

# **Pest Management Guide:**

**Corn**

**Grain sorghum**

**Soybean**

**Winter wheat**

**Rice**

**Cotton**

# Missouri Pest Management Guide

## Preface

This guide is intended to provide current recommendations for control of the most problematic weeds, insects and diseases encountered in Missouri corn, soybean and winter wheat cropping systems. This information can also be accessed on the World Wide Web at <http://extension.missouri.edu/m171>.

The information and recommendations in this publication are based on research conducted at the University of Missouri and elsewhere. This guide is a cooperative publication written by the following faculty members at the University of Missouri-Columbia:

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The trade names within this guide are given with the understanding that no discrimination is intended and no endorsement by the University of Missouri is implied. The pesticides named in this publication are registered by the U.S. Environmental Protection Agency (EPA) and the Missouri Department of Agriculture. These pesticides are designed to be used according to specific label directions pertaining to rates of application, number of applications, intervals between application and harvest, etc. Failure to

follow these directions may result in hazards to humans and/or the environment, unsafe pesticide residues, and fines to the applicator. Any use of a pesticide that is inconsistent with its label is a violation of federal law.

This publication will be revised annually to reflect label updates, name changes and the entry of new herbicide, insecticide, or fungicide active ingredients in the marketplace. The authors welcome reader suggestions to help improve future editions of this publication.

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## Introduction

The information in this guide is based on research conducted at the University of Missouri Agricultural Experiment Station and elsewhere. It addresses crop, soil and weed problems of the state of Missouri. All herbicide information conforms to federal and state regulations at the time of writing. Consult the label attached to the herbicide container for current use precautions and restrictions.

Use this publication as a guide in selecting and comparing herbicides. It is not a substitute for reading product labels. The University of Missouri does not warrant commercial products and regrets any errors or omissions in this guide. Cost of herbicides was not considered in making these recommendations because prices vary with location and time. Herbicides may perform better or worse depending upon weeds infesting the field, rainfall, soil type, temperature and many other environmental factors. Therefore, we have made no effort to list herbicides in order of preference.

Apply herbicides only to labeled crops. Do not exceed the maximum recommended rate for a herbicide. Excessive herbicide application rates are expensive and can result in injury to the crop or make the crop unsafe as food or feed. Apply herbicides only at times specified on the label. Observe label restrictions for required intervals between time of treatment and time of planting, pasturing or harvesting a crop. Guard against injury to nearby, susceptible crops or plants that herbicide drift or volatility could cause.

This publication discusses using herbicides to control weeds. However, good agricultural practices also enhance weed control. You can reduce reliance on herbicides by planting high-quality, weed-free seed. Other practices include proper seedbed preparation, proper planting depths, proper seeding rates, timely cultivation, narrower row widths, maintaining optimum fertility and pH, and crop or tillage rotations.

## Endangered species

The Environmental Protection Agency is planning to restrict the use of certain pesticides that may harm endangered species in some areas of the country. You should check with your local University Outreach and Extension Center, State Game and Fish Office, or your pesticide dealer to determine if the area you are planning to spray with any pesticide is protected for endangered species.

You should request the *Pesticide Use Bulletin for Protection of Endangered Species* for your county. The bulletin indicates which areas are protected for endangered species and lists the pesticides that may and may not be used in that area. In addition, pesticide labels will list counties where endangered species protection zones exist.

## How to use this guide

Farmers frequently ask us, "What herbicides should I use for soybeans (or corn, wheat)?" Unfortunately, there is no simple answer to this question. The herbicide or, more likely, the combination of herbicides you use for producing a crop depends on the weeds you need to control. Herbicide

selection that is not matched to a field's weed problems will probably result in poor weed control and lost profits from lower crop yields. Thus, the first step toward obtaining good weed control is proper identification of the weeds in your field.

Each crop chapter in this book starts with a chart entitled "Guide to Weed Response to Herbicides." You should use this chart to select the herbicide or combination of herbicides that will give good control of the weeds present in your field. In some cases several herbicide choices may do an effective job of controlling the weeds. Other considerations, such as herbicide price, method of application (pre, post), availability of proper equipment, soil type, and tillage practices, should help you narrow your choices. A soil-applied herbicide rate table is also included in most chapters as a guideline to select rates for your field. Be warned that soil-applied herbicide rates are usually dependent on soil texture, percent organic matter, crop and weed species.

All of this information could not be summarized in one table. The herbicide label should always be your final guide to herbicide use.

The largest section of each crop chapter includes specific use rates, timing, application methods and precautions for all of the herbicides and combinations recommended for Missouri. This section is most easily used after you have narrowed your choices by using the herbicide response table. If a herbicide you have heard about is not included in this guide, it could be for the following reasons:

1. The herbicide or herbicide use was not yet registered by the Environmental Protection Agency at this writing (August and September of the year preceding the date of publication).
2. There was insufficient University-generated data to evaluate the herbicides performance and applicability for Missouri crop production (a minimum of three years' data is usually required).
3. The herbicide or herbicide use did not perform well or was not appropriate in Missouri crop production conditions.

At the back of the guide are reference tables giving crop replant and rotational intervals, forage and grazing restrictions, herbicide compatibility with fertilizers, rainfast intervals and preharvest intervals. These tables are designed to answer questions that are encountered during the growing season.

## Herbicide treatment methods and timing

Herbicides are generally applied at the following times:

1. **Early preplant (EPP)** onto the soil and early emerging weeds up to a month before crop planting. Some herbicides are even registered for application in the fall prior to planting the next spring.
2. **Preplant (PPT)** onto the soil or any early emerging weeds before the crop is planted.
3. **Preplant-Incorporated (PPI)** into the soil before crop planting.
4. **Preemergence (PRE)** onto the soil before or after crop

planting, but before weed or crop emergence.

5. **Postemergence-overtop (POST)** onto weeds after the crop and weeds have emerged.
6. **Post-directed (DIR)** onto small weeds in rows of taller crops.

Good coverage of the entire weed is usually necessary to obtain maximum control with postemergence herbicides. Most soil-applied herbicides can be applied in 10 to 20 gallons per acre (gpa) of water. Postemergence herbicides often require a 10 to 20 gpa spray volume using flat fan or hollow cone spray tips. Consult the herbicide label for recommended spray volumes, pressures and application equipment.

## Incorporation

Incorporation of some preplant herbicides is necessary to prevent loss from the soil surface and to place the herbicide in the proper position for weed control. Incorporation may also improve weed control when rainfall is untimely or too low to activate the herbicide.

Allowable waiting periods between herbicide application and incorporation vary. The label gives the maximum acceptable waiting period for the herbicide. However, incorporating as quickly as possible after application will reduce the chances of obtaining poor weed control.

Incorporate herbicides into the top 1.5 to 3 inches of soil. Most weeds germinate within the upper 2 inches of soil. Incorporating a herbicide deeper than recommended on the label “dilutes” the herbicide and gives poor weed control. Incorporating a herbicide too shallow can result in vapor loss from the soil or failure to control weeds germinating below the herbicide zone.

Tandem disks, field cultivators, power-driven cultivation equipment and combination bed conditioners, such as a Do-All or Triple K, all give acceptable herbicide incorporation following seedbed preparation. Set tandem disks to cut to a depth of 4 to 6 inches. Operate them at 4 to 6 mph to obtain adequate incorporation to a depth of 2 to 3 inches. Set field cultivators and bed conditioners to cut 2 to 4 inches deep and operate them at a speed of at least 5 mph. Use field cultivators with three to four rows of sweeps spaced at 7 inches or less. Chisel points are unacceptable for incorporation with a field cultivator.

You need to make two passes for tandem disks, field cultivators and combination bed conditioners. Make the second pass at an angle to the first. You can use power-driven cultivators in a single pass, but don't exceed speeds of 4 mph. The spike-toothed harrow or the rotary hoe alone usually won't give satisfactory herbicide incorporation. Follow the equipment owner's manual and the herbicide label for settings for proper soil incorporation.

## Cultivation

You might want to cultivate shallowly for weed control when rows are spaced far enough apart to allow the use of cultivation equipment. Cultivation can be used to control weeds that escape after herbicide treatment or to control weeds in row middles when applying herbicides in a band. You can save money by banding herbicides over the row and

cultivating the middles. Don't use banding for rows narrower than 20 inches or when spraying perennials such as rhizome johnsongrass where cultivation is ineffective. Set cultivators shallow to prevent crop root pruning and new weeds' seeds from being brought to the soil surface.

A timely rotary hoeing can eliminate the need for postemergence herbicide or at least delay the need for a postemergence herbicide. Rotary hoes are especially useful in narrow-row or broadcast soybeans where you can't use conventional cultivators. You'll get best results with a rotary hoe when the crop has just emerged (just past the crook stage in soybeans, spike to two-leaf stage for corn and grain sorghum). Weeds should be just emerging (within two days). Soil surface should be dry in the top 2 inches for the best hoeing action. Using the hoe properly, you'll destroy less than 5 to 10 percent of a well-established crop stand. Do not use a rotary hoe if stands are already thin.

When following a preplant-incorporated herbicide, cultivate at less than half the depth of incorporation to prevent bringing untreated soil to the surface. Some preemergence herbicides require rainfall for activation to move the chemical into the soil. If it doesn't rain within seven days of application, you might be able to improve weed control with a shallow incorporation with a rotary hoe, harrow or field cultivator.

## Multiple applications

It is usually necessary to make more than one herbicide application to obtain broad spectrum weed control. You might need a preplant incorporated herbicide for grass control, followed by a preemergence treatment for broad-leaf weed control. You might need tank mixtures of two or more herbicides in one application to obtain broad spectrum control. We included only registered **package mixes** (mixtures formulated into one package by a manufacturer) and **tank mixes** (herbicides combined in the spray tank by the grower) in this guide.

## Types of herbicide formulations

This guide lists several herbicide formulations. The abbreviations used are: emulsifiable concentrates (EC), liquids (L), solutions (S), flowables (F), dry flowables (DF), wettable powders (WP) and water dispersible granules (WDG). Most spray mixtures require constant agitation to prevent the herbicide from settling to the bottom of the spray tank. Granular formulations (G) are dry formulations that cannot be mixed with water. Don't mix granular herbicides with other granular pesticides or fertilizers.

## Herbicide additives

Additives are substances added to the spray mixture to enhance effectiveness. Common additives used for weed control are as follows:

**Emulsifiers:** Substances that promote the suspension of one liquid in another (for example, oil into water).

**Surfactants:** Materials that modify wetting, spreading, dispersing, or emulsifying of liquids. Most herbicides that



require surfactants specify *nonionic surfactants*. Most surfactants sold for agricultural use are nonionic. Many surfactants sold for home or industrial use are not nonionic, so don't use them.

**Fertilizers:** Liquid fertilizers such as UAN (urea ammonium nitrate) and 10-34-0 and dry fertilizers such as ammonium sulfate are popular additives for several postemergence herbicides.

**Oil concentrates:** (Also crop oil concentrates). These are normally a mixture of non-phytotoxic oil and 10 to 20 percent surfactant. For herbicides that suggest an "oil concentrate," you can sometimes substitute soybean or vegetable oil concentrates for crop oil concentrates. However, some herbicide labels do not recommend the use of soybean oil. Consult the herbicide label before using a soybean oil.

**Methylated oils:** These can be manufactured from seed oils (such as sunflower) or petroleum oils. Be sure to consult the herbicide label for compatibility with these oils.

**Utility modifiers:** Two types are commonly used with herbicides.

1. Compatibility agents are frequently used to mix herbicides with liquid fertilizers.
2. Anti-foaming agents can be added to the tank or sprayed onto the solution surface to prevent foam or suds from forming when filling the spray tank.

**Spray modifiers:** The most common spray mix modifier used with herbicides is the *thickening agent or drift control agent*. These materials thicken the spray solution to reduce drift problems. These are usually used by aerial applicators.

Be sure you are using the proper additive for the herbicide you are using. Most herbicide labels specify the type and amount of additive to use. Failure to follow the recommendation can result in poor weed control or excessive crop injury. The proper additive is included in this guide when required or suggested by the label. It is also recommended that additives be purchased from reputable sources. Additives are not subject to quality-control regulations. Some herbicides have a list of specifically recommended products.

## Herbicide application

Proper herbicide application is necessary to obtain the best weed control. Check spray equipment frequently for even and proper spray output. Generally you should apply herbicides at pressures ranging from 20 to 40 psi *at the boom*, although some postemergence-contact herbicides require 40 psi or greater for adequate coverage. Most herbicide labels recommend a flat fan or hollow cone spray nozzle. Use stainless steel or nylon tips and 50-mesh screens with wettable powder, flowable or dry flowable formulations. Some herbicide labels state that excess speed with ground equipment (>10 mph) may result in erratic weed control due to poor coverage. Provide adequate agitation to keep herbicides suspended in the tank mix. Wettable powders and flowables are especially susceptible to settling in the tank. Use flat fan, even tips for band applications. All herbicide labels include recommendations for proper spray volume, pressure and nozzle types.

## Spray equipment

Accurate sprayer calibration is essential for proper herbicide application and weed control. Sprayer calibration is not difficult, but most people usually don't calibrate often enough. Screens may become blocked with trash and nozzles wear down, changing delivery patterns and spray rates. Thoroughly inspect and calibrate spray rigs at least once a year.

## Sprayer calibration

It is absolutely essential to know how much spray liquid the sprayer is delivering per acre at the speed and pressure the tractor is operating. Here is a simple method for calibrating a sprayer for broadcast or banding applications.

### Once calibration method

Step 1. Measure the specified distance in the field as determined in the following table. Select the distance that matches the nozzle spacing for broadcast or the row spacing for band applications. This table assumes that nozzle spacing equates to the effective band width per nozzle.

Row or nozzle spacing (inches)	Distance to time for calibration (feet)
40	102
38	107
36	113
34	120
32	127
30	136
28	146
26	157
24	170
22	185
20	204
18	227
16	255
14	291

Step 2. Drive the measured distance at the desired speed and record in seconds the amount of time it takes. Note: Perform the test in the field in which you will be spraying. Attach and operate any equipment you will be using during spraying (disk, planter).

Step 3. Using a measuring cup or baby bottle marked in fluid ounces, catch the discharge from a nozzle for as long as it took to travel your measured distance. If you use more than one nozzle to spray the same band or row (directed banding rigs) catch the spray from each nozzle.

Step 4. The total discharge per nozzle or row measured in step 3 in ounces equals the gallons per acre applied. If you used row spacing in step 1, you must measure all nozzles directed on the row to determine gallons per acre.

Step 5. Repeat the test for each nozzle to ensure even spray distribution. Nozzles should vary no more than 5 percent across the boom.

Step 6. Divide tank capacity by gallons per acre determined in step 4 to calculate the number of acres one tankful of spray will cover.

$$\text{Tank capacity (gals.)} = \text{Number of acres covered}$$

**GPA**

Step 7. Multiply the recommended herbicide rate by the number of acres covered per tank. (Measure rate and amount in ounces, pints, quarts, etc.)

$$\text{Rate} \times \text{acres covered} = \text{Amount to add to tank}$$

Step 8. Band Application. All rates given in this guide are broadcast rates. You must adjust the rate for band applications using the following formula.

$$\frac{\text{Band width} \times \text{Broadcast rate}}{\text{Row width}} = \text{Band rate}$$

**Row width**

Use the above formula to adjust rates if you have calibrated your sprayer on a row-width basis for band spraying.

## Calibration examples

### Example A. Broadcast.

A grower will apply trifluralin with a broadcast boom having nozzles spaced 18 inches apart while pulling a P.T.O.-driven ROTERRA for incorporation.

Step 1. The distance to travel for an 18-inch nozzle spacing is 227 feet. Measure the distance in the field to be sprayed.

Step 2. Measure the time to drive the distance with the incorporation implement. In this example, it took 39 seconds to cover 227 feet (4 mph).

Step 3. Set the pressure to be used and catch the output of one nozzle for 39 seconds.

Step 4. The output in ounces equals the amount of spray applied in gallons per acre. If the nozzle output was 20 ounces in 39 seconds, then the sprayer is applying 20 gpa.

Step 5. Repeat step 4 for each nozzle.

Step 6. Assume you have two 200-gallon saddle tanks and wish to apply 1.5 pints of trifluralin per acre.

$$\text{400 gal per fill} = \text{20 acres covered per fill}$$

**20 gpa**

Step 7. Since the recommended rate is 1.5 pints per acre, you would use 30 pints of trifluralin per refill (15 pints per 200 gallon tank).

$$1.5 \text{ pt/A} \times \text{20 acres} = \text{30 pints}$$

$$\text{30 pints} = \text{15 pints per tank}$$

**2 tanks**

### Example B. Band application.

Two nozzles spraying the same band.

A grower will apply Poast plus crop oil concentrate on a 15-inch band with a 30-inch row.

Step 1. The distance to travel for a 30-inch row is 136 feet.

Step 2. Measure the time required to travel 136 feet in the field. Let's say it took 23 seconds (4 mph).

Step 3. Set pressure and catch the output of each of the two nozzles spraying the band for 23 seconds.

Step 4. The output in ounces of the two nozzles combined is equal to the amount in gallons per acre. If the output of the two nozzles combined was 25 ounces, the sprayer is applying 25 gpa.

Step 5. Repeat step 4 for each set of tips.

Step 6. Assume the grower used a 200-gallon tank and a broadcast rate of 1.5 pints per acre of Poast and 1 quart per acre of crop oil concentrate.

$$\text{200 gal tank} = \text{8 acres covered per tank}$$

**25 gpa**

Step 7. Reduce the rates for a 15-inch band.

$$\frac{15 \text{ in. band} \times 1.5 \text{ pt/A broadcast}}{30 \text{ inch row}} = \text{0.75 pt/A Poast}$$

**30 inch row**

$$\frac{15 \text{ in. band} \times 1 \text{ qt/A broadcast}}{30 \text{ inch row (1 pt/A)}} = \text{0.5 qt/A crop oil}$$

**30 inch row (1 pt/A)**

Step 8.

$$8 \text{ acres} \times \text{0.75 pt/A} = \text{6 pints of Poast per refill.}$$

$$8 \text{ acres} \times \text{1 pt /A} = \text{8 pints of crop oil per refill.}$$

## Mixing chemicals in the tank

1. Fill tank ¼ full with water, liquid nitrogen, or other desired carrier.
2. Start agitation.
3. Add wettable powders or water dispersible granules (WDG) first, then flowables or dry flowables (DF). Allow sufficient time for DFs and/or WDGs to fully dissolve before proceeding to step 4.
4. Add liquids or emulsifiable concentrates next.
5. Add surfactants last when tank is nearly full, to minimize foaming.
6. When using dry formulations, agitation should be maintained in the tank until the spray solution is applied.

## Tank-mix compatibility

Some liquid or dry fertilizers, adjuvants or herbicide combinations may be incompatible. Determine the compatibility of the herbicide with the specific fertilizer to be used. A compatibility agent may be necessary for certain liquid fertilizer/herbicide mixes. Use a jar test if you are uncertain about the compatibility of the mix.

1. Mix an approved compatibility agent and the fertilizer or water to be used in two 1-quart jars.
2. Add the herbicides and adjuvants in both of the jars in the same proportion as that used in the spray tank. Add dry herbicides first, flowables next and emulsifiable concentrates last. The amount and proportion vary with the

herbicide. Check the label for each herbicide used. Add compatibility agent to one of the jars.

3. Invert or shake each jar at least 10 times to mix. Let the mixtures stand for 15 minutes.
4. If no separation, large flakes, precipitation, gels or heavy oil films form, you can use the mixture. If the mixture can be remixed after separation, the tank-mix can be used if good agitation is provided.
5. If the mixture is incompatible, try slurring dry herbicides in water before mixing. Also try adding half the compatibility agent to the fertilizer and half the compatibility agent to emulsifiable concentrate or flowable herbicides before mixing. If the mixture still separates the mix cannot be used. Always consult the label for compatibility tests and agents to use for the herbicides involved.

## Cleaning spray equipment

After using a sprayer, you should flush tanks, lines, booms and nozzles with water for a minimum of 5 minutes. Make sure to remove boom section end caps during flushing. After using any herbicide and flushing the sprayer with water, add any of the following plus detergent, surfactant, or spray tank cleaner to the filled tank, then flush the cleaning solution through the boom, hoses and nozzles. Add more water and then clean again by running the pump and agitation for at least 15 minutes. Remove nozzle and screens and clean separately in a bucket of the cleaning agent and water. Add the following in 50 gallons of water to make the cleaning solution:

1. 0.5 gallon of household ammonia (let stand in sprayer overnight for growth regulator type herbicides such as 2, 4-D, Banvel, or Tordon).
2. 4 pounds trisodium phosphate cleaner.
3. 2.5 pounds sal soda.

Some herbicides have specified cleanout procedures. Check label for specific instructions. Consult MU Extension publication G4852, *Cleaning Field Sprayers to Avoid Crop Injury*, for additional information.

## Algae and moss control in tanks

Moss and algae will appear in plastic tanks during warm weather. There are three ways to prevent or eliminate algae and moss:

1. Keep tanks dry when not in use.
2. Paint tanks black to block sunlight. Algae will not grow without sunlight.
3. Use copper sulfate. Measure copper sulfate by dissolving 1 ounce in a pint of water. Then add 7.5 tablespoons of the copper sulfate solution to each 100 gallons of water and mix.

## Pesticide container disposal

Triple rinse all pesticide containers and puncture them before disposing of them in an approved burial site or sanitary landfill. Missouri has a pesticide container recycling program. Contact your dealer or local University of Missouri Extension center for information. Follow local regulations.

## Ground and surface water protection

Contamination of ground and surface water with pesticides has become a growing public concern. Well-water monitoring of pesticides in Missouri indicates very little pesticide contamination in the state. The levels that have been detected are generally in the parts per billion (ppb) range and are below current health advisory levels considered safe for drinking water. Point-source contamination is usually suspected where levels over a few ppb are detected in water supplies.

Point-source problems are related to a confined area, event or site such as mixing, storage or transport sites. Point-source contamination is probably responsible for a majority of the pesticide detections in wells. These sources of contamination are relatively easy to correct.

The potential for point-source contamination can be reduced by following these suggestions:

1. Mix chemicals in the field away from wells and water sources.
2. If chemicals must be mixed or stored at the well site, use hoses to maintain at least a 150-foot buffer from the well to the spray tank.
3. Keep filling hoses out of the spray tank, maintain an air gap, use check valves and do not leave tanks unattended while filling to avoid back siphoning or overflow.
4. Never dump rinsate or concentrated product in a localized area. Spilling 4 ounces of a chemical in a 100-square-foot area is the equivalent of applying 100 lb per acre! Dispose of rinsate by applying to a labeled crop site.
5. Triple rinse herbicide containers into the spray tank before disposal or return.
6. Properly construct, grout and case new well construction. Properly cap and seal abandoned wells.

Spills or back siphoning of any consequence have the potential to contaminate ground or surface water unless handled properly and promptly. Report spills to the Missouri Department of Natural Resources and local authorities.

**Missouri Department of Natural Resources:  
Environmental Emergency Response  
(573) 634-2436**

Nonpoint water pollution occurs over a broad, generally ill-defined area and the direct cause of contamination may not be readily apparent. Leaching from general field applications within labeled guidelines is often mentioned as a possible cause of nonpoint-source pollution. Field application of herbicides is actually a rare form of water pollution. However, the following steps will further minimize the potential for water contamination.

1. Select herbicides with shorter residual half-lives and strong soil adsorption characteristics, especially for late-season herbicide applications.
2. Leave buffer strips around sinkholes, streams and bodies of water.
3. When possible, banding herbicides, using herbicides with higher unit activity (applied at low lb/A rates), and the use of the reduced-rate herbicide recommendations in this guide can all reduce the overall pesticide load on the environment.

4. Properly calibrate and maintain sprayer equipment to avoid over application.
5. Use practices such as crop rotation, herbicide rotation and cultivation in addition to herbicides for weed control.
6. Use conservation or no-tillage practices on erodible land to reduce off-site herbicide movement that occurs with surface water runoff.
7. See special information for atrazine and cyanazine products.

Good land stewardship dictates that herbicide characteristics be assessed in relation to their ground or surface water pollution potential. Reducing the potential for groundwater pollution (especially point-source contamination) will help ensure the continued availability of agricultural chemicals as an important tool in crop production while protecting our water resources.

**Warning:** The chance of having herbicide crop injury is increased when several herbicides are applied to the same crop. Adherence to labeled rates is especially important when making multiple herbicide applications.

## Weed resistance to herbicides

Weed resistance to many herbicides has been confirmed around the world. The ALS/AHAS inhibiting herbicides (including Accent, Beacon, Classic, Exceed, FirstRate, Harmony Extra, Permit, Pinnacle, Pursuit, Scepter and others) have had numerous cases of herbicide-resistant weeds developing. It is a good general practice to rotate herbicides and herbicide families in a field. Other practices such as cultivation and sequential applications of herbicides from different families can help to reduce the probability of herbicide-resistant weed populations appearing. Herbicide modes of action are given in the table of herbicide name, active ingredients, modes of action and manufacturers found on page 10. Additional information on herbicide family groups, and suggestions for preventing weed resistance problems can be obtained from your county Extension office, your dealer and herbicide manufacturers.

## Special information for atrazine

Atrazine-containing products may not be mixed, loaded or used within 50 feet of any well, including abandoned drainage wells and sinkholes.

In conventional tillage, atrazine may not be surface applied within 66 feet of points where field surface water runoff enters perennial or intermittent streams and rivers or within 200 feet of natural or impounded lakes and reservoirs. On highly erodible land as defined by the USDA Natural Resources Conservation Service (NRCS), the 66-foot buffer for runoff points from fields MUST be planted to crop or seeded with grass.

**Note:** This restriction is voided if (1) the herbicide is applied to fields with heavy plant residues (no-till) or (2) the herbicide is incorporated in conventional tillage crop production.

The maximum annual rate for preemergence application on land designated as having "highly erodible soils" as defined by the NRCS will be 2.0 lb/A active ingredient (a.i.)

of atrazine on fields with greater than 30% surface residue and 1.6 lb a.i./A on fields with less than 30% surface residue. The maximum rate on soils not designated as highly erodible is 2.0 lb a.i./A of atrazine. The maximum annual rate for postemergence applications of atrazine are 2.0 lb a.i./A in fields with no soil-applied atrazine in the same year. The maximum annual amount must not exceed 2.5 lb a.i./A where a soil-applied plus a postemergence application of atrazine is made to a field in the same year.

## Conservation tillage

### Weed control programs

Obtaining good weed control in reduced tillage or no-tillage cropping systems is an important component of successful conservation tillage crop production. Eliminating heavy tillage operations reduces horsepower requirements for farm tractors and reduces the number of trips across the field. Surface mulches from crop residues protect the topsoil from erosion and maintain a higher supply of soil moisture. However, you might need to rely more heavily on herbicides for weed control because you can't till or cultivate.

**Reduced tillage.** There are several reduced tillage systems used for crop production in Missouri. With some systems, primary tillage is completed during dry periods in the fall and winter weeds provide soil protection. A burndown herbicide is then applied before planting. This is sometimes termed *stale seedbed*. In other systems, the soil is worked just enough before planting that winter and annual weeds are controlled; however, residue from the previous year's crop remains to provide ground cover. This system is sometimes termed *stubble* or *mulch tillage*. Perennial weeds are likely to be greatest in this system because tillage is not severe enough to control the deep root systems, and shallow tillage actually spreads these roots.

**Ridge-till** is also practiced in some areas of Missouri. This system provides more winter cover than chisel-disk systems and still allows in-crop cultivation for weed control. This allows herbicide use to be reduced as in conventional tillage systems by banding in the row and cultivating between rows. However, ridge-till is most suited to gently sloping land (less than 2%) and still allows considerable surface water runoff. This can be an advantage on relatively flat, poorly drained fields.

Ridge-till requires frequent trips through the field for cultivation and to maintain the ridges. The ridges are also difficult to maintain during winter small-grain production. Burndown herbicides may also be required as in no-till to control winter weeds before planting. Perennial weeds will also be spread by the shallow tillage as with chisel and disk systems.

**No-till** is rapidly becoming the most important and widely used method of crop production on highly erodible land in Missouri. This system can control erosion and increase water infiltration. Compaction is often lessened in no-till.

You will need herbicide treatments to control winter and early spring weeds, and cover crops that emerge before planting in no tillage (and some ridge-till) fields and to con-

trol weeds that emerge later in the season. Winter and early spring weeds, winter cover crops, and sods growing in a no-tillage field can actually deplete soil moisture levels before planting. This can eliminate the soil-moisture-conserving advantages of the no-tillage mulch. We recommend applying burndown herbicides two weeks before planting for cover crop control. This prevents the cover crop from using available soil moisture in dry years and aids in soil drying and crop seedling establishment in wet years. However, herbicides will be required to kill most cover crops and sods and to reduce the spread of perennial weeds.

Planting crops in narrower rows can enhance weed control in any tillage system by causing the crop canopy to close earlier. Shading the weeds and soil as early as possible makes the crop less susceptible to weed competition and can reduce late-season weed germination or emergence.

Herbicide recommendations made in the no-tillage sections of this guide are designed to control weeds that emerge before planting and also provide residual weed control. If you apply herbicides preemergence either before or after crop planting, do so at higher spray volumes with contact herbicides such as Gramoxone and atrazine (20 to 40 gpa). This improves herbicide penetration through the mulch cover. The only exception is Roundup and mixtures containing Roundup, which are more effective applied in 10 gpa of water.

Some of the herbicide applied preplant or preemergence will be intercepted by the mulch cover; to compensate for this, you need to use the higher recommended rates for your soil type. Consult the herbicide label for specific directions for no-tillage applications. Postemergence herbicides perform similarly in conventional or reduced tillage systems.

**Herbicide trade and common name, formulation, mode of action, and manufacturer**

Trade name	Common name	Formulation	Mode of action/group number <sup>a</sup>	Manufacturer
AAtrex 4L	atrazine	4 lb/gal	PSII/5	Syngenta
AAtrex Nine-0	atrazine	90%	PSII/5	Syngenta
Abundit Extra	glyphosate	3 lb acid eq./gal	EPSP/9	DuPont
Accent Q	nicosulfuron	54.4%	ALS/2	DuPont
Achieve	tralkoxydim	50%	ACCCase/1	Syngenta
Affinity TankMix	thifensulfuron + tribenuron	40% + 10%	ALS/2 + ALS/2	DuPont
Afforia	flumioxazin + thifensulfuron + tribenuron	40.8 + 5% + 5%	PPO/14 + ALS/2 + ALS/2	DuPont
Aim 2EC and 2EW	carfentrazone-ethyl	40%	PPO/14	FMC
Anthem	pyroxasulfone + fluthiacet	2.087 + 0.063 lb/gal	LCFA/15 + PPO/14	FMC
Anthem ATZ	pyroxasulfone + fluthiacet + atrazine	0.485 + 0.014 + 4.00 lb/gal	LCFA/15 + PPO/14 + PSII/5	FMC
Armezon	topramezone	2.8 lb/gal	HPPD/27	BASF
Assure II 0.88 EC	quizalofop	0.88 lb/gal	ACCCase/1	DuPont
Authority Assist	sulfentrazone + imazethapyr	3.33 lb + 0.67 lb/gal	PPO/14 + ALS/2	FMC
Authority Elite	sulfentrazone + S-metolachlor	0.7 + 6.3 lb/gal	PPO/14 + LCFA/15	FMC
Authority First	sulfentrazone + cloransulam	62.1% + 7.9%	PPO/14 + ALS/2	FMC
Authority Maxx	sulfentrazone + chlorimuron	0.62 lb + 0.04 lb/gal	PPO/14 + ALS/2	FMC
Authority MTZ	sulfentrazone + metribuzin	18% + 27%	PPO/14 + PSII/5	FMC
Authority XL	sulfentrazone + chlorimuron	0.62 lb + 0.08 lb/gal	PPO/14 + ALS/2	FMC
Autumn 10WDG	iodosulfuron	10%	ALS/2	Bayer
Axial XL	pinoxaden	0.42 lb/gal	ACCCase/1	Syngenta
Axiom 68 DF	flufenacet + metribuzin	54.4% + 13.6%	LCFA/15 + PSII/5	Bayer
Axiom AT	atrazine + flufenacet + metribuzin	50.5% + 19% + 4.9%	PSII/5 + LCFA/15 + PSII/5	Bayer
Banvel 4E	dicamba	4 lb/gal	GR/4	MicroFlo
Basagran 4S	bentazon	4 lb/gal	PSII/6	MicroFlo
Beacon 75DF	primisulfuron	75%	ALS/2	Syngenta
Balance Flexx	isoxaflutole + safener	2 lb/gal	HPPD/27	Bayer
Balance Pro 4L	isoxaflutole	4 lb/gal	HPPD/27	Bayer
Basis Blend	rimsulfuron + thifensulfuron	20% + 20%	ALS/2 + ALS/2	DuPont
Bestow	rimsulfuron	25%	ALS/2	Chemnova
Bicep II Magnum 5.5L	atrazine + S-metolachlor	3.1 + 2.4 lb/gal	PSII/5 + LCFA/15	Syngenta

**Herbicide trade and common name, formulation, mode of action, and manufacturer - *continued***

Trade name	Common name	Formulation	Mode of action/group number <sup>a</sup>	Manufacturer
Bicep Lite II Magnum 6L	S-metolachlor + atrazine	3.33 + 2.67 lb/gal	LCFA/15 + PSII/5	Syngenta
Blazer 2L	acifluorfen	2 lb/gal	PPO/14	BASF
Boundary 6.5 EC	S-metolachlor + metribuzin	5.25 + 1.25 lb/gal	LCFA/15 + PSI	Syngenta
Breakfree	acetochlor + antidote	6.4 lb/gal	LCFA/15	DuPont
Breakfree ATZ	acetochlor + atrazine	3 + 2.5 lb/gal	LCFA/15 + PSII/5	DuPont
Broclean 4L	bromoxynil	2 lb/gal	PSII/6	Platte Chemical
Bronate 4AS	bromoxynil + MCPA	2 + 2 lb/gal	PSII/6 + GR/4	Bayer
Buctril 2EC	bromoxynil	2 lb/gal	PSII/6	Bayer
Buctril 4EC	bromoxynil	4 lb/gal	PSII/6	Bayer
Buctril + Atrazine 3L	bromoxynil + atrazine	1 + 2 lb/gal	PSII/6 + PSII/5	Bayer
Butyrac 200	2,4-DB	2 lb/gal	GR/4	Bayer
Cadet	fluthiacet-methyl	0.91 lb/gal	PPO/14	FMC
Callisto	mesotrione	4 lb/gal	HPPD/27	Syngenta
Callisto GT	glyphosate + mesotrione	3.8 lb acid eq. + 0.38 lb/gal	ESPS/9 + HPPD/27	Syngenta
Callisto Xtra	mesotrione + atrazine	0.5 lb + 3.2 lb/gal	HPPD/27 + PSII/5	Syngenta
Canopy 75 DF	metribuzin + chlorimuron	64.3% + 10.7%	PSII/5 + ALS/2	DuPont
Canopy EX	chlorimuron + tribenuron	22.7% + 6.8%	ALS/2 + ALS/2	DuPont
Cinch 7.64EC	S-metolachlor	7.64 lb/gal	LCFA/15	DuPont
Cinch ATZ 5.5L	atrazine + S-metolachlor	3.1 + 2.4 lb/gal	PSII/5 + LCFA/15	DuPont
Cinch Lite ATZ 6L	S-metolachlor + atrazine	3.33 + 2.67 lb/gal	LCFA/15 + PSII/5	DuPont
Clarity 4L	dicamba	4 lb/gal	GR/4	BASF
Classic 25DF	chlorimuron	25%	ALS/2	DuPont
Cobra 2EC	lactofen	2 lb/gal	PPO/14	Valent
Command 3 ME	clomazone	2 lb/gal	DS/13	FMC
Corvus	thiencarbazone + isoxaflutole + safener	2.6 lb/gal	ALS/2 + HPPD/27	Bayer
Credit	glyphosate	3 lb/gal	EPSP/9	Nu-farm
Cornerstone	glyphosate	3 lb/gal	EPSP/9	Winfield
Crusher	rimsulfuron + thifensulfuron	25% + 25%	ALS/2 + ALS/2	Chemnova
Dawn	fomesafen	2 lb/gal	PPO/14	Chemnova
Define	flufenacet	4 lb/gal	LCFA/15	Bayer
Degree 3.8L	acetochlor + safener	3.8 lb/gal	LCFA/15	Monsanto
Degree Xtra 4.04L	acetochlor + atrazine	2.7 + 1.34 lb/gal	LCFA/15 + PSII/5	Monsanto
Domain 60DF	metribuzin + flufenacet	24% + 36%	PSII/5 + LCFA/15	Bayer
Distinct 70WG	dicamba + diflufenzopyr	55% + 15%	GR/4	BASF
Dual II Magnum 7.64EC	S-metolachlor	7.64 lb/gal	LCFA/15	DuPont
Duramax	glyphosate (dimethylamine salt)	4 lb acid eq./gal	EPSP/9	Dow
Durango DMA	glyphosate (dimethylamine salt)	4 lb acid eq./gal	EPSP/9	Dow
Enlite	flumioxazin + chlorimuron + thifensulfuron	36.2% + 2.9% + 8.8%	PPO/14 + ALS/2 + ALS/2	DuPont
Envive	flumioxazin + chlorimuron + thifensulfuron	29.2% + 9.2% + 2.9%	PPO/14 + ALS/2 + ALS/2	DuPont
Epic 58DG	flufenacet + isoxaflutole	58% + 10%	LCFA/15 + HPPD/27	Bayer
Equip 32DG	foramsulfuron + iodosulfuron	30% + 2%	ALS/2 + ALS/2	Bayer
Expert 4.9L	atrazine + S-metolachlor + glyphosate	2.14 + 1.74 + 1 lb/gal	PSII/5 + LCFA/15 + EPSP/9	Syngenta
Express TotalSol	tribenuron-methyl	50%	ALS/2	DuPont
Extreme 1.67L <sup>b</sup>	glyphosate + imazethapyr	1.5 + 0.17 lb/gal	EPSP/9 + ALS/2	BASF
Facet L	quinclorac	1.5 lb ae/gal	GR/4	BASF
Fierce 76WDG	flumioxazin + pyroxasulfone	33.5% + 42.5%	PPO/14 + LCFA/15	Valent
Fierce XLT	flumioxazin + pyroxasulfone + chlorimuron	24.6% + 31.2% + 6.67%	PPO/14 + LCFA/15 + ALS/2	Valent
Finesse	chlorsulfuron + metsulfuron	62.5 + 12.5 WG	ALS/2	DuPont

Herbicide trade and common name, formulation, mode of action, and manufacturer - *continued*

Trade name	Common name	Formulation	Mode of action/group number <sup>a</sup>	Manufacturer
Finesse Grass + Broadleaf	chlorsulfuron + flucarbazone	25% + 46.7%	ALS/2 + ALS/2	DuPont
FirstRate 84DG	cloransulam	84%	ALS/2	Dow
Flexstar 1.88ME	fomesafen + adjuvants	1.88 lb ae/gal	PPO/14	Syngenta
Flexstar GT 3.5	fomesafen + glyphosate	0.56 lb + 2.26 lb/gal	PPO/14 + EPSP/9	Syngenta
Frontrow 80 + 84DG	cloransulam + flumetsulam	80% + 84%	ALS/2 + ALS/2	Dow
Fultime NXT	acetochlor + atrazine	2.7 + 1.34 lb/gal	LCFA/15 + PSII/5	Dow
Fusilade DX	fluazifop	2 lb/gal	ACCCase/1	Syngenta
Fusion 2.66EC	fluazifop + fenoxaprop	2 + 0.66 lb/gal	ACCCase/1 + ACCCase/1	Syngenta
Gangster (co-pack)	flumioxazin + cloransulam	51% + 84%	PPO/14 + ALS/2	Valent
Glyphos X-tra	glyphosate	3 lb/gal	EPSP/9	Chemnova
Glyphosate Original	glyphosate (dimethylamine salt)	3 lb/gal	EPSP/9	Griffin
Gramoxone Max 2SL	paraquat	2 lb/gal	PSI/22	Syngenta
Halex GT	S-metolachlor + glyphosate + mesotrione	2.09 + 2.09 + 0.209 lb/gal	LCFA/15 + EPSP/9 + HPPD/27	Syngenta
Harass	thifensulfuron	75%	ALS/2	Chemnova
Harrow	rimsulfuron + thifensulfuron	50% + 25%	ALS/2 + ALS/2	Chemnova
Harmony Extra TotalSol	thifensulfuron + tribenuron	33.3% + 16.7%	ALS/2 + ALS/2	DuPont
Harmony SG TotalSol	thifensulfuron	50%	ALS/2	DuPont
Harness 7EC	acetochlor + antidote	7 lb/gal	LCFA/15	Monsanto
Harness Xtra 5.6L	acetochlor + atrazine	3.1 + 2.5 lb/gal	LCFA/15 + PSII/5	Monsanto
Harness Xtra 6L	acetochlor + atrazine	4.3 + 1.7 lb/gal	LCFA/15 + PSII/5	Monsanto
Hoelon 3EC	diclofop	3 lb/gal	ACCCase/1	Bayer
Hornet 78.5 WDG	clopyralid + flumetsulam	60% + 18.5%	GR/4 + ALS/2	Dow
Huskie	pyrasulfotole + bromoxynil	0.31 + 1.75 lb/gal	HPPD/27 + PSII/6	Bayer
Ignite 280 SL	glufosinate	2.34 lb/gal	GS/10	Bayer
Impact 2.8SC	topramezone	2.8 lb/gal	HPPD/27	Ambac
Instigate	rimsulfuron + mesotrione	4.17% + 41.67%	ALS/2 + HPPD/27	DuPont
Intrro 4EC	alachlor	4 lb/gal	LCFA/15	Monsanto
Keystone LA NXT	acetochlor + atrazine	4.3 + 1.7 lb/gal	LCFA/15 + PSII/5	Dow
Keystone NXT	acetochlor + atrazine	3.1 + 2.5 lb/gal	LCFA/15 + PSII/5	Dow
Landmaster II 1.7 E	glyphosate + 2,4-D amine	0.9 + 0.8 lb/gal	EPSP/9 + GR/4	Monsanto
Lasso 4EC	alachlor	4 lb/gal	LCFA/15	Monsanto
Lariat 4F	alachlor + atrazine	2.5 + 1.5 lb/gal	LCFA/15 + PSII/5	Monsanto
Laudis	tembotrione + safener	3.5 lb/gal	HPPD/27	Bayer
Lexar EZ	S-metolachlor + atrazine + mesotrione	1.74 + 1.74 + 0.224 lb/gal	LCFA/15 + PSII/5 + HPPD/27	Syngenta
Liberty 280 SL	glufosinate	2.34 lb/gal	GS/10	Bayer
Liberty ATZ 4.3L	atrazine + glufosinate	3.3 + 1 lb/gal	PSII/5 + GS/10	Bayer
Lorox	linuron	4 lb/gal	PSII/7	Novasource
Lumax EZ	S-metolachlor + atrazine + mesotrione	2.49 + 0.94 + 0.25	LCFA/15 + PSII/5 + HPPD/27	Syngenta
Marvel 3EC	fluthiacet + fomesafen	0.117 + 2.883 lb/gal	PPO/14 + PPO/14	FMC
MCP amine 4L	MCPA	4 lb/gal	GR/4	Dow, others
Mirage	glyphosate	3 lb/gal	EPSP/9	UAP
Nimble	thifensulfuron + tribenuron	50% + 25%	ALS/2 + ALS/2	Chemnova
NorthStar 47.4DG	dicamba + primisulfuron	39.9% + 7.5%	GR/4 + ALS/2	Syngenta
Olympus 70WDG	propoxycarbazon	70%	ALS/2	Bayer
Olympus Flex	propoxycarbazon + mesosulfuran	6.75 + 4.5	ALS/2 + ALS/2	Bayer
Option 35DG	foramsulfuron	35%	ALS/2	Bayer
OpTill	saflufenacil + imazethapyr	17.8% + 50.2 %	PPO/14 + ALS/2	BASF
OpTill PRO	saflufenacil + imazethapyr + dimethenamid	0.178 + 0.5 + 6.0 lb/gal	PPO/14 + ALS/2 + LCFA/15	BASF

**Herbicide trade and common name, formulation, mode of action, and manufacturer - *continued***

Trade name	Common name	Formulation	Mode of action/group number <sup>a</sup>	Manufacturer
Osprey 4.5WDG	mesosulfuron	4.5%	ALS/2	Bayer
Outlook	dimethenamid-P	6 lb/gal	LCFA/15	BASF
Panoflex	tribenuron + thifensulfuron	40% + 10%	ALS/2 + ALS/2	DuPont
Peak 57DG	prosulfuron	57%	ALS/2	Syngenta
Permit 75DG	halosulfuron	75%	ALS/2	Gowan
Phoenix 2EC	lactofen	2 lb/gal	PPO/14	Valent
Poast 1.5L	sethoxydim	1.5 lb/gal	ACCCase/1	MicroFlo
PowerFlex HL	pyroxsulam	13.13%	ALS/2	Dow
Prefix	S-metolachlor + fomesafen	4.34 lb/gal + 0.95 lb/gal	LCFA/15 + PPO/14	Syngenta
Prequel	rimsulfuron + isoxaflutole	15% + 30%	ALS/2 + HPPD/27	DuPont
Princep 4L	simazine	4 lb/gal	PSII/5	Syngenta
Princep Caliber 90	simazine	90%	PSII/5	Syngenta
Propel	dimethenamid-P	6.0 lb/gal	LCFA/15	Rosen's
Propel ATZ	dimethenamid-P + atrazine	1.7 + 3.3 lb/gal	LCFA/15 + PSII/5	Rosen's
Prowl H <sub>2</sub> O 3.8ACS	pendimethalin	3.8 lb/gal	MI/3	BASF
Pursuit 2AS	imazethapyr	2 lb/gal	ALS/2	BASF
Python 80WDG	flumetsulam	80%	ALS/2	Dow
Raptor 1AS	imazamox	1 lb/gal	ALS/2	BASF
Realm Q	rimsulfuron + mesotrione	7.5% + 31.25%	ALS/2 + HPPD/27	DuPont
Reflex 2LC	fomesafen	2 lb/gal	PPO/14	Syngenta
Resolve	rimsulfuron	25%	ALS/2	DuPont
Resolve Q	rimsulfuron + thifensulfuron	18.4% + 4%	ALS/2 + ALS/2	DuPont
Resource 0.86EC	flumiclorac-pentyl	0.86 lb/gal	PPO/14	Valent
Rhythm 1.88L	fomesafen	1.88 lb/gal	PPO/14	Cheminova
Roundup Ultra 3L	glyphosate	3 lb acid eq./gal	EPSP/9	Monsanto
Roundup PowerMax	Glyphosate (potassium salt)	4.5 lb acid eq./gal	EPSP/9	Monsanto
Roundup WeatherMax 4.5L	Glyphosate (potassium salt)	4.5 lb acid eq./gal	EPSP/9	Monsanto
Select 2EC	clethodim	2 lb/gal	ACCCase/1	Valent
Select Max	clethodim	0.97 lb/gal	ACCCase/1	Valent
Sencor 4L	metribuzin	4 lb/gal	PSII/5	Bayer
Sencor 75DF	metribuzin	75%	PSII/5	Bayer
Sequence 5.25L	glyphosate + S-metolachlor	2.25 + 3 lb/gal	EPSP/9 + LCFA/15	Syngenta
Sharpen	saflufenacil	2.85 lb/gal	PPO/14	BASF
Shotgun 3.25L	atrazine + 2,4-D	2.25 + 1 lb/gal	PSII/5 + GR/4	United Ag Products
Sierra	flucarbazone-sodium	3.5 lb/gal	ALS/2	Syngenta
Solstice	fluthiacet methyl + mesotrione	0.216 + 3.78 lb/gal	PPO/14 + HPPD/27	FMC
Sonalan 3EC	ethalfluralin	3 lb/gal	MI/3	Dow
Sonic	sulfentrazone + cloransulam methyl	62.1% + 7.9%	PPO/14 + ALS/2	Dow
Spartan 4F	sulfentrazone	75%	PPO/14	FMC
Spirit 57DG	primisulfuron + prosulfuron	42.8% + 14.2%	ALS/2 + ALS/2	Syngenta
Starane Ultra	fluroxypyr	2.8 lb/gal	GR/4	Dow
Statement	metolachlor + fomesafen	4.33 + 0.92 lb/gal	LCFA/15 + PPO/14	Cheminova
Status	dicamba + diflufenzopyr + isoxadifen (safener)	16% + 40%	GR/4	BASF
Steadfast Q	nicosulfuron + rimsulfuron	25.2% + 12.5%	ALS/2 + ALS/2	DuPont
SureStart II	acetochlor + flumetsulam + clopyralid	3.75 + 0.12 + 0.38 lb/gal	LCFA/15 + ALS/2 + GR/4	Dow
Surpass NXT	acetochlor + antidote	7 lb/gal	LCFA/15	Dow
Surveil (co-pack)	flumioxin + cloransulam	51% + 84%	PPO/14 + ALS/2	Dow
Synchrony STS XP	chlorimuron + thifensulfuron	21.5% + 6.9%	ALS/2 + ALS/2	DuPont
Touchdown HiTech 5L	glyphosate (potassium salt)	5 lb acid eq./gal	EPSP/9	Syngenta



Herbicide trade and common name, formulation, mode of action, and manufacturer - *continued*

Trade name	Common name	Formulation	Mode of action/group number <sup>a</sup>	Manufacturer
Touchdown Total	glyphosate (potassium salt)	4.17 lb acid eq./gal	EPSP/9	Syngenta
Treflan 4HFP	trifluralin	4 lb/gal	MI/3	Many
Treflan 10G	trifluralin	10%	MI/3	Many
Trific 60DF	trifluralin	60%	MI/3	Riverside/Terra
Trilin 4E	trifluralin	4 lb/gal	MI/3	Griffin
Trilin 10G	trifluralin	10%	MI/3	Tri Corporation
TripleFlex	acetochlor + flumetsulam + clopyralid	3.75 + 0.12 + 0.38 lb/gal	LCFA/15 + ALS/2 + GR/4	Monsanto
Trivence	chlorimuron + flumioxazin + metribuzin	3.9% + 12.8% + 44.6%	ALS/2 + PPO/14 + PSII/5	DuPont
Ultra Blazer	acifluorfen	2 lb/gal	PPO/14	UPI
Unity 75WDG	thifensulfuron	75%	ALS/2	Gowan
Valor 51 SX	flumioxazin	51%	PPO/14	Valent
Valor XLT	flumioxazin + chlorimuron	30% + 10.3%	PPO/14 + ALS/2	Valent
Verdict	saflufenacil + dimethenamid-P	0.57 + 5.0 lb/gal	PPO/14 + LCFA/15	BASF
Warrant	acetochlor	3 lb/gal	LCFA/15	Monsanto
Yukon 67.5 DF	dicamba + halosulfuron	55% + 12.5%	ALS/2	Gowan
Zemax	S-metolachlor + mesotrione	3.34 + 0.33 lb/gal	LCFA/15 + HPPD/27	Syngenta
Zidua	pyroxasulfone	85%	LCFA/15	BASF
2,4-D amine or ester	2,4-D	several	GR/4	Many

<sup>a</sup>**Mode of action abbreviations:** ACCase(1): acetyl coenzyme A carboxylase, the target enzyme for lipid synthesis by selective grass herbicides; ALS(2): acetolactate synthase, the target enzyme for branch-chain amino acid synthesis; EPSP(9): 5-enolpyruvylshikimate-3-phosphate synthase, the target enzyme for aromatic amino acid synthesis; LCFA(15): inhibition of long-chain fatty acids; GR(4): growth-regulating, hormone imitating herbicides; GS(10): glutamine synthetase inhibitor, which results in the build-up of free ammonia; MI(3): mitotic inhibitor of root growth; PPO(14): inhibitor of protoporphyrin IX, which ultimately results in membrane disruption; HPPD(27): inhibition of the enzyme p-hydroxyphenyl pyruvate dioxygenase, pigment inhibiting herbicides; PSII(5): photosynthetic electron transport inhibitor, which ultimately results in membrane disruption; DS(13): inhibition of diterpene synthesis, pigment inhibitors.

