gramoxone (PDS)	Butyrac (PDS)	Metribuzin (PDS)
GRASSES							
Crabgrass	7-8	0	9	2	7	0	8
Crowfootgrass	8	0	—	5	8	0	8
Fall panicum	8	0	9	5	6-8	0	8
Goosegrass	5	0	8	0	8	0	7
Johnsongrass (rhizomes)	7	0	9	0	2	0	0
Johnsongrass (seedlings)	8	0	9+	3	8	0	6
Junglerice	—	0	—	6	8	0	7
Texas panicum	8	0	—	1	8	0	7
SEDGES							
Purple nutsedge	4	2	3	2	4	0	3
Yellow nutsedge	5	6	7	3	5	0	5
BROADLEAF WEEDS							
Balloonvine	—	—	8	9	3	5	8
Bristly starbur	8	—	—	6	8	7	8-9
Cocklebur	9	9	9+	7-8	7	7-8	8
Coffee senna	8	7	—	6	5	6	7-8
Common ragweed	—	8	9	8-9	8	6	7-8
Crotalaria	—	—	8	9+	8	—	7-8
Florida beggarweed	8	2	—	6	6-8	1	8-9
Florida pusley	6-7	6	7	9	6	4	7-8
Hemp sesbania	—	4	7	9+	2	5	8
Morningglory	9	4-7	7-8	8-9	7	7-8	7
Pigweed	7-8	9	9	9+	8	7	8
Prickly sida	8-9	6	7	2	3	4	7-8
Purslane	7	—	8	9	8	7	8
Sicklepod	9	6-7	8	2	7	8	7
Smartweed	—	7	8	7-8	4	4	8
Tropic croton	8	—	—	9	7	4	8

[1] Effectiveness ratings are based on observations of research plot and field use under average weather conditions for several years by weed control workers in Alabama.

KEY TO CONTROL RATINGS AND ABBREVIATIONS 0 = No control; 10 = 100% control; — = Information not available. POST = Postemergence Over-the-top.

FOR MORE INFORMATION on pesticides, pesticide safety, or submitting samples for analysis, see the following publications in the IPM series:
IPM 1293, “Safety.” Safety contact information; worker protection standards; the safe use, handling, and storage of pesticides
IPM 1294, “Submitting Samples.” Procedures for submitting samples for diagnosis, analysis, and identification
IPM 1295, “General Pesticide Information.” Federal and state restricted use pesticide lists; pesticides and water quality
IPM 1317, “Appendix.” Pesticide guidelines for agronomic crops, including preharvest intervals; rain-free requirements; grazing restrictions; crop rotation guidelines; and the names, classifications, and toxicities of pesticides.

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Stored Grains

Insect Control Recommendations for 2014

Stored grains can be heavily damaged by insects if they are not properly conditioned and protected. Small grains, including wheat, are harvested in spring and stored through the hottest and most humid months of the year. These conditions make it extremely difficult to prevent damage. Corn also can be difficult to store because of field infestation by maize weevil.

There are many different kinds of insects that attack grains and grain products. Most are beetles, their larval stages, and the larval stages of moths. Their length varies from about 0.0625 inch to 1.25 inches.

Some of the more important beetle pests in Alabama are the maize weevil, rice weevil, lesser grain borer, red flour beetle, saw toothed grain beetle, and rusty or flat grain beetle. Both adults and larvae of these insects damage and contaminate grains or grain products.

The Indian meal moth is the most common moth pest of stored grain in Alabama. Other moth larvae that damage grains and grain products include Angoumois grain moth and Mediterranean flour moth. Unless the grain is infested when it is placed in storage or some infested grain or grain product is already in the bin, most of the damage from moth larvae will occur in the surface layer of the grain. The Angoumois grain moth was once a serous pest because it attacked corn stored in corn cribs. Now that little corn is stored in this way, the Angoumois grain moth has declined in importance.

Lesser grain borers, maize weevils, and rice weevils are the most serious of these pests because they feed directly on undamaged grain. Most of the other stored-product beetles feed on broken kernels, grain dust, or grain molds. The larval stages of the maize weevil and rice weevil spend their developmental period inside kernels of grains where they are unseen and difficult to detect. Initial infestation by these pests may occur in the field, creating a problem that may not become evident until well into the storage period.

The following sections discuss practices that reduce the likelihood of insect problems in stored grain. These practices also reduce the chances that mold problems will develop in the bin. Once grain has been placed in storage, it is difficult to get rid of insect infestations that develop. The grain will have to be fumigated or treated with a protectant insecticide as it is moved to another bin. The only exception is if surface infestations of moths develop. These can usually be cleaned up with a surface application of an appropriate insecticide.

More information on managing insects in stored grain can be found at the stored grain section of alabamacrops.com.

Steps to Successful Grain Storage

Clean equipment before using it to harvest and handle your grain. Remove all old grain and other debris where insect infestations may be harbored. After thoroughly cleaning the equipment, spray it with a residual insecticide, using one of those listed in Table 3. Concentrate on cracks and crevices where insects may be hiding. It is best to complete this job at least two weeks before harvest.

Preparing the grain bin. Thoroughly clean the storage bin. Removal of all grain, grain products, and other organic matter is essential for eliminating existing infestations. Pay attention to the outside of the bin as well. Control any weeds that are close to the bin, and remove any grain debris or excess equipment lying near the bin. Grain bins with perforated floors can be difficult to clean, but do the best that you can. Any residue remaining in the bin can reduce the effectiveness of the residual insecticide.

Empty Bin Treatments. Spray the floor of the bin, as well as the inside walls as high as can be reached, with a residual insecticide to eliminate existing infestations. Also spray the outside of the bin, as high as can be reached, as well as the ground or concrete pad surrounding the bin, out to a distance of at least 5 feet. Spray the entire inner area of the bin according to the directions on the pesticide label. A small compressed air sprayer can be used for spraying equipment and bins. But better penetration of cracks, crevices, and other remote areas can be obtained by using a power sprayer that will develop at least 150 psi (pounds per square inch) of pressure. An exception is cyfluthrin; use it with as little as 50 psi of pressure. Remove all dead insects before putting grain in the bin.

Completely seal any unnecessary openings in the bin using caulk, polyethylene foam, or other suitable materials such as sheets of polyethylene. Pay particular attention to joints in the metal. At night, place a light inside the bin to find any openings that you may have missed. Or, step inside the empty bin, close the door, and look for places where daylight shines through. The bin must be airtight if the grain is to be fumigated after it is stored.

Loading the grain into the bin. Grain must be in good condition to be stored successfully. The moisture content of the grain should be below critical levels (See Table 1). The grain should be as free of debris as possible. Excessive debris usually ends up in pockets where it traps moisture, and moisture can cause molding and the build-up of insect populations. These trash pockets also prevent good air movement through the grain, which is necessary for effective aeration or fumigation.

Table 1. Maximum Moisture Contents for Grain Storage in the South [1]

GRAIN TYPE AND STORAGE TIME	MAXIMUM MOISTURE CONTENT FOR SAFE STORAGE[2]	
	Aerated	Not Aerated
Shelled Corn and Sorghum		
Sold as #2 grain by spring	14	12
Stored 6 to 12 months	13	11
Stored more than 1 year	12	10
Wheat, Oats, Barley, Rice		
Stored up to 6 months	12	10
Stored 6 to 12 months	11	9
Stored more than 1 year	10	8
Soybeans		
Sold by spring	13	11
Stored 6 to 12 months	12	10
Stored more than 1 year	11	9
Edible Beans		
Stored up to 6 months	14	12
Stored 6 to 12 months	12	10
Stored more than 1 year	10	8

[1] Adapted from "Stored Grain Management Techniques, by Noyes, Ronald T., et.al., in Stored Product Management, Publication E-912, Cooperative Extension Service, Oklahoma State University, and USDA, 1995.

[2] Reduce one percent for poor quality grain, such as grain damaged by blight, drought, etc.

Grain Protectants. Grain protectants are insecticides that are uniformly applied to the grain as it is loaded into the bin. They are recommended for wheat that will be stored for longer than 1 month, corn that is placed into the bins before mid-August, and corn that will be stored for more than 6 months. Apply the protectant to the stream of grain as it is placed in the storage structure. If the protectant is a liquid, a nozzle should be mounted over the stream and adjusted to deliver the recommended amount of protectant in 5 gallons of water per 1000 bushels. Using dust is not as exact, and dust should be applied as uniformly as possible. Good coverage of grain is essential for effective control. Follow manufacturers' recommendations to get good coverage. See Table 2 to see which commodities can be treated with a particular protectant insecticide. Protectants applied as layer treatments as the grain is loaded are not as effective as treating entire grain mass, but this is an option for uninfested grain or short-term storage.

High temperatures cause the grain protectants to break down. Therefore, apply the grain protectant at the coolest point in the grain stream as it is loaded into the bin after drying.

The top surface of the grain should be level. Be careful not to overfill the bin. There should be at least 1 foot of space between the top of the bin and the surface of the grain.

Surface treatments. The insecticides listed in Table 3, in addition to grain protectants, will help maintain insect-free grain. These surface or "top-dress" treatments should be made immediately after grain is stored and repeated as needed.

Monitoring grain. Use grain triers or grain probe traps to check for insects in the grain mass. Monitor at least once per month in the summer months, and once every six weeks in the cooler months. Sample grain from at least five locations in the grain bin. A simple method is to take samples on the north, south, east, and west edges and a sample in the center. How many insects is too many depends on the end use of the grain. If you are using the grain as feed on farm, it is not as critical if you find insects. However, if you are planning on selling the grain, you may need to fumigate the grain to eliminate live insects before you sell it. See "IPM Tactics for On-Farm Stored Grain," www.aces.edu/pubs/docs/A/ANR-1126/ for more information on the number of insects that can be tolerated.

Aerating Grain

Insect development in stored grains slows when temperatures drop into the 60-degree F range, and it effectively stops below 60 degrees F. Lowering grain temperature, therefore, lessens the chance of insect problems. In Alabama, temperatures are still warm during the first few months of wheat storage and the first month of corn storage. However, stored grains can be cooled as soon as the temperature begins to drop in the fall.

Many farm bins are equipped with aeration fans. If fans are available, use them to cool grain as soon as weather permits. Aeration will make the grain temperature uniform, eliminating troublesome hot pockets where insect and mold development is favored. Aeration can also eliminate moisture migration, a process where moisture accumulates in the center of the bin.

The length of time to cool a grain bin depends on the size of bin, the size of fan, the outside temperature, and the condition of the grain. A rule of thumb is that it takes 60 hours of aeration at or below a desired outside temperature at an airflow rate of 0.2 cubic feet per minute per bushel. More powerful fans can make the aeration time even shorter. Many of the grain bins in Alabama can be cooled in less time because they have powerful fans.

Cooling the grain in steps as the temperature begins to drop in the fall can reduce the risk of insect problems. Lowering grain temperature to 65 degrees F, then 60 degrees, and finally to 55 degrees will result in fewer insect development days than waiting to cool the grain when temperatures fall below 55 degrees F. For more information on aerating grain, see "Grain Storage Aeration Guidelines for the Southeast," www.aces.edu/dept/grain/documents/aerationmanual.pdf.

Automatic controllers are now available that will run aeration fans as necessary to cool grain to a desired temperatures. This eliminates much of the guesswork involved in the aeration process. Thermocouples may be placed in the grain and used to monitor grain temperature.

Fumigation

Thorough fumigation is the only effective way to kill stored grain pests after grain is in the storage bin. Fumigants will kill the insects that are in the bin, but they do not prevent reinfestation. An airtight bin is essential for effective fumigation. Most fumigation failures are due to inadequately sealed bins. Fumigants form poisonous gases and they are extremely dangerous. At least two people should be present when fumigants are applied.

The most commonly used fumigant for on-farm storage is aluminum phosphide. Aluminum phosphide is an effective fumigant but is extremely toxic. All label precautions should be carefully followed. In 2004 the law was changed, and these changes are listed on the new label and applicators manual. As part of the new requirements, the fumigator must develop

a written fumigation management plan. Aluminum phosphide is formulated as tablets and pellets. The tablets or pellets generate phosphine gas (hydrogen phosphide) as they contact moisture in the air. The gas, which is released slowly from the tablets or pellets, is highly toxic. The phosphine gas has moderate penetrating ability and does not adversely affect seed germination.

Five gas detectors that monitor the concentration of phosphine gas have been purchased with Alabama Wheat And Feed Grain Check-Off funds. The detectors are available to be checked out for on-farm use. They are kept in Autauga, Henry, Escambia, Morgan, and Calhoun Counties. Your Alabama Cooperative Extension System regional agronomy agent can arrange for you to borrow one. See ANR-1154, "Fumigating Agricultural Commodities With Phosphine" (www.aces.edu/pubs/docs/A/ANR-1154/). A video on fumigating on-farm grain bins can be obtained from your Alabama Cooperative Extension System regional agronomy agent. The video can also be viewed at www.youtube.com/watch?v=H5hkBTITKSI

Sulfuryl fluoride, Profume, applied by commercial applicators, can be used on-farm but is better suited for commercial operations, such as grain elevators, flour mills, and warehouses.

Protecting Small Quantities of Commodities

Here are several tips to keep unwanted visitors from getting into your dried commodities, such as beans, flour, spaghetti, dog biscuits, and peanuts.

1. Avoid buying material that is already infested. Start with high quality material that has been purchased from a reputable source.

2. If there is good reason for thinking the food may be infested, a freeze treatment or heat treatment may clean up the food before it is stored. (See step 6.)

3. Make sure food is dry. (See Table 1.) Whole grains and beans that are stored before they have been completely dried are prone to insect and disease problems.

4. Store food in tightly sealed containers that are safe for food products.

5. Monitor the food periodically for pest infestations. Discard any heavily infested food to keep problems from spreading.

6. A light insect infestation can be dealt with by sifting out as many insects as possible and freezing the affected materials at 0 degrees F for four days. Or, bake the material slowly at about 130 degrees F for 30 minutes.

7. If storing in bulk (more than one gallon), it may be beneficial to use an organic grain protectant. An example is diatomaceous earth, sold as Insecto, Dryacide, Protect-It, and others. These products can be used to protect grains and other stored, dried commodities from insects.

Diatomaceous earth is safe for humans and companion animals. People would not be harmed even if they accidentally ingested some of this product. The naturally occurring material, silicon dioxide, is actually used as an anti-caking agent or filler in foods such as sugar substitutes, coffee creamers, pain killers, antacids, and spices.

When working with this product, wear a mask or work outdoors to avoid over-exposure to dust, particularly if you have pre-existing respiratory ailments. Mixing a bit of diatomaceous earth into the bottom and top layers of stored product can help keep bulk stored commodities insect free. Use it at a rate of 0.5 to 1 cup per 5 gallons of stored product. You may also find food-grade diatomaceous earth at your farmers coop or feed store as an anti-caking agent. Do not use pool-grade diatomaceous earth.

Grain Bag Storage

Storing grain in large plastic grain bags has become popular in recent years. Research studies have shown varying results in terms of how well the system prevents insect and mold infestations. The most important consideration is that bags must be placed on hard, level, well-drained land. If bags are placed on a slope, they must be arranged to run along the direction of the slope, not across it. Every precaution must be taken to prevent the bags from being punctured, which is why bags should not be placed on top of crop stubble or other sharp surfaces. More information on the economics of crop storage can be found in the online publication "Economics of Grain Storage Bags in the Coastal Bend and Upper Gulf Coast of Texas" (http;//farmassistance.tamu.edu/publications/focus/2009-5pages.pdf).

Temporary Grain Storage

Stored grain in the Southeast is at high risk for damage from insects and molds. That risk is dramatically increased if the grain is stored under unaerated conditions or if the grain is not stored in a sealed structure. Use caution in storing grain in piles and in structures not intended for grain storage. For more information see: www.extension.purdue.edu/extmedia/gq/gqtf38/gqtf-38.html

Resistance to Insecticides

Resistance to malathion is a frequent problem. If control failures with malathion have occurred in the past, consider an alternative insecticide. The Angoumois grain moth, almond moth, and at least two species of beetles have shown some resistance to malathion. For this reason malathion is no longer listed in Tables 2 and 3.

Storing Grain Using Organic Insecticides

Producers may want to consider the following insecticides, most if not all of which are OMRI approved. Be sure to read the insecticide label to make sure it meets your needs. The following products contain *Bacillus thuringiensis:* Biobit HP and Dipel DF (subsp. *kurstaki* strain ABTS-351), Javelin WG (subsp. *kurstaki* strain SA-11), and Xentari (subsp. *aizawai* strain ABTS-1857). (Javelin WG is for use on stored soybeans only.) PyGanic Crop Protection EC 5.0$_{II}$ insecticide is OMRI approved and contains natural pyrethrins. There are other insecticides that contain pyrethrins. Be sure to choose one that does not contain piperonyl butoxide, as that chemical is not considered organic. Insecto is a product containing diatomaceous earth. Other organic insecticides may be available.

Table 2. Insecticides and Fumigants Registered for Applying as Grain Protectants, Topdress Treatments, or Layer Treatments for Control of Common Pests on Stored Grain Crops

PESTICIDES	CROPS				
	Barley	Corn	Oats	Peanuts	Popcorn
Actellic		X			X
Aluminum phosphide (Phostoxin, Phosfume2, Weevil-Cide)	X	X	X	X	X
Centynal	X	X	X	—	X
Diacon IGR, Diacon-D IGR[1]	X	X	X	X	X[1]
diatomaceous earth (Insecto, Dryacide, Protect-It)	X	X	X	In shell	X
Prozap Insect Guard[2]	X	X	X	X	X
Dipel; other Bt products	X	X	X	X	
Profume	X	X	X	X	X
Pyganic, Evergreen, Pyronyl and other pyrethrin products	X	X	X	X	
Storcide II	X		X		

continued

[1] Diacon-D is labeled for popcorn; Diacon II is not.

[2] Some formulations list "head space treatment for bulk storage of raw grains, such as corn, soybeans, cocoa beans, and peanuts."

Table 2. Insecticides and Fumigants Registered for Applying as Grain Protectants, Topdress Treatments, or Layer Treatments for Control of Common Pests on Stored Grain Crops (cont.)

PESTICIDES	CROPS				
	Rye	Sorghum	Soybeans	Wheat	Other
Actellic		X			
Aluminum phosphide (Phostoxin, Phosfume2, Weevil-Cide)	X	X	X	X	See label.
Centynal	X	X	—	X	Rice
Diacon IGR, Diacon-D IGR[1]	X	X	X	X	
diatomaceous earth (Insecto, Dryacide, Protect-It)	X	X	X	X	See label.
Prozap Insect Guard[2]	X	X	X	X	
Dipel; other Bt products	X	X	X	X	See label.
Profume		X		X	See applicators manual.
Pyganic, Evergreen, Pyronyl and other pyrethrin products	X	X	X	X	See label.
Storcide II		X		X	Rice

[1] Diacon-D is labeled for popcorn; Diacon II is not.

[2] Some formulations list "head space treatment for bulk storage of raw grains, such as corn, soybeans, cocoa beans, and peanuts."

Table 3. On-Farm Stored Grains Insect Control

Insecticide and Formulation	Dosage	Comments
GRAIN HANDLING MACHINERY: AUGERS, COMBINES, CONVEYORS, SEEDERS		
diatomaceous earth DRYACIDE DIATOMACEOUS EARTH INSECTICIDE	Dust: 0.4 lb./1000 sq.ft.	Dust throughout machine ensuring distribution to hidden or relatively inaccessible parts. For slurry spray, spray as a fine mist.
PROTECT-IT	Dust: 0.6 lb./1000 sq.ft. Slurry spray: 1.5 lb./1.5 gal./1000 sq. ft.	
beta-cyfluthrin TEMPO SC ULTRA	0.025-0.05% solution 0.5-1 T./gal.	Apply beta-cyfluthrin to all surfaces and spray to point of run-off.
cyfluthrin TEMPO 20WP	1 packet/1000 sq.ft.	Apply cyfluthrin to all surfaces and spray to point of run-off.
pyrethrins + piperonyl butoxide + N-Octyl Bicycloheptene Dicarboxide DOUGLAS PYRETHRIN 5	1.3 gal./1000 sq.ft.	Clean equipment; then apply spray solution. Ready-to-use contact spray
EMPTY BIN TREATMENTS APPLIED BEFORE LOADING GRAIN		
General Comments: *Grain dust dramatically reduces the effectiveness of empty bin treatments. Thoroughly clean equipment bins and buildings before treatment. When applying the bin treatment, give special attention to cracks and crevices where insects may hide. Spray the entire surface area of the bin. After treatment, remove dead insects before filling bins.*		
aluminum phosphide fumigant	See fumigation section for dosage	Place tablets or pellets below the floor, if possible, or scatter them over the empty floor. Cover with 6 ml polyethylene or plastic tarp to contain the gas. This is a **RESTRICTED USE** pesticide.
beta-cyfluthrin TEMPO SC ULTRA	0.025-0.05% solution 0.5-1 T./gal.	Apply beta-cyfluthrin to all interior surfaces of grain bin and spray to point of run-off. Spray the pad outside the bin to a distance of at least 5 feet.
cyfluthrin TEMPO 20WP INSECTICIDE IN PACKETS	1 packet/1000 sq.ft	Apply cyfluthrin to all interior surfaces of grain bin and spray to point of run-off. Spray the pad outside the bin to a distance of at least 5 feet.
deltamethrin CENTYNAL	0.25-1.5 fl.oz./gal./1000 sq.ft.	Spray floors, walls, other surfaces. Do not allow runoff to occur.
deltamethrin + chlorpyrifos- methyl STORCIDE II	1.8 fl.oz./gal./1000 sq.ft.	Apply from outside the bin. Only downward-direct spray permitted. **DO NOT** enter the bin until spray has dried.
diatomaceous earth DRYACIDE DIATOMACEOUS EARTH INSECTICIDE	Dust: 0.4 lb./1000 sq.ft. Slurry: 1.2 lb./1.2 gal./1000 sq.ft.	Apply as a dust with a hand or power duster or as a slurry spray.
INSECTO	Dust: 1 lb./1000 sq.ft.	Apply at least 2 to 3 days before filling bin. Use aeration fan or other air supply to apply dust.
PROTECT-IT	Dust: 0.6 lb./1000 sq.ft.	Apply 2 weeks before filling bins. Use a dust blower or bin fan to reach all cracks, crevices, and on surfaces.
	Slurry: 1.5 lb./1.5 gal./1000 sq.ft.	Use a sprayer to reach all cracks, crevices, and on all surfaces, applying spray as a fine mist.
pyrethrins PYGANIC CROP PROTECTION EC 5.0$_{II}$	8 fl.oz./1000 sq.ft.	Spray floors, walls, and other surfaces.
pyrethrins + piperonyl butoxide EVERGREEN CROP PROTECTION EC 60-6	2.8 fl.oz./1.3 gal./1000 sq.ft.	Spray floors, walls, and other surfaces.
PYRONYL CROP SPRAY	2.8 fl.oz./1000 sq.ft.	Spray floors, walls, and other surfaces.

Table 3. On-Farm Stored Grains Insect Control (cont.)

Insecticide and Formulation	Dosage	Comments
EMPTY BIN TREATMENTS APPLIED BEFORE LOADING GRAIN (cont.)		
pyrethrins + piperonyl butoxide + N-Octyl Bicycloheptene Dicarboxide		Spray floors, walls, and other surfaces.
DOUGLAS PYRETHRIN 5	1.3 gal./1000 sq.ft.	Ready-to-use contact spray
pyriproxyfen		Nyguard is an insect growth regulator. It kills immature stages of insects. Use with an adulticide to provide immediate control of adult insects.
NYGUARD	0.8-2.4 t./gal./1500 sq.ft. 4-12 ml/gal./1500 sq.ft.	
(S)-methoprene		
DIACON IGR	Fogging Treatment: 1 ml/1000 sq.ft. 0.2 t./1000 sq.ft. Pressure Spray: 2 ml/1000 sq.ft. 0.4 t./1000 sq.ft.	Apply in water or oil in a cold aerosol generator. Diacon IGR is an insect growth regulator that interferes with the development of insects. It will not kill adult insects. Apply in sufficient water for adequate coverage with a low-pressure sprayer to all areas which may harbor insect pests.
DIACON-D IGR	1.5 oz./1000 sq.ft.	Wear a dust mask and protective gloves. Pay particular attention to cracks and crevices.
PROTECTANT TREATMENTS APPLIED TO THE ENTIRE GRAIN MASS AS IT IS LOADED		
General Comments: *Apply protectant insecticides after grain is dry and cool. Avoid severely dusty application site. See Table 2 to see which commodities can be treated with a particular insecticide.*		
deltamethrin		Othe approved grains include barley, popcorn, rice, and rye.
CENTYNAL	Corn: 8.5 fl.oz./5 gal./1000 bu. Oats: 4.9 fl.oz./5 gal./1000 bu. Sorghum: 8.5 fl.oz./5 gal./1000 bu. Wheat: 9.1 fl.oz./5 gal./1000 bu.	
deltamethrin + chlorpyrifos-methyl		Dilute with water or an FDA-approved food grade mineral oil or soybean oil. Other approved grains include barley and rice.
STORCIDE II	Oats: 6.6 fl.oz./5 gal./1000 bu. Sorghum: 11.6 fl.oz./5 gal./1000 bu. Wheat: 12.4 fl.oz./5 gal./1000 bu.	
diatomaceous earth		
General Comments: *Diatomaceous earth may affect grain handling and/or test weight in some cases. Consider using layer treatments. (See next section of this table)*		
INSECTO	1 lb./ton 1-2 lb./ton (if grain is infested)	Apply uniformly as a dust on grains, soybeans, peanuts, popcorn, and others (see label).
PROTECT-IT	Wheat, beans, peas: 18 lb./1000 bu. Oats: 9.6 lb./1000 bu. Rye: 16.8 lb./1000 bu.	Grain mass treatment cannot be used on corn, popcorn, sorghum, or peanuts in shell. Uniformly treat grain as it is loaded into bin.

Table 3. On-Farm Stored Grains Insect Control (cont.)

Insecticide and Formulation	Dosage	Comments
PROTECTANT TREATMENTS APPLIED TO THE ENTIRE GRAIN MASS AS IT IS LOADED (cont.)		
pirimiphos-methyl		**DO NOT** use if grain has been previously treated with Actellic or if Actellic will be used as a topdress treatment. Apply to grain as uniformly as possible as it is being loaded. Protects against most stored grain pests. No waiting period for use. **DO NOT** store diluted Actellic in spray tank for more than 48 hours before use. For corn and sorghum only.
ACTELLIC 5E INSECTICIDE	8.6-11.5 oz./5 gal./1000 bu. (9.2-12.3 oz./5 gal. /60,000 lb.) 3-4 water soluble packets/60,000 lb.	
pyrethrins		
PYGANIC CROP PROTECTION EC 5.0 II	30 fl.oz./5 gal water/ 1000 bu.	
pyrethrins + piperonyl butoxide		
EVERGREEN CROP PROTECTION EC 60-6	1.1 pt./4 gal./1000 bu. to 1.3 pt./5 gal./1000 bu.	
PYRONYL CROP SPRAY	1.1 pt./4 gal./1000 bu. to 1.4 pt./5 gal./1000 bu.	
(S)-methoprene		Use 5 gallons of water or food grade oil per 1000 bushels. Diacon IGR is an insect growth regulator that interferes with the development of insects. It will not kill adult insects. Treat existing insect populations with adulticide before or at the same time as applying Diacon IGR. Apply only once to grain of known treatment history. Use highest rates for maximum residual. Lowest rate provides shorter residual.
DIACON IGR	Wheat, corn, sorghum: 1.75-7 fl.oz. Oats, peanuts: 1-4 fl.oz. Rice: 1.5-6 fl.oz.	
DIACON-D IGR	8-10 lb./1000 bu.	Apply as uniformly as possible to the commodity stream to assure even coverage.
SURFACE OR TOPDRESS TREATMENTS FOR THE TOP 4 INCHES OF GRAIN (PRIMARILY FOR INDIAN MEAL MOTH LARVAE)		
Bacillus thuringiensis		Apply evenly over the surface immediately after loading and mix into a depth of 4 inches with a scoop or rake. If applied to the surface, split the dosage into three applications and mix the grain between applications. **For the Top 4 Inches of Grain:** Apply 0.6 pint of the mixture to each bushel of grain as it is loaded into the bin.
BIOBIT HP	1 lb./10-20 gal./1000 sq.ft.	
DIPEL DF	1 lb./10-20 gal./1000 sq.ft.	
BIOBIT HP	0.05 lb./gal.	
DIPEL DF	0.05 lb./gal.	
JAVELIN WG	1.5 oz./gal.	
XENTARI DF	1 lb./10-20 gal./1000 sq.ft.	
diatomaceous earth		Apply Insecto as a dust to surface of binned grain (see instructions on the label).
INSECTO	4 lb./1000 sq.ft.	
PROTECT-IT	3 lb./1000 sq.ft. or 40 lb./1000 sq.ft.	Apply the 3-pound rate on surface that has already been treated with Protect-It. Apply the 40-pound rate on surface that has not been previously treated with Protect-It.
pirimiphos-methyl		Spray half of the mixture over the top and rake it 4 inches into grain; apply remaining half on top of raked surface. **DO NOT** use if grain has been previously treated with Actellic spray. For corn and sorghum only.
ACTELLIC 5E INSECTICIDE	3 oz./2 gal./1000 sq.ft. 1 water soluble packet/ 2 gal./1000 sq.ft.	
(S)-methoprene		**DO NOT** flood topdress area. Use sufficient water or oil to provide adequate coverage as a spray or a fogging treatment. Apply only once to grain of known treatment history. Diacon IGR is an insect growth regulator that interferes with the development of insects. It will not kill adult insects.
DIACON IGR	1 ml/1000 sq.ft. 0.2 t./1000 sq.ft.	
DIACON-D IGR	8 lb./1000 sq.ft.	Apply uniformly and rake into the grain to a depth of 1 foot.

Table 3. On-Farm Stored Grains Insect Control (cont.)

Insecticide and Formulation	Dosage	Comments
	HEAD SPACE TREATMENT	
dichlorvos PROZAP INSECT GUARD	80 g strip (900-1200 cu.ft.)	See Table 3 and the label for allowed uses. Controls adult moths in head spaces. Treat in early spring before moths begin to emerge. Calculate cubic feet of air space above the commodity.
	FUMIGATION TREATMENTS	
aluminum phosphide (phosphine gas)		All formulations of aluminum phosphide now require you to prepare a written fumigation management plan. **READ THE LABEL AND THE APPLICATORS MANUAL CAREFULLY BEFORE USING ALUMINUM PHOSPHIDE.** Many on-farm fumigations fail because the bin is not sealed adequately. Seal bin as tightly as possible. Use higher doses for older, less well-sealed grain bins. Dosage must be based on the capacity of the grain bin, not on the amount of grain in storage, unless the surface of the grain is tarped after aluminum phosphide application. If grain is tarped, dose can be based on the volume of the grain in storage. All formulations of aluminum phosphide are **RESTRICTED USE** pesticides. Dosage rate varies with the site. See the Applicators Manual that is part of the label. See ANR-1154, "Fumigating Agricultural Commodities With Phosphine" (www.aces.edu/pubs/docs/A/ANR-1154/) for more information.
pellets	Farm bins:	
WEEVIL-CIDE 60% pellets	350-725 pellets/1000 cu.ft.	
PHOSFUME2 60% pellets	350-725 pellets/1000 cu.ft.	
PHOSTOXIN 60% pellets	350-725 pellets/1000 cu.ft.	
tablets*		
WEEVIL-CIDE 60% tablets	70-145 tablets/1000 cu.ft..	
PHOSFUME2 60% tablets	70-145 tablets/1000 cu.ft.	
PHOSTOXIN 60% tablets	70-145 tablets/1000 cu.ft.	
PHOSTOXIN TABLET PREPAC (33 tablets)**	See label.	Phostoxin tablet prepack is a **RESTRICTED USE** chemical.
cylinderized phosphine + carbon dioxide gas		Eco2Fume is a restricted use insecticide and requires specialized training and equipment.
ECO2FUME FUMIGANT GAS	See label.	
pure phosphine gas		To be blended with carbon dioxide or forced air on site. Contact Cytec Industries for more details (905-374-5899). Vaporph$_3$os is a **RESTRICTED USE** chemical and requires specialized training and equipment for application.
VAPORPH$_3$OS PHOSPHINE FUMIGANT	See label.	
cylinderized sulfuryl fluoride PROFUME		Profume is a **RESTRICTED USE** insecticide. See label and applicators manual.

*Tablets are five times larger than pellets.

**Other trade names and packaging are available.

NOTE: Read manufacturer's label carefully for specific information for all product use restrictions and safety. No waiting period is required for any of these recommended application rates except fumigation. Grains can be fed or sold after fumigant gases have been exhausted, and all warning placards have been removed.

Table 4. Helpful Conversions for Applying Insecticides to Stored Grains*

Bin Diameter (Feet)	Grain Surface Area (Square Feet)	Bushels per Foot of Height	Approximate Surface Area of Empty Bin (Square Feet)
8	50	40	100 + (height x 25)
16	201	161	400 + (height x 50)
24	452	362	900 + (height x 75)
32	804	643	1600 + (height x 100)

* 1 bushel = 1.25 cubic feet; 1 cubic foot = 0.8 bushels.

Number of tons = (Number of bushels x test weight in pounds per bushel) / 2000

Table 5. Manufacturers of Stored Grain Insecticide

Insecticide	Manufacturer or Distributor	Website	Telephone Number
Actellic 5E	Winfield Solutions LLC	www.agrisolutionsinfo.com	1-800-328-9680
Biobit, Dipel, Xentari	Valent	www.valent.com	1-800-6-valent
Centynal	Wellmark International	www.centrallifesciences.com	1-800-877-6374
Dryacide	Winfield Solutions LLC	www.agrisolutionsinfo.com	1-800-328-9680
Diacon IGR, Diacon-D IGR	Wellmark International	www.centrallifesciences.com	1-800-877-6374
Douglas Pyrethrin 5	Douglas Products	www.douglasproducts.com/ag-products/	1-800-223-3684
Eco_2Fume	Cytec Industries	www.cytec.com/specialty-chemicals/agricultural-fumigation.htm	1-973-357-3100
Evergreen Crop Protection EC 60-6	McLaughlin Gormley King Co.	www.mgk.com	1-800-645-6466
Insecto	Natural Insecto Products Inc.	www.insecto.com	1-800-332-2002
Javelin	Certis USA	www.certisusa.com	1-800-847-5620
NyGuard IGR Concentrate	McLaughlin Gormley King Co.	www.mgk.com	1-800-645-6466
Phostoxin	Degesch America Inc.	www.degeschamerica.com	1-540-234-9281 1-800-330-2525
Phosfume2	Douglas Products	www.douglasproducts.com/ag-products/	1-800-223-3684
Profume	Dow AgroScience	www.dowagro.com/profume/us/	1-800-258-3033
Protect-It	Hedley Technologies	www.hedleytech.com	1-888-476-4473
Prozap Insect Guard	Chem-Tech LTD	www.chemtechlimited.com	1-515-287-6778
Prentox Pyronyl Crop Spray	Envincio	www.envincio.com	1-770-552-8076
Pyganic	McLaughlin Gormley King Co.	www.mgk.com	1-800-645-6466
Storcide II	Bayer	www.bayercropscience.us	1-800-248-6907
Tempo SC ULTRA	Bayer	www.bayerprocentral.com	1-800-842-8020
Tempo 20WP	Bayer	www.bayerdvm.com	1-800-633-3796
Weevil-Cide	United Phosphorus Inc.	www.upi-usa.com	1-800-438-6071

Stored Grains: Insect Control Recommendations prepared by Kathy L. Flanders, Extension Entomologist, Professor, Department of Entomology and Plant Pathology, Auburn University.

FOR MORE INFORMATION on pesticides, pesticide safety, or submitting samples for analysis, see the following publications in the IPM series:
IPM 1293, “Safety.” Safety contact information; worker protection standards; the safe use, handling, and storage of pesticides
IPM 1294, “Submitting Samples.” Procedures for submitting samples for diagnosis, analysis, and identification
IPM 1295, “General Pesticide Information.” Federal and state restricted use pesticide lists; pesticides and water quality
IPM 1317, “Appendix.” Pesticide guidelines for agronomic crops, including preharvest intervals; rain-free requirements; grazing restrictions; crop rotation guidelines; and the names, classifications, and toxicities of pesticides.

2014 IPM-0330

For more information, contact your county Extension office. Visit www.aces.edu/counties or look in your telephone directory under your county’s name to find contact information.

Use pesticides **only** according to the directions on the label. Follow all directions, precautions, and restrictions that are listed. Do not use pesticides on plants that are not listed on the label

The pesticide rates in this publication are recommended **only** if they are registered with the Environmental Protection Agency or the Alabama Department of Agriculture and Industries. If a registration is changed or canceled, the rate listed here is no longer recommended. Before you apply **any** pesticide, check with your county Extension agent for the latest information.

Trade names are used **only** to give specific information. The Alabama Cooperative Extension System does not endorse or guarantee any product and does not recommend one product instead of another that might be similar.

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Extension
ALABAMA A&M & AUBURN UNIVERSITIES

IPM-1313

Commercial Turf and Lawns

IPM

Insect Control Recommendations for 2014

Commercial Turf Insect Control

Insecticide and Formulation	Rate	Comments
	BILLBUGS	
bifenthrin		
BRIGADE 2EC	0.08-0.16 fl.oz./1000 sq.ft. or 3.5-7 fl.oz./A	Brigade is a **RESTRICTED USE** insecticide. Use on sod farms only. Apply when adults are first observed.
TALSTAR EZ 0.2% GRANULAR	1.15-2.3 lb./1000 sq.ft. or 50-100 lb./A	For use on lawns in landscaped areas and perimeters around residential, institutional, public, commercial and industrial buildings, parks, recreational areas, and athletic fields. Apply when adults are first observed.
TALSTAR GC 0.2% GRANULAR	1.15-2.3 lb./1000 sq.ft. or 50-100 lb./A	For use on lawns in landscaped areas and perimeters around residential, institutional, public, commercial and industrial buildings, parks, recreational areas, athletic fields, golf courses, and sod farms. Apply when adults are first observed.
TALSTAR 7.9% P	0.25-0.5 fl.oz./1000 sq.ft.	For use on lawns. Apply when adult billbugs are first observed.
TALSTAR PL 0.2% GRANULAR	1.15-2.3 lb./1000 sq.ft. or 50-100 lb./A	For use on lawns in landscaped areas and perimeters around residential, institutional, public, commercial and industrial buildings, parks, recreational areas, and athletic fields. Not for use on golf courses and sod farms. Apply when adult billbugs are first observed.
bifenthrin + zeta-cypermethrin		
TALSTAR XTRA 0.20% + 0.05% GRANULAR	1.15-2.3 lb./1000 sq.ft. or 50-100 lb./A	For use on lawns and landscaped areas around residential, institutional, public, commercial and industrial buildings, parks, recreational areas, and athletic fields. Apply when adults are first observed.
carbaryl		
SEVIN SL	6 fl.oz./1000 sq.ft. or 8 qt./A	Irrigate turfgrass soon after treatment. For use on golf turf, sports fields, domestic and commercial lawns, cemeteries, parks, campsites, and recreational areas.
SEVIN 80 WSP	10 lb./A	Irrigate turfgrass soon after treatment.
chlorantraniliprole		
ACELEPRYN	8-20 fl.oz./A	For use on sod farms, golf courses, landscape and recreational turfgrass.
ACELEPRYN GRANULAR	50-100 lb./A	For use on sod farms, golf courses, landscape and recreational turfgrass.
chlorpyrifos		
DURSBAN 50W	2-4 lb./A	Dursban is a **RESTRICTED USE** insecticide. Use on sod farms only. Apply when adults are first observed.
clothianidin ***See EPA Bee Advisory**		
ARENA 50 WDG	6.4-12.8 oz./A	For use on grass grown in industrial, commercial, and residential landscapes including athletic fields, cemeteries, sod farms, golf courses, home lawns, parks, and playgrounds. Irrigate after application.
ARENA 0.25G	80-160 lb./A	

*The EPA Bee Advisory can be found at the end of this publication.

Commercial Turf Insect Control (cont.)		
Insecticide and Formulation	Rate	Comments
	BILLBUGS (cont.)	
deltamethrin		
DELTAGARD 0.1% G	2-3 lb./1000 sq.ft. or 87-131 lb./A	Not for use on golf courses or sod farms.
DELTAGARD GC 0.1% GRANULAR	2-3 lb./1000 sq.ft. or 87-131 lb./A	DeltaGard GC is a **RESTRICTED USE** pesticide. For use on golf courses and sod farms only. Irrigate as soon as possible after application.
DELTAGARD T&O 0.1% GRANULAR	2-3 lb./1000 sq.ft. or 87-131 lb./A	For sale, use, and storage by commercial applicators only. For outdoor use on lawns, grounds, and perimeter treatments. Irrigate as soon as possible with 0.25 to 0.5 inch water.
DELTAGARD GC 5SC	0.6-0.9 fl.oz./1000 sq.ft. or 26-39 fl.oz./A	DeltaGard GC 5SC is a **RESTRICTED USE** pesticide. For use on golf courses, sod farms, commercial and residential turf.
DELTAGARD T&O 5SC	0.6-0.9 fl.oz./1000 sq.ft. or 26 -39 fl.oz./A	For commercial use only. For use on lawns in landscaped areas, around residential, institutional, public, commercial and industrial buildings, parks, recreational areas, and athletic fields. Irrigate immediately after application.
halofenozide		
MACH 2 1.5 G	133 lb./A	Can be used on any turfgrass site. For control of immature stage only. Must be ingested to be effective. Water must transport material through the thach. May cause short-term discoloration of Tiftdwarf bemudagrass.
MACH 2 2SC	2.9 fl.oz./1000 sq.ft.	Can be used on commercial turfgrass sites such as commercial lawns, grounds or lawns around business or office complexes, cemeteries, golf courses, and sod farms. Controls immature stage only. Water must transport material through the thach. May cause Tiftdwarf bermuda discoloration.
imidacloprid ***See EPA Bee Advisory**		
MERIT 75 WSP	1.6 oz./8250-11,000 sq.ft.	For insect control in turfgrass including sod farms.
MERIT 75 WP	6.4- 8.6 oz./A	For insect control in turfgrass including sod farms. For optimum control make application prior to egg hatch.
MERIT 2F	1.25-1.6 pt./A	For insect control in turfgrass including sod farms. For optimum control make application prior to egg hatch
MERIT 0.5 G	60-80 lb./A	For systemic insect control in turfgrass (home lawns, golf courses, cemeteries, parks, playgrounds, and athletic fields. NOT for use on sod farms. For optimum control make application prior to egg hatch..
imidacloprid + bifenthrin ***See EPA Bee Advisory**		
ALLECTUS GC SC	2.3-4.5 pt./A	Allectus GC SC is a **RESTRICTED USE** insecticide. For use in turfgrass on golf courses and sod farms. Irrigate after application. Apply when billbugs are first observed.
ALLECTUS GC GRANULAR	75-125 lb./A	Allectus GC is a **RESTRICTED USE** insecticide. For use on turfgrass areas of golf courses and sod farms. Apply when adult billbugs are first observed.
ALLECTUS G	75-125 lb./A	For use in turfgrass including athletic fields, parks and residential, commercial, industrial, and recreational lawns. Not for use on golf courses or sod farms.
ALLECTUS SC	1.1-4.5 pt./A or 0.4-1.65 fl.oz./1000 sq.ft.	For use in turfgrass on home lawns, business and office complexes, shopping complexes, multi-family residential complexes, airports, cemeteries, parks, playgrounds, and athletic fields. Not for use on golf courses or sod farms.
lambda-cyhalothrin		
SCIMITAR CS	7 ml/1000 sq.ft. or 10 fl.oz./A	For use by individuals registered by the state to apply pesticide products. For use on lawns in landscaped areas around residential, institutional, public, commercial and industrial buildings, parks, recreational areas, and athletic fields. Irrigate after application.
SCIMITAR GC	7 ml/1000 sq.ft. or 10 fl.oz./A	Scimitar GC is a **RESTRICTED USE** insecticide. For use on same sites as Scimitar CS plus golf course turf and sod farms. Irrigate after application.

*The EPA Bee Advisory can be found at the end of this publication.