## No-tillage burndown Guide to weed response to herbicides

Use this table as a guide for comparing the relative effectiveness of herbicides on individual weeds. Herbicides may perform better or worse than indicated due to extreme weather conditions and other variables if you are obtaining satisfactory results under your growing conditions, changing products as a result of information in this table is not necessarily recommended.

Due to the overwhelming number of package mixes and tank mixes, it has become impractical to list and distinguish these combinations. In the interest of fairness, we are therefore listing no package mixes in this table. A reasonably accurate estimate may be obtained by combining the control ratings from the individual package or tank-mix components

Herbicide	Summer weeds											Cover crops							Established sods								
	Barnyardgrass	Broadleaf signalgrass	Crabgrass	Giant foxtail	Goosegrass	Rhizome johnsongrass	Red rice	Common cocklebur	Common lambsquarters	Entire/ivyleaf morningglory	Redroot/smooth pigweed	Pitted morningglory	Prickly sida/teaweed	Ragweed, common	Ragweed, giant	Annual smartweed species	Annual rye	Winter wheat	Alfalfa	Crimson clover	Red clover	Hairy vetch	Fescue	Orchardgrass	Timothy	Alfalfa	
2,4-D	0	0	0	0	0	0	0	9	9	9	9	9	7	9	8	7	0	0	7	8	8	9	0	0	0	0	6
Aatrex	-	-	7	7	0	0	-	9	10	9	9	9	-	9	9	10	6	6	4	3	5	7	2	4	4	3	
Authority XL	5	-	5	5	3	1	-	7	8	9	-	9	9	8	6	8	-	6	4	4	4	-	1	2	2	-	
Balance Flexx	-	-	-	9	-	-	-	-	-	-	9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Banvel/Clarity	0	0	0	0	-	0	0	8	8	8	9	8	8	9	9	7	0	0	9	8	9	9	0	0	0	0	8
Basis Blend	8	-	7	5	-	2	-	5	9	4	7	4	-	7	5	8	-	5	5	5	5	5	-	-	-	3	
Canopy EX	0	-	1	1	-	0	-	5	6	4	7	4	-	8	7	8	-	1	4	5	5	-	-	-	-	4	
Distinct/Status	2	2	1	2	0	0	0	8	9	9	9	8	8	9	9	8	1	1	8	8	8	8	0	1	1	8	
Glyphosate	8	9	9	9	9	9	7	9	9	7	8	8	7	9	9	8	9	9	4	3	6	6	6	6	6	2	
Gramoxone 2SL	9	9	8	8	8	3	8	6	8	5	9	5	6	8	8	7	7	6	4	9	4	8	5	3	3	3	
Ignite/Liberty	9	8	9	9	8	4	9	9	9	9	9	8	9	9	9	9	-	8	-	-	-	-	-	-	-	-	
OpTill	6	5	6	7	-	0	-	9	9	9	9	9	9	9	9	9	1	1	7	7	7	-	1	1	1	4	
Prequel	9	6	6	9	-	-	-	6	7	6	9	6	-	7	4	6	-	9	8	-	-	-	-	-	-	7	
Sencor	-	-	8	-	5	7	8	8	8	7	8	7	8	7	7	7	9	9	4	3	5	5	5	5	5	2	
Sharpen	0	0	0	0	0	0	0	9	9	9	9	9	9	9	9	9	0	0	7	7	7	-	0	0	0	4	
Spartan	3	3	7	7	2	0	-	7	8	10	10	9	9	-	-	7	-	-	-	-	-	-	-	-	-	-	
Valor	2	-	1	1	-	0	-	-	-	-	-	-	-	7	-	-	-	-	-	-	-	-	-	-	-	-	
Valor XLT	5	-	5	5	3	1	-	7	8	9	9	9	9	8	6	8	-	6	4	4	4	-	1	2	2	-	
Verdict	0	0	0	0	0	0	0	9	9	9	9	9	9	9	9	9	0	0	7	7	7	-	0	0	0	4	

Weed control: 8 to 10 = good 6 to 7 = Fair\* Less than 6 = poor  
 \*A weed control rating of 6 to 7 indicates partial control or suppression.

- = No data available

No-tillage burndown  
Guide to weed response to herbicides - continued

Herbicide	Preplant Interval (days) <sup>a</sup>												Winter Weeds														
	Corn	Cotton	Grain sorghum	Rice	Small grain	Soybean	Annual bluegrass	Little barley	Cheat/down brome	Annual ryegrass	Bittercress	Buttercup	Chickweed	Curly dock (established)	Cutleaf eveningprimrose	Dandelion	Field pennycress	Geranium species	Henbit	Horseweed (marestail)	Prostrate knotweed	Purslane speedwell	Rough (daisy) fleabane	Shepherdspurse	Vetch	Virginia peppercod	Prickly lettuce
2,4-D	b	b	b	b	NL	b	0	0	0	9	9	5	4	4	9	8	8	-	4	8	-	9	6	9	9	9	8
Aim	0	0	0	0	0	0	1	1	1	-	-	2	1	1	5	-	-	2	5	3	-	-	2	2	2	2	-
Atrazine	0	NL	0	NL	NL	NL	10	10	7	9	10	10	4	4	7	4	8	8	8	9	7	10	7	10	9	8	9
Authority XL	NL	NL	NL	NL	NL	0	-	2	1	5	5	6	4	4	-	8	7	5	8	7	-	6	-	7	-	-	-
Balance Flexx	0	NL	NL	NL	NL	NL	-	-	-	-	-	-	-	-	-	-	8	-	8	-	-	-	-	-	-	-	-
Banvel/Clarity	7	NL	15	NL	NL	c	0	0	0	7	7	5	7	7	5	7	8	-	8	9	-	5	8	7	9	7	9
Basis Blend	0	NL	NL	NL	NL	NL	9	-	6	2	9	9	9	3	6	7	9	7	9	6	-	7	8	9	5	7	7
Canopy EX	NL	NL	NL	NL	NL	7	0	0	0	10	9	10	10	5	6	7	9	7	9	6	-	10	8	9	-	9	9
Distinct/Status	d	NL	NL	NL	NL	30	1	1	1	8	7	6	7	7	5	7	8	8	8	8	-	-	8	8	9	9	-
Glyphosate	0	0	0	0	0	0	10	9	9	8	9	10	4	4	6	5	9	8	9	9	7	9	5	10	6	10	8
Gramoxone 2SL	0	0	0	0	0	0	9	9	8	9	9	10	1	1	8	4	8	9	9	6	6	5	5	10	8	8	7
Ignite/Liberty	0	0	180	0	70	0	8	-	-	9	-	9	9	5	-	5	9	9	8	6	8	-	8	9	-	-	-
OpTill	0 <sup>f</sup>	NL	NL	NL	NL	0	5	4	3	-	9	8	9	5	8	6	8	-	8	8	-	7	8	9	-	8	9
Prequel	0	NL	NL	NL	NL	NL	9	-	-	7	-	9	9	-	-	7	9	-	9	-	-	-	-	9	-	-	-
Sencor	NL	NL	NL	NL	NL	0	-	10	8	5	10	10	10	-	6	-	-	7	8	6	6	-	-	6	6	6	8
Sharpen	0	1.5 <sup>e</sup>	0	NL	0	0 <sup>d</sup>	0	0	0	9	8	7	5	5	8	6	9	-	7	9	-	7	8	7	-	7	9
Valor	7	30	30	30	NL	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Valor XLT	NL	NL	NL	NL	4	0	-	1	1	5	5	6	4	4	-	8	6	5	8	6	-	6	-	7	-	-	5
Verdict	0	NL	NL	NL	NL	0	0	0	0	9	8	9	6	6	8	7	9	-	9	9	-	8	9	9	-	9	9

Weed control: 8 to 10 = good 6 to 7 = Fair\* Less than 6 = poor - = No data available

\*A weed control rating of 6 to 7 indicates partial control or suppression.

<sup>a</sup> NL = Not labeled

<sup>b</sup> For 2,4-D, see label for details regarding rates and formulations. Be sure to use a 2,4-D formulation that is labeled for the target crop.

<sup>c</sup> 14 days and 1 inch rainfall are required for 8 fl oz or less and 28 days for 16 fl oz per acre.

<sup>d</sup> Corn can be planted 14 days after a Distinct application of 6 oz or less, 21 days if more than 6 oz is used.

<sup>e</sup> Rotational crop interval for Sharpen is dependent on rate.

<sup>f</sup> Labeled for use in Clearfield corn only.

## Corn

### Guide to grass and sedge weed response to herbicides

Herbicide	Barnyardgrass	Broadleaf signalgrass	Crabgrass	Fall panicum	Giant foxtail	Goosegrass	Johnsongrass, seedling	Johnsongrass, rhizome	Red rice	Shattercane	Woolly cupgrass	Yellow nutsedge	Crop response**
<b>Preplant or preemergence</b>													
Atrazine	8	6	5	3	7	6	2	0	8	0	4	0	0
Balance Flexx	8	7	8	9	7	-	7	0	5	6	9	4	1
Bicep II Magnum/Cinch ATZ/ Others	9	7	9	8	9	-	5	1	-	5	6	8	1
Callisto	4	6	5	-	2	6	0	0	5	1	-	-	0
Corvus	9	8	9	7	9	8	9	6	-	6	6	4	1
Degree Xtra	9	-	9	8	9	-	5	1	-	4	5	8	1
Dual II Magnum/Cinch	8	7	9	9	9	9	8	0	8	5	7	8	1
Harness/Breakfree/Degree	8	7	9	9	9	9	6	0	7	6	8	8	1
Harness Xtra/Fultime NXT/ Others	9	-	9	8	9	-	5	1	-	4	6	8	1
Hornet	0	0	0	0	0	0	0	0	0	0	0	0	2
Instigate	9	7	6	7	9	-	8	0	4	6	-	4	1
Lumax EZ/Lexar EZ	8	8	9	8	9	9	6	1	9	5	7	8	1
Outlook	8	7	9	8	9	9	5	0	8	4	7	7	1
Prequel	9	8	9	8	9	8	8	2	-	9	-	4	1
Princep	7	6	7	6	7	7	2	0	-	1	2	0	0
Python	6	6	6	7	6	-	7	-	4	6	-	-	2
Resolve Q	8	7	6	6	8	-	8	4	0	7	6	3	1
Sharpen	0	0	0	0	0	0	0	0	0	0	0	-	1
SureStart II/TripleFLEX II	8	-	8	7	8	-	4	0	-	2	4	6	1
Verdict	8	-	8	7	8	-	-	2	-	4	6	7	1
Zemax	9	-	9	8	9	-	3	1	-	4	6	8	1
Zidua	8	8	9	9	9	9	8	0	-	6	7	5	1
<b>Preemergence</b>													
Prowl H <sub>2</sub> O	9	-	8	8	9	9	7	0	-	7	7	0	1
<b>Postemergence</b>													
Accent Q	9	8	6	8	8	-	9	9	-	9	7	2	1
Atrazine + oil	8	7	7	5	7	6	3	0	10	2	6	6	1
Banvel/Clarity	0	0	0	0	0	0	0	0	0	0	0	0	1
Basagran	0	0	0	0	0	0	0	0	0	0	0	9	0
Beacon	0	-	0	7	3	-	9	8	-	10	2	2	1
Buctril	0	0	0	0	0	0	0	0	0	0	0	0	1
Cadet	1	1	1	1	1	1	1	1	1	1	1	1	2
Callisto	3	1	8	4	6	3	1	1	2	0	0	3	1
Glyphosate (Roundup Ready corn)	9	10	10	10	10	10	10	10	9	10	9	6	1
Impact/Armezon	8	3	8	6	8	4	3	1	-	6	4	3	1
Laudis	8	-	8	0	8	-	-	1	-	2	-	4	1
Liberty/Ignite (Liberty Link corn)	8	7	7	7	8	7	8	5	7	8	9	6	0
Option	8	6	7	8	9	8	10	9	-	9	-	2	2
Permit	0	0	0	0	0	0	0	0	0	0	0	9	0
Realm Q	8	5	7	8	8	-	5	1	-	8	7	5	1
Resource	-	-	-	-	-	-	-	-	0	-	-	-	1
Sencor	-	-	-	-	-	-	-	-	0	0	-	-	1
Spirit	-	-	0	6	6	-	5	4	-	5	0	0	2
Starane	0	0	0	0	0	0	0	0	0	0	0	0	1
Status	0	0	0	0	0	0	0	0	0	0	0	0	1
Steadfast Q	9	8	8	8	9	8	10	8	-	9	8	4	1
2,4-D	0	0	0	0	0	0	0	0	0	-	-	-	1

Weed control: 8 to 10 = Good    6 to 7 = Fair\*    Less than 6 = Poor    - = No data available

\*A weed control rating of 6 to 7 indicates partial control or suppression.

\*\*Crop response: A rating of 3 or less will not result in loss of crop yield under normal growing conditions.

Use this table as a guide for comparing the relative effectiveness of herbicides on individual weeds. Herbicides may perform better or worse than indicated due to extreme weather conditions and other variables. If you are obtaining satisfactory results under your growing conditions, changing products as a result of information in this table is not necessarily recommended.

## Corn

### Guide to broadleaf weed response to herbicides

Herbicide	Black nightshade	Cocklebur	Jimsonweed	Lambsquarters	Mornings glory, annual	Pigweed, smooth/redroot	Prickly sida	Ragweed, common	Ragweed, giant	Smartweed, annual	Sunflower	Velvetleaf	Waterhemp**
<b>Preplant or preemergence</b>													
Atrazine	9	9	9	9	9	9	9	9	8	9	7	7	9
Balance Flexx	8	6	6	9	4	8	8	-	-	7	7	8	9
Bicep II Magnum/Cinch ATZ/Others	9	9	8	9	7	9	-	9	8	9	7	8	9
Callisto	8	6	9	9	8	9	9	7	8	9	-	9	-
Corvus	8	8	5	9	6	9	-	8	6	8	6	8	9
Degree Xtra	9	9	7	9	7	9	-	9	8	9	7	8	9
Dual II Magnum/Cinch	9	0	4	6	0	9	3	5	3	5	0	2	9
Harness/Breakfree/Degree	-	4	-	9	4	9	-	8	5	6	0	4	9
Harness Xtra/Fultime NXT/Keystone NXT	9	9	8	9	7	9	-	9	8	9	7	8	9
Hornet	8	8	8	9	6	9	-	8	8	8	8	9	9
Instigate	9	8	9	9	7	8	8	8	7	9	8	9	7
Lumax EZ/Lexar EZ	9	9	8	9	8	9	8	9	8	9	8	9	9
Outlook	8	2	4	7	2	9	0	5	2	4	0	2	9
Princep	8	8	8	8	8	9	8	8	6	8	6	7	-
Python	7	7	9	9	6	9	9	8	-	9	8	9	7
Prequel	9	7	8	9	7	9	-	8	7	8	9	9	9
Resolve Q	5	6	5	8	6	8	7	6	4	6	5	4	5
Sharpen	8	9	8	9	8	7	-	8	8	8	7	8	7
Surestart II/TripleFLEX II	8	8	8	9	6	9	-	7	6	8	7	8	8
Verdict	9	8	8	9	8	8	-	8	8	9	8	8	8
Zemax	9	8	8	9	6	9	-	8	7	8	8	9	9
Zidua	9	0	5	6	1	9	7	6	3	6	3	4	9
<b>Preemergence</b>													
Prowl H <sub>2</sub> O	0	0	0	7	0	9	-	0	0	3	0	2	7
<b>Postemergence</b>													
Accent Q	0	2	7	5	5	8	2	2	2	8	5	3	5
Atrazine + oil	9	9	10	10	9	10	9	9	8	9	9	8	9
Banvel/Clarity	9	9	9	9	9	9	8	10	9	9	9	8	8
Basagran	2	9	9	6	5	4	8	8	8	9	8	8	3
Beacon	7	6	8	5	-	8	6	8	8	8	8	6	5
Buctril	9	9	10	9	8	7	4	9	9	9	8	8	6
Cadet	2	2	8	7	7	5	5	4	2	5	3	9	5
Callisto	8	8	9	9	7	9	8	7	8	9	8	9	9
Glyphosate (Roundup Ready corn)	8	9	9	8	6	9	5	9	8	5	8	8	9
Impact/Armezon	8	9	9	9	6	9	8	8	8	7	8	8	9
Laudis	8	8	9	9	6	9	8	8	8	7	8	8	9
Liberty/Ignite (Liberty Link corn)	8	9	9	8	9	7	7	8	8	9	8	7	7
Option	8	7	8	7	4	8	6	-	4	6	8	8	6
Permit	6	9	8	6	6	9	6	8	8	8	9	8	5
Realm Q	9	8	9	9	7	9	9	8	8	9	8	8	9
Resource	5	7	7	6	5	7	0	7	7	5	0	9	7
Sencor	3	7	7	4	5	6	5	5	2	6	6	7	6
Spirit	8	9	9	8	8	7	5	9	8	8	9	7	1
Starane	6	9	6	6	7	-	-	8	4	4	8	8	6
Status	9	9	9	9	9	9	8	10	9	9	9	8	8
Steadfast Q	0	5	9	5	8	9	3	3	3	9	8	4	5
2,4-D	7	9	8	9	9	9	8	9	8	7	9	8	7

Weed control: 8 to 10 = Good 6 to 7 = Fair\* Less than 6 = Poor - = No data available

\*A weed control rating of 6 to 7 indicates partial control or suppression.

\*\*Waterhemp has been observed to routinely escape ALS-herbicide treatments in many areas. Resistance has been formally confirmed in some fields. Control may vary from indicated values on ALS-inhibiting herbicides.

Use this table as a guide for comparing the relative effectiveness of herbicides on individual weeds. Herbicides may perform better or worse than indicated due to extreme weather conditions and other variables.

## Corn

### Soil-applied herbicide rates for corn

Herbicide	Soil texture*		
	Coarse (light, sandy)	Medium (loamy)	Fine (heavy, clay)
	------(Rate per Acre)-----		
Anthem SE	5 to 8 oz	6.5 to 11 oz	9 to 13 oz
Anthem ATZ	1.75 to 2 pt	2 to 2.75 pt	2.25 to 4 pt
Atrazine 4L	3 pt	4 pt	4 pt
Aatrex Nine-0	1.6 lb	2.2 lb	2.2 lb
Axiom 68.8DF	8 to 15 oz	10 to 20 oz	20 to 23 oz
Balance 75WDG	1 to 2 oz	1.5 to 2.5 oz	1.5 to 3 oz
Balance Flexx	3 to 4 fl oz	5 to 6 fl oz	6 fl oz
Bicep II Magnum 5.5L	1.3 to 1.6 qt	1.6 to 2.1 qt	2.1 to 2.6 qt
Bicep Lite II Magnum 6L	0.9 to 1.5 qt	1.1 to 1.5 qt	1.5 to 2.2 qt
Camix 3.7L	2 to 2.4 qt	2 to 2.4 qt	2 to 2.4 qt
Cinch 7.64L	0.8 to 1 pt	1 to 1.33 pt	1.33 to 1.67 pt
Cinch ATZ 5.5L	1.3 to 1.6 qt	1.6 to 2.1 qt	2.1 to 2.6 qt
Cinch Lite ATZ 6L	0.9 to 1.5 qt	1.1 to 1.5 qt	1.5 to 2.2 qt
Callisto	5 to 7.7 fl oz	5 to 7.7 fl oz	5 to 7.7 fl oz
Degree 3.8 L	2.25 to 3.25 pt	3.25 to 4.25 pt	3.25 to 5 pt
Degree Xtra 4.04L	2.9 qt	2.9 to 3.7 qt	3.2 to 3.7 qt
Dual II Magnum 7.64L	0.8 to 1 pt	1 to 1.33 pt	1.33 to 1.67 pt
Epic 58DG	6 to 10 oz	7 to 15 oz	10 to 15 oz
Fultime NXT	2.9 qt	2.9 to 3.7 qt	3.2 to 3.7 qt
Guardsman 5L	3 to 4.5 pt	3.5 to 5 pt	4.5 to 5 pt
Harness 7E	1.25 to 1.75 pt	1.75 to 2.25 pt	1.75 to 2.75 pt
Harness Xtra 5.6L	1.4 to 1.7 qt	1.7 to 2.6 qt	2.3 to 3 qt
Harness Xtra 6L	1.5 to 1.8 qt	1.8 to 2.3 qt	1.8 to 2.3 qt
Hornet 78.5 WDG	4 to 5 oz	4 to 6 oz	4 to 6 oz
Keystone NXT	1.4 to 1.7 qt	1.7 to 2.6 qt	2.3 to 3.0 qt
Lexar EZ	3 to 3.5 qt	3 to 3.5 qt	3 to 3.5 qt
Linex 4L	0.67 to 1.5 pt	1 to 1.5 pt	1.33 to 1.5 pt
Lumax EZ	2.7 to 3.25 qt	2.7 to 3.25 qt	2.7 to 3.25 qt
Outlook 6L	12 to 14 fl oz	14 to 18 fl oz	18 to 21 fl oz
Prequel		1.66 to 2.5 oz	1.66 to 2.5 oz
Princep 90DF		1.1 lb	1.1 lb
Prowl H <sub>2</sub> O 3.8 ACS	2 to 3 pt	3 to 4 pt	3 to 4 pt
Python WDG	0.8 to 1 oz	0.89 to 1.33 oz	0.89 to 1.33 oz
Ramrod 4F	4 to 4.5 qt	4.5 to 5.5 qt	5.25 to 6 qt
Resolve	0.5 to 2 oz	0.5 to 2 oz	0.5 to 2 oz
Sharpen	2 fl oz	2.5 fl oz	3.0 fl oz
Surestart II/TripleFLEX II	1.5 pt	1.5 to 1.75 pt	2.0 pt
Surpass NXT	1.25 to 2 pt	1.75 to 2.75 pt	1.75 to 3 pt
Surpass 100 5SC	2 to 2.4 qt	2.2 to 2.6 qt	2.6 to 4 qt
Verdict	10 to 12 fl oz	13 to 15 fl oz	16 to 18 fl oz
Zidua	1.5 to 2.75 oz	1.5 to 3 oz	2 to 4 oz

\*Refer to herbicide labels for proper rates for your soil texture and organic matter content and for tank mixes.

## Corn, Burndown

Herbicide and formulation	Formulated material per broadcast acre	Herbicide (lb active per acre)	Labeled tank-mix partners	Application method and precautions
The following preemergence corn herbicides may be used for burndown. Application information is listed in the preemergence herbicide section. In most cases, a broad-spectrum, foliar burndown herbicide such as Roundup or Gramoxone should be tank mixed with the preemergence herbicide; however, if grass pressure is light and broadleaf weeds are small, the addition of crop oil to an atrazine-containing product may be sufficient.				
2,4-D LV ester or amine (4 lb/gal formulation)	1 to 3 pt/A	2,4-D 0.5 to 1.5 lb/A	atrazine, Banvel, Bicep, Bronco, Bullet, Callisto, Dual, Glyphosate, Gramoxone, Harness Plus, Lariat, Lasso, Lumax, Outlook, Princep, Python, Surpass	May be applied early preplant (EPP) through planting. Use lower rate for small, susceptible weeds, and higher rates for large or difficult to control weeds.
Aim 2E + Nonionic surfactant	0.25 to 2 fl oz/A + 2 pt/100 gal	carfentrazone 0.004 to 0.031 lb/A	No restrictions listed.	Should be applied with a broad-spectrum burndown herbicide.
Banvel 4E	0.3 to 1 pt/A	dicamba 0.15 to 0.5 lb/A	atrazine, Bicep, Bronco, Bullet, Dual, Gramoxone, Harness Plus, Lariat, Lasso, Lumax, Outlook, Princep, Glyphosate, Surpass, 2,4-D	May be applied early preplant (EPP) until 7 days before planting (EPP7). See label for specific rates and weed stages for application.
Basis Blend/Harrow + Nonionic surfactant or Crop oil concentrate + Urea ammonium nitrate or Ammonium sulfate	0.825 to 2.5 oz/A + 2 pt/100 gal or 1 gal/100 gal + 2 qt/A or 2 lb/A	rimsulfuron + thifensulfuron 0.01 + 0.005 lb to 0.02 + 0.008 lb	Express, Glyphosate, Princep, 2,4-D	May be applied early preplant (EPP) through planting up to the two-collar stage of corn.
Distinct 70WG + Nonionic surfactant	2 to 8 oz/A + 2 pt/100 gal	dicamba + diflufenzopyr 0.06 + 0.025 to 0.25 + 0.1 lb/A	Glyphosate, 2,4-D	Corn can be planted 7 days after application of 6 oz/A. Allow at least 15 days before planting if using more than 6 oz/A.
Expert 4.9L	2.5 to 3.75 qt/A	glyphosate + S-metolachlor + atrazine 0.6 + 1 + 1.33 to 0.9 + 1.63 + 2 lb/A	atrazine, Dual, Princep, Glyphosate, Python, Hornet, Prowl, Banvel, Clarity, 2,4-D	May be applied up to 30 days before planting and before emergence of conventional corn hybrids.
Fierce + Nonionic surfactant or Crop oil concentrate	3 oz/A + 2 pt/100 gal or 1 gal/100 gal	flumioxanin + pyroxasulfone 0.064 + 0.080	Basis, Dicamba, Express, Glyphosate, Gramoxone, 2,4-D	Do not apply within 7 days of planting.
Gramoxone 2SL + Nonionic surfactant or Crop oil concentrate	2 to 3.4 pt/A + 1 to 2 pt/100 gal or 1 gal/100 gal	paraquat 0.7 to 1.4 lb/A	atrazine, Banvel, Bicep, Dual, Bronco, Bullet, Callisto, Dual, Harness Plus, Lariat, Lasso, Lumax, Outlook, Princep, Python, Roundup, Surpass, 2,4-D	May be applied early preplant (EPP) through planting, but before crop emergence. See label for specific rates and weed stages for application. Rate should normally be at least 1.67 pt/A.
Harmony Extra XP	0.3 to 0.6 oz/A	thifensulfuron + tribenuron 0.009 + 0.005 lb/A to 0.018 + 0.01 lb/A	Glyphosate, Gramoxone, 2,4-D	Use for control of smartweed and dock. Tank mix with Gramoxone or Roundup. DO NOT APPLY WITHIN 14 DAYS OF PLANTING.
Liberty/Ignite 280SL + Ammonium sulfate	29 to 36 fl oz/A + 3 lb/A	glufosinate 0.53 to 0.66 lb/A	atrazine, Banvel, 2,4-D	For larger weeds, use higher rate of 36 fl oz at burndown but no additional applications of Ignite 280SL may be made during the growing season.
Prequel + Nonionic surfactant or Crop oil concentrate + Ammoniated sulfate or Urea ammonium nitrate	1.66 to 2.5 oz/A + 2 pt/100 gal or 1 gal/100 gal + or	rimsulfuron + isozaflutole 0.016 + 0.03 lbA to 0.023 + 0.047 lb/A	Dicamba, Glyphosate, Gramoxone, 2,4-D	May be applied preplant through planting but before crop emergence. The addition of a burndown herbicide will enhance control of many large or tough-to-control species.
Roundup brands/ Touchdown brands/other glyphosates  glyphosate 3L or Roundup WeatherMax 4.5L or Roundup PowerMax 4.5L + Recommended additives	   1 to 3 pt/A or 11 to 32 fl oz/A or 11 to 32 fl oz/A + See label	glyphosate 0.38 to 1.12 lb/A	atrazine, Banvel, Bicep, Bullet, Callisto, Dual, Harness Plus, Lariat, Lasso, Lumax, Outlook, Princep, Python, Surpass, 2,4-D	May be applied early preplant (EPP) through planting. Use lower rate for small, susceptible weeds and higher rates for large or difficult to control weeds.

**Corn, Burndown - continued**

Herbicide and formulation	Formulated material per broadcast acre	Herbicide (lb active per acre)	Labeled tank-mix partners	Application method and precautions
Sharpen + Methylated seed oil + Ammonium sulfate or Urea ammonium nitrate	2 to 3 oz/A + 1 gal/100 gal + 8.5 to 17 lb/100 gal or 1.25–2.5 gal/100 gal	saflufenacil 0.04 to 0.06 lb/A	atrazine, Glyphosate, Ignite	Do not apply after corn has emerged. If spray volume is 12 GPA or less, use methylated seed oil at 1 pt/A.
Valor 51 WDG + Nonionic surfactant (80%) or Crop oil concentrate	2 oz/A + 2 pt/100 gal or 1 gal/100 gal	flumioxazin 0.064 lb/A	Basis, Dicamba, Express, Glyphosate, Gramoxone	Do not apply within 7 days of planting.
Verdict + Methylated seed oil + Ammonium sulfate or Urea ammonium nitrate	10 to 18 fl oz/A + 1 gal/100 gal + 8.5 to 17 lb/100 gal or 1.25–2.5 gal/100 gal	saflufenacil + dimethenamid-P 0.015 + 0.4 to 0.08 + 0.72 lb/A	atrazine, Glyphosate, Ignite	Do not apply after corn has emerged. If spray volume is 12 GPA or less, use methylated seed oil at 1 pt/A.

**Fall and early preplant applications of preemergence herbicides for reduced tillage**

Many preemergence herbicides may be used two or more weeks before planting in an early preplant (EPP) application. Advantages include: Early preplant applications will prevent weed emergence and aid or eliminate a formal burndown application. They may limit weed growth if weather delays planting. Some preemergence herbicides have significant postemergence, burndown activity (adjuvants are sometimes required). Some preemergence herbicides increase the activity or spectrum of burndown herbicides. Finally, combining a preemergence herbicide with a burndown herbicide may simply save time and costs by eliminating a second trip for the traditional preemergence, after-planting application.

Several herbicides are registered for fall application. A fall herbicide application may be beneficial if it eliminates the need for a burndown application in the spring and soil erosion is not a problem. Fall applications could also benefit drying of the soil in the spring and could reduce the need for

tillage before planting.

There are many choices and an option that works well in one field may work poorly in another. For most situations we recommend that growers target early preplant applications 15 or less days before planting. The sooner a herbicide is applied, the sooner it will break down and lose effectiveness. If rain delays planting too long, most advantages of extra-early preplant applications may be lost. Also, after 30 days, there is a much higher probability that a burndown application will be needed and most labels specify that additional preemergence herbicide be applied at planting. Finally, exceptionally long (>30 day) preplant intervals remove winter vegetation and leave the soil vulnerable to erosion and may increase the probability of herbicide contamination of ground and surface water.

**Early preplant (EPP) labels for corn herbicides**

Herbicide	Burndown activity	Label allows preplant application		
		45 days	30 days	15 days
Anthem SE	No	Yes**	Yes**	Yes**
Anthem ATZ	Yes	Yes**	Yes**	Yes**
Atrazine	Yes	Yes*	Yes*	Yes
Autumn	Yes	Yes	Yes	No
Axiom	No	Yes*	Yes*	Yes
Balance Pro	Yes	No	Yes	Yes
Basis	Yes	Yes	Yes	Yes
Bicep II Magnum	Yes	Yes*	Yes*	Yes
Bicep Lite II Magnum	Yes	Yes*	Yes*	Yes
Bronco	Yes	Yes	Yes	Yes
Callisto	Yes	No	No	No
Cinch	No	Yes*	Yes*	Yes
Cinch ATZ	Yes	Yes*	Yes*	Yes
Cinch Lite ATZ	Yes	Yes*	Yes*	Yes
Degree	Yes	Yes	Yes	Yes
Degree Extra	Yes	Yes	Yes	Yes
Dual II Magnum	No	Yes*	Yes*	Yes
Epic	Yes	No	Yes	Yes
Fultime NXT	Yes	No***	Yes	Yes
Harness	No	Yes*	Yes*	Yes
Harness Xtra	Yes	Yes*	Yes*	Yes



Early preplant (EPP) labels for corn herbicides - *continued*

Herbicide	Burndown activity	Label allows preplant application		
		45 days	30 days	15 days
Hornet	Yes	No	Yes	Yes
Keystone NXT	Yes	No	Yes	Yes
Lasso	No	Yes*	Yes*	Yes
Lexar EZ	Yes	No	No	Yes
Lumax EZ	Yes	No	No	Yes
Microtech	No	Yes*	Yes*	Yes
Outlook	No	Yes*	Yes	Yes
Prequel	Yes	No	Yes	Yes
Princep	Yes	Yes	Yes	Yes
Python	Yes	No	Yes	Yes
Sharpen	Yes	No	Yes	Yes
Shotgun	Yes	No	No	Yes
Surestart II/TripleFLEX II	Yes	No	Yes	Yes
Surpass NXT	No	No	Yes	Yes
Verdict	Yes	No	Yes	Yes
Zemax	Yes	No	No	Yes

\*Label requires reapplication at the time of planting. (Typically 2/3 applied EPP and 1/3 preemergence at planting.)

\*\*EPP intervals greater than 15 days are not recommended on coarse-textured (light, sandy) soils.

\*\*\*EPP treatments are not recommended on coarse-textured (light, sandy) soils where average annual rainfall exceeds 40 inches.

## Corn, Preplant or preemergence

Herbicide and formulation	Formulated material per broadcast acre	Herbicide (lb active per acre)	Preplant incorporated or preemergence tank-mix partners	Application method and precautions
Aatrex 4L or Aatrex 90DF	3 to 4 pt/A or 1.6 to 2.2 lb/A	atrazine 1.5 to 2 lb/A	Dual, Harness Plus, Lasso, Micro-Tech, Outlook, Princep, Surpass, Surpass 100	Use low rates on coarse (light, sandy) soils and higher rates on fine (heavy, clay) soils.
Anthem	5 to 13 oz/A	pyroxasulfone + fluthiacet 0.082 + 0.0025 to 0.21 + 0.006 lb/A	atrazine, Balance Flexx, Stanza/ Hornet, Callisto, Sharpen, 2,4-D, glyphosate	Preplant surface applications should not be made to coarse soils.
Anthem ATZ	1.5 to 3 pt/A	pyroxasulfone + fluthiacet + atrazine 0.09 + 0.0026 + 0.75 to 0.18 + 0.0052 + 1.5 lb/A	atrazine, Balance Flexx, Stanza/ Hornet, Callisto, Sharpen, 2,4-D, glyphosate	Preplant surface applications should not be made to coarse soils.
Balance Flexx	3 to 6 fl oz/A	isoxaflutole 0.05 to 0.09 lb/A	Aatrex, Axiom, Bicep, Dual, Fultime, Leadoff, Harness, Harness Xtra, Lasso, Outlook, Simazine, Surpass, Surpass 100, Topnotch	Use low rates on coarse (light, sandy) soils and higher rates on fine (heavy, clay) soils. <b>See label for crop safety restrictions.</b> Plant corn at least 1.5 inches deep and ensure that the seed-furrow is closed. May also be applied early postemergence up to V2 corn. <b>Not registered for use in Butler, Cape Girardeau, Dunklin, Mississippi, New Madrid, Pemiscot, Scott and Stoddard counties.</b>
Callisto 4L	5 to 7.7 fl oz/A	mesotrione 0.16 to 0.24 lb/A	atrazine, Axiom, Bicep, Degree, Degree Xtra, Doubleplay, Dual, Fultime, Glyphosate, Gramoxone Max, Leadoff, Harness, Harness Xtra, Outlook, Surpass, Prowl, Topnotch, 2,4-D	Callisto primarily controls broadleaf weeds, tank mix with a grass herbicide for broad-spectrum weed control. Tank mixtures with atrazine-containing products are recommended for optimal morningglory control. Use lower rates when tank-mixed with atrazine and higher rates without atrazine. See label for organophosphate and carbamate insecticide restrictions.
Dual II Magnum 7.64E/Cinch 7.64E	0.8 to 1.67 pt/A	S-metolachlor 0.76 to 1.6 lb/A	atrazine, Princep	Use low rates on coarse (light, sandy) soils and higher rates on fine (heavy, clay) soils.
Harness 7E or Degree 3.8L	1 to 3 pt/A or 2.25 to 5 pt/A	acetochlor + antidote 0.875 to 2.33 lb/A or 1.07 to 2.38 lb/A	Aatrex, Accent, Banvel, Clarity, Glyphosate, Gramoxone Max, Marksman, Permit, Princep, Prowl, Permit, Pursuit,	Use low rates on coarse (light, sandy) soils and higher rates on fine (heavy, clay) soils. Degree is a microencapsulated, slow-release formulation of acetochlor.

**Corn, Preplant or preemergence - *continued***

<b>Herbicide and formulation</b>	<b>Formulated material per broadcast acre</b>	<b>Herbicide (lb active per acre)</b>	<b>Preplant incorporated or preemergence tank-mix partners</b>	<b>Application method and precautions</b>
Instigate	5.25 to 7.0 oz/A	rimsulfuron + mesotrione 0.013 + 0.14 lb/A to 0.018 + 0.18 lb/A	atrazine, Cinch, Dicamba, Princep, 2,4-D	May be applied up to 2 leaf collar stage. Do not apply to corn treated with Counter or tank-mix with foliar applied OP insecticides. Do not apply with Basagran.
Lexar EZ	2.5 to 3.5 qt/A	S-metolachlor + atrazine + mesotrione 1.3 + 1.3 + 0.17 to 1.5 + 1.5 + 0.2 lb/A	atrazine, Glyphosate, Gramoxone, Princep, Touchdown brands	Use low rate when organic matter is less than 3% and high rate when organic matter is more than 3%. <b>See label for insecticide interaction restrictions.</b>
Lumax EZ	2.7 to 3.25 qt/A	S-metolachlor + atrazine + mesotrione 1.68 + 0.63 + 0.17 to 2 + .75 + 0.2 lb/A	atrazine, Glyphosate, Gramoxone, Princep, 2,4-D	Use low rate when organic matter is less than 3% and high rate when organic matter is above 3%. <b>See label for insecticide interaction restrictions.</b>
Outlook 6E	10 to 21 oz/A	dimethenamid-P 0.47 to 0.98 lb/A	atrazine, Princep	Use low rates on coarse (light, sandy) soils and higher rates on fine (heavy, clay) soils.
Prequel	1.66 to 2.5 oz/A	rimsulfuron + isoxaflutole 0.016 + 0.03 lb/A to 0.023 to 0.047 lb/A	atrazine, Cinch, Dicamba, Glyphosate, 2,4-D,	Use higher rates on fine soils. Do not apply to coarse soils with less than 1% organic matter.
Python 80WDG	0.8 to 1.33 oz/A (5 to 3 A/pkt)	flumetsulam 0.04 to 0.07 lb/A	2,4-D, Dual II Magnum, Glyphosate, Gramoxone, Harness, Outlook, Surpass, Touchdown	Use low rates on coarse (light, sandy) soils and higher rates on fine (heavy, clay) soils. See label for crop injury precautions regarding varieties, soil pH, soybean herbicide carryover, at-planting insecticides and cool weather.
Surpass NXT	1.25 to 3 pt/A	acetochlor + antidote 1.1 to 2.6 lb/A	atrazine, Balance Pro, Banvel, Clarity, Glyphosate, Gramoxone, Hornet WDG, Marksman, Pendemax/Prowl, Princep, Python, 2,4-D	Use low rates on coarse (light, sandy) soils and higher rates on fine (heavy, clay) soils.
Zidua	1.5 to 4 oz/A	pyroxasulfone 0.094 to 0.25 lb/A	atrazine, Glyphosate, Prowl H <sub>2</sub> O, Sharpen, others	Use low rates on coarse soils.
<b>Package mixes - Preplant or preemergence</b>				
Axiom 68DF	8 to 23 oz/A	flufenacet + metribuzin 0.27 + 0.07 to 0.78 + 0.19 lb/A	atrazine, Balance, Banvel, Clarity, Glyphosate, Gramoxone, Hornet, Marksman, Pentagon, Prowl, Python, Sencor, 2,4-D	Use low rates on coarse (light, sandy) soils and higher rates on fine (heavy, clay) soils. Rates are further defined depending upon soil organic matter. Plant corn at least 1.5 inches deep.
Bicep II Magnum 5.5L or Cinch ATZ 5.5L	1.3 to 2.6 qt/A	atrazine + S-metolachlor 1 + 0.78 to 2 + 1.56 lb/A	atrazine, Dual	Use low rates on coarse (light, sandy) soils and higher rates on fine (heavy, clay) soils. Atrazine and/or Dual may be added to Bicep to improve weed control in heavy infestations or for hard-to-control weeds.
Bicep II Lite Magnum 6L or Cinch ATZ 6L	0.9 to 2.2 qt/A	S-metolachlor + atrazine 0.75 + 0.6 to 1.83 + 1.47 lb/A	atrazine, Dual	Use low rates on coarse (light, sandy) soils and higher rates on fine (heavy, clay) soils. Atrazine and/or Dual may be added to Bicep to improve weed control in heavy infestations or for hard-to-control weeds.
Epic 58DF	8 to 15 oz/A	flufenacet+ isoxaflutole 0.24 + 0.05 to 0.45 + 0.094 lb/A	atrazine, Axiom, Axiom AT, Banvel, Clarity, Define, Glyphosate, Gramoxone, Hornet, Liberty, Marksman, 2,4-D	Use low rates on coarse (light, sandy) soils and higher rates on fine (heavy, clay) soils. Plant corn at least 1.5 inches deep. <b>See label for crop safety and soil restrictions. Not registered for use in Butler, Cape Girardeau, Dunklin, New Madrid, Mississippi, Pemiscot, Scott and Stoddard counties.</b>

Corn, Preplant or preemergence - *continued*

Herbicide and formulation	Formulated material per broadcast acre	Herbicide (lb active per acre)	Preplant incorporated or preemergence tank-mix partners	Application method and precautions
Harness Xtra 5.6L or Harness Xtra 6L or Degree Xtra 4.04 L	1.4 to 3 qt/A or 1.5 to 2.3 qt/A or 2.9 to 3.7 qt/A	acetochlor + atrazine 1.09 + 0.88 to 2.3 + 1.88 lb/A or 1.6 + 0.6 to 2.5 + 1 lb/A or 1.96 + 0.97 to 2.5 + 1.25 lb/A	Aatrex, Accent, Banvel, Clarity, Glyphosate, Gramoxone, Harness, Hornet, Marksman, Permit, Princep, Prowl, Pursuit, Python,	Use lower rates on coarse (light, sandy) soils and higher rates on fine (heavy, clay) soils. Degree Xtra contains microencapsulated, slow-release acetochlor.
Hornet 78.5 WDG	4 to 5 oz/A	clpyralid + flumetsulam 0.125 + 0.46 to 0.188 + 0.06 lb/A	Banvel, Bicep, Buctril, Clarity, Fultime, Glyphosate, Gramoxone, Harness Xtra, Keystone, Leadoff, Marksman, Touchdown, 2,4-D	Use lower rates on coarse (light, sandy) soils and higher rates on fine (heavy, clay) soils. See label for crop injury precautions regarding varieties, soil pH, soybean herbicide carryover, at-planting insecticides and cool weather.
Keystone NXT or Fultime NXT	1.4 to 3 qt/A or 2.9 to 3.7 qt/A	acetochlor + atrazine 1.1 + 0.88 to 2.3 + 1.9 lb/A or 1.95 + 0.97 to 2.5 + 1.24 lb/A	atrazine, Balance Pro, Banvel, Clarity, Glyphosate, Gramoxone, Hornet WDG, Lasso, Marksman, Pendemax/Prowl, Princep, Python, Surpass, 2,4-D	Use low rates on coarse (light, sandy) soils and higher rates on fine (heavy, clay) soils. Atrazine and/or Surpass may be added to improve control in heavy infestations or for hard-to-control weeds.
Verdict 5.57 EC	10 to 18 fl oz/A	saflufenacil + dimethenamid-p 0.045 + 0.39 to 0.08 + 0.7 lb/A		

## Corn, Preemergence only

Herbicide and formulation	Formulated material per broadcast acre	Herbicide (lb active per acre)	Preemergence tank-mix partners	Application method and precautions
Expert 4.9L	2.5 to 3.75 qt/A	glyphosate + S- metolachlor + atrazine 0.6 + 1 + 1.33 to 0.9 + 1.63 + 2 lb/A	atrazine, Dual, Princep, Glyphosate, Python, Hornet, Prowl, Banvel, Clarity, 2,4-D	May be applied up to 30 days before planting and before emergence of conventional corn hybrids.
Lexar EZ	2.5 to 3.5 qt/A	S-metolachlor + atrazine + mesotrione 1.3 + 1.3 + 0.17 to 1.5 + 1.5 + 0.2 lb/A	atrazine, Glyphosate, Gramoxone, Princep, Touchdown brands	Use low rate when organic matter is less than 3% and high rate when organic matter is more than 3%. <b>See label for insecticide interaction restrictions.</b>
Lumax EZ	2.7 to 3.25 qt/A	S-metolachlor + atrazine + mesotrione 1.68 + 0.63 + 0.17 to 2 + .75 + 0.2 lb/A	atrazine, Glyphosate, Gramoxone, Princep, 2,4-D	Use low rate when organic matter is less than 3% and high rate when organic matter is above 3%. <b>See label for insecticide interaction restrictions.</b>
Prowl H <sub>2</sub> O 3.8ACS	2 to 4 pt/A	pendimethalin 0.95 to 1.9 lb/A	Aatrex, Balance, Banvel, Bicep, Dual, Hornet, Marksman, Python	<b>DO NOT INCORPORATE</b> or serious crop injury may occur. Plant at least 1.5 inches deep.
Resolve Q	1.25 to 2.5 oz/A	rimsulfuron + thifensulfuron 0.014 + 0.003 to 0.028 + 0.006 lb/A	atrazine, Balance, Balance Pro, Bicep, Cinch, Dual, Cinch ATZ, Harness, Lumax, Lexar, Outlook	May be applied preemergence or postemergence to corn that is up to 12 inches tall. Postemergence applications require addition of spray adjuvants.
Zemax	2 to 2.4 qt/A	S-metolachlor + mesotrione 1.68 + 0.17 to 2 + 0.2 lb/A	atrazine, Glyphosate, Gramoxone, Touchdown, 2, 4-D	Use low rate when organic matter is less than 3% and high rate when organic matter is more than 3%. <b>See label for insecticide interaction restrictions.</b>

Corn, Preemergence, Applied postemergence to crop

Herbicide and formulation	Formulated material per broadcast acre	Herbicide (lb active per acre)	Preemergence herbicides applied postemergence tank-mix partners	Application method and precautions
AAtrex 4L or AAtrex Nine-0 + Crop oil concentrate	3 to 4 pt or 1.6 to 2.2 lb + See label	atrazine 1.5 to 2 lb/A	Banvel, Basagran, Buctril, Dual	Apply after weed emergence, but before grass weeds reach 1.5 inches and broadleaf weeds reach 4 inches in height and before corn reaches 12 inches tall. The use of crop oil concentrate may injure corn under conditions of stress. Follow mixing procedures and precautions on label to minimize possible injury.
Balance Flexx	3 to 6 fl oz/A	isoxaflutole 0.05 to 0.09 lb/A		May be applied early postemergence up to V2 corn. Use low rates on coarse (light, sandy) soils and higher rates on fine (heavy, clay) soils. See label for crop safety restrictions.
Callisto 4L + Crop oil concentrate	5 to 7.7 fl oz/A + 1 gal/100 gal	mesotrione 0.16 to 0.24 lb/A	Do not tank mix with emusifiable-concentrate (EC) formulations of grass herbicides.	Callisto primarily controls broadleaf weeds, tank mix with a grass herbicide for broad-spectrum weed control. Tank mixtures with atrazine-containing products are recommended for optimal morningglory control. Use lower rates when tank-mixed with atrazine and higher rates without atrazine. See label for organophosphate and carbamate insecticide restrictions. Do not apply with methylated seed oils.
Dual II Magnum 7.64E/Cinch 7.64E	0.8 to 1.67 pt/A	S-metolachlor 0.76 to 1.6 lb/A	atrazine, Banvel, Clarity, Steadfast	<b>Apply before weed emergence or tank mix with a POST-active herbicide.</b> Apply before corn is 5 inches tall.
Harness 7E or Degree 3.8L	1.25 to 2.75 pt/A or 2.25 to 5 pt/A	acetochlor + antidote 1.1 to 2.4 lb/A or 1.07 to 2.38 lb/A	atrazine, Accent, Banvel, Clarity, Marksman, Permit, Princep, Prowl, Permit, Pursuit, Roundup	<b>Apply before weed emergence or tank mix with a POST-active herbicide.</b> Apply before corn is 11 inches tall. Degree is a microencapsulated, slow-release formulation of acetochlor.
Linex 4L	1 to 1.5 pt/A	linuron 0.5 to 0.75 lb/A	atrazine, Prowl, Dual II Magnum	Apply after planting but before crop emerges. Plant seed at least 1.75 inches deep.
Outlook 6E	12 to 21 fl oz/A	dimethenamid-P 0.56 to 0.98 lb/A	atrazine, Accent, Banvel, Clarity, Marksman, Beacon	<b>Apply before weed emergence or tank mix with a POST-active herbicide.</b> Apply before corn is 8 inches tall.
Prowl H <sub>2</sub> O 3.8ACS	2 to 4 pt/A	pendimethalin 0.95 to 1.9 lb/A	Accent, atrazine, Banvel, Basis Gold, Beacon, Hornet, Marksman	<b>DO NOT INCORPORATE</b> or serious crop injury may occur. This herbicide has no postemergence activity, but may be used to add residual control to other postemergence herbicides. Plant at least 1.5 inches deep. Use lower rates for coarse (light, sandy) soils and higher rates for fine (heavy, clay) soils.
Surpass NXT	1.25 to 3 pt/A	acetochlor 1.1 to 2.6 lb/A	Aim, Accent, Accent Gold, atrazine, Banvel, Basis, Basis Gold, Beacon, Buctril, Buctril/atrazine, Clarity, Distinct, Exceed, Hornet WDG, Liberty, Lightning, Marksman, Peak, Permit, Princep, Prowl, Pursuit, Shotgun, Spirit, Steadfast	<b>Apply before weed emergence or tank mix with a POST-active herbicide.</b> Apply until corn is 11 inches tall.
Topnotch 3.2CS	2 to 3 qt/A	acetochlor 1.6 to 2.4 lb/A	Accent, Banvel, Basis, Basis Gold, Beacon, Buctril, Buctril/atrazine, Clarity, Distinct, Liberty, Lightning, Marksman, Peak, Pendemax/Prowl, Permit, Prowl, Pursuit, Resource, Shotgun, Spirit, Steadfast, 2,4-D	<b>Apply before weed emergence or tank mix with a POST-active herbicide.</b> Apply until corn is 11 inches tall.

Corn, Preemergence, Applied postemergence to crop - *continued*

Herbicide and formulation	Formulated material per broadcast acre	Herbicide (lb active per acre)	Preemergence herbicides applied postemergence tank-mix partners	Application method and precautions
<b>Package mixes - Preemergence applied postemergence</b>				
Bicep II Magnum 5.5L/Cinch ATZ 5.5L	1.3 to 2.6 qt/A	atrazine + S-metolachlor 1 + 0.78 to 2 + 1.56 lb/A		Apply before weeds reach the two-leaf stage and before corn is 5 inches tall.
Bicep Lite II Magnum 6L or Cinch Lite ATZ 6L	0.9 to 2.2 qt/A	S-metolachlor + atrazine 0.75 + 0.6 to 1.83 + 1.47 lb/A	atrazine, Banvel, Clarity, Lorox	Apply before weeds reach the two-leaf stage and before corn is 5 inches tall.
Harness Xtra 5.6L or Harness Xtra 6L or Degree Xtra 4.04 L	1.4 to 3 qt/A  1.5 to 2.3 qt/A  2.9 to 3.7 qt/A	acetochlor + atrazine 1.09 + 0.88 to 2.3 + 1.88 lb/A or 1.6 + 0.6 to 2.5 + 1 lb/A or 1.96 + 0.97 to 2.5 to 1.25 lb/A	atrazine, Accent, Banvel, Clarity, Harness, Hornet, Marksman, Permit, Princep, Prowl, Pursuit, Python, Roundup	Apply before weeds reach the two-leaf stage and before corn is 11 inches tall.
Keystone NXT or Fultime NXT or Breakfree ATZ	1.4 to 3 qt/A  2.9 to 3.7 qt/A  2.2 to 3.4 qt/A	acetochlor + atrazine 1.1 + 0.88 to 2.3 + 1.9 lb/A or 1.95 + 0.97 to 2.5 + 1.24 lb/A or 1.7 + 1.3 to 2.6 + 1.9 lb/A	atrazine, Accent, Banvel, Basis, Beacon, Buctril, Buctril/atrazine, Clarity, Exceed, Marksman, Peak, Permit, Princep, Prowl, Shotgun, Steadfast	Apply before weeds reach the two-leaf stage and before corn is 11 inches tall.
Lexar EZ + Nonionic surfactant	2.5 to 3.5 qt/A  2 pt/100 gal	S-metolachlor + atrazine + mesotrione 1.3 + 1.3 + 0.17 to 1.5 + 1.5 + 0.2 lb/A	atrazine, Accent, Basis, Steadfast, Stout, Touchdown brands (GT corn only)	Apply before corn exceeds 12 inches in height. Use low rate when organic matter is less than 3% and high rate when organic matter is more than 3%. <b>See label for insecticide interaction restrictions.</b> Do not use methylated seed oils or nitrogen additives when applying to corn.
Lumax EZ + Nonionic surfactant	2.7 to 3.25 qt/A  2 pt/100 gal	S-metolachlor + atrazine + mesotrione 1.68 + 0.63 + 0.17 to 2 + .75 + 0.2 lb/A	atrazine, Accent, Basis, Steadfast, Steadfast ATZ, Stout, Touchdown brands (GT corn only)	Apply before corn exceeds 5 inches in height. Use low rate when organic matter is less than 3% and high rate when organic matter is more than 3%. <b>See label for insecticide interaction restrictions.</b> Do not use methylated seed oils or nitrogen additives when applying to corn.
Resolve Q	1.25 to 2.5 oz/A	rimsulfuron + thifensulfuron 0.014 + 0.003 to 0.028 + 0.006 lb/A	atrazine, Balance, Balance Pro, Bicep, Cinch, Dual, Cinch ATZ, Harness, Lumax, Lexar, Outlook	May be applied preemergence or postemergence to corn that is up to 12 inches tall. Postemergence applications require addition of spray adjuvants.
Zemax + Nonionic surfactant	2 to 2.4 qt/A  2 pt/100 gal	S-metolachlor + mesotrione 1.68 + 0.17 to 2 + 0.2 lb/A	atrazine, Accent, Basis, Steadfast, Steadfast ATZ	Apply before corn exceeds 5 inches in height. Use low rate when organic matter is less than 3% and high rate when organic matter is more than 3%. <b>See label for insecticide interaction restrictions.</b> Do not use crop oils or methylated seed oils or nitrogen additives when applying to corn.

**Corn, Postemergence**

<b>Herbicide and formulation</b>	<b>Formulated material per broadcast acre</b>	<b>Herbicide (lb active per acre)</b>	<b>Postemergence tank-mix partners</b>	<b>Application method and precautions</b>
AAtrex 4L or AAtrex Nine-0 + crop oil concentrate containing not more than 20% emulsifier or Emulsifiable oil containing 1 to 2% emulsifier	3 to 4 pt or 1.6 to 2.2 lb + 1 qt or 1 gal/A	atrazine 1.5 to 2 lb/A	Banvel, Basagran, Buctril, Steadfast	Apply after weed emergence, but before weeds reach 1.5 inches in height. The use of oil may injure corn under conditions of stress. Follow mixing procedures and precautions on label to minimize possible injury.
Accent Q + Nonionic surfactant (80%) or crop oil concentrate and 28% or 32% UAN liquid fertilizer (Optional)	0.9 to 1.8 oz/A + 1 to 2 qt/100 gal or 1 gal/100 gal and 2 to 4 qt/100 gal	nicosulfuron 0.031 to 0.062 lb/A	atrazine, Banvel, Basis, Beacon, Buctril, Buctril + atrazine, Clarity, Exceed, Marksman, Northstar	Apply broadcast to corn up to 20 inches tall (up to 6 collars), or 20 to 36 inches tall (less than 10 collars) with drop nozzles. Do not apply to corn treated with any formulation of Counter insecticide. See label for restrictions with other organophosphate insecticides and postemergence herbicides. Split application may be needed for johnsongrass control.
Aim 2E + Nonionic surfactant (80%)	0.5 fl oz/A + 2 pt/100 gal	carfentrazone-ethyl 0.008 lb/A	2,4-D, atrazine, Accent, Banvel, Basis, Basis Gold, Beacon, Clarity, Exceed, Glyphosate, Hornet, Marksman, Permit, Spirit, Liberty	May be applied over-top until corn has 14 collars. See label regarding use of crop oil, EC formulations and crop injury.
Banvel (4 lb/gal formulation)	1 pt/A or 0.5 pt/A	dicamba 0.5 lb/A or 0.25 lb/A	Accent, atrazine, Beacon, Dual II, Lasso, Outlook, Prowl, 2,4-D	Apply from corn planting until corn is 8 inches tall. For best results, apply after weeds have emerged. Do not apply this rate after corn is taller than 8 inches. or Apply anytime after weeds have emerged until corn is 36 inches tall or 15 days before corn tassel emergence.
Basagran 4S	1.5 to 2 pt/A	bentazon 0.75 to 1 lb/A	atrazine	Apply when weeds are small. Add 1 qt/A of crop oil concentrate for yellow nutsedge. Add 2 to 4 qt/A of UAN for velvetleaf.
Beacon 75DF + Non-ionic surfactant (80%) or crop oil concentrate and 28 - 34% UAN liquid fertilizer (Optional)	0.38 to 0.76 oz/A (1 pkt/ 4 to 2 A) + 2 pt/100 gal or 1 to 4 pt/A and 1 to 2 pt/A	primisulfuron 0.018 to 0.036 lb/A	Accent, atrazine, Banvel, Buctril, Clarity, 2,4-D	Use lower rate in split applications and higher rate in single applications. Apply overtop on 4 to 20 inch tall corn. After 20 inches to tasseling use drop nozzles. Do not apply to corn treated with any formulation of Counter insecticide. See label for restriction with other organophosphate insecticides, and other postemergence herbicides. Some corn hybrids may be susceptible to injury, see your dealer for a list of restricted hybrids. Split application is recommended for johnsongrass control and may be made before tassel emergence.
Bestow 25% WDG + Nonionic surfactant (80%) or crop oil concentrate or methylated seed oil and 28 or 32% UAN or AMS (optional)	0.5 to 2 oz/A + 2 pt/100 gal or 1 gal/100 gal or 4 pt/100 gal and 2 qt/A or 2 lb/A	rimsulfuron 0.03 to 0.125 lb/A	glyphosate, glufosinate DO NOT TANK MIX WITH BASAGRAN	Controls selected annual grass and broadleaf weeds. Apply to small, actively growing weeds from corn planting until 12" or 6 collars. Do not apply to field corn grown for seed or popcorn or sweetcorn. See label for insecticide restrictions.

Corn, Postemergence - *continued*

Herbicide and formulation	Formulated material per broadcast acre	Herbicide (lb active per acre)	Postemergence tank-mix partners	Application method and precautions
Buctril 2E or Buctril 4 lb/gal	1 to 1.5 pt/A or 0.5 to 0.75 pt/A	bromoxynil 0.25 to 0.38 lb/A	Accent, atrazine, Beacon	See label for specific rates, crop stages and weed stages for application.
Cadet	0.6 to 0.9 fl oz/A	fluthiacet 0.004 to 0.006 lb/A	Glyphosate, Liberty	See label for specific rates, weed sizes, and tank-mix partner recommendations.
Callisto 4L + crop oil concentrate + Urea ammonium nitrate or Ammonium sulfate	3 fl oz/A + 1 gal/100 gal + 2.5 gal/100 gal or 8.5 lb/100 gal	mesotrione 0.094 lb/A	atrazine, Basagran, Liberty, Liberty ATZ, Stout, Touchdown brands (GT corn only). Do not tank mix with emulsifiable-concentrate (EC) formulations of grass herbicides.	Callisto primarily controls broadleaf weeds, tank mix with a grass herbicide for broad-spectrum weed control. Tank mixtures with atrazine-containing products are recommended for optimal morningglory control. Use lower rates when tank-mixed with atrazine and higher rates without atrazine. See label for organophosphate and carbamate insecticide restrictions.
Callisto Xtra + crop oil concentrate + Ammonium sulfate	20 to 24 oz/A + 1 gal/100 gal + 8.5 lb/100 gal	mesotrione 0.078 to 0.094 lb ai/A + atrazine 0.5 to 0.6 ai/A	AAtrex, Accent Q, Steadfast Q, Stout, Bicep II Magnum, Bicep II Lite Magnum, Buctril, Clarity, Status, Ignite in Liberty Link corn, and Glyphosate in glyphosate-tolerant corn. If tank-mixed with Ignite or Glyphosate, refer to Ignite or Glyphosate labels for adjuvant recommendation.	Callisto Xtra primarily controls broadleaf weeds; tank-mix with a grass herbicide for broad-spectrum control. Apply only up to 12-inch corn. See label for organophosphate and carbamate restriction.
Clarity 4E + 28 - 32% UAN liquid fertilizer (Optional) or Nonionic surfactant (Optional)	16 fl oz/A	diglycolamine salt of dicamba, 0.5 lb/A	Accent, atrazine, Beacon, Steadfast, 2,4-D	May be applied from corn emergence (spike) until corn is 8 inches tall. Addition of UAN is recommended only for velvetleaf control. Nonionic surfactant may be added to improve weed control in dry growing conditions.
Impact 2.8SC/ Armezon + Methylated seed oil + Urea ammonium nitrate or Ammonium sulfate	0.75 to 1 fl oz/A + 1 gal/100 gal + 1.25 to 2.5 gal/100 gal or 8.5 to 17 lb/100 gal	topramezone 0.016 to 0.022 lb/A	atrazine, Accent, Glyphosate, Liberty, Steadfast, Status, others. May be tank-mixed with residual herbicides in early post applications to control emerged weeds.	Impact primarily controls broadleaf weeds. Tank mix with a grass herbicide for broad-spectrum weed control. Tank mixtures with atrazine-containing products will enhance weed control significantly. Impact may be applied from anytime after corn emergence up to 45 days before harvest.
Laudis (3.5 lb/gal formulation)	3 oz/A	tembotrione 0.66 lb/A	atrazine, Liberty, Glyphosate, Accent, Stout, Steadfast, Option	Laudis primarily controls broadleaf weeds. Tank mix with a grass herbicide for broad spectrum weed control. Tank mixtures with atrazine-containing product will enhance weed control significantly.
Option 35DG + Methylated seed oil + Urea ammonium nitrate or Ammonium sulfate	1.5 to 1.75 oz/A + 1.5 pt/A + 1.5 to 2 qt/A or 1.5 to 3 lb/A	foramsulfuron 0.03 to 0.04 lb/A	atrazine, Beacon, Callisto, Degree, Degree Xtra, Banvel, Clarity, Distinct, Exceed, Fultime, Harness, Harness Xtra, Hornet, Keystone, Marksman, Northstar, Outlook, Permit, Prowl, Spirit, Surpass, Topnotch, Tough, Volley, Yukon	Broadcast applications must be made when corn is in the V1 to V6 growth stage. Temporary yellowing (flashing), stunting and internode stacking can sometimes occur. See label for insecticide interaction restrictions.

**Corn, Postemergence - *continued***

<b>Herbicide and formulation</b>	<b>Formulated material per broadcast acre</b>	<b>Herbicide (lb active per acre)</b>	<b>Postemergence tank-mix partners</b>	<b>Application method and precautions</b>
Permit 75DF + Nonionic surfactant (80%) or Crop oil concentrate + Urea ammonium nitrate or Ammonium sulfate (optional)	0.67 to 1.33 oz/A + 1 to 2 qt/A or 1 gal/100gal + 4 gal/100 gal or 2 to 4 lb/A	halosulfuron 0.032 to 0.063 lb/A	Accent, atrazine, Banvel, Beacon, Buctril, Buctril + atrazine, Clarity, Marksman, 2,4-D	Do not cultivate for 7 days following application. Apply from spike to lay-by (corn that's approximately 30 inches tall).
Python 80WDG	0.8 to 1.14 oz/A	flumetsulam 0.04 to 0.057 lb/A	No restrictions	Apply before corn reaches 20 inches or 6 collars.
Resource 0.86 EC + Crop oil concentrate	2 to 4 fl oz/A + 1 to 2 pt/A	flumiclorac-pentyl, 0.013 to 0.027 lb/A	2,4-D, atrazine, Accent, Banvel, Beacon, Buctril, Clarity, Glyphosate, Hornet, Liberty, Marksman, Northstar, Permit, Spirit, Stinger	Velvetleaf control and lambsquarters suppression only. Higher herbicide and adjuvant rates are for drop-nozzle directed application only.
Sencor 75 DF	2 oz/A	metribuzin 0.094 lb/A	2,4-D, atrazine, Banvel, Basagran, Buctril, Buctril Gel, Clarity, Laddok, Marksman, Resource, Pursuit, Tough	Must be applied with a tank-mix partner for acceptable weed control. Do not use crop oil. Consult label for tank-mix partners to determine appropriate adjuvant. Do not use on coarse-textured, low organic matter soils.
Starane 1.5L	2/3 pt/A	fluroxypyr 0.125 lb/A	No restrictions	Apply as a broadcast or band treatment to field corn up to and including 5 fully exposed leaf collars (V5 growth stage). Applications to field corn beyond V5 should be made as a directed spray using drop nozzles. Brittleness of corn after application may cause stalk breakage if windstorms or cultivation follow within 8 to 10 days of treatment. Do not use between tasseling and hard dough stage.
2,4-D amine or ester (4 lb/gal formulation)	0.5 to 1 pt/A	2,4-D amine or ester 0.25 to 0.5 lb/A	Banvel, Beacon	May be applied overtop until corn is 8 inches tall. After corn is over 8 inches tall, and until tasseling, use only directed application. Crop injury may occur when using higher rates or if applied during periods of rapid growth. Brittleness of corn after application may cause stalk breakage if windstorms or cultivation follow within 8 to 10 days of treatment. Do not use between tasseling and hard dough stage.
<b>Package mixes – Postemergence</b>				
Basis 75DG + Crop oil concentrate or Nonionic surfactant + UAN or ammonium sulfate	1/3 oz/A + 1% v/v or 1 qt/100 gal + 2-4 qt/A or 2-4 lb/A	rimsulfuron + thifensulfuron 0.01 + 0.005 lb/A	atrazine, Callisto, Hornet	Apply broadcast to field corn in the spike through four-leaf (2 collar) stage. Do not apply to corn having 3 fully emerged collars or more than 6 inches tall. See label for restrictions regarding insecticide interactions.
Buctril + atrazine 3L	1.5 to 3 pt/A	bromoxynil + atrazine 0.19 + 0.38 to 0.38 + 0.75 lb/A	atrazine, Buctril	See label for specific rates, crop stages and weed stages for application. Buctril and/or atrazine may be added to the package-mix to improve control in heavy infestations or for hard-to-control weeds.



Corn, Postemergence - *continued*

Herbicide and formulation	Formulated material per broadcast acre	Herbicide (lb active per acre)	Postemergence tank-mix partners	Application method and precautions
Equip 32 DG	1.5 oz/A	foramsulfuron + iodosulfuron 0.3 + 0.002 lb/A	atrazine, Degree, Degree Xtra, Banvel, Clarity, Distinct, Fultime, Harness, Harness Xtra, Keystone, Marksman, Outlook, Permit, Prowl, Topnotch, Volley, Yukon	Broadcast applications must be made when corn is in the V1 to V4 growth stage. Temporary yellowing (flashing), stunting and internode stacking can sometimes occur. See label for insecticide interaction restrictions.
Hornet 78.5 WDG + Crop oil concentrate or Methylated seed oil or Nonionic surfactant (80%) and UAN or ammonium sulfate (optional)	2 to 5 oz/A + 1 gal/100 gal or 1 gal/100 gal or 1 qt/100 gal and 2.5 gal/A or 2 lb/A	clopyralid + flumetsulam 0.063 + 0.023 to 0.16 + 0.058 lb/A	Accent, atrazine, Banvel, Basis Gold, Buctril, Callisto Clarity, Distinct, Glyphosate, Option, Steadfast	Apply to actively growing weeds from corn emergence to 20 inches tall over the top or to 20 inches to 36 inches tall with drop nozzles. Do not tank-mix with Basagran, Laddok or Lightning. See label for specific rates and restrictions.
Laddok S-12 5L + Crop oil concentrate	1.3 to 2.3 pt/A + 1 qt/A	bentazon + atrazine 0.52 + 0.52 to 0.73 + 0.73 lb/A	atrazine, Stinger, 2,4-D	See label for specific rates, crop stages and weed stages for application. Corn is tolerant at all stages of growth. However, best performance is obtained when weeds are small.
NorthStar 47.4DG + Nonionic surfactant (80%) or Crop oil concentrate + Urea ammonium nitrate or ammonium sulfate (optional)	5 oz/A + 1 qt/100 gal or 1 to 4 pt/A + 2 to 4 qt/A or 2 to 4 lb/A	dicamba + primisulfuron 0.125 + 0.023 lb/A	atrazine, Accent, Banvel, Beacon, Clarity, Marksman, Resource, Tough	Apply over the top when corn is from 4 to 20 inches tall. Applied in a directed or semi-directed spray when corn is from 20 to 36 inches tall. See label comments regarding insecticide interactions. Do not apply to sensitive varieties.
Realm Q + Nonionic surfactant or Crop oil concentrate + UAN or ammonium sulfate	4 oz/A + 1 qt/100 gal or 1 gal/100 gal + 2 qt/A or 2 lb/A	rimsulfuron + mesotrione 0.018 + 0.078 lb/A	Glyphosate, Ignite, Liberty	Apply to corn up to 20 inches in height. Do not apply to corn taller than 20 inches or exhibiting 7 or more leaf collars, whichever is more restrictive.
Resolve Q + Nonionic surfactant + UAN or ammonium sulfate	1.25 oz/A + 1 qt/100 gal + 2 qt/A or 2 lb/A	rimsulfuron + thifensulfuron 0.014 + 0.003 lb/A	Glyphosate, Cinch, Cinch ATZ, Lumax, Balance PRO, Harness, Outlook, atrazine, others	May be applied to field corn that is up to 12 inches tall. Do not apply to corn taller than 12 inches or exhibiting 6 or more leaf collars, whichever is more restrictive. Do not tank-mix with Basagran, Laddok, 2,4-D-containing products or foliar applied organophosphate insecticides.
Shotgun 3.25L	1.5 to 3 pt/A	atrazine + 2,4-D 0.24 + 0.19 to 0.84 + 0.38 lb/A	atrazine, Banvel, Buctril	Do not tank mix with Accent. Apply at least 7 days before or 3 days after Accent applications. See label for rates regarding soil textures. Apply over the top when corn is from the spike to 8-inch (four-leaf) stage or in drop nozzles from 8-inch to 12-inch (five-leaf) stage.

**Corn, Postemergence - *continued***

<b>Herbicide and formulation</b>	<b>Formulated material per broadcast acre</b>	<b>Herbicide (lb active per acre)</b>	<b>Postemergence tank-mix partners</b>	<b>Application method and precautions</b>
Solstice + Crop oil concentrate or Nonionic surfactant + Urea ammonium nitrate or ammonium sulfate	2.5 to 3.15 fl oz/A + 1 gal/100 gal or 1 qt/100 gal + 2.5% v/v or 8.5 lb/100 gal	fluthiacet-methyl + mesotrione 0.004 + 0.074 to 0.005 + 0.093 lb/A	atrazine	May be applied postemergence up to the V8 growth stage or 30 inches tall.
Spirit 57DG + Nonionic surfactant (80%) or Crop oil concentrate + UAN or ammonium sulfate (optional)	1 oz/A + 1 to 2 qt/100 gal or 1 to 4 pt/A + 2 to 4 at/A or 2 to 4 lb/A	primisulfuron + prosulfuron 0.027 + 0.009 lb/A	2,4-D, atrazine, Accent, Banvel, Beacon, Bicep, Buctril, Clarity, Dual, Marksman, Tough	See label restrictions regarding insecticide interactions. Apply over the top when corn is 4 to 20 inches tall (or 6 collars). Do not apply to sensitive hybrids. This herbicide is an option for areas with higher pH where Peak and Exceed may present carryover problems.
Status 56WG + Nonionic surfactant (80%) or Crop oil concentrate or Methylated seed oil	5 oz/A + 2 pt/100 gal or 1 gal/100 gal or 1 gal/100 gal	Dicamba + diflufenzopyr 0.03 + 0.07	Accent, Steadfast	Apply over the top to corn that is 4 to 36 inches tall. Drop nozzles are not required.
Steadfast Q + Nonionic surfactant (80%) or Crop oil concentrate + UAN or ammonium sulfate	1.50 oz/A + 2 to 4 pt/100 gal or 1 gal/100gal + 2 qt/A or 2 lb/A	nicosulfuron + rimsulfuron 0.023 + 0.012 lb/A	atrazine, Callisto, Clarity, Distinct, Marksman, Hornet, Stinger, Tough	May be applied to corn that is up to 20 inches tall and exhibiting up to and including 6 leaf collars. Do not apply to corn taller than 20 inches or exhibiting more than 6 leaf collars, whichever is more restrictive. See label restrictions regarding insecticide interactions.
Stout 72.5 DF + crop oil concentrate or nonionic surfactant + UAN or ammonium sulfate	0.5 to 0.75 oz/A + 1% v/v or 1 qt/100 gal + 2 qt/A or 2 lb/A	nicosulfuron + thifensulfuron 0.02 to 0.0016 to 0.03 + 0.0002 lb/A	atrazine, Callisto, Distinct, Clarity, Banvel, Dual, Prowl, Cinch, Outlook, others	Apply to field corn that is up to 16 inches tall and is exhibiting up to and including 5 leaf collars. See label for restrictions regarding insecticide interactions.
Yukon 67.5 DF + Nonionic surfactant or Crop oil concentrate + UAN or ammonium sulfate (optional)	4 to 8 oz/A + 2 to 4 pt/100 gal or 1 gal/100 gal + 2 to 4 qt/A or 2 to 4 lb/A	Dicamba + halosulfuron 0.14 + 0.03 to 0.28 + 0.06 lb/A	Accent, atrazine, Beacon, Bullet, Degree, Degree Xtra, Glyphosate, Partner	Apply over the top to corn from spike to 36 inches.

## Herbicide-resistant corn

Herbicide and formulation	Formulated material per broadcast acre	Herbicide (lb active per acre)	Labeled tank-mix partners	Application method and precautions
<b>Liberty Link Corn</b>				
Ignite 280SL + Ammonium sulfate	22 oz/A + 3 lb/A	glufosinate 0.4 lb/A		Use on Liberty Link corn only. Applications may be made from emergence through the 7-collar growth stage. Apply at 22 fl oz/A per application and no more than 44 fl oz/A may be applied per growing season.
Liberty 280SL + Ammonium sulfate	22 oz/A + 3 lb/A	glufosinate 0.4 lb/A	Do not tank mix with Aim, Basis, Prowl, Resource, or Sencor.	Use on Liberty Link corn only. Applications may be made from emergence through the 7-collar growth stage. Apply at 22 fl oz/A per application and no more than 44 fl oz/A may be applied per growing season.
Liberty ATZ 4.3SC + Ammonium sulfate	32 to 40 fl oz/A + 3 lb/A	atrazine + glufosinate 0.83 + 0.25 to 1.03 + 0.31 lb/A	Do not tank mix with Basis, Prowl, Resource, or Sencor.	Use on Liberty Link corn only. Use caution to avoid spraying the wrong field. Consult label to refine rates for particular weed species. Apply overtop from emergence to 12-inch tall corn. See label regarding fertilizer additives. Do not apply within two hours of sunset.
SureStart II/TripleFLEX II	1.5 to 2 pts/A	acetochlor + flumetsulam + clopyralid 0.7 to 0.02 + 0.07 lb/A to 0.9 + 0.03 + 0.10 lb/A	atrazine, glyphosate, Liberty, 2,4-D	Use only on Roundup Ready or Liberty Link corn. Can be applied preplant preemergence, or early postemergence, to corn up to 11 inches tall. Minimum planting depth should be 1.5 inches.
<b>Roundup Ready Corn</b>				
<b><i>Preemergence or postemergence</i></b>				
Expert 4.9L	2.5 to 3.75 qt/A	atrazine + S-metolachlor + glyphosate 1.3 + 1 + 0.63 to 2 + 1.6 + 0.9 lb/A	No tank mixes with other products after corn emerges. Before corn emergence, may be tank mixed with atrazine, Banvel, Clarity, Dual II Magnum, Glyphosate, Hornet, Princep, Prowl, Python, Touchdown, or 2, 4-D	Use on Roundup Ready Corn only. May be applied from 30 days preplant up to 12-inch corn.
Halex GT + Nonionic surfactant + Ammonium sulfate	3.6 to 4 pts/A + 2 pt/100 gal + 8.5 to 17 lb/100 gal	S-metolachlor + glyphosate + mesotrione 0.94 + 0.94 + 0.094 lb/A to 1.05 + 1.05 + 0.105 lb/A	atrazine	Use on Roundup ready corn only. Can be applied postemergence from spike to 30-inch or 8-leaf corn. No PRE applications.
Roundup brands/ Touchdown Total/ other glyphosates + Recommended additives	+ See label	glyphosate 0.77 to 1.1 lb ae/A	Bullet, Harness, Harness Xtra, Micro-Tech, Partner, Permit	Use on Roundup Ready corn only. Use caution to avoid spraying the wrong field. Apply overtop from emergence until corn is 30 inches tall (8 collars). Higher rates per application are allowed on Roundup Ready corn 2. Drop nozzles may also be used on Roundup Ready corn 2 for corn 30 to 48 inches in height.
SureStart II/TripleFLEX II	1.5 to 2 pts/A	acetochlor + flumetsulan + clopyralid 0.7 to 0.02 + 0.07 lb/A to 0.9 + 0.03 + 0.10 lb/A	atrazine, glyphosate, Liberty, 2,4-D	Use only on Roundup Ready or Liberty Link corn. Can be applied preplant preemergence, or early postemergence, to corn up to 11 inches tall. Minimum planting depth should be 1.5 inches.
Callisto GT + Nonionic surfactant + Ammonium sulfate	2 pt/A + 2 pt/100 gal + 8.5 to 17 lb/100 gal	glyphosate + mesotrione 0.95 + 0.095 lb/A	atrazine	Use on Roundup Ready corn only. Apply from emergence up to corn that is 30 inches tall.

**Corn, special problems**

Herbicide and formulation	Formulated material per broadcast acre	Herbicide (lb active per acre)	Weeds controlled	Application method and precautions
<p><b>Note:</b> Shattercane and johnsongrass have similar foliar responses to treatments; however, rhizomes of johnsongrass are more difficult to kill and regrowth is possible. Heavy johnsongrass infestations will require split and/or sequential herbicide applications for optimal control. Rhizome johnsongrass should typically be allowed to grow larger than seedling johnsongrass or shattercane so that more leaf area is available to absorb herbicides and translocate them to rhizomes.</p>				
<b>Johnsongrass, Preplant burndown</b>				
Roundup brands/ Touchdown brands/ other glyphosates + Recommended additives	+ See label	glyphosate at least 0.77 lb ae/A	Johnsongrass (seedling and rhizome), shattercane and other annual grass and broadleaf weeds.	Treat with glyphosate before plants are 12 inches tall. Allow 7 or more days after application before tillage. Roundup may be tank-mixed with several preemergence herbicides. Control will be limited if johnsongrass is just emerging.
<b>Johnsongrass, Postemergence</b>				
Accent Q + Nonionic surfactant (80%) or Crop oil concentrate and 28 or 32% UAN liquid fertilizer (Optional)	0.9 oz/A + 1 to 2 qt/100gal or 1 gal/100 gal and 2 to 4 qt/100gal	nicosulfuron 0.031 lb/A	Seedling and rhizome johnsongrass, shattercane and other annual grass weeds.	Apply to 4- to 10-inch seedling and 8 to 12 inch rhizome johnsongrass. If regrowth occurs, second application may be made when johnsongrass is 8 to 10 inches tall. May be applied up to 20-inch corn broadcast, and 20- to 36-inch corn with drop nozzles. Do not apply to corn treated with Counter insecticide. See label for restrictions with other organophosphate insecticides, and postemergence herbicides.
Beacon 75DF + Nonionic surfactant (80%) or crop oil concentrate and 28 - 32% UAN liquid fertilizer (Optional)	1 water soluble packet per 2 acres + 2 pt/100 gal or 1 to 4 pt/A and 1 to 2 pt/A	primisulfuron 0.036 lb/A	Seedling and rhizome johnsongrass, shattercane and other annual broadleaf weeds.	Apply to 4- to 12-inch tall seedling and 8- to 16-inch tall rhizome johnsongrass. Another option is a half-rate, split application where a second application is made when regrowth is 8 to 16 inches tall. May be applied over the top to 4- to 20-inch tall corn. Use drop nozzles for 20-inch corn to tasseling. Do not apply to corn treated with Counter insecticide. See label for restrictions with other organophosphate insecticides, and postemergence herbicides. Some corn hybrids may be susceptible to injury, see your dealer for a list of restricted hybrids.
Roundup brands/other glyphosates  Glyphosate 3L or Roundup WeatherMax 4.5L or Roundup PowerMax 4.5L + Recommended additives	1 to 2 pt/A or 11 to 21 fl oz/A or 11 to 21 fl oz/A + See label	glyphosate 0.375 to 0.75 lb/A	Johnsongrass (seedling and rhizome), most grass and broadleaf weeds	Roundup Ready corn only. For optimal results, apply to 15- to 20-inch tall rhizome johnsongrass and retreat if new growth reaches 6 to 12 inches tall.
Roundup brands/other glyphosates  Glyphosate 3L or Roundup WeatherMax 4.5L or Roundup PowerMax 4.5L + Recommended additives	1.3 fl oz/gallon     + See label	glyphosate 1% solution	Johnsongrass (seedling and rhizome), and many annual and perennial grass and broadleaf weeds.	Spot spray only, corn plants in treated area will be severely injured or killed. Cover foliage thoroughly. Apply to 12- to 18- inch tall johnsongrass.

**Corn, special problems - *continued***

Herbicide and formulation	Formulated material per broadcast acre	Herbicide (lb active per acre)	Weeds controlled	Application method and precautions
<b>Harvest aid</b>				
Aim + Crop oil concentrate or Nonionic surfactant or Methylated seed oil	1 to 2 oz/A	Carfentrazone 0.015 to 0.031	—	Allow a minimum of three days between application and harvest.
Gramoxone 2SL + Nonionic surfactant or Crop oil concentrate	1.2 to 2 pt/A	paraquat 0.4 to 0.7	Most grass and broadleaf weeds	Preharvest treatment: Apply after the black layer has formed, at least 7 days before harvest.
2,4-D amine or 2,4-D ester (4 lb/gal formulation)	1.5 to 2 pt or 1 to 2 pt/A	2,4-D 0.75 to 1 lb or 0.5 to 1 lb/A	Cocklebur, common ragweed, jimsonweed, morningglories, velvetleaf and suppression of vines such as honeyvine milkweed, field bindweed, trumpet creeper and redvine that interfere with harvesting.	Preharvest treatment: Apply after hard dough or denting stage. Do not forage or feed corn fodder for 7 days following application.
Roundup brands/other glyphosates  Glyphosate 3L or Roundup WeatherMax 4.5L or Roundup PowerMax 4.5L + Recommended additives	  2 to 6 pt/A or 21 to 64 fl oz/A or 22 fl oz/A + See label	glyphosate 0.75 to 2.25 lb/A	Most grass and broadleaf weed species	Preharvest treatment: Apply at 35% moisture or less (black layer). Allow a minimum of 7 days between application and harvest. Do not treat corn grown for seed because reductions in germination or vigor may occur.

**Cotton**

Better control of a wide spectrum of weeds, including grasses and broadleaf weeds, can be obtained using two herbicides: one applied preplant incorporated and the other applied preemergence at rates specified on the label. A complete weed control program also requires timely applications of herbicides postemergence while weeds are small. A directed spray with the first cultivation or a well-timed over-the-top application generally is more satisfactory than waiting until the second cultivation.

Follow fungicide recommendations whenever preemergence herbicides are used in cotton. Plant seed at least 0.5 inch deep and cover well with soil. If replanting is necessary, do not re-treat with any herbicide.

Substituted urea herbicides such as diuron and fluometuron used in combination with organophosphate systemic insecticides at planting may injure cotton.

**Cotton, Estimated levels of preplant foliar weed control normally expected**

Herbicides	Annual bluegrass	Bittercress	Buttercup	Carolina geranium	Chickweed	Cheat	Evening primrose	Groundsel	Henbit	Prostrate knotweed	Shepherd's-purse	Wild lettuce	Virginia pepperweed	Vetch	Little barley/ Car. foxtail	Horseweed	Curly dock (seedling)	Rye grass	Barnyard grass	Broadleaf signalgrass	Crabgrass	Goosegrass	Seedling johnsongrass	Cocklebur	Entireleaf morningglory	Pitted morningglory	Smallflower morningglory	P. smartweed	Hemp sesbania	Prickly sida	Spurred anoda	Pigweed	Sicklepod	Cutleaf groundcherry	Common ragweed	Red rice	Upright spurge	Soil activity			
Preplant -PPF*																																									
Caparol/ Cotton Pro	-	9	9	7	10	-	7	-	8	6	8	9	7	6	6	7	8	-	-	-	-	-	-	7	7	9	9	7	8	7	7	9	-	-	-	-	-	-	yes		
Clarity	0	9	9	8	9	0	8	-	9	8	9	9	9	9	0	7	9	0	0	1	1	1	0	9	9	9	9	9	8	9	8	8	9	9	9	0	9	no			
Goal	9	10	9	9	8	7	8	7	9	9	9	9	8	7	-	9	9	9	-	-	-	-	-	8	8	9	9	8	9	9	8	9	-	-	-	-	-	-	yes		
Gramoxone Inteon	8	10	10	7	10	8	8	9	9	6	9	7	8	8	0	6	8	9	9	9	9	8	9	6	5	5	7	5	6	6	8	9	9	7	8	7	8	no			
Harmony Extra/ Firstshot	0	9	9	8	8	0	8	-	7	-	9	9	9	9	0	6	10	0	0	0	0	0	0	8	7	8	8	-	6	4	-	8	4	-	-	0	-	no			
Glyphosate	9	10	9	7	10	9	7	9	9	7	9	7	8	5	10	8	7	9	9	9	9	8	9	8	7	8	8	7	6	7	5	9	8	9	9	7	9	no			
"Glyphosate + 2,4-D"	10	10	10	9	10	10	8	-	10	10	9	10	10	9	8	7	-	-	-	-	-	9	9	9	9	8	8	8	8	10	8	9	-	-	10	-	-	no			
Glyphosate + dicamba	10	10	10	9	10	10	9	-	10	10	9	10	10	9	9	7	-	-	-	-	-	9	9	9	9	8	8	8	8	9	9	9	-	-	10	-	-	yes			
Glufosinate	6	-	-	8	10	-	7	-	6	-	-	-	9	8	7	9	-	8	8	8	8	8	8	9	10	10	10	9	8	8	7	-	8	7	-	-	-	-	no		

\*Plus approved adjuvant according to label instructions. Consult labels for approved adjuvants.

**Cotton, Estimated levels of weed control normally expected**

Herbicides	Barnyardgrass	Bermudagrass	Broadleaf signalgrass	Crabgrass	Fall Panicum	Goosegrass	Johnsongrass - rhizome	Johnsongrass -seedling	Nutsedge - yellow	Cocklebur	Hemp sesbania	Honeyvine milkweed	Palmer Amaranth	Prickly Sida	Purslane	Smartweed	Spurred Anoda	Velvetleaf	Sicklepod	Redvine	Morningglory-Entireleaf	Morningglory-Pitted	Lambsquarters	Crop Tolerance
<b>Preplant</b>																								
Prowl	9	0	9	9	9	9	3	9	0	0	0	0	9	0	9	2	0	0	1	0	2	2	8	G
Treflan	9	0	9	9	9	9	3	9	0	0	0	0	9	0	9	2	0	0	1	0	2	2	9	G
Reflex	5	0	4	5	6	5	2	5	7	7	3	0	8	7	7	-	1	1	4	0	6	6	-	G
<i>A preplant incorporated (PPI) followed by a preemergence (PRE) treatment will control a broader spectrum of weeds. However, the effectiveness on any given species will be no higher than the highest rated product selected.</i>																								
<b>Preemergence</b>																								
Command	9	-	9	9	8	9	3	9	-	6	4	-	7	9	9	8	9	10	0	-	-	-	-	F
Cotoran	8	0	8	9	7	8	0	6	0	6	6	0	9	9	9	7	3	3	8	0	8	8	9	G
Cotoran+Dual	9	0	9	9	9	9	0	7	7	6	6	0	9	9	9	7	3	3	8	-	-	-	-	G
Dual II Magnum	9	0	8	9	9	9	0	5	6	0	-	-	8	3	-	4	3	3	0	0	5	2	7	F/G

Cotton, Estimated levels of weed control normally expected - *continued*

Herbicides <sup>1</sup>	Banyardgrass	Bermudagrass	Broadleaf signalgrass	Crabgrass	Fall Panicum	Goosegrass	Johnsongrass - rhizome	Johnsongrass - seedling	Nutsedge - yellow	Cocklebur	Hemp sesbania	Honeyvine milkweed	Palmer Amaranth	Prickly Sida	Purslane	Smartweed	Spurred Anoda	Velvetleaf	Sicklepod	Redvine	Morningglory-Entireleaf	Morningglory-Pitted	Lambquarters	Crop Tolerance
Direx	7	0	8	8	7	8	0	6	0	4	4	0	9	6	9	7	2	7	5	0	8	8	9	G
Reflex	5	0	4	5	-	5	0	5	7	7	3	0	8	7	7	-	1	1	4	0	6	6	-	F
Staple	-	-	-	-	-	-	-	-	-	4	4	-	9	9	-	-	-	-	6	0	8	8	-	G
Solicam DF	8	2	8	9	7	8	2	7	4	3	3	0	7	9	9	6	8	7	4	-	-	-	-	G
Warrant	6	0	6	6	6	6	0	2	4	0	-	-	6	2	-	2	2	0	0	0	0	0	-	F
<b>Postemergence directed</b>																								
Aim	0	0	0	0	0	0	0	0	0	7	6	0	8	6	-	-	-	10	0	0	10	10	-	G
DSMA or MSMA	7	0	8	8	7	4	5	8	6	9	2	1	3	2	3	1	0	0	3	0	3	3	5	G
Caparol	7	-	7	7	7	7	-	7	1	6	6	-	8	7	-	-	-	-	-	-	-	-	-	G
+MSMA	8	0	9	9	8	8	5	8	6	9	6	2	9	8	8	4	5	7	8	0	8	8	9	F
Cobra	3	0	3	3	3	3	-	3	2	8	-	5	9	8	8	7	7	8	-	-	-	-	-	G
+MSMA	8	0	8	8	7	8	5	9	6	9	7	5	9	8	9	7	7	8	5	-	-	-	-	F
Cotoran	6	0	6	6	6	6	-	6	1	5	4	-	6	5	-	-	-	-	-	-	-	-	-	G
+MSMA	8	0	9	9	8	8	5	8	6	9	5	2	9	7	6	4	3	6	8	0	8	8	9	F
Direx	5	0	5	6	5	5	2	5	0	4	4	1	7	4	5	3	3	3	8	-	-	-	-	G
+MSMA	8	0	9	9	8	8	5	9	6	9	5	2	9	7	7	4	4	4	8	0	8	8	9	F
Goal	4	0	4	4	4	4	2	4	2	8	-	2	9	8	9	9	-	8	-	-	-	-	-	G
+MSMA	8	0	8	8	7	8	5	9	6	9	7	2	9	8	9	9	5	8	8	-	-	-	-	F
Linex/Lorox	5	0	5	5	5	8	2	5	0	7	8	2	8	7	8	4	5	6	8	0	8	8	9	G
+MSMA	8	0	9	9	8	5	5	9	6	9	7	2	9	9	8	4	5	7	8	-	-	-	-	G
Suprend	7	0	7	7	7	7	-	7	1	9	9	-	8	7	-	-	-	-	9	-	9.5	10	-	G
<b>Postemergence over-the-top</b>																								
Assure II	8	9	9	8	9	8	9	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	E
Fusilade DX	9	9	9	9	9	9	9	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	E
Poast Plus	9	8	9	9	9	9	8	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	E
Select	9	9	9	9	8	9	9	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	E
Dual Magnum	8	0	8	8	-	8	0	8	7	2	0	-	8	2	-	-	0	0	2	0	5	2	7	-
Envoke	2	0	2	2	-	2	5	7	7	9	9	-	7	2	-	-	-	-	9	-	9	9	-	F
Glyphosate	8	5	9	9	9	8	7	9	6	8	6	3	9	8	6	9	8	7	7	6	8	8	9	G
Liberty	8	-	8	7	-	6	2	8	4	8	9	-	7	8	-	8	9	-	9	5	10	10	7	E
Sequence	9	6	9	9	9	8	8	9	7	8	6	4	9	7	9	7	9	7	8	-	-	-	-	G
Staple	0	0	0	0	0	0	3	6	5	7	9	-	5	7	6	7	9	9	5	-	9	8.5	0	G
<b>Layby - preemergence activity</b>																								
Command	9	-	9	9	8	9	3	9	-	6	4	-	7	9	9	8	9	10	0	-	-	-	-	F
Layby Pro	6	0	6	6	6	6	1	6	0	5	5	0	7	6	7	5	4	5	8	-	-	-	-	G
Lorox/Linex	6	0	6	6	6	6	1	5	0	4	4	0	7	6	8	6	2	5	4	-	-	-	-	G
Valor	8	0	9	9	9	9	6	9	4	9	-	-	8	10	8	8	8	8	9	2	10	10	9	F

Notes:

Rating scale: 0-3 = none to slight, 4-6 = fair, 7-8 = good, 9-10 = excellent. Ratings assume the herbicides are applied in the manner suggested in the guidelines and according to label under optimum growing conditions. Crop tolerance rating scale: E = excellent, G = good, F = Fair.