Commercial Turf Insect Control (cont.)		
Insecticide and Formulation	Rate	Comments
BILLBUGS (cont.)		
thiamethoxam		For use on turfgrasses on golf courses, residential lawns and commercial grounds (includes sod farms, playgrounds, and athletic fields).
MERIDIAN 0.33G	7-9 lb./5000 sq.ft. or 60-80 lb./A	
MERIDIAN 25WG	12.7-17 oz./A	For use on turfgrasses on golf courses, residential lawns, and commercial grounds.
CHINCH BUGS		
acephate		For use on golf courses or sod farms only.
ORTHENE TTO 97	2.5-4 lb./A (golf course). 2.5-3 lb./A (sod farm)	
ORTHENE TTO 75 WSP	3.33-5.33 lb./A (golf course). 3.33-4 lb./A (sod farm)	For use on golf courses or sod farms only.
bifenthrin		Brigade is a **RESTRICTED USE** insecticide. For use on sod farms only. Irrigate before treatment.
BRIGADE 2EC	7-14 oz./A	
TALSTAR EZ 0.2% GRANULAR	100 lb./A (residential use) 200 lb./A (non-residential use)	For use on lawns in landscaped areas and perimeters around residential, institutional, public, commercial and industrial buildings, parks, recreational areas, and athletic fields. Irrigate with up to 0.25 inch of water after application.
TALSTAR GC 0.2% GRANULAR	100 lb./A (residential use) 200 lb./A (non-residential use)	For use on lawns in landscaped areas and perimeters around residential, institutional, public, commercial and industrial buildings, parks, recreational areas, athletic fields, golf courses, and sod farms. Irrigate with up to 0.25 inch of water after application.
TALSTAR 7.9% P	0.5-1 fl.oz./1000 sq.ft.	Irrigate before application. For use on lawns.
TALSTAR PL 0.2% GRANULAR	100 lb./A (residential use) 200 lb./A (non-residential use)	For use on lawns in landscaped areas and perimeters around residential, institutional, public, commercial and industrial buildings, parks, recreational areas, and athletic fields. Not for use on golf courses and sod farms. Irrigate with up to 0.25 inch of water after application.
bifenthrin + zeta-cypermethrin		For use on lawns and landscaped areas around residential, institutional, public, commercial and industrial buildings, parks, recreational areas, and athletic fields. Irrigate with up to 0.25 inch of water after application.
TALSTAR XTRA 0.20% + 0.05% GRANULAR	100 lb./A (residential use) 200 lb./A (non-residential use)	
carbaryl		For agricultural or commercial use only. For use on turfgrass on golf courses, sports fields, domestic and commercial lawns, cemeteries, parks, campsites, and recreational areas. Do not allow public use of treated areas during applications or until sprays have dried. Irrigate prior to application. Do not irrigate within 24 hours following application.
SEVIN SL	6-8 qt./A	
SEVIN 80 WSP	7.5-10 lb./A	Irrigate before application; then do not irrigate for 24 hours.
clothianidin ***See EPA Bee Advisory**		For use on grass grown in industrial, commercial, and residential landscapes including athletic fields, cemeteries, sod farms, golf courses, home lawns, parks, and playgrounds. Irrigate after application.
ARENA 50 WDG	9.6-12.8 oz./A	
ARENA 0.25 G	120-160 lb./A	For use on grass grown in industrial, commercial, and residential landscapes including athletic fields, cemeteries, sod farms, golf courses, home lawns, parks, and playgrounds. Irrigate after application.

*The EPA Bee Advisory can be found at the end of this publication.

Commercial Turf Insect Control (cont.)		
Insecticide and Formulation	Rate	Comments
	CHINCH BUGS (cont.)	
cyfluthrin		
TEMPO 20 WP GC	55 g/7800 sq.ft.	Tempo GC is a **RESTRICTED USE** pesticide. For turf on residential and commercial sites, including golf courses, home lawns, around business and office complexes, and multi-family residential complexes airports, cemeteries, parks, playgrounds, athletic fields, and other sites.
TEMPO 20 WP POWERPAK	50 g/7500 sq.ft.	For commercial use only. For residential and commercial lawns. Not for use on golf courses.
TEMPO 20 WP 420 GRAM JAR	10 g/1000 sq.ft. or 15.4 oz./A	For pest management professionals and commercial use only. For residential and commercial lawns. Not for use on golf courses.
TEMPO SC ULTRA	8 mg/1000 sq.ft. or 12 fl.oz./A	For pest management professionals and commercial use only. For landscape and residential turf. Not for use on golf courses.
TEMPO ULTRA GC	8 mg/1000 sq.ft. or 12 fl.oz./A	Tempo GC is a **RESTRICTED USE** pesticide. For use on turf on residential and commercial sites including golf courses.
TEMPO ULTRA WP	10 g/1000 sq.ft. or 15.4 oz./A	For pest management professionals and commercial use only. For turf on residential and commercial lawns only. Not for use on golf courses or sod farms. Irrigate after application.
TEMPO ULTRA WSP	50 g/5000 sq.ft.	For pest management professionals and commercial use only. For turf on residential and commercial lawns only. Not for use on golf courses or sod farms. Irrigate after application.
deltamethrin		
DELTAGARD 0.1% G	2-3 lb./1000 sq.ft. or 87-131 lb./A	For sale to, use, and storage by commercial applicators only. For turfgrass on lawns, grounds, and perimeter treatments. Not for use on golf courses or sod farms. Irrigate after application.
DELTAGARD GC 0.1% GRANULAR	2-3 lb./1000 sq.ft. or 87-131 lb./A	DeltaGard GC is a **RESTRICTED USE** insecticide. For use on golf courses and sod farms only. Irrigate as soon as possible after application.
DELTAGARD T&O 0.1% GRANULAR	2-3 lb./1000 sq.ft. or 87-131 lb./A	For sale, use, and storage by commercial applicators only. For outdoor use on lawns, grounds, and perimeter treatments. Irrigate after application.
DELTAGARD GC 5SC	0.6-0.9 fl.oz../1000 sq.ft. or 26-39 fl.oz./A	DeltaGard GC is a **RESTRICTED USE** insecticide. For use on golf courses, sod farms, commercial and residential turf.
DELTAGARD T&O 5SC	0.6-0.9 fl.oz../1000 sq.ft. or 26-39 fl.oz./A	For commercial use only. Lawns in landscaped areas, around residential, institutional, public, commercial and industrial buildings, parks, recreational areas, and athletic fields. Irrigate immediately after application.
dinotefuran ***See EPA Bee Advisory**		
ZYLAM 20 SG	2.7 lb./A or 1 oz./1000 sq.ft.	For use on outdoor residential, recreational, and commercial turfgrass. For suppression only. Make application prior to hatching of first instar nymphs. Irrigate after application.
halofenozide		
MACH 2 1.5 G	133 lb./A	Can be used on any turfgrass site. For control of immature stage only. Must be ingested to be effective. Water must transport material through the thach. May cause short-term discoloration of Tiftdwarf bemudagrass.
MACH 2 2SC	2.9 fl.oz./1000 sq.ft.	Can be used on commercial turfgrass sites such as commercial lawns, grounds or lawns around business or office complexes, cemetetries, golf courses, and sod farms. Controls immature stage only. Water must transport material through the thach. May cause Tiftdwarf bermuda discoloration.

*The EPA Bee Advisory can be found at the end of this publication.

Commercial Turf Insect Control (cont.)		
Insecticide and Formulation	Rate	Comments
CHINCH BUGS (cont.)		
imidacloprid ***See EPA Bee Advisory**		
MERIT 75 WSP	1.6 oz./8250 sq.ft.	For insect control in turfgrass including sod farms. For use on outdoor residential, recreational, and commercial turfgrass. For suppression of chinch bugs apply prior to hatching of first instar nymphs.
MERIT 75 WP	8.6 oz./A	For insect control in turfgrass including sod farms. For suppression of chinch bugs apply prior to hatching of first instar nymphs
MERIT 0.5 G	80 lb./A or 1.8 lb./1000 sq.ft.	For systemic insect control in turfgrass (home lawns, golf courses, cemeteries, parks, playgrounds, and athletic fields. **NOT** for use on sod farms. For suppression of chinch bugs apply prior to hatching of first instar nymphs
MERIT 2F	1.6 pt./A	For insect control in turfgrass including sod farms. For suppression of chinch bugs apply prior to hatching of first instar nymphs
imidacloprid + bifenthrin ***See EPA Bee Advisory**		
ALLECTUS G	75-125 lb./A or 1.7-2.9 lb./1000 sq.ft.	For use in turfgrass including athletic fields, parks and residential, commercial, industrial and recreational lawns. Not for use on golf courses or sod farms. Irrigate before application.
ALLECTUS SC	3.6-4.5 pt/A or 1.32-1.65 fl.oz./1000 sq.ft.	For use in turfgrass on home lawns, business and office complexes, shopping complexes, multi-family residential complexes, airports, cemeteries, parks, playgrounds and athletic fields. Not for use on golf courses or sod farms. Irrigate before application.
ALLECTUS GC GRANULAR	75-125 lb./A or 1.7-2.9 lb./1000 sq.ft.	Allectus GC Granular is a **RESTRICTED USE** insecticide. For use on turfgrass areas of golf courses and sod farms. Irrigate prior to application.
ALLECTUS GC SC	2.3-4.5 pt./A	Allectus GC SC is a **RESTRICTED USE** insecticide. For use in turfgrass on golf courses and sod farms. Make applications when chinchbugs are first observed. Irrigate before application.
lambda-cyhalothrin		Use on landscape turf only. Apply using 2 to 10 gallons of spray per 1,000 square feet. Water in following application 0.25 to 0.5 inch.
SCIMITAR CS	0.47 fl.oz. (14 ml)/ 1000 sq.ft. or 20 oz./A	
SCIMITAR GC	20 oz./A	Scimitar GC is a **RESTRICTED USE** insecticide. Irrigate after application.
thiamethoxam ***See EPA Bee Advisory**		For use on turfgrasses on golf courses, residential lawns and commercial grounds (includes sod farms, playgrounds, and athletic fields). Irrigate after application.
MERIDIAN 0.33G	7-9 lb./5000 sq.ft. or 60-80 lb./A	
MERIDIAN 25WG	12.7-17 oz./A	For use on turfgrasses on golf courses, residential lawns and commercial grounds. Apply when young nymphs first appear.
trichlorfon		For use on landscape and recreational turf and golf courses and residential turf.
DYLOX 420 SL	4.6-6.9 fl.oz./1000 sq.ft. or 200-300 fl.oz./A	
DYLOX 80 T&O	3.75 oz./1000 sq.ft.	For use on landscape and recreational lawns and turf.

*The EPA Bee Advisory can be found at the end of this publication.

Commercial Turf Insect Control (cont.)		
Insecticide and Formulation	Rate	Comments
FIRE ANTS		
Baits		
fenoxycarb		
AWARD BAIT	1-3 T./mound 1-1.5 lb./A	
hydromethylnon		
AMDRO BAIT	5 T./mound 1-1.5 lb./A	
MAXFORCE FIRE ANT KILLER GRANULAR BAIT	2-4 oz./5000 sq.ft. 1-2 lb./A	
MAXFORCE FINE GRANULAR BAIT	2 T./mound 1 oz./1800 sq.ft.	
AMDRO PRO FIRE ANT BAIT	2-5 T./mound 1-1.5 lb./A	
hydromethylnon + s-methoprene		
EXTINGUISH PLUS	2-5 T./mound	
AMDRO BAIT	1.5 lb./A	
indoxacarb		Avoid applying all baits just before or after irrigation or rain. The most effective method for control of ants over a broad area is the use of a broadcast bait two times per year (spring and fall) coupled with individual mound treatments as needed. Do not disturb mound.
ADVION FIRE ANT BAIT	4 T./mound 1.5 lb./A	
s-methoprene	3-5 T./mound	
EXTINGUISH BAIT	1-1.5 lb./A	
Mound Drench Treatments		
acephate		Drench mounds when queen and brood are located close to soil surface on warm, dry days. Generally it takes 1 to 2 gallons of water to drench a fire ant mound effectively
ORTHENE TTO 75WP	1 oz./5 gal. water	
ORTHENE TTO 97	0.75 oz./5 gal. water	
bifenthrin		
TALSTAR GC GRANULAR	0.5 cup/mound	Drench treated mound with 1 to 2 gallons of water.
TALSTAR EZ GRANULAR	0.5 cup/mound	Drench treated mound with 1 to 2 gallons of water.
TALSTAR P PROFESSIONAL	1 oz./gal. water	
TALSTAR PL GRANULAR	0.5 cup/mound	Drench treated mound with 1 to 2 gallons of water.
bifenthrin + zeta-cypermethrin		
TALSTAR XTRA GRANULAR	0.5 cup/mound	Drench treated mound with 1 to 2 gallons of water.
carbaryl		
SEVIN SL	0.75 fl.oz./gal. water	
deltamethrin		
DELTAGARD GC 5SC	1.5 fl.oz./gal. water	DeltaGard GC 5SC is a **RESTRICTED USE** insecticide.
imidacloprid + bifenthrin ***See EPA Bee Advisory**		
ALLECTUS GC SC	0.66 fl.oz./gal. water	Allectus GC SC is a **RESTRICTED USE** insecticide. Use on golf courses and sod farms only.
lambda-cyhalothrin		
SCIMITAR CS	0.5 fl.oz./2.5 gal. water	Use on landscape turf only.
SCIMITAR GC	0.5 fl.oz./2.5 gal. water	Scimitar GC is a **RESTRICTED USE** insecticide.
permethrin		Astro is a **RESTRICTED USE** insecticide. Use on landscape turf only. Apply 1 to 2 gallons of emulsion to each mound.
ASTRO	0.5 % emulsion	
spinosad		
CONSERVE	0.1 fl.oz./gal. water	
thiamethoxam ***See EPA Bee Advisory**		
MERIDIAN 25WG	0.1-0.3 oz./gal. water	Use 2 to 3 gallons of solution per mound.

*The EPA Bee Advisory can be found at the end of this publication.

Commercial Turf Insect Control (cont.)		
Insecticide and Formulation	Rate	Comments
FIRE ANTS (cont.)		
Dry Mound Treatments		
cyfluthrin		
BAYER FIRE ANT KILLER	1 t./mound	
deltamethrin		
BENGAL ULTRA DUST FIRE ANT KILLER 0.05%	1 T/mound	
TERRO FIRE ANT KILLER (0.05%)	1 T/mound	
DELTAGARD GC	2 T/mound	Deltagard GC is a **RESTRICTED USE** insecticide. Immediately after applying granules, sprinkle mound gently with at least 1 gallon of water.
DELTAGARD G	2 T/mound	Immediately after applying granules, sprinkle mound gently with at least 1 gallon of water.
DELTAGARD T&O GRANULAR	2 T/mound.	Immediately after applying granules, sprinkle mound gently with at least 1 gallon of water.
DELTAGARD T&O 5SC	1.5 fl.oz./gallon	Gently sprinkle mound with diluted insecticide
DELTA DUST		Apply dust in shaker can and thoroughly cover mound.
imidacloprid + bifenthrin ***See EPA Bee Advisory**		
ALLECTUS GC	0.5 cup/mound	Allectus GC is a **RESTRICTED USE** insecticide. Use on golf courses and sod farms only. Apply product; then treat mound with 1 to 2 gallons of water.
ALLECTUS G	0.5 cup/mound	Apply product; then treat mound with 1 to 2 gallons of water.
Broadcast Treatments		
bifenthrin		Brigade is a **RESTRICTED USE** insecticide. Use on sod farms only.
BRIGADE 2EC	7-14 fl.oz./A	
TALSTAR EZ GRANULAR	2.3-4.6 lb./1000 sq.ft.	If soil is not moist, irrigate before application.
TALSTAR GC GRANULAR	2.3-4.6 lb./1000 sq.ft.	Talstar GC is a **RESTRICTED USE** insecticide. If soil is not moist, irrigate before application. Can be used on golf courses and sod farms.
TALSTAR P PROFESSIONAL	0.5-1.0 fl.oz./1000 sq.ft.	If soil is not moist, irrigate before application. Not for use on golf courses or sod farms.
TALSTAR PL GRANULAR	2.3-4.6 lb./1000 sq.ft.	If soil is not moist, irrigate before application. Not for use on golf courses or sod farms.
carbaryl		
SEVIN SL	3 fl.oz./1000 sq.ft.	
cyfluthrin		Use on landscape and recreational turf only.
TEMPO SC ULTRA	8 ml/1000 sq.ft.	
TEMPO ULTRA WP	15.4 oz./A	Use on residential and commercial lawns only.
TEMPO WP GC	55 g/7,800 sq.ft.	Tempo GC is a **RESTRICTED USE** insecticide. Use on golf courses, residential lawns, cemeteries, parks, playgrounds, and athletic fields.
deltamethrin		
DELTAGARD GC 5SC	1.5 fl.oz./gal.	DeltaGard GC 5SC is a **RESTRICTED USE** insecticide.
DELTAGARD T&O 5SC	1.5 fl.oz./gal.	Use on landscape turf only.
DELTAGARD G	2-3 lb./1000 sq.ft.	Use on landscape turf only.
DELTAGARD GC	2-3 lb./1000 sq.ft.	DeltaGard GC is a **RESTRICTED USE** insecticide. Use on golf courses, sod farms, and perimeter areas.
DELTAGARD T&O GRANULAR	2-3 lb./1000 sq.ft.	Use on lawns, grounds, and perimeter areas
fipronil		For use on golf courses, sod farms, sports fields, and other locations.
CHIPCO CHOICE	4.6 oz./1000 sq.ft.	
TOP CHOICE	2 lb./1000 sq.ft.	For use on golf courses, sod farms, sports fields, and other locations. Irrigate after application.

*The EPA Bee Advisory can be found at the end of this publication.

Commercial Turf Insect Control (cont.)		
Insecticide and Formulation	Rate	Comments
FIRE ANTS (cont.)		
Broadcast Treatments (cont.)		
imidacloprid + bifenthrin ***See EPA Bee Advisory**		
ALLECTUS GC SC	1.32-1.65 fl.oz./1000 sq.ft.	Allectus GC is a **RESTRICTED USE** insecticide. For use on golf courses and sod farms.
ALLECTUS SC	1.32-1.65 fl.oz./1000 sq.ft.	Use on landscape turf, athletic fields, and parks.
ALLECTUS GC	2.9 lb./1000 sq.ft.	Allectus GC is a **RESTRICTED USE** insecticide.
ALLECTUS G	up to 5.7 lb./1000 sq.ft.	Use on landscape turf, athletic fields, and parks. Not for use on golf courses or sod farms. For heavy fire ant infestations, use up to 5.7 pounds per 1,000 square feet in non-residential areas only.
lambda-cyhalothrin		Use on landscape turf, athletic fields, and parks.
SCIMITAR CS	3.4-7 ml/1000 sq.ft. or 5-10 fl.oz./A	
SCIMITAR GC	3.4-7 ml/1000 sq.ft. or 5-10 fl.oz/A	Scimitar GC is a **RESTRICTED USE** insecticide. Use on golf courses, sod farms, and other locations.
MOLE CRICKETS		
acephate		For use on golf courses and sod farms only.
ORTHENE TTO 97	3.9 lb./A (golf course) 2.5-3 lb./A (sod farm)	
ORTHENE TTO WSP	2.66-5.33 lb./A (golf course) 3.33-4 lb./A (sod farm)	For use on golf courses and sod farms only.
bifenthrin		Brigade is a **RESTRICTED USE** insecticide. If soil is dry, irrigate before application. Also irrigate after application. Use only on sod farms.
BRIGADE 2EC	0.16-0.32 fl.oz./1000 sq.ft. or 7-14 fl.oz./A	
TALSTAR GC GRANULAR	2.3-4.6 lb./1000 sq.ft.	Talstar GC is a **RESTRICTED USE** insecticide. Irrigate before and after application. Apply during peak egg hatch. Use on golf courses, sod farms, and recreational areas.
TALSTAR EZ GRANULAR	2.3-4.6 lb./1000 sq.ft.	Irrigate before and after application. Apply during peak egg hatch. Do not apply more than 2.3 pounds per 1,000 square feet per application to residential lawns. Not for use on golf courses and sod farms.
TALSTAR P PROFESSIONAL	0.5-1.0 fl.oz./1000 sq.ft.	Irrigate before and after application. Not for use on golf courses or sod farms.
TALSTAR PL GRANULAR	2.3-4.6 lb./1000 sq.ft.	Irrigate before and after application. Do not apply more than 2.3 pounds per 1,000 square feet per application to residential lawns. Not for use on golf courses or sod farms.
TALSTAR XTRA GRANULAR	100 lb./A (residential) 200 lb./A (non-residential)	Treat site immediately before peak egg hatch. Irrigate before and after application.
carbaryl		This is a bait. Do not water following teatment. Baits are used primarily for control of large nymphs and adults.
MOLE CRICKET BAIT	0.75-0.9 lb./1000 sq.ft.	
clothianidin ***See EPA Bee Advisory**		Irrigate after application. Apply during peak egg hatch. For suppression
ARENA 50WDG	12.8 oz./A	
ARENA 0.25G	160 lb./A	

*The EPA Bee Advisory can be found at the end of this publication.

Commercial Turf Insect Control (cont.)		
Insecticide and Formulation	Rate	Comments
MOLE CRICKETS (cont.)		
cyfluthrin		
TEMPO 20 WP GC	55 g/7800 sq.ft.	Tempo 20 WP GC is a **RESTRICTED USE** insecticide. For use on residential and commercial sites, including golf courses.
TEMPO 20 WP POWER PAK	50 g/7500 sq.ft.	For commercial use only. For use on residential and commercial lawns. Not for use on golf courses.
TEMPO 20 WP 420 GRAM JAR	10 g/1000 sq.ft.	For pest managment professionals and commercial use only. For use on residential and commercial lawns. Not for use on golf courses.
TEMPO SC ULTRA	8 ml/1000 sq.ft. or 12 fl.oz./A	For pest managment professionals and commercial use only. For use on landscape and recreational turfgrass. Not for use on golf courses.
TEMPO ULTRA GC	8 ml/1000 sq.ft. or 12 fl.oz./A	Tempo Ultra GC is a **RESTRICTED USE** insecticide. For use on residential and commercial sites, including golf courses. Apply at peak egg hatch.
TEMPO ULTRA WP	10 g/1000 sq.ft. or 15.4 oz./A	For pest managment professionals and commercial use only. For use on residential and commercial lawns. Not for use on golf courses or sod farms.
TEMPO ULTRA WSP	50 g/5000 sq.ft.	For pest managment professionals and commercial use only. For use on residential and commercial lawns only. Not for use on golf courses or sod farms.
deltamethrin		
DELTAGARD GC 0.1% GRANULAR	2-3 lb./1000 sq.ft.	DeltaGard GC products are **RESTRICTED USE** insecticides. For use on golf courses and sod farms only. Irrigate as soon as possible after application with 0.25 to 0.5 inch of water.
DELTAGARD G 0.1% GRANULAR	2-3 lb./1000 sq.ft.	For sale, use, and storage by commercial applicators only. For outdoor use on lawns, grounds, and perimeter treatments. After application, irrigate as soon as possible with 0.25 to 0.5 inch of water. Do not apply more than once per week.
DELTAGARD TT&O 0.1% GRANULAR	2-3 lb./1000 sq.ft. or 87-131 lb./A	For sale, use, and storage by commercial applicators only. For outdoor use on lawns, grounds, and perimeter treatments. After application, irrigate as soon as possible with 0.25 to 0.5 inch of water.
DELTAGARD GC 5SC	0.6-0.9 fl.oz./1000 sq.ft. or 26 to 39 fl.oz./A	DeltaGard GC products are **RESTRICTED USE** insecticides. For use on golf courses, sod farms, and commercial and residential turf.
DELTAGARD TT&O 5SC	0.6-0.9 fl.oz./1000 sq.ft. or 26 to 39 fl.oz./A	For commercial use only on lawns in landscaped areas; around residential, institutional, public, commercial, and industrial buildings; and in parks, recreational areas, and athletic fields. Irrigate immediately after application.
dinotefuran ***See EPA Bee Advisory**		
ZYLAM 20SG	1 oz./1000 sq.ft.	Apply prior to or during the peak egg hatch period. When adults or large nymphs are present and actively tunneling, tank mix with a curative insecticide.
fipronil		
CHIPCO CHOICE	4.6-9.4 oz./1000 sq.ft. or 12.5-25 lb./A	Apply using slit-placement application equipment. For use on golf courses, sod farms, sports fields, and other locations.

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Commercial Turf Insect Control (cont.)		
Insecticide and Formulation	Rate	Comments
MOLE CRICKETS (cont.)		
imidacloprid ***See EPA Bee Advisory**		
MERIT 75 WSP	1.6 oz./8250 sq.ft.	For insect control in turfgrass, including sod farms. Apply during peak egg hatch. Irrigate witin 24 hours after application.
MERIT 75 WP	8.6 oz./A.	For insect control in turfgrass, including sod farms. Apply prior to peak egg hatch. Irrigate witin 24 hours after application.
MERIT 2F	1.6 pt./A. or 0.6 fl.oz./1000 sq.ft.	For insect control in turfgrass including sod farms. Apply prior to or during peak egg hatch. Irrigate witin 24 hours after application.
MERIT 0.5G	80 lb./A.	For systemic insect control in turfgrass, including home lawns, golf courses, cemeteries, parks, playgrounds, and athletic fields. **NOT** for use on sod farms. Apply prior to egg hatch. Irrigation or rain fall needed after application.
imidacloprid + bifenthrin ***See EPA Bee Advisory**		
ALLECTUS G	2.9 lb./1000 sq.ft. or up to 250 lb./A	For use in turfgrass, including athletic fields, parks, and residential, commerical, industrial, and recreational lawns. Not for use on golf courses or sod farms. Irrigate prior to application if soil is dry and after application. Use higher rate for heavy infestation in non-residential turf.
ALLECTUS GC GRANULAR	2.9 lb./1000 sq.ft. or up to 250 lb./A	Allectus GC is a **RESTRICTED USE** insecticide. For use on golf courses and sod farms. Irrigate if it does not rain within 24 hours of application. Use higher rate for heavy infestation in non-residential turf.
ALLECTUS SC	1.32-1.65 fl.oz./1000 sq.ft.	For use in turgrass on home lawns, business and office complexes, shopping complexes, multi-family residentail complexes, airports, cemeteries, parks, playgrounds, and athletic fields. Not for use on golf courses or sod farms. Irrigation or rainfall should occur within 24 hours after application.
ALLECTUS GC SC	1.32-1.65 fl.oz./1000 sq.ft.	Allectus GCis a **RESTRICTED USE** insecticide. For use in turfgrass on golf courses and sod farms. Irrigate after application.
indoxacarb		
ADVION INSECT GRANULE	1.15-4.6 lb./1000 sq.ft.	A granular insecticide baIt for use on lawns in residential, commercial, public and institutional landscaped areas, golf courses, parks, recreational areas, and sports and/or athletic fields. For best results apply in late afternoon. If soil is not moist, irrigate before application to bring mole crickets to soil surface.
PROVAUNT	0.275 oz./1000 sq.ft. or 12 oz./A	For use on landscape and recreational turfgrass, including golf courses. Not for use on sod farms.
lambda-cyhalothrin		
SCIMITAR CS	7 ml/1000 sq.ft. (nymphs and young adults)	For use by individuals registered by the state to apply pesticide products. Use on lawns in landscaped areas around residential, institutional, public, commercial and industrial buildings, parks, recreational areas, and athletic fields. Apply in 4 to 10 gallons of water per 1,000 square feet. Use a non-ionic wetting agent. Water immediately after application.
SCIMITAR GC	7 ml/1000 sq.ft. (nymphs and young adults)	Scimitar GC is a **RESTRICTED USE** insecticide. For use on same sites as Scimitar CS plus golf courses and sod farms. Apply in 4 to 10 gallons of water per 1,000 square feet. Use a wetting agent. Apply to turf wet with dew or rain or that has been irrigated. Water immediately after application with up to 0.5 inch of water.
permethrin		
ASTRO	1.6 fl.oz./2000 sq.ft.	For use by individals licensed by the state to apply insecticide products. For insect control on lawns, around residential, institutional, public, commercial and industrial buildings, parks, recreational areas, and athletic fields. Apply in a minimum of 8 gallons of water per 2,000 square feet.

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Commercial Turf Insect Control (cont.)		
Insecticide and Formulation	Rate	Comments
MOLE CRICKETS (cont.)		
thiamethoxam ***See EPA Bee Advisory**		For use on turfgrass on golf courses, residential lawns, and commercial grounds, including sod farms, playgrounds, and athletic fields. Provides suppression of mole crickets.
MERIDIAN 0.33G	7-9 lb./5000 sq.ft. or 60-80 lb./A	
MERIDIAN 25WG	12.7-17 oz./A	For use on turfgrass on golf courses, residential lawns, and commercial grounds. Provides suppression of mole crickets.
trichlorfon		For use on landscape and recreational turf and golf courses and residential turf. Irrigate after applicaiton to moisten the top 1 inch of soil
DYLOX 420 SL	6.9 fl.oz./1000 sq.ft.	
DYLOX 6.2 GRANULAR	3 lb./1000 sq.ft.	For commerical use only. Can be used on golf courses, Irrigate after application.
DYLOX 80 T&O	3.75 oz./1000 sq.ft.	For use on landscape and recreational lawns and turf. Irrigate after application
SPITTLEBUG		
acephate		For use on golf courses and sod farms only.
ORTHENE TTO 75 WSP	2.66-5.33 lb./A (golf course) 3.33-4 lb./A (sod farms)	
ORTHENE TTO 97 WSP	2-3.9 lb./A (golf course) 2.5-3 lb./A (sod farms)	For use on golf courses and sod farms only.
bifenthrin		For use on lawns, recreational areas, athletic fields.
ONYX	0.07-0.15 fl.oz./1000 sq.ft.	
carbaryl		For agricultural or commercial use only. For use on turfgrass on golf courses, sports fields, domestic and commercial lawns, cemeteries, parks, campsites, and recreational areas. Do not allow public use of treated areas during applications or until sprays have dried. Irrigate prior to application. Do not irrigate within 24 hours following application.
SEVIN SL	2-4 qt./A	
SEVIN 80 WSP	2.5-5 lb./A	Do not irrigate within 24 hours of application.
deltamethrin		For sale to, use, and storage by commercial applicators only. For turfgrass on lawns, grounds and perimeter treatments. Not for use on golf courses or sod farms.
DELTAGARD 0.1% G	2-3 lb./1000 sq.ft. or 87-131 lb./A	
DELTAGARD GC 0.1% GRANULAR	2-3 lb./1000 sq.ft. or 87-131 lb./A	DeltaGard GC is a **RESTRICTED USE** insecticide. For use on golf courses and sod farms only. Irrigate as soon as possible after application
DELTAGARD T&O 0.1% GRANULAR	2-3 lb./1000 sq.ft. or 87-131 lb./A	For sale, use, and storage by commercial applicators only. For outdoor use on lawns, grounds and perimeter treatments. Irrigate after application.
TURF CATERPILLARS		
acephate		For use on golf courses and sod farms only. Use a minimum of 5 gallons of water per 1000 square feet.
ORTHENE TTO 75 WP	1.33-3.33 lb./A	
ORTHENE TTO 97	1-2.5 lb./A	For use on golf courses and sod farms only. Use a minimum of 5 gallons of water per 1000 square feet.

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Commercial Turf Insect Control (cont.)		
Insecticide and Formulation	Rate	Comments
TURF CATERPILLARS (cont.)		
bifenthrin		
BRIGADE 2EC	2.2-3.5 fl.oz./A	Brigade is a **RESTRICTED USE** insecticide. Use on sod farms only. Delay watering or mowing for 24 hours after application.
TALSTAR EZ 0.2% GRANULAR	50 lb./A	For use on lawns in landscaped areas and perimeters around residential, institutional, public, commercial and industrial buildings, parks, recreational areas, athletic fields, golf courses, and sod farms. Irrigate with up to 0.1 inch of water after application.
TALSTAR GC 0.2% GRANULAR	50 lb./A	For use on lawns in landscaped areas and perimeters around residential, institutional, public, commercial and industrial buildings, parks, recreational areas, and athletic fields. Irrigate with up to 0.1 inch of water after application.
TALSTAR 7.9% P	0.18-0.25 fl.oz./1000 sq.ft.	For use on lawns. Delay watering or mowing for 24 hours after application.
TALSTAR PL 0.2% GRANULAR	50 lb./A	For use on lawns in landscaped areas and perimeters around residential, institutional, public, commercial and industrial buildings, parks, recreational areas, athletic fields. Not for use on golf courses and sod farms. Irrigate with up to 0.1 inch of water after application.
bifenthrin + zeta-cypermethrin		
TALSTAR XTRA 0.20% + 0.05% GRANULAR	50-100 lb./A	For use on lawns and landscaped areas around residential, institutional, public, commercial and industrial buildings, parks, recreational areas, and athletic fields. Irrigate with water after application.
carbaryl		
SEVIN SL	2-4 qt./A (armyworms, cutworms) 6-8 qt./A (sod webworms)	For agricultural or commercial use only. For use on turfgrass on golf courses, sports fields, domestic and commercial lawns, cemeteries, parks, campsites, and recreational areas. Do not allow public use of treated areas during applications or until sprays have dried. Irrigate prior to application. Do not irrigate within 24 hours following application.
SEVIN 80 WSP	2.5-5 lb./A	Do not irrigate following insecticide application. Use 7.5 pounds of Sevin 80 WSP per acre for sod webworm control.
chlorantraniliprole		
ACELEPRYN	2-4 fl.oz./A	Use on landscape and recreational turfgrass, golf courses and sod farms. Delay watering or mowing for 24 hours after application.
ACELEPRYN GRANULAR	50-100 lb./A	Use on landscape and recreational turfgrass, golf courses and sod farms. Delay watering or mowing for 24 hours after application.
chlorpyrifos		
DURSBAN 50	2 lb./A	Apply to turfgrass grown for sod or seed. For sod webworms delay watering or mowing for 12 to 24 hours after application.
cyfluthrin	55 grams/7,800 sq.ft.	Tempo 20 GC is a **RESTRICTED USE** insecticide. For turf on residential and commercial sites, including golf courses, home lawns, business and office complexes, and multi-family residential complexes, airports, cemeteries, parks, playgrounds, athletic fields, and other sites. Delay watering for 24 hours after application.
TEMPO 20 WP GC		
TEMPO 20 WP POWERPAK	50 grams/ 7,500-10,000 sq.ft.	For commercial use only. For residential and commercial lawns. Not for use on golf courses.
TEMPO SC ULTRA	8 ml/1000 sq.ft. or 6-12 fl.oz./A	For pest management professionals and commercial use only. For landscape and residential turf. Not for use on golf courses.

Commercial Turf Insect Control (cont.)		
Insecticide and Formulation	Rate	Comments
TURF CATERPILLARS (cont.)		
cyfluthrin (cont.)		
TEMPO ULTRA GC	4-8 ml/1000 sq.ft. or 6-12 fl.oz./A	Tempo Ultra GC is a **RESTRICTED USE** insecticide. For use on turf on residential and commercial sites including golf courses. Do not water or mow for 24 hours after application.
TEMPO ULTRA WP	5-10 g/1000 sq.ft. or 7.7-15.4 oz./A	For pest management professionals and commercial use only. For turf on residential and commercial lawns only. Not for use on golf courses or sod farms. Do not water or mow for 24 hours after application.
TEMPO ULTRA WSP	50 g/5000-10,000 sq.ft.	For pest management professionals and commercial use only. For turf on residential and commercial lawns only. Not for use on golf courses or sod farms. Do not water or mow for at least 24 hours after application.
TEMPO 20 WP 420 GRAM JAR	5-10 g/1000 sq.ft. or 15.4 oz./A	For pest management professionals and commercial use only. For residential and commercial lawns. Not for use on golf courses. Do not water or mow for 24 hours after application.
deltamethrin		
DELTAGARD 0.1% G	2-3 lb./1000 sq.ft. or 87-131 lb./A	For sale to, use, and storage by commercial applicators only. For turfgrass on lawns, grounds, and perimeter treatments. Not for use on golf courses or sod farms. Irrigate after application.
DELTAGARD GC 0.1% GRANULAR	2-3 lb./1000 sq.ft. or 87-131 lb./A	DeltaGard GC is a **RESTRICTED USE** insecticide. For use on golf courses and sod farms only. Irrigate as soon as possible after application.
DELTAGARD T&O 0.1% GRANULAR	2-3 lb./1000 sq.ft. or 87-131 lb./A	For sale, use, and storage by commercial applicators only. For outdoor use on lawns, grounds and perimeter treatments. Irrigate after application.
DELTAGARD GC 5SC	0.4-0.6 fl.oz./1000 sq.ft. or 8.75-17.5 fl.oz./A	DeltaGard GC is a **RESTRICTED USE** insecticide. For use on golf courses, sod farms, commercial and residential turf.
DELTAGARD T&O 5SC	0.2-0.4 fl.oz./1000 sq.ft. or 8.75-17.5 fl.oz./A	For commercial use only. Lawns in landscaped areas, around residential, institutional, public, commercial and industrial buildings, parks, recreational areas, and athletic fields. Irrigate immediately after application.
diflubenzuron		
DIMILIN 2L	2 oz. /A	Dimilin is a **RESTRICTED USE** insecticide. Use on sod farms only. Apply before larvae become a half inch long in 20 to 50 gallons of water per acre.
halofenozide		
MACH 2 1.5G	67 lb./A	Can be used on any turfgrass site. For control of immature stage only. Must be ingested to be effective. Water must transport material through the thach. May cause short-term discoloration of Tiftdwarf bemudagrass.
MACH 2 2SC	1.5 fl.oz./1000 sq.ft. or 2 qt./A	Can be used on commercial turfgrass sites such as commercial lawns, grounds, or lawns around business or office complexes, cemeteries, golf courses, and sod farms. Controls immature stage only. Water must transport material through the thach. May cause Tiftdwarf bermuda discoloration.

Commercial Turf Insect Control (cont.)		
Insecticide and Formulation	Rate	Comments
TURF CATERPILLARS (cont.)		
imidacloprid + bifenthrin ***See EPA Bee Advisory**		
ALLECTUS G	50-125 lb./A or 1.2-2.9 lb./1000 sq.ft.	For use in turfgrass including athletic fields, parks, and residential, commercial, industrial, and recreational lawns. Not for use on golf courses or sod farms. Irrigate after application
ALLECTUS GC GRANULAR	50-125 lb./A or 1.2-2.9 lb./1000 sq.ft.	Allectus GC is a **RESTRICTED USE** insecticide. For use on turfgrass areas of golf courses and sod farms. Irrigate after application
ALLECTUS SC	1.1-4.5 pt./A or 0.4-1.65 fl.oz./1000 sq.ft.	For use in turfgrass on home lawns, business and office complexes, shopping complexes, multi-family residential complexes, airports, cemeteries, parks, playgrounds, and athletic fields. Not for use on golf courses or sod farms. Delay watering or mowing for 24 hours after application..
ALLECTUS GC SC	1.8-4.5 pt./A or 0.67-1.65 fl.oz./1000 sq.ft.	Allectus GCis a **RESTRICTED USE** insecticide. For use in turfgrass on golf courses and sod farms. Irrigate after application. Make applications when billbugs are first observed. Irrigate before application. Delay watering or mowing for 24 hours after application
indoxacarb		For use on landscape and recreational turfgrass, including golf courses. Delay mowing and irrigation for 24 hours after application. If applied to turf maintained at greater than 1 inch, use 4 ounces per acre application rate.
PROVAUNT	2-4 oz./A or 0.046-0.092 oz./ 1000 sq.ft.	
lambda-cyhalothrin		For use on lawns in landscaped areas around residential, institutional, public, commercial, and industrial buildings, parks, recreational areas, and athletic fields. Apply in 2 to 5 gallons of water per 1,000 square feet. Delay watering or mowing for 24 hours after application. Not for use on golf courses or sod farms
SCIMITAR CS	3.4-7 ml/1000 sq.ft. or 5-10 fl.oz./A	
SCIMITAR GC	3.4-7 ml/1000 sq.ft. or 5-10 fl.oz./A	Scimitar GC is a **RESTRICTED USE** insecticide. Use on same sites as Scimilar CS plus golf courses and sod farms. Apply in 2 to 5 gallons of water per 1,000 square feet. Delay watering or mowing for 24 hours after application
spinosad		For use on turfgrass. Lower rates effective against small fall armyworms and sod webworms, but higher rate is required against cutworms. Delay watering or mowing for 24 hours after application.
CONSERVE SC	0.25-0.8 fl.oz./1000 sq.ft. or 10-35 fl.oz./A	
trichlorfon		
DYLOX 80 T&O	2.5-3.75 oz./1000 sq.ft. or 6.8-10.2 lb./A	For caterpillars, do not irrigate following application.
DYLOX 420 SL	4.6-6.9 fl.oz./1000 sq.ft. or 200-300 fl.oz./A	For use on landscape and recreational turf and golf courses and residential turf.
WHITE GRUBS		
carbaryl		For agricultural or commercial use only. For use on turfgrass on golf courses, sports fields, domestic and commercial lawns, cemeteries, parks, campsites, and recreational areas. Do not allow public use of treated areas during applications or until sprays have dried. Irrigate prior to application. Do not irrigate within 24 hours following application.
SEVIN SL	8 qt./A or 6 fl.oz./1000 sq.ft.	
SEVIN 80 WSP	10 lb./A	Irrigate turfgrass soon after treatment.
chlorantraniliprole		Use on landscape and recreational turfgrass, golf courses, and sod farms. Irrigate immediately after treatment.
ACELEPRYN	8-16 fl.oz./A or 0.184-0.367 fl.oz./1000 sq.ft.	
ACELEPRYN GRANULAR	50-100 lb./A or 1.15-2.3 lb./1000 sq.ft.	Use on landscape and recreational turfgrass, golf courses, and sod farms. Irrigate immediately after treatment.

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Commercial Turf Insect Control (cont.)		
Insecticide and Formulation	Rate	Comments
WHITE GRUBS (cont.)		
clothianidin ***See EPA Bee Advisory**		
ARENA 50 WDG	12.8 oz./A	For use on grass grown in industrial, commercial, and residential landscapes including athletic fields, cemeteries, sod farms, golf courses, home lawns, parks, and playgrounds. Irrigate after application. Suppression only.
ARENA 0.25 G	160 lb./A	For use on grass grown in industrial, commercial, and residential landscapes including athletic fields, cemeteries, sod farms, golf courses, home lawns, parks, and playgrounds. Irrigate after application.
dinotefuran		
ZYLAM 20SG	2.7 lb./A or 1 oz./1000 sq.ft.	For use on outdoor residential, recreational, and commercial turfgrass For optimum control make application prior to or during egg hatch. Irrigate within 24 hours after application.
halofenozide		
MACH 2 1.5G	133 lb./A	Can be used on any turfgrass site. For control of immature stage only. Must be ingested to be effective. Water must transport material through the thach. May cause short-term discoloration of Tiftdwarf bemudagrass.
MACH 2 2SC	2.9 fl.oz./1000 sq.ft.	Can be used on commercial turfgrass sites such as commercial lawns, grounds or lawns around business or office complexes, cemetetries, golf courses, and sod farms. Controls immature stage only. Water must transport material through the thach. May cause Tiftdwarf bermuda discoloration.
imidacloprid ***See EPA Bee Advisory**		
MERIT 75 WSP	1.6 oz./8250 sq.ft.	For insect control in turfgrass including sod farms. For use on outdoor residential, recreational, and commercial turfgrass. Make application prior to or during the peak egg hatch period. Irrigate within 24 hours after application.
MERIT 75 WP	8.6 oz./A.	For insect control in turfgrass including sod farms. Make application prior to or during the peak egg hatch period. Irrigate within 24 hours after application.
MERIT 2F	1.6 pt./A. or 0.6 fl.oz./1000 sq.ft.	For insect control in turfgrass including sod farms. Make application prior to or during the peak egg hatch period. Irrigate within 24 hours after application.
MERIT 0.5G	80 lb./A. or 1.8 lb./1000 sq.ft.	For systemic insect control in turfgrass (home lawns, golf courses, cemeteries, parks, playgrounds, and athletic fields. **NOT** for use on sod farms. Make application prior to or during the peak egg hatch period. Irrigate within 24 hours after application.
imidacloprid + bifenthrin ***See EPA Bee Advisory**		
ALLECTUS G	100-125 lb./A or 2.3-2.9 lb./1000 sq.ft.	For use in turfgrass including athletic fields, parks and residential, commercial, industrial, and recreational lawns. Not for use on golf courses or sod farms. Apply prior to or during peak egg hatch. Irrigate after application. For heavily infested areas use a single seasonal application rate of 200 to 250 pounds per acre to non-residential turf.
ALLECTUS GC GRANULAR	100-125 lb./A or 2.3-2.9 lb./1000 sq.ft.	Allectus GC is a **RESTRICTED USE** insecticide. For use on turfgrass areas of golf courses and sod farms. Apply before egg hatch for optimum control. Irrigate after application.
ALLECTUS SC	3.6-4.5 pt./A or 1.32-1.65 fl.oz./1000 sq.ft.	For use in turfgrass on home lawns, business and office complexes, shopping complexes, multi-family residential complexes, airports, cemeteries, parks, playgrounds, and athletic fields. Not for use on golf courses or sod farms. Irrigate after application.
ALLECTUS GC SC	3.6-4.5 pt./A or 1.32-1.65 fl.oz./1000 sq.ft.	Allectus GC is a **RESTRICTED USE** insecticide. For use in turfgrass on golf courses and sod farms. Irrigate after application.

*The EPA Bee Advisory can be found at the end of this publication.

Commercial Turf Insect Control (cont.)		
Insecticide and Formulation	Rate	Comments
	WHITE GRUBS (cont.)	
thiamethoxam ***See EPA Bee Advisory**		
MERIDIAN 0.33G	7-9 lb./5000 sq.ft. or 60-80 lb./A	For use on turfgrasses on golf courses, residential lawns and commercial grounds (includes sod farms, playgrounds, and athletic fields). Make application from egg hatch to second instar. Irrigate after application.
MERIDIAN 25WG	12.7-17 oz./A	For use on turfgrasses on golf courses, residential lawns and commercial grounds. For optimum control treat from peak flight to peak egg hatch. Irrigate after application.
trichlorfon		
DYLOX 420 SL	6.9 oz./1000 sq.ft. or 300 fl.oz./A	For use on landscape and recreational turf and golf courses and residential turf. Irrigate after application and moisten the top inch of soil. Under dry conditions where thach is present, water also prior to application.
DYLOX 80 T&O	3.75 oz./1000 sq.ft. or 10.2 lb./A	Irrigate following application. For use on landscape and recreational turf including golf courses. Do not apply within 25 feet of surface waters.
DYLOX 6.2 G	3 lb./1000 sq.ft. or 130 lb./A	Can be used on golf courses. Do not apply within 25 feet of surface waters. Not for use on turf being grown for sale or other commercial use as sod. Irrigate following application.

EPA Bee Advisory: The EPA provided registrants of all outdoor foliar products containing clothianidin, dinotefuran, imidacloprid, or thiamethoxam with letters dated August 15, 2013, stating that the agency will require label changes that require addition of a "Pollinator Protection Box" and pollinator language that must be added to all of the labels of these neonicotinoid insecticides. At the time the recommendatons in the Alabama Pest Management Handbook were going to press, the exact wording for the pollinator protection statement had not been finalized. Also, no official word had been issued by the EPA stating whether or not neonicotinoid insecticides bottled before 2014 would be subject to the new bee advisory. Please check with the product manufacturer or your local Extension office or visit www.alabamacrops.com for updates on specific regulations intended to protect pollinators.