<sup>1</sup>See glossary for trade names.

## Cotton, Rotational crop restrictions

Many herbicides used in cotton have planting restriction intervals for crops other than cotton. If a rotational crop is being considered for the year after cotton, the following table could assist in choosing the proper cotton herbicide for the current year. If a rotational crop is planted within the interval stated, or before the interval has expired, unacceptable injury to the rotational crop can occur.

Cotton herbicides	Rotation interval <sup>1</sup>					
	Corn	Grain sorghum	Rice	Soybeans	Wheat	Other grains
Assure II	120 d	120 d	120 d	none	120 d	120 d
Prometryn (Caparol, Cotton-Pro, etc.)	next y	next y	next y	next y	next y <sup>2</sup>	next y <sup>2</sup>
Cobra	none	none	none	none	none	none
Command	9 m	9 m	9 m	none	12 m <sup>3</sup>	12 m <sup>3</sup>
FirstShot	14 d	14 d	0 d	7 d	none	none <sup>4</sup>
Fluometuron (Cotoran, Meturon, etc.)	6 m	6 m	6 m	6 m	6 m	6 m
DSMA	none	none	none	none	none	none
Dual Magnum	none	none	spring	none	4.5 m	4.5 m
Envoke	7 m	7 m	7 m	7 m	3 m	18 m
Fusilade DX	60 d	60 d	60 d	none	60 d	60 d
Goal	10 m	10 m	10 m	60 d	10 m	10 m
Gramoxone Inteon	none	none	none	none	none	none
Liberty	none	70 d	none	none	70 d	70 d
Diuron (Direx, Karmex)						
band PRE or POE	4 m	4 m	4 m	4 m	4 m	4 m
band Pre + POE	spring	spring	1 y	spring	1 y	1 y
broadcast PRE	spring	spring	1 y	spring	1 y	1 y
broadcast PRE + band POE	spring	spring	1 y	spring	1 y	1 y
broadcast POE	spring	spring	1 y	1 y	1 y	1 y
Lorox/Linex	none	none	4 m	none	4 m	1 y <sup>5</sup>
MSMA	none	none	none	none	none	none
Poast Plus	none	none	none	none	none	none
Prowl H <sub>2</sub> O	none	none	none	none	4 m	NS <sup>6</sup>
Glyphosate	none	none	none	none	none	none
Clethodim	6 d	30 d	30 d	none	30 d	30 d
Staple LX	10 m <sup>7</sup>	2 y	9 m	10 m	4 m	10 m <sup>8</sup>
Trifluralin (Treflan, Trilin, Tri-4, etc.)	none	none	none	none	none	none
Valor	30 d <sup>9</sup>	30 d <sup>9</sup>	30 d <sup>9</sup>	0 d	30 d <sup>9</sup>	4-12 m
Solicam DF	24 m	24 m	24 m	45 d	24 m	24 m
Zidua <sup>10</sup>						
1 oz/A	0	6 m	10 m	0	1 m	11 m
2 oz/A	0	6 m	12 m	0	1 m	11 m
3 oz/A	0	10 m	18 m	0	4 m	11 m
4 oz/A	0	12 m	24 m	4 m	6 m	11 m

**Notes:**  
<sup>1</sup>d, m, y, spring, fall, and NS indicate days after application, months after application, years after application, spring following application, fall following application, and next season, respectively.  
<sup>2</sup>Wheat or small-grain crops may be planted for a cover crop the fall following prometryn application, but may not be harvested for feed or food.  
<sup>3</sup>Wheat may be planted for a cover crop at any time but cannot be harvested for food or feed or grazed if planted less than 9 months after treatment.  
<sup>4</sup>Barley, triticale, and oats can be planted immediately. Other grains require 45 days before planting.  
<sup>5</sup>Barley, oats, and rye may be replanted after 4 months  
<sup>6</sup>Do not plant wheat or barley until next season if rhizome johnsongrass or red rice or itchgrass suppression rates are applied.  
<sup>7</sup>Corn may be planted 10 months after Staple LX application was made in cotton providing that the total amount of Staple LX from all applications does not exceed 3.8 fluid ounces per acre. No additional soil mixing is required beyond that normally performed for a production system  
<sup>8</sup>In addition to the 10-month interval, a successful field bioassay must be conducted. This requires a test strip of the rotational crop be grown to maturity.  
<sup>9</sup>This applies to applications of 2 ounces per acre or less; additionally, 1 inch of rainfall or irrigation must occur between application and planting.  
<sup>10</sup>Cotton may be planted 1 to 4 months after a fall/winter post-harvest application or early-spring preplant application according to rate applied.



## Cotton, Postharvest/fallowbed/preplant foliar

Postharvest/fallowbed or preplant foliar herbicide applications are designed to provide residual control of winter annuals or burndown of existing vegetation. Applications can be made during or after fall tillage, up to various time intervals before planting, depending on which herbicide is used. Fall application of residual herbicides can reduce the need for spring tillage or spring burndown herbicides. However, exceeding the maximum use rates in any single year is possible with certain herbicides. Also, fall application of most herbicides eliminates the possibility of fall cover crops becoming properly established. For expected levels of control for various weeds, see the tables presented earlier in this section: *Cotton, Estimated levels of preplant foliar weed control normally expected* and *Cotton, Estimated levels of weed control normally expected*.

Active chemical per treated land acre	Formulation needed to treat 1 acre broadcast (See Appendix 1 for band rates )	Time of application	Weeds controlled	Special instructions and remarks
dicamba 0.188 to 0.25 lb/A	Clarity 4AS – 6 to 8 fl oz/A	Preplant for vegetation knockdown.	Cutleaf evening primrose, buttercup species, clovers, Pennsylvania smartweed, and other winter annual weeds.	Consult the label to determine rates for weeds and growth stages. Include nonionic surfactant at 0.25% v/v. If applied in the spring following a fall application the total amount applied cannot exceed 2 pounds of active ingredient per acre. Clarity applied as a preplant burndown treatment must be applied at least 21 days before planting. Consult the label for added restrictions following a fall application.
flumioxazin at 0.064 lb/A	Valor SX at 2 oz/A	14 to 30 days depending on application rate and tillage system.	Provides some postemergence activity on emerged weeds. Provides excellent residual control of most broadleaf weeds and suppression of annual grass weeds.	A spray-grade nitrogen (2 to 2.5 pounds per acre of AMS or 1 to 2 quarts per acre of 28 or 32% UAN) source can be added to spray mixture along with COC, methylated seed oil, or nonionic surfactant. Nitrogen addition should not replace spray adjuvant. When applying with a glyphosate formulation preformulated with a spray adjuvant, additional adjuvant is not required.
fomesafen at 0.25 lb ai/A	Reflex at 1 pt/A	Apply 14-21 days before planting cotton.	Reflex will provide preemergence control of Palmer Amaranth (including glyphosate-resistant Palmer amaranth), and control or partial control of other broadleaf weeds, sedges, and grasses listed on the federal label.	Application must be at least 14 days before planting and a minimum of 0.5 inch of rainfall or overhead irrigation must occur before planting cotton on medium soils. Do not disturb or rework soils following a Reflex application. Cotton must be planted at least 0.75 inches in depth. Avoid overlapping spray swaths. The use of an in-furrow or seed applied fungicide will generally assist with seedling establishment and development.
glyphosate at 0.37 to 0.75 lb ae/A	Consult label for rates	After weed emergence.	Consult label for a complete list of weeds controlled.	Refer to glyphosate product label for surfactant/adjuvant recommendation for specific glyphosate formulation. Use the higher rate for larger weeds or heavy infestations. Use of flood-jet nozzles is not suggested. If tillage is intended after treatment, wait at least 3 days (7 days for rhizome johnsongrass). Cultivation before johnsongrass emergence will result in better control after glyphosate application. Avoid drift to nearby crops or areas not intended to be treated. Do not use with galvanized (zinc-coated) spray equipment.
MSMA at 2 lb/A	MSMA – 2.7 pt of a 6 lb per gal formulation in 10 to 20 gal water/A. Add 1 qt nonionic surfactant to each 100 gal of spray mix unless formulation contains surfactant.	After weeds emerge but before planting cotton.	Most annual grasses and cocklebur. Weak on most other broadleaf weeds. Top kill of Johnsongrass.	This treatment is useful where planting was delayed and weeds have emerged. Control decreases in cool weather. Cotton may be planted immediately after spraying.
norflurazon at 1 to 2 lb/A	Solicam DF – 1.25 to 2.5 lb/A	Surface applied in fall after final disking or bed formation.	Annual bluegrass, chickweed, bittercress. Poor control of henbit and Carolina geranium.	Do not exceed broadcast rates of 1.25 pounds per acre for light soils, 1.9 pounds per acre on medium soils, or 2.5 pounds per acres on heavy soils in any year.
paraquat at 0.625 to 1 lb/A	Gramoxone Inteon (2 lb/gal) – 2.5 to 4 pt/A. Add 1 qt surfactant per 100 gal water or 1% v/v COC. Minimum application volume of 10 gal/A by ground and 5 gal/A by air.	For burndown of existing vegetation before planting, but before weeds are 6 inches tall.	Top kill of most annual and perennial weeds and grasses. Perennials will regrow.	Paraquat is nonselective, so avoid spray drift onto desirable vegetation. Use the low rate on weeds under 2 inches tall.

**Cotton, Postharvest/fallowbed/preplant foliar - *continued***

Active chemical per treated land acre	Formulation needed to treat 1 acre broadcast (See Appendix 1 for band rates)	Time of application	Weeds controlled	Special instructions and remarks
pendimethalin at 0.75 to 1 to 1.5 lb/A	Prowl H2O 3.8L – 1.5 to 2 to 3 pt/A	Up to 15 days before planting	Most winter annuals and other small seeded annuals.	Incorporate within 7 days of application if rainfall does not occur. Do not apply to soils or soils subject to prolonged flooding.
prometryn at 0.75 to 1 lb/A	4 lb/gal formulation – 1.5 to 2 pt/A with crop oil concentrate.	Nov. 1 up to 30 days before planting.	Residual control of most winter annuals and postemergence control of small (less than 2 inches) existing vegetation.	Use the high rate for early applications and the low rate for application nearer to planting. Use crop oil concentrate if vegetation is present at time of application. If weeds are large than 2 inches, addition of Gramoxone or Roundup may improve control. Do not make multiple applications to exceed seasonal maximum rate for cotton.
oxyflourfen at 0.25 to 0.5 l/A	Goal 2XL – 1 to 2 pt/A in a minimum of 20 gal water by ground	Early fall up to 7 days before planting.	Residual control of most winter annuals, especially henbit. Postemergence control of henbit, common groundsel, and shepherd's purse up to the 4-leaf stage with the addition of suitable surfactant. Fair control of chickweed.	Use the lower rate for short residual (late winter, early spring) application. Use the higher rate for long residual (fall, early winter) applications. Soil must be tilled to a depth of 2 inches before planting unless treatment is 30 days or more before planting and at least three rainfalls of 0.25 inch or more have fallen since application. For best preemergence activity, rainfall or irrigation should occur within 3 to 4 weeks after application, and the soil should be left undisturbed during the period of desired weed control.
thifensulfuron + tribenuron at 0.25 to 0.4 oz/A	FirstShot – 0.5 to 0.8 oz/A with NIS at 1 qt per 100 gal water or 1% v/v COC	After weed emergence but 45 days before planting	Postemergence control of winter weeds such as curly dock, chickweed, henbit, and buttercup.	Apply to young, actively growing weeds. Allow 1 to 3 weeks after application for full control. May be mixed with other preplant herbicides to broaden weed spectrum.
trifloxysulfuron at 0.075 oz/A	Envoke 75 DF – 0.1 oz/A with 1 qt NIS per 100 gal of water	Minimum of 90 days before planting.	Excellent control of many broadleaf weed species, including henbit and horseweed.	If weeds are emerged at the time of application, tank mix with Envoke with Gramoxone Inteon or glyphosate. DO not exceed a total of 0.4 ounce per acre of Envoke from all applications in one season.
trifluralin at 1 to 1.25 lb/A	4 lb/gal formulation – 2 to 2.5 pt/A	Apply and incorporate any time between Oct. 15 and Dec. 31. May be left flat or bedded	Annual bluegrass, chickweed, henbit, and other winter annuals	Do not apply to wet soils or soils subject to flooding.

**Cotton, Preplant incorporated**

Active chemical per treated land acre	Formulation needed to treat 1 acre broadcast (See Appendix 1 for band rates)	Time of application	Weeds controlled	Special instructions and remarks
norflurazon at 1 to 2 lb/A	Solicam DF – 1.25 to 2.5 lb/A depending on soil texture.	Within 30 days of planting.	Most annual grasses and small-seeded broadleaf weeds. Good to excellent control of prickly sida and good control of spurred anoda.	Incorporate no deeper than 2 to 3 inches after beds have been reduced for planting. Do not use where johnsongrass or morning glory is a major problem. Incorporation offers potential advantages over surface application: (1) better control under early-season dry conditions; (2) better suppression of deep germinating weeds such as cocklebur and morningglory; and (3) better suppression of perennials such as nutsedge and bermudagrass. The application also may be split with half the rate preplant incorporated and the other half applied on the surface after planting.

Cotton, Preplant incorporated - *continued*

Active chemical per treated land acre	Formulation needed to treat 1 acre broadcast (See Appendix 1 for band rates)	Time of application	Weeds controlled	Special instructions and remarks
pendimethalin at 0.48 to 1.9 lb/A	Prowl H <sub>2</sub> O 3.8L – 1 to 4 pt/A depending on soil texture and tillage system	Preplant incorporated – up to 60 days before planting; Preplant surface – up to 15 days before planting.	Residual control of most annual grasses and small-seeded broadleaf weeds, such as purslane and pigweed.	Use 1 to 2 pints per acre on coarse-textured soils (conventional or reduced tillage systems) and 2 pints per acre on coarse textured soils under no-till systems. Use 2 pints per acre on medium-textured soils for conventional or reduced tillage and 3 pints per acre in no-till. Use 3 pints per acre on fine-textured soils in conventional or reduce tillage and 4 pints per acre in no-till. Incorporate 1 to 2 inches deep immediately after application for best results. When making band applications, avoid removal of treated soil from the seed-bed during incorporation and planting.
trifluralin at 0.5 to 0.75 to 1 lb/A	4 lb/gal formulation – 1 to 1.5 to 2 pt/A or 5 lb/gal formulation - 0.8 to 1.2 to 1.6 pt/A in 5 gal water by air or 10 gal water by ground	Any time after Jan. 1 to immediately before planting.	Most annual grasses and small-seeded broadleaf weeds, such as pigweed and purslane.	Incorporate 1 to 2 inches deep immediately after application for best results. A 30% loss can occur if incorporation is delayed 24 hours. When making band applications, avoid removal of treated soil from seed-bed during incorporation and planting.

## Cotton, Preemergence

Preemergence herbicide applications should be made after planting but before weed or crop emergence. Avoid planting cotton seed less than 0.5 inch deep to avoid excessive injury during periods of heavy rainfall. Substituted-urea herbicides such as fluometuron or diuron may interact when used in combination with organophosphate insecticides at planting, resulting in cotton injury. Use of an organophosphate insecticide, in-furrow, is mandatory when applying clomazone preemergence.

Active chemical per treated land acre	Formulation needed to treat 1 acre broadcast (See Appendix 1 for band rates)	Time of application	Weeds controlled	Special instructions and remarks
clomazone at 0.5 to 1 lb/A	Command 3 ME at 1.33 to 2.67 pt/A	At planting.	Excellent control of annual grasses and many small-seeded broadleaf weeds, except pigweed. Use low rate when only velvetleaf control is desired. Addition of fluometuron at recommended rates improves morningglory and cocklebur control.	Use an organophosphate insecticide, in-furrow, to prevent cotton injury! Failure to do so will result in severe cotton injury and stand loss. These insecticides may, however, cause injury when used with fluometuron and diuron. Clomazone has a high potential for off-site movement by drift and/or volatility. Do not apply within 1,200 feet of residential areas, unsafened cotton, horticultural crops, and other sensitive species. Do not apply during periods of high winds over 10 mph and/or expected heavy rainfall. Apply to dry soil when potential for drift is low. Use low pressure and drift control agents where possible.
diuron at 0.5 to 1.0 to 1.6 lb/A	4 lb/gal liquid formulation – 1 to 2 to 3.2 pt/A in 10 to 20 gal water	At planting.	Most annual grasses and small-seeded broadleaf weeds. Fair to good control of prickly sida and morningglory.	If stand failure occurs, cotton may be replanted through the treated band with minimum disturbance of treated soil. In a single season, do not exceed 0.8 pound of active ingredient on loamy sand, 1.2 pounds on sandy loam, 1.6 pounds on clay loam, or 2.2 pounds on clay. Injury may occur if used with soil-applied organophosphate pesticides. Rebed only after thorough tillage.
fluometuron at 0.75 to 1.5 to 2 lb/A	4 lb/gal formulation – 0.75 to 1.5 to 2 qt/A	At planting.	Most annual grasses and small-seeded broadleaf weeds. Good to excellent control of prickly sida and morningglory.	If stand failure occurs, cotton may be replanted through the treated band with minimum disturbance of treated soil. Injury may occur if used with soil-applied organophosphate pesticides. Rebed only after thorough tillage.

**Cotton, Preemergence - *continued***

Active chemical per treated land acre	Formulation needed to treat 1 acre broadcast (See Appendix 1 for band rates)	Time of application	Weeds controlled	Special instructions and remarks
fluometuron at 1 to 1.5 to 2 lb/A + metolachlor at 0.75 to 1 to 1.33 lb/A or S-metolachlor at 0.48 to 1.27 lb/A	Cotoran 4L – 2 to 3 to 4 pt/A + Parrlay – 0.75 to 1 to 1.33 pt/A or Dual Magnum – 0.5 to 1.33 pt/A	At planting.	Most annual grasses and small-seeded broadleaf weeds. Good to excellent control of prickly sida and morning glory. Addition of Parlay or Dual improves control of annual grasses, spurge, and yellow nutsedge.	Plant seed at least 1 inch deep to reduce possibility of injury. Use the high rate of Dual or Parlay on fine-textured soils containing appreciable clay. If stand failure occurs, cotton may be replanted through the treated band with minimum disturbance of treated soil or the area may be reworked in several ways before replanting. Rebed only after thorough tillage.
fomesafen at 0.25 to 0.375 lb ai/A	Reflex at 1 to 1.5 pt/A	At planting on coarse textured soils only (sandy loam, loamy sand, sandy clay loam).	Control or suppression of broadleaf, grass, and sedge weeds. Good to excellent control of morningglory, prickly sida, pigweed, and yellow nutsedge.	Use a minimum of 10 gallons per acre spray volume. Rainfall within 7 days of application is necessary for activation. Some cotton injury can occur if rain falls during or soon after cotton emergence. Do not apply more than 1.5 pints per acre during the growing season.
norflurazon at 1 to 1.5 to 2 lb/A	Solicam DF – 1.25 to 1.9 to 2.5 lb/A in 10 to 20 gal water	At planting.	Most annual grasses and small-seeded broadleaf weeds. Good to excellent control of prickly sida, and good control of spurred anoda. Inadequate control of morningglory.	If stand failure occurs, cotton, soybeans, or peanuts may be replanted through the treated band with minimum disturbance of the treated soil, or the area may be reworked. Rebed only after thorough tillage. Norflurazon also may be applied preplant incorporated or as a split application with half preplant incorporated and the other half preemergence. See the preplant incorporated section.
pendimethalin at 0.5 to 0.75 to 1 lb/A	Prowl H2O 3.8L – 1 to 1.5 to 2 pt/A	Within 2 days after planting	Most grasses from seed and some small-seeded broadleaf weeds, such as pigweed and purslane.	Rainfall or overhead irrigation is needed within 7 days for activity. Seedling diseases, cold weather, excessive moisture, shallow or deep planting, low or high soil pH, high soil salt concentration, or drought can weaken seedlings and increase the possibility of crop damage.
pyrithiobac at 0.0325 to 0.0525 lb ai/A	Staple LX at 1.3 to 2.1 oz/A.	At planting.	Spurge, pigweed, and prickly sida.	Do not use on coarse soils such as sands or loamy sands.

**Cotton, Postemergence, directed**

Many of the suggested postemergence treatments include MSMA with another herbicide for broader spectrum weed control. Costs can be reduced by omitting the MSMA where nutsedge, cocklebur or grasses are not a problem. When omitting MSMA in the spray mixture, be sure to add surfactant.

Use of arsenical herbicides (DSMA and MSMA) is limited to two applications whether used alone or in combination with other herbicides. Timely directed applications are preferable to over-the-top applications because of better weed control and less cotton injury. Do not apply DSMA or MSMA after first bloom. A number of instances of MSMA/DSMA resistance in common cocklebur have been documented.

**3-inch cotton or larger**

Active chemical per treated land acre	Formulation needed to treat 1 acre broadcast (See Appendix 1 for band rates)	Time of application	Weeds controlled	Special instructions and remarks
DSMA at 3.6 lb/A or MSMA at 2 lb/A	DSMA – 8 pt/A of a formulation containing 3.6 lb/gal DMSA hexahydrate equivalent in 20 gal water or MSMA – 2.7 pt/A of a 6 lb/gal formulation in 20 gal water	Apply once or twice after the smallest cotton reaches a height of 3 inches	Most annual grasses, susceptible cocklebur, and some other annual broadleaf weeds. Nutsedge and small johnsongrass plants will be topkilled. Combinations with other herbicides more effective on goose grass than when used alone.	DSMA is preferred for the first application when cotton is small or stressed from adverse weather, disease, thrips, etc. Do not apply after first bloom. Addition of fluometuron or prometryn will broaden the spectrum of weeds controlled. This treatment is more effective during hot, dry periods than in cool, wet periods. For both DSMA and MSMA, add 1 quart of surfactant per 100 gallons of spray mix unless the formulation contains surfactant.

**3-inch cotton or larger - *continued***

Active chemical per treated land acre	Formulation needed to treat 1 acre broadcast (See Appendix 1 for band rates)	Time of application	Weeds controlled	Special instructions and remarks
fluometuron at 0.8 lb/A (or plus DSMA or MSMA, see above)	4 lb/gal formulation – 0.8 qt/A in 20 gal. Add 1 qt surfactant for each 100 gal of spray mix.	Apply once or twice when cotton is 3 to 6 inches tall.	Annual grasses and most seedling broadleaf weeds.	This treatment is relatively safe on young cotton and also provides residual preemergence weed control.
prometryn at 0.5 lb/A (or plus DSMA or MSMA, see above)	4 lb/gal formulation – 1 pt/A in 20 gal. Add 1 qt surfactant for each 100 gal of spray mix.	Apply once or twice after cotton is 3 inches tall.	Most seedling broadleaf weeds including prickly sida if sprayed before 2 inches tall. Addition of DSMA or MSMA improves grass control.	Do not apply at the 3-inch stage if cotton is stressed. Provides some residual preemergence control in addition to killing emerged weeds.

**6-inch cotton or larger (in addition to herbicides listed for smaller cotton)**

Active chemical per treated land acre	Formulation needed to treat 1 acre broadcast (See Appendix 1 for band rates)	Time of application	Weeds controlled	Special instructions and remarks
carfentrazone 0.012-0.024 lb/A	Aim 2EC – 0.8 to 1.6 oz/A	Cotton should be at least 6 inches tall with 5 to 6 nodes.	Morningglories, pigweed, and velvetleaf.	Applications to shorter than 6 inches must be made with cotton hooded or shielded sprayer equipment to completely avoid contact with cotton plants. Directed spray equipment should position nozzles a minimum of 3 to 4 inches above the soil, with nozzles directed under the crop canopy. Do not allow spray solution to contact cotton foliage or green stem tissue. Coverage is essential for good control. For control of additional broadleaf weeds and grasses, Aim herbicide may be tank mixed with glyphosate, Staple LX, Caparol, Cotoran (or other products containing Fluometuron), Karmex, MSMA, or other herbicides registered for cotton postdirected and/or layby applications. Do not apply more than 3.2 ounces of 2EC total per season by postdirected and layby applications. Use a crop oil concentrate at 1% v/v (1 gallon per 100 gallons of spray solution).
diuron at 0.2 to 0.5 lb/A (or plus DSMA or MSMA, see above)	80% formulation – 0.25 to 0.62 lb/A or 4L formulation 0.4 to 1 pt/A in 20 gal water. Add 1 qt surfactant to each 100 gal of spray mix.	Apply once or twice after cotton is 6 inches tall.	Most seedling broadleaf weeds. Addition of MSMA or DSMA improves grass control.	Apply as directed spray. Diuron plus MSMA provides better weed control under a wide range of growing conditions than either herbicide alone. Use the higher rate of diuron as cotton and weeds become larger. The higher rate provides some residual preemergence control in addition to emerged weeds.
fomesafen at 0.25 to 0.375 lb ai/A	Reflex at 1 to 1.5 pt/A in a minimum of 10 gal water. Add 1% v/v crop oil concentrate or 1 qt surfactant for each 100 gal of spray mix.	Apply to emerged cotton.	Control or suppression of broadleaf, grass, and sedge weeds. Good to excellent control of morningglory, pigweed, common ragweed, hemp sesbania, and Pennsylvania smartweed.	Apply postdirect to cotton at least 6 inches tall. Use shielded or hooded applications on 6- to 12-inch cotton. Contact with cotton foliage can cause significant injury. Adjust nozzles to provide complete coverage of weeds. Do not apply with liquid nitrogen. Do not apply within 70 days of cotton harvest. Do not apply more than 1.5 pints per acre per season.
lactofen at 0.2 lb/A (or plus DSMA or MSMA, see above)	Cobra 2E – 0.8 pt in 20 gal water. Add 0.5 to 1 pt/A crop oil concentrate for cotton 6 to 8 inches tall or 1 to 2 pt/A for cotton taller than 12 inches	Apply once or twice after cotton is 6 inches tall.	Most small broadleaf weeds. Addition of MSMA or DSMA improves grass control.	For best results, spray weeds before 3-inch height. Use a well directed basal spray to minimize cotton injury. Height differential between cotton and weeds is important since good spray coverage on the weeds is necessary for control.

6-inch cotton or larger (in addition to herbicides listed for smaller cotton) - *continued*

Active chemical per treated land acre	Formulation needed to treat 1 acre broadcast (See Appendix 1 for band rates)	Time of application	Weeds controlled	Special instructions and remarks
linuron 0.5 to 0.75 lb/A	1 to 1.5 pt/A of Linex 4L	When cotton is at least 8 inches tall and weeds are not over 2 inches tall.	Annual grass and broadleaf species.	Linex 4L or Lorox 50DF should be applied as a directed spray with nozzles adjusted to minimize contact with cotton. 1 pt of surfactant may be added for each 25 gallons of spray mixture if emerged weeds are present. If a second application is needed, use the same rate and apply 1 week or more after first treatment. Do not use this treatment on Pima varieties. Do not feed forage or gin trash from treated areas to livestock. Do not graze treated fields.
linuron + diuron 0.25 to 0.375 + 0.25 to 0.375 lb/A	LaybyPro 4L 1 to 1.5 pt/A	When cotton is 6 to 8 inches tall.	Annual grass and broadleaf weeds.	Apply as a directed spray. Use the lower rate on 6-inch cotton and the higher rate on 8-inch cotton or taller. For control of emerged weeds, add a nonionic surfactant at 0.5% v/v or a crop oil concentrate at 1%v/v. Do not use a crop oil concentrate on cotton that is less than 12 inches in height.
oxyflourfen at 0.25 or 0.5 lb/A (or plus DSMA or MSMA, see above)	Goal 2XL – 1 or 2 pt/A in 20 gal water. Add 1 qt of surfactant for each 100 gal of spray mix.	After cotton is 6 inches tall and before weeds have more than 4 true leaves.	Most seedling broadleaf weeds including prickly sida, morningglory, and hemp sesbania. Addition of MSMA or DSMA improves grass control.	Good spray coverage on the weeds is essential for control. Oxyflourfen is most effective under optimum growing conditions. Use the higher rate on larger weeds or under drought conditions.
prometryn + trioxysulfuron 0.8 to 1.2 lb/A + 0.007 to 0.0105 oz/A	Suprend 80DF 1 to 1.5 lb/A	When cotton is at least 6 inches tall	Controls morningglories, velvetleaf, smooth pigweed, tall waterhemp, sicklepod, cocklebur, and hemp sesbania while providing suppression of various other broadleaf and grass species.	For best results apply to weeds less than 6 inches in height. Do not apply within 60 days of harvest. Use postdirected application methods to provide coverage of weed foliage while adjusting nozzles to minimize contact of cotton foliage with spray or drift. Do not exceed a total of 2.7 pounds per acre of Suprend per season. Do not exceed a total of 0.0188 pound of active ingredient of trioxysulfuron per acre per season in applications of Suprend or Envoke. Application of Suprend to soils with pH higher than 7.5 may increase the potential for rotational crop injury. Unacceptable cotton injury may occur if you tank-mix Suprend with malathion, profenofos (Curacron) or emamectin-benzoate-containing insecticides (Denim), acephate, Bidrin, Capture, or Karate. A nonionic surfactant at 0.25% v/v or 1% v/v of COC should be used with Suprend.
pyroxasulfone at 0.04 to 0.11 lb/ac	0.75 to 2.1 ozs/A	Directed broadcast from 5-leaf stage to beginning bloom.	Annual grasses including barnyardgrass, large and smooth crabgrass, seedling johnsongrass, broadleaf signalgrass, foxtail species and goosegrass, annual broadleaf weeds such as palmer amaranth, lambsquarters, prickly sida, entireleaf morningglory and suppression of horseweed (Marestail), common ragweed and velvetleaf. See label for complete listing of weeds controlled or suppressed.	Only one application per year. Provides control of weeds germinating after application. Will <b>not</b> control emerged weeds. Hooded or shielded sprayers recommended to minimize contact with cotton foliage. DO NOT use as a preplant, preemergence, or postemergence over the top treatment. See label for rates, tank mix partners and other restrictions.

## Cotton, Postemergence, over-the-top

Active chemical per treated land acre	Formulation needed to treat 1 acre broadcast (See Appendix 1 for band rates)	Time of application	Weeds controlled	Special instructions and remarks
clethodim at 0.0625 to 0.125 lb/A	Select Max - 12 to 16 oz/A when applied alone or 9 to 16 oz/A when applied with glyphosate (see Appendix 2) in 10 to 30 gal/A by ground or 3 gal/A by air. Add 1 qt/A crop oil concentration.	Apply to actively growing grasses up to 60 days before harvest (see Appendix 2).	Annual and perennial grasses.	Apply over the top or semi-directed to cover grasses. Adjust spray volume and pressure to ensure thorough coverage of grass. Do not apply more than 32 ounces per acre per season. Do not apply within 1 hour of anticipated rainfall. Do not apply to stressed grasses. Do not cultivate within 7 days of application.
DSMA at 1.2 to 3.2 lb/A or MSMA at 0.75 to 1 lb/A	1 to 1.3 pt/A of a 6 lb/gal MSMA formulation or 1.6 to 4.3 pt/A of a 3.6 lb/gal DSMA formulation in 10 to 20 gal water. Add 1 qt nonionic surfactant to each 100 gal of spray mix unless formulation contains surfactant.	Apply when cotton is 3 to 6 inches tall. Do not apply after first square or when cotton is more than 6 inches tall.	Excellent control of susceptible cocklebur and small annual grasses. Poor control of hemp sesbania and prickly sida.	Use as a salvage treatment only. Possible burning and reddish color of foliage may appear. May delay cotton maturity. Do not tank mix with other herbicides. Apply only to healthy cotton under favorable growing conditions.
fluometuron at 0.5 to 1 lb/A	4 lb/gal formulation – 1 to 2 pt/A. Add 1 qt surfactant for each 100 gal of spray mix.	Apply after cotton reaches 3 inches and weeds are as small as possible.	A wide spectrum of annual weed seedlings controlled or suppressed to allow more effective directed sprays later.	Use as a salvage treatment only. Crop injury may occur. Apply only to healthy cotton under favorable growing conditions. Use the higher rate on vigorously growing cotton and bigger weeds.
fluaizop at 0.094 to 0.188 lb/A	Fusilade DX – 0.375 to 0.75 pt/A in a minimum of 5 gal water by air or ground equipment. Add either a crop oil concentrate at 1% or a surfactant at 0.25%.	Apply to actively growing grasses (see Appendix 3).	Most annual grasses, rhizome johnsongrass, and bermudagrass (see Appendix 3).	Apply over the top of cotton or as a semi-directed spray to the grass at rates given in Appendix 3. Adjust spray volume and pressure to ensure thorough coverage of grass foliage. For annual grasses, re-treat if needed for late emerging grasses. If regrowth of johnsongrass or bermudagrass occurs following the first application, a second application can be made as indicated in Appendix 3. Do not apply more than 48 ounces per acre per season. Do not apply after boll set or within 90 days of harvest.
metolachlor at 0.75 to 1.33 lb/A or s-metolachlor at 0.48 to 1.27 lb/A	Parrlay – 0.75 to 1.33 pt/A or Dual Magnum – 0.5 to 1.33 pt/A	Apply when cotton is 3 to 12 inches tall.	Preemergence control of annual grasses and small-seeded broadleaf weeds.	This treatment will not provide postemergence control of emerged species. Do not apply within 100 days of harvest.
pyrithiobac at 0.065 to 0.095 lb ai/A	Staple LX at 2.6 to 3.8 oz/A. Add nonionic surfactant at 1 qt per 100 gal of spray mix.	From 1-true-leaf cotton up to 60 days before harvest; after weed emergence up to 1- to 4-inch weeds, except sicklepod and prickly sida.	Excellent postemergence control of most broadleaf weeds. Poor grass control.	Optimum control depends upon proper timing, thorough coverage of weed foliage, and a well-designed pre-emergence program. Do not tank mix with insecticides containing malathion. Staple antagonizes grass control with postemergence grass herbicides. Adequate control can be achieved by treating grass 3 to 5 days before or 5 to 7 days after Staple application. Apply as a “sloppy” post-directed spray when applying Staple with MSMA or DSMA. Do not tank mix with Dual as a postemergence treatment. Do not exceed 3.8 ounces per acre in a single application or 5.1 ounces per acre per season. Do not apply within 60 days of harvest. If the rate does not exceed 3.8 ounces per acre, corn may be planted 10 months after the last application. Apply to prickly sida up to 1 inch tall for adequate control. See label for sicklepod program.
pyrithiobac + glyphosate 0.0325 to 0.095 lb ai/A + 0.77 lb ae/A	Staple LX at 1.3 to 3.8 oz/A plus glyphosate formulation as per product label.	May be applied over the top of Roundup Ready through the 4-true-leaf stage and over the top of Roundup Ready Flex until 60 days before harvest.	Excellent post emergence control of most broadleaf, grass, and sedge weeds.	See the previous instructions for pyrithiobac. For over-the-top application to Roundup Ready Flex cotton, use only glyphosate formulations approved for Roundup Ready Flex varieties.

**Cotton, Postemergence, over-the-top - *continued***

Active chemical per treated land acre	Formulation needed to treat 1 acre broadcast (See Appendix 1 for band rates)	Time of application	Weeds controlled	Special instructions and remarks
quizalofop at 0.0313 to 0.0625 lb/A	Assure II – 5 to 10 oz/A in a minimum of 10 gal/A by ground or 2 gal/A by air. Add crop oil concentrate at 1% v/v or nonionic surfactant at 0.25% v/v. Use crop oil at 0.5% v/v for aerial application. Use only petroleum-based crop oils.	Apply to actively growing grasses any time prior to 80 days before harvest (see Appendix 4)	Annual and perennial grasses; excellent control of johnsongrass.	Apply over the top or semi-directed to cover grasses. Adjust pressure and spray volume to ensure thorough coverage of grass. Do not apply using crop-origin (vegetable) oils as an adjuvant or carrier. Do not apply more than 18 fluid ounces per season. Do not apply within 24 hours of a postemergence broadleaf herbicide. Do not cultivate within 7 days of application.
sethoxydim at 0.19 to 0.28 lb/A	Poast Plus – 1.5 to 2.25 pt/A in a minimum of 5 gal water by air or ground equipment. Add a crop oil concentrate at 1 qt/A with aerial and ground applications.	Apply to actively growing grasses (see Appendix 5)	Most annual grasses, seedling and rhizome johnsongrass, and bermudagrass.	Apply over the top of cotton or as a semi-directed spray to the grass. Adjust spray volume and pressure to ensure thorough coverage of grass foliage. Apply at rates and growth stages given in Appendix 5. If more annual grasses emerge after the first application, then a second application can be made. A second application can be made to control regrowth of johnsongrass and bermudagrass. Do not apply within 40 days of harvest.
trifloxysulfuron 0.08 - 0.11 oz/A	Envoke 75 DG 0.1 – 0.15 oz/A	When cotton has reached a minimum of 5 true leaves.	Morningglories, sicklepod, pigweed, and nutsedge.	Envoke may cause a temporary yellowing or stunting of cotton plants, but they usually recover quickly. A nonionic surfactant should be added to the spray solution at 0.25% v/v. Do not apply in combination with any other herbicide when applied over-the-top. Envoke may be tank mixed with other products when applied as a post-directed spray (see label for specifics). Do not tank mix with insecticides containing malathion, profenofos, or emamectin-benzoate or unacceptable injury may occur. Envoke antagonizes grass control with postemergence grass herbicides. Do not apply these products within 7 days of Envoke application.

CULTIVATION – use so that the soil moved by it will not interfere with subsequent use of postemergence herbicides. Cultivation will not normally detract from the control obtained from the previously applied herbicides, but frequently will offer an economical means of extending or completing control established by herbicides. Deep cultivation (more than 2 inches) usually is not necessary and may damage the crop.

**Liberty Link cotton varieties only**

Active chemical per treated land acre	Formulation needed to treat 1 acre broadcast (See Appendix 1 for band rates)	Time of application	Weeds controlled	Special instructions and remarks
glufosinate at 0.4 to 0.78 lb ai/A	Liberty at 22 to 29 oz/A. Single application rate can be as high as 43 oz/A.	Apply to tolerant cotton from emergence to early bloom. Weeds should not exceed 3 to 6 inches.	Excellent control of cocklebur, hemp sesbania, and morningglory species. Good control of sicklepod and some pigweed species.	For use only in Liberty Link cotton. Ground application should be applied in a minimum of 15 gallons of spray mix. Do not apply more than 72 to 87 fluid ounces per acre in a single growing season. The maximum total application rate is dependant upon whether Ignite was applied at burndown, as well as the application rate at that time. Do not apply within 70 days of harvest.



## Roundup Ready cotton varieties only

Active chemical per treated land acre	Formulation needed to treat 1 acre broadcast (See Appendix 1 for band rates)	Time of application	Weeds controlled	Special instructions and remarks
glyphosate at 0.375 to 0.75 lb ae/A	see product label for rates	After weed emergence but before cotton reaches 4-leaf stage.	Postemergence control of most annual broadleaf and grass weeds, including johnsongrass. A well-designed preemergence program is recommended for optimum control.	For use only on Roundup Ready cotton. Do not apply over the top beyond 4-leaf stage. Allow two nodes of growth and 10 days between sequential applications. Do not mix with surfactants. Topical applications beyond the 4th leaf stage reduces early season fruit retention. Apply as a postdirected spray after the 4th leaf stage. Postdirecting does not ensure tolerance. Use precision with postdirect applications, and minimize cotton contact with spray solution. Multiple applications without allowing sufficient growth between treatments and/or improper application causes abnormal fruiting patterns and yield losses.
S-metolachlor + glyphosate acid at 0.94 to 1.33 lb/A + 0.70 to 0.98 lb/A	Sequence 2.5 to 3.5 pt/A	Make postemergence applications from 3-inch cotton up to the 4th leaf stage.	Postemergence control of most annual broadleaf and grass weeds. Preemergence control of annual grasses and small-seeded broadleaf weeds.	For use only on Roundup Ready cotton. Do not apply beyond the 4-leaf stage of cotton development as severe injury, including yield loss, could occur. Do not exceed 2.5 pints per acre of Sequence in a single application, and do not exceed 3.5 pints per acre in a season. Do not apply within 100 days of harvest.

## Roundup Ready Flex cotton varieties

Active chemical per treated land acre	Formulation needed to treat 1 acre broadcast (See Appendix 1 for band rates)	Time of application	Weeds controlled	Special instructions and remarks
glyphosate at 0.375 to 1.12 lb ae/A	see product label for rates	After weed emergence. May be applied to Roundup Ready Flex cotton until 7 days prior to harvest.	Postemergence control of most annual broadleaf and grass weeds, including johnsongrass. A well-designed residual herbicide program is recommended for optimum control and resistance management.	For use only on Roundup Ready Flex cotton. Drift of this product onto adjacent fields of post 4-leaf (node) Roundup Ready cotton may cause extensive injury including boll loss, delayed maturity, and/or yield loss. Do not apply at rates above 32 fluid ounces per acre. In-crop application rates above 22 fluid ounces per acre made alone or with the addition of other crop chemical products containing surfactant may cause a crop response including leaf speckling or leaf necrosis. From cracking until 60% open bolls, up to 4 quarts may be applied. The maximum allowed from 60% open bolls until 7 days prior to harvest is 44 fluid ounces per acre. The maximum allowed per year, including preplant burndown applications, is not to exceed 5.3 quarts per acre.
S-metolachlor + glyphosate acid at 0.94 to 1.33 lb/A + 0.70 to 0.98 lb/A	Sequence 2.5 to 3.5 pt/A	Make postemergence applications from 3-inch to 12-inch cotton.	Postemergence control of most annual broadleaf and grass weeds. Preemergence control of annual grasses and small-seeded broadleaf weeds.	This treatment is for use only on Roundup Ready Flex cotton. Do not exceed 2.5 pints per acre of Sequence in a single application. Do not exceed 3.5 pints per acre in a season. Do not apply within 100 days of harvest.

**Cotton, Spot treatment**

Active chemical per treated land acre	Formulation needed to treat 1 acre broadcast (See Appendix 1 for band rates)	Time of application	Weeds controlled	Special instructions and remarks
clethodim	Select Max – 12 to 16 oz/A when applied alone or 9 to 16 oz/A when applied with glyphosate. Include 1% COC when applying Select Max alone.	Apply to actively growing grasses up to 60 days before harvest.	Annual and perennial grasses.	Spray to wet foliage but not to the point of runoff.
fluazifop	Fusilade DX 1% + 0.25% surfactant or 1% crop oil concentrate (see Appendix 6).	Apply to all actively growing grasses.	Johnsongrass and bermudagrass.	Apply to 8- to 18-inch johnsongrass or bermudagrass up to 3 inches tall before runners are 8 inches long. Spray grass to wet all foliage but not to the point of runoff. Do not apply more than 48 ounces per acre per season. Do not apply after boll set or within 90 days of harvest.
glyphosate spray	glyphosate – 1% solution in water for most weeds, including johnsongrass. Increase to 2% solution for harder-to-control perennials, such as bermudagrass.	Spray to wet foliage of weeds before cotton bolls open.	Johnsongrass, bermudagrass, trumpet creeper, and most other emerged annual and perennial weeds.	Treatment is most effective on large, actively growing weeds. Conventional cotton sprayed with herbicide solution will be severely injured or killed. Avoid windy conditions and high pressure to minimize cotton injury. Repeat treatments may be necessary to control weeds regenerating from underground parts or seed. See label for details.
glyphosate rope wick	glyphosate – 1 gal + 2 gal water. Quantity used per acre will vary depending on the density of weeds. Do not add surfactant to the herbicide solution.	Apply when johnsongrass is at least 18 inches tall and 8 inches taller than crop plants.	Johnsongrass.	Use rope wick made of polyester over acrylic. Position wick bar 2 to 4 inches above crop plants to avoid contact with herbicide-laden rope. Repeat applications as needed to control johnsongrass that later grows above crop canopy. Treatments may be applied in conjunction with tillage of the crop. Crop will be injured if the herbicide comes in contact with the foliage by dripping or rubbing. Keep ground speed under 5 mph and reduce speed as weed density increases.
quizalofop	Assure II – 0.375% + 1% v/v/ crop oil concentrate or 0.25% nonionic surfactant	Apply to actively growing grasses up to 80 days before harvest.	Annual and perennial grasses.	Treat plants on a spray-to-wet basis insuring good coverage.
sethoxydim	Poast Plus – 1.5% +1% crop oil concentrate (see Appendix 7)	See Appendix 7	Bermudagrass and johnsongrass	Mix as shown in Appendix 7. Spray grass to wet all foliage but not to the point of runoff. Spray actively growing foliage when johnsongrass is 15 to 20 inches tall and bermudagrass plants do not exceed 6 inches in diameter. Do not apply within 40 days of harvest.

## Cotton, Layby

Active chemical per treated land acre	Formulation needed to treat 1 acre broadcast (See Appendix 1 for band rates)	Time of application	Weeds controlled	Special instructions and remarks
carfentrazone 0.012 – 0.024 lb/A	Aim 2EC– 0.8 to 1.6 oz/A	Layby applications of Aim or Aim tank mixtures at later growth stages may be made when cotton is at least 12 inches tall with sufficient bark development and height differential between bottom leaves and soil.	Morningglories, pigweed, and velvetleaf.	Spray solution should be directed at the base of cotton plants for minimal contact with green stem tissue or foliage while maintaining maximum contact with broadleaf weeds that are at appropriate treatment size. Do not allow spray to contact cotton foliage or green stem tissue. Coverage is essential for good control. For control of additional broadleaf weeds and grasses, Aim herbicide may be tank mixed with other herbicides registered for use in cotton. Aim may be tank mixed with glyphosate, Staple LX, Caparol, Cotoran (or other products containing Fluometuron), Karmex, MSMA, or other herbicides registered for cotton postdirected and/or layby applications. Do not apply more than 3.2 ounces of 2EC total per season by postdirected and layby applications. Use a crop oil concentrate at 1% v/v (1 gallon per 100 gallons of spray solution).
dimethipin 0.23 to 0.55 lb ai/A	Harvade 5F – 6 to 14 oz/A	Apply the tank mix combinations from early postemergence through layby.	Sicklepod and morningglories.	Apply when the young weeds are less than 4 inches tall and the cotton is at least 10 inches tall. If the cotton is less than 10 inches tall, apply the tank mix combination with a hooded sprayer. Direct contact of the spray mixture with cotton leaves and tender stems will result in crop injury. Do not use more than a total of 14 fluid ounces of Harvade 5F per acre per year on your cotton crop for combined postdirected and defoliation applications. A petroleum-based crop oil concentrate (83-17) must be added to the spray mixture at 1 to 2 pints per acre.
diuron at 0.5 to 1 to 1.2 lb/A	4 lb/gal formulation – 1 to 2 to 2.4 pt/A in 20 gal water. Add 1 qt surfactant for each 100 gal of spray mix.	Apply when cotton is at least 12 inches tall.	Most late-emerging annual grasses and small-seeded broadleaf weeds will be controlled if rain occurs within 10 days after treatment. Also, young, actively growing weeds less than 3 inches tall will be controlled.	Apply broadcast spray as indicated. Omit surfactant if no emerged weeds are present at time of treatment. Where the weed problem is light, apply a half rate after the cotton is 12 inches tall and re-treat only if necessary.
flumioxazin 1.02 oz/A	Valor SX 2 oz/A	When cotton is at least 16 inches tall. Apply to 2- to 4-inch emerged weeds.	Provides contact control of cocklebur and morningglories. Provides residual control of morningglories, tall waterhemp, hemp sesbania, and various annual grass species.	Severe crop injury may result if application is made to green or unbarked stem. Do not apply more than 2 ounces of Valor per acre per application, and do not exceed 4 ounces of Valor during a single growing season. Wait at least 30 days between sequential applications, and do not apply within 60 days of harvest. Do not allow spray to come into contact with crop foliage. Use a nonionic surfactant at 0.25% v/v. Do not use a COC, methylated seed oils, organo-silicant surfactants, or products containing these ingredients as severe crop injury may occur. Layby application may be made once cotton is at least 16 inches tall. Valor application should be directed to the bottom of the stem in order to avoid cotton injury.
fomesafen at 0.25 to 0.375 lb ai/A	Reflex at 1 to 1.5 pt/A in a minimum of 10 gal water. Add 1% v/v crop oil concentrate or 1 qt surfactant for each 100 gal spray mix.	When plants have at least 4 inches of brown bark.	Control or suppression of broadleaf, grass, or sedge weeds. Good to excellent control of morningglory, pigweed, common ragweed, hemp sesbania, and Pennsylvania smartweed.	Apply directed to the base of cotton plants with at least 4 inches of brown bark, avoiding contact with any non-barked portions. Adjust nozzles to provide complete coverage of weeds. Do not apply with liquid nitrogen. Do not apply within 70 days of cotton harvest. Do not apply more than 1.5 pints per acre per season.

**Cotton, Layby - *continued***

Active chemical per treated land acre	Formulation needed to treat 1 acre broadcast (See Appendix 1 for band rates)	Time of application	Weeds controlled	Special instructions and remarks
linuron 1 to 1.5 lb/A	Linex 4L – 2 to 3 pt/A	Apply when cotton is at least 20 inches tall and weeds are not over 2 inches tall.	Most late emerging annual grasses and small-seeded broadleaf weeds will be controlled if rain occurs within 10 days after treatment. Also young, actively growing weeds less than three inches tall will be controlled.	Apply as a directed spray with nozzles adjusted to minimize contact to cotton. Omit surfactant if no emerged weeds are present at time of treatment. Where the weed problem is light, apply a half rate after the cotton is 12 inches tall and re-treat only if necessary.
linuron + diuron 0.8 to 1.2 + 0.8 to 1.2 lb/A	Layby Pro 4L 1.6 to 2.4 pt/A	Apply layby to cotton at least 15 inches tall and weeds no more than 4 inches tall.	Annual grass and broadleaf weeds.	For control of emerged weeds, add a nonionic surfactant at 0.5% v/v or a crop oil concentrate at 1% v/v.
pendimethalin at 0.5 to 1.5 lb ai/A	Prowl H <sub>2</sub> O 3.8L – 1 to 3 pt/A depending on soil texture	After last normal soil cultivation (layby).	Most annual grasses and small-seeded broadleaf weeds such as pigweed and purslane.	Apply to the soil between rows as a directed spray following the last normal cultivation. Destroy existing weeds prior to application. Avoid spray contact to nonwoody portion of cotton stems and foliage or serious crop injury may occur. Apply at least 60 days before harvest.

**Cotton, Alternative weed management techniques**

Hooded sprayers – Use of nonselective herbicides applied with hooded sprayers to avoid contact with the crop may be desirable for weed control in row middles, especially in no-till or conservation tillage systems. Addition of a residual-type herbicide will extend weed control and may negate the need for a layby application made to cotton at least 12 inches tall.

Active chemical per treated land acre	Formulation needed to treat 1 acre broadcast (See Appendix 1 for band rates)	Time of application	Weeds controlled	Special instructions and remarks
flumioxazin 0.064 lb/A	Valor SX 2 oz/A	Valor may be applied with a hooded or shielded sprayer after cotton is at least 6 inches tall.	Provides some post-emergence activity on emerged weeds. Provides excellent residual control of most broadleaf weeds and suppression of annual grass weeds.	Use only hooded sprayer equipment designed to minimize exposure of the spray to cotton foliage. Hoods must be operated on the ground or skidding along the ground to minimize spray contact with the desirable vegetation. Refer to flumioxazin under the Preplant Foliar section for information on spray adjuvant requirements. Do not apply more than 4 ounces per acre in any growing season. Do not make sequential applications within 30 days. Do not apply within 60 days of harvest.
glufosinate at 0.4 to 0.78 lb ai/A	Liberty at 22 to 43 oz/A.	Liberty may be applied from emergence through early bloom using a hooded sprayer.	Annual grasses and broadleaf weeds, especially morningglory.	Use only hooded sprayer equipment designed to minimize exposure of the spray to cotton foliage when applying to cotton varieties not tolerant to Liberty. Hoods must be operated on the ground or skidding along the ground to minimize spray contact with the desirable vegetation. Make up to three applications per season. A single application up to 43 ounces per acre can be made. Total seasonal application must not exceed 72 to 87 ounces per acre. Do not harvest cotton within 70 days of the last application of Liberty.
glyphosate at 0.75 to 1.5 lb ae/A	see label for rates	Apply to 6-inch tall cotton.	Annual and perennial grasses and broadleaf weeds less than 6 inches tall.	Use a hooded sprayer ONLY. Keep the bottom edge of the hood in contact with soil surface. Avoid crop contact with spray solution. Allow 7 days between application and harvest. Do not exceed 8 quarts per acre per season. Tank mixing with triazine or urea herbicides may antagonize grass control.
paraquat at 0.312 to 0.625 lb/A	Gramoxone Max at 0.84 to 1.7 pt/A with 0.25% (v/v) nonionic surfactant or 1% (v/v) crop oil concentrate	Apply to 6-inch tall cotton.	Annual grasses and broadleaf weeds less than 6 inches tall.	Use a hooded sprayer ONLY. Keep the bottom edge of the hood in contact with soil surface. Avoid crop contact with spray solution. Avoid use of spray tips that produce fine spray droplets.

## Cotton, Appendixes

### 1. Factors to convert broadcast rate/A to a band rate at various band and row widths

Band width (inches)	Row spacing (inches)								
	20	24	28	30	32	36	38	40	
6	0.3	0.25	0.21	0.20	0.19	0.17	0.16	0.15	
8	0.4	0.33	0.29	0.27	0.25	0.22	0.21	0.20	
10	0.5	0.42	0.36	0.33	0.31	0.28	0.26	0.25	
12	0.6	0.50	0.43	0.40	0.37	0.33	0.31	0.30	
14	0.7	0.58	0.50	0.47	0.44	0.39	0.37	0.35	
16	0.8	0.67	0.57	0.53	0.50	0.44	0.42	0.40	
18	0.9	0.75	0.64	0.60	0.56	0.50	0.47	0.45	
20	1.0	0.93	0.71	0.67	0.62	0.56	0.53	0.50	

### 2. Recommended rate of Select Max when applied with glyphosate to various grasses

Kind of grass	Weed height (inches)	Rate (fl oz/A)
Seedling johnsongrass	4-10	12
Volunteer corn	4-18	12
Red rice	1-3	12
Most annual grasses	2-6	12
Rhizome johnsongrass	12-24	16
2nd application	6-10	12
Bermudagrass	3	16
2nd application	3	16

### 3. Recommended rate of Fusilade DX when applied to various grasses

Kind of grass	Size (inches)	Rate lb ai/A	Rate (oz/A)
Seedling johnsongrass	2-8 tall	0.094	6
Goosegrass	2-4 tall	0.125	8
Barnyard and crabgrass	1-2 tall	0.188	12
Broadleaf signalgrass	2-4 tall	0.188	12
Rhizome johnsongrass	8-18 tall	0.188	12
2nd application	6-12 tall	0.125	8
Bermudagrass	4-8 runners	0.188	12
2nd application	4-8 runners	0.125	8

### 4. Recommended rate of Assure II when applied to various grasses

Kind of grass	Weed height (inches)	Rate (fl oz/A)
Seedling johnsongrass	2-8	5
Volunteer corn	8-18	5
Most annual grasses	2-6	7
Barnyard grass	2-6	8
Broadleaf signalgrass	2-6	8
Crabgrass	2-6	8
Red rice	1-4	9
Rhizome johnsongrass	10-24	10
2nd application	6-10	7
Bermudagrass	3	10
2nd application	3	7

**5. Recommended rate of Fusilade DX when applied to various grasses**

Kind of grass	Size (inches)	Rate (lb ai/A)	Rate (oz/A)
Crabgrass and goosegrass	up to 6 tall	0.19	1.5
Other annual grasses including seedling johnsongrass	up to 8 tall	0.19	1.5
Rhizome johnsongrass <sup>1</sup>	15-20 tall	0.19	1.5
2nd application	6-10 tall	0.19	1.5
Bermudagrass	plant diameter 6 or less	0.28	2.25
2nd application	regrowth 1-4 long	0.19	1.5

<sup>1</sup>If spray volume is more than 10 gallons per acre, increase the rate on johnsongrass at first application to 2.25 pt/A.

**6. Recommended rate of Fusilade DX for spot treatments**

Spray mix	Surfactant (0.25%)	or	Oil conc. (1%)	Fusilade DX
1 gal	0.5 oz	or	1.5 oz	0.75 oz
100 gal	1 pt	or	8 pt	8 pt

**7. Recommended rate of Poast Plus for spot treatments**

Spray mix	Oil conc. (1%)	Poast Plus - herbicide conc. (1.5%)
1 gal	1.28 oz	1.9 oz
100 gal	8 pt	12 pt

Grain sorghum: Guide to weed response to herbicides

Herbicide	Barnyardgrass	Broadleaf signalgrass	Crabgrass	Fall panicum	Foxtail, giant	Goosegrass	Seedling johnsongrass	Rhizome johnsongrass	Red rice	Shattercane	Yellow nutsedge	Eastern black nightshade	Cocklebur	Jimsonweed	Common lambsquarters	Entire/lyleaf morningglory	Pitted morningglory	Redroot and smooth pigweed	Prickly sida	Common ragweed	Giant ragweed	Annual smartweed spp.	Sunflower	Velvetleaf	Tall waterhemp	Crop response***
<b>Preplant incorporated or preemergence</b>																										
Atrazine	8	6	5	3	7	6	2	0	8	0	0	9	9	10	9	9	10	10	9	9	8	9	7	8	10	1
Dual II Magnum/Cinch	8	7	9	9	9	9	6	0	9	5	8	9	0	4	6	2	2	9	3	5	3	5	0	2	9	1**
Intrro	8	7	9	9	9	9	6	0	8	5	7	9	0	4	6	2	2	9	4	5	3	5	0	2	9	1**
Fulltime NXT	9	7	9	9	9	-	6	0	-	4	6	9	7	8	9	7	7	9	-	8	6	-	7	7	9	1**
Outlook	8	7	9	9	9	9	6	0	9	4	8	8	2	4	7	2	2	9	0	5	2	4	0	2	9	1**
<b>Preemergence</b>																										
Lexar EZ	8	8	9	9	9	8	6	0	9	5	7	9	8	9	9	7	7	9	8	8	6	9	6	9	9	2
Lumax EZ	8	8	8	8	9	8	6	0	9	5	7	9	8	9	9	7	7	9	8	8	6	9	6	9	9	2
Sharpen	0	0	0	0	0	0	0	0	0	0	-	8	9	8	8	9	9	8	8	9	9	9	9	9	8	1
<b>Postplant incorporated</b>																										
Treflan	8	-	8	7	8	8	7	0	-	7	0	0	0	0	8	0	0	8	-	0	0	3	0	0	7	1
Paramount	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Prout/others	9	-	9	8	9	9	7	0	-	7	0	0	0	0	7	0	0	8	-	0	0	3	0	0	7	1
<b>Postemergence</b>																										
Aim	2	1	2	3	3	-	2	1	1	1	-	10	6	9	9	7	7	9	7	7	6	9	7	9	8	1
Atrazine + oil	8	7	7	5	7	6	3	0	10	2	6	9	9	10	10	9	9	10	9	9	8	9	9	9	10	1
Banvel/Clarity	0	0	0	0	0	0	0	0	0	0	0	9	9	9	9	9	10	9	8	10	9	9	9	9	8	1
Basagran	0	0	0	0	0	0	0	0	0	0	7	2	9	9	6	5	7	4	8	8	8	9	8	8	3	0
Buctril	0	0	0	0	0	0	0	0	0	0	9	9	9	10	9	8	8	7	4	9	9	9	8	8	6	1
Huskie	0	0	0	0	0	0	0	0	0	0	0	9	9	8	9	8	9	8	-	8	7	9	9	9	8	1
Paramount	7	-	2	4	7	-	-	-	-	2	2	5	5	8	5	-	5	-	5	-	5	-	-	-	5	1
Peak	0	0	0	0	0	0	0	0	0	0	0	-	8	8	7	8	8	9	8	7	8	8	9	8	5	1
Permit	0	0	0	0	0	0	0	0	0	0	9	6	9	8	6	6	6	9	7	8	8	7	9	9	5	0
Starane	0	0	0	0	0	0	0	0	0	0	0	7	9	-	-	9	9	8	-	9	-	-	9	9	8	1
2,4-D	0	0	0	0	0	0	0	0	0	0	0	7	9	8	9	9	10	9	8	9	8	7	9	8	8	1
<b>Post directed</b>																										
Linex	7	-	8	8	8	-	7	0	6	-	-	-	8	-	9	8	8	9	9	8	-	8	-	9	-	1
Gramoxone 2SL	9	9	9	8	8	8	8	0	9	6	3	-	4	7	9	5	4	9	4	8	-	5	-	6	-	1

Weed control: 8 to 10 = Good 6 to 7 = Fair\*\*\* Less than 6 = Poor - = No data available

\*Shallow incorporation needed for this level of control.

\*\*Treated seed.

\*\*\*A weed control rating of 6 to 7 indicates partial control or suppression.

Due to the overwhelming number of package mixes and tank mixes, it has become impractical to list and distinguish these combinations. In the interest of fairness, we are therefore listing no package mixes in this table. A reasonably accurate estimate may be obtained by combining the control ratings from the individual package or tank-mix component.

## Grain sorghum: Soil-applied herbicide rates for grain sorghum

Herbicide	Soil texture*		
	Coarse (light, sandy)	Medium (loamy)	Fine (heavy, clay)
----- (Rate per acre) -----			
Atrazine 4L	DO NOT USE	3.2 to 4 pt	4.0 to 4.75 pt
AAtrex Nine-0	DO NOT USE	1.7 to 2.2 lb	2.2 to 2.6 lb
Bicep II Magnum/Cinch ATZ	DO NOT USE	1.6 to 2.1 qt	1.6 to 2.1 qt
Bicep Lite II Magnum/Cinch Lite	DO NOT USE	1.1 to 1.5 qt	1.1 to 1.5 qt
Dual II Magnum/Cinch	1 to 1.33 pt	1.33 to 1.5 pt	1.33 to 1.67 pt
Fultime NXT	2 to 2.9 qt	2 to 3.7 qt	2 to 3.7 qt
Intro	1.5 to 2.5 qt	2 to 2.75 qt	2 to 3 qt
Lexar EZ	DO NOT USE	3 qt	3 qt
Lumax EZ	DO NOT USE	2.5 qt	2.5 qt
Outlook	12 to 18 fl oz	14 to 21 fl oz	14 to 21 fl oz
Paramount 75DF	5.3 to 8 oz	5.3 to 8 oz	5.3 to 8 oz
Prowl 3.3E/others	DO NOT USE	1.8 pt	2.4 pt
Sharpen	1 to 2 oz	1 to 2 oz	1 to 2 oz

\*Refer to herbicide labels for proper rates for your soil texture and organic matter content and for tank mixes.

## Grain sorghum, Burndown

Herbicide and formulation	Formulated material per broadcast acre	Herbicide (lb active per acre)	Labeled tank-mix partners	Application method and precautions
The following preemergence grain sorghum herbicides may be used for burndown: atrazine, Bicep, Guardsman, Marksman, Ramrod/atrazine. Application information is listed in the preemergence herbicide section. In most cases, a broad-spectrum, foliar burndown herbicide such as Roundup or Gramoxone should be tank mixed with the preemergence herbicide; however if grass pressure is light and broadleaf weeds are small, the addition of crop oil to an atrazine-containing product may be sufficient.				
Aim 2E + Nonionic surfactant	0.25 to 2 fl oz/A + 2 pt/100 gal	carfentrazone 0.004 to 0.031 lb/A	No restrictions listed.	Should be applied with a broad-spectrum burndown herbicide.
Clarity 4L	8 oz/A	dicamba 0.25 lg/A		Do not apply within 15 days of planting.
Gramoxone 2SL + Nonionic surfactant or Crop oil concentrate	2 to 4 pt/A + 1 to 2 pt/100 gal or 1 gal/100 gal	paraquat 0.7 to 1.4 lb/A	atrazine, Bicep, Dual, Lasso, Lariat	May be applied early preplant (EPP) through planting, but before crop emergence. See label directions for specific rates, weed stages, and tank-mix instructions. Rate should normally be at least 1.67 pt/A
Roundup brands/ Touchdown brands/ other glyphosates 3L or Roundup WeatherMax 4.5L or Roundup PowerMax 4.5L + Recommended additives	1 to 3 pt/A or 11 to 32 fl oz/A or 11 to 32 fl oz./A + See label	glyphosate 0.38 to 1.12 lb/A	atrazine, Bicep, Dual, Lasso, Lariat	May be applied early preplant (EPP) through planting, but before crop emergence. See label directions for specific rates, weed stages, and tank-mix instructions.
Sharpen + Methylated seed oil + Ammonium sulfate or Urea ammonium nitrate	2 to 3 oz/A + 1 gal/100 gal + 8.5 to 17 lb/100 gal or 1.25–2.5 gal/100 gal	saflufenacil 0.04 to 0.06 lb/A	atrazine, Bicep, Glyphosate	Do not apply after grain sorghum has emerged. If spray volume is 12 GPA or less, use methylated seed oil at 1 pt/A.
Starane	0.66 pt/A	fluroxypyr 0.12 lb/A	atrazine	For burndown applications, apply after planting, but before grain sorghum emergence.
Valor 51 WDG + Nonionic surfactant (80%)	2 to 2.5 oz/A + 1 qt/100 gal	flumioxazin 0.064 to 0.08 lb/A	Roundup, Gramoxone	<b>Do not apply within 30 days of planting.</b>
2,4-D LV ester (4 lb/gal formulation)	1 to 3 pt/A	2,4-D 0.5 to 1.5 lb/A	atrazine, Lariat, Lasso	



Grain sorghum, Burndown - *continued*

Herbicide and formulation	Formulated material per broadcast acre	Herbicide (lb active per acre)	Labeled tank-mix partners	Application method and precautions
<b>Package mixes - Preplant incorporated or preemergence</b>				
Lexar EZ + Crop oil concentrate	3 qt/A + 1 gal/100 gal	mesotrione at 0.1659 lb ai + atrazine 1.3 lb ai + S-metolachlor 1.3 lb ai	Touchdown/glyphosate + Gramoxone	Lexar can be applied preplant non-incorporated from 7 to 21 days before planting. Applying Lexar less than 7 days before sorghum planting will increase the risk of crop injury. Use sorghum seed treated with Concep III. Do not apply to sandy soils: (sand, sandy loam, or loamy sand). Do not apply to emerged grain sorghum. Do not use on forage sorghum, sweet sorghum, sudangrass, or any dual-purpose sorghum.
Lumax EZ + Crop oil concentrate	2.5 qt + 1 gal/100 gal	mesotrione at 0.1675 lb ai + atrazine 0.63 lb ai + S-metolachlor 1.68 lb ai	Touchdown/glyphosate + Gramoxone	Lumax can be applied preplant non-incorporated from 7 to 21 days before planting. Applying Lumax less than 7 days before sorghum planting will increase the risk of crop injury. Use sorghum seed treated with Concep III. Do not apply to sandy soils: (sand, sandy loam, or loamy sand). Do not apply to emerged grain sorghum. Do not use on forage sorghum, sweet sorghum, sudangrass, or any dual-purpose sorghum.
Expert 4.9L	2.5 to 3.75 qts/A	glyphosate + S-metolachlor + atrazine 0.6 + 1 + 1.33 to 0.9 + 1.63 +2 lb/A	Glyphosate, Touchdown	USE SAFENED SEED.
Sequence 5.25L + Ammonium sulfate	2 to 4 pt/A + 8.5 to 17 lb/A	glyphosate + S-metolachlor 0.5 + 0.75 to 1.1 + 1.5 lb/A	atrazine, Bicep, Dual, Banvel, Claity, Touchdown	USE SAFENED SEED.

## Fall and early preplant applications of preemergence herbicides for reduced tillage

Many preemergence herbicides may be used two or more weeks before planting in an early preplant (EPP) application. Advantages include: Early preplant applications will prevent weed emergence and aid or eliminate a formal burndown application. They may limit weed growth if weather moderately delays planting. Some preemergence herbicides have significant postemergence, burndown activity (adjuvants are sometimes required). Some preemergence herbicides increase the activity or spectrum of burndown herbicides. Finally, combining a preemergence herbicide with a burndown herbicide may simply save time and costs by eliminating a second trip for the traditional preemergence, after-planting application.

Several herbicides are registered for fall application. A fall herbicide application may be beneficial if it eliminates the need for a burndown application in the spring and soil erosion is not a problem. Fall applications could also benefit

drying of the soil in the spring and could reduce the need for tillage before planting.

There are many choices and an option that works well in one field may work poorly in another. For most situations we recommend that growers target early preplant applications 15 days or less before planting. The sooner a herbicide is applied, the sooner it will break down and lose effectiveness. If rain delays planting too long, most advantages of extra-early preplant applications may be lost. Also, after 30 days, there is a much higher probability that a burndown application will be needed and most labels specify that additional preemergence herbicide be applied at planting. Finally, exceptionally long (>30 day) preplant intervals remove winter vegetation and leave the soil vulnerable to erosion and may increase the probability of herbicide contamination of ground and surface water.

## Early preplant (EPP) labels for grain sorghum herbicides

Herbicide	Burndown activity	Label allows preplant application		
		45 days	30 days	15 days
atrazine	Yes	Yes*	Yes*	Yes
Bicep II/Magnum/Bicep Lite II/Magnum/Cinch	Yes	Yes*	Yes*	Yes
Dual II/ Magnum/Cinch	No	Yes*	Yes*	Yes
Lexar EZ	Yes	No	No	Yes
Lumax EZ	Yes	No	No	Yes
Intrado/Lasso/Microtech	No	Yes*	Yes*	Yes
Outlook	No	Yes*	Yes*	Yes
Sharpen	Yes	Yes	Yes	Yes

\*Label recommends reapplication at the time of planting (Typically 2/3 applied EPP and 1/3 preemergence at planting)  
 \*\*EPP intervals greater than 15 days are not recommended on coarse-textured (light, sandy) soils.

## Grain sorghum, Preplant, preplant incorporated or preemergence

Herbicide and formulation	Formulated material per broadcast acre	Herbicide (lb active per acre)	Labeled tank-mix partners	Application method and precautions
<b>Preplant incorporated or preemergence</b>				
Atrazine, 4L or Aatrex Nine-0	3.2 to 4 pt or 1.7 to 2.2 lb/A	atrazine 1.6 to 2 lb/A	Bicep, Dual, Lariat, Lasso	Do not use on coarse (light, sandy) soils. Do not use on medium (loam) or fine (heavy, clay) soils with less than 1% organic matter.
Dual II Magnum 7.64E/Cinch	1 to 1.67 pt/A	s-metolachlor 1 to 1.6 lb/A	atrazine, Bicep	USE SAFENED SEED.
IntRRo 4L	1.5 to 3 qt/A	alachlor 1.5 to 3 lb/A	atrazine, Lariat	USE SAFENED SEED. Preplant treatment should be shallow incorporated. Use higher recommended rate if shallow incorporated.
Lexar EZ	3 qt/A	mesotrione at 0.1659 lb ai + atrazine 1.3 lb ai + s-metoachlor 1.3 lb ai	Touchdown/glyphosate + Gramoxone	Lexar can be applied preplant non-incorporated from 7 to 21 days before planting. Applying Lexar less than 7 days before sorghum planting will increase the risk of crop injury. Use sorghum seed treated with Concep III Do not apply to sandy soils: (sand, sandy loam, or loamy sand). Do not apply to emerged grain sorghum. Do not use on forage sorghum, sweet sorghum, sudangrass, or any dual-purpose sorghum.
Lumax EZ	2.5 qt/A	mesotrione at 0.1675 lb ai + atrazine 0.63 lb ai + s-metoachlor 1.68 lb ai.	Touchdown/glyphosate + Gramoxone	Lumax can be applied preplant non-incorporated from 7 to 21 days before planting. Applying Lumax less than 7 days before sorghum planting will increase the risk of crop injury. Use sorghum seed treated with Concep III Do not apply to sandy soils: (sand, sandy loam, or loamy sand). Do not apply to emerged grain sorghum. Do not use on forage sorghum, sweet sorghum, sudangrass, or any dual-purpose sorghum.
Paramount 75DF	5.3 to 8 oz/A	quinclorac 0.25 to 0.38 lb/A	atrazine, Clarity, Roundup, 2,4-D	
<b>Package mixes - Preplant incorporated or preemergence</b>				
Bicep II Magnum 5.5L or Cinch ATZ	1.6 to 2.1 qt/A	atrazine + s-metolachlor 1.24 + 0.96 to 1.63 + 1.26 lb/A	atrazine, Dual	USE SAFENED SEED. Do not use on coarse (light, sandy) soils. Do not use on medium (loam) soils with less than 1.5% organic matter.
Bicep Lite II Magnum 6L or Cinch Lite ATZ	1.1 to 1.5 qt/A	s-metolachlor + atrazine 0.92 + 0.73 to 1.25 + 1 lb/A	atrazine, Dual	USE SAFENED SEED. Do not use on coarse (light, sandy) soils. Do not use on medium (loam) soils with less than 1.5% organic matter.
Fultime NXT	2 to 3.7 qt/A	acetochlor + atrazine 1.95 + 0.97 to 2.5 + 1.24 lb/A	atrazine	USE SAFENED SEED. Fultime NXT may be applied preplant incorporated, preemergence surface, or postemergence.
Verdict 5.57 EC	5 to 10 fl oz/A	saflufenacil + dimethenamid-p 0.023 + 0.195 to 0.045 + 0.39 lb/A	Outlook, atrazine, glyphosate	Do not apply after crop emergence. Consult label for adjuvant requirements for burndown applications. Do not apply to sweet or forage sorghum.

Grain sorghum, Preplant, preplant incorporated or preemergence - *continued*

Herbicide and formulation	Formulated material per broadcast acre	Herbicide (lb active per acre)	Labeled tank-mix partners	Application method and precautions
<b>Preemergence only</b>				
Linex 4L	0.625 to 2 pt/A	linuron 0.3 to 1 lb/A		Consult label for specific rates according to soil type. Apply after planting but before crop emergence.
<b>Early postemergence incorporated</b>				
Prowl 3.3EC/others	1.8 to 2.4 pt/A	pendimethalin 0.74 to 1.0 lb/A		BOOTHEEL COUNTIES ONLY. Cultivation with sweeps or a rolling cultivator is required before and after application. Do not use on coarse (light, sandy) soils. Apply after grain sorghum is more than 4 inches tall until last (layby) cultivation.
Prowl H2O 3.8ACS	2 pts/A	pendimethalin 0.74 to 1.0 lb/A		BOOTHEEL COUNTIES ONLY. Cultivation with sweeps or a rolling cultivator set to provide thorough incorporation in the top 1 inch of soil. Do not use on coarse (light, sandy) soils. Apply after grain sorghum is more than 4 inches tall until last (layby) cultivation.
Treflan 4EC/ others	0.75 to 2 pt/A	trifluralin 0.38 to 1 lb/A		Cultivation with sweeps or a rolling cultivator is required before and after application. Apply after grain sorghum is more than 8 inches tall.

Grain sorghum, Postemergence and directed

Herbicide and formulation	Formulated material per broadcast acre	Herbicide (lb active per acre)	Labeled tank-mix partners	Application method and precautions
Aim 2E + Nonionic surfactant	0.5 fl oz/A + 2 pt/100 gal	carfentrazone 0.008 lb/A	atrazine, Banvel, Clarity, Laddok, Peak, Permit	Do not use crop oil concentrate. Leaf speckling is likely. Weeds must be 4 inches or less for adequate control.
Atrazine 4L or AAtrex Nine-0 + Crop oil concentrate (optional)	2 qt/A or 2.2 lb/A	atrazine 2 lb/A	Basagran, Buctril, Laddok	See label precautions for the use of crop oil concentrate. Apply after grain sorghum reaches three-leaf stage but before the 12-inch stage. Apply before weeds exceed 1.5 inches tall. Do not use on sand or loamy sand.
Banvel/Clarity (4 lb/gal formulation)	0.5 pt	dicamba 0.25 lb/A	None	Apply before sorghum is more than 15 inches tall. From 8 to 15 inches, use only directed applications with drop pipes. Apply to weeds less than 3 inches tall for best performance.
Basagran 4S	1.5 to 2 pt/A	bentazon 0.75 to 1 lb/A	None	Apply when weeds are small. May be applied up to and including early boot stage. Add 1 qt/A oil concentrate for use on yellow nutsedge and other hard-to-control weeds listed on the label.
Buctril 2E or Buctril 4 lb/gal	1 to 1.5 pt/A or 0.5 to 0.75 pt/A	bromoxynil 0.25 to 0.38 lb/A	atrazine	See label for specific rates and weed stages for application. Do not spray when grain sorghum foliage is wet. Application may be made from the three-leaf stage of sorghum up to 14 inches tall.
Paramount 75DF + Crop oil concentrate + Urea ammonium nitrate or ammonium sulfate (optional)	5.3 to 8 oz/A + 1 gal/100 gal + 0.5 to 10 gal/100 gal or 2.5 lb/A	quinclorac 0.25 to 0.38 lb/A	atrazine, Clarity, Peak, 2,4-D	Apply to grain sorghum up to 12 inches tall. For best annual grass control apply with 0.5 to 1 lb/A atrazine when weeds are less than 2 inches tall. Do not tank mix with fungicides, insecticides or fertilizers.

## WEED MANAGEMENT - GRAIN SORGHUM

### Grain sorghum, Postemergence and directed - *continued*

Herbicide and formulation	Formulated material per broadcast acre	Herbicide (lb active per acre)	Labeled tank-mix partners	Application method and precautions
Peak 57DG + Nonionic surfactant (80%) or Crop oil concentrate + Urea ammonium nitrate or ammonium sulfate (optional)	0.5 to 1 oz/A (1 pkt/ 6 to 3 A) + 1 gal/100 gal or 4 gal/100 gal + 1 gal or 2 lb/A	prosulfuron 0.018 to 0.036 lb/A	atrazine, Banvel, Buctril, Marksman, 2,4-D	Apply to actively growing weeds when sorghum is 5 to 30 inches tall.
Permit 75 DF + Nonionic surfactant (80%) or Crop oil concentrate + Urea ammonium nitrate or ammonium sulfate (optional)	0.67 to 1.33 oz/A + 1 to 2 qt/A or 1 gal/ 100 gal + 4 gal/100 gal or 2 to 4 lb/A	halosulfuron 0.032 to 0.047 lb/A	atrazine	Do not cultivate for 7 days following application. Do not apply to sorghum treated with an organophosphate insecticide.
Starane	0.66 pt/A	fluroxypyr 0.12 lb/A	atrazine	May be applied from the 3-leaf growth stage through the 7-leaf stage. Use drop nozzles and directed spray from the 8-leaf stage to the boot stage.
2,4-D amine (4 lb/gal formulation)	1 pt/A	2,4-D 0.5 lb/A	None	Treat only after grain sorghum is over 6 inches tall and before it is 15 inches tall. If crop is over 8 inches tall, use drop nozzles to keep spray off leaves.
2,4-D LV ester	0.5 pt/A	2,4-D 0.25 lb/A	None	Treat only after grain sorghum is more than 5 inches tall and before it is 15 inches tall. If crop is more than 8 inches tall, use drop nozzles to keep spray off of leaves.
<b>Package mixes: Postemergence overtop</b>				
Buctril/ Atrazine 3F	1.5 to 3 pt/A	bromoxynil + atrazine 0.19 + 0.38 to 0.38 + 0.75 lb/A	Buctril, atrazine	See label for specific rates, crop and weed stages for application. Buctril and/or atrazine may be added to the package mix to improve control in heavy infestations or for hard-to-control weeds. Application may be made from the 2-leaf stage (0.19 lb Buctril rate), the 3-leaf stage (0.25 lb rate) or the 4-leaf stage (0.38 lb rate) of sorghum up to 10 inches tall.
Huskie	12.8 to 16 oz/A	pyrasulfotole + bromoxynil 0.0331 + 0.175 to 0.038 + 0.22 lb/A	atrazine, Bicep II, Magnum, Outlook	Apply to actively growing grain sorghum from 3-leaf stage up to 30 inches in height and/or prior to flag leaf emergence.
Laddok S-12 5L + Crop oil concentrate or 28% urea ammonium nitrate	2 to 3.5 pt/A + 1 qt/A or 2 to 4 qt/A	bentazon + atrazine 0.52 + 0.52 0.73 + 0.73 lb/A	None	Apply when weeds are small. May be applied up to and including early boot stage. Use higher rates for yellow nutsedge and other hard-to-control weeds listed on the label.
Shotgun 3.25L	2 pt/A	atrazine + 2,4-D 0.56 + 0.25 lb/A	atrazine, Banvel, Buctril	Apply to actively growing weeds. Apply over the top from spike- to 8-inch (4-leaf) growth stages and in a directed spray from 8-inch to 12-inch growth stages.
Yukon 67.5 DF + Nonionic surfactant or Crop oil concentrate + Urea ammonium nitrate or ammonium sulfate (optional)	4 to 6 oz/A + 2 to 4 pt/100 gal or 1 gal/100 gal + 2 to 4 qt/A or 2 to 4 lb/A	dicamba + halosulfuron 0.14 + 0.03 to 0.21 + 0.045 lb/A	atrazine, Bullet, Partner	Apply over the top to grain sorghum from 2 leaf through 8 inches and with drop nozzles until 15 inches tall.

Grain sorghum, Postemergence and directed - *continued*

Herbicide and formulation	Formulated material per broadcast acre	Herbicide (lb active per acre)	Labeled tank-mix partners	Application method and precautions
<b>Postemergence directed</b>				
Linex 4L or Lorox 50DF + Surfactant	1 to 2 pt/A or 1 to 2 lb/A + 2 qt/100 gal	linuron 0.5 to 1 lb/A	None	Keep spray off all but the lower 3 inches of grain sorghum plants. See label directions for application methods, equipment and proper crop and weed heights for application.
Gramoxone Inteon + Nonionic surfactant	1 to 2 pt/A + 8 oz/100 gal	paraquat 0.34 to 0.7 lb/A	None	
				Apply after grain sorghum is more than 12 inches tall, but before weeds are more than 3 inches tall. Keep spray off all but the lower 3 inches of grain sorghum plants.

Grain sorghum, Special problems

Herbicide and formulation	Formulated material per broadcast acre	Herbicide (lb active per acre)	Weeds controlled	Application method and precautions
<b>Johnsongrass control</b>				
Roundup brands/Other glyphosates 3L or Roundup WeatherMax 4.5L or Roundup PowerMax 4.5L + Recommended additives	1 to 3 pt/A or 11 to 32 fl oz/A or 11 to 32 fl oz./A + See label	glyphosate 2% solution	Johnsongrass (seedling and rhizome), shattercane and many annual and perennial grass and broadleaf weeds.	Cover foliage thoroughly. Sorghum plants in treated area will be severely injured or killed.
Roundup brands/Other glyphosates 3L or Roundup WeatherMax 4.5L or Roundup PowerMax 4.5L + Recommended additives	33% solution + See label	glyphosate 1 gal + 2 gal water	Johnsongrass (rhizome), shattercane and many annual and perennial grass and broadleaf weeds.	
<b>Perennial vine control</b>				
Note: Consider using a tank mixture of two or more of the listed herbicides for optimal perennial vine control.				
2,4-D amine (4 lb/gal formulation) or 2,4-D LV ester (4 lb/gal formulation)	1.5 to 2 pt or 0.75 to 1 pt/A	2,4-D 0.75 to 1 lb or 0.38 to 0.5 lb/A	Annual morningglories and suppression of vines such as honeyvine milkweed, field bindweed, trumpetcreeper, and redvine.	These rates are more likely to cause some crop injury than the lower rates in the "post-emergence" section. Treat only after grain sorghum is more than 6 inches tall and before it is 15 inches tall. If crop is more than 8 inches tall, use drop nozzles to keep spray off of grain sorghum leaves.
Banvel (4 lb/gal formulation)	2 to 4 pt/A	dicamba 1 to 2 lb/A	Field bindweed, trumpetcreeper, redvine and many other problem broadleaf weeds.	
				Between cropping application: Apply as a broadcast or spot treatment to emerged and actively growing weeds after crop harvest but before a killing frost. Majority of weeds should be 8 inches or taller. Avoid disturbing treated areas for at least 7 days. Rates depend on type and density of weeds. Corn, grain sorghum or soybeans may be planted in the spring following application. Wheat may be planted in the fall, but planting must be delayed 45 days for each pint of Banvel applied.

**Grain sorghum, Special problems - *continued***

<b>Herbicide and formulation</b>	<b>Formulated material per broadcast acre</b>	<b>Herbicide (lb active per acre)</b>	<b>Weeds controlled</b>	<b>Application method and precautions</b>
Roundup Brands/Other glyphosates 3L or Roundup WeatherMax 4.5L or Roundup PowerMax 4.5L +	2 to 4 pt/A or 21 to 42 fl oz/A or 26 to 52 fl oz./A +	glyphosate 0.75 to 1.5 lb/A	Field bindweed and other problem grass and broadleaf weeds.	Between cropping applications: Apply as a broadcast or spot treatment to emerged and actively growing weeds, after crop harvest but before a killing frost. Majority of weeds should be 8 inches or taller. Avoid disturbing treated areas for 14 days. See labels for rates on type and density of weeds present. Wheat may be planted in the fall, but planting must be delayed 45 days for each pint of Banvel applied. Corn, sorghum and soybeans may be planted in the spring following application.
Recommended additives	See label			

***Hooded sprayer application***

Gramoxone 2SL +	1 to 2 pt/A +	paraquat 0.34 to 0.7 lb/A		Gramoxone drift is injurious to grain sorghum. May be applied with a postemergence directed sprayer when corn is 12 inches or taller.
Nonionic surfactant (80%) or Crop oil concentrate	1 to 2 pt/100 gal or 1 gal/100 gal			
Roundup Brands/Other glyphosates 3L or Roundup WeatherMax 4.5L or Roundup PowerMax 4.5L +	2 pt/A or 21 fl oz/A or 26 fl oz./A +	glyphosate 0.375 to 0.75 lb/A	Grass and broadleaf weeds in row middles.	See label for hood specifications and application directions. Avoid drift. Roundup drift is extremely injurious to grain sorghum. Weeds in the drill will not be controlled.
Recommended additives	See label			

***Harvest aid***

Reglone 2L	1.5 to 2 pt/A	diquat, 0.38 to 0.5 lb/A	Desiccation of green weed foliage.	Make applications at 30% grain moisture or less. Apply 1 to 2 weeks before harvest. Do not use seed from treated plants for food, feed or oil purposes.
Roundup Brands/Other glyphosates 3L or Roundup WeatherMax 4.5L or Roundup PowerMax 4.5L +	2 to 4 pt/A or 21 to 42 fl oz/A or 26 to 52 fl oz./A +	glyphosate 0.75 to 1.5 lb/A	Most grass and broadleaf weeds	Make applications at 30% grain moisture and at least 7 days prior to harvest. Do not apply to grain sorghum grown for seed.
Recommended additives	See label			

Rice: Weed response ratings for rice herbicides

Herbicides	Amazon sprangletop	Ammania (redstem)	Barnyardgrass	Bearded sprangletop	Broadleaf signalgrass	Crabgrass	Dayflower	Ducksalad	Eclipta	Fall panicum	Flatsedges	Gooseweed	Hemp sesbania (coffee bean)	Morningglory Species	Northern jointvetch	Nutsedge	Purslane	Smartweed	Spikerush	Texasweed (2-3 leaf)	Johnsongrass (rhizome)	Red rice	Volunteer glyphosate-resistant soybean <sup>a</sup>	Glyphosate-resistant horseweed <sup>b</sup>
<b>Preemerg</b>																								
Command	8	0	9	8	9	8	0	0	0	9	0	0	0	0	0	0	0	0	0	0	0	0	0	-
Facet	0	0	9	0	9	8	5	0	8	7	5	3	6	7	7	0	-	0	-	-	-	-	-	-
League	0	-	0	0	0	0	-	-	-	0	8	-	9	2	7	8	-	-	-	8	-	0	-	-
<b>Delayed preemerg</b>																								
Bolero	8	7	8	8	4	7	7	8	8	7	7	6	4	4	-	4	-	4	7	5	-	-	-	-
Facet + Bolero	8	7	9	8	9	9	7	8	9	9	8	5	8	8	-	0	-	5	7	-	-	-	-	-
Facet + Prowl	8	3	9	8	9	9	5	0	8	9	5	3	6	8	-	0	8	2	-	-	-	-	-	-
Prowl	8	3	9	8	8	8	0	0	0	9	0	0	0	0	0	0	8	2	0	0	-	-	0	-
<b>Early postemergence</b>																								
Facet	0	3	9	0	9	7	3	3	9	6	5	-	8	8	8	0	-	0	-	3	-	-	2	6
Facet + Prowl	0	3	9	0	9	9	3	3	8	6	5	-	8	8	7	0	8	2	-	6	-	-	-	-
Facet + Bolero	8	5	9	8	9	9	7	7	9	9	7	5	8	8	-	0	6	4	7	-	-	-	5	-
Facet + Propanil	5	6	9	4	9	7	5	6	8	9	9	5	9	8	9	5	7	5	9	8	-	-	8	8
Grandstand	0	8	0	0	0	0	6	4	9	0	6	5	9	9	8	0	-	6	5	8	0	0	9	6
Propanil	5	6	9	4	9	9	5	7	8	8	9	5	9	5	-	4	7	6	9	6	-	-	8	1
Propanil+ Bolero	9	8	9	9	8	7	8	8	9	9	9	6	9	6	-	5	7	6	9	8	-	-	8	-
Propanil + Prowl	9	7	9	9	9	7	5	7	9	9	9	5	9	5	0	4	7	5	7	6	6	-	-	-
Propanil Sequential (3+3)	8	6	9	7	9	7	6	7	9	9	9	5	9	5	0	6	8	8	9	8	-	-	8	-
Propanil + Grandstand	5	9	9	4	9	7	7	6	9	9	8	9	9	9	9	5	-	7	9	8	-	-	9	-
Propanil + Londax or DUET	5	9	9	4	9	7	8	7	9	9	9	9	9	9	9	8	7	8	9	8	-	-	-	-
Clincher SF	8	0	9	9	9	6	0	0	0	8	0	0	0	0	0	0	0	0	0	0	4	0	0	0
Grasp	2	7	8	2	2	0	8	8	8	2	9	-	8	5	8	3	-	7	8	6	-	0	9	8
Regiment	2	7	9	2	3	0	8	8	7	0	8	0	8	7	7	0	0	8	-	8	-	0	9	5
Ricestar HT	8	0	9	9	9	8	0	0	0	7	0	0	0	0	0	0	0	0	0	0	7	0	0	0
Londax	0	8	0	0	0	0	8	9	8	0	8	9	4	0	7	6	-	6	8	8	-	-	-	-
Aim	0	6	0	0	0	0	7	5	6	0	5	-	9	9	9	3	9	8	-	8	-	-	2	-
Permit	0	-	0	0	0	0	8	4	0	0	8	-	8	4	4	9	-	-	-	-	-	-	8	6
Permit Plus	0	8	0	0	0	0	9	7	7	0	-	4	8	5	5	9	-	8	-	5	-	0	-	-
Strada	0	8	0	0	0	0	8	6	8	0	9	-	9	7	9	7	-	6	-	6	0	0	8	5
Basagran	0	8	0	0	0	0	9	7	7	0	8	7	3	3	-	7	-	7	8	5	-	-	0	-
Basagran + Propanil	5	9	9	4	9	7	9	7	9	9	9	7	9	5	9	6	7	9	9	5	-	-	-	-
Storm early	2	9	3	2	3	3	7	8	7	2	8	-	9	8	-	7	6	8	-	8	-	-	0	-
<b>Midseason postemergence</b>																								
Ultra Blazer	0	0	0	0	0	0	0	0	0	0	0	0	9	4	-	0	-	0	0	4	-	-	0	-
Grandstand	0	9	0	0	0	0	-	3	8	0	5	9	8	-	-	-	-	3	3	7	-	-	-	-
Propanil + Grandstand	0	9	2	0	2	2	8	5	6	2	6	9	9	8	8	-	-	4	9	5	-	-	-	-
Propanil	0	4	4	0	4	4	0	3	4	4	5	0	8	0	0	3	-	5	7	6	-	-	-	-
2,4-D	0	9	0	0	0	0	9	9	9	0	8	6	9	9	-	5	-	6	8	-	-	-	-	-
<b>Clearfield rice</b>																								
Clearpath	6	8	9	6	9	9	6	6	8	6	9	0	7	8	7	8	-	6	-	7	0	8	-	-
Newpath fb Newpath/Beyond	6	8	9	8	9	9	5	6	0	9	9	5	0	7	0	8	0	8	9	5	0	9	0	-

Notes:

Control expected under optimum conditions. University of Missouri does not guarantee these estimates since many factors cause herbicide performance to vary.