Commercial Turf and Lawns: Insect Control Recommendations prepared by Tim Reed, Extension Entomologist, Alabama Cooperative Extension System, Alabama A&M University and Auburn University; and David Held, Associate Professor, Department of Entomology and Plant Pathology, Auburn University.

FOR MORE INFORMATION on pesticides, pesticide safety, or submitting samples for analysis, see the following publications in the IPM series:
IPM 1293, "Safety." Safety contact information; worker protection standards; the safe use, handling, and storage of pesticides
IPM 1294, "Submitting Samples." Procedures for submitting samples for diagnosis, analysis, and identification
IPM 1295, "General Pesticide Information." Federal and state restricted use pesticide lists; pesticides and water quality
IPM 1317, "Appendix." Pesticide guidelines for agronomic crops, including preharvest intervals; rain-free requirements; grazing restrictions; crop rotation guidelines; and the names, classifications, and toxicities of pesticides.

ALABAMA A&M & AUBURN UNIVERSITIES

2014 IPM-1313

For more information, contact your county Extension office. Visit www.aces.edu/counties or look in your telephone directory under your county's name to find contact information.

Use pesticides **only** according to the directions on the label. Follow all directions, precautions, and restrictions that are listed. Do not use pesticides on plants that are not listed on the label

The pesticide rates in this publication are recommended **only** if they are registered with the Environmental Protection Agency or the Alabama Department of Agriculture and Industries. If a registration is changed or canceled, the rate listed here is no longer recommended. Before you apply **any** pesticide, check with your county Extension agent for the latest information.

Trade names are used **only** to give specific information. The Alabama Cooperative Extension System does not endorse or guarantee any product and does not recommend one product instead of another that might be similar.

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Extension
ALABAMA A&M & AUBURN UNIVERSITIES

IPM-1291

Commercial Turf and Lawns

IPM

Disease and Nematode Control Recommendations for 2014

Table 1. Commercial Turf and Lawns: Disease and Nematode Control

Fungicide and Formulation	Amount to Use per 1000 sq. ft. or as Specified	Comments[1]
ALGAE		
chlorothalonil		Apply at 7- to 14-day intervals in 2 to 10 gallons of water per 1000 square feet as needed. See label for additional instructions. **DO NOT** use on residential lawns.
DACONIL WEATHER STIK	2-0.36 fl.oz.	
DACONIL ULTREX	1.8-5 oz. (5-13.5 lb./A)	
LEGEND	2-3.6 fl.oz.	
chlorothalonil + acibenzolar S-methyl		Apply as needed at 7- to 14-day intervals in 1 gallon of water per 1,000 square feet of turf. See label for use guidelines for golf course greens, tees, and fairways.
DACONIL ACTION	2-3.5 fl.oz.	
chlorothalonil + azoxystrobin		For suppression of algae, apply at 14-day intervals as needed. When algae is well established, dry out affected area. Once dry, manage to enhance turfgrass recovery in conjunction with Renown treatments.
RENOWN	2.5-4 fl.oz.	
fludioxonil		For suppression of algae, apply on a 10- to 14-day schedule. When algae is well established, dry out affected area. Once dry, manage to enhance turfgrass recovery in conjunction with Medallion treatments. May tank mix with 3.2 ounces per 1,000 square feet of Daconil Ultrex to enhance algae suppression.
MEDALLION	0.5 oz.	
mancozeb		Apply as needed to affected areas. For professional use only.
DITHANE T/O RAINSHIELD	6 oz.	
4 FLOWABLE MANCOZEB	9.6 fl.oz.	
FORE 80W	6 oz.	
MANCOZEB DG	6 oz.	
PROTECT T/O	6 oz.	
triticonazole		For curative control add chlorothalonil or mancozeb to tank mixture. Repeat as needed at 14- to 28-day intervals.
TRINITY	0.5-1 fl.oz.	
TRITON 70WDG	0.15-0.6 oz	
ANTHRACNOSE		
azoxystrobin		Occurs in summer on bentgrass and poa greens and tees. Apply at 14- to 28-day intervals in 2 to 4 gallons of water per 1000 square feet when conditions favor disease. Use the higher rate at the shortest interval when disease is present. DO NOT apply more than six times or 3.7 ounces per year.
HERITAGE TL	1-2 fl.oz.	
HERITAGE G	2-4 oz.	
HERITAGE FUNGICIDE	0.2-0.4 oz.	
azoxystrobin + propiconazole		Use preventively. Apply when conditions favor disease and repeat applications at 14- to 28-day intervals as needed at a rate of 2 to 4 gallons of water per 1,000 square feet of turf. Use higher rate at shorter interval when disease pressure is high.
HEADWAY	1.5-3 fl.oz.	
HEADWAY G	2-4 lb.	Apply when conditions favor disease and repeat applications at 14- to 28-day intervals as needed. Alternate applications with Daconil. Use higher rate at shorter interval when disease pressure is high.

[1] Fungicide products are registered for use on residential lawns except as specified in comments.

Table 1. Commercial Turf and Lawns: Disease and Nematode Control (cont.)

Fungicide and Formulation	Amount to Use per 1000 sq. ft. or as Specified	Comments[1]
ANTHRACNOSE (cont.)		
chlorothalonil		**Bentgrass Tees, Greens, Fairways:** Apply to tees and greens at 7- to 10-day intervals in 2 to 10 gallons of water per 10000 square feet. Use 0.8 to 1 gallon water per 1000 square feet on fairways. Apply at shorter intervals and higher rate when disease appears.
DACONIL ULTREX	1.8-5 oz.	
DACONIL WEATHER STIK	2-5.5 fl.oz.	
ECHO 6 ETQ	3.6-5.5 fl.oz.	
LEGEND	3-3.6 fl.oz.	
chlorothalonil + acibenzolar S-methyl		Apply before symptoms appear and when conditions favor disease. Repeat at 7- to 14-day intervals in 1 gallon of water per 1,000 square feet of turf. See label for use guidelines for golf course greens, tees, and fairways.
DACONIL ACTION	3-5.4 fl.oz.	
chlorothalonil + azoxystrobin		Use preventatively. Begin applications when conditions favor disease and prior to disease symptoms development. Repeat at 14 to 28 day intervals. Do not exceed 14-day treatment interval on golf greens.
RENOWN	2.5-4 fl.oz.	
chlorothalonil + propiconazole		**Golf Courses and Sod Farms:** Apply at 14-day intervals in a minimum of 0.3 gallons of water per 1,000 square feet when conditions favor disease development.
ECHO/PROPICONAZOLE EC CO-PACK	2.0 + 0.36 fl.oz.	
CONCERT II	4.5-8.5 fl.oz.	Use preventively. Apply when conditions favor disease and repeat applications at 7- to 28-day intervals as needed at a rate of 1 gallon of water per 1,000 square feed of turf. Use higher rate at shorter interval when disease pressure is high. Not for use in residential landscapes.
chlorothalonil + propiconazole + fludioxonil		Use as preventive treatment. Begin applications when conditions favor disease and repeat as needed every 14 to 28 days. Use higher rate at shorter interval under high disease pressure.
INSTRATA	2.75-6.0 fl.oz.	
chlorothalonil + tebuconazole		**Golf Course Turf:** Apply when conditions favor disease and repeat at 28-day intervals as needed in 1 to 3 gallons of water per 1000 square feet. Up to six applications may be made per year.
E-SCAPE ETQ	2.6 fl.oz.	
chlorothalonil + thiophanate-methyl		**Golf Courses, Sod Farms, Commercial and Institutional Grounds:** Apply in 2 to 4 gallons of water per 1000 square feet every 7 to 14 days as needed. See label for additional instructions.
SPECTRO 90	3.7-5.7 oz.	
CONSYST WDG	2-4 oz.	
TEE-1-UP	2-4 oz.	
fenarimol		Begin sprays before symptoms appear; apply at 30-day intervals as long as conditions favor disease.
RUBIGAN AS	1.75-3.5 fl.oz.	
fludioxonil		Begin applications before disease symptoms are seen. Repeat applications at 14-day intervals. For best results, use as part of comprehensive preventive control program.
MEDALLION	0.25-0.5 oz.	
fluoxastrobin		**Bentgrass and Other Cool season Turfgrasses:** Apply at 14- to 28-day intervals in 1 to 4 gallons of water per 1,000 square feet when conditions favor disease development. Repeat as needed.
DISARM 480SC	8-16 fl.oz.	
DISARM G	2.3-4.6 lb.	Use preventively. Apply when conditions favor disease and repeat applications at 14- to 28-day intervals as needed at a rate of 1 gallon of water per 1,000 square feed of turf. Use higher rate at shorter interval when disease pressure is high. May be applied to residential turf by a certified applicator.
fluoxastrobin + chlorothalonil		**Foliar Blight on Bentgrass:** Begin applications when conditions favor disease and repeat as needed every 14 to 28 days. Apply in 1 to 4 gallons per 1,000 square feet of turf area.
DISARM C	3-5.9 fl.oz.	
	3-5.9 fl.oz.	**Crown Rot on Bentgrass:** Tank mix with another fungicide labeled for anthracnose control. Begin applications when conditions favor disease and repeat as needed every 14 to 28 days. Apply in 1 to 4 gallons per 1,000 square feet of turf area.

[1] Fungicide products are registered for use on residential lawns except as specified in comments.

Table 1. Commercial Turf and Lawns: Disease and Nematode Control (cont.)

Fungicide and Formulation	Amount to Use per 1000 sq. ft. or as Specified	Comments[1]
ANTHRACNOSE (cont.)		
fluoxastrobin + myclobutanil		Use preventively. Apply when conditions favor disease and repeat applications at 14- to 28-day intervals as needed. Use higher rate at shorter interval when disease pressure is high. May be applied to residential turf by a certified applicator.
DISARM M	0.25-1 fl.oz.	
iprodione + thiophanate-methyl		**Golf and Institutional Turf:** Apply when conditions favor disease and repeat at 14- to 21-day intervals as needed. Use higher rate at shorter interval when disease pressure is high. Not for home lawn use.
26/36 FUNGICIDE	2-4 fl.oz.	
metconazole		Use preventively. Apply when conditions favor disease and repeat applications at 14- to 21-day intervals as needed. Use higher rate at shorter interval when disease pressure is high.
TOURNEY	0.28-0.37 fl.oz.	
myclobutanil		Apply in summer at 14- to 21-day intervals when conditions favor disease. Use higher rate at shorter interval when disease is active.
EAGLE 20EW	1.2 fl.oz.	
GOLDEN EAGLE G	2-8 lb.	
polyoxin D zinc salt		**Residential Lawns, Golf Courses, Commercial and Institutional Lawns:** Begin applications when conditions favor disease development and before symptoms are seen. Repeat applications at 7- to 14-day intervals. Shorten the application interval when disease is present. Apply in at least 1 gallon of water per 1000 square feet. See label for resistance management recommendations and list of target turfgrasses.
ENDORSE WP	0.25 lb.	
AFFIRM WDG	0.9 oz.	
propiconazole		Apply at 14- to 28-day intervals. Use higher rate at shorter interval when disease is present.
BANNER MAXX	1-2 fl.oz.	
BANNER MAXX II	1-2 fl.oz.	
PROPICONAZOLE PRO	1-2 fl.oz.	
PROPICONAZOLE SPC 14.3MEC	1-2 fl.oz.	
PROPENSITY 1.3ME	1-2 fl.oz.	
SPECTATOR ULTRA	1-2 fl.oz.	
STRIDER	1-2 fl.oz.	
pyraclostrobin		Begin applications when conditions favor disease development and before symptoms are seen. Repeat at 14- to 28-day intervals. Apply in 2 to 4 gallons of water per 1000 square feet. See label for resistance management recommendations.
INSIGNIA	0.5 - 0.9 oz.	
INSIGNIA INTRINSIC	0.4-0.7 fl.oz.	Use preventively. Apply when conditions favor disease and repeat applications at 14- to 28-day intervals as needed. Use higher rate at shorter interval when disease pressure is high.
pyraclostrobin + boscalid		**Golf Course Turf:** Apply when conditions favor disease and repeat applications at 14- to 28-day intervals as needed.
HONOR INTRINSIC	0.55-1.1 oz.	
pyraclostrobin + triticonazole		Use preventatively. Begin applications when conditions favor disease and prior to disease symptoms development. Repeat at 14- to 28-day intervals. Do not make more than five applications of Pillar G per year.
PILLAR G	3 lb.	
tebuconazole		**Golf Course Turf:** Apply when conditions favor disease and before symptoms appear. Alternate applications of Torque with another fungicide with a different mode of action. A second application may be made after 21 days. **Torque is a Group 3 triazole fungicide.**
CLEARSCAPE ETQ	0.6 fl.oz.	
TORQUE	0.6 fl.oz.	

[1] Fungicide products are registered for use on residential lawns except as specified in comments.

Table 1. Commercial Turf and Lawns: Disease and Nematode Control (cont.)

Fungicide and Formulation	Amount to Use per 1000 sq. ft. or as Specified	Comments[1]
ANTHRACNOSE (cont.)		
thiophanate-methyl		Apply when disease first appears and repeat at 7- to 14-day intervals as needed. Allow spray to dry before watering. Use higher rate at shorter intervals for curative control.
3336F	2-8 fl.oz.	
3336G	6-12 lb.	
3336 WP	2-8 oz.	
3336 PLUS	2-8 oz.	
CAVALIER 4.5F	4-8 fl.oz.	
CAVALIER 2G	3-9 lb.	
CAVALIER WSB	2-8 oz.	
SYSTEC 1998 F	1-2 fl.oz.	
SYSTEC 1998 50W	0.7-1.3 oz.	
TEE-OFF 4.5E	4-8 fl.oz.	
SYSTEMIC FUNGICIDE	1.35-2.7 lb.	
thiophanate-methyl (cont.)		For prevention on previously damaged greens, apply twice at 14-day intervals when soil temperature reaches 60°F. For curative control, apply when disease first appears and continue at 14-day intervals as needed. Rotate with application of chlorothalonil or triadimefon. See label for spreader settings.
3336 DG LITE	3-9 oz.	
thiophanate-methyl + chlorothalonil		Apply at 7- to 14-day intervals. Use higher rate at shorter intervals when disease is present.
CONSYST	2-8 oz.	
TEE-1-UP	2-8 oz.	
triadimefon		For summer disease on bentgrass greens. Apply Bayleton at 30-day intervals in 2 to 4 gallons of water per 1000 square feet when conditions favor disease. Apply Granular Turf Fungicide at 30-day intervals. See label for spreader settings. May be applied to residential lawns by a certified applicator.
BAYLETON T/O	1 oz.	
BAYLETON FLO	1 fl.oz.	
GRANULAR TURF FUNGICIDE	1.5-3 lb.	
FUNGICIDE VII	1.3-5 lb.	
trifloxystrobin		
COMPASS 50WDG	0.15-0.25 oz.	Apply every 14 to 21 days when conditions favor disease. Use higher rate for curative control.
COMPASS G	5 lb.	Apply every 21 days as needed when conditions favor disease. May be tank mixed with Bayleton T/O to control dollar spot.
trifloxystrobin + triadimefon		Apply at 14- to 28-day intervals in 1 to 2 gallons of water per 1,000 square feet when conditions favor disease development.
ARMADA 50WDG	0.6-1.2 oz.	
TARTAN	1-2 fl.oz.	
triticonazole		Apply preventively when conditions are favorable for disease development. Continue as needed at 14- to 28-day intervals. Under conditions for severe disease or for an early curative application, apply the higher rate at a shorter interval. Do not use on ultradwarf bermudagrass cultivars.
TRINITY	0.5-1 fl.oz.	
TRITON FLO	0.41-1.1 fl.oz	
TRITON 70WDG	0.15-0.6 oz.	
triticonazole + chlorothalonil		Begin fungicide applications preventively when conditions are favorable for disease development. Continue as needed at 14- to 28-day intervals. Under conditions for severe disease or for an early curative application, use the higher rate and shorter interval.
RESERVE	3.2-5.4 fl.oz.	
BENTGRASS DEAD SPOT		
boscalid		Begin applications prior to or in the early stages of disease development. Apply at 14-day intervals during prolonged favorable weather for disease development.
EMERALD	0.18 oz.	
fludioxonil		Begin applications prior to appearance of symptoms and reapply at 14-day intervals. For broader disease control, tank mix with 1 to 2 fluid ounces per 1,000 square feet of Banner Maxx.
MEDALLION	0.3-0.5 oz.	
pyraclostrobin + triticonazole		Use preventatively. Begin applications when conditions favor disease and prior to disease symptoms development. Repeat at 14- to 28-day intervals. Do not make more than five applications of Pillar G per year.
PILLAR G	3 lb.	
PILLAR G INTRINSIC		

[1] Fungicide products are registered for use on residential lawns except as specified in comments.

Table 1. Commercial Turf and Lawns: Disease and Nematode Control (cont.)

Fungicide and Formulation	Amount to Use per 1000 sq. ft. or as Specified	Comments[1]
BERMUDAGRASS DECLINE		
chlorothalonil + tebuconazole		
E-SCAPE ETQ	2.6 fl.oz.	**Golf Course Turf:** Apply 2 to 4 weeks before histocial appearance of symptoms. Aerify or verticut prior to application. Combine application program with appropriate management practices. Reapply afer 28 days.
pyraclostrobin		
INSIGNIA INTRINSIC	0.7 fl.oz.	Aids in control of bermudagrass decline when combined with appropriate cultural practices. Make one application in spring after green up and second application in the fall when the air temperature remains above 80°F in 4 gallons of water per 1,000 square feet.
pyraclostrobin + boscalid		
HONOR INTRINSIC	1.1 fl.oz.	Aids in control of bermudagrass decline when combined with appropriate management practices. Make one application in spring and second application in the fall when the air temperature exceeds 80°F and the relative humidity exceeds 75 percent. Apply in 4 gallons of water per 1,000 square feet. Aerify prior to application.
pyraclostrobin + triticonazole		
PILLAR G	3 lb.	Aids in control of bermudagrass decline when combined with appropriate cultural practices. Make one application in spring after greenup and second application in the fall when the air temperature remains above 80°F in 4 gallons of water per 1,000 square feet..
PILLAR G INTRINSIC		
tebuconazole		
CLEARSCAPE ETQ	0.6 fl.oz.	**Golf Course Turf:** Apply 2 to 4 weeks before historical appearance of symptoms. Aerify or verticut prior to application. Combine application program with appropriate management practices. Reapply after 28 days.
thiophanate-methyl		
3336 DG LITE	6-9 oz.	Apply in mid-July or when symptoms first appear and repeat at 14-day intervals for suppression. Use higher rates under most severe disease expression. Follow proper agronomic recommendations to maintain plant vigor.
BROWN PATCH AND BROWN RING PATCH		
azoxystrobin		
HERITAGE TL	1-2 fl.oz.	Apply at 14- to 28-day intervals when conditions favor disease. Use the highest rate at the shortest interval when disease is present. **DO NOT** apply more than six times or 3.7 ounces per year. Does not control dollar spot. Also for brown ring patch control.
HERITAGE G	2-4 oz.	
HERITAGE FUNGICIDE	0.2-0.4 oz.	
azoxystrobin + propiconazole		
HEADWAY	0.75-3 fl.oz.	Use preventively. Apply when conditions favor disease and repeat applications at 14- to 28-day intervals as needed at a rate of 2 to 4 gallons of water per 1,000 square feet of turf. Use higher rate at shorter interval when disease pressure is high. Also for brown ring patch control.
HEADWAY G	2-4 lb.	Apply when conditions favor disease and repeat applications at 14- to 28-day intervals as needed. Alternate applications with Daconil. Use higher rate at shorter interval when disease pressure is high. Also for brown ring patch control.
chlorothalonil		**Tees, Greens, and Fairways:** Apply at 7- to 10-day intervals in 2 to 10 gallons of water per 1000 square feet for greens, tees, and lawns. Apply 0.8 to 1 gallon per 1000 square feet on fairways before damage appears. Shorten intervals to 7 days and increase rate when disease appears. **DO NOT** use on residential lawns.
DACONIL ULTREX	1.8-5 oz.	
DACONIL WEATHER STIK	2-5.5 fl.oz.	
ECHO 6 ETQ	2-3.6 fl.oz.	
LEGEND	3-3.6 fl.oz.	
MANICUR DG	1.75-6.5 oz.	
MANICUR FLOWABLE	3-11 fl.oz.	
chlorothalonil		**Golf Course Fairways, Sod Farms, Athletic Fields, Parks:** Apply in 30 to 40 gallons per acre when conditions favor disease and repeat as long as conditions persist. Use higher rate and shorter spray schedule when disease is severe.
DACONIL ULTREX	5-13.5 lb./A	
DACONIL WEATHER STIK	5.5-15.1 pt./A	
ECHO 90DF	4.5-8 lb./A	
MANICUR DG	4.5-8 lb./A	
MANICUR FLOWABLE	8-14 pt./A	

[1] Fungicide products are registered for use on residential lawns except as specified in comments.

Table 1. Commercial Turf and Lawns: Disease and Nematode Control (cont.)

Fungicide and Formulation	Amount to Use per 1000 sq. ft. or as Specified	Comments[1]
BROWN PATCH AND BROWN RING PATCH (cont.)		
chlorothalonil + acibenzolar S-methyl		
DACONIL ACTION	2-3.5 fl.oz.	**Preventive:** Apply before symptoms appear and when conditions favor disease. Repeat at 7- to 14-day intervals in 1 to 3 gallons of water per 1,000 square feet of turf. See label for use guidelines for golf course greens, tees, and fairways.
	4-5.4 fl.oz.	**Curative:** Repeat at 7- to 14-day intervals in 1 to 3 gallons of water per 1,000 square feet of turf. See label for use guidelines for golf course greens, tees, and fairways. Not for use in residential landscapes
chlorothalonil + azoxystrobin		
RENOWN	2.5-4 fl.oz.	Use preventatively. Begin applications when conditions favor disease and prior to disease symptoms development. Repeat at 14- to 21-day intervals. Also controls brown ring patch
chlorothalonil + propiconazole		
ECHO/PROPICONAZOLE EC CO-PACK	2.0 + 0.36 fl.oz.	**Golf Courses and Sod Farms:** Apply at 14-day intervals in a minimum of 0.3 gallons of water per 1,000 square feet when conditions favor disease development.
CONCERT II	3-8.5 fl.oz.	Use preventively. Apply when conditions favor disease and repeat applications at 7- to 28-day intervals as needed at a rate of 40 gallons of water per acre. Use higher rate at shorter interval when disease pressure is high. Not for use in residential landscapes.
chlorothalonil + propiconazole + fludioxonil		Begin applications when conditions favor disease and repeat as needed every 14 to 21 days. Use higher rate at shorter interval under high disease pressure.
INSTRATA	2.75-6.0 fl.oz.	
chlorothalonil + tebuconazole		
E-SCAPE ETQ	2.6 fl.oz.	**Golf Course Turf:** Apply when conditions favor disease and repeat at 28-day intervals as needed in 1 to 3 gallons of water per 1000 square feet. Up to six applications may be made per year.
chlorothalonil + thiophanate-methyl		
SPECTRO 90	2-5.7 oz.	**Golf Courses, Sod Farms, Commercial and Institutional Grounds:** Apply in 2 to 4 gallons of water per 1000 square feet every 7 to 14 days as needed. See label for additional instructions.
CONSYST WDG	2-4 oz.	
TEE-1-UP	2-4 oz.	
fenarimol		
RUBIGAN AS	1.5 fl.oz.	Apply at 7- to 14-day intervals in 2 to 5 gallons of water per 1000 square feet. Shorten intervals when disease appears. Tank mix with Daconil 2787 at minimum label rate under severe disease conditions. Turf areas containing *Poa annua* **SHOULD NOT** be treated with fenarimol unless suppression is desired.
fenarimol + chlorothalonil		Apply at 7- to 10-day intervals. Begin sprays when conditions favor disease.
BROADWAY 4.4F	3-6 fl.oz.	
TWO SOME 4.4F	3-6 fl.oz.	
fludioxonil		
MEDALLION	0.25-0.5 oz.	Begin applications before disease symptoms are seen. Repeat applications at 7- to 14-day intervals. Use higher rate at shorter interval when disease symptoms are seen. For best results, use as part of comprehensive preventive control program.
fluoxastrobin		
DISARM 480SC	8-16 fl.oz.	**Bentgrass and Other Cool Season Turfgrasses:** Apply at 14- to 28-day intervals in 1 to 4 gallons of water per 1,000 square feet when conditions favor disease development. Repeat as needed. For brown patch on zoysiagrass in spring, make one or two applications at 50 percent greenup at 14- to 28-day intervals. Use higher rate at shorter interval on turf previously damaged by brown patch.
DISARM G	2.3-4.6 lb.	Use preventively. Apply when conditions favor disease and repeat applications at 14- to 28-day intervals as needed at a rate of 1 gallon of water per 1,000 square feed of turf. Use higher rate at shorter interval when disease pressure is high. May be applied to residential turf by a certified applicator.

[1] Fungicide products are registered for use on residential lawns except as specified in comments.

Table 1. Commercial Turf and Lawns: Disease and Nematode Control (cont.)

Fungicide and Formulation	Amount to Use per 1000 sq. ft. or as Specified	Comments[1]
BROWN PATCH AND BROWN RING PATCH (cont.)		
fluoxastrobin + chlorothalonil		**Cool Weather Brown Patch:** Make one or two applications in the fall or when conditions favor disease. Apply in 1 to 4 gallons per 1,000 square feet of treated area. Repeat applications at 14- to 28-day intervals as needed.
DISARM C	1.5-5.9 fl.oz.	
fluoxastrobin + myclobutanil		Use preventively. Apply when conditions favor disease and repeat 14 to 28 days later as needed. Use higher rate at shorter interval when disease pressure is high. May be applied to residential turf by a certified applicator. Also for brown ring patch control.
DISARM M	0.5-1 fl.oz.	
flutolanil		Apply in 2 to 5 gallons of water at 14- to 21-day intervals when conditions favor disease. Apply up to 3.3 ounces for curative control. Does not control dollarspot.
PROSTAR 70WDG	1.5-2.2 oz.	
flutolanil + triadimefon		Apply in 2 to 5 gallons of water per 1000 square feet at 30-day intervals. See label for mixing and application directions.
PROSTAR PLUS	1 bag/8000-12,000 sq.ft.	
iprodione		Apply at 14- to 21-day intervals in 2 to 10 gallons of water per 1000 square feet as required for disease control. Under severe conditions, shorten spray interval and/or increase rates. Apply when weather conditions favor disease. Repeat at 2-week intervals as needed. See Fungicide X label for spreader settings. Make no more than six applications per year. For golf course use only.
IPRODIONE PRO 2SE	2-4 fl.oz.	
IPRODIONE SPC FUNGICIDE	2-4 fl.oz.	
CHIPCO 26019 50W	1-2 oz. (9-13 T.)	
26 GT FLO	4 fl.oz.	
FUNGICIDE X	2.4-4.8 lb.	
iprodione + thiophanate-methyl		**Golf and Institutional Turf:** Apply when conditions favor disease and repeat at 14- to 21-day intervals as needed. Use higher rate at shorter interval when disease pressure is high. Not for home lawn use.
26/36 FUNGICIDE	2-4 fl.oz.	
iprodione + trifloxystrobin		Apply when conditions favor disease and repeat applications on greens at 14- to 28-day intervals as needed. Application interval for fairways and other turfs is 14 to 28 days. Use lower application rates on fairways.
INTERFACE	3-5 fl.oz.	
mancozeb		Apply at 7- to 14-day intervals in 3 to 5 gallons per 1000 square feet when disease threatens. Use the high rate at shortest spray interval when disease is severe. Tank-mix with Eagle under severe disease conditions. For professional use only.
DITHANE T/O RAINSHIELD	4 oz.	
4 FLOWABLE MANCOZEB	6.4 fl.oz.	
FORE 80W	4 oz. (10-27 T.)	
MANCOZEB DG	4 oz.	
PROTECT T/O	4 oz.	
metconazole		Use preventively. Apply when conditions favor disease and repeat applications at 14- to 21-day intervals as needed. Use higher rate at shorter interval when disease pressure is high. Also for brown ring patch control.
TOURNEY	0.28-0.37 fl.oz.	
myclobutanil		Apply at 14-day intervals in 1 to 3 gallons of water per 1000 square feet. See label for restrictions. If disease appears, tank-mix with recommended rate of Dithane T/O or Fore. Use higher rate at shorter intervals when disease is active.
EAGLE 20EW	1.2 fl.oz.	
GOLDEN EAGLE G	2-8 lb.	
PCNB		Apply in 10 to 15 gallons to cover 1000 square feet and repeat every 3 to 4 weeks. Lightly water after application. See label for setting granular spreaders.
DEFEND 2F	1 qt.	
DEFEND 10G	7.5 lb.	
REVERE 75W	1 lb.	
REVERE 4000	16-24 fl.oz.	
TURFCIDE 10G	7.5 lb.	
TURFCIDE 400	16-24 fl.oz.	

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Table 1. Commercial Turf and Lawns: Disease and Nematode Control (cont.)

Fungicide and Formulation	Amount to Use per 1000 sq. ft. or as Specified	Comments[1]
BROWN PATCH AND BROWN RING PATCH (cont.)		
polyoxin D zinc salt		**Residential Lawns, Golf Courses, Commercial and Institutional Lawns:** Begin applications when conditions favor disease development and before symptoms are seen. Repeat applications at 7- to 14-day intervals. Shorten the application interval when disease is present. Apply in at least 1 gallon of water per 1000 square feet. See label for resistance management recommendations and list of target turfgrasses.
AFFIRM WDG	0.9 oz.	
ENDORSE WP	0.25 lb.	
VERANDA T WDG	2.4 lb./A	
propiconazole		Apply in 2 to 5 gallons of water per 1000 square feet before symptoms are present. Repeat at 14- to 28-day intervals. **DO NOT** exceed 4 fluid ounces per 1000 square feet in a 30-day period for bermudagrass.
BANNER MAXX	1-2 fl.oz.	
BANNER MAXX II	1-2 fl.oz.	
PROPICONAZOLE PRO	1-2 fl.oz.	
PROPICONAZOLE SPC 14.3MEC	1-2 fl.oz.	
PROPENSITY 1.3ME	1-2 fl.oz.	
SPECTATOR ULTRA	1-2 fl.oz.	
STRIDER	1-2 fl.oz.	
PROPHESY 0.7G	2.5 lb.	Apply Prophesy 0.7G at 14- to 21-day intervals as need to control disease. See label for spreader settings.
pyraclostrobin		Begin applications when conditions favor disease development and before symptoms are seen. Repeat at 14- to 28-day intervals. Apply in 2 to 4 gallons of water per 1000 square feet. Use higher rate at longer treatment interval. See label for resistance management recommendations.
INSIGNIA	0.5-0.9 oz.	
INSIGNIA INTRINSIC	0.4-0.7 fl.oz.	Use preventively. Apply when conditions favor disease and repeat applications at 14- to 28-day intervals as needed. Use higher rate at shorter interval when disease pressure is high. Do not make more than three consecutive applications of Insignia.
pyraclostrobin + boscalid		**Golf Course Turf:** Apply when conditions favor disease and repeat applications at 14- to 28-day intervals as needed.
HONOR INTRINSIC	0.55-1.1 oz.	
pyraclostrobin + triticonazole		Use preventatively. Begin applications when conditions favor disease and prior to disease symptoms development. Repeat at 14- to 28-day intervals. Do not make more than five applications of Pillar G per year.
PILLAR G	3 lb.	
PILLAR G INTRINSIC		
tebuconazole		**Golf Course Turf:** Apply when conditions favor disease and before symptoms appear. Alternate applications of Torque with another fungicide with a different mode of action. A second application may be made after 21 days. **Torque is a Group 3 triazole fungicide.**
CLEARSCAPE ETQ	0.6 fl.oz.	
TORQUE	0.6 fl.oz.	
thiophanate-methyl		Apply at 5- to 14-day intervals in 5 gallons of water per 1000 square feet. Shorten intervals and increase rate when disease appears. Continuous use may result in control failure due to resistance. **DO NOT** tank-mix with highly alkaline pesticides such as Bordeaux mixture or lime sulfur. See label for appliction intervals for 3336 Plus.
3336 50W	4-8 oz.	
3336F	1-2 fl.oz.	
3336G	1.5-3 lb.	
3336 PLUS	4-8 oz.	
CAVALIER 4.5F	1-2 fl.oz.	
CAVALIER WSB	2 oz.	
FUNGO FLO	1-2 fl.oz.	Apply Systec at 7- to 14-day intervals. Use higher rate at shorter intervals when disease is present.
SYSTEC 1998 F	1-2 fl.oz.	
SYSTEC 1998 WDG	0.6-1.3 oz.	
TEE-OFF 4.5F	1-2 fl.oz.	
T-STORM 50W	1-4 oz.	
3336 DG LITE	1.5-6 oz.	For prevention use low rate and apply before symptoms appear or before weather conditions favor disease development. Reapply at 14-day intervals as needed. Rotate with application of chlorothalonil or triadimefon. See label for spreader settings.

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Table 1. Commercial Turf and Lawns: Disease and Nematode Control (cont.)

Fungicide and Formulation	Amount to Use per 1000 sq. ft. or as Specified	Comments[1]
BROWN PATCH AND BROWN RING PATCH (cont.)		
thiophanate-methyl + chlorothalonil		Apply at 7- to 14-day intervals. Use higher rate at shorter intervals when disease is present.
CONSYST	3-8 oz.	
TEE-1-UP	2-8 oz.	
thiophanate-methyl + iprodione		**Golf Courses, Sod Farms, and Institutional Turf:** Apply at 1- to 2-week intervals in 4 to 7 gallons of water per 1000 square feet. Use higher rate and/or shorter intervals when disease appears. **DO NOT** water or mow within 24 hours of application.
FLUID FUNGICIDE	1.1-2.1 fl.oz.	
26/36 FUNGICIDE	2-4 fl.oz.	
TWOSOME	1-4 fl.oz.	
triadimefon		Apply at 15- to 30-day intervals in 2 to 4 gallons of water per 1000 square feet. Use higher rate and shorter intervals when disease appears.
BAYLETON T/O	0.5-1 oz.	
BAYLETON FLO	0.5 fl.oz.	
FUNGICIDE VII	2.7-5.3 lb.	For use on bentgrass, perennial ryegrass, and bermudagrass. For preventive use, apply to moist or dry foliage at low rate every 14 days as needed. If disease appears, apply at a higher rate every 14 days. Refer to label for spreader settings.
GRANULAR TURF FUNGICIDE	1.5-3 lb.	
trifloxystrobin		Apply every 14 days when conditions favor disease and repeat as needed.Use higher rate for curative control.
COMPASS 50WDG	0.1-0.2 oz. 0.15-0.25 oz.	
COMPASS G	2-5 lb.	Apply every 21 days when conditions favor disease and repeat as needed. Does not control dollarspot. No PGR activity on bentgrass or bermudagrass.
trifloxystrobin + triadimefon		Apply at 14- to 28-day intervals in 1 to 2 gallons of water per 1,000 square feet when conditions favor disease development.
ARMADA 50WDG	0.6-1.2 oz.	
TARTAN	1-2 fl.oz.	
triticonazole		Apply preventively when conditions are favorable for disease development. Continue as needed at 14- to 28-day intervals. Under conditions for severe disease or for an early curative application, apply the higher rate at a shorter interval. May be tank mixed with 26GT or ProStar for improved brown patch control.
TRINITY	0.75-2 fl.oz.	
TRITON FLO	0.41-1.1 fl.oz	
TRITON 70WDG	0.225-0.6 oz.	
triticonazole + chlorothalonil		Begin fungicide applications preventively when conditions are favorable for disease development. Continue as needed at 14- to 28-day intervals.
RESERVE	3.2-5.4 fl.oz.	
vinclozolin		**Golf Courses, Sod Farms, Sports Turf, Commercial and Institutional Grounds:** Apply in 1 to 4 gallons of water per 1000 square feet on a 14- to 28-day schedule when conditions favor disease. Apply no more than 3 ounces per 1000 square feet per year.
CURALAN EG	1 oz.	
TOUCHÉ EG	1 oz.	
DOLLAR SPOT		
azoxystrobin + propiconazole		Use preventively. Apply when conditions favor disease and repeat applications at 14- to 28-day intervals as needed at a rate of 2 to 4 gallons of water per 1,000 square feet of turf. Use higher rate at shorter interval when disease pressure is high. Tank mix with Daconil for application on non-residential turf.
HEADWAY	0.75-1.5 fl.oz.	
HEADWAY G	2-4 lb.	Apply when conditions favor disease and repeat applications at 14- to 28-day intervals as needed. Alternate applications with Daconil. Use higher rate at shorter interval when disease pressure is high.
boscalid		**Golf Course Use Only:** Begin applications prior to or at early stages of the disease. Repeat applications at 14- to 28-days. Use shorter interval and/or higher rate when conditions favor disease. Apply in 2 to 4 gallons of water per 1000 square feet.
EMERALD	0.13-0.18 oz.	

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Table 1. Commercial Turf and Lawns: Disease and Nematode Control (cont.)

Fungicide and Formulation	Amount to Use per 1000 sq. ft. or as Specified	Comments[1]
DOLLAR SPOT (cont.)		
chlorothalonil		**Tees and Greens:** Apply at 7- to 14-day intervals in 2 to 5 gallons of water per 1000 square feet before disease is seen. When disease appears, shorten intervals to 7 days and increase rate. **DO NOT** use on residential lawns.
DACONIL ULTREX	1.8-5 oz.	
DACONIL WEATHER STIK	2-5.5 fl.oz.	
ECHO 90DF	1.75-6.5 oz.	
LEGEND	1-3.6 fl.oz.	
MANICUR DG	1.75-6.5 oz.	
MANICUR FLOWABLE	3-11 fl.oz.	
chlorothalonil		**Golf Course Fairways, Athletic Fields, Parks, Sod Farms:** Apply in 30 to 40 gallons of water per acre when conditions favor disease. Repeat as long as conditions persist. Use higher rate and shorter intervals when disease is severe. DO NOT use on residential lawns.
DACONIL ULTREX	5-13.5 lb./A	
DACONIL WEATHER STIK	5.5-15.1 pt./A	
ECHO 6 ETQ	2-3.6 fl.oz.	
LEGEND	1-3.6 fl.oz.	
MANICUR DG	2.25-8 lb./A	
MANICUR FLOWABLE	4-14 pt./A	
chlorothalonil + acibenzolar S-methyl		
DACONIL ACTION	1-3.5 fl.oz.	**Preventive:** Apply before symptoms appear and when conditions favor disease. Repeat at 7- to 14-day intervals in 1 to 3 gallons of water per 1,000 square feet of turf. See label for use guidelines for golf course greens, tees, and fairways.
	4-5.4 fl.oz.	**Curative:** Repeat at 7- to 14-day intervals in 1 to 3 gallons of water per 1,000 square feet of turf. See label for use guidelines for golf course greens, tees, and fairways. Not for use in residential landscapes
chlorothalonil + azoxystrobin		
RENOWN	2.5-4 fl.oz.	Use preventatively. Begin applications when conditions favor disease and prior to disease symptoms development. Repeat at 14-day intervals.
chlorothalonil + propiconazole		
ECHO/PROPICONAZOLE EC CO-PACK	2.0 + 0.36 fl.oz.	**Golf Courses and Sod Farms:** Apply at 14-day intervals in a minimum of 0.3 gallons of water per 1,000 square feet when conditions favor disease development.
CONCERT II	1.5-8.5 fl.oz.	Use preventively. Apply when conditions favor disease and repeat applications at 7- to 28-day intervals as needed at a rate of 1 gallon of water per 1,000 square feed of turf. Use higher rate at shorter interval when disease pressure is high. Not for use in residential landscapes.
chlorothalonil + propiconazole + fludioxonil		Begin applications when conditions favor disease and repeat as needed every 21 to 28 days. Use higher rate at shorter interval under high disease pressure.
INSTRATA	2.75-7.0 fl.oz.	
chlorothalonil + tebuconazole		**Golf Course Turf:** Apply when conditions favor disease and repeat at 28-day intervals as needed in 1 to 3 gallons of water per 1000 square feet. Up to six applications may be made per year.
E-SCAPE ETQ	2.6 fl.oz.	
chlorothalonil + thiophanate-methyl		
SPECTRO 90	2-5.7 oz.	**Golf Courses, Sod Farms, Commercial and Institutional Grounds:** Apply in 2 to 4 gallons of water per 1000 square feet every 7 to 14 days as needed. See label for additional instructions.
TEE-1-UP	2-4 oz.	
CONSYST WDG	2-4 oz.	
fenarimol		Apply at 10- to 28-day intervals in 2 to 5 gallons of water per 1000 square feet. Use highest rate at the shortest interval when disease is present; then reduce rate for subsequent applications. Tank-mix with Daconil at the minimum label rate when disease is severe. Turf areas containing *Poa annua* **SHOULD NOT** be treated with fenarimol unless suppression is desired.
RUBIGAN AS	0.75-1.5 oz.	
fenarimol + chlorothalonil		Apply on a 2- to 3-week spray schedule. Begin sprays when conditions favor disease.
BROADWAY 4.4F	3-4.5 fl.oz.	
TWO SOME 4.4F	3-4.5 fl.oz. (1-1.5 gal./A)	

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Table 1. Commercial Turf and Lawns: Disease and Nematode Control (cont.)

Fungicide and Formulation	Amount to Use per 1000 sq. ft. or as Specified	Comments[1]
DOLLAR SPOT (cont.)		
fluoxastrobin + chlorothalonil		Use preventively. Apply when conditions favor disease and repeat at 14- to 21-day intervals as needed. Use higher rate at shorter interval when disease pressure is high. Tank mix or alternate a DMI fungicide for resistance management. Not for home lawn use.
DISARM C	3-5.9 fl.oz.	
fluoxastrobin + myclobutanil		Use preventively. Apply when conditions favor disease and repeat applications at 14- to 21-day intervals as needed. Use higher rate at shorter interval when disease pressure is high. May be applied to residential turf by a certified applicator.
DISARM M	0.25-1 fl.oz.	
iprodione		**Golf Courses, Sod Farms, Commercial and Institutional Turf:** Apply at 14- to 28-day intervals in 2 to 10 gallons of water per 1000 square feet when conditions favor disease or symptoms appear. Continue applications as long as needed. Use the higher rate and/or shorter spray interval when disease pressure is severe. Make no more than six applications per year. Golf course use **ONLY.**
IPRODIONE PRO 2SE	2-4 fl.oz.	
IPRODIONE SPC FUNGICIDE	4 fl.oz.	
CHIPCO 26019 50W	1-2 oz. (6-13 T.)	
26GT FLO	3-4 fl.oz.	
iprodione + thiophanate-methyl		**Golf and Institutional Turf:** Apply when conditions favor disease and repeat at 14- to 21-day intervals as needed. Use higher rate at shorter interval when disease pressure is high. Not for home lawn use.
26/36 FUNGICIDE	2-4 fl.oz.	
iprodione + trifloxystrobin		Apply when conditions favor disease and repeat applications on greens at 14- to 28-day intervals as needed. Application interval for fairways and other turfs is 14 to 28 days. Use lower application rates on fairways.
INTERFACE	3-5 fl.oz.	
metconazole		Use preventively. Apply when conditions favor disease and repeat applications at 14- to 21-day intervals as needed. Use higher rate at shorter interval when disease pressure is high.
TOURNEY	0.18-0.37 fl.oz.	
myclobutanil		Apply at 14- to 28-day intervals in 1 to 3 gallons of spray volume per 1000 square feet. **DO NOT** apply more than 7.2 ounces of Eagle per 1000 square feet per year. Use higher rate at shorter intervals when disease is active. See label for spreader settings.
EAGLE 20EW	1.0-2.4 fl.oz.	
GOLDEN EAGLE G	2-8 lb.	
PCNB		Apply in enough water (10 to 15 gallons) to cover 1000 square feet. Repeat 3 to 4 weeks later if conditions still favor disease. See label for granular spreader settings.
DEFEND 75W	7-10 oz.	
DEFEND 10G	7.5 lb.	
REVERE 75W	7-10 oz.	
TURFCIDE 2E	1-1.5 qt.	
TURFCIDE 10G	50-75 lb.	
TURFCIDE 400	10.5-15 fl.oz.	
propiconazole		Apply at 7- to 28-day intervals in 2 to 5 gallons of water per 1000 square feet when conditions favor the disease. **DO NOT** exceed 2 fluid ounces per 1000 square feet on bermudagrass and St. Augustinegrass. See label for additional use restrictions.
BANNER MAXX	0.5-2 fl.oz.	
BANNER MAXX II	1-2 fl.oz.	
PROPICONAZOLE PRO	0.5-2 fl.oz.	
PROPICONAZOLE SPC 14.3MEC	0.5-2 fl.oz.	
PROPENSITY 1.3ME	1-2 fl.oz.	
SPECTATOR ULTRA	1-2 fl.oz.	
STRIDER		
PROPHESY 0.7G	2.5 lb.	Apply Prophesy 0.7G at 14- to 28-day intervals when conditions favor disease. To reduce the risk of control failures due to resistance, make no more than three consecutive applications of this or another triazole-type fungiciede. See label for spreader settings.
pyraclostrobin + boscalid		**Golf Course Turf:** Apply when conditions favor disease and repeat applications at 14- to 28-day intervals as needed. Use higher rate at shorter interval when disease pressure is high.
HONOR INTRINSIC	0.83-1.1 oz.	

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Table 1. Commercial Turf and Lawns: Disease and Nematode Control (cont.)