<sup>a</sup>Control ratings do not apply to sulfonylurea-tolerant soybean (STS).

<sup>b</sup>Control ratings apply only to glyphosate-resistant horseweed emerging in spring. Lower control can be expected for glyphosate-resistant horseweed emerging in the fall.

Rating scale: 0-3 = none to slight; 4-6 = fair; 7-8 = good; 9-10 excellent.

Consult labels for approved adjuvants.

## Rice, Preplant

Active chemical per treated land acre	Formulation needed to treat 1 acre broadcast	Time of application	Weeds controlled	Special instructions and remarks
flumioxazin- 0.51 to 1.02 lb/A	Valor 51 WDG – 1 to 2 oz/A	30 days preplant.	Will enhance control of cutleaf evening primrose, henbit, Carolina geranium, and wild mustard, when applied in a burndown program with glyphosate, paraquat, or 2,4-D.	Used in a burndown program at 2 ounces per acre will provide residual control of horseweed, henbit, chickweed, and dandelion.
glyphosate – 1 to 1.5 lb/A	See label of glyphosate formulation used for rates.	Preplant or preemergence	Annual and perennial grasses and broadleaf weeds.	Apply to actively growing weeds less than 6 inches tall. Use higher rate for weeds more than 6 inches tall. Apply up to 5 pounds of active ingredient per acre for control of perennial weeds. See labels for specific weeds. See aerial application restrictions? Glyphosate may be tank-mixed with soil-applied herbicides for residual activity.
halosulfuron – 0.023 to 0.062 lb/A	Permit 75 WG – 0.5 to 1.33 oz/A in a minimum of 3-15 gallons of water per acre for aerial equipment and a minimum of 10 acres for ground equipment.	Preplant/Preemergence	Yellow nutsedge, annual weeds	Avoid off-site movement to soybean. Add a non-ionic surfactant at 0.25% v/v or a crop oil concentrate at 1% v/v. Application is safe to rice when soil pH is less than 8.0. Do not make more than one preplant/preemergence per growing season. Do not apply within 48 days of harvest.
imazethapyr – 0.063 to 0.094 lb/A	Newpath 2 AS – 4 to 6 oz/A	Preplant-incorporated. Sequential application to 3- to 5-leaf rice required.	Red Rice and most annual grasses. Also controls morningglory, smartweed, and nutsedges.	Use on Clearfield rice varieties and hybrids only. Use 4 to 6 ounces per acre for enhanced tolerant Clearfield rice varieties (CL161, CL131, and CL151). Use only 4 ounces per acre for Clearfield hybrids. Flush for activation if rainfall does not occur within a few days of planting. Must be followed by one postemergence application of Newpath. Avoid off-site movement of Newpath onto conventional rice varieties.
paraquat – 0.47 to 0.94 lb/A	Gramoxone Inteon 2 SL – 1.88 to 3.75 pt/A	Preplant/Preemergence	Annual and perennial grasses and broadleaf weeds. 1-3 inches; 1.3-1.7 pt, 3-6 inches: 1.7-2 pt, 6 inches: 2-2.7 pt	Add nonionic surfactant at 0.25% v/v.
thifensulfuron + tribenuron – 0.016 to 0.025 lb/A	FirstShot 50 SG – 0.5 to 0.8 oz/A	Before planting.	Winter annual and some perennial broadleaf weeds including curly dock.	Apply to actively growing weeds. May be mixed with other preplant herbicides to broaden weed spectrum. Extend time from application to planting to 7 days when FirstShot is used on light-textured soil (sand, sandy loam) or when FirstShot is used on high pH soils (>7.9).
thiobencarb – 4 lb/A	Bolero 8 EC – 4 pt/A	Preplant/Preflood (water seeded).	Barnyardgrass, sprangletop, and 3-4 weeks of aquatic weed control.	Prepare seedbed for water seeding with levees constructed. Destroy all vegetation before Bolero application. Apply Bolero and establish flood immediately. Wait 3 days after flood establishment before seeding.
2,4-D amine – 0.5 to 1 lb/A	Various formulations – 1 to 2 pt/A	During winter and early spring at least 30 days before planting.	Annual and perennial broadleaf weeds.	Do not apply by air after March 31. Do not apply more than 2.5 pints per growing season.
orthosulfamuron – 0.053 to 0.065 lb/A + clomazone – 0.3 to 0.6 lb/A	Strada 50 WG – 1.7 to 2.1 oz/A + Command 3ME – 0.8 to 1.6 pt/A (see Appendix)	14 days before planting until 7 days after planting	To provide preemergence and residual control of grass weeds and annual sedge, hemp sesbania, and jointvetch.	See MO 24(c) label. See labels for surfactant requirements. Only one application of Strada is allowed per year. Do not apply more than 1.6 pints of Command per season.



Rice, Preplant - *continued*

Active chemical per treated land acre	Formulation needed to treat 1 acre broadcast	Time of application	Weeds controlled	Special instructions and remarks
orthosulfamuron – 0.053 to 0.065 lb/A + clomazone – 0.3 to 0.6 lb/A + propanil 3 to 6 lb/A	Strada 50 WG – 1.7 to 2.1 oz/A + Command 3ME – 0.8 to 1.6 pt/A (see Appendix) + SuperWHAM!3 to 6 qt/A of	14 days before planting until 7 days after planting	Annual and perennial grasses and broadleaf weeds.	See MO 24(c) label. See labels for surfactant requirements. Only one application of Strada is allowed per year. Do not apply more than 1.6 pints of Command per season. See general remarks for propanil below.

## Rice, Preemergence/delayed pre

Active chemical per treated land acre	Formulation needed to treat 1 acre broadcast	Time of application	Weeds controlled	Special instructions and remarks
clomazone – 0.3 to 0.6 lb/A	Command 3 ME – 0.8 to 1.6 pt/A (see Appendix)	Preemergence	Barnyardgrass, broadleaf signalgrass, crabgrass, panicum sp., sprangletop.	Command may be applied from planting to rice emergence but before weed emergence. Do not apply to recently land-formed fields. Caution: follow label when tank-mixing.
glyphosate + pendimethalin – 0.37 to 2 lb/A + 0.75 to 1 lb/A	See label of glyphosate formulation used for rates + Prowl or Pendimax 3.3 EC – 1.8 to 2.4 pt/A; Prowl H2O 3.8 CS – 1.6 to 2.1 pt/A	Delayed Pre.	Winter annual weeds and residual grass control.	See precautions for glyphosate alone and for pendimethalin.
imazethapyr – 0.063 to 0.094 lb/A	Newpath 2 AS – 4 to 6 oz/A	Preemergence. Sequential application to 3- to 5-leaf rice required.	Red Rice and most annual grasses. Also controls morningglory, smartweed, and nutsedges.	Use on Clearfield rice varieties and hybrids only. Use 4 to 6 ounces per acre for enhanced tolerant Clearfield rice varieties (CL161, CL131, and CL151). Use only 4 ounces per acre for Clearfield hybrids. Flush for activation if rainfall does not occur within a few days of planting. Must be followed by one postemergence application of Newpath. Avoid off-site movement of Newpath onto conventional rice varieties.
imazosulfuron – 4 to 6.4 oz/A	League 75DF 0.19 to 0.3 lb ai/A	Preemergence or Delayed Pre	Ducksalad, rice flatsedge, hemp sesbania, eclipta, jointvetch, yellow nutsedge. See label for full list and rates.	Drill seeded rice ONLY. Do NOT apply to first rice crop after land forming operations. Do NOT apply organophosphate insecticide 21 days before or 7 days after application. If weeds are emerged at application, use an approved surfactant. May apply up to 2 inch interval.
imazosulfuron – 3.2 oz/A fb imazosulfuron – 3.2 oz/A	League 75DF 0.15 lb ai/A fb League 75DF 0.15 lb ai/A	Preemergence fb Early postemergence	Same as above.	POST application should be applied no sooner than 21 days after the PRE application. See additional comments above.
imazosulfuron – 3.2 to 4 oz/A	0.15 to 0.3 ob ai/A	Tank mix applications	Ducksalad, rice flatsedge, hemp sesbania, eclipta, jointvetch, yellow nutsedge. See label for full list and rates.	See comments under <i>Rice, Preemergence/delayed pre</i> . Can apply as a tank mix partner with labeled rates of propanil, Bolero, Facet, Command, NewPath, or Prowl. When tank mixing, follow most restrictive label language.
pendimethalin – 0.75 to 1 lb/A	Prowl or Pendimax 3.3 EC – 1.8 to 2.4 pt/A; Prowl H2O 3.8 CS – 1.6 to 2.1 pt/A	Delayed Pre.	Annual grasses including sprangletop and broadleaf signalgrass.	Apply after the rice seed has absorbed water and germinated and after the soil has been previously sealed over the seed by at least 1 inch of rainfall or by irrigation (flush). If the soil has not been sealed by rain or flush, apply when 80% of germinated seeds have primary root (radicle) or shoot at least 0.5 inch long. If applied to soil prior to these conditions or to cracked soil, stand reduction or stunting may occur. Under some conditions the use of gibberellic acid-treated seed, heavy rainfall or flushing after application may result in herbicide injury to rice. Rice can overcome moderate injury with appropriate cultural practices.

**Rice, Preemergence/delayed pre - *continued***

Active chemical per treated land acre	Formulation needed to treat 1 acre broadcast	Time of application	Weeds controlled	Special instructions and remarks
quinclorac – 0.25 to 0.5 lb/A	Facet 75 DF – 0.33 to 0.67 lb/A	Pre/ Delayed Pre.	Annual grasses except sprangletop, controls morningglory, sesbania, and eclipta.	Do not use on sand or loamy sand soils. Apply in 10-40 gallons per acre by ground and 5 gallons per acre by air. See general instructions and remarks for Facet below. Do not apply on precision-cut land until the second rice crop. Rice seed exposed to the spray may be severely injured.
quinclorac + pendimethalin – 0.25 to 0.5 lb/A + 0.75 to 1 lb/A	Facet 75 DF – 0.33 to 0.67 lb/A + Prowl or Pendimax 3.3 EC – 1.8 to 2.4 pt/A; Prowl H2O 3.8 CS – 1.6 to 2.1 pt/A	Delayed Pre.	Annual grasses, including sprangletop. Also controls morningglory and sesbania.	See special instructions and remarks for pendimethalin. See general instructions and remarks for Facet below. Do not apply on precision-cut land until the second rice crop. Rice seed exposed to the spray may be severely injured.
quinclorac + thiobencarb – 0.25 to 0.5 lb/A + 3 to 4 lb/A	Facet 75 DF – 0.33 to 0.67 lb/A + Bolero 8 EC – 3 to 4 pt/A	Pre/ Delayed Pre.	Annual grasses, including sprangletop. Also controls morningglory, sesbania, eclipta, and aquatics.	See general instructions and remarks for Facet below. Do not apply on precision-cut land until the second rice crop. Rice seed exposed to the spray may be severely injured. Application to rice stressed by high salt and/or high pH soil may cause excessive rice injury.
thiobencarb – 4 lb/A	Bolero 8 EC – 4 pt/A	Delayed Pre. (1-5 before rice and weed emergence).	Barnyardgrass, sprangletop, ducksalad, redstem, water hyssop, false pimpernel, annual umbrella plant, and spikerush.	Seedbed should be sealed by rain or flushing. Do not allow soil to crack after application. Application to rice stressed by high salt and/or high pH soil may cause excessive rice injury.
thiobencarb + pendimethalin – 4 lb/A + 0.75 to 1 lb/A	Bolero 8 EC – 4 pt/A + Prowl or Pendimax 3.3 EC – 1.8 to 2.4 pt/A; Prowl H2O 3.8 CS – 1.6 to 2.1 pt/A	Delayed Pre. (1-5 before rice and weed emergence).	Barnyardgrass, sprangletop, ducksalad, redstem, water hyssop, false pimpernel, annual umbrella plant, and spikerush.	See special instructions and remarks above for pendimethalin. Seedbed should be sealed by rain or flushing. Do not allow soil to crack after application. Application to rice stressed by high salt and/or high pH soil may cause excessive rice injury.

**General instructions and remarks for Facet**

See table below for soil type restriction. Facet on soil requires water for activation. For preemergence application, apply to moist soil or apply to dry soil and flush the field within 3 to 5 days. For postemergence application, flush 3 to 14 days after application or when new grass/weeds have emerged and are less than 1 inch tall.

**Do not do the following:**

- DO NOT apply more than 0.67 pound per acre of Facet per season.
- DO NOT use on soil that does not have good water-holding capacity.
- DO NOT use Facet in tank mixes other than those listed on the Facet label or supplemental labels.
- DO NOT allow Facet to drift onto sensitive crops such as cotton, soybeans, corn, or vegetables.
- DO NOT plant any crop other than rice for a period of 309 days following Facet application.
- DO NOT use Facet on precision-cut fields until the second rice crop.

**Preemergence application for drill-seeded rice**

Soil texture	Facet rate
sand, loamy sand	Do not use
sandy loam	0.33 – 0.44 lb/A
loam, silt loam, silt, sandy clay loam	0.44 – 0.5 lb/A
silty clay loam, clay loam, sandy clay, silty clay, clay	0.5 – 0.67 lb/A

## Rice, Postemergence

Active chemical per treated land acre	Formulation needed to treat 1 acre broadcast	Time of application	Weeds controlled	Special instructions and remarks
acifluorfen + bentazon – 0.25 to 0.5 lb/A + 0.25 to 0.5 lb/A	Storm 4L – 1.5 pt/A	Apply after rice tillering to early boot.	Cocklebur, dayflower, hemp sesbania, redstem, smartweed, and yellow nutsedge.	Add a nonionic surfactant at 0.25% v/v.
bentazon – 0.75 to 1 lb/A	Basagran 4L – 1.5 to 2 pt/A in 10 gal water for aerial application.	Apply at least 24 hours before permanent flooding. On flooded fields, lower flood or drain before application.	Day flower, smartweed, redstem, cocklebur, and yellow nutsedge.	Refer to label for rates and stages of weed growth. Apply early to actively growing weeds. Do not apply to submerged weeds because thorough coverage is necessary. A second application may be made 10 to 14 days later if needed. Do not apply more than 2 pounds per acre per season. Tank mix with propanil to increase weed spectrum. Add a nonphytotoxic crop oil concentrate at 1.25% v/v.
bensulfuron – 0.038 to 0.06 lb/A	Londax 60 DF – 1 to 1.6 oz/A in 10 gal water aerial application.	Apply to flooded field preemergence to weeds or very early postemergence to submerged aquatic weeds. Redstem and yellow nutsedge should be 3 to 4 inches above water at application.	Aquatic weeds and yellow nutsedge.	Apply after flood establishment but before weeds reach the 3-leaf stage. Hold water static for at least 7 days after application. May be tank mixed with propanil 1-7 days pre-flood for increased yellow nutsedge and rice flatsedge control. See label for tank mix rates. Add C.O.C. 1% or N.I.S. 0.25% if used alone or with a dry flowable herbicide.
bispyribac-sodium 0.02 to 0.033 lb/A	Regiment 80 WP – 0.4 to 0.67 oz/A	3-leaf rice before first elongated internode exceeds 0.5 inch.	Barnyardgrass, junglerice, johnsongrass, hemp sesbania, ducksalad, and Pennsylvania smart weed.	See label for a list of adjuvants approved by Valent. Regiment is rainfast after 8 hours. Apply at least 10 gal per acre and do not exceed 1.06 ounce per year. Do not use AI nozzles. Avoid off-site movement to soybeans. Little to no control of sprangletop.
carfentrazone – 0.025 to 0.05 lb/A	Aim 2 EC – 1.6 to 3.2 oz/A	2-leaf rice or larger and weeds up to 4 inches tall.	Cocklebur, jointvetch, morningglory, smartweed, hemp sesbania, Texasweed.	Do not apply more than 8.6 ounces per season. If flood is lowered, return to normal 24 hours following treatment. Hold water 30 days after treatment. Add a nonionic surfactant at 0.25% v/v or a nonphytotoxic crop oil concentrate at 1% v/v. Avoid applications from flag leaf emergence through harvest-aid application.
clomazone – 0.3 to 0.6 lb/A	Command 3 ME – 0.8 to 1.6 pt/A	1- to 2-leaf rice.	To provide preemergence and residual control of grass weeds.	For control of existing grass weeds present at time of application include a postemergence herbicide from the list on the Command label.
cyhalofop-butyl – 0.25 to 0.28 lb/A	Clincher SF 2.38 EC – 13.5 to 15 oz/A	1-leaf rice up to 60 days before harvest.	Barnyardgrass, broadleaf signalgrass, fall panicum, johnsongrass (seedling), large crabgrass, sprangletop 13.5 oz up to 4 leaf, 13.5-15 oz post flood prior to heading.	Apply 10 gallons or more per acre by air or ground. Do not apply by air within 2 miles downwind or 4 miles upwind of peaches or nectarines. A nonphytotoxic crop oil concentrate must be used at 1 quart per acre. It is essential to have good soil moisture and actively growing grass. Tank mixing with broadleaf or sedge herbicides can result in loss of grass activity. May be used in sequential applications. Do not exceed 25 ounces per acre per year.
fenoxaprop + safener 0.06 to 0.077 lb/A	Ricestar HT 0.58 EC – 13 to 17 oz/A	1-leaf rice to tillering but before panicle initiation.	Barnyardgrass, sprangletop, broadleaf signalgrass, johnsongrass (seedling), and fall panicum.	Do not apply within 48 hours of an application of methyl parathion. Soil moisture is critical for good activity. Tank mix only with approved herbicides on Ricestar HT label.
halosulfuron – 0.032 to 0.063 lb/A	Permit 75 WG – 0.067 to 1.33 oz/A	Prior to rice emergence until after flooding.	1- to 6-inch yellow or purple nutsedge, 0.67 oz/A; 6- to 12-inch sedges, 1.33 oz/A.	Do not apply within 48 days of harvest. Avoid off-site movement to soybeans. Add a nonionic surfactant at 0.25% v/v or a crop oil concentrate at 1% v/v.

**Rice, Postemergence - *continued***

Active chemical per treated land acre	Formulation needed to treat 1 acre broadcast	Time of application	Weeds controlled	Special instructions and remarks
imazethapyr – 0.063 to 0.094 lb/A	Newpath 2 AS – 4 to 6 oz/A	3-leaf through 5-leaf prior to permanent flooding.	Red rice and most annual grasses. Also controls morningglory, smartweed, and nutsedges.	Use on Clearfield rice varieties and hybrids only. Must be preceded by one Newpath PPI or PRE application. Use 4 to 6 ounces per acre for enhanced tolerant Clearfield rice varieties (CL 161, CL 131, and CL 151). Use only 4 ounces per acre for Clearfield hybrids. Tank mixing with other products will be required for control of broadleaf weeds, including hemp sesbania, northern joint vetch, and eclipta. Avoid off-site movement of Newpath onto conventional rice varieties. Add a nonionic surfactant at 0.25% v/v or a crop oil concentrate at 1% v/v.
imazethapyr – 0.063 to 0.094 lb/A followed by 0.063 to 0.094 lb/A	Newpath 2 AS – 4 to 6 oz/A followed by 4 to 6 oz/A	Make first postemergence application at spike to 1-leaf rice followed by a second postemergence application 10 to 14 days later.	Red rice and most annual grasses. Also controls morningglory, smartweed, and nutsedges.	Use on Clearfield rice varieties and hybrids only. Use 4 to 6 ounces per acre for enhanced tolerant Clearfield rice varieties (CL 161, CL 131, and CL 151). Use only 4 ounces per acre for Clearfield hybrids. A soil-applied herbicide should be used for sprangletop and to aid in control of annual grasses. Tank mixing with other products will be required for control of broadleaf weeds, including hemp sesbania, northern joint vetch, and eclipta. Avoid off-site movement of Newpath onto conventional rice varieties. Add a nonionic surfactant at 0.25% v/v or a crop oil concentrate at 1% v/v.
imazethapyr + quinclorac – 0.063 + 0.312 lb/A	Clearpath 75 DF – 0.5 lb/A	Preplant incorporated, preemergence, or postemergence (up to 5-leaf rice).	Red rice and most annual grasses. Also controls morningglory, smartweed, and nutsedges. Improved control of some grasses and broadleaf weeds over Newpath.	Use on Clearfield rice varieties and hybrids only. Tank mixing with other products will be required for complete control of broadleaf weeds, including hemp sesbania, northern joint vetch, and eclipta. Avoid off-site movement of Newpath onto conventional rice varieties. This product provides 4 ounces per acre of Newpath and 0.4 pound per acre of Facet. Add a crop oil concentrate at 1% v/v. Only one application of Clearpath is allowed per season.
imazosulfuron – 3.2 to 4 oz/A	0.15 to 0.19 lb ai/A	Early postemergence	Ducksalad, rice flatsedge, hemp sesbania, eclipta, jointvetch, yellow nutsedge. See label for full list and rates.	See comments under <i>Rice, Preemergence/delayed pre</i> . POST application can be applied to drill- or water-seeded rice.
orthosulfamuron – 0.053 to 0.065 lb/A + clomazone – 0.3 to 0.6 lb/A	Strada 50 WG – 1.7 to 2.1 oz/A + Command 3ME – 0.8 to 1.6 pt/A (see Appendix)	1-2 leaf stage	To provide control of grass weeds and annual sedge, hemp sesbania, and jointvetch.	See MO 24(c) label. See labels for surfactant requirements. Only one application of Strada is allowed per year. Do not apply more than 1.6 pints of Command per season.
orthosulfamuron – 0.053 to 0.065 lb/A + clomazone – 0.3 to 0.6 lb/A + propanil 3 to 6 lb/A	Strada 50 WG – 1.7 to 2.1 oz/A + Command 3ME – 0.8 to 1.6 pt/A (see Appendix) + SuperWHAM! - 3 to 6 qt/A of	1-2 leaf stage	Annual and perennial grasses and broadleaf weeds.	See MO 24(c) label. See labels for surfactant requirements. Only one application of Strada is allowed per year. Do not apply more than 1.6 pints of Command per season. See general remarks for propanil below.
penoxsulam – 0.031 to 0.036 lb/A	Grasp 2 SL – 2 to 2.3 oz/A	Emergence to 60 days before harvest.	Up to 7-leaf eclipta, hemp sesbania, jointvetch, flatsedge, and smartweed; up to 4-leaf ducksalad, pigweed, and barnyardgrass.	Do not apply to drought-stressed weeds. Little to no control of sprangletop, broadleaf signalgrass, and fall panicum. May cause stunting and root pruning, especially if higher than labeled rates are applied. Avoid use on high pH soils (>7.8). Add a nonphytotoxic crop oil concentrate or methylated seed oil adjuvant at 1 quart per acre. May be aerially applied tank mixed with Command 3ME with or without other herbicides in no less than 10 gallons of water per acre in MO.

Rice, Postemergence - *continued*

Active chemical per treated land acre	Formulation needed to treat 1 acre broadcast	Time of application	Weeds controlled	Special instructions and remarks
propanil 3 to 6 lb/A	3 to 6 qt/A of a 4lb/gal formulation in 10 gal water for aerial application and 15 to 20 gal water for ground application.	When barnyardgrass is in the 1- to 4-leaf stage.	Barnyardgrass and many other grasses and broadleaf weeds common in rice fields.	See general remarks for propanil below. If grass is in the 4- to 5-leaf stage, apply 4 to 5 pounds of active material per acre. To prevent reinfestation, flood 1 or 2 days after application. Weed foliage must not be covered with water at time of application. Consult label concerning use of surfactants or crop oil concentrates.
<b>General instructions and remarks for propanil</b>				
For aerial application, apply 10 gallons of spray mixture and avoid drift to susceptible crops. Complete spray coverage is necessary. Weeds should be growing actively at treatment time. Rice plants may show yellowing after treatment; however, plants recover quickly. Do not exceed 6 pounds per acre per application or 8 pounds per acre per season. Do not apply when rain is expected within 6 hours or during periods when daily maximum temperatures are below 75°F, or above 100°F. Application during high temperatures may result in excessive rice injury. Do not use in spray equipment that has contained organophosphate insecticides unless the equipment has been cleaned thoroughly, and do not apply these insecticides within 14 days before or after applying propanil.				
propanil – 6 to 8 lb/A (For split application where flooding is delayed)	6 to 8 qt/A of a 4lb/gal formulation in two applications	Split application, 3 to 4 lb/A when weeds are in 1- to 3-leaf stage and apply second 3 to 4 lb/A treatment when needed.	Barnyardgrass, Amazon sprangletop, and many other grasses and broadleaf weeds common in rice fields.	See general remarks for propanil above. Flood 1 or 2 days after final application. Treatment may not give satisfactory control of other sprangletop species. Weed foliage must not be covered with water at time of application. Consult label concerning use of surfactants or crop oil concentrates.
propanil + bensulfuron – 3 to 5 lb/A + 0.038 to 0.063 lb/A	Duet 4.03 EC – 3 to 5 qt/A	For post emergence control, use 3 qt when most grasses have reached 1- to 3-leaf or 4- to 5-leaf stage.	Many grasses, broadleaf weeds and yellow nutsedge.	
propanil + pendimethalin – 3 to 4 lb/A + 0.75 to 1 lb/A	propanil – 3 to 4 qt/A of 4 lb/gal formulation + Prowl or Pendimax 3.3 EC – 1.8 to 2.4 pt/A; Prowl H2O 3.8 CS – 1.6 to 2.1 pt/A in 10 gal water for aerial application	After rice emerges and barnyardgrass is in 1- to 3-leaf stage.	Postemergence control of barnyardgrass and many other grasses and broadleaf weeds common in rice fields. Preemergence control of barnyardgrass, sprangletop, broadleaf signalgrass, and crabgrass.	See general remarks for propanil above. Seedbed should be firm and free of large clods, trash, and surface water at time of application. Field should be flushed if adequate rainfall does not occur within 7 days. Do not make more than one application of pendimethalin per season.
quinclorac – 0.25 to 0.5 lb/A	Facet 75 DF – 0.33 to 0.67 lb/A	Early postemergence	1- to 2-leaf barnyardgrass, broadleaf signalgrass, crabgrass, junglerice, sesbania, and eclipta. Controls 2- to 6-leaf morningglory.	Add a nonphytotoxic crop oil concentrate at 1 quart per acre to maximize weed control. Facet can be applied to water seeded rice after the first true leaf of rice has developed. Do not use on precision-cut fields until the second year as rice injury may occur. Does not control sprangletop.
quinclorac + bentazon – 0.25 to 0.5 lb/A + 0.75 to 1 lb/A	Facet 75 DF – 0.33 to 0.67 lb/A + Basagran 4L – 1.5 to 2 pt/A	Early postemergence	Weeds controlled by Facet, plus redstem, ducksalad, and cocklebur.	Add a nonphytotoxic crop oil concentrate at 1 quart per acre. See label for mixing instructions. Do not use on precision-cut fields until the second year as rice injury may occur.
quinclorac + propanil - 0.25 to 0.5 lb/A + 3 to 5 lb/A	Facet 75 DF – 0.33 to 0.67 lb/A + propanil – 3 to 5 qt/A of 4 lb/gal formulation	Early postemergence	Broad spectrum grass and broadleaf weeds.	See label for mixing instructions. Do not use on precision-cut fields until the second year as rice injury may occur. Weed foliage must not be covered with water at time of application. Consult label concerning use of surfactants or crop oil concentrates.
quinclorac + propanil +molinate - 0.25 to 0.5 lb/A + 2.25 to 3 lb/A	Facet 75 DF – 0.33 to 0.67 lb/A + Arrosolo – 3 to 4 qt/A	Early postemergence	Broad spectrum grass, especially Amazon sprangletop, and broadleaf weeds.	Add a nonphytotoxic crop oil concentrate at 1 quart per acre. See label for mixing instructions. Do not use on precision-cut fields until the second year as rice injury might occur.
triclopyr – 0.25 to 0.375 lb/A	Grandstand 3 SL – 0.67 to 1 pt/A	3-leaf to 0.5 inch internode elongation	Many annual broadleaf weeds.	Flood must be delayed 72 hours to prevent rice injury from applications made prior to flood. If flood is lowered for application, do not expose the crown of the rice plants and wait 48 hours before raising the flood level. Add a nonionic surfactant at 0.25% or C.O.C. at 1% v/v. Do not use on precision-cut fields until the second rice crop.

**Rice, Postemergence - *continued***

Active chemical per treated land acre	Formulation needed to treat 1 acre broadcast	Time of application	Weeds controlled	Special instructions and remarks
triclopyr + propanil – 0.19 lb/A + 3 to 4 lb/A	Grandstand 3 SL – 0.5 pt/A + propanil – 3 to 4 qt/A	Early postemergence 2-leaf rice to midseason.	Many grass and broadleaf weeds.	Do not add a surfactant or crop oil concentrate when using propanil EC. However, a nonionic surfactant at 0.25% v/v is recommended when using propanil formulated as a dry product or flowables. Do not apply to recent land-formed fields. Do not use on precision-cut fields until the second rice crop.
thiobencarb + propanil – 3 to 4 lb/A + 3 to 4 lb/A	Bolero 8 EC – 3 to 4 pt/A + propanil - 3 to 4 qt/A of 4 lb/gal formulation	Early postemergence. Grass in 1- to 3-leaf stage or less, aquatics less than 0.5 inch tall and broadleaf weeds less than 2 inches tall.	Many grass and broadleaf weeds common in rice.	See general instructions for propanil application. Soil should be moist at time of application and not allowed to crack after application. Do not apply to stressed rice.
quinclorac + acifluorfen – 0.25 to 0.5 lb/A + 0.125 to 0.25 lb/A	Facet 75 DF – 0.33 to 0.67 lb/A + Ultra Blazer 2 L – 0.5 to 1 pt/A	Apply after rice is past the 3-leaf stage.	Broad spectrum of grasses and broadleaf weeds.	Add a nonionic surfactant at 0.25% v/v. See label for mixing instructions. Do not apply to recent land-formed fields.
quinclorac + acifluorfen + bentazon – 0.25 to 0.5 lb/A + 0.25 to 0.5 lb/A	Facet 75 DF – 0.33 to 0.67 lb/A + Storm 4L – 1.5 pt/A	Apply after rice is past the 3-leaf stage.	Grasses and broadleaf weeds such as cocklebur, dayflower, hemp sesbania, redstem, smartweed, and yellow nutsedge.	Add a nonionic surfactant at 0.25% v/v. See label for mixing instructions. Do not apply to recent land-formed fields.
quinclorac + bensulfuron – 0.25 to 0.5 lb/A + 0.038 to 0.06 lb/A	Facet 75 DF – 0.33 to 0.67 lb/A + Londax 60 DF – 1 to 1.6 oz/A	Postemergence 1-2 days prior to permanent flood.	Grasses, broadleaf weeds, and yellow nutsedge.	Add a nonphytotoxic crop oil concentrate at 1 quart per acre. See label for mixing instructions.

**Rice, Midseason**

Active chemical per treated land acre	Formulation needed to treat 1 acre broadcast	Time of application	Weeds controlled	Special instructions and remarks
acifluorfen – 0.125 to 0.25 lb/A	Ultra Blazer 2 L – 0.5 to 1 pt/A in 5 to 10 gal water	Apply to actively growing sesbania before it flowers. Apply to rice prior to early boot stage.	Hemp sesbania	Add a nonionic surfactant at 0.25% v/v. Do not mix Blazer with oils, drift control agents, liquid fertilizers, or other pesticides. See label for other restrictions.
propanil – 2 to 3 lb/A	2 to 3 qt/A of 4 lb/gal formulation	Midseason when the first elongating internode of rice is less than 0.5 inch in length.	Hemp sesbania less than 5 feet. Lower rates may be used on weeds 3 feet or less.	See general instructions and remarks for propanil. Treatment may be applied to flooded or drained fields. Complete kill may require 2 to 3 weeks. Weed foliage must not be covered with water at time of application. Consult label concerning the use of surfactants or crop oil concentrates.
triclopyr – 0.25 to 0.38 lb/A	Grandstand 3 SL – 0.67 to 1 pt/A	Apply from 3-leaf to midseason.	Many midseason broadleaf weeds.	Add a nonionic surfactant at 0.25 – 0.5% v/v. Do not apply to recent land-formed fields.
2,4-D amine – 1 to 1.5 lb/A	Various formulations – 2 to 3 pt/A	Late tillering stage but before first elongating internode exceeds 0.5 inch in length.	Hemp sesbania, curly indigo, redstem, ducksalad, gooseweed, smartweed, spikerush, rice flatsedge, water hyacinth, morningglory, and dayflower.	Follow Division of Plant Industry regulations for phenoxy herbicides. Add 1 pint of surfactant to each 50 gallons of spray mix. Fields should have shallow flood at time of treatment. Do not apply nitrogen within 5- to 21-day period before treatment. Use extreme caution to prevent drift to susceptible crops.

## Rice, Salvage

Active chemical per treated land acre	Formulation needed to treat 1 acre broadcast	Time of application	Weeds controlled	Special instructions and remarks
bispyribac-sodium – 0.034 lb/A	Regiment 80WP – 0.67 oz/A	Postflood but before 0.5-inch internode elongation.	Barnyardgrass, junglerice (4 tiller up to booting).	Emergency salvage treatment. See label for list of adjuvants approved by Valent. Avoid off-site movement to soybeans.
Cyhalofop-butyl – 0.25 to 0.28 lb/A	Clincher SF 2.38 EC – 13.5 to 15 oz/A	Postflood.	Annual grasses.	Emergency salvage treatment. Add a nonphytotoxic crop oil concentrate at 1 quart per acre.
imazamox – 0.04 lb/A	Beyond 1 AS – 5 oz/A	Apply only after two applications of Newpath. Apply to red rice prior to heading. Apply no later than 14 days past panicle initiation of Clearfield rice.	Late season suppression of red rice.	Use on Clearfield rice varieties and hybrids only. Must be applied from tillering to 14 days after panicle initiation. Avoid off-site movement of Beyond onto conventional rice varieties. Add a nonphytotoxic crop oil concentrate at 1 quart per acre. Do not apply more than one application of Beyond per year. Do not apply more than 5 oz of Beyond per acre per year.
penoxsulam – 0.036 to 0.044 lb/A	Grasp 2 SL – 2.3 to 2.8 oz/A	Postflood to 60 days before harvest but before heading if targeting barnyardgrass	Barnyardgrass (prior to heading), hemp sesbania, jointvetch, flatsedge, and duckweed.	Emergency salvage treatment. Regrowth of treated weeds may occur. Add a nonphytotoxic crop oil concentrate or methylated seed oil adjuvant at 1 quart per acre.

## Red rice control

Steps should be taken to prevent the introduction of this weed into rice fields. These steps include use of rice seed free of red rice, cleaning equipment before entering uninfested fields, and hand roguing of light infestations. Where severe infestations occur, several cycles of a 2-year soybean or a 1-year sorghum/1-year soybean rotation with rice are suggested. During the years out of rice, strive for 100% red rice control. Use a combination of preemergence and postemergence herbicides recommended for the control of red rice. A combination of shallow spring and fall disking in conjunction with clod disruption also should be used to reduce the soil reserves of red rice by stimulating germination and destroying germinated seed. When rice is planted, an early-season variety should be used. It should be planted late to allow additional spring tillage and seeded at a rate that allows a good competitive stand. The early-season varieties mature earlier, thereby limiting the amount of red rice that shatters before harvesting as well as extending the time interval for additional fall tillage.

## Rice, Appendix

Command 3 ME herbicide applied alone Soil texture	Broadcast rates per acre*
<b>Coarse (light) soils:</b> (sand, loamy sand, sandy loam)	Do not use
<b>Medium soils:</b> (loam, silt, silt loam, sandy clay, sandy clay loam)	0.8 to 1.125 pt/A (0.3 to 0.4 lb ai/A)
<b>Fine (heavy) soils:</b> (silty clay, clay loam, silty clay loam, clay)	1.33 to 1.6 pt/A (0.5 to 0.6 lb ai/A)

\*Select lower to higher rates based on lighter to heavier soils

Soybean: Guide to grass and sedge weed response to herbicides

Herbicide	Barnyardgrass	Broadleaf signalgrass	Crabgrass	Fall panicum	Foxtail, giant	Goosegrass	Johnsongrass, seedling	Johnsongrass, rhizome	Shattercane	Volunteer corn***	Volunteer wheat	Woolly cupgrass	Yellow nutsedge	Crop response**
<b>Preplant incorporated</b>														
Treflan/others	9	9	9	9	10	9	9	3	9	7	6	9	0	0
<b>Preplant or Preemergence</b>														
Authority Assist	6	5	6	6	7	5	6	4	7	4	3	5	7	1
Authority Elite	9	-	9	9	9	8	6	0	5	0	3	7	8	1
Authority First/Sonic	2	0	2	2	2	-	0	0	1	1	-	1	8	1
Authority Maxx	4	0	5	5	5	0	0	0	0	1	-	0	7	1
Authority MTZ	5	-	4	4	4	4	2	0	1	1	-	-	6	2
Authority XL	4	0	5	4	4	0	0	0	0	1	-	0	7	2
Boundary	8	5	9	8	8	8	5	1	4	1	-	4	6	1
Canopy DF	1	2	1	3	4	2	1	0	0	1	-	0	2	2
Canopy EX	1	-	3	2	4	2	1	0	0	0	-	0	4	2
Command	9	9	9	9	10	9	9	2	6	4	8	8	-	0
Define	9	8	9	8	9	8	5	1	4	0	3	5	6	0
Dual II Magnum/Cinch	8	7	9	9	9	8	6	0	5	0	3	7	8	0
Envive	4	2	3	3	5	2	1	0	0	1	-	0	5	2
Fierce 76WDG	9	-	9	8	9	-	3	0	3	-	-	-	2	2
Fierce XLT	9	2	9	8	9	2	3	0	4	0	3	-	7	2
FirstRate	4	-	5	-	3	-	2	0	0	-	-	-	7	0
Gangster/Surveil	1	2	3	3	3	1	1	0	0	1	-	1	2	1
Intro	8	7	9	9	9	9	6	0	5	0	3	7	7	0
OpTill	6	5	4	5	7	5	6	2	6	4	2	3	5	2
OpTill PRO	8	6	9	8	8	8	8	2	7	4	2	5	6	2
Outlook	8	-	9	9	9	-	-	0	5	0	3	7	7	0
Prefix	8	6	8	7	8	6	5	1	2	4	-	4	6	1
Prowl H <sub>2</sub> O	9	9	9	9	10	9	9	3	8	7	6	9	0	0
Pursuit	6	-	7	6	7	-	-	4	6	4	-	5	3	1
Python	6	6	6	7	6	-	7	-	6	0	6	-	-	1
Sencor	6	6	6	6	6	6	5	0	1	2	-	-	2	2
Sharpen	6	5	4	5	7	5	6	2	6	1	2	3	5	2
Spartan	-	-	-	6	6	-	-	-	-	-	-	-	9	2
Synchrony XP	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Lorox/Linex	6	6	6	6	6	6	4	0	0	0	-	-	0	1
Prowl H <sub>2</sub> O	9	-	8	8	9	9	7	0	6	6	5	8	0	2
Trivence	7	-	7	6	6	5	5	0	4	1	2	-	5	2
Valor	2	-	2	-	2	-	-	-	-	-	-	-	-	2
Valor XLT	4	2	4	4	4	2	1	0	0	1	-	0	5	2
Warrant	8	-	9	8	9	9	6	0	5	0	3	-	7	1
Zidua	8	8	9	9	9	8	7	0	6	0	2	8	6	2
<b>Postemergence overtop</b>														
Assure II	8	9	9	9	10	9	10	9	8	9	9	9	0	0
Basagran	0	0	0	0	0	0	0	0	0	0	0	0	7	0
Cadet	1	1	1	1	1	1	1	1	1	1	1	1	1	2
Classic	0	0	0	0	0	0	0	0	0	0	-	0	7	1
Cobra/Phoenix	0	0	0	0	0	0	0	0	0	2	4	-	2	2
FirstRate/Amplify	3	-	4	-	5	-	6	-	5	2	-	-	7	0
Flexstar/Reflex/Rhythm/Dawn	0	0	0	0	0	0	0	0	3	2	3	-	3	1
Fusilade DX	8	8	8	8	9	9	10	9	10	9	9	9	0	0
Glyphosate (Roundup Ready only)	10	10	10	10	10	10	10	9	10	0	10	9	7	0
Harmony GT XP/Unity	0	0	0	0	0	0	0	0	0	0	0	-	0	2
Ignite (Libery Link only)	8	8	7	7	8	7	8	6	8	6	-	7	5	1
Poast Plus	9	10	9	9	10	9	10	8	9	8	7	9	0	0
Pursuit	7	7	7	7	8	5	6	4	9	4	3	5	4	1
Raptor	7	7	7	8	9	5	8	6	9	7	6	5	5	1
Resource	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Select/Select Max	9	9	9	9	9	9	10	9	8	9	9	9	0	0
Ultra Blazer	0	0	0	0	0	0	0	0	0	2	3	-	2	1

Weed control: 8 to 10 = Good 6 to 7 = Fair\* Less than 6 = Poor - = No data available

\*A weed control rating of 6 to 7 indicates partial control or suppression.

\*\*Crop response: A rating of 3 or less will not result in loss of crop yield under normal growing conditions.

\*\*\*Indicates volunteer Roundup Ready© corn.

Use this and the following table as a guide for comparing the relative effectiveness of herbicides on individual weeds. Herbicides may perform better or worse than indicated due to extreme weather conditions and other variables.



### Soybean: Guide to broadleaf weed response to herbicides

Herbicide	Black nightshade	Carpetweed	Cocklebur	Hopornbeam copperleaf	Jimsonweed	Lambsquarters	Morningglory, annual	Pigweed, smooth/redroot	Palmer amaranth	Prickly sida	Ragweed, common	Ragweed, giant	Smartweed, annual	Spurred anoda	Sunflower	Velvetleaf	Waterhemp
<b>Preplant incorporated</b>																	
Treflan/others	0	10	0	0	3	9	3	10	8	0	3	0	3	0	0	3	8
<b>Preplant or preemergence</b>																	
Authority Assist	8	-	8	8	8	9	7	9	8	7	8	7	8	6	8	8	8
Authority Elite	9	9	6	7	8	9	8	9	9	8	6	5	8	-	7	6	9
Authority First/Sonic	8	-	8	8	8	9	6	9	8	7	9	7	8	4	7	8	8
Authority MTZ	8	9	7	8	6	9	7	9	8	7	8	7	9	8	8	7	8
Authority Maxx	9	9	7	9	9	9	8	9	9	8	8	7	8	-	8	8	9
Authority XL	9	9	8	9	9	9	8	9	9	8	9	7	9	-	8	8	9
Boundary	8	9	6	5	7	9	4	9	8	6	8	6	8	9	8	7	8
Canopy DF	4	9	8	-	9	9	8	8	6	-	9	7	9	8	8	8	6
Canopy EX	4	-	8	-	9	9	8	7	6	6	8	7	9	-	8	8	4
Command	5	0	6	3	9	9	0	5	3	9	8	3	7	8	3	10	4
Define	6	-	2	3	3	5	4	9	9	3	7	2	3	0	0	2	9
Dual II Magnum/Cinch	9	9	2	5	4	6	2	9	9	4	5	3	5	0	0	2	9
Envive	9	9	8	-	9	9	8	8	8	8	9	7	9	9	8	8	8
Fierce	9	9	4	9	9	9	8	9	9	8	7	5	-	9	4	9	9
Fierce XLT	9	9	8	9	9	9	8	9	9	8	8	7	8	9	8	9	9
FirstRate	-	-	9	-	9	7	8	7	5	6	9	9	-	-	9	7	5
Gangster/Surveil	9	9	8	9	9	9	8	9	8	8	9	8	9	9	9	8	8
Intrro	9	9	0	5	4	6	0	9	8	4	5	3	5	0	0	2	8
OpTill	6	9	7	8	-	9	7	8	8	7	7	6	9	6	7	7	8
OpTill PRO	9	9	7	8	-	9	7	9	9	7	7	7	9	8	7	7	9
Outlook	8	-	2	-	4	7	2	9	8	0	5	2	4	-	0	2	8
Prefix	8	9	6	-	-	6	4	9	8	4	8	6	8	-	6	6	8
Prowl H <sub>2</sub> O	0	10	0	0	3	9	3	9	8	0	3	0	3	0	0	3	8
Pursuit	9	-	6	-	7	8	7	8	5	-	7	6	9	-	7	8	5
Python	-	-	8	-	9	9	7	9	7	9	7	7	8	9	7	9	7
Sencor	5	9	7	9	7	8	2	9	8	9	9	6	9	9	7	8	8
Sharpen	8	-	8	-	8	0	7	6	6	8	9	9	9	-	8	9	6
Spartan	8	-	3	6	6	9	8	8	9	-	4	3	2	-	4	6	9
Lorox/Linex	4	9	6	-	-	9	4	8	8	8	8	5	7	-	5	6	8
Prowl/others PRE	0	-	0	0	0	7	0	9	7	-	0	0	3	0	0	2	7
Trivence	9	9	8	9	9	9	8	9	9	8	9	7	9	9	8	9	9
Valor	9	9	2	9	9	9	8	9	8	8	8	7	7	-	2	7	9
Valor XLT	9	9	8	9	9	9	8	9	8	8	9	7	9	9	8	8	8
Warrant	8	-	2	5	-	8	2	9	9	4	5	3	5	0	0	2	9
Zidua	9	9	2	5	4	7	2	9	9	4	7	3	3	-	3	5	9
<b>Postemergence overtop</b>																	
Aim	9	-	6	-	-	8	7	9	6	6	-	-	-	-	-	9	6
Assure II	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Basagran	2	0	9	0	9	6	5	4	3	8	8	7	9	8	8	8**	3
Cadet	2	-	2	4	8	7	6	5	4	5	4	3	5	8	3	9	5
Classic	5	2	9	4	8	3	7	8	5	3	8	6	8	2	9	8**	5
Cobra/Phoenix	9	10	9	9	9	5	7	10	9	6	9	8	7	7	8	7	9
FirstRate/Amplify	5	-	9	-	9	4	8	7	5	6	9	9	9	-	9	9	5
Flexstar/Reflex/Rhythm/Dawn	8	10	9	8	9	5	8	10	9	2	8	8	7	2	6	7	9
Fusilade DX	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Glyphosate (Roundup Ready only)	9	9	10	8	9	9	8	10	9	8	9	9	7	-	9	8	9
Harmony GT XP/Unity	4	-	6	-	4	8	2	9	5	4	5	4	8	2	6	9	5
Ignite (Liberty Link only)	8	9	9	8	9	8	9	7	8	8	8	8	9	-	9	7	8
Poast Plus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pursuit	9	-	8	2	8	5	7	9	5	5	8	6	8	6	8	8	5
Raptor	9	7	8	5	8	7	7	9	5	5	7	6	8	7	8	8	5
Resource	-	-	7	-	7	6	5	7	7	-	7	7	5	-	-	9	7
Select/Select Max	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Synchrony XP	5	-	8	-	9	8	6	8	6	-	8	6	8	-	9	8	2
Ultra Blazer	9	10	7	9	9	5	8	10	9	2	9	5	8	2	6	7**	9

Weed control: 8 to 10 = Good 6 to 7 = Fair\*\*\* Less than 6 = Poor - = No data available

\*Shallow incorporation needed for this level of control.

\*\*Split application required for this level of control.

\*\*\*A weed control rating of 6 to 7 indicates partial control or suppression.

\*\*\*\*Waterhemp has been observed to routinely escape ALS-herbicide treatments in many areas. Resistance has been formally confirmed in some fields. Control may vary from indicated valued on ALS-inhibiting herbicides.

## Soybean

### Soil-applied herbicide rates

Herbicide	Soil texture*		
	Coarse (light, sandy)	Medium (loamy)	Fine (heavy, clay)
----- (Rate per acre) -----			
Authority Eilte	19 to 25 oz	25 to 32 oz	25 to 38.7 oz
Authority First	3.2 to 6.4 oz	3.2 to 8 oz	3.2 to 8 oz
Authority Maxx	5.0 to 7.0 oz	6.0 to 8.0 oz	7.0 to 9.6 oz
Authority MTZ	8 to 14 oz	8 to 18 oz	10 to 20 oz
Authority XL (full use rates)	5 to 7 oz	6.5 to 8 oz	7 to 9.6 oz
Authority XL (for GMO)	3 to 4 oz	3.2 to 4.8 oz	4 to 5 oz
Axiom 68DF	8 to 15 oz	10 to 20 oz	20 to 23 oz
Boundary 6.5L	1.2 to 1.8 pt	1.8 to 2.4 pt	2.4 to 3 pt
Canopy	2.25 to 7 oz	2.25 to 7 oz	2.25 to 7 oz
Canopy EX 29.5 WDG	1.1 to 3.3 oz	1.1 to 3.3 oz	1.1 to 3.3 oz
Cinch 7.64EC	1 to 1.33 pt	1.33 to 1.67 pt	1.33 to 2 pt
Command 3ME	2 to 3.33 pt	2 to 3.33 pt	2 to 3.33
Domain 60DF	Do not use	9 to 16 oz	9 to 16 oz
Dual II Magnum 7.64 EC	1 to 1.33 pt	1.33 to 1.67 pt	1.33 to 2 pt
Enlite	2 to 4 oz	2 to 4 oz	2 to 4 oz
Envive	2.5 to 5.25 oz	2.5 to 5.25 oz	2.5 to 5.25 oz
Fierce	3 oz	3.75 oz	4.5 oz
Fierce XLT	3.75 oz	4 to 4.5 oz	4.5 to 5.25 oz
FirstRate 84 DG	0.6 to 0.75 oz	0.6 to 0.75 oz	0.6 to 0.75 oz
Outlook	12 to 18 fl oz	14 to 21 fl oz	14 to 21 fl oz
Gangster/Surveil (co-pack)	3 to 3.6 oz	3 to 3.6 oz	3 to 3.6 oz
Intro 4E	2 to 2.25 qt	2 to 2.75 qt	2 to 3 qt
Linex 4L	1 to 2 pt	1 to 2 pt	1 to 2 pt
OpTill	2 oz	2 oz	2 oz
Prefix	2 to 2.25 pt	2 to 2.5 pt	2 to 2.5 pt
Prowl H <sub>2</sub> O 3.8ACS	1.5 to 2 pt	2.5 to 3 pt	3 pt
Pursuit 2AS	4 oz	4 oz	4 oz
Python WDG	0.8 to 1 oz	0.89 to 1.33 oz	0.89 to 1.33 oz
Scepter 70DG	2.8 oz	2.8 oz	2.8 oz
Sencor 4L	Do not use	0.75 to 1.25 pt	1 to 1.5 pt
Sencor 75DF	Do not use	0.5 to 0.8 lb	0.66 to 1 lb
Sequence 5.25L	2.5 to 3.5 pt	3.5 to 4 pt	3.5 to 4 pt
Sharpen	1 oz	1 oz	1 oz
Sonalan 3EC	1.5 to 2 pt	2 to 2.5 pt	2.5 to 3 pt
Sonic	3.2 to 6.4 oz	3.2 to 6.4 oz	3.2 to 8 oz
Spartan 4F	4 oz	4 oz	4 oz
Statement	2 to 2.5 pt	2.0 to 3 oz	2.5 to 3.5 oz
Treflan 4EC	1 pt	1.5 pt	2 pt
Valor 51WDG	2 oz	2 to 2.5 oz	2.5 oz
Valor XLT	3 to 4 oz	3 to 5 oz	3 to 5 oz
Verdict	5 oz	5 oz	5 oz
Warrant	1.25 to 1.7 qt	1.25 to 1.9 qt	1.25 to 2 qt
Zidua	1.5 to 2.1 oz	2.0 to 3 oz	2.5 to 3.5 oz

\*Refer to herbicide labels for proper rates on your soil texture and organic matter content, and for tank mixes.

## Soybean

### Weed control recommendations for double-crop soybeans

A significant percentage of soybeans are grown in a double-crop rotation with winter wheat. Our research suggests a different weed control approach with herbicides is necessary for double-crop soybeans.

Soybeans are produced in a double-crop system with conventional or no-tillage methods. The recommendations that follow can be used for either tillage system. However, no-tillage weed control will require the use of a preemergence application of a “burndown” herbicide to control weeds at the time of planting. You should use Gramoxone Max or glyphosate if weeds are less than 6 inches tall at the time of planting. You should use glyphosate if weeds are taller than 6 inches or if you have rhizome johnsongrass infesting the field at the time of planting.

Preemergence herbicides or postemergence herbicides are the two herbicide strategies used to control weeds in soybeans. Preemergence applications often must be followed with postemergence herbicides applications to control weed escapes. Our research indicates you should strongly consider a postemergence-only approach to weed control in double-crop soybeans (following a preemergence “burndown” application if needed at the time of planting). The postemergence approach is more successful in a double-crop system because of the lower rainfall amounts in late June and July when double-crop soybeans are planted. Lack of rainfall will frequently result in poor “activation” of preemergence her-

bicides. In addition, if rainfall is low, weeds may not germinate which will eliminate the need to apply postemergence herbicides at all. Our experience suggests low weed germination will occur about 1 in 3 years in Missouri.

If you choose to use a preemergence herbicide program you should consider only using shorter residual herbicides. These herbicides are less likely to have carryover problems for crop rotation than some of the newer, long-residual herbicides. Be aware that crop rotation intervals are extended for many herbicides if they are applied late in the summer. Check the label or the crop rotation guide in this book for more information.

The preemergence and no-till programs listed in this guide will work in double-crop soybeans if you will also follow the above suggestions. Postemergence herbicide listings in this guide will perform the same in any system. However, be aware that postemergence herbicide performance is reduced during the hot, dry weather frequently encountered during late summer. Be sure to use the higher rates listed and the proper additives.

Planting soybeans in narrow or drilled rows has several advantages in double-crop soybeans. One of the main advantages is faster canopy closure, which enhances weed control by shading the soil and preventing late weed germination. We strongly recommend you use narrow (<15 inches) or drilled rows when growing double-crop soybeans.

### Soybean, Burndown

Herbicide and formulation	Formulated material per broadcast acre	Herbicide (lb active per acre)	Labeled tank-mix partners	Application method and precautions
The following preemergence soybean herbicides may be used for burndown: Spartan, FirstRate, Pursuit, Python, Scepter, Sencor, Boundary, Canopy EX, Pursuit Plus, Squadron and Valor. Application information is listed in the preemergence herbicide section. In most cases, a broad-spectrum, foliar burndown herbicide such as glyphosate or Gramoxone Max should be tank-mixed with the preemergence herbicide.				
Aim 2E + Nonionic surfactant	0.25 to 2 fl oz/A + 2 pt/100 gal	carfentrazone 0.004 to 0.031 lb/A	No restrictions listed.	Should be applied with a broad-spectrum burndown herbicide.
Canopy EX + Crop oil concentrate or Nonionic surfactant	1.1 to 3 oz/A + 1 gal/100 gal or 2 pt/100 gal	chlorimuron + tribenuron 0.016 + 0.0005 lb/A to 0.04 + 0.012 lb/A	Assure II, glyphosate, Gramoxone, Sencor, 2,4-D	Soybeans may be planted 7 days after application for rates up to 2.2 oz/A. Rates higher than 2.2 oz/A require a 14-day planting interval.
Gramoxone 2SL + Nonionic surfactant or Crop oil concentrate	2 to 4 pt/A + 1 to 2 pt/100 gal or 1 gal/100 gal	paraquat 0.7 to 1.4 lb/A	Aim, Boundary, Command, Dual, Harmony Extra, Lasso, Lorox, Micro-Tech, Prefix, Prowl, Pursuit, Python, Sencor, Squadron, Surflan, Valor, 2,4-DB	May be applied early preplant (EPP) through planting, but before crop emergence. See label for specific rates and weed stages for application. Rate should normally be at least 1.67 pt/A.
Harmony SG 50% + Crop oil concentrate or Nonionic surfactant	0.45 to 0.9 oz/A + 1 gal/100 gal or 2 pt/100 gal	thifensulfuron 0.014 to 0.028 lb/A	Dicamba, glyphosate, 2,4-D	Applications up to 0.6 oz/A can be made preplant through planting in soybeans.
Harmony Extra SG 50%/Nimble SG 50%	0.4 to 0.9 oz/A	thifensulfuron + tribenuron 0.009 + 0.005 lb/A to 0.018 + 0.01 lb/A	Gramoxone, glyphosate, 2,4-D	Use for control of smartweed and dock. Tank mix with Gramoxone or glyphosate. DO NOT APPLY WITHIN 14 DAYS OF PLANTING.
Liberty 280SL/Ignite 280SL + Ammonium sulfate	29 to 36 fl oz/A + 3 lb/A	glufosinate 0.53 to 0.66 lb/A	Dicamba, 2,4-D	A single application may be made up to 36 fl oz/A, but only one additional in-season application of up to 29 fl oz/A may be made to Liberty Link soybean.

**Soybean, Burndown - *continued***

<b>Herbicide and formulation</b>	<b>Formulated material per broadcast acre</b>	<b>Herbicide (lb active per acre)</b>	<b>Labeled tank-mix partners</b>	<b>Application method and precautions</b>
OpTill + Methylated seed oil + Ammonium sulfate or Urea ammonium nitrate	2 oz/A + 1 gal/100 gal + 8.5 to 17 lb/100 gal or 1.25 to 2.5 lb/100 gal	saflufenacil + imazethapyr 0.02 + 0.06 lb/A	Glyphosate, Ignite	Do not apply after soybeans have emerged. It is suggested to add blyphosate for optimum burndown. If spray volume is 12 GPA or less, use methylated seed oil at 1 pt/A.
Sharpen + Methylated seed oil + Ammonium sulfate or Urea ammonium nitrate	1 oz/A + 1 gal/100 gal + 8.5 to 17 lb/100gal or 1.25 to 2.5 lb/100 gal	saflufenacil 0.02 lb/A	Glyphosate, Ignite	Do not apply after soybeans have emerged. It is suggested to add blyphosate for optimum burndown. If spray volume is 12 GPA or less, use methylated seed oil at 1 pt/A.
Roundup brands/ Touchdown brands/ other glyphosates + Recommended additives	+ See label	glyphosate at least 0.77 lb ae/A	Aim, Command, Dual, Lasso, Lorox, Lorox Plus, Micro-Tech, Prowl, Python, Sencor, Squadron, Valor	May be applied early preplant (EPP) through planting. Use lower rate for small, susceptible weeds and higher rates for large or difficult to control weeds.
2,4-D	0.5 to 2.66 pt/A	2,4-D 0.25 to 1.33 lb/A	Aim, Command, Dual, Domain, Glyphosate, Gramoxone, Harmony Extra, Lasso, Lorox, Lorox Plus, Micro-Tech, Prowl, Python, Select, Sencor, Squadron, Valor	Be sure to use a formulation labeled for burndown in soybeans. <b>Preplant intervals:</b> 30 days for greater than 1 pint, 15 days for 1 pint or less of amine, 7 days for 1 pint or less of ester. Plant soybean seed 1.5 to 2 inches deep and ensure seed slot closure.
Verdict + Methylated seed oil + Ammonium sulfate or Urea ammonium nitrate	5 oz/A + 1 gal/100 gal + 8.5 to 17 lb/100 gal or 1.25 to 2.5 lb/100 gal	saflufenacil + dimethenamid-P 0.02 + 0.2 lb/A	Glyphosate, Clarity, OpTill, Sharpen	A minimum preplant interval of 30 days is required for coarse soils with no more than 2% organic matter. Do not apply after soybeans have emerged.

**Fall and early preplant applications of preemergence herbicides for reduced tillage**

Many preemergence herbicides may be used two or more weeks before planting in an early preplant (EPP) application. Advantages include: Early preplant applications will prevent weed emergence and aid or eliminate a formal burndown application. They may limit weed growth if weather moderately delays planting. Some preemergence herbicides have significant postemergence, burndown activity (adjuvants are sometimes required). Some preemergence herbicides increase the activity or spectrum of burndown herbicides. Finally, combining a preemergence herbicide with a burndown herbicide may simply save time and costs by eliminating a second trip for the traditional preemergence, after-planting application.

Several herbicides are registered for fall application. A fall herbicide application may be beneficial if it eliminates the need for a burndown application in the spring and soil erosion is not a problem. Fall applications could also benefit

drying of the soil in the spring and could reduce the need for tillage before planting.

There are many choices and an option that works well in one field may work poorly in another. For most situations we recommend that growers target early preplant applications 15 or less days before planting. The sooner a herbicide is applied, the sooner it will break down and lose effectiveness. If rain delays planting too long, most advantages of extra-early preplant applications may be lost. Also, after 30 days, there is a much higher probability that a burndown application will be needed and most labels specify that additional preemergence herbicide be applied at planting. Finally, exceptionally long (>30 day) preplant intervals remove winter vegetation and leave the soil vulnerable to erosion and may increase the probability of herbicide contamination of ground and surface water.

## Early preplant (EPP) labels for soybean herbicides

Herbicide	Burndown activity**	Label allows preplant application		
		45 days	30 days	15 days
Afforia	Yes	Yes	Yes	Yes
Authority First	Yes	Yes	Yes	Yes
Authority Maxx	Yes	Yes	Yes	Yes
Authority MTZ	Yes	Yes	Yes	Yes
Authority XL	Yes	Yes	Yes	Yes
Axiom	No	No	No	Yes
Boundary	Yes	No	No	Yes
Canopy 75DF	Yes	Yes	Yes	Yes
Canopy EX	Yes	Yes	Yes	Yes
Command	No	No	Yes	Yes
Domain	Yes	No	No	Yes
Dual II/ Magnum/Cinch	No	Yes*	Yes*	Yes
Enlite	Yes	Yes	Yes	Yes
Envive	Yes	Yes	Yes	Yes
Express TotalSol	Yes	Yes	Yes	Yes
Fierce 76WDG	Yes	Yes	Yes	Yes
Fierce XLT	Yes	Yes	Yes	Yes
FirstRate	Yes	No	Yes	Yes
Outlook	No	Yes*	Yes*	Yes
Gangster/Surveil	Yes	Yes	Yes	Yes
Harmony Extra XP/Nimble	Yes	Yes	Yes	Yes
Harmony GT XP/Unity	Yes	Yes	Yes	Yes
Linex 4L	Yes	No	Yes	Yes
Prefix	Yes	No	No	Yes
Prowl H <sub>2</sub> O	No	No	No	Yes
Pursuit	Yes	Yes	Yes	Yes
Pursuit Plus	Yes	Yes	Yes	Yes
Python	No	No	Yes	Yes
Sencor	Yes	Yes	Yes*	Yes
Sequence	Yes	Yes	Yes	Yes
Spartan	Yes	No	Yes	Yes
Synchrony	Yes	Yes	Yes	No
Treflan/others	No	Yes	Yes	Yes
Trivence	Yes	Yes	Yes	Yes
Valor/Valor XLT	Yes	Yes	Yes	Yes

\*Label requires reapplication at the time of planting (Typically 2/3 applied EPP and 1/3 preemergence at planting)

\*\*Burndown activity may not necessarily be broad spectrum.

## Soybean, Preplant incorporated

Herbicide and formulation	Formulated material per broadcast acre	Herbicide (lb active per acre)	Preplant incorporated tank-mix partners	Application method and precautions
Treflan/others 4EC	1 to 2 pt	trifluralin 0.5 to 1 lb/A	Command, Salute, Sencor	See label for incorporation directions. Use low rates on coarse (light, sandy) soils and higher rates on fine (heavy, clay) soils.

## Soybean, Preplant or preemergence

Herbicide and formulation	Formulated material per broadcast acre	Herbicide (lb active per acre)	Preplant incorporated or preemergence tank-mix partners	Application method and precautions
Authority Assist	8 to 12 oz/A	sulfentrazone + imazethapyr 0.21 + 0.04 to 0.31 + 0.063 lb/A	Glyphosate, 2,4-D, Gramoxone	May be applied preplant or preemergence up to 3 days after planting.
Authority Elite	19 to 38.7 oz/A	sulfentrazone + S-metolachlor 0.103 + 0.94 to 0.21 + 1.9 lb/A	Glyphosate, 2,4-D, Gramoxone	May be applied preplant or preemergence up to 3 days after planting.
Authority Maxx	5 to 9.6 oz/A	sulfentrazone + chlorimuron 0.19 + 0.0125 to 0.37 + 0.024 lb/A	Glyphosate, 2,4-D, Gramoxone	May be applied preplant or preemergence up to 3 days after planting.

**Soybean, Preplant or preemergence - *continued***

<b>Herbicide and formulation</b>	<b>Formulated material per broadcast acre</b>	<b>Herbicide (lb active per acre)</b>	<b>Preplant incorporated or preemergence tank-mix partners</b>	<b>Application method and precautions</b>
Authority XL	5 to 9.6 oz/A	sulfentrazone + chlorimuron 0.19 + 0.25 to 0.37 + 0.05 lb/A	Glyphosate, 2,4-D, Gramoxone	Fall, preplant or preemergence up to 3 days after planting. Do not use on soils with pH > 7.6. Fall followed by spring applications of ALS-inhibiting herbicides can occasionally result in crop injury.
Command 3ME	2 to 3.33 pt/A	clomazone 0.75 to 1.25 lb/A	Dual, Lasso, Lorox, Micro-Tech, Prowl, Sencor, Sonalan, Squadron, trifluralin	See label for incorporation directions. Use low rates on coarse (light, sandy) soils and higher rates on fine (heavy, clay) soils. Do not apply within 1,200 feet of housing developments, commercial vegetable or fruit production, nurseries or greenhouses. See label for precautions for application near other desirable vegetation.
Dual II Magnum 7.64L/ Cinch 7.64L	1 to 2 pt/A	S-metolachlor 0.96 to 1.91 lb/A	Command, Lorox, Pursuit, Sonalan, trifluralin	May be applied preplant, preplant incorporated or preemergence. Use low rates on coarse (light, sandy) soils and higher rates on fine (heavy, clay) soils.
Fierce 76% WDG	3.0 to 4.5 oz/A	flumioxazin + pyroxasulfone 0.063+0.08 to 0.094 + 0.12 lb/A		Use low rates on coarse (light, sandy) soils and higher rates on fine (heavy, clay) soils.
FirstRate 84DG/Amplify 84 DG	0.6 to 0.75 oz/A (2 to 2.5 A/pkt)	cloransulam 0.031 to 0.039 lb/A	None listed.	Use lower rate on soils with less than 3% organic matter and higher rate on soils more than 3% organic matter.
Outlook	12 to 21 fl oz/A	dimethenamid 0.56 to 1 lb/A	Command, Lorox, Pursuit, Prowl, Sonalan, Treflan	May be applied preplant, preplant incorporated or preemergence. May be applied postemergence to crop, but emerged weeds will not be controlled. Use low rates on coarse (light, sandy) soils and higher rates on fine (heavy, clay) soils.
Intrro 4L	2 to 3 qt/A	alachlor 2 to 3 lb/A or 2 to 4 lb/A or 2 to 4 lb/A	(Excluding 15G) Canopy, Command, Lorox, Pursuit, Sencor, trifluralin	May be applied preplant, preplant incorporated (shallow) or pre-emergence. Use low rates on coarse (light, sandy) soils and higher rates on fine (heavy, clay) soils. Do not use Lasso II (15G) on coarse soils.
Prowl H <sub>2</sub> O 3.8 ACS	1.5 to 3 pt/A	pendimethalin 0.7 to 1.4 lb/A	Command, Dual, Lasso, Lorox, Pursuit, Sencor	See label for incorporation directions. Caution: Under cool wet conditions, preemergence, surface-applied Prowl may cause stem brittleness.
Pursuit 2 AS	4 fl oz/A	imazethapyr 0.063 lb/A	Dual, Lasso, Outlook, Prowl, Treflan	Use the same rate for all soil types. May be applied preplant, preplant incorporated or preemergence. Incorporation provides better weed control than surface application.
Python 80WDG	0.8 to 1.33 oz/A (5 to 3 A/pkt)	flumetsulam 0.04 to 0.07 lb/A	Not specified	Use low rates on coarse (light, sandy) soils and higher rates on fine (heavy, clay) soils.
Scepter 70DG	2.8 oz/A	imazaquin 0.125 lb/A	Dual, Lasso, Prowl, Sencor, trifluralin	Use the same rate for all soil types.
Sencor 4L or Sencor 75DF	0.75 to 1.5 pt or 0.5 to 1 lb/A	metribuzin 0.38 to 0.75 lb/A	Command, Commence, Dual, Lasso, Prowl, Pursuit, Pursuit Plus, Sonalan, trifluralin	Use low rates on coarse (light, sandy) soils and higher rates on fine (heavy, clay) soils. See label for proper rate for your soil type and percent organic matter. Plant seed at least 1.5 inches deep.

Soybean, Preplant or preemergence - *continued*

Herbicide and formulation	Formulated material per broadcast acre	Herbicide (lb active per acre)	Preplant incorporated or preemergence tank-mix partners	Application method and precautions
Spartan 4F	4.5 to 12 fl oz/A	sulfentrazone 0.14 to 0.37 lb/A	Assure II, Canopy XL, Command, Dual, Lasso, Outlook, Prowl, Sonolan, Treflan, 2,4-D	May be applied preplant, preplant incorporated or preemergence. See label restrictions for coarse (light, sandy) soils with low organic matter.
<b>Package mixes, preplant or preemergence</b>				
Authority First	3.2 to 8 oz/A	sulfentrazone + cloransulam 0.14 + 0.016 to 0.35 + 0.04	Aim, Glyphosate, Gramoxone Inteon, Gramoxone Max, 2,4-D	May be applied in fall, preplant or preemergence up to 3 days after planting.
Authority MTZ	8 to 20 oz/A	sulfentrazone + metribuzin 0.9 + 0.14 lb/A to 0.23 + 0.34 lb/A	Glyphosate, 2,4-D	May be applied in fall, preplant or preemergence up to 3 days after planting.
Axiom 68DF	8 to 13 oz/A	flufenacet + metribuzin 0.27 + 0.07 to 0.44 + 0.12 lb/A	Authority/Spartan, Canopy XL, Command, FirstRate, Gramoxone, Lorox, Pentagon, Prowl, Pursuit, Python, Roundup, Sencor, Sonolan, Treflan	May be applied preplant, preplant incorporated or preemergence. See label statement regarding rate: The 13-ounce rate should provide season-long control of annual grass and small-seeded broadleaf weeds on coarse (light, sandy) soils, but only early-season control on heavier soils.
Boundary 6.5EC	1.5 to 3 pt	S-metolachlor + metribuzin 1 + 0.24 to 2 + 0.48 lb/A	Canopy XL, Command, FirstRate, Prowl, Python	Plant soybeans at least 1.5 inches deep and do not use rates higher than 1.25 pt/A on soils with pH above 7.
Canopy 75DF	4 to 7 oz/A	metribuzin + chlorimuron 0.16 + 0.03 to 0.28 + 0.05 lb/A	Sencor, Linex	Use low rates on coarse (light, sandy) soils and higher rates on fine (heavy, clay) soils. On soils with a composite pH greater than 7.0, do not exceed 2.25 oz/A.
Domain 60DF	9 to 16 oz/A	metribuzin + flufenacet 0.20 + 0.14 to 0.36 + 0.24 lb/A	Any registered soybean herbicide that does not prohibit a Domain tank mixture.	See label for soybean variety restrictions. Plant soybeans at least 1.5 inches deep. Use rates are designed for a relatively short residual period. See label for discussion of rates.
OpTill PRO	co-pack: 2 oz dry + 21 oz liquid + 1 gal/100 gal	saflufenacil + imazethapyr + dimethenamid 0.022 + 0.063 + 0.089 lb/A	Clarity, Glyphosate, Prowl	On coarse soils with less than 2% organic matter, a minimum soybean planting interval of 30 days must be followed.
+ Methylated seed oil	+ 1 gal/100 gal			
+ Ammonium sulfate	+ 8.5 to 17 lb/100 gal			
or Urea ammonium nitrate	or 1.25 to 2.5 lb/100 gal			
Prefix	2 pts/A	S-metolachlor + fomesafen 0.95 lb + 0.25 lb	Canopy, Glyphosate, Gramoxone, Lorox, Lorox Plus, Preview, Pursuit, Sencor, Treflan	May also be applied postemergence to soybeans but will control only weeds that have not emerged.
Sonic	3.2 to 8 oz/A	sulfentrazone + cloransulam 0.14 + 0.016 to 0.35 + 0.04	Aim, Glyphosate, Gramoxone, Gramoxone Max, 2,4-D	Apply at plant or within 3 days after planting.
Verdict	5 oz/A	saflufenacil + dimethenamid-P 0.02 + 0.2 lb/A	Glyphosate, Clarity, OpTill, Sharpen	A minimum preplant interval of 30 days is required for coarse soils with no more than 2% organic matter. Do not apply after soybeans have emerged.
+ Methylated seed oil	+ 1 gal/100 gal			
+ Ammonium sulfate	+ 8.5 to 17 lb/100 gal			
or Urea ammonium nitrate	or 1.25 to 2.5 lb/100 gal			
Warrant	1.25 to 2 qt/A	acetochlor 0.94 to 1.5 lb/A	Glyphosate, Liberty	Use low rates on coarse soils and higher rates on fine soils.

**Soybean, Preplant or preemergence - *continued***

<b>Herbicide and formulation</b>	<b>Formulated material per broadcast acre</b>	<b>Herbicide (lb active per acre)</b>	<b>Preplant incorporated or preemergence tank-mix partners</b>	<b>Application method and precautions</b>
<b><i>Preemergence only</i></b>				
Linex 4L	1 to 2 pt/A	linuron 0.5 to 1 lb/A	Boundary, Classic, Domain, Dual Magnum, Dual II Magnum, Gangster, Prowl, Sencor, Synchrony	Consult label for specific rates according to soil type. For preemergence burndown applications, addition of an adjuvant is required.
Valor 51WDG	2 to 2.5 oz/A	flumioxazin 0.064 to 0.08 lb/A	Command, FirstRate, Gramoxone, Lorox, Prowl, Python, Roundup, Sencor, Warrant, 2,4-D	Do not use in combination with Axiom, Boundary, Domain, Dual, Intro, Micro-Tech, or Outlook unless directed by state 24c labeling.
<b><i>Package mixes, Preemergence only</i></b>				
Afforia	2.5 to 3.75 oz/A	flumioxazin + thifensulfuron + rebenuron 0.05 + 0.008 + 0.008 to 0.95 + 0.012 + 0.012 lb/A	24-D, glyphosate	May be applied any time from fall through spring but not after the soybean crop has emerged.
Canopy EX	1.1 to 33 oz/A	chlorimuron + tribenuron 0.016 + 0.005 to 0.047 + 0.014 lb/A	Command, Lasso, Dual, Outlook, Prowl, Treflan, Sencor, Sonolan, 2,4-D	May be applied after fall harvest anytime up to 7 or 14 days before soybean planting, depending on rate.
Enlite	2 to 4 oz/A	flumioxazin + chlorimuron 0.045 + 0.035 + 0.01 lb/A to 0.089 + 0.007 + 0.02 lb/A	2,4-D	Can be applied in fall or spring up to 3 days after planting.
Envive	2.5 to 5.25 oz/A	flumioxazin + chlorimuron + triflorsulfuron 0.045 + 0.014 + 0.0045 lb/A to 0.094 + 0.03 + 0.009 lb/A	2,4-D	Can be applied in fall or spring up to 3 days after planting.
Fierce XLT	4 to 5.25 oz/A	flumioxazin + pyroxasulfone + chlorimuron 0.063 + 0.08 + 0.016 to 0.094 + 0.12 + 0.21 lb/A	Adhere to label for pH and rotation restrictions. Apply PRE, up to 3 days after planting. Do not incorporate.	
Gangster/Surveil 51DF+81DF	1.8 to 3.6 oz/A	flumioxazin + cloransulam 0.08 + 0.026 to 0.09 + 0.032 lb/A	Command, Glyphosate, Gramoxone, Prowl, Select, 2, 4-D	Do not apply after soybean emergence, or severe crop injury will occur. Do not use in combination with Axiom, Boundary, Domain, Dual, Intro, Micro-Tech, or Outlook unless directed by state 24c labeling.
Prefix	2 pt/A	S-metolachlor + fomesafen 1.0 + 0.24 lb/A	Gramoxone, Glyphosate, Fusilade, Fusion, Poast Plus, Select, 2,4-D	Can be applied up to 15 days before planting and postemergence up to V3 soybeans.
Sequence 5.25L	2.5 to 4 pt/A	glyphosate + S-metolachlor 0.7 + 0.9 to 1.1 + 1.5 lb/A	Authority, Boundary, Canopy, Canopy XL, Command, Dual, Firstrate, Flexstar, Fusilade, Fusion, Linex, Lorox, Outlook, Prowl, Pursuit, Reflex, Scepter, Sencor, Squadron, Steel, 2,4-D, 2,4-DB	Contains glyphosate. May be applied before, during, or after planting but before the crop emerges on conventional soybeans.
Trivence	6 to 10 oz/A	chlorimuron + flumioxazin + metribuzin 0.015 + 0.05 + 0.17 to 0.024 + 0.08 + 0.28 lb/A	2,4-D, glyphosate	Adhere to label for pH and rotation restrictions. Apply anytime from fall through spring, up to 3 days after planting.
Valor XLT	3 to 5 oz/A	flumioxazin + chlorimuron 0.06 + 0.02 lb/A to 0.09 + 0.03 lb/A	Dicamba, Express, Gramoxone, Glyphosate, Harmony, 2,4-D	On soils with pH >6.8, use at 2.5 oz/A and add 0.5 to 1 oz/A Valor SX. Do not incorporate.



## Soybean, Postemergence

Herbicide and formulation	Formulated material per broadcast acre	Herbicide (lb active per acre)	Postemergence tank-mix partners	Application method and precautions
Assure II 0.88EC + Crop oil concentrate or Nonionic surfactant (80%)	4 to 12 oz/A + 4 qt/100 gal or 1 qt/100 gal	quizalofop 0.027 to 0.083 lb/A	Basagran, Classic, Harmony GT/ Pinnacle, Synchrony	See label directions for specific weeds, rates and tank-mix instructions. Use 4 fl oz for volunteer corn control up to 12 inches tall. Do not use more than 18 oz/A in one season. Do not cultivate within 7 days before or 7 days after application.
Basagran 4S + Crop oil concentrate (Optional) or 28% (UAN) nitrogen (optional)	1.5 to 2 pt/A + 1 qt/A (1 pt/A by air) or 1 gal/A	bentazon 0.75 to 1 lb/A	Assure II, Blazer, Fusilade, Fusion, Poast, Poast Plus, Harmony GT, Pinnacle, Pursuit, Scepter, Select, Storm, 2,4-DB	The use of 28% urea is recommended only for velvetleaf and may result in reduced control of other weed species. See label directions for specific weeds, rates, and tank-mix instructions. The split application should be made 10-14 days apart.
Blazer 2L + Nonionic surfactant (80%) or Urea ammonium nitrate	1.5 to 2 pt/A + 1 to 4 pt/100 gal or 2 to 4 qt/A	acifluorfen 0.38 to 0.5 lb/A	Basagran, Fusilade, Fusion, Poast, Poast Plus, Pursuit, Scepter, Select, Storm, 2,4-DB	See label directions for specific weeds, rates and tank-mix instructions. Hemp sesbania may be controlled until bloom with 1 pt/A of Blazer + surfactant. The use of 28% (UAN) nitrogen fertilizer is recommended only for velvetleaf and may result in reduced control of other weed species.
Cadet + Crop oil concentrate or Nonionic surfactant	0.4 to 0.9 oz/A + 1 gal/100 gal or 1 qt/100 gal	fluthiacet 0.003 to 0.006 lb/A	Glyphosate/Ignite	Primarily targets velvetleaf. Consult labels of other products for tank mixes.
Classic 25DF + Nonionic surfactant (80%) or Crop oil concentrate + 28% UAN or 10-34-0 liquid fertilizer (optional)	0.5 to 0.75 oz/A + 1 qt/100 gal or 1 gal/100 gal + 1 gal/A (UAN) or 1 to 2 qt/A (10-34-0)	chlorimuron 0.008 to 0.012 lb/A	Assure II, Basagran, Cobra, FirstRate, Flexstar, Fusilade, Fusion, Harmony GT/Pinnacle, Poast, Reliance, Poast Plus, Reflex, Roundup, Select, 2,4-DB	See label directions for specific weeds, rates and tank-mix instructions. No pH restrictions for Classic in Missouri. The use of 28% nitrogen or 10-34-0 is recommended only for velvetleaf and must be used with a surfactant.
Cobra 2EC + Crop oil concentrate or Nonionic surfactant (80%) and UAN or Ammonium sulfate	6 to 12.5 oz/A + 1 pt/A or 2 pt/100 gal and 4% v/v or 2 to 4 lb/A	lactofen 0.094 to 0.2 lb/A	Assure II, Basagran, Classic, FirstRate Fusilade, Fusion, Harmony GT, Pursuit, Reliance STS, Roundup, Scepter, Select Max, Synchrony STS, 2,4-DB	Crop oil, nonionic surfactant and ammonium sulfate are preferred adjuvants if tank-mixing with any product other than glyphosate. See label for specific adjuvant recommendations according to relative humidity.
FirstRate 84DG + Nonionic surfactant or methylated seed oil + Urea ammonium nitrate or Crop oil concentrate + Ammonium sulfate (optional)	0.3 oz/A (5 A/pkt) + 1 to 2 pt/100 gal or 5 qt/100 gal + 2.5 gal/100 gal or 5 qt/100gal + 2.5 gal/100 gal or 2 lb/A	cloransulam 0.016 lb/A	Assure II, Basagran, Blazer, Classic, Cobra, Flexstar, Fusion, Harmony GT/Pinnacle, Pursuit, Raptor, Reflex, Reliance, Resource, Roundup/others, Select, Stellar, Synchrony	See label directions for specific weeds, adjuvant and tank-mix instructions. Special labeling allows a 0.6 oz/A rate to be used in the Delta counties of southeast Missouri.
Flexstar 1.88ME/Rhythm 1.88L + adjuvant	1 to 1.3 pt/A + see label	fomesafen 0.24 to 0.31 lb/A	Fusilade DX, Fusion, Select, Assure, Poast Plus, Basagran, Classic, Harmony GT/Pinnacle, Raptor, Synchrony STS, Butyrac	Same active ingredient as Reflex with increased activity and burn. Consult label for particular adjuvant recommendations.
Fusilade DX 2E + Crop oil concentrate or Nonionic surfactant (80%)	0.375 to 1.5 pt/A + 1 qt/25 gal or 0.5 pt/25 gal	fluazifop 0.094 to 0.375 lb/A	Basagran, Blazer, Classic, Pursuit, Reflex	See label directions for specific weeds, rates and tank-mix instructions.

**Soybean, Postemergence - *continued***

<b>Herbicide and formulation</b>	<b>Formulated material per broadcast acre</b>	<b>Herbicide (lb active per acre)</b>	<b>Postemergence tank-mix partners</b>	<b>Application method and precautions</b>
Harmony SG + Nonionic surfactant (80%) and UAN or 10-34-0 liquid fertilizer (Optional)	1/8 oz/A + 1 pt/100 gal and 1 gal/A	thifensulfuron 0.004 lb/A	Assure II, Basagran, Classic, Fusion	See label directions for specific weeds and rates. The use of 28% nitrogen or 10-34-0 is recommended only for velvetleaf and must be used with a surfactant.
Marvel 3EC + Nonionic surfactant or Crop oil concentrate + Urea ammonium nitrate or Ammonium sulfate	6 to 7.25 oz/A + 0.25 to 0.5% v/v or 0.5 to 1% v/v + 1 to 2 qt/A or 2.5 lb/A	fluthiacet + fomesafen 0.0055 + 0.135 to 0.007 + 0.16 lb/A	glyphosate, Ignite	See label directions for specific weed and rate recommendations.
Outlook 6EC	10 to 18 fl oz/A	0.47 to 0.84 lb/A	glyphosate, Pursuit	Must be applied before weed emergence for control. Use lower rates on coarse (light, sandy) soils. Do not apply after 5th trifoliolate soybeans (V5)
Phoenix 2L + Nonionic surfactant (80%) or Crop oil concentrate	8 to 12.5 fl oz/A + 2 pt/100 gal and 4% v/v	lactofen 0.13 to 0.2 lb/A	Basagran, Classic, FirstRate, Harmony GT, Pursuit, Raptor, Resource, Roundup, Select Max, Synchrony, 2,4-DB	Crop oil, nonionic surfactant and ammonium sulfate are preferred adjuvants if tank-mixing with any product other than glyphosate. See label for specific adjuvant recommendations according to relative humidity.
Pursuit 2AS + Crop oil concentrate or Nonionic surfactant (80%) + UAN or 10-34-0 or Ammonium sulfate	4 fl oz/A + 1.25 gal/100 gal or 2 pt/100 gal + 1 to 2 qt/A or 2.5 lb/A	imazethapyr 0.063 lb/A	Basagran, Cobra, Fusilade, Fusion, Harmony GT/ Pinnacle, Prestige, Roundup, Select	Apply to 1- to 3-inch tall weeds for best performance. Ammonium sulfate may be used at 2.5 lb/A instead of liquid fertilizer. See label directions for specific weed stages, rates and tank-mix instructions.
Python 80WDG + Nonionic surfactant (80%) + Urea ammonium nitrate	0.125 oz/A + 1 qt/100gal + 2 to 5 gal/100 gal	flumetsulam 0.0063 lb/A	None specified	Control of prickly sida, supplemental label.
Raptor 1AS + Crop oil concentrate or Nonionic surfactant + UAN or 10-34-0 or Ammonium sulfate	4 to 5 fl oz/A + 1 gal/100 gal or 2 pt/100 gal + 1 to 2 qt/A or 2.5 lb/A	imazamox 0.031 to 0.039 lb/A	Assure II, Blazer, FirstRate, Fusilade DX, Fusion, Prestige, Select	Apply to 1- to 3-inch tall weeds for best performance. See label directions for specific weed stages, rates, tank-mix instructions and adjuvants.
Reflex 2LC/Dawn + Nonionic surfactant (80%) or Crop oil concentrate	0.75 to 1.25 pt/A + 0.5 to 1 pt/100 gal or 1 qt/25 gal	fomesafen 0.18 to 0.31 lb/A	Basagran, Classic, Fusilade, Fusion, Select, 2,4-DB	The 1.25 pt/A rate may only be used in the Bootheel counties of Missouri. The 1 pt/A rate may give slightly lower weed control than indicated in the performance chart. Do not apply Reflex in the same field more than once every two years.
Resource 0.86 EC + Crop oil concentrate + Ammonium sulfate	2 to 12 fl oz/A + 1 to 2 pt/A + 2.5 lb/A	flumiclorac pentyl, 0.013 to 0.027 lb/A	Cobra, Glyphosate, Phoenix, Select Max	Velvetleaf control and lambsquarters suppression only.
Scepter 70 DG + Nonionic surfactant or Crop oil concentrate	1.4 to 2.8 oz/A + 2 pt/100 gal or 1 qt/A	imazaquin 0.063 to 0.125 lb/A	Basagran, Blazer, Cobra	See label directions for specific weed application stages, rates and tank-mix instructions.

Soybean, Postemergence - *continued*

Herbicide and formulation	Formulated material per broadcast acre	Herbicide (lb active per acre)	Postemergence tank-mix partners	Application method and precautions
Select 2EC/Clethodim 2EC + Crop oil concentrate + UAN or Ammonium sulfate (optional)	6 to 10 fl oz/A + 1 qt/A + 1 to 2 qt/A or 2.5 to 4 lb/A	clethodim 0.094 to 0.156 lb/A	Basagran, Blazer, Classic, Cobra, FirstRate, Flexstar, Glyphosate, Phoenix, Pursuit, Reflex, Reliance, Resource, Storm, Synchrony	See label directions for specific applications stages, rates, tank-mix and adjuvant instructions
Select Max + Crop oil concentrate + UAN or Ammonium sulfate	9 to 24 fl oz/A + 1 qt/A + 1 to 2 qt/A or 2.5 to 4 lb/A	clethodim 0.09 to 0.18 lb/A	Glyphosate	Nonionic surfactants may be used in place of crop oil concentrate in certain situations. For volunteer Roundup Ready corn control, apply 6 to 12 oz/A with glyphosate. Apply 6 oz rate to corn less than 12 inches tall, 9 oz to 24-inch-tall corn, and 12 oz to 36-inch-tall corn.
Ultra Blazer 2L + Nonionic surfactant (80%) or Crop oil concentrate + UAN or Ammonium sulfate	1 to 1.5 pt/A + 1 to 2 pt/100 gal or 1 to 2 pt/A + 2-4 qt/A or 1.5 lb/A	acifluorfen 0.25 to 0.38 lb/A	Assure, Basagran, Classic, Dual, FirtRate, Fusilade, Fusion, Glyphosate, Harmony GT, Lasso, Outlook, Poast Plus, Pursuit, Resource, Select, 2,4-DB	See label directions for specific weeds, rates and tank-mix instructions. Hemp sesbania may be controlled until bloom with 1 pt/A of Blazer + surfactant. The use of 28% (UAN) nitrogen fertilizer is recommended only for velvetleaf and may result in reduced control of other weed species.
Warrant	1.25 to 2 qt/A	acetochlor 0.94 to 1.5 lb/A	Glyphosate/Liberty	Should be applied postemergence to crop (VI-V3 preferably) but preemergence to weeds. Warrant does not control emerged weed seedlings.
Zidua 85WG	1.0 to 3.0 oz/A	0.05 to 0.16 lb/A	glyphosate, Pursuit	Must be applied before weed emergence for control. Use lower rates on coarse (light, sandy) soils. Do not apply before first trifoliolate soybeans (V1) or after third trifoliolate soybeans (V3).
<b>Package mixes – Overtop</b>				
Conclude Xact B 4EC + Conclude Xact G 2EC + Crop oil concentrate	1.5 pt/A + 1.5 pt/A + 1 gal/100 gal water	bentazon + acifluorfen + sethoxydim 0.5 + 0.25 + 0.375 lb/A	None	Apply to small, actively growing weeds.
Frontrow 84 + 80 WDG + Crop oil concentrate or Nonionic surfactant + UAN (optional) or Ammonium sulfate (optional)	0.21 oz/A (1 pkt/5A) + 4.75 qt/100 gal or 1 qt/ 100 gal + 2.5 gal/100 gal or 2 lb/A	cloransulam + flumetsulam 0.009 + 0.004 lb/A	Assure II, Basagran, Blazer, Cobra, Flexstar, Fusion, Glyphosate, Harmony GT/Pinnacle, Reflex, Poast Plus, Pursuit, Select, Touchdown	Apply to small, actively growing weeds. Grass control antagonism can occur with Assure II and Fusion tank mixes.
Fusion 2.66 EC + Crop oil concentrate or Nonionic surfactant (80%) + UAN liquid fertilizer or similar (Optional)	6 to 12 fl oz/A + 1 to 2 pt/100 gal or 0.5 to 1 pt/25 gal + 1 gal/100 gal	fluazifop + fenoxaprop 0.094 + 0.031 to 0.188 to 0.062 lb/A	Basagran, Blazer, Classic, Harmony GT/ Pinnacle, Pursuit, Reflex, Storm	See label directions for specific weeds, rates and tank-mix instructions. Only for shattercane and volunteer corn control.
Prefix + Nonionic surfactant	2 pt/A + 1 pt/100 gal	metolachlor + fomesafen 1.09 + 0.24 lb/A	Glyphosate in Roundup Ready soybeans only	Prefix may be applied from cracking to the third trifoliolate stage. Necrotic bronzing and spotting may occur after an application of Prefix POST. For broader spectrum weed control, tank-mix with glophosate and add NIS only to unloaded glyphosate formulations. Do not tank-mix Prefix POST with COC as increased crop injury may result.

**Soybean, Postemergence - *continued***

Herbicide and formulation	Formulated material per broadcast acre	Herbicide (lb active per acre)	Postemergence tank-mix partners	Application method and precautions
Storm 4SL + Nonionic surfactant (80%) or Crop oil concentrate or UAN liquid fertilizer	1.5 pt/A + 1 to 2 pt/100 gal or 1 to 2 pt/A or 2 to 4 qt/A	bentazon + acifluorfen 0.5 + 0.25 lb/A	Classic, 2,4-DB	See label directions for specific weeds, rates and tank-mix instructions. The use of 28% UAN fertilizer is recommended only for velvetleaf control, and may result in reduced control of other weed species.
Synchrony XP + Nonionic surfactant + Ammonium sulfate	0.375 oz/A + 1 pt/100 gal + 2 to 4 lb/A	chlorimuron + thifensulfuron 0.005 + 0.002 lb/A	Glyphosate, others	

**Herbicide-resistant soybeans**

Herbicide and formulation	Formulated material per broadcast acre	Herbicide (lb active per acre)	Labeled tank-mix partners	Application method and precautions
<b>Liberty Link soybeans</b>				
Liberty 280SL/Ignite 280SL + Ammonium sulfate	22-36 fl oz/A + 3 lb/A	Glufosinate 0.4 to 0.66 lb/A	Assure II, Classic, Cobra, Firstrate, Flexstar, Fusilade DX, Fusion, Harmony, Phoenix, Poast Plus, Pursuit, Raptor, Reflex, Resource, Select Max, Synchrony, Ultra Blazer	Use on Liberty Link soybeans only. Do not apply more than 65 fl oz/A per growing season. Apply from emergence up to but not including the bloom stage at 22 to 29 fl oz/A. A single application of 36 fl oz/A may be made.
<b>Roundup Ready soybeans</b>				
Roundup brands/ Touchdown brands/ other glyphosates + Recommended additives	+ See label	glyphosate 0.56 to 1.5 lb/A	Consult labels	Use on Roundup Ready soybeans only. Use caution to prevent drift and to avoid spraying the wrong field. Consult label to refine rates for particular weed species and sizes. Roundup has no residual control. Do not apply more than 3 quarts per acre per year to soybeans, including preharvest treatments.
<b>Package mixes</b>				
Extreme 1.67 + Nonionic surfactant (80%) + Urea ammonium nitrate or Ammonium sulfate (optional)	3 pt/A + 1 pt/100 gal + 1 to 2 qt/A or 2.5 lb/A	glyphosate + imazethapyr 0.56 + 0.064 lb/A	None listed	Use on Roundup Ready soybeans only. The formulation stated on the label is 2.17 lb/gal; however, this is for the IPA salt of glyphosate. All other glyphosate listings in this guide are for glyphosate acid. Extreme contains 1.67 lb/gal calculated on a glyphosate-acid basis.
Flexstar GT 3.5 + Ammonium sulfate	3.5 to 4.5 pt/A + 8.5 to 17 lb/100 gal	fomesafen + glyphosate 0.25 to 0.31 lb ai + 1 to 1.23 lb ae)	Touchdown brands/ glyphosate, Fusilade	Under adverse growing conditions or a known population of glyphosate-tolerant/resistant broadleaf weeds are present, a methylated seed oil or crop oil concentrate should be added at 1 gal/100 gal. Target weeds ≤4 inches tall. The use of drift control agents that affect droplet size and coverage can negatively affect weed control. Do not use Flexstar GT on fields that have already been treated with other fomesafen-containing products.
Sequence 5.25C	2.5 to 3 pt/A	glyphosate + S-metolachlor 0.7 + 0.9 to 0.8 + 1.1 lb/A	—	On Roundup Ready soybeans, may be used from cracking up to the 3rd trifoliolate stage of soybean growth.
<b>STS soybeans</b>				
Synchrony XP + Nonionic surfactant + Ammonium sulfate	0.375 to 1.125 oz/A + 1 pt/100 gal + 2 to 4 lb/A	chlorimuron + thifensulfuron 0.005 + 0.002 to 0.015 + 0.005 lb/A	Assure II, Cobra, FirstRate, Flexstar, Fusilade, Fusion, Poast Plus, Select, 2,4-DB	For use only on soybean varieties designated as "STS" in the variety name. The use of crop oil concentrate plus an ammonium nitrogen fertilizer is required. See label directions for specific weeds, rates and tank-mix instructions.