Fungicide and Formulation	Amount to Use per 1000 sq. ft. or as Specified	Comments[1]
DOLLAR SPOT (cont.)		
pyraclostrobin + triticonazole		Use preventatively. Begin applications when conditions favor disease and prior to disease symptoms development. Repeat at 14- to 28-day intervals. Do not make more than five applications of Pillar G per year.
PILLAR G	3 lb.	
PILLAR G INTRINSIC		
tebuconazole		**Golf Course Turf:** Apply when conditions favor disease and before symptoms appear. Alternate applications of Torque with another fungicide with a different mode of action. A second application may be made after 21 days. **Torque is a Group 3 triazole fungicide.**
CLEARSCAPE ETQ	0.6 fl.oz.	
TORQUE	0.6 fl.oz.	
thiophanate-methyl		Apply at 5- to 14-day intervals in 5 gallons of water per 1000 square feet. Shorten intervals and increase rate when disease appears. Continuous use may result in control failures due to resistance. See label for application intervals for 3336 Plus.
3336 50W	2-4 oz.	
3336F	2-4 fl.oz.	
3336G	1.5-6 lb.	
3336 PLUS	2-4 oz.	
CAVALIER 4.5F	1-2 fl.oz.	
CAVALIER WSB	2 oz.	
FUNGO FLO	1-2 fl.oz.	Apply Systec at 7- to 14-day intervals. Use higher rate at shorter interval when disease is present.
SYSTEC 1998 F	1-2 fl.oz.	
SYSTEC 1998 WDG	0.6-1.3 oz.	
TEE-OFF	1-2 fl.oz.	
T-STORM	1-4 oz.	
3336 DG LITE	1.5-6 oz.	For prevention use low rate and apply before symptoms appear or before weather conditions favor disease development. Reapply at 14-day intervals as needed. Rotate with application of chlorothalonil or triadimefon. See label for spreader settings.
thiophanate-methyl + iprodione		**Golf Courses, Sod Farms, and Institutional Turf:** Apply at 7- to 14-day intervals in 4 to 7 gallons of spray volume per 1000 square feet. Use higher rate at shorter intervals when disease appears. **DO NOT** water or mow within 24 hours of application.
FLUID FUNGICIDE	1.1-2.1 fl.oz.	
26/36 FUNGICIDE	2-4 fl.oz.	
TWOSOME	1-4 fl.oz.	
thiram		Start preventative applications when conditions for disease occurrence are favorable and repeat at 14-day intervals until disease threat is past. Start curative applications when disease first appears and repeat at 14-day intervals as necessary. For best results, use spray mixture the same day it is prepared. Apply after mowing or avoid mowing for 12 hours after application. This product can be mixed with iprodione, thiophanate-methyl, propiconazole, triadimefon, chlorothalonil, PCNB, myclobutanil, azoxystrobin, and mancozeb for use on listed.
SPOTRETE	3.75 fl.oz.	
triadimefon		Apply Bayleton at 30-day intervals in 2 to 4 gallons of water per 1000 square feet. When disease is present, use full rate; then reduce rate for subsequent applications.
BAYLETON T/O	0.25-1 oz.	
BAYLETON FLO	0.25 fl.oz.	
FUNGICIDE VII	1.3-5.3 lb.	Use Fungicide VII or Granular Turf Fungicide on bentgrass, perennial ryegrass, and bermudagrass. For preventive use, apply low rate on moist or dry foliage at 14-day intervals as needed. If disease appears, apply higher rate at 14-day intervals. May be applied to residential turf by a certified applicator.
GRANULAR TURF FUNGICIDE	0.75-3 lb.	
trifloxystrobin + triadimefon		Apply at 14- to 28-day intervals in 1 to 2 gallons of water per 1,000 square feet when conditions favor disease development.
ARMADA 50WDG	0.6-1.2 oz.	
TARTAN	1-2 fl.oz.	
triticonazole		Apply preventively when conditions are favorable for disease development. Continue as needed at 14- to 28-day intervals. Under conditions for severe disease or for an early curative application, apply the higher rate at a shorter interval. Do not use on ultradwarf bermudagrass cultivars. Rotate with Emerald or Curalan fungicides for resistance management.
TRINITY	1-2 fl.oz.	
TRITON FLO	0.28-1.1 fl.oz	
TRITON 70WDG	0.15-0.6 oz.	

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Table 1. Commercial Turf and Lawns: Disease and Nematode Control (cont.)

Fungicide and Formulation	Amount to Use per 1000 sq. ft. or as Specified	Comments[1]
DOLLAR SPOT (cont.)		
triticonazole + chlorothalonil		Begin fungicide applications preventively when conditions are favorable for disease development. Continue as needed at 14- to 28-day intervals. Under conditions for severe disease or for an early curative application, use the higher rate and shorter interval.
RESERVE	3.2-4.5 fl.oz.	
vinclozolin		**Golf Courses, Sod Farms, Sports Turf, Commercial and Institutional Grounds:** Apply in 1 to 4 gallons of water per 1000 square feet on a 14- to 28-day schedule when conditions favor disease. Apply no more than 3 ounces per 1000 square feet per year.
CURALAN EG	1 oz.	
TOUCHÉ EG	1 oz.	
DOWNY MILDEW OF ST. AUGUSTINEGRASS		
chlorothalonil + thiophanate-methyl		**Sod Farms, Commercial and Institutional Grounds:** Apply in 2 to 4 gallons of water per 1000 square feet every 7 to 14 days as needed. See label for additional instructions.
SPECTRO 90	2-5.7 oz.	
TEE-1-UP WDG	4-8 oz.	
DOWNY MILDEW (YELLOW TUFT)		
aluminum tris		Apply at 14- to 21-day intervals as a prevntive treatment in 1 to 5 gallons of water per 1000 square feet of turf when conditions favor disease. Do not mow after application. Not intended for home lawn use.
SIGNATURE	4-8 fl.oz.	
mefenoxam		**Established Turf:** Apply at 10- to 21-day intervals in 3 to 5 gallons of water per 1000 square feet of turf when conditions favor disease. Use higher rate or shorter interval when disease is active.
SUBDUE MAXX	0.5-1 fl.oz.	
pyraclostrobin		Apply when conditions favor disease and repeat application at 14- to 28-day intervals as needed. Do not make more than three consecutive applications of Insignia.
INSIGNIA	0.5-0.9	
pyraclostrobin + boscalid		**Golf Course Turf:** Apply when conditions favor disease and repeat applications at 14- to 28-day intervals as needed.
HONOR INTRINSIC	0.55-1.1 oz.	
pyraclostrobin + triticonazole		Use preventatively. Begin applications when conditions favor disease and prior to disease symptoms development. Repeat at 14- to 28-day intervals. Do not make more than five applications of Pillar G per year.
PILLAR G	3 lb.	
PILLAR G INTRINSIC		
FAIRY RING		
azoxystrobin		Apply Heritage TL in 4 gallons of water per 1000 square feet as symptoms first appear. Reapply as needed 28 days later. Irrigate with 0.5 inch of water within 24 hours of application.
HERITAGE TL	2 fl.oz.	
HERITAGE G	2-4 oz.	
HERITAGE FUNGICIDE	0.4 oz.	
azoxystrobin + propiconazole		Use preventively. Apply when conditions favor disease and repeat applications at 14- to 28-day intervals as needed at a rate of 2 to 4 gallons of water per 1,000 square feet of turf. Use higher rate at shorter interval when disease pressure is high. Aerify or tank mix with wetting agent to improve soil penetration
HEADWAY	1.5-3 fl.oz.	
HEADWAY G	2-4 lb.	Apply soon after fairy ring symptoms appear. Irrigate with 0.5 inch of water within 24 hours of application. Reapply after 14 to 28 days as needed.
chlorothalonil + azoxystrobin		Apply as soon as symptoms appear. Apply in 4 gallons of water per 1,000 square feet (174 GPA). Add a wetting agent to tank mixture. Spray; then irrigate with 0.25 inch of water per 1000 square feet. Repeat at 14-day intervals. Takes several weeks for symptoms to disappear.
RENOWN	2.5-4 fl.oz.	
fluoxastrobin		Apply to area where fairy rings have been observed in the past or at the first sign of ring development. Irrigate after application to move fungicide into root zone. Repeat as needed.
DISARM 480SC	16 fl.oz.	

[1] Fungicide products are registered for use on residential lawns except as specified in comments.

Table 1. Commercial Turf and Lawns: Disease and Nematode Control (cont.)

Fungicide and Formulation	Amount to Use per 1000 sq. ft. or as Specified	Comments[1]
FAIRY RING (cont.)		
fluoxastrobin + chlorothalonil DISARM C	4.5-5.9 fl.oz.	As symptoms appear, apply in 4 gallons of water per 1,000 square feet of treated area. Add a wetting agent to facilitate soil penetration. Reapply at 21- to 28-day intervals.
fluoxastrobin + myclobutanil DISARM M	0.5-1 fl.oz.	Apply when rings first appear and repeat 21 to 28 days later as needed in 4 gallons of water per 1,000 square feet. Use higher rate at shorter interval when disease pressure is high. May be applied to residential turf by a certified applicator.
flutolanil PROSTAR 70WDG	2.2-4.5 oz.	Apply in 10 to 30 gallons of water per 1000 square feet. If needed, make a second application at least 30 days later. Use lower rate for preventive control and higher rate for curative control of fairy ring. Core aerify before applying. Irrigate before and after applying. See label for additional instructions.
metconazole TOURNEY	0.37 fl.oz.	Apply when rings first appear and repeat 21 days later as needed in 4 gallons of water per 1,000 square feet of turf. Aerify or tank mix with wetting agent to iprove soil penetration.
polyoxin D zinc salt AFFIRM WDG ENDORSE WP VERANDA T WDG	 0.9 oz. 0.25 lb. 1 oz.	**Residential Lawns, Golf Courses, Commercial and Institutional Lawns:** Make two to three applications and then water in with 0.5 to 1 inch of water.
pyraclostrobin INSIGNIA	0.9 oz.	Apply immediately after fairy ring appears. Repeat applications at 28-day intervals as needed. Apply in 2 to 4 gallons of water per 1000 square feet. See label for resistance management recommendations.
INSIGNIA INTRINSIC	0.7 fl.oz.	Apply shortly after appearance of fairy ring. Use 2 to 4 gallons of water per 1000 square feet of turf treated. Ring symptoms should disappear in two to three weeks. Reapply 28 days after first treatment as needed. Irrigate immediately after application of Insignia Intrinsic.
pyraclostrobin + boscalid HONOR INTRINSIC	1.1 oz.	**Golf Course Turf:** Apply shortly after appearance of fairy ring. Use 2 to 4 gallons of water per 1000 square feet of turf treated. Ring symptoms should disappear in two to three weeks. Reapply 28 days after first treatment as needed. Irrigate immediately after application of Honor Intrinsic.
pyraclostrobin + triticonazole PILLAR G PILLAR G INTRINSIC	3 lb.	Use preventatively. Begin applications when conditions favor disease and prior to disease symptoms development. Repeat at 14- to 28-day intervals. Do not make more than five applications of Pillar G per year.
tebuconazole TORQUE	0.6-1.1 fl.oz.	**Preventative on Cool Season Turf:** Apply before symptoms appear in spring starting when 5 day average soil temperatures at 2 inches reach 55 to 60°F in 1.5 to 3 gallons of water per 1,000 square feet of turf and irrigate within 4 hours. Only use a wetting agent as required for the penetration of active hydrophobic soil conditions. Make a second application when the 5 day average soil temperatures reach 65 to 70°F. Do not exceed a 21-day interval between applications. Complete green-up should occur before treatment to avoid potential growth reduction. Do not make two consecutive applications of Torque fungicide or other Group 3 triazole fungicides and alternate with another fungicide with a different mode of action whenever possible.
triticonazole TRINITY	1-2 fl.oz.	Use preventatively. Begin applications when conditions favor disease and prior to disease symptoms development. Repeat at 14- to 28-day intervals.

[1] Fungicide products are registered for use on residential lawns except as specified in comments.

Table 1. Commercial Turf and Lawns: Disease and Nematode Control (cont.)

Fungicide and Formulation	Amount to Use per 1000 sq. ft. or as Specified	Comments[1]
	GRAY LEAF SPOT	
azoxystrobin		Apply every 14 to 28 days when conditions favor disease. Use highest rate at shortest interval when disease is present. **DO NOT** apply more than six times or a total of 3.7 ounces of Heritage 50DG per year.
HERITAGE TL	1-2 fl.oz.	
HERITAGE G	4-7 oz.	
HERITAGE FUNGICIDE	0.2-0.4 oz.	
azoxystrobin + propiconazole		
HEADWAY	1.5-3 fl.oz.	Use preventively. Apply when conditions favor disease and repeat applications at 14- to 28-day intervals as needed at a rate of 2 to 4 gallons of water per 1,000 square feet of turf. Use higher rate at shorter interval when disease pressure is high.
HEADWAY G	2-4 lb.	Apply when conditions favor disease and repeat applications at 14- to 28-day intervals as needed. Alternate applications with Daconil. Use higher rate at shorter interval when disease pressure is high.
chlorothalonil		**Sod Farms, Parks:** Apply at 7- to 10-day intervals in 2 to 10 gallons of water per 1000 square feet for greens, tees, and lawns. Apply in 0.8 to 1 gallon per 1000 square feet for fairways. Use higher rate and/or shorter spray interval when disease is severe. Wait for spray to dry before mowing or irrigating turf. use on residential lawns.
DACONIL ULTREX	1.8-5 oz.	
DACONIL WEATHER STIK	2-5.5 fl.oz.	
ECHO 6 ETQ	2-3.6 fl.oz.	
LEGEND	2-3.6 fl.oz.	
MANICUR DG	1.75-6.5 oz.	
MANICUR FLOWABLE	3-11 fl.oz.	
chlorothalonil + acibenzolar S-methyl		**Preventive:** Apply before symptoms appear and when conditions favor disease. Repeat at 7- to 14-day intervals in 1 to 3 gallons of water per 1,000 square feet of turf. See label for use guidelines for golf course greens, tees, and fairways.
DACONIL ACTION	1-3.5 fl.oz.	
	4-5.4 fl.oz.	**Curative:** Repeat at 7- to 14-day intervals in 1 to 3 gallons of water per 1,000 square feet of turf. See label for use guidelines for golf course greens, tees, and fairways. Not for use in residential landscapes
chlorothalonil + azoxystrobin		Use preventatively. Begin applications when conditions favor disease and prior to disease symptoms development. Repeat at 14-day intervals.
RENOWN	2.5-4 fl.oz.	
chlorothalonil + propiconazole		
CONCERT II	3-8.5 fl.oz.	Use preventively. Apply when conditions favor disease and repeat applications at 7- to 28-day intervals as needed at a rate of 1 gallon of water per 1,000 square feed of turf. Use higher rate at shorter interval when disease pressure is high. Not for use in residential landscapes.
chlorothalonil + propiconazole + fludioxonil		Begin applications when conditions favor disease and repeat as needed every 21 to 28 days. Use higher rate at shorter interval under high disease pressure.
INSTRATA	2.75-6.0 fl.oz.	
chlorothalonil + thiophanate-methyl		**Sod Farms, Commercial and Institutional Grounds:** Apply in 2 to 4 gallons of water per 1000 square feet every 7 to 14 days as needed. See label for additional instructions.
SPECTRO 90	3.7-5.7 oz.	
TEE-1-UP	2-8 oz.	
CONSYST WDG	2-4 oz.	
fenarimol + chlorothalonil		Apply at 7- to 10-day intervals. Begin sprays when conditions favor disease.
BROADWAY 4.4F	3-9 fl.oz.	
TWO SOME 4.4F	3-9 fl.oz.	
fluoxastrobin		Begin applications when conditions favor disease and prior to disease symptoms development. Tank mix with another product labeled for gray leaf spot control.
DISARM 480SC	8-16 fl.oz.	
fluoxastrobin + chlorothalonil		Begin applications when conditions favor disease and prior to disease symptons development. Tank mix with another product labeled for gray leaf spot control.
DISARM C	3-5.9 fl.oz.	

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Table 1. Commercial Turf and Lawns: Disease and Nematode Control (cont.)

Fungicide and Formulation	Amount to Use per 1000 sq. ft. or as Specified	Comments[1]
	GRAY LEAF SPOT (cont.)	
fluoxastrobin + myclobutanil		
DISARM M	0.25-1 fl.oz.	Use preventively. Apply when conditions favor disease and repeat applications at 14- to 28-day intervals as needed. Use higher rate at shorter interval when disease pressure is high. May be applied to residential turf by a certified applicator.
fludioxonil		
MEDALLION	0.25-0.5 oz.	Begin applications before disease symptoms are seen. Repeat applications at 14-day intervals. Use higher rate when disease symptoms are seen. For best results, use as part of comprehensive preventive control program.
metconazole		
TOURNEY	0.37 fl.oz.	Apply when conditions favor disease and repeat applications at 14-day intervals as needed.
myclobutanil		
EAGLE 20EW	1.2 fl.oz.	Apply when conditions favor disease and repeat at 14-day intervals as needed.
propiconazole		
BANNER MAXX	1-2 fl.oz.	Apply at 14-day intervals when conditions favor disease. Use higher rate when disease is present. Use lower rate when tank-mixed with a contact fungicide.
BANNER MAXX II	1-2 fl.oz.	
PROPICONAZOLE PRO	1-2 fl.oz.	
PROPICONAZOLE SPC 14.3MEC	1-2 fl.oz.	
PROPENSITY 1.3ME	1-2 fl.oz.	
SPECTATOR ULTRA	1-2 fl.oz.	
STRIDER	1-2 fl.oz.	
pyraclostrobin		
INSIGNIA	0.5 - 0.9 oz.	Begin applications when conditions favor disease development and before symptoms are seen. Repeat at 14- to 28-day intervals. Apply in 2 to 4 gallons of water per 1000 square feet. See label for resistance management recommendations.
INSIGNIA INTRINSIC	0.4-0.7 fl.oz	Use preventively. Apply when conditions favor disease and repeat applications at 14- to 28-day intervals as needed. Use higher rate at shorter interval when disease pressure is high. Do not make more than three consecutive applications of Insignia Intrinsic.
pyraclostrobin + boscalid		
HONOR INTRINSIC	0.55-1.1 oz.	**Golf Course Turf:** Apply when conditions favor disease and repeat applications at 14- to 28-day intervals as needed.
pyraclostrobin + triticonazole		
PILLAR G	3 lb.	Use preventatively. Begin applications when conditions favor disease and prior to disease symptoms development. Repeat at 14- to 28-day intervals. Do not make more than five applications of Pillar G per year.
PILLAR G INTRINSIC		
tebuconazole		
CLEARSCAPE ETQ	0.6 fl.oz.	**Golf Course Turf:** Apply in 1 to 3 gallons of water per 1000 square feet when conditions in summer favor disease and before symptoms appear. Reapply after 21 days. A contact fungicide may be added to enhance disease control. Do not make two consecutive applications of Torque Fungicide or other Group 3 triazole fungicides and alternate with another fungicide with a different mode of action whenever possible.
TORQUE	0.6 fl.oz.	
triadimefon		
BAYLETON T/O	0.5-1 oz.	Apply every 14 days. Tank mix Bayleton with a contact fungicide to control moderate to severe
BAYLETON FLO	0.5-1 fl.oz.	outbreaks.
trifloxystrobin		
COMPASS 50WDG	0.15-0.2 oz.	Apply every 14 days when conditions favor disease. Repeat as needed.
	0.25 oz.	Apply every 21 days when conditions favor disease. Repeat as needed.
COMPASS G	3-4 lb.	Apply every 14 days as needed.
trifloxystrobin + triadimefon		
ARMADA 50WDG	0.6-1.2 oz.	Apply at 14- to 28-day intervals in 1 to 2 gallons of water per 1,000 square feet when conditions favor disease development. Use higher rate at shorter intervals when disease is present.
TARTAN	1-2 fl.oz.	

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Table 1. Commercial Turf and Lawns: Disease and Nematode Control (cont.)

Fungicide and Formulation	Amount to Use per 1000 sq. ft. or as Specified	Comments[1]
GRAY LEAF SPOT (cont.)		
triticonazole + chlorothalonil		Begin fungicide applications preventively when conditions are favorable for disease development. Continue as needed at 14- to 28-day intervals. Under conditions for severe disease or for an early curative application, use the higher rate and shorter interval.
RESERVE	3.2-4.5 fl.oz.	
HELMINTHOSPORIUM LEAF SPOT AND CROWN ROT (MELTING-OUT)		
azoxystrobin		Apply at 14- to 21-day intervals when conditions favor disease. Use highest rate at the shortest interval when disease is present. **DO NOT** apply more than six times per year.
HERITAGE TL	1-2 fl.oz.	
HERITAGE G	2-4 oz.	
HERITAGE FUNGICIDE	0.2-0.4 oz.	
azoxystrobin + propiconazole		Use preventively. Apply when conditions favor disease and repeat applications at 14- to 28-day intervals as needed at a rate of 2 to 4 gallons of water per 1,000 square feet of turf. Use higher rate at shorter interval when disease pressure is high.
HEADWAY	1.5-3 fl.oz.	
HEADWAY G	2-4 lb.	Apply when conditions favor disease and repeat applications at 14- to 28-day intervals as needed. Alternate applications with Daconil. Use higher rate at shorter interval when risk of diseaase is high.
chlorothalonil		**Tees, Greens, and Fairways:** Apply at 7- to 10-day intervals in 2 to 10 gallons of water per 1000 square feet for tees, greens, and lawns. Apply in 0.8 to 1 gallon per 1000 square feet for fairways. Use higher rate and/or shorter spray intervals when disease is severe. Wait for spray to dry before mowing or irrigating turf. **DO NOT** use on residential lawns.
DACONIL ULTREX	1.8-5 oz.	
DACONIL WEATHER STIK	2-5.5 fl.oz.	
ECHO 6 ETQ	2-3.6 fl.oz.	
LEGEND	2-3.6 fl.oz.	
MANICUR DG	1.75-6.5 oz.	
MANICUR FLOWABLE	3-11 fl.oz.	
chlorothalonil		**Golf Course Fairways, Sod Farms, Athletic Fields, Parks:** Apply in 30 to 40 gallons per acre when conditions favor disease and repeat as long as conditions persist. Use higher rate and shorter intervals when disease is severe.
DACONIL ULTREX	5-13.5 lb./A	
DACONIL WEATHER STIK	5.5-15.1 pt./A	
ECHO 90DF	4.5-8 lb./A	
chlorothalonil + acibenzolar S-methyl		**Preventive:** Apply before symptoms appear and when conditions favor disease. Repeat at 7- to 14-day intervals in 1 to 3 gallons of water per 1,000 square feet of turf. See label for use guidelines for golf course greens, tees, and fairways.
DACONIL ACTION	2-3.5 fl.oz.	
	4-5.4 fl.oz.	**Curative:** Repeat at 7- to 14-day intervals in 1 to 3 gallons of water per 1,000 square feet of turf. See label for use guidelines for golf course greens, tees, and fairways. Not for use in residential landscapes
chlorothalonil + azoxystrobin		Use preventatively. Begin applications when conditions favor disease and prior to disease symptoms development. Repeat at 14-day intervals.
RENOWN	2.5-4 fl.oz.	
chlorothalonil + propiconazole		**Golf Courses and Sod Farms:** Apply at 14-day intervals in a minimum of 0.3 gallons of water per 1,000 square feet when conditions favor disease development.
ECHO/PROPICONAZOLE EC CO-PACK	2.0 + 0.36 fl.oz.	
CONCERT II	3.5-8.5 fl.oz.	Use preventively. Apply when conditions favor disease and repeat applications at 7- to 28-day intervals as needed at a rate of 1 gallon of water per 1,000 square feed of turf. Use higher rate at shorter interval when disease pressure is high. Not for use in residential landscapes.
chlorothalonil + propiconazole + fludioxonil		Begin applications when conditions favor disease and repeat as needed every 21 to 28 days. Use higher rate at shorter interval under high disease pressure.
INSTRATA	2.75-6.0 fl.oz.	
chlorothalonil + tebuconazole		**Golf Course Turf:** Apply when conditions favor disease and repeat at 28-day intervals as needed in 1 to 3 gallons of water per 1000 square feet. Up to six applications may be made per year.
E-SCAPE ETQ	2.6 fl.oz.	

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Table 1. Commercial Turf and Lawns: Disease and Nematode Control (cont.)

Fungicide and Formulation	Amount to Use per 1000 sq. ft. or as Specified	Comments[1]
HELMINTHOSPORIUM LEAF SPOT AND CROWN ROT (MELTING-OUT) (cont.)		
chlorothalonil + thiophanate-methyl		**Golf Courses, Sod Farms, Commercial and Institutional Grounds**: Apply in 2 to 4 gallons of water per 1000 square feet every 7 to 14 days as needed. See label for additional instructions.
SPECTRO 90	2-5.7 oz.	
TEE-1-UP	2-8 oz.	
CONSYST WDG	2-4 oz.	
fenarimol + chlorothalonil		
BROADWAY 4.4F	2-4 fl.oz.	Apply on a 2- to 3-week spray schedule.
TWO SOME 4.4F	2-4 fl.oz.	
fluoxastrobin		Begin applications when conditions favor disease and prior to disease symptoms development. Repeat as needed at 14- to 21-day intervals.
DISARM 480SC	8-16 fl.oz.	
fluoxastrobin +chlorothalonil		Begin applications when conditions favor disease and repeat as needed every 14 to 28 days. Apply in 1 to 4 gallons per 1,000 square feet of turf area.
DISARM C	3-5.5 fl.oz.	
fluoxastrobin + myclobutanil		Use preventively. Apply when conditions favor disease and repeat applications at 14- to 28-day intervals as needed. Use higher rate at shorter interval when disease pressure is high. May be applied to residential turf by a certified applicator.
DISARM M	0.25-1 fl.oz.	
fludioxonil		Begin applications before disease symptoms are seen. Repeat applications at 14- to 21-day intervals. Use higher rate at shorter interval when disease symptoms are seen. For best results, use as part of comprehensive preventive control program.
MEDALLION	0.25-0.5 oz.	
iprodione		**Golf Courses, Sod Farms, and Institutional Turf:** Apply at 14- to 28-day intervals in 2 to 10 gallons of water per 1000 square feet. Use higher rate and/or shorter intervals when disease is severe. Make no more than six applications per year. Residential use is prohibited.
IPRODIONE PRO 2SE	2-4 fl.oz.	
IPRODIONE SPC FUNGICIDE	2-4 fl.oz.	
CHIPCO 26019 50W	1.5-2 oz.	
26GT FLO	3-4 fl.oz.	
FUNGICIDE X	2.4-4.8 lb.	Apply Fungicide X to moist or dry foliage when weather conditions favor disease. Repeat at 14-day intervals as needed. Make no more than six applications per year. See label for accurate spreader settings. For use on golf courses **ONLY**.
iprodione + thiophanate-methyl		**Golf and Institutional Turf:** Apply when conditions favor disease and repeat at 14- to 21-day intervals as needed. Use higher rate at shorter interval when disease pressure is high. Not for home lawn use.
26/36 FUNGICIDE	2-4 fl.oz.	
iprodione + trifloxystrobin		Apply when conditions favor disease and repeat applications on greens at 14- to 21-day intervals as needed. Application interval for fairways and other turfs is 14 to 28 days. Use lower application rates on fairways.
INTERFACE	3-5 fl.oz.	
mancozeb		Apply in 3 to 5 gallons per 1000 square feet at 7- to 14-day intervals when disease threatens. Use higher rate and/or shorter spray intervals when disease is severe. For professional use only.
DITHANE T/O RAINSHIELD	4 oz.	
4 FLOWABLE MANCOZEB	6.4 fl.oz.	
FORE 80W	4 oz.	
MANCOZEB DG	4 oz.	
PROTECT T/O	4 oz.	
myclobutanil		Apply 2 to 3 gallons of spray solution per 1000 square feet of turf every 14 to 21 days when conditions permit.
EAGLE 20EW	1.2 fl.oz.	
polyoxin D zinc salt		**Residential Lawns, Golf Courses, Commercial and Institutional Lawns:** Begin applications when conditions favor disease development and before symptoms are seen. Repeat applications at 7- to 14-day intervals. Shorten the application interval when disease is present. Apply in at least 1 gallon of water per 1000 square feet. See label for resistance management recommendations and list of target turfgrasses.
AFFIRM WDG	0.9 oz.	
ENDORSE WP	0.25 lb.	

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Table 1. Commercial Turf and Lawns: Disease and Nematode Control (cont.)

Fungicide and Formulation	Amount to Use per 1000 sq. ft. or as Specified	Comments[1]
HELMINTHOSPORIUM LEAF SPOT AND CROWN ROT (MELTING-OUT) (cont.)		
propiconazole		Apply at 14-day intervals to reduce severity of leafspot under light to moderate disease pressure. Use lower rate when tank-mixed with a contact fungicide.
BANNER MAXX	1-2 fl.oz.	
BANNER MAXX II	1-2 fl.oz.	
PROPICONAZOLE PRO	1-2 fl.oz.	
PROPICONAZOLE SPC 14.3MEC	1-2 fl.oz.	
PROPENSITY 1.3ME	1-2 fl.oz.	
SPECTATOR ULTRA	1-4 fl.oz.	
STRIDER	1-4 fl.oz.	
PROPHESY 0.7G	2.5 lb.	For control of light to moderate disease outbreaks. Apply at 14-day intervals. See label for spreader settings.
pyraclostrobin		Begin applications when conditions favor disease development and before symptoms are seen. Repeat at 14- to 28-day intervals. Apply in 2 to 4 gallons of water per 1000 square feet. See label for resistance management recommendations.
INSIGNIA	0.5-0.9 oz.	
INSIGNIA INTRINSIC	0.4-0.7 fl.oz.	Use preventively. Apply when conditions favor disease and repeat applications at 14- to 28-day intervals as needed. Use higher rate at shorter interval when disease pressure is high. Do not make more than three consecutive applications of Insignia Instrinsic.
pyraclostrobin + boscalid		**Golf Course Turf:** Apply when conditions favor disease and repeat applications at 14- to 28-day intervals as needed.
HONOR INTRINSIC	0.55-1.1 oz.	
pyraclostrobin + triticonazole		Use preventatively. Begin applications when conditions favor disease and prior to disease symptoms development. Repeat at 14- to 28-day intervals. Do not make more than five applications of Pillar G per year.
PILLAR G	3 lb.	
PILLAR G INTRINSIC		
thiophanate-methyl + iprodione		**Golf Courses, Sod Farms, and Institutional Turf:** Apply at 1- to 2-week intervals in 4 to 7 gallons of water per 1000 square feet. Use higher rate and/or shorter intervals when disease appears. **DO NOT** water or mow within 24 hours of application.
FLUID FUNGICIDE	1.1-2.1 fl.oz.	
26/36 FUNGICIDE	2-4 fl.oz.	
TWO SOME	1-4 fl.oz.	
trifloxystrobin		Apply every 14 days when conditions favor disease. High rate may be applied at 21-day intervals. Repeat as needed.
COMPASS 50WDG	0.15-0.25 oz.	
COMPASS G	2-5 lb.	
trifloxystrobin + triadimefon		Apply at 14- to 28-day intervals in 1 to 2 gallons of water per 1,000 square feet when conditions favor disease development. Use higher rate at shorter intervals when disease is present.
ARMADA 50WDG	0.6-1.2 oz.	
TARTAN	1-2 fl.oz.	
triticonazole		Apply preventively when conditions are favorable for disease development. Continue as needed at 14- to 28-day intervals. Under conditions for severe disease or for an early curative application, apply the higher rate at a shorter interval.
TRINITY	0.5-2 fl.oz.	
TRITON 70WDG	0.15-0.6 oz.	
triticonazole + chlorothalonil		Begin fungicide applications preventively when conditions are favorable for disease development. Continue as needed at 14- to 28-day intervals. Under conditions for severe disease or for an early curative application, use the higher rate and shorter interval.
RESERVE	3.2-4.5 fl.oz.	
NEMATODES		
1,3 dichloropropene		Curfew is a postplant fumigant for control of nematodes on bentgrass and bermudagrass greens and tees. Custom application only.
CURFEW	—	
abamectin		Apply in early morning or irrigate area with 0.1 inch water prior to treatment. Make three to four consecutive applications at 14- to 21-day intervals in 2 gallons of water per 1000 square feet. Immediately apply at least 0.1 inch of water. Best results can be achieved when treatments are started in the spring. Tank mix with a non-ionic surfactant. For best results tank mix with recommended rate of Heritage TL or Heritage WG fungicide.
AVID 0.15EC	1.3 fl.oz. (57 fl.oz./A)	

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Table 1. Commercial Turf and Lawns: Disease and Nematode Control (cont.)

Fungicide and Formulation	Amount to Use per 1000 sq. ft. or as Specified	Comments[1]
NEMATODES (cont.)		
Bacillus firmus (strain I-1582)		
NORTICA	0.7-2.3 lb.	Apply to moist soil by spraying or drenching every 3 months as needed. If product is applied prior to planting, maintain moist soil with daily irrigation until planting. It is preferable to apply product with irrigation at the beginning of the irrigation cycle and after foliar or drench treatment. When drenching, use conventional equipment. Following drenching, the treated area must be irrigated with adequate water to moisten the entire root system so that product will not damage plant stand. Apply in early spring for best results.
chitin and other organic nitrogen sources		
CLANDOSAN 618 25G	45-140 lb. (1-3 T./A)	Irrigate with 0.5 inch of water immediately after treatment with all products to avoid foliar burn. Clandosan contains 10.4 percent urea.
fermented solutes of *Myrothecium verrucaria*		
DiTERA	0.3-2.3 lb.	Apply as needed to suppress nematodes. May be applied as a dry product or in enough water to ensure movement of product with the root system. See label for mixing instructions. Efficacy has been questioned.
furfural		
MULTIGUARD PROTECT	0.126-0.184 gal.	Apply up to six applications annually every 14 to 28 days. Dilute product 1:9 with water. Within 15 minutes of application, irrigate product into the soil to a depth of 6 inches with overhead sprinklers in 0.25 to 0.5 inch of water. **NOTE**: The entire golf course must be closed during treatment. See label for additional use restrictions.
Pasteuria usage		
ECONEM	2-10 lb.	Apply prior to, during, and after turf green-up in 3- to 4-week intervals using calibrated, standard granule application equipment such as a drop spreader. For best control, a minimum of three sequential applications is required. For warm-season grasses, these green-up periods may be in early spring and again in later summer. Apply 0.1 inch water immediately following all applications. Use the higher application rates on sites with high sting nematode populations (more than 60 sting nematodes per 100 cubic centimeters of soil), on areas with extensive nematode damage such as bare turf areas, on dying turf areas, or on turf with root systems less than 0.8 to 1.2 inches in length.
PYTHIUM BLIGHT		
aluminum tris		
SIGNATURE	4-8 fl.oz.	Apply at 14- to 21-day intervals as a preventive treatment in 1 to 5 gallons of water per 1000 square feet of turf when conditions favor disease. Do not mow after application.
azoxystrobin		
HERITAGE TL	2 fl.oz.	Apply at 14- to 28-day intervals when conditions favor disease. Use highest rate at the shortest interval when disease is present. **DO NOT** apply more than six times per year. See label for resistance management guidelines.
HERITAGE G	2-4 oz.	
HERITAGE FUNGICIDE	0.4 oz.	
azoxystrobin + propiconazole		
HEADWAY	3 fl.oz.	Use preventively. Apply when conditions favor disease and repeat applications at 14- to 28-day intervals as needed at a rate of 2 to 4 gallons of water per 1,000 square feet of turf.
chloroneb		Apply at 5- to 10-day intervals when conditions favor disease.
FUNGICIDE V	4 oz.	
TEREMEC SP 65W	4 oz.	
chloroneb + thiophanate-methyl		
FUNGICIDE IX	1.9-5.8 lb.	Apply to wet foliage at 5- to 7-day intervals when conditions favor disease. Increase rate when symptoms appear. See label for spreader settings.
chlorothalonil + acibenzolar S-methyl		
DACONIL ACTION	2-3.5 fl.oz.	**For Suppression of Pythium Blight, Preventive:** Apply before symptoms appear and when conditions favor disease. Repeat at 7- to 21-day intervals in 1 gallon of water per 1,000 square feet of turf. See label for use guidelines for golf course greens, tees, and fairways. Not for use in residential landscapes.

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Table 1. Commercial Turf and Lawns: Disease and Nematode Control (cont.)

Fungicide and Formulation	Amount to Use per 1000 sq. ft. or as Specified	Comments[1]
PYTHIUM BLIGHT (cont.)		
chlorothalonil + azoxystrobin		Use preventatively. Begin applications when conditions favor disease and prior to disease symptoms development. Repeat at 10-day intervals.
RENOWN	4 fl.oz.	
cyazofamid		**Established Turf:** Apply at 14- to 21-day intervals as preventive treatment in 2 to 4 gallons of water per 1000 square feet of turf when conditions favor disease but before symptoms appear. When conditions favor disease for prolonged periods, alternate applications of Segway with mefenozam or fosetyl-Al (Group 21 fungicide).
SEGWAY	0.45-0.9 fl.oz.	
	0.45 fl.oz.	**Newly Seeded Turf:** Apply immediately after seeding in 2 to 4 gallons of water per 1000 square feet of turf.
etridiazole		**Established Turf:** Apply at 5- to 10-day intervals in 5 gallons of water per 1000 square feet when conditions favor disease.
KOBAN 30W	2-4.5 oz.	
	4.5 oz.	**Newly Seeded Turf:** Apply in 5 to 10 gallons of water per 1000 square feet immediately after seeding and irrigate promptly. Repeat application 5 to 7 days later with recommended fungicide to maintain control. For overseeded cool-season grasses.
TERRAZOLE 35W	2-4 oz.	**Golf Course Greens and Tees:** Apply in 5 gallons of water per 1000 square feet. Begin at first sign of disease and repeat every 5 to 10 days when conditions favor disease.
fluoxastrobin		Begin applications when conditions favor disease and before symptoms appear. Repeat applications as needed on a 14- to 28-day schedule. Apply at 21-day intervals and alternate with another fungicide with a differnt mode of action for resistance management.
DISARM 480SC	12-16 fl.oz.	
fluoxastrobin + chlorothalonil		**Use as a preventive treatment.** Begin applications when conditions favor disease and repeat as needed every 14 to 28 days. Apply in 1 to 4 gallons per 1,000 square feet of turf area. When disease is active, tank mix Disarm C with another fungicide registered for pythium contol.
DISARM C	3-5.9 fl.oz.	
fluoxastrobin + myclobutanil		Use preventatively. Begin applications when conditions favor disease and prior to disease symptoms development. Repeat at 14-day intervals. When conditions favor heavy disease pressure, tank mix with another fungicide registered for Pythium blight control. Also controls Pythium root dysfunction.
DISARM M	0.5-1.0 fl.oz.	
fluopicolide + propamocarb		Apply when conditions favor disease and reapply after 14 days as needed. Maximum of two application fo Stellar per year. For golf course and sod farms.
STELLAR	1.2 fl.oz.	
fosetyl-Al		Apply when conditions favor disease at 14- to 21-day intervals in 1 to 5 gallons of water per 1000 square feet. Use higher rate and/or shorter intervals when disease is present. **DO NOT** mow or water until foliage dries. **Summer Stress Complex:** Apply tank-mix Aliette T/O with 8 ounces of Chipco 26019, Chipco Flo, Daconil Ultrex, or Dithane/Fore WP per 1000 square feet at 14-day intervals. Fosethyl-Al is not compatible with flowable formulations of Daconil 2787 (4F or 6F) or Fore Fungicide.
ALIETTE T/O	4 oz.	
PRODIGY (SIGNATURE DG)	4 oz.	

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Table 1. Commercial Turf and Lawns: Disease and Nematode Control (cont.)

Fungicide and Formulation	Amount to Use per 1000 sq. ft. or as Specified	Comments[1]
	PYTHIUM BLIGHT (cont.)	
mefenoxam [2]		**Established Turf:** Apply at 10- to 14-day intervals. Use higher rate at shorter intervals when disease is severe.
PYTHIUM CONTROL	0.8-1.5 lb.	
MEFENOXAM 2AQ	0.5-1 fl.oz.	**Newly Seeded Turf:** Apply immediately after seeding and repeat treatments when conditions favor disease.
SUBDUE MAXX	0.5-1 fl.oz.	**Established Turf:** Apply at 10- to 14-day intervals in 1 to 5 gallons of water per 1000 square feet when conditions favor disease. Use higher rate and/or shorter interval when disease is severe. Tank-mix with Fore/Dithane T/O at 8 ounces per 1000 square feet to improve performance. See label for mixing directions.
	0.5-1 fl.oz.	**Newly Seeded Turf:** Apply in 1 to 5 gallons of water per 1000 square feet immediately after seeding; then irrigate with 0.25 to 0.5 inch of water. Repeat at 7- to 14-day intervals if conditions favor disease. Tank-mixing with Fore/Dithane T/O at 8 ounces per 1000 square feet will improve performance.
SUBDUE GR	5-25 oz.	**Established Turf:** Apply uniformly as a preventive treatment. Repeat every 10 to 14 days when conditions favor disease. Irrigate at once with 0.25 to 0.5 inch of water.
		Newly Seeded Turf: Apply uniformly after seeding and irrigate with 0.25 to 0.5 inch of water. If needed, repeat at 7- to 14-day intervals.
phosphorous acid salts		**Golf Courses, Sod Farms, Commercial and Institutional Turf:** Apply in 1 to 5 gallons of water per 1000 square feet at 7- to 14-day intervals when conditions favor disease.
ALLUDE	5-10 fl.oz.	
MAGELLAN	4.1 fl.oz.	
propamocarb		**Established and Overseeded Sports and Commerical Turf:** Apply in 2 to 5 gallons of water per 1000 square feet as a preventive treatment when conditions favor disease. Repeat applications at 7- to 21-day intervals according to conditions. Under severe conditions, use the highest rate at the shortest interval.
BANOL 66.5L	1.33-4 fl.oz.	
pyraclostrobin		Begin applications when conditions favor disease development and before symptoms are seen. Repeat at 10- to 14-day intervals. Apply in 2 to 4 gallons of water per 1000 square feet. To suppress root rot, lightly irrigate after application. Under severe disease, apply mefenoxam or etridizole followed by Insignia. See label for resistance management recommendations.
INSIGNIA	0.9 oz.	
INSIGNIA INTRINSIC	0.4-0.7 fl.oz.	Use preventively. Apply when conditions favor disease and repeat applications at 14- to 28-day intervals as needed. Use higher rate at shorter interval when disease pressure is high. Do not make more than three consecutive applications of Insignia Intrinsic.
pyraclostrobin + boscalid		**Golf Course Turf:** Apply when conditions favor disease and before symptoms appear. Repeat applications at 14- to 28-day intervals as needed. Will not control active Pythium blight.
HONOR INTRINSIC	1.1 oz.	
pyraclostrobin + triticonazole		Use preventatively. Begin applications when conditions favor disease and prior to disease symptoms development. Repeat at 14- to 28-day intervals. Do not make more than five applications of Pillar G per year. Also labeled for control of Pythium root dysfunction.
PILLAR G	3 lb.	
PILLAR G INTRINSIC		
	RUST	
azoxystrobin		Apply at 14- to 21-day intervals when conditions favor disease.
HERITAGE TL	1-2 fl.oz.	
HERITAGE G	2-4 oz.	
HERITIAGE FUNGICIDE	0.4 oz.	

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[2] Caution: To reduce risk of resistance, make no more than three applications of mefenoxam per year and alternate mefenoxam with another systemic fungicide.

Table 1. Commercial Turf and Lawns: Disease and Nematode Control (cont.)

Fungicide and Formulation	Amount to Use per 1000 sq. ft. or as Specified	Comments[1]
RUST (cont.)		
azoxystrobin + propiconazole		
HEADWAY	1.5-3 fl.oz.	Use preventively. Apply when conditions favor disease and repeat applications at 14- to 28-day intervals as needed at a rate of 2 to 4 gallons of water per 1,000 square feet of turf. Use higher rate at shorter interval when disease pressure is high.
HEADWAY G	2-4 lb.	Apply when conditions favor disease and repeat applications at 14- to 28-day intervals as needed. Alternate applications with Daconil. Use higher rate at shorter interval when disease pressure is high.
chlorothalonil + azoxystrobin		
RENOWN	2.5-4 fl.oz.	Use preventatively. Begin applications when conditions favor disease and prior to disease symptoms development. Repeat at 14-day intervals.
chlorothalonil + propiconazole		
CONCERT II	4.5-8.5 fl.oz.	Use preventively. Apply when conditions favor disease and repeat applications at 14- to 21-day intervals as needed at a rate of 1 gallon of water per 1,000 square feed of turf. Use higher rate at shorter interval when disease pressure is high. Not for use in residential landscapes.
fluoxastrobin + chlorothalonil		
DISARM C	3-5.9 fl.oz.	Apply when conditions favor disease or at first sign of symptoms. Repeat as needed on a 14- to 28-day schedule.
fluoxastrobin + myclobutanil		
DISARM M	0.25-1 fl.oz.	Use preventively. Apply when conditions favor disease and repeat applications at 14- to 28-day intervals as needed. Use higher rate at shorter interval when disease pressure is high. May be applied to residential turf by a certified applicator.
iprodione + trifloxystrobin		
INTERFACE	3-5 fl.oz.	Apply when conditions favor disease and repeat applications on greens at 14- to 28-day intervals as needed. Application interval for fairways and other turfs is 14 to 28 days. Use lower application rates on fairways.
mancozeb		Apply at 7- to 14-day intervals in 3 to 5 gallons of water per 1000 square feet when disease threatens. Use higher rate and/or shorter intervals when disease is severe. For professional use only.
DITHANE T/O RAINSHIELD	4 oz.	
4 FLOWABLE MANCOZEB	6.4 fl.oz.	
FORE 80W	4 oz.	
MANCOZEB DG	4 oz.	
PROTECT T/O	4 oz.	
metconazole		Apply when conditions favor disease and repeat applications at 14-day intervals as needed.
TOURNEY	0.37 fl.oz.	
myclobutanil		Apply 2 to 3 gallons of spray solution per 1000 square feet of turf at 14- to 28-day intervals when conditions favor disease.
EAGLE 20EW	1.2 fl.oz.	
propiconazole		Apply in 2 to 5 gallons of water per 1000 square feet before symptoms appear. Repeat at 14- to 28-day intervals as needed.
BANNER MAXX	1-2 fl.oz.	
BANNER MAXX II	1-2 fl.oz.	
PROPICONAZOLE PRO	1-2 fl.oz.	
PROPENSITY 1.3ME	1-2 fl.oz.	
SPECTATOR ULTRA	1-2 fl.oz.	
STRIDER	1-2 fl.oz.	
pyraclostrobin		
INSIGNIA	0.5-0.9 oz.	Begin applications when conditions favor disease development and before symptoms are seen. Repeat at 14- to 28-day intervals. Apply in 2 to 4 gallons of water per 1000 square feet. See label for resistance management recommendations.
INSIGNIA INTRINSIC	0.4-0.7 fl.oz.	Use preventively. Apply when conditions favor disease and repeat applications at 14- to 28-day intervals as needed. Use higher rate at shorter interval when disease pressure is high. Do not make more than three consecutive applications of Insignia Intrinsic.
pyraclostrobin + boscalid		
HONOR INTRINSIC	0.55-1.1 oz.	**Golf Course Turf:** Apply when conditions favor disease and repeat applications at 14- to 28-day intervals as needed.

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Table 1. Commercial Turf and Lawns: Disease and Nematode Control (cont.)

Fungicide and Formulation	Amount to Use per 1000 sq. ft. or as Specified	Comments[1]
RUST (cont.)		
pyraclostrobin + triticonazole PILLAR G PILLAR G INTRINSIC	3 lb.	Use preventatively. Begin applications when conditions favor disease and prior to disease symptoms development. Repeat at 14- to 28-day intervals. Do not make more than five applications of Pillar G per year.
tebuconazole CLEARSCAPE ETQ TORQUE	0.6 fl.oz. 0.6 fl.oz.	**Golf Course Turf:** Apply in 1 to 3 gallons of water per 1,000 square feet when conditions favor disease and before symptoms appear. Alternate applications of Torque with another fungicide with a different mode of action. A second application may be made after 21 days. Torque is a Group 3 triazole fungicide. Do not make two consecutive applications of Torque Fungicide or other Group 3 triazole fungicides and alternate with another fungicide with a different mode of action whenever possible.
triadimefon BAYLETON T/O BAYLETON FLO	0.5-1 oz. 0.5-1 fl.oz.	Apply at 15- to 30-day intervals in 2 to 4 gallons of water per 1000 square feet when conditions favor disease. Use high rate once disease appears and shorten spray intervals; then return to original spray program. Mow and water after residue dries.
trifloxystrobin COMPASS 50WDG COMPASS G	0.1-0.15 oz. 0.2-0.25 oz. 2-5 lb.	Apply at 14-day intervals as needed. Apply at 21-day intervals as needed. Apply at 14- to 21-day intervals.
trifloxystrobin + triadimefon ARMADA 50WDG	0.6-1.2 oz.	Apply at 14- to 28-day intervals in 1 to 2 gallons of water per 1,000 square feet when conditions favor disease development. Use higher rate at shorter intervals when disease is present.
triticonazole TRINITY TRITON FLO TRITON 70WDG	0.5-1 fl.oz. 0.28-0.55 fl.oz 0.15-0.3 oz.	Apply preventively when conditions are favorable for disease development. Continue as needed at 14- to 28-day intervals. Under conditions for severe disease or for an early curative application, apply the higher rate at a shorter interval.
triticonazole + chlorothalonil RESERVE	3.2-4.5 fl.oz.	Begin fungicide applications preventively when conditions are favorable for disease development. Continue as needed at 14- to 28-day intervals. Under conditions for severe disease or for an early curative application, use the higher rate and shorter interval.
SPRING DEAD SPOT (SDS)		
azoxystrobin HERITAGE TL HERITAGE FUNGICIDE	2 fl.oz. 0.4 oz.	Apply once or twice in late fall or when conditions favor disease. Apply at 28-day intervals. **DO NOT** apply more than six times per year.
azoxystrobin + propiconazole HEADWAY	3 fl.oz.	Apply once or twice in late summer to early fall to previously damaged turf. Reapply after 14- to 28-day in 2 to 4 gallons of water per 1,000 square feet of turf.
HEADWAY G	2-4 lb.	Apply once or twice in late summer to early fall to previously damaged turf. Reapply after 14 to 28 days. Irrigate with 0.5 inch of water within 24 hours of application.
chlorothalonil + tebuconazole E-SCAPE ETQ	2.6 fl.oz.	**Golf Course Turf:** Apply in fall as soil temperature reaches 65°F and again in the spring under the same conditions. Apply 0.25 to 0.5 inch of water after application. Aerify or verticut prior to application. Combine application program with appropriate management practices.
fenarimol RUBIGAN AS	4-6 fl.oz.	Make one application of 4 fluid ounces per 1000 square feet in September or October or use 6 fluid ounces in November. Use enough water for uniform coverage. Will reduce annual bluegrass stands at all SDS control rates. May interfere with establishment of overseeded ryegrass.
fluoxastrobin DISARM 480SC	16 fl.oz.	Make one to two applications approximately 1 to 2 months prior to bermudagrass dormancy begins in the fall. Aerify before application and apply 0.25 to 0.5 inch of water after applicaiton. not for home lawn use.

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Table 1. Commercial Turf and Lawns: Disease and Nematode Control (cont.)

Fungicide and Formulation	Amount to Use per 1000 sq. ft. or as Specified	Comments[1]
SPRING DEAD SPOT (SDS) (cont.)		
fluoxastrobin + chlorothalonil		Make one to two applications before bermudagrass dormancy begins in fall. Aerify before application and apply 0.25 to 0.5 inch of water after application. Not for home lawn use..
DISARM C	5.9 oz.	
fluoxastrobin + myclobutanil		Use preventively. Apply in early fall. Make a second application 14 to 28 days later as needed before bermudagrass dormancy. Water in with 0.25 to 0.5 inch of water immediately after application. Use higher rate at shorter interval on turf previously damaged by spring dead spot. May be applied to residential turf by certified applicator.
DISARM M	0.5-1 fl.oz.	
myclobutanil		Make two to three monthly applications beginning in August. Use at least 2 to 3 gallons of spray volume per 1000 square feet.
EAGLE 20EW	2-4 fl.oz.	
propiconazole		Make one to three applications at 30-day intervals beginning in August.
BANNER MAXX	4 fl.oz.	
BANNER MAXX II	1-2 fl.oz.	
PROPICONAZOLE PRO	4 fl.oz.	
PROPICONAZOLE SPC 14.3MEC	4 fl.oz.	
PROPENSITY 1.3ME	4 fl.oz.	
SPECTATOR ULTRA	4 fl.oz.	
STRIDER	4 fl.oz	
PROPHESY 0.7G	5.0 lb.	Follow one or two fall applications with one or two spring applications. See label for spreader settings.
tebuconazole		**Golf Course Turf:** Apply in 1 to 3 gallons of water per 1000 square feet in fall when soil temperatures reach 65°F and before symptoms appear. Repeat application at greenup in early spring. Irrigate immediately after application to redistribute fungicide into root zone. Initiate cultural practices to help control disease.
CLEARSCAPE ETQ	0.6 fl.oz.	
TORQUE	0.6 fl.oz.	
thiophanate-methyl		Apply before turf growth stops and make a second application in the spring. For curative control, apply high rate every 7 to 14 days beginning when disease first appears.
3336 4.5F	4-8 fl.oz.	
3336 50W	4-8 oz.	
3336 G	6-12 lb.	
SUMMER STRESS		
triticonazole		Begin applications prior to the onset of conditions for abiotic stress to reduce symptoms of summer stress/decline. Continue as needed on a 14- to 28-day interval. Tank mix Chipco Signature to improve the relief in symptoms on turf under moderate to severe stress.
TRINITY	0.5-1.0 fl.oz.	
TRITON FLO	0.55-1.1 fl.oz	
TRITON 70WDG	0.15-0.6 oz.	
TAKE-ALL PATCH, TAKE-ALL ROOT ROT, BERMUDAGRASS DECLINE		
azoxystrobin		Make two applications at 28-day intervals in the spring and in the fall. Also controls Zoysia Patch caused by *Gaeumannomyces incrustans*. **DO NOT** apply more than six times per year.
HERITAGE 50W	2 fl.oz.	
HERITAGE G	2-4 oz.	
HERITAGE FUNGICIDE	0.4 oz.	
azoxystrobin + propiconazole		Apply once or twice in early spring before disease development occurs. Reapply after 14- to 28-day in 2 to 4 gallons of water per 1,000 square feet of turf.
HEADWAY	3 fl.oz.	
HEADWAY G	3.5-4 lb.	Apply twice at 14- to 28-day intervals in spring and again in fall. Irrigate with 0.5 inch of water within 24 hours of application.
chlorothalonil + azoxystrobin		Use preventatively in fall and spring. Apply when conditions favor disease and prior to disease symptoms development. Repeat after 30 days.
RENOWN	4 fl.oz.	

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Table 1. Commercial Turf and Lawns: Disease and Nematode Control (cont.)

Fungicide and Formulation	Amount to Use per 1000 sq. ft. or as Specified	Comments[1]
TAKE-ALL PATCH, TAKE-ALL ROOT ROT, BERMUDAGRASS DECLINE (cont.)		
chlorothalonil + propiconazole		
CONCERT II	8.5 fl.oz.	Use preventively. Make one or two applications in September and October 14 days apart followed by one or two applications in April and May 14 days apart. Apply in 1 gallon of water per 1,000 square feet of turf. Water in with 0.25 to 0.5 inch of water after application. Use higher rate at shorter interval when disease pressure is high. Not for use in residential landscapes.
chlorothalonil + tebuconazole		
E-SCAPE ETQ	2.6 fl.oz.	**Golf Course Turf:** Apply in fall at soil temperatures between 55 and 65°F and again in the spring under the same conditions. Apply 0.25 to 0.5 inch of water after application. Aerify or verticut prior to application. Combine application program with appropriate management practices.
fluoxastrobin		
DISARM 480SC	16 fl.oz.	Make two applications in spring and fall with 30-day intervals between applications. Apply 0.25 to 0.5 inch of water after application to move Disarm into root zone.
fluoxastrobin + myclobutanil		
DISARM M	0.5-1 fl.oz.	Use preventively. Apply twice at 28-day intervals in spring and again in fall. Water in with 0.25 to 0.5 inch of water immediately after application. Use higher rate at shorter interval on turf previously damaged by take-all. May be applied to residential turf by a certified applicator.
metconazole		
TOURNEY	0.37 fl.oz.	Apply twice at 14-day intervals in spring and again in fall. Immediately apply 0.25 to 0.5 inch of water. Aerify or verticut before application.
propiconazole		
BANNER MAXX	2-4 fl.oz.	Make one to two applications in September and October and, if needed, again in April and May. Schedule applications about 30 days apart.
BANNER MAXX II	1-2 fl.oz.	
PROPICONAZOLE PRO	2-4 fl.oz.	
PROPICONAZOLE SPC 14.3MEC	2-4 fl.oz	
PROPENSITY 1.3ME	2-4 fl.oz.	
SPECTATOR ULTRA	4 fl.oz.	
STRIDER	4 fl.oz.	
pyraclostrobin		
INSIGNIA	0.9 oz.	Begin applications to bentgrass when conditions favor disease development and before symptoms are seen. Make two applications 28 days apart in the fall and two applications 28 days apart in the spring. Apply in 2 to 4 gallons of water per 1000 square feet.
pyraclostrobin + triticonazole		
PILLAR G PILLAR G INTRINSIC	3 lb.	Use preventatively. Begin applications when conditions favor disease and prior to disease symptoms development. Make two applications at 28-day intervals in fall and again in spring as needed. Do not make more than five applications of Pillar G per year.
tebuconazole		
CLEARSCAPE ETQ	0.6 fl.oz.	**Golf Course Turf:** For prevention, make two applications in fall at the lower rate in 1 to 3 gallons of water per 1000 square feet when conditions favor disease and several weeks before symptoms appear. Irrigate immediately to redistribute fungicide into root zone. Initiate cultural practices at time of first application to help control disease. A spring application may be necessary in areas where disease pressure is known to be heavy.
TORQUE	0.6 fl.oz.	
triadimefon		
BAYLETON T/O	1-2 oz.	**Preventive Control:** Apply 2 to 4 weeks before symptoms normally appear. Repeat at 21- to 28-day intervals. Thoroughly water immediately after each application.
BAYLETON FLO	1-2 fl.oz.	
BAYLETON T/O	2 oz.	**Curative Control:** When disease appears, make one or two applications at 14- to 21-day intervals; then, apply 2 ounces every 21 to 28 days. Thoroughly water after each application. For control of diseases incited by Gaeuman nomyces graminis var. graminis on St. Augustinegrass, zoysiagrass, bermudagrass, and centipedegrass.
BAYLETON FLO	2 fl.oz.	

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Table 1. Commercial Turf and Lawns: Disease and Nematode Control (cont.)

Fungicide and Formulation	Amount to Use per 1000 sq. ft. or as Specified	Comments[1]
TAKE-ALL PATCH, TAKE-ALL ROOT ROT, BERMUDAGRASS DECLINE (cont.)		
trioxystrobin + triadimefon		Make one or two applications as needed. Apply at 28-day intervals in 2 gallons of water per 1000 square feet. Aerify or verticut prior to each application.
TARTAN	1.5-2 oz.	
triticonazole		Make one or two applications in the fall and repeat at 14- to 28-day intervals. Under preventive applications where light disease pressure is anticipated, use the lower rate and longer interval. Under conditions or prior history for severe disease or for an early curative application, apply the higher rate at a shorter interval.
TRINITY	1-2 fl.oz.	
TRITON FLO	0.55-1.1 fl.oz	
TRITON 70WDG	0.3-0.6 oz.	
ZOYSIA PATCH, COOL WEATHER BROWN PATCH, OR YELLOW PATCH OF ZOYSIAGRASS		
azoxystrobin		Make one or two applications in late fall or when conditions favor disease. Apply at 28-day intervals.
HERITAGE TL	1-2 fl.oz.	
HERITAGE G	2-4 oz.	
HERITAGE FUNGICIDE	0.4 oz.	
fludioxonil		Begin applications prior to appearance of symptoms and reapply at 14- to 28-day intervals. For best disease control, tank mix with 1 to 2 fluid ounces per 1,000 square feet of Banner Maxx,
MEDALLION	0.5 oz.	
flutolanil		
PROSTAR 70WDG	2.2 oz.	Apply at 30-day intervals as needed.
ipiodione		**Golf Courses, Sod Farms, and Institutional Turf:** Apply once in fall when conditions favor disease. Repeat in spring as needed at 14- to 21-day intervals. Use on residential lawns is prohibited.
CHIPCO 26019	2 oz.	
CHIPCO FLO	3-4 fl.oz.	
26GT FLO	3-4 fl.oz.	
metconazole		Apply when conditions favor disease and repeat applications at 14-day intervals as needed.
TOURNEY	0.37 fl.oz.	
myclobutanil		Make a single application in fall before turf goes dormant.
EAGLE 20EW	2-4 fl.oz.	
propiconazole		To control zoysia patch, make one application in early fall before symptoms appear.
BANNER MAXX	3-4 fl.oz.	
BANNER MAXX II	1-2 fl.oz.	
PROPICONAZOLE PRO	3-4 fl.oz.	
PROPICONAZOLE SPC 14.3MEC	3-4 fl.oz.	
PROPENSITY 1.3ME	3-4 fl.oz.	
STRIDER	3-4 fl.oz.	
pyraclostrobin + triticonazole		Use preventively. Begin applications when conditions favor disease and before disease symptoms development in the fall; repeat in spring following greenup as needed. Repeat at 14- to 28-day intervals. Do not make more than five applications of Pillar G per year.
PILLAR G	3 lb.	
PILLAR G INTRINSIC		
tebuconazole		**Golf Course Turf:** For prevention, make two applications at the lower rate in 1 to 3 gallons of water per 1000 square feet when conditions favor disease in late summer or early fall and before symptoms appear. An early spring application may be needed where disease pressure is heavy.
CLEARSCAPE ETQ	0.6 fl.oz.	
TORQUE	0.6 fl.oz.	
thiophanate-methyl + ipiodione		**Golf Courses, Sod Farms, and Institutional Turf:** Apply in 1 to 10 gallons of water per 1,000 square feet when conditions favor disease. Reapply as needed to maintain disease control.
26/36 FUNGICIDE	2-4 fl.oz.	
triadimefon		To control zoysia patch, apply in early fall before symptoms appear. If needed, apply in early spring where disease is known to be severe.
BAYLETON T/O	1-2 oz.	
BAYLETON FLO	1-2 fl.oz.	
triticonazole		Make one or two applications in the fall and repeat at 14- to 28-day intervals. Under preventive applications where light disease pressure is anticipated, use the lower rate and longer interval. Under conditions or prior history for severe disease or for an early curative application, apply the higher rate at a shorter interval. May be applied to residential turf by a certified applicator.
TRITON FLO	0.55-1.1 fl.oz	
TRITON 70WDG	0.3-0.6 oz.	

[1] Fungicide products are registered for use on residential lawns except as specified in comments.

Table 2. Preplant Fumigant Nematicides

Nematicide and Formulation	Amount to Use per Acre	Comments[1]
dazomet		All preplant nematicides are **RESTRICTED USE** pesticides. For best results, apply fumigant to soil in seedbed condition, free of clods and undecomposed matter. Soil temperature at 6-inch depth should be between 50o and 80°F. Telone II is effective **ONLY** against nematodes. See product labels for specific application instructions.
BASAMID 99G	222-350 lb. (5-8.1 lb./ 1000 sq.ft.)	
dichloropropene		
TELONE II	9-15 gal.	
dichloropropene + chloropicrin		
TELONE C-17	11-17 gal.	
TERR-O-CIDE 30D	15-25 gal.	
metam sodium		
VAPAM	40-100 gal.	

[1] Fungicide products are registered for use on residential lawns except as specified in comments.

Table 3. Fungicide Seed Dressings

Fungicide and Formulation	Amount to Use per 100 lb. Seed	Comments
etridiazole		Add to seed in commercial seed treatment equipment. Mix until thorough coverage is obtained.
KOBAN 30W	4.5-7 oz.	
mefenoxam		Apply as water slurry with commercial seed treatment equipment.
APRON FL	1.5 fl.oz.	
APRON 25W	2-4 oz.	
APRON DRY SEED PROTECTION 12.5W	4-8 oz.	Apply just prior to planting. Thoroughly mix seed with product for maximum seed coverage.

Commercial Turf and Lawns: Disease and Nematode Control Recommendations prepared by Austin Hagan, Extension Plant Pathologist, Professor, Department of Entomology and Plant Pathology, Auburn University.

FOR MORE INFORMATION on pesticides, pesticide safety, or submitting samples for analysis, see the following publications in the IPM series:
IPM 1293, "Safety." Safety contact information; worker protection standards; the safe use, handling, and storage of pesticides
IPM 1294, "Submitting Samples." Procedures for submitting samples for diagnosis, analysis, and identification
IPM 1295, "General Pesticide Information." Federal and state restricted use pesticide lists; pesticides and water quality
IPM 1317 "Appendix." Pesticide guidelines for agronomic crops, including preharvest intervals; rain-free requirements; grazing restrictions; crop rotation guidelines; and the names, classifications, and toxicities of pesticides.

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2014 IPM-1291

For more information, contact your county Extension office. Visit www.aces.edu/counties or look in your telephone directory under your county's name to find contact information.
Use pesticides **only** according to the directions on the label. Follow all directions, precautions, and restrictions that are listed. Do not use pesticides on plants that are not listed on the label

The pesticide rates in this publication are recommended **only** if they are registered with the Environmental Protection Agency or the Alabama Department of Agriculture and Industries. If a registration is changed or canceled, the rate listed here is no longer recommended. Before you apply **any** pesticide, check with your county Extension agent for the latest information.

Trade names are used **only** to give specific information. The Alabama Cooperative Extension System does not endorse or guarantee any product and does not recommend one product instead of another that might be similar.

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ALABAMA A&M & AUBURN UNIVERSITIES

IPM-0022

Commercial Turf and Lawns

IPM

Chemical Weed Control Recommendations for 2014

PREPLANT

Table 1. Herbicide Preplant Recommendations

Herbicide	Herbicide Rate: Formulation per 1000 Square Feet	Herbicide Rate: Lb. Active Ingredient per Acre	Weeds Controlled	Time of Application and Special Instructions
			PREPLANT	
glyphosate ROUNDUP PRO	4-6 T. of 4 lb./gal.	3-4 lb. (isopropyl-amine salt)	Annual and perennial grasses, broadleaf weeds and sedges, including nutsedge, bermudagrass, bahiagrass, torpedograss, etc.	**Turfgrass Renovation.** This must be applied by a professional applicator. Apply to actively growing vegetation that is at least 4 to 5 inches tall. Mowing, tillage, or renovation techniques should be delayed for 7 to 14 days after application to allow proper translocation into underground plant parts. A second application may be necessary. Mid to late summer is the best time to treat for control of warm-season weeds. Desirable turfgrasses may be established as soon as acceptable control has been obtained on existing vegetation. See label for precautionary statements.
ROUNDUP PRO MAX	3 T. of 5.5 lb./gal.	3-4 lb. (potassium salt)		

PREEMERGENCE

Preemergence herbicide treatments should be applied to turfgrasses prior to emergence of the specific target weed. The recommended herbicide rates given below are for turfgrasses growing under optimum conditions of light, moisture, and nutrients. For sensitive grasses or for any grasses growing under stress conditions (such as on golf greens, in shade, or in drought situations), apply the lowest effective rate in split applications. Make two applications, 10 to 14 days apart, with each application using half of the lowest effective rate.

Table 2. Herbicide Preemergence Recommendations

Herbicide	Herbicide Rate: Formulation per 1000 Square Feet	Herbicide Rate: Lb. Active Ingredient per Acre	Weeds Controlled	Time of Application and Special Instructions
			NEW PLANTINGS	
			Preemergence	
oxadiazon RONSTAR 2G	2.25-3.3 lb.	2-3	Crabgrass, goosegrass	Make application to weed-free area immediately after sprigging bermudagrass or zoysiagrass. Irrigate immediately after application. **DO NOT** apply to newly seeded areas. See label for additional precautions.

Table 2. Herbicide Preemergence Recommendations (cont.)

Herbicide	Herbicide Rate: Formulation per 1000 Square Feet	Herbicide Rate: Lb. Active Ingredient per Acre	Weeds Controlled	Time of Application and Special Instructions
ESTABLISHED WARM-SEASON–BERMUDAGRASS, CENTIPEDEGRASS, ST. AUGUSTINEGRASS, ZOYSIAGRASS ESTABLISHED COOL-SEASON–TALL FESCUE, KENTUCKY BLUEGRASS				
Preemergence				
atrazine				For use **ONLY** on warm-season turfgrasses listed on label. Apply after October 1 for control of winter weeds or during late winter but before April 15 for control of summer annual weeds. Use the low rate on newly sprigged turfgrass, on hybrid bermudagrass, or for the control of annual bluegrass. **DO NOT** make more than two applications per year. **DO NOT** use on alkaline soils or on golf greens. Read label carefully before using this product around trees and ornamentals. **DO NOT** overseed for 6 months after application. Atrazine is a **RESTRICTED USE** pesticide. **DO NOT** apply more than 2 pounds of atrazine a.i. per acre per year.
AATREX 4L	0.75-1.5 fl.oz. of 4 lb./gal.	1-2	Annual bluegrass, henbit, spurweed, burclover, other annual broadleaf weeds	
AATREX NINE-O	0.4-0.8 oz. of 90 WDG	1-2		
benefin				Apply to well-established warm and cool-season turfgrasses. An additional treatment may be made 8 weeks after initial application for continued weed control. **DO NOT** apply to golf greens. Use high rate for annual bluegrass control on warm-season grasses when applied in late summer or early fall. Delay overseeding for 6 to 16 weeks after treatment, depending on rate used.
BALAN	1.8-2.75 lb. of 2.5G	2-3	Crabgrass, goosegrass, annual bluegrass, others	
benefin + oryzalin				Apply to established warm-season turfgrasses in February or early March for crabgrass control. For goosegrass control, use high rate. For annual bluegrass control, apply in late August or early September at high rate. Delay overseeding for 6 to 16 weeks after treatment, depending on rate used. Read label for additional directions and application instructions.
XL 2G	2.5-3.5 lb. of 2G	2-3	Crabgrass, goosegrass, annual bluegrass, barnyardgrass, foxtail	
benefin + trifluralin				Same as for XL 2G, above.
TEAM 2G	2.4-3.37 lb. of 2G	2-3	Crabgrass, goosegrass, annual bluegrass	
bensulide				Apply to well-established bermudagrass, centipedegrass, St. Augustinegrass, zoysiagrass, Kentucky bluegrass, and tall fescue in March for summer weed control. For goosegrass control, apply about 4 to 6 weeks later. For crabgrass and goosegrass control within 50 miles of Gulf Coast, apply in late February. For winter weed control, apply in late August or early September. Follow directions on label.
BENSUMEC 4LF	5-9 fl.oz. of 4LF	7.5-12.5	Crabgrass, goosegrass, annual bluegrass, other annual grasses, small-seeded broadleaf weeds	
PRE-SAN 7G	2.4-4.1 lb of 7G	7.5-12.5		
bensulide + oxadiazon				For use on established bermudagrass, zoysiagrass, tall fescue, and perennial bluegrass. Apply prior to weed seed germination and while grass is dormant. Irrigate immediately after application. Delay overseeding for 5 months after application. May be used on bermudagrass and bentgrass putting greens only under conditions of heavy goosegrass infestations and where the herbicide side effects are tolerable. Yellowing and thinning for up to 4 weeks may be observed on such greens. Can be used to control annual bluegrass on established bentgrass greens. **DO NOT** use on bermudagrass putting greens to be overseeded. See label for other application instructions.
ANDERSON'S GOOSEGRASS/ CRABGRASS CONTROL	2.6 lb. of 6.5G	7.5	Crabgrass, goosegrass	

Table 2. Herbicide Preemergence Recommendations (cont.)

Herbicide	Herbicide Rate: Formulation per 1000 Square Feet	Herbicide Rate: Lb. Active Ingredient per Acre	Weeds Controlled	Time of Application and Special Instructions
ESTABLISHED WARM-SEASON AND COOL-SEASON GRASSES (cont.)				
Preemergence (cont.)				
dithiopyr				Provides preemergence control of annual grasses and certain broadleaf weeds. Also controls small crabgrass (before tillering). Dimension does not provide consistent control of goosegrass at labeled rates. Apply as a spring or fall treatment. **DO NOT** apply more than 1.5 fluid ounces of 1EC or 0.46 ounce of 40 WP per 1000 square feet per application. **DO NOT** apply more than 4.5 fluid ounces of 1EC or 1.375 ounces of 40 WP per 1000 square feet per year. **DO NOT** overseed or sprig treated areas for 3 months after application. See label for tolerant hybrid bermudagrasses.
DIMENSION 1EC	1.5 fl.oz. of 1 lb./gal.	0.5	Crabgrass, yellow foxtail, smutgrass, woodsorrel, annual bluegrass	
DIMENSION ULTRA	0.46 oz. of 40 WP	0.5		
indazaflam				Use on well-established warm-season turfgrasses. **DO NOT** use on cool-season turf. If uncertain of cultivar tolerance, treat a small area and observe turf tolerance.
SPECTICLE 20WP	2.1-3.75 oz. of 20WP	0.027-0.047	Crabgrass, goosegrass, annual bluegrass	
isoxaben				Use on established warm- and cool-season grasses listed. For summer weed control, apply during early spring. For fall and winter control, apply during late summer to early fall. **DO NOT** apply to golf course putting greens. Apply 0.5 inch of water within 25 days after application. **DO NOT** reseed treated area within 60 days.
GALLERY 75DF	0.25-0.5 oz. of 75DF	0.5-1	Chickweed, clover, henbit, bittercress, spurge, plantains, and other broad-leaf weeds	
metolachlor				For established bermudagrass, centipedegrass, St. Augustinegrass, and zoysiagrass **ONLY**. Make application before yellow nutsedge emerges. If rainfall does not occur within 7 days, irrigate with 0.5 inch of water. **DO NOT** use on golf greens, tees, and aprons. **DO NOT** seed or overseed with desirable turfgrasses within 4 months before or 6 months after treatment.
PENNANT MAGNUM 7.62EC	1 fl.oz. of 7.62 lb./gal.	2.5	Yellow nutsedge, annual sedges, annual grasses	
oryzalin				Apply to established warm-season turf in February or early March for crabgrass control. For goosegrass control, apply 4 to 6 weeks later at low rate, except in South Alabama. For annual bluegrass control, apply in late August or early September, using low rate. Some movement may occur if not "watered in." Read label for additional directions and application instructions. **DO NOT** use on putting greens or tees. Reseeding should be delayed for 120 days after treatment.
SURFLAN 4AS	1-1.5 fl.oz. of 4 lb./gal.	1.5-2	Crabgrass, goosegrass, annual bluegrass, barnyardgrass, foxtail	
oxadiazon				Ronstar G can be used on all warm- and cool-season grasses, except red fescue, centipedegrass, and bentgrass. **DO NOT** apply more than 3 pounds of the 2G formulation per 1000 square feet to St. Augustinegrass. Ronstar 50WSP can only be applied on ***dormant established*** bermudagrass, St. Augustinegrass, and zoysiagrass. Ronstar is not labeled for use on home lawns. Delay overseeding for 4 months after application. See label for additional application instructions.
RONSTAR 2G	2.25-4.5 lb. of 2G	2-4	Crabgrass, goosegrass, annual bluegrass	
RONSTAR 50WSP	1.5-2.2 oz. of 50WSP	2-3		

Table 2. Herbicide Preemergence Recommendations (cont.)

Herbicide	Herbicide Rate: Formulation per 1000 Square Feet	Herbicide Rate: Lb. Active Ingredient per Acre	Weeds Controlled	Time of Application and Special Instructions
ESTABLISHED WARM-SEASON AND COOL-SEASON GRASSES (cont.)				
Preemergence (cont.)				
pendimethalin				Apply the high rate to all warm-season grasses and the low rate to all cool-season grasses. A late summer application at the low rate will control annual bluegrass and the other winter annuals. Apply prior to weed seed germination. **DO NOT** reseed, sprig, or sod with new grass or seed until 4 to 5 months after treatment.
PENDULUM 2G	1.7-3.4 lb. of 2G	1.5-3	Crabgrass, goosegrass, annual bluegrass, chickweed, henbit	
PENDULUM 3.3EC	1.8-2.6 fl.oz. of 3.3EC	1.5-3		
PENDULUM AQUACAP	1.12-2.3 fl.oz. of 3.8CS	1.5-3		
prodiamine				Provides preemergence control of annual grasses and certain broadleaf weeds in established turfgrasses. See label for maximum use rate per season. **DO NOT** make more than two applications per season. See overseeding restrictions on label (3-18 months).
BARRICADE 65WDG	0.4 oz. of 65WDG	0.75	Crabgrass, annual bluegrass, chickweed, spurge, goosegrass	
BARRICADE 4FL	0.5 fl.oz. of 4LF	0.75		
STONEWALL 60WDG	0.4 oz. of 65WDG	0.75		
PROCLIPSE 65WDG	0.4 oz. of 65 WDG	0.75		
pronamide				For use on warm-season turfgrasses listed on label. Apply in October or November when annual bluegrass begins to germinate or is in the 1- to 2-leaf stage. **CAUTION:** Kerb moves with surface water. **DO NOT** use on golf putting greens or lawns and other turf areas to be overseeded. Excessive rate will cause injury. Irrigate after application. **DO NOT** overseed within 90 days of application. Kerb is a **RESTRICTED USE** pesticide.
KERB SC T/O	1-2 T. of 3.3 lb./gal. (1.25-2.5 pt.)	0.5-1	Annual bluegrass, other cool-season grasses, and broadleaf weeds	
simazine				For use **ONLY** on warm-season turfgrasses listed on label. Apply after September 1 for control of winter weeds or during late winter but before germination for control of summer annual weeds. **DO NOT** apply after June 1. Use the low rate on newly sprigged turfgrass, on hybrid bermudagrass, or for the control of annual bluegrass. **DO NOT** make more than two applications per year. **DO NOT** use on alkaline soils or on golf greens. Read label carefully before using this product around trees and ornamentals. **DO NOT** overseed for 6 months after application.
PRINCEP LIQUID	0.75-1.5 fl.oz. of 4 lb./gal.	1-2	Annual bluegrass, burclover, henbit, other annual grasses and broadleaf weeds	
SIMAZINE 90DF	0.4-0.8 oz. of 90DF	1-2		
sulfentrazone + prodiamine				For use in established tall fescue, Kentucky bluegrass, centipede, bermudagrass, and zoysiagrass. High rate only for use on bermudagrass. **DO NOT** apply to newly laid sod. **DO NOT** add surfactant. **DO NOT** apply to putting greens.
ECHELON 4SC	0.4-0.83 fl.oz. of 4 lb./gal.	0.56-1.12	Many annual grasses, some broadleaf weeds, annual sedges, yellow nutsedge	
SOD PRODUCTION ONLY				
Preemergence				
simazine				For use on centipedegrass and St. Augustinegrass. **DO NOT** apply to actively growing bermudagrass. Apply within 2 days after lifting sod or on new beds 7 to 10 days after sprigging or plugging. The soil should be well settled around sprigs and plugs before applying herbicide. Use low rate on sandy soils and/or on bermudagrass. Apply in fall for winter weed control and in spring for summer weed control. **DO NOT** apply within 30 days of harvesting sod. **DO NOT** apply to cool-season turfgrasses.
PRINCEP LIQUID	0.75-1.5 fl.oz. of 4 lb./gal.	1-2	Many annual grasses and broadleaf weeds	
SIMAZINE 90DF	0.4-0.8 oz. of 90DF	1-2		

Table 2. Herbicide Preemergence Recommendations (cont.)

Herbicide	Herbicide Rate: Formulation per 1000 Square Feet	Herbicide Rate: Lb. Active Ingredient per Acre	Weeds Controlled	Time of Application and Special Instructions
SOD PRODUCTION ONLY (cont.)				
Postemergence				
clethodim ENVOY PLUS	0.4-0.8 fl.oz. of 0.97 lb./gal.	0.125-0.25	Common bermudagrass	**For Sod Farms Only.** Apply to centipedegrass in the spring at least 3 weeks after green-up to actively growing common bermudagrass. Two applications will be necessary for control. Make second application 3 to 4 weeks after first when there is 1 to 2 inches of bermudagrass regrowth. Use high rate on patches of well-established common bermudagrass. Avoid mowing sod for one week before or after application. Always add a non-ionic surfactant to spray mix at rate of 2 pints per 100 gallons. State Label.

POSTEMERGENCE

ESTABLISHED BERMUDAGRASS AND/OR ZOYSIAGRASS

Spray when weeds are actively growing, preferably when weeds are in the seedling stage. Postemergence herbicide applications should be made in 30 to 40 gallons of water per acre. Control may be greatly increased by using a non-ionic surfactant at 0.5 percent of spray solution (1 pint per 25 gallons).

Air temperature in the 80-degree range for MSMA and the 70-degree range for 2,4-D and dicamba is advisable. For sensitive grasses or for grasses growing under stress conditions (such as grasses growing in shady areas, on golf greens, or in drought situations), the lowest effective rate should be applied in split applications. Two applications should be made 10 to 14 days apart with each application using one-half of the lowest effective rate.

Table 3. Herbicide Postemergence Recommendations for Warm-Season Grasses

Herbicide	Herbicide Rate: Formulation per 1000 Square Feet	Herbicide Rate: Lb. Active Ingredient per Acre	Weeds Controlled	Time of Application and Special Instructions
ESTABLISHED BERMUDAGRASS AND/OR ZOYSIAGRASS				
Postemergence				
2,4-D amine AMINE 4 WEEDAR 64 (Other trade names)	0.375-0.75 fl.oz. of 4 lb./gal. (1-2 pt./A)	0.5-1	Many broadleaf weeds, dandelion, dock, plantains, certain clovers	Apply when weeds are young and actively growing. Repeat applications may be necessary. Use low pressure–25 psi. Avoid spray drift to susceptible flowers and shrubs. Use lower rate on Tifgreen and Tifdwarf bermudagrass. **DO NOT** allow people (other than applicator) or pets to enter treatment areas until sprays have dried. Refer to label for instructions on adding a surfactant.
2,4-D amine AMINE 4 WEEDAR 64 (Other trade names)	1-1.5 fl.oz. of 4 lb./gal. (3-4 pt.)	1.5-2	Wild onion and garlic	Same as 2,4-D amine above. Apply in November or December and again in February or early March. Repeat applications on this cycle for 2 to 5 years. Use of ester formulations usually causes more problems when drift occurs. See label use rate.

Table 3. Herbicide Postemergence Recommendations for Warm-Season Grasses (cont.)

Herbicide	Herbicide Rate: Formulation per 1000 Square Feet	Herbicide Rate: Lb. Active Ingredient per Acre	Weeds Controlled	Time of Application and Special Instructions
ESTABLISHED BERMUDAGRASS AND/OR ZOYSIAGRASS (cont.)				
Postemergence (cont.)				
2,4-D + clopyralid + dicamba MILLENNIUM ULTRA 2	0.73-1.1 fl.oz. of 3.75 lb./gal. (2-3 pt./A)	0.75-1.12 + 0.09-0.14 + 0.09-0.14	Broad spectrum of broadleaf weeds	For use on common bermudagrass and zoysiagrass. When treating grass growing under stress conditions, use half rates. Slight turf yellowing will disappear after one week. To minimize turf injury, a second application should not be made for at least 4 weeks. **DO NOT** spray when air temperature exceeds 90°F. **DO NOT** reseed for 3 to 4 weeks after application. **DO NOT** use on residential lawn areas. **DO NOT** compost treated lawn clippings. Read label before use.
2,4-D + dicamba + fluroxypyr ESCALADE 2	0.75-1.1 fl.oz. of 4 lb./gal. (2-3 pt./A)	0.8-1.2 + 0.1-0.15 + 0.1-0.15	Broad spectrum of broadleaf weeds	Apply to actively growing established bermudagrass and zoysiagrass. Use low rate on closely mowed turf or to turf under stress. Some turf yellowing can be expected. To minimize grass injury, retreatment should not occur until later than 4 weeks after initial treatment. See label for reduced rate and timings of use on sod farms.
2,4-D + mecoprop + 2,4-DP TRIAMINE	See label.	See label.	Broad spectrum of weeds	For use on zoysiagrass and common bermudagrass only. **DO NOT** spray when air temperatures exceed 85°F or when turfgrass is growing under stress conditions. Delay reseeding for 4 weeks after treatment. Avoid applications when turfgrass is emerging from winter dormancy.
2,4-D + mecoprop + dicamba TRIMEC CLASSIC TRIPLET SF	Follow label directions on Trimec or equivalent.	0.8-1 lb. *See Special Instructions.	Broad spectrum of broadleaf weeds, including wild onion or garlic	***Special Instructions: DO NOT** apply more than 0.8-1 pound of 2,4-D from any formulation. **DO NOT** apply when day temperature exceeds 85°F. **DO NOT** use within drip line of trees or shrubs. Observe precautions for each component part. Excellent herbicide for broad spectrum weed control.
2,4-D + MCPP + dicamba + carfentrazone SPEEDZONE SOUTHERN	0.75-1.5 fl.oz. of 0.81 lb./gal. (2-4 pt./A)	0.13-0.26 + 0.05-0.1 + 0.012-0.025 + 0.01-0.02		Controls a number of broadleaf weeds, including spurge and ground ivy. Apply when day temperature is between 60 and 85°F. May be applied 4 weeks after sprigging or sodding turfgrass.
2,4-D + MCPP + dicamba + sulfentrazone SURGE	1-1.2 fl.oz. of 2.18 lb./gal. (2.75-3.25 pt./A)	0.47-0.57 + 0.17-0.2 +0.07-0.09 + 0.01-0.02	Broad spectrum of broadleaf weeds	Apply to established turfgrass or to turfgrass that has been sprigged or sodded for at least 4 weeks. Sequential broadcast treatments can be made 2 to 6 weeks later depending on weed growth. Do not treat turfgrass during spring or fall transition. Fully dormant turfgrass can be treated for winter weeds.
2,4-D + dicamba + quinclorac QUINCEPT	2.6-2.9 fl.oz. of 1.875 lb./gal (7-8 pt./A).	1.6-1.8	Crabgrass, signalgrass	Apply to bermudagrass or zoysia to control a few seedling grasses and many broadleaf weeds. Use lower rate on these grasses. **DO NOT** apply when temperatures exceed 90°F or when turf is stressed. Temporary discoloration may be observed.

Table 3. Herbicide Postemergence Recommendations for Warm-Season Grasses (cont.)

Herbicide	Herbicide Rate: Formulation per 1000 Square Feet	Herbicide Rate: Lb. Active Ingredient per Acre	Weeds Controlled	Time of Application and Special Instructions
ESTABLISHED BERMUDAGRASS AND/OR ZOYSIAGRASS (cont.)				
Postemergence (cont.)				
amicarbazone XONERATE 70WDG	0.069-0.23 of 70WDG (3-10 oz./A)	0.13-0.44	Annual bluegrass, chickweed, henbit, spurge, speedwell	Apply to bermuda or zoysia grasses established a minimum of 6 months. When applying at rates of 3 to 5 ounces per acre, repeat application is recommended at a 14- to 21-day interval. **DO NOT** exceed the maximum total use rate of 10 ounces per acre per season. See label for possible tank-mix partners. Refer to label concerning the overseeding of cool-season grasses prior to use.
bentazon BASAGRAN T/O	0.75 fl.oz. of 4 lb./gal. (2 pt./A)	1	Yellow nutsedge	Apply when yellow nutsedge is actively growing under good moisture conditions. Make additional applications at intervals of 10 to 14 days until nutsedge is eliminated. **DO NOT** make more than three applications in a single growing season. Avoid spraying adjacent trees, shrubs, and flowers. **DO NOT** mow 3 to 5 days before or after application. Purple nutsedge will not be controlled by this treatment. Add a crop oil concentrate to the spray mix at a rate of 2 pints per acre when making application to yellow nutsedge.
bromoxynil BUCTRIL 2EC	0.375-0.75 fl.oz. of 2 lb./gal. (1-2 pt./A)	0.25-0.5	Many seedling broadleaf weeds	**For Non-Residential Turf and Sod Production Only.** Apply to newly seeded, sprigged, or established bermudagrass and zoysiagrass to control seedling broadleaf weeds. Weeds must be small and actively growing. Good spray coverage is essential. Apply in 20 to 40 gallons of water per acre or in 2 to 4 gallons of water per 1000 square feet.
carfentrazone QUICKSILVER T&O	0.023-0.048 fl.oz. of 1.9 lb./gal. (1-2.1 oz./A)	0.015-0.03	Numerous seedling broadleaf weeds	To expand the weed spectrum, QuickSilver may be tank-mixed with 2,4-D, 2,4-DP, and/or dicamba. Add a non-ionic surfactant at the rate of 1 to 2 pints surfactant per 100 gallons of spray mix. See AIM herbicide label for use on sod farms.
carfentrazone + quinclorac SQUARE ONE 70WDG	0.28-0.41 of 70WDG (0.75-1.12 lb./A)	0.53-0.79	Wide spectrum of broadleaf weeds, some sedges and grasses	Use only on established bermudagrass and zoysiagrass not growing under stress. See label for surfactant and rate to use for sedge control.
chlorsulfuron CORSAIR 75 WDG	0.06-0.12 oz. of 75 WDG (0.16-0.32 lb./A)	0.13-0.25	Tall fescue, wild violet	Apply as a postemergence spot treatment to tall fescue plants in bermudagrass using a hand-held or boom sprayer. Spray **ONLY** to wet the tall fescue blades. Avoid overapplication. Repeat treatment may be needed in 60 days. **DO NOT** apply under desirable trees. Add a non-ionic surfactant to spray mix at rate of 1 quart per 100 gallons of spray mix.
clopyralid LONTREL T&O	0.1-0.5 fl.oz. of 3 lb./gal. (0.25-1.33 pt./A)	0.09-0.5	Clovers, black medic, dandelions, vetch, other broadleaf weeds	See label for specific rate for target pest. Can cause injury to desirable legumes and composite species. **DO NOT** apply to residential lawn areas. **DO NOT** compost treated lawn clippings. **DO NOT** irrigate for at least 2 hours after application.
dicamba VANQUISH 4S	0.16-0.32 fl.oz. of 4 lb./gal. (0.5-1 pt./A)	0.25-0.5	Most broadleaf weeds, including wild onions	**DO NOT** use around shrubs or trees. Roots take up the chemical from the soil and some species are damaged. Good for use on golf tees, fairways, and roughs. **DO NOT** exceed a total of 1 pound a.i. per acre per year.

Table 3. Herbicide Postemergence Recommendations for Warm-Season Grasses (cont.)

Herbicide	Herbicide Rate: Formulation per 1000 Square Feet	Herbicide Rate: Lb. Active Ingredient per Acre	Weeds Controlled	Time of Application and Special Instructions
ESTABLISHED BERMUDAGRASS AND/OR ZOYSIAGRASS				
Postemergence (cont.)				
diclofop-methyl ILLOXAN 3EC	0.75-1 fl.oz. of 3 lb./gal. (1-1.4 qt./A)	0.75-1	Goosegrass	Use **ONLY** on bermudagrass on golf courses. A non-ionic surfactant can be added at the rate of 2 pints per 100 gallons of spray mix to improve control of goosegrass growing under adverse conditions. Use the low rate when treating goosegrass in the 1- to 3-leaf stage and the high rate when treating goosegrass in the 1-tiller stage. Make application using 20 to 40 gallons of water per acre at 30 to 60 psi using flat fan nozzle spray tips. Application should result in a uniform spray pattern with minimum overlap. Illoxan is most effective on closely mowed goosegrass (not less than 0.33 inch cutting height). **DO NOT** mow for 36 hours after application. **DO NOT** apply with any other pesticide or liquid fertilizer. **DO NOT** overseed treated area for 3 months after application. **DO NOT** apply more than 65 ounces of Illoxan per acre per year. Illoxan is a **RESTRICTED USE** pesticide.
diquat dibromide REWARD L&A	0.33-0.67 fl.oz. of 2 lb./gal. (1-2 pt./A)	0.25-0.5	Annual bluegrass, Carolina geranium, henbit, little barley	**Apply To Dormant Bermudagrass Only.** Apply to small, actively growing weeds in established turf. **DO NOT** apply during "green up" in spring. Add 1 to 2 pints of a non-ionic surfactant to every 100 gallons of spray mix.
ethofumesate PROGRASS 1.5 EC	2-2.2 fl.oz. of 1.5 lb./gal. (5.4-6 pt./A)	1-1.1	Annual bluegrass, common chickweed	Use **ONLY** on dormant bermudagrass overseeded with perennial ryegrass. Apply in fall after bermudagrass is dormant and 1 to 2 weeks after emergence of perennial ryegrass. One or two additional applications at 21- to 28-day intervals may be needed to maintain control during the winter. Provides postemergence and preemergence control of listed weeds. **DO NOT** apply after February 1. **DO NOT** use on golf greens.
fenoxaprop ACCLAIM EXTRA	0.33-0.66 fl.oz. of 0.57 lb./gal. (14-28 oz./A)	0.06-0.125	Crabgrass, goosegrass, barnyardgrass, johnsongrass, and common bermudagrass	**For Newly Plugged Or Established Zoysiagrass Only**. Apply in late spring or early summer to actively growing weedy grasses in the 3-leaf (low rate) to 5-tiller (high rate) growth stage. Apply using 30 to 60 gallons of water per acre at 30 to 60 psi. Add a non-ionic surfactant (1 quart per 100 gallons) if using a spray pressure less than 30 psi or when spray volumes are larger than 60 gallons per acre. Make no more than three applications per season at spray intervals greater than 14 days. Tank-mixing Acclaim with phenoxy or related herbicides will reduce grass control on larger (tillered) grasses. Acclaim will not control annual bluegrass.
fluroxypyr SPOTLIGHT	0.25-0.5 fl. oz. of 1.5 lb./gal. (0.67-1.33 pt./A)	0.125-0.25	Bedstraw, chickweed, Virginia buttonweed, clover, woodsorrel, ground ivy	Apply postemergence to established bermudagrass and zoysiagrass to control a number of annual and perennial broadleaf weeds. Use the low rate on bermudagrass. Repeat treatment can be made 4 weeks after previous treatment. Do not apply more than 2.5 pints per acre per year. See label concerning need for addition of non-ionic surfactant.

Table 3. Herbicide Postemergence Recommendations for Warm-Season Grasses (cont.)

Herbicide	Herbicide Rate: Formulation per 1000 Square Feet	Herbicide Rate: Lb. Active Ingredient per Acre	Weeds Controlled	Time of Application and Special Instructions
ESTABLISHED BERMUDAGRASS AND/OR ZOYSIAGRASS (cont.)				
Postemergence (cont.)				
fluazifop FUSILADE II T/O	0.07-0.11 fl.oz. of 2 lb./gal. (3-6 oz./A)	0.05-0.10	Common and hybrid bermudagrass	Apply to zoysia in late spring (around June 1) and repeat every 30 days. Higher rate can be used during hot summer applications, and lower rates can be used in fall before dormancy. Add 1 quart of non-ionic surfactant to every 100 gallons of spray mix. Higher use rates may cause temporary zoysia discoloration. For use on zoysia turf except commercial sod farms.
foramsulfuron REVOLVER	0.2-0.6 fl.oz. of 0.19 lb./gal. (8.8-26.2 oz./A)	0.013-0.04	Annual bluegrass, ryegrass, fescue (tall), rough bluegrass (*Poa trivialis*), goosegrass	May be applied to established bermudagrass to (a) remove ryegrass and annual bluegrass during spring transition; (b) control annual bluegrass before overseeding bermudagrass with perennial ryegrass or Poa trivialis; or (c) control annual bluegrass, tall fescue, ryegrass, and other cool-season grasses in non-overseeded bermudagrass. Apply during transition when bermudagrass has resumed active growth. Rate and temperature will influence speed of weed removal. Apply 14 days prior to overseeding to control annual bluegrass. See label for directions for use on bermudagrass greens, tees, and collars. Use high rate for goosegrass control and centipedegrass suppression.
glufosinate FINALE 1.0	2.2-4.4 fl.oz. of 1 lb./gal. (3-6 qt./A)	0.75-1.5	Annual bluegrass, ryegrass, wild onion, woodsorrel	**Dormant Established Bermudagrass.** Controls numerous winter annual broadleaf weeds and annual bluegrass. Treat when weeds are small and actively growing. Do not apply to spring green up.
halosulfuron SEDGEHAMMER 75DF	0.015-0.03 oz. of 75DF (0.67-1.33 oz./A)	0.031-0.062	Yellow nutsedge, purple nutsedge	Apply to established bermudagrass and zoysiagrass. Apply after nutsedge has reached 3- to 8-leaf stage. Apply 2 quarts of non-ionic surfactant per 100 gallons of spray mix, but **DO NOT** exceed 2 pints of surfactant per acre. A second application can be made 6 to 10 weeks later when nutsedge has three to eight leaves. **DO NOT** make more than two applications or apply more than 0.125 pound a.i. per acre. **DO NOT** apply to golf course putting greens.
imazaquin IMAGE 70DG	0.2-0.26 oz. of 70DG (8.6-11.4 oz./A)	0.375-0.5	Wild garlic, wild onion, nutsedge, sandbur, henbit, chickweed	Apply to well-established, actively growing turf when weeds are small. Add non-ionic surfactant to the spray solution at the rate of 2 pints per 100 gallons. A repeat treatment may be needed in 6 to 8 weeks for season-long control. **DO NOT** apply when turfgrass is emerging from dormancy. Image will severely damage fescue and ryegrass.
MCPA + MCPP + 2,4-DP TRIAMINE II	See label.	See label.	Broad spectrum of broadleaf weeds	For zoyiagrass **ONLY**. Refer to label for use rate. **DO NOT** use when air temperature is above 90°F. Delay reseeding for 4 weeks after treatment.
MCPA + MCPP + dicamba TRI-POWER	See label.	See label.	Broad spectrum of broadleaf weeds	Refer to label for use rate. **DO NOT** apply during green-up growth stage. **DO NOT** apply when air temperature exceeds 85°F. Delay reseeding for 3 to 4 weeks after treatment.

Table 3. Herbicide Postemergence Recommendations for Warm-Season Grasses (cont.)

Herbicide	Herbicide Rate: Formulation per 1000 Square Feet	Herbicide Rate: Lb. Active Ingredient per Acre	Weeds Controlled	Time of Application and Special Instructions
ESTABLISHED BERMUDAGRASS AND/OR ZOYSIAGRASS (cont.)				
Postemergence (cont.)				
MCPA + MCPP + dicamba + carfentrazone				Controls a number of broadleaf weeds including spurge and ground ivy. Apply when day temperatures are between 45 and 75°F. May be applied 4 weeks after sprigging or sodding turfgrass.
POWER ZONE	0.75-1.5 fl.oz. of 2.91 lb./gal. (2-4 pt./A)	0.55-1.1 + 0.11-0.22 + 0.055-0.11 + 0.01-0.02		
MCPA + triclopyr + dicamba				Read the label. When treating dormant turf, use higher rate. When treating actively growing turf, use low rate. Turf injury will occur if application is made when turf is under stress. **DO NOT** reseed sooner than 3 to 4 weeks after application. **DO NOT** spray when air temperature is above 85°F. Cool Power contains the ester formulations primarily for use during the cool winter months.
COOL POWER	0.91-1.29 fl.oz. of 3.6 lb./gal. (2.5-3.5 pt./A)	0.94-1.31 + 0.09-0.13 + 0.09-0.13	Broad spectrum of broadleaf weeds	
HORSEPOWER	0.73-1.1 fl.oz. of 4.4 lb./gal. (2-3 pt./A)	0.95-1.4 + 0.09-0.14 + 0.09-0.14		
MSMA*			Crabgrass, dallisgrass, bahiagrass, goosegrass (seedling), nutsedge	Mow turfgrass to a height of 1 to 1.5 inches before application. Repeat applications at 7- to 10-day intervals are necessary. For dallisgrass and bahiagrass control, repeat applications on a 5-day interval (sod farms). Adequate soil moisture gives best results. **DO NOT** water for 24 hours after application. Use on new plantings after several mowings. Zoysiagrass cultivars vary in toletance to MSMA. "Meyer" is more tolerant than "Emerald" or Matrella." **DO NOT** use on carpetgrass, centipedegrass, or St. Augustinegrass.
DREXEL MSMA PLUS Other labeled products	1 fl.oz. of 6 lb./gal. (2.7 pt.)	1.8		
metribuzin				For use on established bermudagrass on golf course fairways, grounds, and lawns. Make application when turf is actively growing and not under stress conditions for postemergence control of goosegrass. Temporary discoloration of turf may result. See label for directions and rates for use on dormant bermudagrass. An application to dormant turf can provide postemergence control of henbit, common chickweed, and spurweed.
SENCOR 75TURF	See label for rate to use.	0.25-0.5	Goosegrass	
metsulfuron methyl				Apply as a postemergence treatment on established bermudagrass to control target weeds. Add a non-ionic surfactant to spray mix at the rate of 1 quart per 100 gallons of spray mix. Use the low to medium rate to control many broadleaf weeds, but use the higher rate to control bahiagrass.
MANOR 60WDG	0.005-0.02 oz. of 60 WDG (0.25-1 oz./A)	0.009-0.0375	Bahiagrass, clover, chickweed, dandelion, spurge, wild garlic	

*NOTE: Effective December 31, 2009, the Environmental Protection Agency (EPA) announced the cancellation for sale for many of the labeled uses of MSMA (monosodium methanarsonate), which included residential turfgrass. Existing quantities of labeled MSMA products could be used in residential turf (as labeled) until supply was exhausted. No use of MSMA in residential turf was permitted after December 31, 2010. After this date, the few remaining uses were greatly modified and limited to golf courses and sod farms through December 31, 2013. On March 27, 2013 the EPA permitted the continued use of MSMA on golf courses and sod farms until the review of data is completed by the National Academy of Science in 2015. Final EPA action can be expected after this review. Golf courses will be allowed to make one broadcast application of MSMA on newly constructed courses. Existing courses will be limited to spot treatment (100 square feet per spot) but not to exceed 25 percent of the total course in one year. Sod farms will be permitted to make two broadcast applications if a 25-foot buffer strip is maintained adjacent to water bodies.

Table 3. Herbicide Postemergence Recommendations for Warm-Season Grasses (cont.)

Herbicide	Herbicide Rate: Formulation per 1000 Square Feet	Herbicide Rate: Lb. Active Ingredient per Acre	Weeds Controlled	Time of Application and Special Instructions
ESTABLISHED BERMUDAGRASS AND/OR ZOYSIAGRASS (CONT.)				
Postemergence (cont.)				
quinclorac				Requires two applications each year. **DO NOT** apply more than 1.5 pounds a.i. per acre per year. Must be applied with a methylated seed oil at a rate of 1.5 pints per acre to spray mix. **DO NOT** apply within root zone of ornamentals.
DRIVE 75DF	0.367 oz. of 75DF (1 lb./A)	0.75	Torpedograss suppression	
DRIVE XLR8	1.45 fl.oz. of 1.5 lb./gal. (4 pt./A)	0.75		
quinclorac + MCPP + dicamba				Apply to bermudagrass or zoysia to control few grasses and many broadleaf weeds. **DO NOT** apply more than two times per year. **DO NOT** apply when temperature is above 90°F.
ONETIME	1.45 fl.oz. of 2.45 lb./gal. (4 pt./A)	0.75 + 0.35 + 0.10	Crabgrass, signalgrass, dandelions, clover, others	
rimsulfuron				Use on established bermudagrass **ONLY**. **DO NOT** apply to residential lawns. To control annual bluegrass in non-overseeded bermudagrass, apply 2 ounces per acre in November/December and again in February/March. If annual bluegrass population is heavy and plants are large, a single application of 4 ounces per acre can be made. Add a non-ionic surfactant with each application at the rate of 1 quart per 100 gallons of spray mix. To control perennial ryegrass and rough bluegrass overseeded in bermudagrass, apply Tranxit at a rate of 2 ounces per acre in the spring three to four weeks before the desired date for overseed removal. Add a non-ionic surfactant to the spray mix at a rate of 1 quart per 100 gallons. Repeat treatment in 3 weeks, if needed. See label for use on putting greens. See label for use on zoysia.
TRANXIT GTA	1.3 g of 25DF (2 oz./A)	0.031	Annual bluegrass, perennial ryegrass, rough bluegrass (*Poa trivialis*)	
sulfentrazone				Apply to established turfgrass or sodded or seeded turfgrasses after the second mowing. See label for instructions on sedge control. Spartan is labeled for use **ONLY** on sod farms.
DISMISS 4SC	0.18-0.275 fl.oz. of 4 lb./gal. (0.5-0.75 pt./A)	0.25-0.375	Nutsedges, annual sedges, wide spectrum of broadleaf weeds	
SPARTAN 4F	0.18-0.275 fl.oz. of 4 lb./gal. (0.5-0.75 pt./A)	0.25-0.375	Nutsedges, annual sedges, wide spectrum of broadleaf weeds	
sulfentrazone + metsulfuron				Use only on established bermudagrass and zoysiagrass not growing under stress. See label for surfactant and rate to use for sedge control.
BLINDSIDE 66WDG	0.15-0.23 oz. of 66WDG (6.5-10 oz./A)	0.27-0.41	Wide spectrum of broadleaf weeds, some sedges and grasses	
sulfentrazone + quinclorac				Use only on established bermudagrass and zoysiagrass not growing under stress. See label for surfactant and rate to use for sedge control.
SOLITAIRE 75WDG	0.37-0.74 oz. of 75WDG (1-2 lb./A)	0.75-1.5	Wide spectrum of broadleaf weeds, some sedges and grasses	

Table 3. Herbicide Postemergence Recommendations for Warm-Season Grasses (cont.)

Herbicide	Herbicide Rate: Formulation per 1000 Square Feet	Herbicide Rate: Lb. Active Ingredient per Acre	Weeds Controlled	Time of Application and Special Instructions
ESTABLISHED BERMUDAGRASS AND/OR ZOYSIAGRASS (cont.)				
Postemergence (cont.)				
sulfosulfuron CERTAINTY	0.017-0.029 oz. of 75DF (0.75-1.25 oz./A)	0.035-0.059	Yellow nutsedge, purple nutsedge, annual sedges, tall fescue	Apply postemergence to established bermudagrass and zoysiagrass to control listed weeds and other broadleaf weeds. A second application can be made 4 to 10 weeks after the initial treatment if needed. Add a non-ionic surfactant to spray mix at rate of 1 quart per 100 gallons of spray mix. Some turf yellowing can be expected. Certainty can be applied to dormant or actively growing bermudgrass (not overseeded) to control annual bluegrass. Use higher rate if annual bluegrass is heavy or dense. See label for fall application or for bermudagrass application prior to overseeding.
triclopyr + clopyralid CONFRONT	0.37-0.75 fl.oz. of 3 lb./gal. (1-2 pt./A)	0.375-0.75	Broad spectrum of broadleaf weeds	Apply to established bermudagrass and zoysiagrass mowed to a height taller than 0.5 inch. **DO NOT** apply in areas of shallow-rooted trees and shrubs. **DO NOT** apply more than 1.5 pounds a.i. (4 pints) per acre per year. Repeat treatments to control wild violets and woodsorrel. Some discoloration may be seen on hybrid bermudagrass. **DO NOT** reseed for 3 weeks after application. **DO NOT** apply to residential lawn areas. **DO NOT** compost treated lawn clippings.
triencarbazone + foramsulfuron + halosulfuron TRIBUTE TOTAL	0.023-0.073 oz. of 60.5% WDG [1-3.2 oz./A]	0.038-0.121	Many problem weeds and grasses, including dallisgrass, sedges, goosegrass, crabgrass, Virginia buttonweed, doveweed	Provides control of a number of annual and perennial grasses, sedges, and broadleaf weeds growing in established bermudagrass. For the specific weeds listed, the use rate is 3.2 ounces per acre with repeat treatment needed at scheduled intervals. **DO NOT** exceed a total of 6.4 ounces of Tribute Total per acre per season. Apply with the addition of a non-ionic surfactant or methylated seed oil (MSO) and ammonium suflate (AMS) to the spray mix. See label for weeds controlled, the use rate and specific additives needed, and timing of application. **DO NOT** apply when bermudagrass is stressed by drought or high temperatures.
trifloxysulfuron-sodium MONUMENT 75WG	0.007-0.013 oz. of 75WG (0.35-0.53 oz./A)	0.015-0.026	Annual bluegrass, ryegrass, nutsedge, tall fescue, signalgrass, spurge, green kyllinga, clover	May be used in established bermudagrass and zoysiagrass. **DO NOT** apply to residential lawns. Add a non-ionic surfactant at the rate of 1 to 2 quarts per 100 gallons of spray mix. Control may not occur for up to 4 weeks after treatment. Repeat treatment may be necessary on difficult weeds in 4 to 6 weeks. At reduced rates (see label), Monument may be used to remove overseeded perennial ryegrass and *Poa trivialis* from bermudagrass during spring transition.

Table 3. Herbicide Postemergence Recommendations for Warm-Season Grasses (cont.)

Herbicide	Herbicide Rate: Formulation per 1000 Square Feet	Herbicide Rate: Lb. Active Ingredient per Acre	Weeds Controlled	Time of Application and Special Instructions
ESTABLISHED BERMUDAGRASS AND/OR ZOYSIAGRASS (cont.)				
Postemergence (cont.)				
bispyribac-sodium VELOCITY SG	0.14 oz. of 17.6 SG (6 oz./A)	0.066	Annual bluegrass	Apply to established bermudagrass overseeded with perennial ryegrass on golf course fairways. Apply between February 1 and March 15 to bermudagrass overseeded the previous fall with perennial ryegrass for annual bluegrass control and seedhead suppression. Earlier or later application may decrease efficacy or increase risk of ryegrass injury. The first application should be made just as soon as annual bluegrass seedheads begin to emerge. Make a second application at the same rate 14 to 21 days after the first application. **DO NOT** apply if air temperature is less than 50°F or if maximum temperature is expected to be less than 50°F for the first 3 days after treatment. Not recommended for applications above 80°F or when air temperature is expected to exceed 80°F for the first 3 days after treatment. **DO NOT** apply to golf course greens, non-overseeded bermudagrass, or to ryegrass mowed less than 0.38 inch.

ESTABLISHED CENTIPEDEGRASS AND/OR ST. AUGUSTINEGRASS

Spray when weeds are actively growing, preferably when they are in seedling stage. Postemergence herbicides should be applied in 30 to 40 gallons of water per acre. A non-ionic surfactant at 0.5 percent of the spray solution (1 pint per 25 gallons) greatly increases control. Air temperatures in the 70-degree range are advisable. Application during dormancy will minimize turf damage. For the sensitive grasses or for grasses growing under stress conditions (such as those growing in shade or in drought situations), use the lowest effective rate in split applications. Make two applications 10 to 14 days apart with each application using one-half of the lowest effective rate.

Table 3. Herbicide Postemergence Recommendations for Warm-Season Grasses (cont.)

Herbicide	Herbicide Rate: Formulation per 1000 Square Feet	Herbicide Rate: Lb. Active Ingredient per Acre	Weeds Controlled	Time of Application and Special Instructions
ESTABLISHED CENTIPEDEGRASS AND/OR ST. AUGUSTINEGRASS				
Postemergence				
2,4-D + mecoprop + 2,4-DP TRIAMINE	See label.	See label.	Broad spectrum of weeds	**DO NOT** spray centipedegrass when air temperature exceeds 90°F and **DO NOT** spray St Augustinegrass when air temperature exceeds 80°F. Turfgrass should not be sprayed when growing under stress or drought conditions Delay reseeding for 4 weeks after treatment. Avoid application when turfgrass is emerging from winter dormancy..
2,4-D + mecoprop + dicamba TRIMEC BROADLEAF HERBICIDE BENTGRASS FORMULA	2-3 T. of 0.5 + 1.5 + 0.2 lb./gal. (3-4 pt./A)	0.17 + 0.55 + 0.07	Broad spectrum of broadleaf weeds	Read label. **DO NOT** overdose or apply during hot summer months. Repeat after 3 weeks if necessary. Spraying while grass is dormant reduces possibility of injury. Temperature should be above 70°F, but below 85°F.

Table 3. Herbicide Postemergence Recommendations for Warm-Season Grasses (cont.)

Herbicide	Herbicide Rate: Formulation per 1000 Square Feet	Herbicide Rate: Lb. Active Ingredient per Acre	Weeds Controlled	Time of Application and Special Instructions
ESTABLISHED CENTIPEDEGRASS AND/OR ST. AUGUSTINEGRASS (cont.)				
Postemergence (cont.)				
2,4-D + MCPA + dicamba + carfentrazone SPEEDZONE SOUTHERN	See label.	See label.	Chickweed, clover, dollarweed, henbit, ground ivy, oxalis, spurge, red sorrel	Apply only to centipedegrass and common St. Augustinegrass. Controls a number of broadleaf weeds. May be applied as a single broadcast treatment or as sequential treatments with a 2- to 6-week time interval. **DO NOT** apply when day temperatures are below 50°F or above 85°F. May be applied to newly seeded areas after the second mowing or 4 weeks after sodding, sprigging, or plugging. **DO NOT** apply this product to Floratam, Bitterblue, or other improved varieites of St. Augustinegrass.
amicarbazone XONERATE 70WDG	0.069-0.23 of 70WDG (3-10 oz./A)	0.13-0.44	Annual bluegrass, chickweed, henbit, spurge, speedwell	Apply to centipede or St. Augustine grasses established a minimum of 6 months. **DO NOT** use Xonerate on St. Augustinegrass in the summer months when air temperature is greater than 90°F. When applying at rates of 3 to 5 ounces per acre, repeat application is recommended at a 14- to 21-day interval. **DO NOT** exceed the maximum total use rate of 10 ounces per acre per season. See label for possible tank-mix partners.
bentazon BASAGRAN T/O	1.5 T. of 4 lb./gal. (2 pt./A)	1	Yellow nutsedge	Apply when yellow nutsedge is actively growing under good moisture conditions. Make additional applications at intervals of 10 to 14 days until nutsedge is eliminated. **DO NOT** make more than three applications in a single growing season. Avoid spraying adjacent trees, shrubs, and flowers. **DO NOT** mow 3 to 5 days before or after application. Purple nutsedge will not be controlled by this treatment. Add a crop oil concentrate to spray mix at a rate of 2 pints per acre when making application to yellow nutsedge.
bromoxynil BUCTRIL 2E	0.375-0.75 fl.oz. of 2 lb./gal. (1-2 pt./A)	0.25-0.5	Many seedling broadleaf weeds	**For Non-Residential Turf and Sod Production Only.** Apply to established St. Augustinegrass to control seedling broadleaf weeds. Weeds must be actively growing, and good spray coverage is essential. Apply in 20 to 40 gallons of water per acre or in 0.5 to 1 gallon of water per 1000 square feet.
carfentrazone QUICKSILVER T&O	0.023-0.048 fl.oz. of 1.9 lb./gal. (1-2.1 oz./A)	0.015-0.03	Numerous seedling broadleaf weeds	To expand the weed spectrum, QuickSilver may be tank-mixed with 2,4-D, 2,4-DP, and/or dicamba. Add a non-ionic surfactant at the rate of 1 to 2 pints surfactant per 100 gallons of spray mix.
carfentrazone + quinclorac SQUARE ONE 70WDG	0.28-0.41 of 70WDG (0.75-1.12 lb./A)	0.53-0.79	Wide spectrum of broadleaf weeds, some sedges and grasses	Use only on established centipedegrass not growing under stress. See label for surfactant and rate to use for sedge control.

Table 3. Herbicide Postemergence Recommendations for Warm-Season Grasses (cont.)

Herbicide	Herbicide Rate: Formulation per 1000 Square Feet	Herbicide Rate: Lb. Active Ingredient per Acre	Weeds Controlled	Time of Application and Special Instructions
ESTABLISHED CENTIPEDEGRASS AND/OR ST. AUGUSTINEGRASS (cont.)				
Postemergence (cont.)				
clethodim ENVOY PLUS	0.4-0.8 fl.oz. of 0.97 lb./gal. (17-34 oz./A)	0.125-0.25	Common bermudagrass	Use only on centipedegrass grown on sod farms. Add a non-ionic surfactant at rate of 1 quart per 100 gallons of spray mix. Two applications will be necessary for control. Make second application 3 to 4 weeks after the initial treatment when new growth (regrowth) is 1 to 2 inches tall. Use the high rate when treating established bermudagrass. Avoid mowing sod for one week before and after applications. **DO NOT** apply until 3 weeks after 100-percent green-up of centipedegrass in spring. STATE LABEL.
clopyralid LONTREL T&O	0.1-0.5 fl.oz. of 3 lb./gal. (0.25-1.33 pt.)	0.09-0.5	Clovers, black medic, dandelions, vetch, other broadleaf weeds	See label for specific rates for target pests. Can cause injury to desirable legumes and composite species. **DO NOT** irrigate for at least 2 hours after application. **DO NOT** apply to residential lawn areas. **DO NOT** compost treated lawn clippings.
dicamba VANQUISH 4S	0.16-0.33 fl.oz. of 4 lb./gal. (0.5-1 pt.)	0.25-0.5	Many broadleaf weeds	Apply to established centipedegrass only. **DO NOT** use within drip line of trees or shrubs. Follow label directions. Make only one application per year.
fluroxypyr SPOTLIGHT	0.25-0.5 fl. oz. of 1.5 lb./gal. (0.67-1.33 pt./A)	0.125-0.25	Bedstraw, chickweed, Virginia buttonweed, clover, woodsorrel, ground ivy	Apply postemergence to established centipedegrass and St. Augustinegrass to control a number of annual and perennial broadleaf weeds. Use low rate on St. Augustinegrass if injury can be tolerated. Repeat treatment can be made 4 weeks after previous treatment. Do not apply more than 2.5 pints per acre per year. See label concerning need for addition of non-ionic surfactant.
halosulfuron SEDGEHAMMER 75DF	0.015-0.03 oz. of 75DF (0.67-1.33 oz./A)	0.031-0.062	Yellow nutsedge, purple nutsedge	Apply to established centipedegrass and St. Augustinegrass. Apply after nutsedge has reached 3- to 8-leaf stage. Apply 2 quarts of non-ionic surfactant per 100 gallons of spray mix, but **DO NOT** exceed 2 pints of surfactant per acre. A second application can be made 6 to 10 weeks after the first one when nutsedge has three to eight leaves. **DO NOT** make more than two applications or apply more than 0.125 pound a.i. per acre per year.
imazaquin IMAGE 70DG	0.2-0.26 oz. of 70DG (8.6-11.4 oz./A)	0.375-0.5	Wild garlic, wild onion, nutsedge, sandbur, henbit, chickweed	Apply to well-established, actively growing turf when weeds are small. Add non-ionic surfactant to the spray solution at the rate of 2 pints per 100 gallons. A repeat treatment may be needed for season-long control. St. Augustinegrass should not be mowed until 48 hours after application. **DO NOT** use on St. Augustinegrass for winter weed control.

Table 3. Herbicide Postemergence Recommendations for Warm-Season Grasses (cont.)

Herbicide	Herbicide Rate: Formulation per 1000 Square Feet	Herbicide Rate: Lb. Active Ingredient per Acre	Weeds Controlled	Time of Application and Special Instructions
ESTABLISHED CENTIPEDEGRASS AND/OR ST. AUGUSTINEGRASS (cont.)				
Postemergence (cont.)				
metsulfuron methyl MANOR 60WDG	0.005-0.02 oz. of 60WDG (0.25-1 oz./A)	0.009-0.0375	Bahiagrass, clover, chickweed, dandelion, spurge, wild garlic	Apply as a postemergence treatment to control target weeds. **DO NOT** apply more than 0.01 ounce of Manor per 1000 square feet to centipedegrass. Some yellowing and stunting may be observed. Add a non-ionic surfactant to spray mix at the rate of 1 quart per 100 gallons of spray mix. Use the low to medium rate (0.01 ounce per 1000 square feet) to control most broadleaf weeds and bahiagrass. Repeat treatment may be necessary in 4 to 6 weeks.
sethoxydim SEGMENT 1EC	0.55-0.77 fl.oz. of 1EC (1.5-2.25 pt./A)	0.18-0.28	Crabgrass	Apply to seedling and established centipedegrass only, but no sooner than 3 weeks after spring green-up. Apply low rate to seedling centipede and high rate to established centipede. Make application before crabgrass is well established. **DO NOT** mow turf area for 7 days before or after application. **DO NOT** make more than two applications per season. **DO NOT** add additional additives.
sulfentrazone DISMISS 4SC	0.18-0.275 fl.oz. of 4 lb./gal. (0.5-0.75 pt./A)	0.25-0.375	Nutsedges, annual sedges, wide spectrum of broadleaf weeds	Apply to established centipede and St. Augustine grasses. St. Augustinegrass may exhibit temporary discoloration. See label for instructions on sedge control.
sulfentrazone + metsulfuron BLINDSIDE 66WDG	0.15-0.23 oz. of 66WDG (6.5-10 oz./A)	0.27-0.41	Wide spectrum of broadleaf weeds, some sedges and grasses	Use only on established centipedegrass and St. Augustinegrass not growing under stress. See label for surfactant and rate to use for sedge control.
sulfentrazone + quinclorac SOLITAIRE 75WDG	0.37-0.74 oz. of 75WDG (1-2 lb./A)	0.75-1.5	Wide spectrum of broadleaf weeds, some sedges and grasses	Use only on established centipedegrass not growing under stress. See label for surfactant and rate to use for sedge control.
sulfosulfuron CERTAINTY	0.017-0.029 oz. of 75DF (0.75-1.25 oz./A)	0.035-0.059	Yellow nutsedge, purple nutsedge, annual sedges	Apply postemergence to established centipedegrass and St. Augustinegrass to control listed sedges and broadleaf weeds. A second application can be made 4 to 10 weeks after the initial treatment if needed. Add a non-ionic surfactant to spray mix at rate of 1 quart per 100 gallons of spray mix. Some turf yellowing or stunting can be expected. **DO NOT** exceed 2.66 ounces per acre per year.
triclopyr + clopyralid CONFRONT	0.37-0.75 fl.oz. of 3 lb./gal. (1-2 pt./A)	0.375-0.75	Broad spectrum of broadleaf weeds	Apply to established centipedegrass only. **DO NOT** apply in areas of shallow-rooted trees and shrubs. **DO NOT** apply more than 1.5 pounds a.i. per year. Repeat treatments to control wild violets and woodsorrel. **DO NOT** use on residential lawn areas. **DO NOT** compost treated lawn clippings. **DO NOT** apply when air temperatures exceed 85°F.

ESTABLISHED KENTUCKY BLUEGRASS, FESCUES, AND RYEGRASS

Table 4. Herbicide Postemergence Recommendations for Cool-Season Grasses

Herbicide	Herbicide Rate: Formulation per 1000 Square Feet	Herbicide Rate: Lb. Active Ingredient per Acre	Weeds Controlled	Time of Application and Special Instructions
ESTABLISHED KENTUCKY BLUEGRASS, FESCUES, AND RYEGRASS				
Postemergence				
2,4-D + clopyralid + dicamba MILLENNIUM ULTRA 2	0.73-1.1 fl.oz. of 3.75 lb./gal. (2-3 pt./A)	0.75-1.12 + 0.09-0.14 + 0.09-0.14	Broad spectrum of broadleaf weeds	Read the label. When treating grass growing under stress conditions, use half rates. Slight yellowing of turf will disappear after one week. To minimize turf injury, a second application should not be made for at least 4 weeks. **DO NOT** spray when air temperatures exceed 90°F. **DO NOT** reseed for 3 to 4 weeks after application. **DO NOT** apply to residential lawn areas. **DO NOT** compost treated lawn clippings.
2,4-D + dicamba + fluroxypyr ESCALADE 2	0.75-1.1 fl.oz. of 4.4 lb/gal. (2-3 pt./A)	0.8-1.2 + 0.1-0.15 + 0.2-0.3	Broad spectrum of broadleaf weeds	Apply to actively growing established fescue and Kentucky bluegrass. Use low rate on closely mowed turf or turf under stress. Some turf yellowing can be expected. To minimize grass injury, retreatment should not occur until later than 4 weeks after initial treatment. See label for reduced rate and timings of use on sod farms.
2,4-D + MCPP + dicamba TRIMEC CLASSIC (Other trade names)	Follow label directions on Trimec or equivalent.	*See Special Instructions.	Broad spectrum of broadleaf weeds including wild garlic and onion	***DO NOT** apply more than 1 pound of 2,4-D per acre per application. **DO NOT** use within the dripline of trees or shrubs. Avoid spraying during long periods of dry or hot weather. Reseeding can occur 4 weeks after treatment. Make no more than two applications per year.
2,4-D + MCPP + dicamba + sulfentrazone SURGE	1.2-1.5 fl.oz. of 2.18 lb./gal. (3.25-4 pt./A)	0.57-0.7 + 0.2-0.25 + 0.09-0.11 + 0.02-0.03	Broad spectrum of broadleaf weeds	Apply to established cool season perennial turfgrasses. Sequential broadcast treatment can be made 2 to 6 weeks later depending on weed growth. Make only two applications per year. **DO NOT** apply if air temperature exceeds 90°F.
2,4-D + quinclorac+ dicamba QUINCEPT	2.6-2.9 fl.oz. of 1.875 lb./gal. (7-8 pt./A)	0.875-1 + 0.66-0.75 + 0.11-0.125	Crabgrass, signalgrass, oxalis, clover, others	Apply to cool-season established turfgrass for control of seedling broadleaf weeds and suppression or control of few grasses. **DO NOT** apply when temperatures exceed 90°F or when turf is stressed.
amicarbazone XONERATE 70WDG	0.046-0.092 oz. of 70WDG (2-4 oz./A)	0.09-0.18	Annual bluegrass, chickweed, henbit, spurge, speedwell	Apply when air temperature ranges from 50 to 85°F. Applications made in summer or fall when day temperature is greater than 85°F will result in unacceptable injury. Apply to fescue or perennial ryegrass established a minimum of 6 months. Kentucky bluegrass must be established at least 12 months prior to treatment. For annual bluegrass control in fescue or ryegrass, apply Xonerate twice at 2 to 4 ounces per acre at a 14- to 21-day interval. For annual bluegrass control in Kentucky bluegrass, apply Xonerate twice at 2 ounces per acre at a 14- to 21-day interval. See label for possible tank-mix partners for broader spectrum of weeds controlled.

Table 4. Herbicide Postemergence Recommendations for Cool-Season Grasses (cont.)

Herbicide	Herbicide Rate: Formulation per 1000 Square Feet	Herbicide Rate: Lb. Active Ingredient per Acre	Weeds Controlled	Time of Application and Special Instructions
ESTABLISHED KENTUCKY BLUEGRASS, FESCUES, AND RYEGRASS (cont.)				
Postemergence (cont.)				
bentazon BASAGRAN T/O	0.75 fl.oz. of 4 lb./gal. (2 pt./A)	1	Yellow nutsedge	Apply when yellow nutsedge is actively growing under good moisture conditions. Make additional applications at intervals of 10 to 14 days until nutsedge is eliminated. **DO NOT** make more than three applications in a single growing season. Avoid spraying adjacent trees, shrubs, and flowers. **DO NOT** mow 3 to 5 days before or after application. Purple nutsedge will not be controlled by this treatment. Add a crop oil concentrate to the spray mix at a rate of 2 pints per acre when making application to yellow nutsedge.
carfentrazone QUICKSILVER T&O	0.023-0.048 fl.oz. of 1.9 lb./gal. (1-2.1 oz./A)	0.015-0.03	Numerous seedling broadleaf weeds	To expand the weed spectrum, QuickSilver may be tank-mixed with 2,4-D, 2,4-DP, and dicamba. Add a non-ionic surfactant at the rate of 1 to 2 pints surfactant per 100 gallons of spray mix.
chlorsulfuron CORSAIR 75WDG	0.06-0.12 oz. of 75WDG	0.13-0.25	Tall fescue, wild onion, wild violet	Apply as a postemergence spot treatment to established Kentucky bluegrass or fine fescue turf. Spray **ONLY** to wet the tall fescue blades. Avoid over-application. Repeat treatment may be needed in 60 days. **DO NOT** apply under desirable trees. Add a non-ionic surfactant to spray mix at rate of 1 quart per 100 gallons of spray mix.
clopyralid LONTREL T&O	0.1-0.5 fl.oz. of 3 lb./gal. (0.25-1.33 pt.)	0.09-0.5	Black medic, clovers, dandelions, vetch, other broadleaf weeds	See label for specific rate for target pest. Can cause injury to desirable legumes and composite species. **DO NOT** irrigate for at least 2 hours after application. **DO NOT** apply to residential lawn areas. **DO NOT** compost treated lawn clippings.
ethofumesate PROGRASS 1.5E	2-4 fl.oz. of 1.5 lb./gal. (2.6-5.2 qt.)	1-2	Annual bluegrass, common chickweed	Use **ONLY** on established perennial ryegrass. Apply in early fall (September) about the time of annual bluegrass germination. One to two additional applications at 21- to 28-day intervals may be needed to maintain control. Provides postemergence and preemergence control of listed weeds. May be used during the establishment of perennial ryegrass. See label for additional instructions.
fenoxaprop ACCLAIM EXTRA	0.33-0.83 fl.oz. of 0.57 lb./gal. (13-39 fl.oz./A)	0.06-0.17	Crabgrass, goosegrass, barnyardgrass, johnsongrass, common bermudagrass	Apply Acclaim in late spring or early summer to actively growing weedy grasses in the 3-leaf (low rate) to 5-tiller (high rate) growth stage. Apply with 30 to 60 gallons of water per acre at 30 to 60 psi. Add a non-ionic surfactant (1 quart per 100 gallons) if application is made using a spray pressure less than 30 psi or when spray volumes are larger than 60 gallons per acre. Spray intervals should be greater than 14 days. **DO NOT** apply more than 120 ounces per acre per year. Tank-mixing Acclaim with phenoxy or related herbicides will reduce grass control on larger (tillered) grasses. Acclaim will not control annual bluegrass.

Table 4. Herbicide Postemergence Recommendations for Cool-Season Grasses (cont.)

Herbicide	Herbicide Rate: Formulation per 1000 Square Feet	Herbicide Rate: Lb. Active Ingredient per Acre	Weeds Controlled	Time of Application and Special Instructions
ESTABLISHED KENTUCKY BLUEGRASS, FESCUES, AND RYEGRASS (cont.)				
Postemergence (cont.)				
halosulfuron SEDGEHAMMER 75DF	0.015-0.03 oz. of 75DF (0.67-1.33 oz./A)	0.031-0.062	Yellow nutsedge, purple nutsedge	Apply to established tall fescue, Kentucky bluegrass, and perennial ryegrass. Apply after nutsedge has reached 3- to 8-leaf stage. Apply 2 quarts of non-toxic surfactant per 100 gallons of spray mix, but **DO NOT** exceed 2 pints of surfactant per acre. A second application can be made 6 to 10 weeks after the first one when nutsedge has three to eight leaves. **DO NOT** make more than two applications or apply more than 0.125 pound a.i. per acre.
MCPA + MCPP + dicamba TRI-POWER	See label.	See label.	Broad spectrum of broadleaf weeds	For tall fescue and Kentucky bluegrass. Refer to appropriate label for use rates. **DO NOT** use when air temperature is above 85°F. Delay reseeding for 3 to 4 weeks after treatment.
MCPA + triclopyr + dicamba COOL POWER	0.91-1.29 fl.oz. of 3.6 lb./gal. (2.5-3.5 pt./A)	0.94-1.31 + 0.09-0.13 + 0.09-0.13	Broad spectrum of broadleaf weeds	Read the label. Turf injury will occur if application is made when turf is under stress. **DO NOT** reseed sooner than 3 to 4 weeks after application. **DO NOT** spray when air temperature is above 85°F. Cool Power contains the ester formulations primarily for use during the cool winter months.
HORSEPOWER	0.73-1.10 fl.oz. of 4.4 lb./gal. (2-3 pt./A)	0.95-1.4 + 0.09-0.14 + 0.09-0.14		
mesotrione TENACITY	0.11-0.18 fl.oz. of 4 lb./gal. (5-8 fl.oz.)	0.16-0.25	Controls a few grasses and a number of broadleaf weeds. Aids with preemergence control of some weeds by other herbicides.	Apply to established cool-season turfgrasses. See label for application instructions for use during seeding. See label for reduced use rate for perennial ryegrass and fine fescues. Retreatment after 2 to 3 weeks may be required for adequate control. Apply with a non-ionic surfactant.
metsulfuron methyl MANOR 60WDG	0.005-0.01 oz. of 60WDG (0.25-0.5 oz./A)	0.009-0.018	Bahiagrass, clover, chickweed, dandelion, spurge, wild garlic	Apply as a postemergence treatment to control target weeds in fine fescues and Kentucky bluegrass. **DO NOT** apply to tall fescue or ryegrass turf. Some yellowing and stunting may be observed in fine fescues and Kentucky bluegrass. Add a non-ionic surfactant to spray mix at the rate of 1 quart per 100 gallons of spray mix. Repeat treatments may be necessary in 4 to 6 weeks.
quinclorac DRIVE 75 DF	0.367 oz. of 75DF (1 lb./A)	0.75	Torpedograss suppression	Requires two applications each year. **DO NOT** apply more than 1.5 pound a.i. per acre in one year. Must be applied with a methylated seed oil at rate of 1.5 pints per acre to spray mix. **DO NOT** apply within root zone of ornamentals.
DRIVE XLR8	1.45 fl.oz. of 1.5 lb./gal. (4 pt./A)	0.75		

Table 4. Herbicide Postemergence Recommendations for Cool-Season Grasses (cont.)

Herbicide	Herbicide Rate: Formulation per 1000 Square Feet	Herbicide Rate: Lb. Active Ingredient per Acre	Weeds Controlled	Time of Application and Special Instructions
ESTABLISHED KENTUCKY BLUEGRASS, FESCUES, AND RYEGRASS (cont.)				
Postemergence (cont.)				
quinclorac + MCPP + dicamba ONETIME	1.45 fl.oz. of 2.45 lb./gal. (4 pt./A)	0.75 + 0.35 + 0.10	Crabgrass, signal-grass, dandelions, clover, others	Apply to tall fescue and Kentucky bluegrass to control few grasses and many broadleaf weeds. **DO NOT** apply more than two times per year. **DO NOT** apply when temperature is above 90°F.
quinclorac + sulfentrazone + 2,4-D + dicamba Q4 PLUS TURF HERBICIDE	2.6-3 fl.oz of 1.54 lb./gal. (7-8 pt./A)	0.44-0.5 + 0.05-0.06 + 0.77-0.88 + 0.09-0.10	Broadleaf weeds, few grasses; suppression of yellow nutsedge	Apply to established cool season perennial grasses. Sequential treatment can be made 14 to 21 days after initial application. Make only two applications per year. **DO NOT** apply if air temperature exceeds 90°F. **DO NOT** apply to diseased or drought-stressed turfgrass.
sulfentrazone DISMISS 4SC	0.092-0.18 fl.oz. of 4 lb./gal. (0.25-0.5 pt./A)	0.125-0.25	Nutsedges, annual sedges, wide spectrum of broadleaf weeds	Apply to established tall fescue and Kentucky bluegrass turfgrasses. See label for instructions on nutsedge control.
triclopyr + clopyralid CONFRONT	0.37-0.75 fl.oz. of 3 lb./gal. (1-2 pt./A)	0.375-0.75	Broad spectrum of broadleaf weeds	Apply to tall fescue, Kentucky bluegrass, and perennial ryegrass. Repeat treatments will be necessary to control wild violets and woodsorrel. Mow newly seeded turf two to three times before treatment. **DO NOT** water for 24 hours after applying. **DO NOT** apply to exposed roots of shallow-rooted trees and shrubs. **DO NOT** reseed for 3 weeks after application. **DO NOT** apply to residential lawn areas. **DO NOT** compost treated lawn clippings. **DO NOT** app;ly when air temperature exceeds 85°F.

Table 5. Herbicide Postemergence Recommendations for Special Problems

Herbicide	Herbicide Rate: Formulation per 1000 Square Feet	Herbicide Rate: Lb. Active Ingredient per Acre	Weeds Controlled	Time of Application and Special Instructions
glufosinate FINALE	2.2-4.4 fl.oz. of 1 lb./gal. (3-6 qt./A)	0.75-1.5	Most annual broadleaf weeds and grasses	Non-selective weed control around buildings, fencerows, parking lots, ditchbanks, and other public areas.
glyphosate ROUNDUP PRO ROUNDUP ORIGINAL Generics	2-3 fl.oz. of 4 lb./gal. (3-4 qt./A)	3-4 (isopropyl-amine salt)	Most annual and perennial broadleaf and grass weeds such as bermudagrass, bahiagrass, johnsongrass, honeysuckle, kudzu, nutsedge, etc.	Non-selective weed control around buildings, fencerows, airports, parking areas, schools, parks, golf courses, and other public areas. Avoid drift to non-target plants. **DO NOT** use galvanized (zinc-coated) spray equipment. Weeds **MUST** be actively growing. Best results are obtained in mid to late summer. Control is slow. No residual activity. Refer to label for need and rate of surfactant.
paraquat GRAMOXONE INTEON 2.0	0.75-1.5 fl.oz. of 2 lb./gal. (2-4 pt./A)	0.5-1	Most annual broadleaf and grass weeds; top-kill of perennials	Non-selective weed control around buildings, fencerows, power plants, and other similar noncrop areas. This is a **RESTRICTED USE** pesticide. Avoid contact with foliage of ornamentals or other desirable plants. Add a non-ionic surfactant to spray mix at rate of 1 quart per 100 gallons of spray mix.

Table 6. Estimated Control from Preemergence Herbicides [1, 2]

WEEDS	HERBICIDES							
	atrazine	benefin	bensulide	benefin + oryzalin	benefin + trifluralin	dithiopyr	isoxaben	metolachlor
Annual bluegrass	G	G	G	G	G	E	N	F
Chickweed	E	N	F	F	G	—	E	—
Clovers	G	N	N	N	—	—	G	—
Crabgrass	F	G	E	E	G	E	N	G
Dandelion	—	N	N	N	N	—	G	N
Florida betony	E	N	N	N	N	N	—	N
Goosegrass	F	F	F	F	G	G	—	F
Ground ivy	G	N	N	N	N	N	—	N
Henbit	E	N	N	N	—	—	G	—
Lawn burweed	G	N	N	N	N	N	—	—
Lespedeza	G	N	N	N	N	N	—	—
Pennywort	E	N	N	N	N	N	G	N
Plantain	—	N	N	N	N	N	G	—
Prostrate spurge	—	N	N	N	N	—	F	N
Woodsorrel	G	N	N	N	N	N	G	—

continued

[1] E = Excellent; G = Good; F = Fair; N = No control; — = Data not available.

[2] Adapted from information contained in Turf Weed Control Guidelines for Mississippi, Mississippi State University Extension Service and Mississippi Agricultural and Forestry Experiment Station, Mississippi State, MS 39762.

Table 6. Estimated Control from Preemergence Herbicides [1, 2] (cont.)

WEEDS	HERBICIDES						
	oryzalin	oxadiazon	oxadiazon + prodiamine	pendimethalin	prodiamine	pronamide	simazine
Annual bluegrass	E	G	G	E	E	E	E
Chickweed	G	F	F	G	—	F	E
Clovers	N	N	—	N	—	—	F
Crabgrass	E	G	E	E	E	N	F
Dandelion	N	N	N	N	N	N	F
Florida betony	N	N	N	N	N	N	—
Goosegrass	G	E	E	G	E	—	N
Ground ivy	N	N	N	N	N	N	G
Henbit	N	G	—	N	—	—	E
Lawn burweed	N	F	N	N	—	—	E
Lespedeza	N	—	N	N	N	—	F
Pennywort	N	N	N	N	N	N	N
Plantain	N	N	N	N	N	N	F
Prostrate spurge	N	G	F	F	—	—	G
Woodsorrel	F	G	F	F	F	—	G

[1] E = Excellent; G = Good; F = Fair; N = No control; — = Data not available.

[2] Adapted from information contained in Turf Weed Control Guidelines for Mississippi, Mississippi State University Extension Service and Mississippi Agricultural and Forestry Experiment Station, Mississippi State, MS 39762.

Table 7. Estimated Control from Postemergence Herbicides [1, 2]

WEEDS	HERBICIDES						
	2,4-D	2,4-D + dicamba	2,4-D + dicamba + fluroxypy	2,4-D + mecoprop	2,4-D + mecoprop + dicamba	amicarbazone	atrazine
Annual bluegrass	N	N	N	N	N	G	E
Bahiagrass	N	N	N	N	N	N	N
Chickweed	F	G	E	G	E	G	E
Clovers	N	E	E	G	E	F	G
Crabgrass	N	N	N	N	N	F	F
Dallisgrass	N	N	N	N	N	N	N
Dandelion	E	E	E	E	E	N	F
Florida betony	N	G	G	F	G	F	F
Goosegrass	N	N	N	N	N	N	N
Ground ivy	G	—	G	—	G	N	G
Henbit	F	G	E	G	E	G	E
Lawn burweed	F	G	G	F	G	F	E
Lespedeza	F	G	G	G	G	—	F
Nutsedge, purple	N	N	N	N	N	N	N
Nutsedge, yellow	N	N	N	N	N	N	N
Pennywort	F	G	F	G	G	N	F
Plantain	E	G	G	G	G	N	F
Prostrate spurge	N	G	G	F	G	—	G
Virginia buttonweed	N	G	F	F	G	N	N
Wild garlic	F	F	—	F	F	N	N
Woodsorrel	N	F	G	N	F	—	G

continued

[1] E = Excellent; G = Good; F = Fair; N = No control; — = Data not available.

[2] Adapted from information contained in Turf Weed Control Guidelines for Mississippi, Mississippi State University Extension Service and Mississippi Agricultural and Forestry Experiment Station, Mississippi State, MS 39762.

Table 7. Estimated Control from Postemergence Herbicides [1] (cont.)

WEEDS	HERBICIDES						
	bentazon	bispyribac	carfentrazone	clethodim	clopyralid	clopyralid + triclopyr	diclofop
Annual bluegrass	N	G	N	F	N	N	—
Bahiagrass	N	N	N	—	N	N	N
Chickweed	N	E	G	N	—	E	N
Clovers	N	E	G	N	E	E	N
Crabgrass	N	N	N	G	N	N	—
Dallisgrass	N	N	N	N	N	N	N
Dandelion	—	F	G	N	F	E	N
Florida betony	—	N	—	N	—	—	N
Goosegrass	N	N	N	F	N	N	E
Ground ivy	—	—	G	N	—	G	N
Henbit	—	E	G	N	—	E	N
Lawn burweed	—	G	—	N	—	—	N
Lespedeza	N	—	—	N	—	—	N
Nutsedge, purple	N	N	N	N	N	N	N
Nutsedge, yellow	E	—	N	N	N	N	N
Pennywort	—	N	—	N	—	—	N
Plantain	—	G	—	N	G	F	N
Prostrate spurge	—	—	E	N	N	E	N
Virginia buttonweed	N	N	N	N	—	F	N
Wild garlic	—	N	—	N	N	F	N
Woodsorrel	—	F	—	N	—	—	N

continued

[1] E = Excellent; G = Good; F = Fair; N = No control; — = Data not available.

Table 7. Estimated Control from Postemergence Herbicides [1] (cont.)

WEEDS	HERBICIDES						
	dicamba	fenoxaprop	fluroxypyr	halosulfuron	imazaquin	mecoprop	mesotrione
Annual bluegrass	N	—	—	N	N	N	N
Bahiagrass	N	N	—	N	—	N	N
Chickweed	E	N	E	—	G	G	G
Clovers	E	N	E	—	—	E	G
Crabgrass	N	E	—	N	—	N	F-G
Dallisgrass	N	N	—	N	N	N	N
Dandelion	G	N	F	N	F	F	G
Florida betony	G	N	F	N	—	N	G
Goosegrass	N	G	—	N	N	N	F-G
Ground ivy	—	N	G	—	—	N	F
Henbit	E	N	F	N	F	F	G
Lawn burweed	G	N	—	—	—	N	G
Lespedeza	E	N	—	N	—	G	—
Nutsedge, purple	N	N	—	E	E	N	N
Nutsedge, yellow	N	N	—	E	E	N	G
Pennywort	G	N	—	N	—	N	G
Plantain	F	N	F	N	—	F	N
Prostrate spurge	F	N	—	N	—	N	—
Virginia buttonweed	F	N	G	N	—	N	N
Wild garlic	F	N	—	—	E	N	N
Woodsorrel	G	N	E	N	F	F	G

continued

[1] E = Excellent; G = Good; F = Fair; N = No control; — = Data not available.

Table 7. Estimated Control from Postemergence Herbicides [1] (cont.)

WEEDS	HERBICIDES						
	metribuzin	metsulfuron	MSMA	rimsulfuron	sethoxydim	sulfentrazone	sulfosulfuron
Annual bluegrass	G	N	N	E	F	N	G
Bahiagrass	—	E	F	—	F	N	N
Chickweed	G	G	N	—	N	G	G
Clovers	N	G	N	—	N	G	E
Crabgrass	N	N	E	—	G	—	N
Dallisgrass	N	N	E	—	N	N	N
Dandelion	N	G	N	—	N	G	—
Florida betony	N	G	N	—	N	N	—
Goosegrass	N	N	F	—	F	G	N
Ground ivy	G	G	N	E	N	F	—
Henbit	G	G	N	—	N	G	G
Lawn burweed	G	—	N	G	N	G	—
Lespedeza	N	G	N	—	N	G	F
Nutsedge, purple	N	N	F	—	N	F-G	G
Nutsedge, yellow	N	N	F	—	N	G	G
Pennywort	N	N	F	—	N	—	—
Plantain	N	G	N	—	N	F	—
Prostrate spurge	N	G	N	—	N	G	—
Virginia buttonweed	N	—	N	—	N	N	N
Wild garlic	N	N	N	—	N	G	N
Woodsorrel	N	G	N	—	N	G	—

[1] E = Excellent; G = Good; F = Fair; N = No control; — = Data not available.

Table 8. Tolerance of Established Turfgrasses to Herbicides [1]

ESTABLISHED TURF	HERBICIDES							
	atrazine (PRE)	bensulide (PRE)	dithiopyr (PRE)	isoxaben (PRE)	oxadiazon (PRE)	prodiamine (PRE)	simazine (PRE)	pronamide (PRE, POST)
WARM SEASON								
Bahiagrass	I-S	T	—	T	—	T	I-S	—
Bermudagrass	I-D	T	T	T	T	T	I-D	T
Centipedegrass	T	T	T	T	T	T	T	I
St. Augustinegrass	T	T	T	T	T	T	T	I
Zoysiagrass	I	T	T	T	—	T	I	I
COOL SEASON								
Kentucky Bluegrass	S	T	T	T	—	T	S	S
Red Fescue	S	T	—	T	—	T	S	S
Tall Fescue	S	T	T	T	—	T	S	S

continued

[1] Ratings are based on observations of research plots and field use of herbicides under average weather conditions for several year sby weed control workers in Alabama. Control may vary depending on factors such as time and method of application, weather conditions, size of weeds, etc.

KEY TO RATINGS AND ABBREVIATIONS

T = Tolerant.
I = Intermediately tolerant; use herbicide with care.
S = Sensitive; do not use this herbicide.
D = Dormant grasses tolerant to this herbicide; will kill growing plants.
— = Information not available.
PRE = Preemergence

NOTE: Some of the above combinations show a tolerance rating although such usage is not currently labeled.

Table 8. Tolerance of Established Turfgrasses to Herbicides [1] (cont.)

ESTABLISHED TURF	HERBICIDES							
	2,4-D (POST)	2,4-D + dicamba + fluoxypyr (POST)	amicarb-azone (POST)	bentazon (POST)	bispyribac (POST)	carfentra-zone (POST)	clethodim (POST)	clopyralid (POST)
WARM SEASON								
Bahiagrass	T	I-S	S	T	T	I	S	T
Bermudagrass	T	T	T	T	T	T	S	T
Centipedegrass	I	S	T	T	I	S	T	T
St. Augustinegrass	I	S	T	T	I	S	S	T
Zoysiagrass	T	T	T	T	T	S	S	T
COOL SEASON								
Kentucky Bluegrass	I	T	I	T	T	S	S	T
Red Fescue	I	I	T	T	T	S	S	T
Tall Fescue	T	T	T	T	T	S	S	T

continued

[1] Ratings are based on observations of research plots and field use of herbicides under average weather conditions for several years by weed control workers in Alabama. Control may vary depending on factors such as time and method of application, weather conditions, size of weeds, etc.

KEY TO RATINGS AND ABBREVIATIONS

T = Tolerant.
I = Intermediately tolerant; use herbicide with care.
S = Sensitive; do not use this herbicide.
D = Dormant grasses tolerant to this herbicide; will kill growing plants.
— = Information not available.
PRE = Preemergence
POST = Postemergence

NOTE: Some of the above combinations show a tolerance rating although such usage is not currently labeled.

Table 8. Tolerance of Established Turfgrasses to Herbicides [1] (cont.)

ESTABLISHED TURF	HERBICIDES						
	dicamba (POST)	fluroxypyr (POST)	glyphosate (POST)	halosulfuron (POST)	imazaquin (POST)	mecoprop (POST)	metribuzin (POST)
WARM SEASON							
Bahiagrass	T	S	S	T	I	T	I
Bermudagrass	T	I	S	T	T	T	T
Centipedegrass	I	T	S	T	T	I	S
St. Augustinegrass	S	I	S	T	T	I	S
Zoysiagrass	T	T	S	T	T	T	S
COOL SEASON							
Kentucky Bluegrass	I	T	S	T	S	T	S
Red Fescue	I	I	S	T	S	T	S
Tall Fescue	T	T	S	T	S	T	S

continued

[1] Ratings are based on observations of research plots and field use of herbicides under average weather conditions for several years by weed control workers in Alabama. Control may vary depending on factors such as time and method of application, weather conditions, size of weeds, etc.

KEY TO RATINGS AND ABBREVIATIONS

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POST = Postemergence

NOTE: Some of the above combinations show a tolerance rating although such usage is not currently labeled.

Table 8. Tolerance of Established Turfgrasses to Herbicides [1] (cont.)

ESTABLISHED TURF	HERBICIDES						
	mesotrione (POST)	metsulfuron (POST	MSMA (POST)	rimsulfuron (POST)	sethoxydim (POST)	sulfentrazone (POST)	sulfosulfuran (POST)
WARM SEASON							
Bahiagrass	—	T	I-S	I	S	T	S
Bermudagrass	S	T	T	T	S	T	S
Centipedegrass	T	T	S	T	T	T	T
St. Augustinegrass	T	T	S	T	S	T	S
Zoysiagrass	S	T	T	T	S	T	S
COOL SEASON							
Kentucky Bluegrass	T	T	T	S	S	T	S
Red Fescue	T	T	I	S	S	T	S
Tall Fescue	T	T	T	S	S	T	S

[1] Ratings are based on observations of research plots and field use of herbicides under average weather conditions for several years by weed control workers in Alabama. Control may vary depending on factors such as time and method of application, weather conditions, size of weeds, etc.

KEY TO RATINGS AND ABBREVIATIONS

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POST = Postemergence

NOTE: Some of the above combinations show a tolerance rating although such usage is not currently labeled.

Commercial Turf and Lawns: Chemical Weed Control Recommendations prepared by John W. Everest, Professor Emeritus, Department of Crop, Soil and Environmental Sciences, Auburn University.

FOR MORE INFORMATION on pesticides, pesticide safety, or submitting samples for analysis, see the following publications in the IPM series:
IPM 1293, “Safety.” Safety contact information; worker protection standards; the safe use, handling, and storage of pesticides
IPM 1294, “Submitting Samples.” Procedures for submitting samples for diagnosis, analysis, and identification
IPM 1295, “General Pesticide Information.” Federal and state restricted use pesticide lists; pesticides and water quality
IPM 1317, “Appendix.” Pesticide guidelines for agronomic crops, including preharvest intervals; rain-free requirements; grazing restrictions; crop rotation guidelines; and the names, classifications, and toxicities of pesticides.

2014 IPM-0022

For more information, contact your county Extension office. Visit www.aces.edu/counties or look in your telephone directory under your county’s name to find contact information.

Use pesticides **only** according to the directions on the label. Follow all directions, precautions, and restrictions that are listed. Do not use pesticides on plants that are not listed on the label

The pesticide rates in this publication are recommended **only** if they are registered with the Environmental Protection Agency or the Alabama Department of Agriculture and Industries. If a registration is changed or canceled, the rate listed here is no longer recommended. Before you apply **any** pesticide, check with your county Extension agent for the latest information.

Trade names are used **only** to give specific information. The Alabama Cooperative Extension System does not endorse or guarantee any product and does not recommend one product instead of another that might be similar.

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Appendix

Alabama Pest Management Handbook for 2014

Table 1. Preharvest Intervals (PhI) for Postemergence Herbicide Applications on Field Corn, Grain Sorghum, and Wheat

Chemical Trade Name	Minimum Days from Last Application to Harvest: Field Corn	Grain Sorghum	Wheat
2,4-D	NIL	NIL	NIL
Accent	NIL	N/A	N/A
Achieve	N/A	N/A	60
Atrazine	NIL	NIL	N/A
Banvel	NIL	NIL	N/A
Basagran	NIL	NIL	N/A
Beacon	60	N/A	N/A
Evik	NIL	N/A	N/A
Express	N/A	N/A	45
Gramoxone/ Firestorm (PDS)	NIL	N/A	N/A
Harmony Extra	N/A	N/A	45
Hoelon	N/A	N/A	77
Lorox	NIL	NIL	N/A
Peak	N/A	NIL	NIL
Permit	NIL	NIL	N/A
Princep	NIL	N/A	N/A
Prowl	NIL	N/A	N/A

KEY TO ABBREVIATIONS

NIL = No preharvest interval is listed on label

N/A = Do not apply this chemical to the crop indicated

PDS = Post Directed Spray

Table 2. Preharvest Intervals (PhI) for Postemergence Herbicide Applications on Cotton, Peanuts, and Soybeans

Chemical Trade Name	Minimum Days from Last Application to Harvest			Chemical Trade Name	Minimum Days from Last Application to Harvest		
	Cotton	Peanuts	Soybeans		Cotton	Peanuts	Soybeans
2,4-DB	N/A	45	60	Lorox	N/A	N/A	60
Assure II	80	N/A	80	Meturon (PDS)	60	N/A	N/A
Basagran	N/A	NIL	NIL	Poast	N/A	40	N/A
Butyrac 200	N/A	45	60	Poast Plus	40	40	75
Cadre	N/A	90	N/A	Prowl	NIL	NIL	NIL
Caparol (PDS)	NIL	N/A	N/A	Pursuit	N/A	85	85
Classic	N/A	NIL	60	Reflex	N/A	N/A	NIL
Cobra	70	N/A	90	Roundup Weather Max	N/A	N/A	7
Cotoran (PDS)	60	N/A	N/A	Scepter	N/A	N/A	90
Envoke	60	N/A	N/A	Scepter O.T.	N/A	N/A	90
Firestorm	N/A	NIL	NIL	Select	60	N/A	60
FirstRate	N/A	N/A	65	Staple	60	N/A	N/A
Flexstar	N/A	N/A	NIL	Storm	N/A	75	50
Fusilade DX	90	N/A	NIL	Strongarm	N/A	30	N/A
Fusion	90	N/A	NIL	Touchdown	NIL	N/A	7
Goal (PDS)	75	N/A	N/A	Tough	N/A	68	N/A
Gramoxone Max	N/A	28	15	Typhoon	N/A	N/A	NIL
Ignite	70	N/A	60	Ultra Blazer	N/A	75	50
Karmex (PDS)	NIL	N/A	N/A				

KEY TO ABBREVIATIONS

NIL = No preharvest interval is listed on label

N/A = Do not apply this chemical to the crop indicated

PDS = Post Directed Spray

Table 3. Rainfree Requirements Following Postemergence Herbicide Applications on Field Corn, Grain Sorghum, and Wheat

Chemical Trade Name	Minimum Days from Last Application to Harvest			Chemical Trade Name	Minimum Days from Last Application to Harvest		
	Field Corn	Grain Sorghum	Wheat		Field Corn	Grain Sorghum	Wheat
2,4-D	12[1]	12[1]	12[1]	Firestorm (PDS)	0.5	N/A	N/A
Accent	4	N/A	N/A	Gramoxone (PDS)	0.5	N/A	N/A
Achieve	N/A	N/A	1	Harmony Extra	N/A	N/A	4
Atrazine	121	121	N/A	Hoelon	N/A	N/A	1
Banvel	121	121	N/A	Lorox	12[1]	12[1]	N/A
Basagran	8	8	N/A	Sandea	4	4	N/A
Beacon	4	N/A	N/A	Peak	N/A	4	4
Evik	12[1]	N/A	N/A	Princep	12[1]	N/A	N/A
Express	4	N/A	N/A	Prowl	0	N/A	N/A

[1] Products with no rainfree requirements listed on label were assigned a time interval of 12 hours.

KEY TO ABBREVIATIONS

N/A = Do not apply this chemical to the crop indicated

PDS = Post Directed Spray

Table 4. Rainfree Requirements Following Postemergence Herbicide Applications on Cotton, Peanuts, and Soybeans

Chemical Trade Name	Minimum Hours from Application to Rainfall/Irrigation			Chemical Trade Name	Minimum Hours from Application to Rainfall/Irrigation		
	Cotton	Peanuts	Soybeans		Cotton	Peanuts	Soybeans
2,4-DB	N/A	6	6	Karmex (PDS)	12[1]	N/A	N/A
Assure II	1	N/A	1	Lorox	N/A	N/A	12[1]
Basagran	N/A	4	4	Meturon (PDS)	12[1]	N/A	N/A
Butyrac 200	N/A	6	6	Poast	N/A	1	1
Cadre	N/A	1	N/A	Poast Plus	1	1	1
Caparol (PDS)	12[1]	N/A	N/A	Pursuit	N/A	1	N/A
Classic	N/A	1	1	Reflex	N/A	N/A	1
Cobra	1	1	1	Roundup Weather Max	NIL	N/A	NIL
Cotoran (PDS)	12[1]	N/A	N/A	Scepter	N/A	N/A	8
Firestorm	N/A	0.5	0.5	Select	1	N/A	1
FirstRate	N/A	N/A	2	Staple	4	N/A	N/A
Flexstar	N/A	N/A	1	Storm	N/A	4	4
Fusilade DX	1	N/A	1	Strongarm	N/A	NIL	N/A
Fusion	1	N/A	1	Touchdown	NIL	N/A	NIL
Goal	8	N/A	N/A	Ultra Blazer	N/A	4	4
Gramoxone Max	N/A	0.5	0.5				

[1] Products with no rainfree requirements listed on label were assigned a time interval of 12 hours.

KEY TO ABBREVIATIONS

N/A = Do not apply this chemical to the crop indicated

NIL = No Information on Label

PDS = Post Directed Spray

Table 5. Forage, Feed, and Grazing Restrictions for Herbicide-Treated Field Corn, Grain Sorghum, and Wheat

Chemical Trade Name	Minimum Days from Application to Harvesting for Forage or Grazing			Chemical Trade Name	Minimum Days from Application to Harvesting for Forage or Grazing		
	Field Corn	Grain Sorghum	Wheat		Field Corn	Grain Sorghum	Wheat
2,4-D	7	7	14	Gramoxone Max	NIL	NIL	N/A
Accent	30	N/A	N/A	Harmony Extra	N/A	N/A	DNFG
Achieve	N/A	N/A	45	Harness	NIL	N/A	N/A
Atrazine	21	21	N/A	Intrro	NIL	70	N/A
Banvel	NIL	NIL	37	Lorox	90	90	N/A
Basagran	12	12	N/A	Peak	N/A	30-40	30-40
Beacon	30-45	N/A	N/A	Permit	30	30	N/A
Bicep II	30	N/A	N/A	Princep	DNFG	N/A	N/A
Buctril	30	N/A	30	Prowl	NIL	21	N/A
Dual II Magnum	30	NIL	N/A	Roundup Weather Max	56	DNFG	56
Evik	30	N/A	N/A	Surpass	NIL	N/A	N/A
Express	N/A	N/A	DNFG	Sutan +	NIL	N/A	N/A
Outlook	40	N/A	N/A	TopNotch	NIL	N/A	N/A

KEY TO ABBREVIATIONS

N/A = Do not apply this chemical to the crop indicated

NIL = No preharvest interval is listed on label

DNFG = Do not feed or graze

Table 6. Forage, Feed, and Grazing Restrictions for Herbicide-Treated Cotton and Peanuts

Chemical Trade Name	Minimum Days from Application to Harvesting for Forage or Grazing		Chemical Trade Name	Minimum Days from Application to Harvesting for Forage or Grazing	
	Cotton	Peanuts		Cotton	Peanuts
2,4-DB	N/A	DNGF	Intrro	N/A	NIL
Assure II	DNGF	N/A	Meturon	DNGF	N/A
Basagran	N/A	NIL	Poast	N/A	DNGF
Cadre	N/A	DNGF	Poast Plus	DNGF	DNGF
Caparol	DNGF	N/A	Prowl	DNGF	NIL
Cobra	DNGF	N/A	Pursuit	N/A	DNGF
Command	DNGF	N/A	Roundup Weather Max	NIL	N/A
Cotoran	DNGF	N/A	Select	DNGF	N/A
Dual	DNGF	NIL	Sonalan	N/A	DNGF
Firestorm	N/A	DNGF	Staple	DNGF	N/A
Outlook	N/A	80	Storm	N/A	DNGF
Fusilade DX	DNGF	N/A	Strongarm	N/A	DNGF
Fusion	DNGF	N/A	Touchdown	DNGF	N/A
Goal	DNGF	N/A	Treflan	NIL	N/A
Gramoxone Max	DNGF	DNGF	Ultra Blazer	N/A	DNGF
Karmax	DNGF	N/A	Zorial/Solicam	DNGF	NIL

KEY TO ABBREVIATIONS

N/A = Do not apply this chemical to the crop indicated

NIL = No preharvest interval is listed on label

DNGF = Do not graze treated fields or feed treated forage or hay to livestock

Table 7. Forage, Feed, and Grazing Restrictions for Herbicide-Treated Soybeans

Chemical Trade Name	Minimum Days from Application to Harvesting for Forage or Grazing	Chemical Trade Name	Minimum Days from Application to Harvesting for Forage or Grazing
Assure II	DNGF	Lorox	DNGF
Basagran	36	Poast Plus	DNGF
Butyrac 200	60	Prowl	0
Canopy	DNGF	Pursuit	DNGF
Classic	DNGF	Reflex	DNGF
Cobra	DNGF	Roundup Weather Max*	14
Command	DNGF	Scepter	DNGF
Dual	NIL	Scepter O.T.	DNGF
FirstRate	DNGF	Select	DNGF
Flexstar	DNGF	Squadron	DNGF
Outlook	DNGF	Touchdown	DNGF
Fusilade DX	DNGF	Trifluralin	DNGF
Fusion	DNGF	Turbo	DNGF
Gramoxone Max	DNGF	Ultra Blazer	DNGF
Intrro	DNGF		

KEY TO ABBREVIATIONS

NIL = No preharvest interval is listed on label

DNGF = Do not graze treated fields or feed treated forage or hay to livestock

* = Use on Roundup Ready soybeans only

Table 8. Guidelines for Crop Rotation in Fields Previously Treated with Herbicides

Chemical Trade Name	Planting Intervals Following Herbicide Application by Crops						Remarks
	Field Corn	Cotton	Peanuts	Sorghum	Soybeans	Wheat	
2,4-D amine	14 days*	NIL	NIL	NIL	7-30 days*	NIL	*See label for rate and timing.
Accent	None	10 months	10 months	10 months (≤7.5 pH)	15 days	4 months	
Achieve	106 days	106 days	106 days	106 days	106 days	30 days	
Assure II	120 days	None	120 days	120 days	None	120 days	
Atrazine (AAtrex)	None	FY	FY	None	FY	FY	If applied after June 10, rotate only to corn or sorghum the following year. Do not plant vegetables, dry beans, or small-seeded legumes and grasses the following year. Injury may develop on soybeans on soils with a calcareous surface layer.
Banvel	FY	See label.	See label.	FY	FY	Fall	In areas with greater than 30 inches of rainfall, delay planting soybeans for 30 days per pint of Banvel per treated acre.
Basagran	NIL	NIL	NIL	NIL	None	NIL	
Beacon	14 days	8 months	8 months	8 months	8 months	3 months	Crop injury may occur if dry weather prevails during much of the time between applying Beacon and seeding sorghum, alfalfa, or wheat.
Butoxone	NIL	NIL	NIL	NIL	NIL	NIL	
Cadre	9 months	18 months	None	18 months	9 months	4 months	
Canopy	10 months	10 months	8 months	10 months	None	4 months	Rotation intervals are based on soil pH of ≤7.0. See label for high pH soils. IR corn may be planted 8 months after application.
Classic	7 months	8 months	6 months	9 months	None	3 months	If applied after August 1, extend recrop interval by 2 months on corn, cotton, and sorghum.
Cobra	NIL	NIL	NIL	NIL	NIL	NIL	No crop rotation guidelines are listed on label.
Command	9 months	9 months	9 months	9 months	None	12 months	Cover crops may be planted anytime, but stand reduction may occur.
Cotoran	6 months	None	6 months	6 months	6 months	6 months	Do not make more than three applications to the same crop or field in any one year.

continued

KEY TO ABBREVIATIONS NIL = No rotation interval is listed on label; FY = Following year

Table 8. Guidelines for Crop Rotation in Fields Previously Treated with Herbicides (cont.)

Chemical Trade Name	Planting Intervals Following Herbicide Application by Crops						Remarks
	Field Corn	Cotton	Peanuts	Sorghum	Soybeans	Wheat	
Cotton Pro	FY	None	FY	FY	FY	18 months	Wheat as a cover crop may be planted in the fall following herbicide treatment by only one of these methods: preplant incorporated, preemergence, or only one chemical hoe treatment. Cover crops must be plowed down and not used for food or feed.
Direx	FY	FY	12 months	FY	FY	12 months	
Dual II Magnum	None	12 months	None	None	None	4.5 months	If crop treated with Dual alone is lost, any crop on the label may be planted immediately.
Evik	FY	FY	FY	FY	FY	Fall	
Express	60 days	60 days	60 days	60 days	60 days	None	
FirstRate	9 months	9 months	9 months	9 months	None	3 months	
Flexstar	10 months	10 months	10 months	10 months	None	4 months	
Fusilade DX	60 days	None	NIL	60 days	None	60 days	Do not plant any rotation grass crop, such as cereals, within 60 days of last application.
Fusion	60 days	None	NIL	60 days	None	60 days	Do not plant any rotation grass crop, such as cereals, within 60 days of last application.
Goal	10 months	7 days	60 days	10 months	7 days	10 months	
Gramoxone Max	None	None	None	None	None	None	
Harmony Extra	60 days	60 days	60 days	60 days	60 days	None	
Harness	None	NIL*	FY	FY	FY	Fall	*Do not rotate to cotton.
Karmex	FY	FY	12 months	FY	FY	12 months	Do not plant treated area to any other crop within one year.
Intrro	None	12 months	None	None	None	4 months	Grain sorghum seed must be screen-treated.
Ignite/Liberty	None	None	120 days	70 days	None	70 days	
Lightning	8.5 months	See label.	9.5 months	18 months	9.5 months	4 months	
Lorox	4 months	4 months	4 months	4 months	None	4 months	
MCPA Amine	NIL	NIL	NIL	NIL	NIL	NIL	
Meturon	6 months	None	6 months	6 months	6 months	6 months	Do not make more than three applications to the same crop or field in any one year.

continued

KEY TO ABBREVIATIONS: NIL = No rotation interval is listed on label; FY = Following year

Table 8. Guidelines for Crop Rotation in Fields Previously Treated with Herbicides (cont.)

Chemical Trade Name	Planting Intervals Following Herbicide Application by Crops						
	Field Corn	Cotton	Peanuts	Sorghum	Soybeans	Wheat	Remarks
Peak	1 month	10 months	10 months	1 month	10 months	None	
Pentagon	None	None	None	FY	None	4 months	Most other crops may be planted the following year. Injury may occur when replanting corn due to stand failure. See label.
Poast	120 days	None	None	120 days	None	120 days	
Poast Plus	NIL	NIL	NIL	NIL	NIL	NIL	
Princep	None	FY	FY	FY	FY	FY	Treated fields may be rotated only to corn unless stated otherwise on the label.
Prowl	None	None	None	FY	None	4 months	Most other crops may be planted the following year. Injury may occur when replanting corn due to stand failure. See label.
Pursuit	9.5 months	18 months	None	18 months	None	4 months	IMI-Corn (resistant/tolerant to Pursuit) has no restrictions.
Python	None	18 months	4 months	12 months	None	4 months	
Reflex	10 months	None	10 months	10 months	None	4 months	
Roundup Weather Max	None	None	None	None	None	None	
Scepter	11 months	18 months	11 months	11 months	None	4 months	Field corn may be planted in spring of year following herbicide application unless fewer than 15 inches of rainfall or irrigation was received during the 6 months following last application.
Select	NIL	None	NIL	NIL	None	NIL	
Sonalan	FY	FY	None	FY	None	4 months	
Squadron	11 months	18 months	11 months	11 months	None	4 months	Field corn may be planted in spring of year following herbicide application unless fewer than 15 inches of rainfall or irrigation was received during the 6 months following last application.
Storm	NIL	NIL	None	NIL	None	NIL	In case of crop failure, only soybeans or peanuts may be replanted immediately. Root crops must not be planted in treated fields for 18 months.
Strongarm	18 months	10 months	None	18 months	None	4 months	
Surpass	None	NIL*	NIL	FY	FY	4 months	*Do not rotate to cotton.

continued

KEY TO ABBREVIATIONS: NIL = No rotation interval is listed on label; FY = Following year

Table 8. Guidelines for Crop Rotation in Fields Previously Treated with Herbicides (cont.)

Chemical Trade Name	Planting Intervals Following Herbicide Application by Crops						
	Field Corn	Cotton	Peanuts	Sorghum	Soybeans	Wheat	Remarks
Tillam	NIL	NIL	NIL	NIL	NIL	NIL	
Touchdown	35 days	None	NIL	35 days	None	35 days	
Treflan	FY	None	NIL	12 months	None	NIL	Unless crop injury is acceptable, do not plant proso millet, sorghum (milo), oats, or perennial grass crops or grass mixtures for 12 months after a spring application or 14 months after a fall application.
Tri-Scept	11 months	18 months	11 months	11 months	None	4 months	Field corn may be planted in spring of the year following application unless fewer than 15 inches of rainfall or irrigation was received during the 6 months following last application.
Turbo	8 months	8 months	12 months	12 months	None	4.5 months	
Ultra Blazer	NIL	NIL	None	NIL	None	NIL	In case of crop failure, only peanuts or soybeans may be immediately replanted. Root crops (carrots, turnips, sweet potatoes, etc.) must not be planted for 18 months in fields treated with Ultra Blazer.
Zorial/Solicam	16 months	None	30 days	16 months	45 days	16 months	

KEY TO ABBREVIATIONS: NIL = No rotation interval is listed on label; FY = Following year

Table 9. Grazing Restrictions on Commonly Used Herbicides

Herbicide	Crop	Minimum Days from Last Application to Grazing
2,4-D	Pasture (non-lactating cattle) Pasture (lactating dairy cattle)	None 7-14
2,4-DB	Peanuts	Do not graze
AAtrex 90DF, 4L (pre, post)	Corn	21
Accent	Corn	30
Achieve	Wheat	45
Ally	Pasture	1
Arsenal (pre)	Non-crop areas	Do not graze
Assure II	Soybeans	Do not graze
Banvel (post)	Corn, sorghum before harvest Small grains before harvest	Do not graze Do not graze
Banvel (post) 1 pint	Pasture (non-lactating cattle) Pasture (lactating dairy cattle)	None 7
Banvel (post) 1 quart	Pasture (lactating dairy cattle)	21
Basagran + 2,4-DB (post)	Peanuts	Do not graze
Basagran 4EC (post)	Soybeans, peanuts, corn, sorghum	None
Beacon	Corn	30
Buctril 4EC	Corn, small grains	Do not graze
Cadre	Peanuts	Do not graze
Canopy (pre)	Soybeans	Do not graze
Caparol 80W, 4L (pre)	Cotton	Do not graze
Casoron 4G, 50W (pre)	All crops	Do not graze
Classic (post)	Soybeans	Do not graze
Cobra	Soybeans	Do not graze
Command	Cotton Soybeans	Do not graze 9 months
Cotoran 80W, 4L (pre)	Cotton	Do not graze
Crossbow	Hay (not dairy cattle) Pasture (non-lactating cattle) Pasture (dairy cattle)	7 None 14
Dacthal 75W (pre)	All crops	Do not graze
Devrinol 50W, 10G (pre)	All crops	Do not graze
Dual 8E (pre)	Pod crops	Do not graze
Envoke	Cotton	Do not graze
Eradicane 6E (ppi)	Corn	None
Evik (directed)	Corn	30
Express	Wheat	Do not graze
FirstRate	Soybeans	14
Flexstar	Soybeans	Do not graze

Table 9. Grazing Restrictions on Commonly Used Herbicides (cont.)

Herbicide	Crop	Minimum Days from Last Application to Grazing
Fusilade DX	Soybeans, cotton	Do not graze
Garlon	All areas	Do not graze
Goal 1.6E (pre, post)	All crops	Do not graze
Gramoxone (post)	Pasture crops Row crops	40 Do not graze
Grazon P+D	Pasture (dairy cattle)	7
Harmony Extra	Wheat, barley	Do not graze
Karmex + Zorial (pre)	Cotton	Do not graze
Karmex (pre)	Cotton	Do not graze
Kerb	Alfalfa	25
Intrro (ppi, pre)	Soybeans	40
Ignite/Liberty	Corn, Cotton, Soybean	70 days
Lightning	Corn	45 days
Lorox + Dual + Gramoxone	Soybeans	Do not graze
Lorox + Dual (pre)	Soybeans	Do not graze
Lorox + 2,4-DB (directed)	Soybeans	Do not graze
Lorox (post directed)	Cotton	Do not graze
Lorox (pre)	Soybeans	None
Option	Corn	45 days
Oust	Noncrop areas	Do not graze
Outlook	Corn	40 days
Peak	Corn	40
Poast 1.5E/Poast Plus (post)	All crops	Do not graze
Prefar 4E (ppi, pre)	All crops	Do not graze
Princep 90, 4L (pre)	Corn, pecans	Do not graze
Prowl + Dual (ppi, pre)	Soybeans	Do not graze
Prowl + Lorox (pre)	Soybeans	None
Prowl (ppi)	Cotton	Do not graze
Prowl (ppi, pre)	Soybeans Fruits and nuts	None Do not graze
Pursuit	Peanuts	Do not graze
Python	Corn	Do not graze
	Soybeans	Do not graze
Reflex	Soybeans	Do not graze
Remedy	Hay (not dairy cattle) Pasture (non-lactating cattle) Pasture (dairy cattle)	7 None 14

Table 9. Grazing Restrictions on Commonly Used Herbicides (cont.)

Herbicide	Crop	Minimum Days from Last Application to Grazing
Roundup (post)	Hay, pasture	56
Roundup (preharvest)	Cotton Other row crops	Do not graze 56
Roundup (spot treat)	Hay, pasture	14
Sandea	Corn	30
Scepter (ppi, pre, post)	Soybeans	Do not graze
Select	Peanuts, Soybeans	Do not graze
Sencor DF + Dual (ppi, pre)	Soybeans	40
Sencor DF + Gramoxone (min-till)	Soybeans	40
Sencor DF + Intrro 4E (ppi, pre)	Soybeans	40
Sencor DF + Prowl 3.3E (ppi, pre)	Soybeans	40
Sencor DF + Sonalan (ppi)	Soybeans	Do not graze
Sencor DF + Treflan (ppi)	Soybeans	40
Solicam DF	Pecans, tree fruits	Do not graze
Sonalan EC	Soybeans, peanuts	Do not graze
Staple	Cotton	Do not graze
Strongarm	Peanuts	Do not graze
Surflan AS (pre)	All crops	Do not graze
Sutan 6.7E (ppi)	Corn	None
Tillam 6E (ppi)	Tomatoes	Do not graze
Tordon	All areas	Do not graze
Touchdown	Cotton	Do not graze
Treflan EC	Soybeans	40
Ultra Blazer (post)	Soybeans, peanuts	Do not graze
Valor	Peanuts	Do not graze
Velpar L	Noncrop areas	Do not graze
Zorial 80DF	Cotton, soybeans	Do not graze

* NOT INCLUSIVE. Read product label for a complete listing of all restrictions.

KEY TO ABBREVIATIONS

ppi = preplant incorporated

pre = preemergence

post = postemergence

min-till = minimum tillage

Table 10. Rotation Restrictions on Commonly Used Herbicides

Herbicide	Rotational Crops	Time Restriction
2,4-D	Crops not on label	12 months
2,4-DB	Crops not on label	12 months
Accent	Crops not on label Soybeans Wheat, barley, rye Oats Beans, peas, cotton	18 months 0.5 month 4 months 8 months 10 months
Achieve	Most row crops	3.5 months
Ally	Crops not on label	4-22 months
Arsenal	None	Bioassay after 3 years
Assure	Crops not on label	4 months
Atrazine	Crops not on label Application made after 6/10	12 months 18 months
Banvel	Soybeans, wheat Crops not on label	2 months 12 months
Basagran	Crops not on label	12 months
Beacon	Crops not on label Wheat, barley, rye Sweet corn, cotton, peanuts, soybeans, peas, beans, sorghum	18 months 3 months 8 months
Buctril	Crops not on label	1 month
Cadre	Rye, wheat Field corn, peas, soybeans Sweet corn, cotton, oats, sorghum Others	4 months 9 months 18 months 26+ months
Canopy (pH<6.8)	Wheat, barley Corn, cotton, sorghum	4 months 10 months
Canopy (pH>6.8)	Corn, cotton, sorghum Peanuts All other crops	18 months 18 months 30 months
Caparol	Crops not on label	6-12 months
Casoron	Crops not on label	12 months
Classic (pH<6.8)	Wheat, barley Corn, cotton, sorghum, peanuts All other crops	3 months 9 months 18 months
Command	Field corn, sorghum Small grains	9 months 12 months
Cotoran	Crops not on label	6 months
Crossbow	None	12 months
Dacthal	Crops not on label	8 months
Devrinol	Crops not on label	12 months
Dual	Crops not on label	18 months
Envoke	Wheat Peanuts, soybeans, corn Crops not on label	3 months 7 months 18 months
Eptam	Crops not on label	12 months
Eradicane	Crops not on label	12 months
Evik	Small grains Crops not on label	6 months 12 months
Express	Most row crops	1.5 months

Table 10. Rotation Restrictions on Commonly Used Herbicides (cont.)

Herbicide	Rotational Crops	Time Restriction
FirstRate	Wheat	3 months
	Field corn, cotton, peanuts, sorghum, peas	9 months
	Sweet corn	18 months
Fusilade	Crops not on label	2 months
Garlon	None	Bioassay after 24 months
Goal	Crops not on label	18 months
Gramoxone	Crops labeled	None
Grazon P+D	Crops not on label	24 months
Harmony Extra	Crops not on label	2 months
Karmex	Crops not on label	24 months
Intrro	Crops not on label	12 months
Linex/Lorox	Crops not on label	4 months
Oust	Crops not on label	Bioassay after 24 months
Poast/Poast Plus	Crops not on label	4 months
Prefar	Soybeans	12 months
	Other crops not on label	18 months
Princep/Simazine	Crops not on label	12 months
Prowl	Wheat (conventionally planted)	4 months
	Other crops not on label	12 months
Pursuit	Rye, wheat	4 months
	Field corn	8.5 months
	Sweet corn, cotton, oats, sorghum	18 months
	Other crops not on label	26+ months
Python	Peas, beans, peanuts, small grains	4 months
	Popcorn, forage grasses	9 months
	Potatoes, sorghum	12 months
	Cotton, sweet corn, sunflowers	18 months
Reflex/Flexstar	Small grains (grain production only)	4 months
	Corn, cotton, peanuts	10 months
	Other crops not on label	18 months
Sandea	Wheat, barley, oats	2 months
	Cotton	4 months
	Peanuts	6 months
	Peas, beans, potatoes, soybeans	9 months
Scepter	Wheat	3 months
	Field corn	9.5 months
	Barley, beans, oats, peanuts, sorghum	11 months
	Cotton	18 months
Sencor	Alfalfa, corn, forage grasses, potatoes, tomatoes	4 months
	Wheat	8 months
	Root crops	18 months
	Crops not on label	12 months
Sonalan	Crops not on label	12 months
Spike	None	Bioassay after 36 months
Staple	Wheat	4 months
	Peanuts, soybeans	10 months
	Sorghum, corn (Staple broadcast)	16 months
	Corn (Staple banded)	9 months

Table 10. Rotation Restrictions on Commonly Used Herbicides (cont.)

Herbicide	Rotational Crops	Time Restriction
Strongarm	Wheat, barley	4 months
	Oats, rye	6 months
	Cotton	10 months
	Corn, sorghum	18 months
Surflan	Crops not on label	12 months
Tillam	Crops not on label	12 months
Tordon	None	Bioassay after 36 months
Treflan	Crops not on label	5 months
Ultra Blazer	Root crops	18 months
Velpar	Corn	12 months
	Crops not on label	24 months

* NOT INCLUSIVE. Read product label for a complete listing of all rotational restrictions.

NAMES, CLASSIFICATION, AND TOXICITY OF PESTICIDES

Names

The chemical names of pesticide active ingredients are mostly long and complex and seldom used. The common name of a pesticide active ingredient is the one that is most often used by appropriate scientific groups and pesticide users. The trade name of a pesticide active ingredient is a copyrighted name used by its producer. A pesticide active ingredient will usually have only one common name, but it may have several trade names. Unless otherwise indicated, the trade names listed in these tables are capitalized and are followed by an asterisk (*). They should not be confused with the brand names used by formulators and distributors of pesticide products.

Pesticide products are sold commercially by trade and brand names and may not have a common name on the container label. However, recommendations are often made by the common name or by the chemical name. The following tables provide a cross reference for the trade and common names of herbicides and a list of common names for insecticides, miticides, nematicides, fungicides, and bacteri-cides for use in identifying the toxicity of the products.

Classification

Insecticides, herbicides, fungicides, and other pesticides are primarily classified on the basis of their chemical structure or origin. The inorganic pesticides are those which contain no carbon in their chemical structure. The organic pesticides, those that contain carbon, are usually synthetic, but some are obtained from natural sources such as plants or microorganisms. Some synthetic organic pesticides such as the pyrethroids, or synthetic pyrethrins, are based on naturally occurring chemicals. The main classifications of pesticides along with the abbreviations used in the tables are as follows:

Insecticides, Miticides, and Nematicides. Organic phosphates or organophosphates (OP), carbamates (Car.), chlorinated hydrocarbons or organochlorines (CH), pyrethroids (SyP), botanicals (Bot.), microbials (M), insect growth regulators (IGR), fumigants (Fum.), inorganics (Inor.), repellents (Rep.), insecticide (I), acaricide (A), rodenticide (R), nicotinoid or neonicotinoid (N), miscellaneous (Misc.).

Fungicides and Bactericides. Dithiocarbamates (DC), thiazoles (TZ), triazines (T), substituted aromatics (SA), dicarboximides (DO), oxythiins (OX), benzimidazoles (BZ), acylalamines (AC), triazoles (TR), piperazines (PI), imides (IM), dinitrophenols (DN), aliphatic nitrogen compounds (AN), quinones (QN), organotins (OT), organophosphates (OP), antibiotics (AB), fumigants (Fum.), inorganics (Inor.), miscellaneous (Misc.).

Toxicity

The Environmental Protection Agency uses the results of acute toxicity studies on test animals, usually rats and rabbits, to place pesticides in toxicity categories (I-IV) which determine what signal word must appear on the label. Registration standards by EPA require these signal words and special precautions in label wording. Although inhalation toxicity and eye and skin corrosiveness studies are also used, results of acute dermal and acute oral toxicity studies are more publicized and probably more important.

The LD50 is the lethal dose of a substance required to kill half of the exposed test animals. It is based on the body weight of the animal and is expressed in milligrams of the substance per kilogram of body weight (mg/kg). One mg/kg is equivalent to 1 ppm. The lower the LD50, the greater the toxicity. Although most LD50 values are for the pesticide active ingredient or actual toxicant, the signal word on each pesticide product is determined by the toxicity of that particular formulation. Formulated pesticides are usually, but not necessarily, less toxic than the active ingredient.

The following table shows signal words that must appear on the pesticide label for each toxicity category. It also shows the range of the oral and dermal median lethal doses (LD50) for each. For example, a pesticide that falls into category I only because of eye or skin corrosiveness must bear "Danger" but not "Poison" or the skull and crossbones symbol on its label.

Toxicity categories and signal words on the pesticide label are based on acute toxicity studies, but sub-acute and chronic toxicity studies are also conducted. Acute toxicity involves the rather rapid response of the test animal to a single large exposure to the pesticide. Sub-acute toxicity refers to the response of the animal to repeated or continuous exposure to smaller doses over less than half of its normal life span. In chronic toxicity studies, exposures are repeated or continued for longer than half of the animal's life span. The toxicity categories given in the following tables are based solely on the accompanying LD50 values which, unless stated otherwise, are for the active ingredient. EPA would not necessarily assign the same category shown in the tables.

The Office of Pesticide Programs maintains a database of all pesticide products registered in the United States. This database also contains detailed information for all conventional, antimicrobial, and biopesticides. Also included are the MSDS sheets that outline toxicity, classification, and chemical compostition of pesticides. For further information please visit www.iaspub.epa.gov/apex/pesticides/f?p=chemicalsearch:1.

Toxicity Category	Signal Words Required on Label by EPA	Oral LD_{50} (mg/kg)	24-Hr. Exposure (mg/kg)	Equivalent Oral Dose for Adult Humans
I. Highly Toxic	DANGER, POISON, Plus Skull & Crossbones Symbol	0-50	0-200	A few drops to 1 t.
II. Moderately Toxic	WARNING	50-500	200-2000	1 t. to 2 T.
III. Slightly Toxic	CAUTION	500-5000	2000-20,000	1 oz. to 2 pt. (1 lb.)
IV. Low Toxicity	CAUTION	5000	20,000	1 pt. (1 lb.) or more

Table 11. Names, Classification, and Toxicity of Pesticides

Pesticide Name	Other Names (all not listed)	Class	Toxicity Category	Acute LD_{50} Values Oral (mg/kg) White Rats	Dermal (mg/kg) Rabbits
INSECTICIDES, MITICIDES, AND NEMATICIDES					
abamectin	Ascend*, Clinch*, Varsity*	Misc.	IV	5000	2000
acephate	Orthene*	OP	III	866-945	10,250
acetamiprid	Assail		III	1064	>2000
aldrin		CH	I	39-60	50-100 (rat)
allethrin		SyP	III	920	
alpha-cypermethrin	Fastac				
aluminum phosphide	Phosfume2*, Phostoxin*, Weevilcide*	Misc.	I	0.3 ppm	
aminocarb	Matacil*	Car.	I	30	275 (rat)
amitraz	BAAM*	Car.	III	800	200
	cypermethrin	SyP	II	251 (corn oil)	1600 (rat)
	trichlorfon	OP	II	150-400	500 (rat)
aprocarb	Baygon*, propoxur	Car.	II	70-200	500
azinphosethyl	Ethyl Guthion*	OP	I	17.5	250 (rat)
azinphosmethyl	Guthion*	OP	I	13-16.4	220 (rat)
Bacillus popilliae	Doom*, milky disease spores, Japademic*	M	IV	non-toxic	
Bacillus thuringiensis	Agree*, Biobit*, Dipel*, Javelin*, Thuricide*, XenTari*	M	III	>5050	>2020 - >5000
bendiocarb	Ficam*	Car.	II	40-156	1000 (rat)
benzene hexachloride	BHC	CH	III	1250	
benzyl benzoate		Rep.	III	500-5000	
beta-cyfluthrin	Baythroid XL*, Tempo SC Ultra*	SyP	IV	960-1150	>2000 (rat)
bifenazate	Acramite		IV	>5000	>5000
bifenthrin	Capture*, Talstar*, many others	SyP	III	375	2000
binapacryl	Morocide*	Misc.	II	421	720-810 (rat)
borax		Inor.	III	2660-5190	
boric acid		Inor.	III	3000	
bromophos	Nexion*	OP	III	3750-8000	
bufencarb	Bux*	Car.	II	85-105	680
buprofezin	Courier				
calcium polysulfide	lime sulfur, Polycal*	Inor.	IV		caustic
carbaryl	Carbaryl*, Sevin*	Car.	III	500-850	4000 (rat)
carbophenothion	Trithion*	OP	I	6.8-36.9	1270
carbosulfan	Advantage*	Car.	II	209	
chlorantraniliprole	Coragen*, Prevathon*		IV	>5000	>5000
chlorbenside	Chlorocide*	CH	III	2000	
chlordecone	Kepone*	CH	II	114-140	345-475
chlordimeform	Fundal*, Galecron*, chlorophenamidine	Misc.	II	127-352	3000
chlorethoxyfos	Fortress*	I, OP	I	44-124	>2000

Table 11. Names, Classification, and Toxicity of Pesticides (cont.)

Pesticide Name	Other Names (all not listed)	Class	Toxicity Category	Acute LD_{50} Values Oral (mg/kg) White Rats	Dermal (mg/kg) Rabbits
INSECTICIDES, MITICIDES, AND NEMATICIDES (cont.)					
chlorfenvinphos	Cpd 4072*, Supona*	OP	I	10-39	400-4700
chlorobenzilate	Acaraben*, Akar*	CH	III	2784-3880	10,200 (4E)
chlorophenamidine	chlordimeform, Fundal*, Galecron*	Misc.	II	127-352	3000
chloropicrin	Larvicide*	Misc.	I	250	200 ppm (vapor)
chloropropylate	Acaralate*	CH	III	5000 (2EC)	
chlorpyrifos	Chlorpyrifos*, Dursban*, Killmaster II*, Lorsban*, many others	OP	II	97-276	2000
chlorpyrifos-methyl	Reldan*	OP	III	1000-3700	2000
clothianidin	Belay, Clutch, Inside NipsIt, Poncho pro*, Poncho 600	N	IV	>5000	>2000
coumaphos	Co-Ral*	OP	I	17-240	860 (rat)
crotoxyphos	Ciodrin*	OP	II	53	385
crufomate	Ruelene*	OP	III	770	400-600
cryolite	Kryocide*	Inor.	IV	5000	
cube	rotenone	Bot.	II	132-1500	940
cyfluthrin	Tempo WP*, Tombstone*	SyP	II	900	5000
cyhexatin	Plictran*	Misc.	III	540	2000
cypermethrin	Ammo*, Cymbush*, Demon*	SyP	III	251 (corn oil)	1600 (rat)
cythioate	Cyflee*, Proban*	OP	II	160	2500
dazomet	Mylone*, DMTT*	Misc.	II	640	
deet	Off*, diethyltoluamide	Rep.	III	2000	
deltamethrin	Centynal, Decis*, Delta Gold*	SyP	II	42.9	>2000 (rat)
demeton	Systox*	OP	I	2.5-12	8.2-14 (rat)
derris	rotenone	Bot.	II	132-1500	940
dialifor	Torak*	OP	I	5-53	145
diamidfos	Nellite*	OP	I	140	100-200
diatomaceous earth	Dryacide*, Insecto*, Protect It*	Inor.	IV	non-toxic to mammals	
diazinon	Many	OP	II	300-400	3600
dibutyl phthalate	DBP	Rep.	IV	8000	
dichlofenthion	Mobilawn*, VC-13*	OP	II	270	
dichloropropene	Telone* II	Fum.	II	250-500	500 ppm (vapor)
dichlorvos (dichlorphos)	DDVP, Prozap InsectGuard*	OP	I	56-80	107
dicofol	Kelthane*	CH	II	684-809	2100
dicrotophos	Bidrin*	OP	I	17-22	224
dieldrin		CH	I	40-60	50-100 (rat)
dienochlor	Pentac*	CH	III	3160	3160
diethyltoluamide	deet, Off*	Rep.	III	2000	
diflubenzuron	Dimilin*	IGR	III	4640	2000

Table 11. Names, Classification, and Toxicity of Pesticides (cont.)

Pesticide Name	Other Names (all not listed)	Class	Toxicity Category	Acute LD_{50} Values Oral (mg/kg) White Rats	Acute LD_{50} Values Dermal (mg/kg) Rabbits
INSECTICIDES, MITICIDES, AND NEMATICIDES (cont.)					
dimethoate	Cygon*, De-Fend*, Dimethoate*, Rebelate*	OP	II	215	400-610 (rat)
dinitrocresol	DNOC	Misc.	I	20-50	200-600 (rat)
dinocap	Karathane*	Misc.	III	980	4700
dinoseb	DNBP	Misc.	I	40-60	80-200
dinotefuran	Venom, Zylam		IV	>5000	>5000
dioxathion	Delnav*, Deltic*	OP	I	45	235 (rat)
disulfoton	Di-Syston*	OP	I	2-12	6-25 (rat)
d-phenothrin	sumithrin	SyP	IV	10,000	10,000 (rat)
d-trans allethrin		SyP	III	860	
dymet		OP	III	2000	8000
endrin		CH	I	7-15	15 (rat)
emamectin benzoate	Proclaim		III	1516	>2000
EPN		OP	I	26	420
esfenvalerate	Asana*, S-Fenvalostar	SyP	II	75	2000
ethion		OP	I	208	915
ethoprop	Mocap*	OP	I	61.5	2.4
ethylene dibromide	EDB, Soilbrom*	Fum.	II	146	200 ppm (vapor)
famphur	Warbex*	OP	I	36-62	2730
fenbutatin-oxide	Vendex*, Hexakis*	Misc.	III	2631	2000
fenitrothion	Sumithion*	OP	II	500	1300 (rat)
fenoxycarb	Award*	Car.	IV	>5000	>2000
fenpropathrin	Danitol*	SyP	I	66.7-70.6	2000
fenpyroximate	Portal	Phenyl-pyrozole	III	810	>5000
fensulfothion	Dasanit*	OP	I	2-10	3-30 (rat)
fenthion	Baytex*, Entex*, Tiguron*	OP	III	255-298	1600-2830 (rat)
fenvalerate	Pydrin*, Ectrin*	SyP	III	3200	2500
fipronil	Regent	Phenyl-pyrozole	II	336	382
flonicamid	Beleaf		III	>2000	>2000
flubendiamide	Belt*, Synapse*		III	>2000	>4000
flucythrinate	Pay-Off*	SyP	II	67	1000
fluvalinate	Mavrik*	SyP	II	261-282	20,000
fonofos	Dyfonate*	OP	I	8-17.5	25
formetanate hydrochloride	Carzol*	Misc.	I	20	10,200
fosthietan	Nem-A-Tak*	OP	I	4.7-7.7	27.4-66.3
gamma-cyholothrin	Declare*, Proaxis*, Prolex*	SyP		2500	>5000
heptachlor		CH	II	147-220	2000
hydramethylnon	Amdro*, Probait*, Siege Pro*	Misc.	III	1131-1300	5000
hydropene	Altozar*	IGR	IV	34,000	4550
imidacloprid	Admire*, Attendant*, Gaucho*, Imidacloprid*, Marathon II*, Provado*, Senator*, Trimax *(cotton)	N	II-III	450	>5000 (rat)
indoxacarb	Advion*, Avaunt*,Steward*	Car.		751-3619	>5000 (rat)
isazofos	Triumph*	OP	I	60	3100

Table 11. Names, Classification, and Toxicity of Pesticides (cont.)

Pesticide Name	Other Names (all not listed)	Class	Toxicity Category	Acute LD_{50} Values Oral (mg/kg) White Rats	Acute LD_{50} Values Dermal (mg/kg) Rabbits
INSECTICIDES, MITICIDES, AND NEMATICIDES (cont.)					
isofenphos	Amaze*, Oftanol*	OP	I	28-38	163-315
kinoprene	Enstar*	IGR	III	5900-6000	9000
lambda-cyhalothrin	Karate* with Zeon Technology, Lambdastar*, Lamcap, Warrior* with Zeon Technology, many others	SyP	II	79	632-696
lead arsenate		Inor.	I	100	
leptophos	Phosvel*	OP	II	52.8	10,000 (rat)
lime sulfur	calcium polysulfide, Polycal*	Inor.	IV		caustic
lindane	gamma isomer of BHC	CH	II	88-125	1000 (rat)
malathion	Atropa*, Cythion*, Malathion*	OP	III	1375	4100
mephosfolan	Cytrolane*	OP	I	8.9	28.7
metaflumizone		Misc.	III	>2000	>4000 (rat)
metaldehyde	Many	Misc.	III	630	
metam-sodium	Vapam*, VPM*	Car.	III	820	
methamidophos	Monitor*	OP	I	30	118
methiocarb	Mesurol*	Car.	II	10-130	2000
methiodothion	Supracide*	OP	I	44	200
methomyl	Lannate*, Nudrin*	Car.	I	17-24	5000
methoprene	Altosid*, Diacon IGR*, Diacon D IGR*, Extinguish* Precor*	IGR	IV	34,600	3000
methoxychlor	Marlate*	CH	III	6000	6000 (rat)
methoxyfenozide	Intrepid*	Misc.	IV	>5000	>5000
methyl bromide		Fum.	II	200 ppm (vapor)	
methyl parathion	Methyl Parathion*, Penncap*	I, A, OP	I	6-50	300
methyl trithion		OP	I	200	190-215 (rat)
mevinphos	Phosdrin*	OP	I	16-33	33.8
mexacarbate	Zectran*	Car.	I	24	500
milky disease spores	Bacillus popilliae	M	IV	non-toxic	
naled	Dibrom*	OP	II	430	1100
napthalene		Fum.	III	2400	2500 (rat)
nicotine		Bot.	I	50-60	50
novaluron	Rimon		III	>5000	>2000
NPD	Aspon*	OP	III	2710-5010	
oxamyl	Vydate*	Car.	I	5.4	710 (24% liq.)
oxydemeton-methyl	Metasystox-R*	OP	II	65-75	250 (rat)
oxythioquinox	Morestan*	Misc.	III	2500-3000	2000 (rat)
para-dichlorobenzene	PDB	Fum.	II	500	2000
paris green		Inor.	II	22	2400 (rat)
permethrin	Atroban*, Ectiban*, Permethrin*, Pounce*, Pramax*, Torpedo*, many others	SyP	III	4000	2000
phorate	Thimet*, Phorate*	OP	I	2-4	2.5-6.2 (rat)

Table 11. Names, Classification, and Toxicity of Pesticides (cont.)

Pesticide Name	Other Names (all not listed)	Class	Toxicity Category	Acute LD_{50} Values Oral (mg/kg) White Rats	Acute LD_{50} Values Dermal (mg/kg) Rabbits
INSECTICIDES, MITICIDES, AND NEMATICIDES (cont.)					
phosalone	Zolone*	OP	II	120	1250
phosfolan	Cyolane*	OP	I	8.9	23
phosmet	Imidan*	OP	II	147-316	4640
phosphamidon	Dimecron*	OP	I	17-30	267
phoxim	Baythion*	OP	III	1845	1000 (rat)
piperonyl butoxide		Misc.	II	7500	
pirimicarb	Pirimor*	Car.	II	147	500 (rat)
pirimiphos-methyl	Actellic*	OP	III	200	4600
profenofos	Curacron*	OP	II	358	472
propargite	Omite*, Comite*	Misc.	III	2200	
propoxur	Baygon*, aprocarb	Car.	II	70-200	500
pymethozine	Fulfill		III	>5000	>2000
pyrethrum	Douglas Pyrethrin 5, Pyganic, pyrethrins	Bot.	III	1500	1800 (rat)
pyriproxifen	Distance*, Esteem*, Nyguard*	pyridine	III	>5000	>2000
resmethrin	Chryson*, Synthrin*	SyP	III	4240	2500
ronnel	Korlan*, Trolene*, Viozene*	OP	III	1740	1000-2000
ryania		Bot.	III	1200	4000
sabadilla		Bot.	III	4000	
sodium fluorite	various	Inor.	I	75 (man)	
spinetoram	Radiant		IV	>5000	>5000
spinosad	Tracer*, Spintor	Misc.	IV	>5000	>5000
spiromesifen	Oberon		III	>2000	>2000
spirotetramat	Movento		III	>2000	>4000
sulfotepp	Bladafume*	OP	I	7-10	
sulfuryl fluoride	Profume*	I, R, Inor.	I	50-500	>5000
sulprofos	Bolstar*	OP	II	107	820
sumithrin	d-phenothrin	SyP	IV	10,000	10,000 (rat)
tefluthrin	Force*	SyP	III	1550	
tempephos	Abate*, Biothion*	OP	III	8600	1300-1930
terbufos	Counter*	OP	I	4.5-9.2	1.1
tetrachlorvinphos	Rabon*, Gardona*	OP	III	4000-5000	2500
tetradifon	Tedion*	OP	III	14,700	10,000
tetraethyl pyrophosphate	TEPP	OP	I	1.2-2	2.4 (rat)
tetramethrin	Neopyamin*	SyP	III	4640	
thiamethoxam	Actara*, Cruiser*, Platinum*	N	III	>5000	>2000
thiodicarb	Larvin*	Car.	II	66-120	
toxaphene		CH	II	69	780-1075 (rat)
trichlorfon	Dylox*, Dipterex*, Neguvon*, Anthon*, Proxol*	OP	II	450	2000 (rat)
trichloronate	Agritox*	OP	I	37.5	341 (rat)

Table 11. Names, Classification, and Toxicity of Pesticides (cont.)

Pesticide Name	Other Names (all not listed)	Class	Toxicity Category	Acute LD_{50} Values Oral (mg/kg) White Rats	Dermal (mg/kg) Rabbits
INSECTICIDES, MITICIDES, AND NEMATICIDES (cont.)					
triflumuron	Alsystin*, Mascot*	Misc.	IV	5000	
zeta-cypermethrin	Mustang Max*, Respect*	SyP	II	157	>5000
FUNGICIDES AND BACTERICIDES					
bichloride of mercury	corrosive sublimate	Inor.	I	1-5	
biteranol	Baycor*	TR	IV	5000	5000 (rat)
blue stone	copper sulfate	Inor.	I	470	
blue vitriol	copper sulfate	Inor.	I	470	
Bordeaux mixture	copper sulfate plus hydrated lime in varying proportions	Inor.		low toxicity	
brimstone	sulfur	Inor.	IV	low toxicity	
captan	Orthocide*	DO	I, III	9000	
carboxin	Vitavax*	OX	I, III	3820	8000
chlorothalonil	Bravo*, Termil*, Daconil*	SA	I, II, III	10,000	10,000
copper	fixed copper	Inor.	III	3000+	
copper ammonium carbonate	Copper-Count N*	Misc.		low toxicity	
copper hydroxide	Kocide*	Inor.	III	1000	
copper naphthenates	Cuprinol*	Misc.	II	6.0	
copper oleate		Misc.	IV	6000	
copper oxychloride		Inor.	III	1000 (formulation)	
copper resinate	Citcop*	Misc.	IV	10,000-20,000	
copper sulfate	blue stone, blue vitriol	Inor.	I	470	
copper sulfate (basic)		Inor.	III	1000	
dichloropropene	Telone II*	Fum.	I	250-500	500 ppm (vapor)
dodine	Cyprex*	AN	II	1000	1500
fenarimol	Rubigan*	PY	III	2500	
ferbam	carbamate	DC	IV	17,000	
fixed copper	basic copper fungicides, various commercial products	Inor.	III	3000+	
folpet	Phaltan*	DO	IV	10,000	
fosethyl Al	Aliette*	OP	III	5800	2000
iprodione	Rovral*, Chipco 26019*	IM	III	4400	75,000
lime sulfur		Inor.	I	low toxicity	caustic
mancozeb	Dithane M-45*, Fore*, Manzate 200*	DC	IV	8000	
maneb	Dithane M-22*, Manzate D*	DC	IV	8000	
mefanoxam	Ridomil*, Apron*	AC	II	669	3100 (rat)

Table 11. Names, Classification, and Toxicity of Pesticides (cont.)

Pesticide Name	Other Names (all not listed)	Class	Toxicity Category	Acute LD_{50} Values Oral (mg/kg) White Rats	Dermal (mg/kg) Rabbits
FUNGICIDES AND BACTERICIDES (cont.)					
metam-sodium	Vapam*, Busan 1020*	DC	III	1700-1800 (formulation)	3100
orthophenylphenol		Misc.	III	2700	
phosethyl Al	Aliette*	OP	IV	5400	
propamicarb hydrochloride	Previcur N*, Banol*	AN	IV	8600	3000
propiconazole	Tilt*, Orbit*	TR	III	1500	
prothiocarb	Dynone*, Previcur*	AN	III	1300	
quintozene	PCNB*, Terraclor*	SA	IV	1700	
streptomycin	Agrimycin*, Agristrep*, Phytomycin*	AB	IV	9000	
sulfur	brimstone	Inor.	IV	low toxicity	
thiophanate-methyl	Topsin M*	BZ	IV	7500	
thiram	Arasan*, Thylate*, Thiramad*	DC	III	780	
triadimefon	Bayleton*	TR	II	1000	5000
triadimenol	Baytan*	TR	III	700-1200	
tribasic copper sulfate	fixed copper	Inor.		low toxicity	
triforine	Funginex*	PI	II, IV	16,000	
vinclozolin	Ronilan*	IM	IV	10,000	
HERBICIDES					
2,4-D	Various formulations		II, III	T-600	>2000
2,4-DB	Butoxone*, Butyrac*		III	>3500	>2000
AAtrex*	atrazine, Atrazine*		III	WP-5100	WP-9300
Accent*	nicosulfuron, NIC-IT*		III	DF>5000	DF>2000
Acclaim*	fenoxaprop, Whip*		III	T-3310	T>2000
Accurate*	Escort*, Manor*, metsulfuron methyl, Valuron*		II	T >5000	T>2000
acetochlor	Harness*, Surpass*, TopNotch*		I	T-2148	T-4166
Achieve*	tralkoxydim		III	T>5000	T>2000
aciflurofen	Ultra Blazer*		I	4790	3250
Aim*	carfentrazone, Quicksilver*		IV	4077	DF>4000
alachlor	Intrro*, Micro-Tech*		III	1782	>5000
ametryn	Evik*		III	WP-1750	WP-10,000
aminopyralid	Milestone*			>5000	>5000
amitrol R.U.	Amitrol*		IV	T-5000	T-2000
Amitrol*	amitrole R.U.		IV	T-5000	T-2000
Arsenal*	imazapyr, Habitat*		III	>5000	>2000
Assure*	quizalofop		IV	EC-5700	EC-5000
asulam	Asulox*		IV	T-5000	T-2000
Asulox*	asulam		IV	T-5000	T-2000
atrazine	AAtrex*, Atrazine*		III	WP-5100	WP-9300
Atrazine*	atrazine, AAtrex*		III	WP-5100	WP-9300
Authority*	Dismiss*, Spartan*, sulfentrazone		III	T-2689	T>2000

Table 11. Names, Classification, and Toxicity of Pesticides (cont.)

Pesticide Name	Other Names (all not listed)	Class	Toxicity Category	Acute LD_{50} Values Oral (mg/kg) White Rats	Acute LD_{50} Values Dermal (mg/kg) Rabbits
		HERBICIDES (cont.)			
Axial*	pinoxaden			EC-3129	EC>2000
Balan*	benefin		I	500	>2000
Banvel*	dicamba, Clarity*, Vanquish*		III	L-1028	2000
Barricade*	prodiamine, Endurance*, Stonewall*		III	DF>5000	DF>2000
Basagran*	bentazon		II	T-1100	2500 (rat)
Beacon*	primisulfuron		III	T-5050	T>2010
benefin	Balan*		I	500	>2000
bensulide	Betasan*, Prefar*		III	T-1770	EC-10,000
bentazon	Basagran*		II	T-1100	2500 (rat)
Betasan*	bensulide		III	T-1770	EC-10,000
bispyribac-sodium	Velocity*		III	2635	>2000
Blizzard*	Cadet*, fluthiacet		III	L>5000	L>2000
bromacil	Hyvar*		III	T-5200	T-5000
bromoxynil	Buctril*		II	T-440	T-3660
Buctril*	bromoxynil		II	T-440	T-3660
Butoxone*	2,4-DB, Butyrac*		III	>3500	>2000
Butyrac*	2,4-DB, Butoxone*		III	>3500	>2000
Cadet*	Blizzard*, fluthiacet		III	L>5000	L>2000
Cadre*	imazapic, Impose*, Plateau*		III	DF>5000	DF>5000
Caparol*	prometryne, Cotton-Pro*		II	WP-3750	3100
carfentrazone	Aim*, Quicksilver*		IV	4077	DF>4000
Casoron*	dichlobenil		III	T-3160	2460
Certainty*	Outrider*, sulfosulfuron		IV	T>5000	T>5000
chloransulam-methyl	FirstRate*		III	T>5000	T>2000
chlorimuron	Classic*		III	T-4100	2000
chlorsulfuron	Corsair*		III	T-5545	T-3400
Clarity*	dicamba, Banvel*, Vanquish*		III	T-1707	T>2000
Classic*	chlorimuron		III	T-4100	2000
clethodim	Envoy*, Prism*, Select*		II	T-1630	T>5000
clomazone	Command*		II	T-1564	T-2000
clopyralid	Lontrel*, Stinger*, Transline*		III	T-4300	T>2000
Cobra*	lactofen		I	EC-2533	EC-2000
Command*	clomazone		II	T-1564	T-2000
Corsair*	chlorsulfuron		III	T-5545	T-3400
Cotoran*	fluometuron		II	WP-1840	10,000
Cotton-Pro*	prometryne, Caparol*		III	T-4550	T>2020
Curbit*	ethalfluralin, Sonalan*		II	3300	T>5000
Dacthal*	DCPA		IV	T-3000	10,000
DCPA	Dacthal*		IV	T-3000	10,000
Devrinol*	napropamide		III	T-5000	>5000
dicamba	Banvel*, Clarity,* Vanquish*		III	L-1028	2000
dichlobenil	Casoron*		III	T-3160	2460
diclosulam	Strongarm*		IV	>5000	>2000
Dimension*	dithiopyr		II	EC>3600	EC>5000

Table 11. Names, Classification, and Toxicity of Pesticides (cont.)

Pesticide Name	Other Names (all not listed)	Class	Toxicity Category	Acute LD_{50} Values Oral (mg/kg) White Rats	Acute LD_{50} Values Dermal (mg/kg) Rabbits
		HERBICIDES (cont.)			
dimethenamid	Outlook*		I	T-1570	D>2000
diquat	Diquat*, Reward*		II	L-230	400
Diquat*	diquat, Reward*		II	L-230	400
Direx*	diuron, Karmex*		III	6100	>5000
Dismiss*	Authority*, Spartan*, sulfentrazone		III	T-2689	T>2000
dithiopyr	Dimension*		II	T>5000	T>5000
diuron	Direx*, Karmex*		III	6100	>5000
Drive*	quinclorac		III	T>2610	T-2000
Dual*	metolachlor, Pennant Magnum*		II	EC-2534	10,000
Endurance*	Barricade* prodiamine, Stonewall*		III	DF>5000	DF>2000
Envoke*	trifloxysulfuron		II	>5000	>2000
Envoy*	clethodim, Prism*, Select*		II	T-1630	T>5000
EPTC	Eptam*, Eradicane*		III	T-1652	10,000
Eptam*	EPTC, Eradicane*		III	T-1652	10,000
Eradicane*	EPTC, Eptam*		III	T-1652	10,000
Escort*	Accurate*, metsulfuron methyl, Manor*, Valuron*		II	T-5000	T-2000
ET*	pyraflufen		IV	>5000	>5000
ethalfluralin	Curbit*, Sonalan*		II	3300	>5000
ethofumesate	Prograss*		III	T<6400	T<20,050
Evik*	ametryn		III	WP-1750	WP-10,000
Express*	tribenuron		III	DG-5000	DG>2000
fenoxaprop	Acclaim*, Whip*		III	T-3310	T>2000
Finale*	glufosinate		II	T-1910	T-1380
Firestorm*	Gramoxone Inteon*, paraquat		I	T-120	236
FirstRate*	chloransulam-methyl		III	DF>5000	DF>2000
Flexstar*	fomesafen, Reflex*		III	T-1499	T>780
fluazifop-butyl	Fusilade*		III	EC-4830	2420
flumetsulam	Python*		II	T>5000	T>2000
flumiclorac	Resource*		III	3200	2000
flumioxazin	Payload*, Valor*		IV	WP>5000	WP>2000
fluometuron	Cotoran*, Meturon*		II	WP-1840	10,000
fluridone	Sonar*		IV	T-10,000	T-2000
fluroxypyr	Spotlight*, Vista*		III	3162	>2000
fluthiacet	Blizzard*, Cadet*		III	L>5000	L>2000
fomesafen	Flexstar*, Reflex*		II	6950	>1000
foramsulfuron	Revolver*		IV	>5000	>5000
fosamine ammonium	Krenite*		IV	>5000	>5000
Fusilade*	fluazifop-butyl		III	EC-4830	2420
Gallery*	isoxaben		III	T>10,000	T>2000
Garlon*	triclopyr, Remedy*		III	1338	>2000
glufosinate	Finale*		II	T-1910	T-1380
glufosinate-ammonium	Liberty*, Rely*, Ignite*		II	T-1910	T-1380
Glyfos*	glyphosate, Glyphomax*, Roundup*		III	L>5000	T>5000
Glyphomax*	glyphosate, Glyfos*, Roundup*		III	L>5000	T>5000
glyphosate	Glyfos*, Glyphomax*, Rodeo*, Roundup*, Touchdown*, others		III	L>5000	L>5000

Table 11. Names, Classification, and Toxicity of Pesticides (cont.)

Pesticide Name	Other Names (all not listed)	Class	Toxicity Category	Acute LD_{50} Values Oral (mg/kg) White Rats	Acute LD_{50} Values Dermal (mg/kg) Rabbits
		HERBICIDES (cont.)			
Goal*	oxyflurofen		II	T-5000	10,000
Gramoxone Inteon*	Firestorm,* paraquat		I	T-120	236
Habitat*	Arsenal*, imazapyr		III	>5000	>2000
Harness*	acetochlor, Surpass*, Topnotch*		I	T- 2148	T-4166
halosulfuron	Permit*, Sandea*, SedgeHammer*		III	DF-1287	DF>5000
hexazinone	Velpar*		II	T-1690	5278 (rat)
Hoelon*	diclofop-methyl		III	EC-2020	2000 (rat)
Hyvar*	bromacil		III	T-5200	T-5000
Ignite*	glufosinate-ammonium, Liberty*, Rely*		II	T-2030	T-1390
Illoxan*	diclofop-methyl		III	T-580	T>5000
Image*	imazaquin, Scepter*		III	>6500	>2000
imazapic	Cadre*, Impose*, Panoramic*		III	T>5000	T>2000
imazapyr	Arsenal*, Habitat*		III	>5000	>2000
imazaquin	Image*, Scepter*		IV	>6500	>2000
imazethapyr	Pursuit*		III	T>5000	T>2000
Impose*	Cadre*, imazapic, Panoramic*, Plateau*		III	T>5000	T>2000
Intrro*	alachlor, Micro-Tech*		III	1782	>5000
isoxaben	Gallery*		III	T>10,000	T>2000
Karmex*	diuron, Direx*		III	6100	>5000
Kerb*	pronamide		IV	>5000	>2000
Krenite*	fosamine ammonium		IV	>5000	>5000
lactofen	Cobra*		I	EC-2533	EC-2000
Lardis	tembotrione		III	1750	>5000
Liberty*	glufosinate-ammonium, Ignite*, Rely*		II	T-1910	T-1380
Linex	linuron, Lorox*		III	>4300	>2000
linuron	Linex*, Lorox*		III	>4300	>2000
Lontrel*	clopyralid, Stinger*, Transline*		III	T-4300	T>2000
Lorox*	Linex*, linuron		III	>4300	>2000
Manor*	Accurate, Escort*, metsulfuron methyl, Valuron*		III	DF>5000	DF>2000
Matrix*	rimsulfuron, Tranxit*		IV	T>5000	T>5000
MCPP*	mecoprop		III	930	4000
mecoprop	MCPP*		III	930	4000
mesosulfuron-methyl	Osprey*		III	>2000	>2000
metham	Vapam*		III	T-820	>2000
metolachlor	Dual Magnum*, Pennant*		II	EC-2534	10,000
metribuzin	Metribuzin*, Metri*		III	T-1090	20,000
metsulfuron methyl	Accurate*, Escort*, Manor*, Patriot*, Valuron*		II	T-5000	T-2000
Meturon*	fluometuron		II	WP-1840	10,000
Micro-Tech*	alachlor, Intrro*		III	1782	>5000
Milestone*	aminopyralid			>5000	>5000
Monument*	trifloxysulfuron-sodium		IV	WG>5000	WG>2000
nicosulfuron	Accent*, NIC-IT*		III	T>5000	T>2000

Table 11. Names, Classification, and Toxicity of Pesticides (cont.)

Pesticide Name	Other Names (all not listed)	Class	Toxicity Category	Acute LD_{50} Values Oral (mg/kg) White Rats	Dermal (mg/kg) Rabbits
		HERBICIDES (cont.)			
NIC-IT*	Accent*, nicosulfuron		III	DF>5000	DF>2000
norflurazon	Predict*, Solicam*, Zorial*		IV	T-8000	20,000
oryzalin	Surflan*		IV	T-5000	T-2000
Osprey*	mesosulfuron-methyl		III	>2000	>2000
Oust*	sulfometuron-methyl		IV	>5000	>5000
Outlook*	dimethenamid		I	T-1570	D>2000
Outrider*	Certainty*, sulfosulfuron		IV	>5000	>5000
oxadiazon	Ronstar*		I, II	T-8000	8000
oxyflurofen	Goal*		II	T-5000	10,000
Panoramic*	Cadre*, imazapic, Impose*		III	T>5000	T>2000
paraquat	Firestorm*, Gramoxone Inteon*		I	T-150	236
Patriot*	Accurate*, Escort*, metsulfuron Manor,* Valuron*		II	T-5000	T-2000
Payload*	flumioxazin, Valor*		IV	WP>5000	WP>2000
Peak*	prosulfuron		III	DF-4360	DF>2020
pebulate	Tillam*		III	T-920	4640
pelargonic acid	Scythe*		III	T>5000	T>2000
pendimethalin	Pentagon*, Pre-M*, Prowl*		II	EC-3380	5000
Pennant Magnum*	Dual*, metolachlor		II	EC-2534	10,000
Pentagon*	pendimethalin, Pre-M*, Prowl*		III	T>5000	T>2000
Permit*	halosulfuron, Sandea*, SedgeHammer*		III	DF-1287	DF>5000
picloram	Tordon*		II, III	T-8200	4000
pinoxaden	Axial*			EC-3129	EC>2000
Poast*	Poast Plus*, sethoxydim, Vantage*		III	T-2700	5000 (rat)
Poast Plus*	Poast*, sethoxydim, Vantage*		III	T-2700	5000 (rat)
Pramitol*	prometon		I	EC-2276	2000
Predict*	norflurazon, Solicam*, Zorial*		III	T>9000	T>20,000
Prefar*	bensulide, Betasan*		III	T-770	3950 (rat)
Pre-M*	pendimethalin, Pentagon*, Prowl*		III	T>5000	T>2000
primisulfuron	Beacon*		III	T-5050	T>2010
Princep*	simazine		IV	T-5000	3100
Prism*	clethodim, Envoy*, Select*		II	T-1630	T>5000
prodiamine	Barricade*, Endurance, Stonewall*		III	T>5000	T>2000
prosulfuron	Peak*		III	DF-4360	DF>2020
Prograss*	ethofumesate		III	T<6400	T<20,050
prometon	Pramitol*		I	EC-2276	2000
prometryne	Caparol*, Cotton-Pro*		II	WP-3750	3100
pronamide	Kerb*		IV	>5000	>2000

Table 11. Names, Classification, and Toxicity of Pesticides (cont.)

Pesticide Name	Other Names (all not listed)	Class	Toxicity Category	Acute LD_{50} Values Oral (mg/kg) White Rats	Acute LD_{50} Values Dermal (mg/kg) Rabbits
		HERBICIDES (cont.)			
prosulfuron	Peak*		III	T-4360	T>2020
Prowl*	pendimethalin, Pentagon*, Pre-M*		II	EC-3380	5000
Pursuit*	imazethapyr		III	T>5000	T>2000
pyraflufen	ET*		IV	>5000	>5000
pyrithiobac sodium	Staple*		II	T>1000	T>2000
Python*	flumetsulam		II	T>5000	T>2000
Quicksilver*	Aim*, carfentrazone		IV	4077	DF>4000
quinclorac	Drive*		III	T>2610	T-2000
quizalofop	Assure*		IV	EC-5700	EC-5000
Reflex*	fomesafen, Flexstar*		II	6950	>1000
Rely*	glufosinate-ammonium, Liberty*		II	T-1910	T-1380
Remedy*	triclopyr, Garlon*		III	1338	>2000
Resource*	flumiclorac		III	3200	2000
Revolver*	foramsulfuron		IV	>5000	>5000
Reward*	diquat, Diquat*		I	L-230	T>400
rimsulfuron	Matrix*, Tranxit*		IV	T>5000	T>2000
Rodeo*	glyphosate		III	L>5000	L>5000
Ronstar*	oxadiazon		I, II	T-8000	8000
Roundup*	glyphosate, Glyfos*, Glyphomax*, others		III	L>5000	L>5000
Sandea*	halosulfuron, Permit*, SedgeHammer*		III	DF-1287	DF>5000
Scepter*	imazaquin, Image*		IV	>6500	>2000
Scythe*	pelargonic acid		III	T>5000	T>2000
SedgeHammer*	halosulfuron, Permit*, Sandea*		III	DF-1287	DF>5000
Select*	clethodim, Envoy*, Prism*		II	EC-3610	T>5000
sethoxydim	Poast*, Poast Plus*, Vantage*		III	T-2700	5000 (rat)
siduron	Tupersan*		IV	T>7500	T>10,000
simazine	Princep*		IV	T-5000	3100
Sinbar*	terbacil		III	T-1225	T>5000
Solicam*	norflurazon, Predict*, Zorial*		IV	T-8000	20,000
Sonalan*	ethalfluralin, Curbit*		II	3300	>5000
Sonar*	fluridone		IV	T-10,000	T-2000
Spartan*	Authority*, Dismiss*, sulfentrazone		III	T-2689	T>2000
Spike*	tebuthiuron		III	>2000	>2000
Spotlight*	fluroxypyr, Vista*		III	3162	>2000
Staple*	pyrithiobac sodium		II	T>1000	T>2000
Stinger*	clopyralid, Lontrel*, Transline*		III	SL>5000	SL>5000
Stonewall*	Barricade*, Endurance*, prodiamine		III	T>5000	T>2000
Strongarm*	diclosulam		IV	>5000	>2000
sulfentrazone	Authority*, Dismiss*, Spartan*		III	T-2689	T>2000
sulfometuron-methyl	Oust*		IV	>5000	>5000
sulfosulfuron	Certainty*, Outrider*		IV	T>5000	T>5000
Surflan*	oryzalin		IV	T-5000	T-2000
Surpass*	acetochlor, Harness*, Top Notch*		I	T-2148	T-4166
tebuthiuron	Spike*		III	>2000	>2000

Table 11. Names, Classification, and Toxicity of Pesticides (cont.)

Pesticide Name	Other Names (all not listed)	Class	Toxicity Category	Acute LD_{50} Values: Oral (mg/kg) White Rats	Acute LD_{50} Values: Dermal (mg/kg) Rabbits
HERBICIDES (cont.)					
tembotrione	Lardis*		III	1750	>5000
terbacil	Sinbar*		III	T-1225	T>5000
Tillam*	pebulate		III	T-920	4640
TopNotch*	acetochlor, Harness*, Surpass*		I	T-2148	T-4166
Tordon*	picloram		II, III	T-8200	4000
Touchdown*	glyphosate		III	L>5000	L>5000
tralkoxydim	Achieve*		III	T>5000	T>2000
Tranxit*	Matrix*, rimsulfuron		IV	T>5000	T>5000
Transline*	clopyralid, Lontrel*, Stinger*		III	T-4300	T>2000
Treflan*	trifluralin, Trilin*		III	3738	>5000
tribenuron	Express*		III	T-5000	T>2000
triclopyr	Garlon*, Remedy*		III	1338	>2000
trifloxysulfuron	Envoke*		II	>5000	>2000
trifloxysulfuron-sodium	Monument*		IV	WG>5000	WG>2000
trifluralin	Treflan*, Trilin*		III	3738	>2000
Tupersan*	siduron		IV	T>7500	T>10,000
Ultra Blazer*	aciflurofen		I	4790	3250
Valor*	flumioxazin, Payload		IV	WP>5000	WP>2000
Vanquish*	dicamba, Banvel*, Clarity*		III	T-1707	T>2000
Vantage*	sethoxydim, Poast*, Poast Plus*		III	T-2676	T>5000
Vapam*	metham		III	T-820	>2000
Velocity*	bispyribac-sodium		III	2635	>2000
Velpar*	hexazinone		II	T-1690	5278 (rat)
Vista*	fluroxypyr, Spotlight*		III	3162	>2000
Whip*	fenoxaprop, Acclaim*		III	T-3310	T>2000
Zorial*	norflurazon, Predict*, Solicam*		IV	T-8000	20,000
PLANT GROWTH REGULATORS–DEFOLIANTS					
BLIZZARD*	fluthiacet-methyl		III	2537	2020
DEF*	tributyl phosphorotrithioate		II	200	1000 (rat)
DROPP*	thidiazuron		IV	4000	1000
EMBARK*	mefluidide		III	4000	4000
PLANT GROWTH REGULATORS–DEFOLIANTS (cont.)					
PREP*	ethephon		I, II	4229	
PRO-GIBB*	gibberellic acid		III	15,000	

NOTE: T = technical material; WP = wettable powder formulation; EC = emulsifiable concentrate; L = liquid formulation; DF = dry flowable. Acute oral or dermal scale: 0-50 = highly toxic; 50-500 = moderately toxic; 500-5000 = slightly toxic; greater than 5000 = low toxicity. Acute oral means the amount fed to test animals at one time. * Indicates trade name.

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Table 12. Abbreviations Used Throughout the Alabama Pest Management Handbook

A	acre(s)	oz.	ounce(s)
a.i.	active ingredient	PDS	postemergence directed spray
AS	aqueous suspension	POST	postemergence
bu	bushel(s)	POT	postemergence over-the-top
cu.ft.	cubic foot (feet)	PPI	preplant incorporated
cwt	hundredweight	ppm	parts per million
DF	dry flowable	PRE	preemergence
E	emulsifiable	psi	pounds per square inch
EC	emulsifiable concentrate	pt.	pint(s)
F	flowable	qt.	quart(s)
F.	Farenheit	RWA	rope wick applicator
fl.oz.	fluid ounce(s)	S	sprayable
ft.	foot (feet)	SL	sprayable liquid
G	granule	SP	soluble powder
gal.	gallon(s)	sq.ft.	square foot (feet)
kg	kilogram(s)	t.	teaspoon
L	liquid	T.	tablespoon
lb.	pound	W	wettable
LC	liquid concentrate	WDG	water dispersible granules
LD	lethal dose	WP	wettable powder
mg	milligram(s)	<	less than
min.	minute(s)	>	greater than
ml	milliliter(s)		

FOR MORE INFORMATION on pesticides, pesticide safety, or submitting samples for analysis, see the following publications in the IPM series:
IPM 1293, "Safety." Safety contact information; worker protection standards; the safe use, handling, and storage of pesticides
IPM 1294, "Submitting Samples." Procedures for submitting samples for diagnosis, analysis, and identification
IPM 1295, "General Pesticide Information." Federal and state restricted use pesticide lists; pesticides and water quality

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For more information, contact your county Extension office. Visit www.aces.edu/counties or look in your telephone directory under your county's name to find contact information.

Use pesticides **only** according to the directions on the label. Follow all directions, precautions, and restrictions that are listed. Do not use pesticides on plants that are not listed on the label

The pesticide rates in this publication are recommended **only** if they are registered with the Environmental Protection Agency or the Alabama Department of Agriculture and Industries. If a registration is changed or canceled, the rate listed here is no longer recommended. Before you apply **any** pesticide, check with your county Extension agent for the latest information.

Trade names are used **only** to give specific information. The Alabama Cooperative Extension System does not endorse or guarantee any product and does not recommend one product instead of another that might be similar.

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