## Broadleaf-Grass weed herbicide tank mixes

Many tank-mix combinations are not labeled; however, these applications do not necessarily need to be labeled by the manufacturers for use. When broadleaf and grass herbicides are tank-mixed, antagonism in the form of reduced grass control frequently (but not always) occurs. Some of this antagonism is due to the rapid “burn” of many broadleaf herbicides preventing the slower uptake and translocation of most grass herbicides. There are three recommended ways to avoid antagonism: (1) Apply the grass herbicide first (which allows it to be absorbed and translocated); then apply the broadleaf herbicide a day later. (2) Apply the broadleaf herbicide first and then wait seven days (which allows the grass to resume active growth); then apply the grass herbi-

cide. (3) Increase the rate of the grass herbicide by 50 percent to overcome the antagonism. A tank mix may provide good control of small, actively growing grass, but avoid tank mixes when grass is large or stressed. Package-mixes and co-packages of grass herbicides (Conclude, Typhoon) usually provide a higher-than-normal rate of the grass herbicide at a discounted price. Read the label before tank-mixing a grass and broadleaf herbicide. The manufacturer may not be liable for performance or may restrict certain mixtures. Antagonism is not exclusive to grass-broadleaf herbicide mixtures. Several herbicides will reduce the grass and broadleaf performance of glyphosate in burndown and Roundup Ready soybean situations.

## Soybean, Special problems

Herbicide and formulation	Formulated material per broadcast acre	Herbicide (lb active per acre)	Weeds controlled	Application method and precautions
<b><i>Johnsongrass, Preplant burndown</i></b>				
Roundup brands/other glyphosates		glyphosate 0.75 to 2.25 lb/A	Seedling and rhizome johnsongrass.	Apply glyphosate when johnsongrass is at least 18 inches tall and has reached the boot-to-head stage of growth. Allow 7 or more days after application before tillage. Roundup may be tank-mixed with several preemergence herbicides.
Glyphosate 3L	2 to 6 pt/A			
or	or			
Roundup WeatherMax 4.5L	21 to 64 fl oz/A			
or	or			
Roundup PowerMax 4.5L	21 to 64 fl oz/A			
+	+			
Recommended additives	See label			
<b><i>Johnsongrass, Preplant incorporated</i></b>				
Prowl 3.3E/others	2.4 to 4.8 pt/A	pendimethalin 1 to 2 lb/A	Seedling and rhizome johnsongrass, red rice, certain other grass and broadleaf weeds.	Follow rate and incorporation directions on label. Use for two consecutive years. Do not plant winter wheat or winter barley in the fall after application.
Treflan 4HFP, others	2 to 4 pt	1 to 2 lb/A	Seedling and rhizome johnsongrass, red rice, certain other grass and broadleaf weeds.	Follow rate and incorporation directions on label. Use for two consecutive years. In the season following this double-rate treatment, plant only rice and those crops for which Treflan can be applied as a preplant treatment.
<b><i>Johnsongrass, Postemergence</i></b>				
Assure II 0.88EC	5 to 10 oz/A	quizalofop 0.034 to 0.069 lb/A	Seedling and rhizome johnsongrass, certain other grasses.	Use 5-oz rate for seedling johnsongrass that is 2 to 8 inches tall. Apply 10 oz/A rate to 10- to 24-inch rhizome johnsongrass. If regrowth occurs, apply 7 oz/A in a second application when johnsongrass is 6 to 10 inches tall. Follow label directions for tank mixes and sequential applications with postemergence broadleaf herbicides. Do not cultivate within 7 days before or 7 days after application.
+	+			
Crop oil concentrate	4 qt/100 gal			
or	or			
Nonionic surfactant (80%)	1 qt/100 gal			
Fusilade DX 2E	6 to 12 fl oz/A	fluzifop 0.09 to 0.19 lb/A	Seedling and rhizome johnsongrass, certain other grasses.	Use 0.75 pt/A for seedling johnsongrass that is no more than 8 inches tall. Apply 1.5 pt/A rate to 8- to 18-inch rhizome johnsongrass and before boot stage. If regrowth occurs, apply 1 pt/A in a second application when johnsongrass is 6 to 12 inches tall. Follow label directions for tank mixes and sequential applications with postemergence broadleaf herbicides. Make last application before first bloom.
+	+			
Crop oil concentrate	1 qt/25 gal			
or	or			
Nonionic surfactant (80%)	0.5 pt/25 gal			

**Soybean, Special problems - continued**

<b>Herbicide and formulation</b>	<b>Formulated material per broadcast acre</b>	<b>Herbicide (lb active per acre)</b>	<b>Weeds controlled</b>	<b>Application method and precautions</b>
Fusion 2.66EC + Crop oil concentrate or Nonionic surfactant (80%)	6 to 12 fl oz/A + 1 qt/25 gal or 0.5 pt/25 gal	fluzifop + fenoxaprop 0.09 + 0.03 to 0.19 + 0.05 lb/A	Seedling and rhizome johnsongrass, certain other grasses.	Use 0.75 pt/A for seedling johnsongrass that is no more than 8 inches tall. Apply 1.5 pt/A rate to 8- to 18-inch rhizome johnsongrass and before boot stage. If regrowth occurs, apply 1 pt/A in a second application when johnsongrass is 6 to 12 inches tall. Follow label directions for tank mixes and sequential applications with postemergence broadleaf herbicides. Make last application before first bloom.
Poast Plus 1E + Crop oil concentrate or Dash	1.5 pt/A + 2 pt/A or 2 pt/A	sethoxydim 0.19 lb/A	Seedling and rhizome johnsongrass, certain other grasses.	Apply to 15- to 20-inch-tall rhizome johnsongrass. If regrowth occurs, reapply when johnsongrass is 6 to 12 inches tall. Follow label directions for tank mixes and sequential applications with postemergence broadleaf herbicides.
Roundup/Others  Glyphosate 3L or Roundup WeatherMax 4.5L or Roundup PowerMax 45L or Touchdown brands + Recommended additives	  at least 1 qt/A or at least 22 fl oz/A or at least 22 fl oz/A or at least 24 fl oz/A + See label	glyphosate at least 0.77 lb ae/A	Seedling and rhizome johnsongrass and most other broadleaf and grass weeds.	Roundup Ready soybeans only. Apply to 15- to 20-inch-tall rhizome johnsongrass. If regrowth occurs, reapply when johnsongrass is 6 to 12 inches tall.
Select 2EC + Crop oil concentrate	6 to 10 fl oz/A + 1 qt/A	clethodim 0.094 to 0.156 lb/A	Seedling and rhizome johnsongrass, certain other grasses.	Use 6 to 8 oz/A rate for seedling johnsongrass 4 to 10 inches tall. Apply 8 to 10 oz/A rate for rhizome johnsongrass 12 to 24 inches tall. A repeat application of 6 to 8 oz/A can be applied if regrowth occurs when johnsongrass is 6 to 10 inches tall. Follow label directions for tank mixes and sequential applications with postemergence broadleaf herbicides.
<b>Red rice</b>				
General Comments: Red rice control requires an integrated program. Dual Magnum, Lasso, Outlook or an equivalent product should be applied preemergence. This will provide excellent, early-season red rice control; season-long weed control will be inadequate. Then one of the following postemergence, grass-controlling herbicides should be applied.				
Assure II 0.88EC + Crop oil concentrate or Nonionic surfactant (80%)	9 oz/A + 4 qt/100 gal or 1 qt/100 gal	quizalofop 0.062 lb/A	Red rice and certain other grass weeds.	Apply early postemergence when red rice has 1 to 4 leaves. Repeat if regrowth occurs.
Roundup/Others  Glyphosate 3L or Roundup WeatherMax 4.5L or Roundup PowerMax 45L or Touchdown brands + Recommended additives	  at least 1 qt/A or at least 22 fl oz/A or at least 22 fl oz/A or at least 24 fl oz/A + See label	glyphosate at least 0.77 lb ae/A	Red rice and most other grass and broadleaf weeds	Roundup Ready soybeans only. Only use lower rates on red rice less than 2 inches tall under optimum growing conditions.
Select 2EC + Crop oil concentrate	6 to 8 fl oz/A + 1 qt/A	clethodim 0.94 to 0.125 lb/A	Red rice and certain other grass weeds.	Apply early postemergence before red rice is 3 inches tall.
Select 2EC/Section 2EC/ Clethodim 2EC + Crop oil concentrate	4 fl oz/A + 1 qt/A	clethodim 0.0625 lb/A	Late-season seed head suppression of red rice	Timing is critical. Apply from 4" internode elongation up to boot stage of red rice. Seedhead suppression only.

Soybean, Special problems - *continued*

Herbicide and formulation	Formulated material per broadcast acre	Herbicide (lb active per acre)	Weeds controlled	Application method and precautions
<b>Spot-spray treatment of severe weed infestations</b>				
Roundup/Others		glyphosate at least 0.77 lb ae/A	Johnsongrass, cocklebur, giant ragweed, pigweed, sunflower, volunteer corn, shattercane, velvetleaf.	Use 0.5% solution on annual weeds less than 6 inches tall and 1% solution when annual weeds are more than 6 inches tall. Apply 2% when johnsongrass is in boot to early head stage, and to other perennial weeds. Cover foliage thoroughly on a spray-to-wet basis.
Glyphosate 3L or Roundup WeatherMax 4.5L or Roundup PowerMax 45L or Touchdown brands + Recommended additives	at least 1 qt/A or at least 22 fl oz/A or at least 22 fl oz/A or at least 24 fl oz/A + See label			
<b>Harvest aid</b>				
Aim	0.5 to 0.9 fl oz/A	carfentrazone	Desiccation of some green weed foliage.	Do not apply within 3 days of harvest.
Gramoxone 2SL + Nonionic surfactant or Crop oil concentrate	0.5 to 1 pt/A + 1 to 2 pt/100 gal or 1 gal/100 gal	paraquat 0.175 to 0.35 lb/A	Desiccation of green weed foliage.	<b>Determinate varieties:</b> Apply when soybeans are fully mature, at least half of leaves have dropped and remaining leaves are turning yellow. <b>Indeterminate varieties:</b> Apply when at least 65% of seed pods have mature brown color or when seed moisture is 30% or less. Do not pasture livestock within 15 days of treatment. Mature cocklebur is tolerant of Gramoxone and desiccation will not be complete. Restricted Use Pesticide.
Roundup/Others		glyphosate at least 0.77 lb ae/A	Suppression of many annual and perennial weeds.	Apply after soybean pods have set and lost all green color. Allow a minimum of 7 days between application and harvest. Do not apply to soybeans grown for seed. A maximum rate of 1 qt/A may be applied by air. Roundup Ready soybeans may be treated 14 days or earlier before harvest.
Glyphosate 3L or Roundup WeatherMax 4.5L or Roundup PowerMax 45L or Touchdown brands + Recommended additives	at least 1 qt/A or at least 22 fl oz/A or at least 22 fl oz/A or at least 24 fl oz/A + See label			
Sodium chlorate	2 gal/A of 3 lb/gal formulation	sodium chlorate 6 lb/A	Desiccation of green weed foliage.	Apply 7 to 10 days before harvesting.
Seed crops only Reglone 2L	1.5 to 2 pt/A	diquat 0.38 to 0.5 lb/A	Desiccation of green weed foliage.	Apply 1 week before harvest. Do not use treated plants for food feed or oil purposes.

Small grain: Guide to weed response to small-grain herbicides

Herbicide	Winter weeds										Summer weeds								
	Annual ryegrass	Cheat/downy brome	Chickweed	Cornflower	Dandelion	Field pennycress	Henbit	Horseweed (marestail)	Prickly lettuce	Shepherdspurse	Wild buckwheat	Wild garlic	Wild mustard	Common lambsquarters	Common ragweed	Giant ragweed	Redroot/smooth pigweed	Annual smartweed species	Velvetleaf
2,4-D	0	0	5	8	9	1	5	8	9	9	5	6	9	9	9	9	9	6	8
Achieve	8	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aim	-	-	-	3	-	9	-	-	-	-	-	-	-	9	7	6	9	9	9
Axial XL	9	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Banvel/Clarity	0	0	6	-	8	6	6	9	8	8	9	5	6	9	9	9	9	9	7
Buctril	0	0	6	8	8	8	8	6	6	8	9	0	9	9	9	8	7	9	-
Finesse	8	6	8	7	-	8	8	-	-	8	-	4	8	8	-	-	4	-	-
Harmony Extra	0	0	7	2	0	7	9	-	4	9	7	8	9	8	5	4	9	8	9
Hoelon	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Huskie	0	0	8	-	-	9	9	9	8	9	8	4	9	9	9	8	8	8	8
MCPA	0	0	5	8	9	9	5	8	9	9	8	5	9	9	9	9	9	7	5
Olympus Flex	9	7	4	-	2	9	6	-	-	9	2	2	9	-	-	-	-	-	-
Osprey	9	2	8	6	-	-	8	-	-	8	-	3	8	-	-	-	-	-	-
Peak	-	-	8	-	5	9	5	0	9	8	8	8	9	7	9	7	8	7	9
PowerFlex HL	9	7	8	-	-	9	8	5	6	8	6	-	9	8	-	-	8	6	-
Sencor	3	7	8	3	-	8	8	-	-	8	-	0	8	-	-	-	-	-	-
Sierra	6	6	-	-	-	9	6	-	-	9	6	-	9	-	-	-	4	9	-
Starane Ultra	0	0	8	-	8	8	5	8	8	6	5	3	5	5	8	7	5	5	9

Weed control: 8 to 10 = good 6 to 7 = Fair\* Less than 6 = poor - = No data available

\*A weed control rating of 6 to 7 indicates partial control or suppression.

Use this table as a guide for comparing the relative effectiveness of herbicides on individual weeds. Herbicides may perform better or worse than indicated due to extreme weather conditions and other variables. If you are obtaining satisfactory results under your growing conditions, changing products as a result of information in this table is not necessarily recommended.

Due to the overwhelming number of package mixes and tank mixes, it has become impractical to list and distinguish these combinations. In the interest of fairness, we are therefore listing no package mixes in this table. A reasonable accurate estimate may be obtained by combining the control ratings from the individual package or tank-mix components.



## Small grain, Burndown

Herbicide and formulation	Formulated material per broadcast acre	Herbicide (lb active per acre)	Labeled tank-mix partners	Application method and precautions
Aim 2E + Nonionic surfactant	0.25 to 2 fl oz/A + 2 pt/100 gal	carfentrazone 0.004 to 0.031 lb/A	No restrictions listed.	Should be applied with a broad-spectrum burndown herbicide.
Gramoxone Inteon + Nonionic surfactant or Crop oil concentrate	2 to 4 pt/A + 1 to 2 pt/100 gal or 1 gal/100 gal	paraquat 0.7 to 1.4 lb/A	not specified	
Roundup/Others  Glyphosate 3L or Roundup WeatherMax 4.5L or Roundup PowerMax 45L or Touchdown brands + Recommended additives	at least 1 qt/A or at least 22 fl oz/A or at least 22 fl oz/A or at least 24 fl oz/A + See label	glyphosate at least 0.77 lb ae/A		May be applied early preplant (EPP) through planting. Use lower rate for small, susceptible weeds and higher rates for large or difficult to control weeds.
Sharpen + Methylated seed oil + Ammonium sulfate or Urea ammonium nitrate	1 to 2 fl oz/A + 1 gal/100 gal + 8.5 to 17 lb/100 gal or 1.25 to 2.5 lb/100 gal	saflufenacil 0.02 to 0.04 lb/A	Clarity, Glyphosate	Should be applied with a broad-spectrum burndown herbicide like glyphosate. Do not apply after small grains have emerged or crop injury will occur. If spray volume is 12 GPA or less, use methylated seed oil at 1 pt/A.

## Small grain herbicides

Herbicide and formulation	Formulated material per broadcast acre	Herbicide (lb active per acre)	Weeds controlled	Application method and precautions
<b>Preemergence or fall postemergence</b>				
Finesse 75DF + Nonionic surfactant	0.2 to 0.5 oz/A + 1 qt/100 gal	chlorsulfuron + metsulfuron 0.008 + 0.0016 to 0.02 + 0.004 lb/A	Ryegrass and common broadleaf weeds.	Use on wheat or barley. Use surfactant when applying postemergence to weeds. Read label for crop rotation restrictions. <b>STS varieties of soybeans must be planted if double-crop soybeans are to follow wheat.</b>
Hoelon 3EC	Preemergence: 2.7 pt/A 1-3 lf ryegrass: 1.3 pt/A 4-5 lf ryegrass: 2 pt/A 5 lf to 2 tiller ryegrass: 2.7 pt/A	diclofop 0.5 to 1 lb/A	Ryegrass	Use on winter wheat only. Expect slow results. Larger weeds require higher rates. Hoelon will kill oats.
<b>Postemergence, fall only</b>				
Achieve 40DG + Supercharge brand adjuvant	0.44 to 0.6 lb/A + 2 qt/100 gal	tralkoxydim 0.18 to 0.24 lb/A	Ryegrass	Use on winter wheat only. Expect slow results. Achieve will kill oats.
Peak 57 WG + Nonionic surfactant or Crop oil concentrate	0.5 oz/A + 1 to 2 qt/100 gal or 1-4 pt/A	prosulfuron 0.018 lb/A	Wild garlic, field pennycress, chickweed, prickly lettuce, common ragweed, velvetleaf, shepherdspurse, wild mustard, wild buckwheat	Label prohibits the planting of soybeans following application. Apply to oats and wheat from 3-leaf stage to before second node is detectable.
General information for Sencor: Wheat cultivars vary in their tolerance to Sencor. Check Bayer's list of Sencor-tolerant varieties before application.				
Sencor, 75DF	1 to 10.5 oz/A	metribuzin 0.05 to 0.5 lb/A	Cheat, downy brome, shepherdspurse, field pennycress, wild mustard, henbit, other winter annual broadleaf weeds	Contact a Bayer representative to determine if your wheat variety is Sencor-tolerant. See label to refine rates for soil texture, organic matter and crop and weed size. Low rates are for exceptionally early application to small weeds, higher rates require larger wheat.
<b>Fall or spring postemergence</b>				
Axial	16.4 fl oz/A	pinoxaden 0.05 lb/A	Annual ryegrass, wild oat, foxtail species	Apply to wheat or barley from the 2-leaf to preboot stage. Grass weed control only.

**Small grain herbicides - *continued***

<b>Herbicide and formulation</b>	<b>Formulated material per broadcast acre</b>	<b>Herbicide (lb active per acre)</b>	<b>Weeds controlled</b>	<b>Application method and precautions</b>
Finesse Grass & Broadleaf + Nonionic surfactant + UAN or Ammonium sulfate	0.6 tp 0.9 oz/A + 2 pt/100 gal + 2 qt/A or 2 lb/A	chlorsulfuron + flucarbazone 0.009 + 0.018 lb/A to 0.014 + 0.026 lb/A	Ryegrass, mustards, cutleaf eveningprimrose, pennycress, henbit, shepherdspurse	Apply postemergence to crop and weeds. Read label for crop rotation restrictions.
Harmony Extra TotalSol/Nimble	0.45 to 0.9 oz/A	thifensulfuron + tribenuron 0.009 + 0.004 to 0.018 + 0.009 lb/A	Wild garlic, field pennycress, henbit, shepardspurse, wild mustard, smartweed	Apply to wheat or barley. Do not apply to wheat or barley crops underseeded with another crop. Apply from when crop is in the 2-leaf stage up to before the flag leaf is visible. Wild garlic plants should be less than 12 inches tall with 2 to 4 inches of new growth. Refer to label for additional rate information on weed size and density. When applied using liquid nitrogen fertilizer as the carrier, early crop yellowing and stunting may occur. Control is enhanced when applications are made during warm temperatures (60 degrees F or more) to actively growing weeds. Do not harvest sooner than 45 days after application.
Huskie	11 to 15 fl oz/A	pyrasulfotole + bromoxynil 0.027 + 0.15 to 0.036 + 0.20 lb/A	Chickweed, henbit, horseweed, pennycress	Apply to actively growing wheat, barley, rye or triticale between 1-leaf and up to flag leaf emergence.
Prowl H <sub>2</sub> O	1.5 to 3 pt/A	pendimethalin 0.7 to 1.4 lb/A	Henbit, field pennycress	Should be applied before weed emergence. Can be applied from the first leaf stage of wheat until just before the flag leaf is visible.
Olympus 70D + Nonionic surfactant	0.6 to 0.9 oz/A + 1 to 2 qt/100 gal	propoxycarbazone-sodium 0.03 to 0.04 lb/A	Downy brome, cheat, other <i>Bromus</i> species, some mustards	May be applied from emergence up to jointing.
Olympus Flex + Nonionic surfactant + Urea ammonium nitrate or Ammonium sulfate	3 to 3.5 oz/A + 2 qt/100 gal + 1 to 2 qt/A or 3 lb/A	propoxycarbazone + mesosulfuron 0.013 + 0.008 to 0.015 + 0.009 lb/A	Downy brome, cheat, wild oat, annual ryegrass, some mustards	May be applied from emergence up to jointing.
Osprey 4.5 D + Methylated seed oil	4.75 oz/A + 1.5 pt/A	mesosulfuron 0.013 lb/A	Ryegrass control and supression of common broadleaf weeds.	See label regarding insecticide and fertilizer restrictions. Apply to winter wheat when ryegrass is between the 1-leaf to the 2-tiller stage.
Power Flex HL + Nonionic surfactant	2 oz/A + 1 to 2 qt/100 gal	pyroxsulam 0.016 lb/A	Annual ryegrass, cheat, chickweed	Apply to wheat in either fall or spring from the 3-leaf to jointing stage.
Sierra + Nonionic surfactant or Methylated seed oil	0.5 to 1 fl oz/A + 2 pt/100 gal or 1% v/v	flucarbazone-sodium 0.014 to 0.027 lb/A	Mustards, field pennycress, shepherd's-purse, mustards, wild oat	Apply from 1-leaf to jointing stage.
Starane Ultra	0.3 to 0.4 pt/A	fluroxypyr 0.1 to 0.14 lb/A	Chickweed, field pennycress, other broadleaf weeds.	Wheat, barley, oats, triticale. Apply from 2-lear crop stage p to flag leaf emergence.
<b>Spring postemergence</b>				
Aim 2E + Nonionic surfactant (80%) + UAN (optional)	0.5 to 1 fl oz/A + 2 pt/100 gal + 2 to 4 gal/100 gal	carfentrazone 0.008 to 0.016 lb/A	Catchweed bedstraw, field pennycress, flixweed, tansy mustard, nightshade, pigweed, velvetleaf	Wheat. Apply before jointing.

Special note regarding safe application stages for hormone herbicides: The stage at which winter wheat is treated with growth-regulator-type herbicides such as 2,4-D, Banvel and MCPA is critical if crop damage is to be avoided. This growth stage has traditionally been described as "after fully tillered but before jointing." A newer, more accurate and safer evaluation is based on the distance from the soil surface to the top of the highest exposed leaf sheath. When this distance is between 2 and 4 inches, wheat has the most tolerance to growth-regulator herbicides.

Small grain herbicides - *continued*

Herbicide and formulation	Formulated material per broadcast acre	Herbicide (lb active per acre)	Weeds controlled	Application method and precautions
2,4-D amine (4 lb/gal formulation) or 2,4-D LV ester (4 lb/gal formulation)	1 to 1.5 pt or 0.5 to 1 pt/A	2,4-D 0.5 to 0.75 lb or 0.25 to 0.5 lb/A	Dandelion, field pennycress, shepherdspurse, wild mustard, common and giant ragweed, lambsquarters, pigweed, velvetleaf.	Barley, oats, rye and wheat. Apply in spring after full tillering stage but before jointing (stem elongation). Use lower rates on oats, which are less tolerant than other small grains. Underseeded legumes will be severely injured.
2,4-D LV ester (4 lb/gal formulation)	1.5 to 2 pt/A	0.75 to 1 lb/A	Wild garlic, vetch, many other broadleaf weeds.	Barley, rye and wheat. Apply in spring after full tillering stage but before jointing (stem elongation). Wild garlic will not be killed, but dockage should be reduced. Do not use unless possible crop injury is acceptable. Underseeded legumes will be severely injured.
Banvel/Clarity (4 lb/gal formulation)	2 to 4 fl oz/A	dicamba 0.0625 to 0.125 lb/A	Field pennycress, wild buckwheat, common and giant ragweed, kochia, lambsquarters, pigweed, smartweed.	Barley and wheat. Apply in spring after winter dormancy but before jointing (stem elongation). Underseeded legumes will be severely injured.
Buctril 2EC or Buctril 4 lb/gal	1.5 to 2 pt or 0.75 to 2 pt	bromoxynil 0.38 to 0.5 lb/A	Wild buckwheat, common ragweed, lambsquarters, velvetleaf.	Apply to wheat or barley from emergence to boot stage. Apply on weeds up to 4-leaf stage or rosettes less than 1.5 inches across. Underseeded legumes will be severely injured.
MCPA 4L	0.3 to 0.5 pt/A	MCPA 0.15 to 0.25 lb/A	Field pennycress, shepherdspurse, wild mustard, common and giant ragweed, lambsquarters, pigweed.	May be applied to oats, barley and wheat. Apply in spring just prior to jointing (stem elongation). Apply in 5 to 10 gallons of water per acre. Some legume tolerance if covered by small grain foliage and weeds.
Bronate 4L	1 to 2 pt/A	bromoxynil + MCPA 0.25 + 0.25 to 0.5 + 0.5 lb/A	Field pennycress, lambsquarters, other broadleaf weeds.	May be applied to oats, barley, rye and wheat. See label for weeds and rates. Apply between the 3- to 4-leaf stage and the boot stage of the crop. Weeds should be less than 6 inches tall and not past the 3- to 4-leaf stage. Underseeded legumes will be severely injured.

## Small grain, Special problems

Herbicide and formulation	Formulated material per broadcast acre	Herbicide (lb active per acre)	Weeds controlled	Application method and precautions
<b>Harvest aid</b>				
2,4-D amine (4 lb/gal formulation) or 2,4-D ester (4 lb/gal formulation)	1 to 2 pt or 1 to 2 pt/A	2,4-D 0.5 to 1 lb/A	Suppression of wild garlic and broadleaf weeds that interfere with harvesting.	Apply when small grains are in the hard dough stage. Ester formulation may be more effective on wild garlic than the amine formulation. Best results will be obtained when soil moisture is sufficient to cause succulent weed growth. Underseeded legumes will be severely injured.
Clarity 4L	8 oz/A	dicamba 0.25 lb/A	Suppression of broadleaf weeds that interfere with harvesting.	Apply when wheat is in the hard dough stage and green color is gone from nodes (joints). Do not use wheat for seed unless germination tests are 95% or better. Can be tank-mixed with Roundup or 2,4-D. Do not apply within 7 days of harvest.
Roundup/Others Glyphosate 3L or Roundup WeatherMax 4.5L or Roundup PowerMax 45L or Touchdown brands + Recommended additives	at least 1 qt/A or at least 22 fl oz/A or at least 22 fl oz/A or at least 24 fl oz/A + See label	glyphosate at least 0.77 lb ae/A	Suppression of grass and broadleaf weeds that interfere with harvesting	Apply when small grains are in the hard dough stage (30% moisture or less). Do not apply to wheat grown for seed.

## Crop replant and rotation guide for herbicides

(See end of table for key to abbreviations.)

Herbicide	Corn	Cotton	Grain sorghum	Rice	Soybean	Wheat	Unspecified crops	Other crops	Rotation interval	+Additional precautions and information
	Months between application & planting									
2,4-D (various trade names)	0.5	-	-	1	+	-	FY	FG	+	+Wait 30 days before planting if more than 1 pint is used, 15 days for 1 pint or less of amine, 7 days for 1 pint or less of ester. +For forage grasses, wait 2 weeks per pint of 2,4-D used before seeding.
Accent Q	0	10	18+	18+	+	4	18+	B, RG O SC, AL SF	4 mo. 8 mo. 10 mo. 18 mo.+	<b>Grain sorghum</b> is 10 months if pH is less than 7.5. <b>Soybeans</b> are 15 days. <b>Unspecified crops</b> are 10 months if pH is less than 6.5 <b>Sunflower</b> is 11 months if pH is less than 7.5
Achieve	1	1	1	1	1	1	4+			<b>Unspecified crops:</b> Actual wording is that all other rotational crops must be planted 106 days after application.
Afforia	1+	2+	1+	2+		2+	12+			+Check label for specific restrictions. Rotational restrictions listed are the maximum for the highest labeled rate used. Rotational intervals are less for lower rates.
Aim	0	0	0	0	0	0	1			
Assure II	4	0	4	4	0	4	4			
Atrazine	0	FY+	0	FY+	FY+	FY	FY+			If applied after June 10, only corn and grain sorghum can be planted the following year.
Authority Assist	10	18	18	40	0	4	30			
Authority Elite	10	18+	10	10	0	4.5	12			+Cotton may be planted after 12 months under certain conditions. Check label.
Authority First	10+	18	12	10	0	4	30	AL, B, RG	12 mo.	+Corn interval is 18 months if Sonic is applied at 6.45 to 8 oz on soils of 1.5% organic matter or less.
Authority Maxx	10	18+	10	10	0	4	36			+Cotton may be planted after 12 months under certain conditions. Check label.
Authority MTZ	10+	18	12	10	4	4	18	AL B	12 mo. 4 mo.	+Field corn may be planter after 4 months when applied at 14 oz/A or less.
Authority XL	10+	12	10+	10+	0	4	36	AL	12	Corn, grain sorghum and rice: Rotational intervals are increased to 18 months if soil pH is above 6.8.
Autumn	1	9	9	18	9	4	+	AL	18 mo.	+Unspecified crops may be seeded only after the completion of a successful field bioassay.
Axial XL	4	4	4	4	4	0	4	-	-	
Axiom	0	+	24	12	0	12	24	PT RG, AL, O, B, CL	1 mo. 12 mo.	<b>Cotton</b> rotational interval not determined at the time of printing.
Axiom AT	0	+	FY	+	FY	+	+			+No information on label.
Balance Flexx	0	6	6	6	6	4	18	B, SC, PT SF AL	6 mo. 10 mo.	
Banvel	+	+	+	+	+	+	+	Corn Sorghum Wheat	7 da. 14 da. 30 da/pt	Actual label wording is "following normal harvest of crop." <b>Wheat</b> planting must be delayed 30 days after application per pint of Banvel used.
Basagran	0	+	+	+	0	+	+			No restrictions on label.
Basis Blend	0	10	10	18	1+	4	18	AL	10	Crop rotation interval for soybeans is intended to support a soybean replant following a failed corn crop where Basis has been applied. Not intended for use as part of a planned soybean herbicide program. For counties along I-70 and south, soybean replant interval is 60 days for 1.25 oz/A rate, 15 days for 0.825 oz/A rate.
Beacon	+	8	8	18	8	3	18	B, RY AL, SC	3 mo. 8 mo.	<b>Corn</b> is 14 days. Injury may occur if dry weather prevails during much of the time between Beacon application and seeding of wheat or sorghum.
Bestow	1	10	18	18	10	4	18			
Bicep II Magnum, Bicep Lite II Magnum/Cinch ATZ	0	FY	0+	NI	FY	15	18	SG	15 mo.	<b>Grain sorghum:</b> Use Concep-treated seed. If applied after June 10, only corn and grain sorghum can be planted the following year.

**Crop replant and rotation guide for herbicides - continued**

(See end of table for key to abbreviations.)

Herbicide	Corn	Cotton	Grain sorghum	Rice	Soybean	Wheat	Unspecified crops	Other crops	Rotation interval	+Additional precautions and information
	Months between application & planting									
Blazer	FY	FY	FY	FY	0	FA	FY+			<b>Root crops</b> (such as carrots, turnips, sweet potatoes, etc.) must not be planted in treated fields for a period of 18 months following treatment.
Boundary	8	8	12	8	0	4.5	18+	AL PT	4.5 mo. 8 mo.	<b>Root crops</b> are 18 months.
Bronco	0	FY	0+	FY	0	FA	FA			<b>Grain sorghum:</b> use SCREEN-TREATED seed.
Buctril + atrazine	0	NI	0	NI	FY+	NI	+			<b>Soybean and unspecified crops:</b> If applied after June 15, plant only corn or grain sorghum the next year. Unspecified crops should not be planted the year following application.
Buctril	0		0			FA				
Butyrac/ Butoxone (2,4-DB)	-	-	-	-	-	-	-			No restrictions on label.
Cadet	0	FA	FA	FH	0	FHF	FH			
Callisto	0	FY	0+	18	FY	4	18	SC, SF, CA, PT, T	FY	
Callisto Xtra	0	FY	0+	18	FY	FY	18			
Canopy 75DF	10+	10	12	10	0	4	30	AL	10	+Seed corn inbred lines may vary in their sensitivity to trace amounts of herbicide carryover.
Canopy EX	10	10	12	10	0.5	4	30	AL FG	10 mo. 4 mo	Even though Canopy EX may be applied in the fall, for purposes of recropping, do not start counting months for recropping until normal soybean planting time in the spring.
Camix	0	FY	0+	18	FY	4.5	18	RG	FY	If applied after June 10, do not rotate to crops other than corn or sorghum the following year.
Clarity	+	+	+	+	+	+	+			<b>Corn:</b> 7 days. <b>Grain sorghum:</b> 15 days. <b>Wheat</b> planting must be delayed 22 days after each 8 fl oz used. For other crops, actual label wording is "following normal harvest of crop."
Classic (All of MO with soil pH 7 or less)	9+	9+	9+	9+	0	3	18+	SG, RG AL, CL, T	3 mo. 15 mo.+	<b>Corn, cotton, grain sorghum and rice</b> intervals must be extended by 2 months if applied after Aug. 1. If applied the same year as Scepter or Pursuit, do not plant anything except soybeans for 15 months. <b>Unspecified crops</b> require a successful bioassay. See label for information.
Cobra	1	0	1	1	0	1	-			No restrictions on label
Command	9+	9+	12+	12+	0	12	16+	T DB SC	0 mo. 9 mo. 12 mo.	<b>Corn</b> is 9 months at rates of 2 pt/A and less. <b>Cotton</b> may be replanted immediately if Disyston or Thimet are applied (reapplied) in-furrow. <b>Cover crops</b> may be planted anytime, but stand reductions may occur. <b>Rice</b> may be replanted immediately if the Command rate is within the label for rice.
Command Xtra	10	18	10	10	0	12	18	T B, O, RG SC	0 16 mo. 18 mo.	
Conclude Xact B	FY	FY	FY	FY	0	FA	FY+			<b>Root crops</b> (such as carrots, turnips, sweet potatoes, etc.) Must not be planted for 18 months following treatment
Conclude Xact G	-	-	-	-	-	-	-			No restrictions on label.
Corvus	0	17	17	17	9	4	17	AL	17 mo.	
Crusher	1	-	10	10	+	4	18			+Soybean: rotational interval south of I-70 is 2 months and north of I-70 is 10 months.
Dawn	10	1	18	10	1	4	18			
Distinct	+	4	4	4	4	4	4			<b>Corn:</b> 7 days.
Domain	1	24	12	12	0	24	12	PT	1 mo.	
Dual II Magnum	0	0	0+	FY	0	4.5	FY	SG, AL	4.5 mo.	<b>Grain sorghum:</b> Use Concep-treated seed.
Epic	0	6	12	12	6	12	24	PT	6 mo.	See label for specific vegetable crops.

**Crop replant and rotation guide for herbicides - continued**

(See end of table for key to abbreviations.)

Herbicide	Corn	Cotton	Grain sorghum	Rice	Soybean	Wheat	Unspecified crops	Other crops	Rotation interval	+Additional precautions and information
	Months between application & planting									
Equip	0.5	9	9	18	9	2	18	AL, SF B, RG O	18 2 9	See label for specific soil insecticide restrictions.
Expert	0	FY	0+	-	FY	15	-			<b>Grain Sorghum:</b> Use Concep-treated seed. If applied after June 10, do not rotate to crops other than corn or sorghum the following year.
Extreme	8.5+	18	18	40	0	4	40	AL, RG, DB	4 mo.	Corn: IMI, IR, IT or Clearfield corn may be replanted immediately
Fierce 76WDG	+	1.5	18	10	0	1	18	AL	18	Corn: 7 days
Fierce XLT	10	18	18	18	0	10	30	AL	18	
Finesse	11	14	14	NI	14+	0	+			<b>Soybeans:</b> STS soybeans may be planted the spring following Finesse <b>Other crops:</b> Other crops will require a successful bioassay.
FirstRate	9	9	9	9	0	4	18	AL PT T	9 mo. 18 mo. 30 mo.	<b>Unspecified crops</b> require a successful bioassay. <b>Tobacco:</b> See label for rates and transplant intervals.
Flexstar	10	0	18+	10	0	4	18	SG AL	4 mo. 10 mo.	<b>Grain sorghum</b> is 10 months in Southeast Missouri Delta counties.
Flexstar GT	10	0	18+	10	0	4	18			<b>Grain sorghum</b> is 10 months in Southeast Missouri Delta counties.
Frontrow	9	9	9	26	0	3	26+	SG	3 mo.	<b>Unspecified crops</b> require a successful bioassay.
Fultime NXT	0	+	FY	+	FY	15	+			<b>Cotton, rice and soybeans</b> should not be planted the year following application.
Fusilade DX	2	0	2	2	0	2	2			
Fusion	2	0	2	2	0	2	2			
Gangster	9	9	9	9	0	3	-	SF	30	
Gauntlet	10	18	10	10	0	4	-	AD, DB SC AL, DB	12 mo. 18 mo. 30 mo.	<b>Popcorn</b> is 9 months
Glyphosate <sup>a</sup>	0	0	0	0	0	0	0+	T	1 mo.	<b>Tobacco</b> is an exception to Unspecified crops.
Goal	10	1+	10	10	1+	10	10			<b>Cotton and soybeans</b> may be planted 7 days after application if soil is worked 2" deep. See label for additional rainfall restrictions.
Gramoxone Max	-	-	-	-	-	-	-			No restrictions on label
Halex GT	0	10	0+	18	10	4	18	AL	10 mo.	+If grain sorghum is replanted, it must be Concep treated.
Harass	1	1/4	1	1	1	1	1.5			
Harmony GT XP/Unity	0	0	0	0	+	1.5	1.5			+ <b>Soybeans</b> may be planted 7 days after application for rates up to 2.2 oz/A.
Harmony Xtra	1/2	1/2	1/2	2	0+	0	2	B, O	0 mo.	+Soybeans may be planted 7 days after application.
Harness Xtra	0	+	+	+	FY	+	+	T	FY	No additional information on label
Harness	0	+	+	+	FY	+	+	T	FY	No additional information on label
Harrow	1	10	18	18	10	4	18			
Hoelon	-	-	-	-	-	-	-			No information on label.
Hornet	0	18	12	10.5	10.5	4	26+	B, O, RG AL PT, SF, T	4 mo. 10.5mo. 18 mo.	<b>Unspecified crops</b> require a successful bioassay.
Huskie	9	+	4	+	4	1	+			+Where a crop is not specified, conduct a field bioassay as specified on the label.
Impact/Armezon	0	9	9	18	9	3	18	AL, SF	18 mo.	
Instigate	0	10	10	18	10	4	18			
Intrro	0	FY	0+	FY	0	FA	FY			<b>Grain Sorghum:</b> Apply only to grain sorghum planted with seed that has been properly treated with a seed protectant or safener.
Keystone NXT/Breakfree ATZ	0	+	FY	+	FY	15	+	T+	FY	<b>Cotton, rice and unspecified crops:</b> Do not plant the year following application. If applied after June 10, only corn may be replanted the following year.

**Crop replant and rotation guide for herbicides - continued**

(See end of table for key to abbreviations.)

Herbicide	Corn	Cotton	Grain sorghum	Rice	Soybean	Wheat	Unspecified crops	Other crops	Rotation interval	+Additional precautions and information
	Months between application & planting									
Laddok S-12	+	+	+	+	+	+	+			See label.
Liberty	0	4	3+	4	0	3+	4			<b>Grain sorghum and wheat:</b> Actual wording is 70 days
Liberty ATZ	0	FY	0	FY	FY	FY	FY			
Lexar EZ	0	FY+	0+	FY+	FY+	FY+	+			<b>+Cotton, grain sorghum rice soybeans and wheat:</b> If applied after June 10, do not rotate with crops other than corn the following year. <b>Other crops</b> should not be planted the season following application.
Linex	0+	4	0+	4	0+	4	4			<b>Corn, grain sorghum and soybeans:</b> Thoroughly rework soil before replanting. Plant corn at least 1.75 inches deep and grain sorghum at least 1 inch deep.
Lumax EZ	0	FY+	0+	FY+	FY+	4.5+	+			<b>+Cotton, grain sorghum rice soybeans and wheat:</b> If applied after June 10, do not rotate with crops other than corn the following year. <b>Other crops</b> should not be planted the season following application.
Marvel	10	0	-	10	0	4		-		
Nimble	½	½	½	1	¼	1	1.5			
NorthStar	+	8	8	18	8	4	18	B AL, SC, DB, PT, SF, T	3 mo. 8 mo.	<b>Corn</b> is 14 days, IR corn may be replanted immediately
Olympus	18	12	12	-	12+	0	-			<b>+STS Soybean</b> may be planted 4 months after application. Specific mitigation measures are required in certain MO counties where endangered species occur. See label for specific guidelines and restrictions.
Olympus Flex	12	10	9	-	5	0	+	AL, O, PT	24 mo.	+A field bioassay must be conducted for crops not listed on this label and for crops for which the cumulative precipitation requirements are not satisfied.
OpTill	8.5	18	18	40	0+	4	40	AL SF	4 18	+On coarse soils with less than 2% organic matter, the planting interval for soybeans is 1 month.
OpTill PRO	8.5	18	18	40	0+	4	40	AL	9 mo.	+On coarse soils with <2% organic matter, a 1-month preplant interval is required between application and planting.
Option	0.5	2	2	2	0.5	2	2			
Osprey	12	3	-	3	3	0.25	10	B, SF	1 mo.	
Outlook	0	FY	0+	FY	0	4	FY	SG	4 mo.	+Use Concep or Screen-treated seed.
Paramount	10	10	0	10	10	0	24	AL, CL, PT, SF	+	+These crops require 24 months and a successful bioassay
Peak	1+	10	1	10	10	0	18+	SG SC, FG, PT, T, CA AL, CL PT, SF	1 10 mo. 15 mo. 24 mo.	<b>See label for specific pH and application time restrictions.</b> <b>Corn:</b> IR corn may be replanted immediately. <b>Sunflower and potato</b> is an exception to the 18-month-all interval
Permit	1+	4	2	1	9	2	+	SG SC AL, CL, DB, PT CA SF	2 mo. 3 mo. 9 mo. 15 mo. 18 mo.	<b>Corn:</b> IR may be replanted immediately. <b>Unspecified crops:</b> Label does not have an "Unspecified-crops" interval.
Phoenix	1	0	1	1	0	1	-			No restrictions on label
Pinnacle	1.5	1.5	1.5	1.5	1.5	1.5	1.5			
Poast	-	-	-	-	-	1	-			No restrictions on label.
PowerFlex HL	9	3	3	12	5	1	12			
Prefix	10	1	18	10	0	4.5	18	AL	4	
Prequel	0	18	10	18	10	4	18			
Princep	0	+	+	+	+	+	+			<b>Cotton, grain sorghum, rice, soybean, wheat and unspecified crops:</b> Do not plant the year following application

**Crop replant and rotation guide for herbicides - continued**

(See end of table for key to abbreviations.)

Herbicide	Corn	Cotton	Grain sorghum	Rice	Soybean	Wheat	Unspecified crops	Other crops	Rotation interval	+Additional precautions and information
	Months between application & planting									
Prowl H <sub>2</sub> O	FY	0	FY	FY	0	4	FY	B, RG, AI, T, CL	4 mo.	
Prowl (2X Rate)	FY	0	FY	FY	0	FY	FY			Do not rework soil deeper than treated zone.
Pursuit	8.5+	18	18	40	0	3	40	AL, RG, T, B, O, SC, PT	4 mo. 9.5 mo. 18 mo. 26 mo.	<b>Corn:</b> IMI, IR, IT and Clearfield corn may be replanted immediately. See label for restrictions regarding the use of other ALS-inhibiting herbicides.
Python	0	18	12	6	0	4	26+	AL, DB, B, O, RG, PT, SF, SC+	4 mo. 12 mo. 18 mo.	<b>Popcorn</b> is 9 months. <b>Unspecified crops</b> require a successful bioassay.
Ramrod	0	FY	0	FY	FY	FA	FA			
Raptor	8.5	9	9	9	0	3	18	B, RG, AL, SC, DB, O, PT, SF	4 mo. 9 mo.	
Realm Q	0	10	10	18	10	4	18	AL	10	
Reflex	10	0	18	18	0	4	18	SG	4 mo.	All of Missouri except the Boot heel: Do not apply to any field more than once every two years.
Resolve Q	0	10	10	10	10	4	-	AL, PT	10 mo. 0 mo.	For alfalfa and grain sorghum, rotational intervals should be extended to 18 months if drought conditions prevail after application.
Resource	-	-	-	-	-	-	-			No restrictions on label.
Rhythm	10	0	18+	10	0	4	18	SG, AL	4 mo. 10 mo.	+Grain sorghum is 10 months in southeast Missouri Delta counties.
Select/ Select Max	1+	0	1	1	0	1	1+			+May apply 6 oz Select Max and replant corn in 6 days. <b>Unspecified crops:</b> do not plant crops for which Select is not registered for 30 days following application.
Sencor	4	8	12	8	4	8	18+	AL, FG, PT, B+	4 mo. 8 mo.	<b>Barley and wheat</b> are 4 months if Sencor was applied to soybeans. <b>Unspecified crops:</b> Non-root crops are 12 months.
Sequence	0	0	0	FY	0	4.5	-	AL	4 mo.	
Sharpen	0	+	0		+	0	4			+ <b>Cotton:</b> 1.5 month for 1 oz/A; 3 months for 2 o/A; 4 months for 3 oz/A. + <b>Soybean:</b> 0 to 1 month for 1 oz/A; 1 to 2 months for 2 oz/A; 2 to 3 months for 3 oz/A
Shotgun	+	-	+	-	-	-	-			+Corn and grain sorghum are 3 weeks. Label does not specify rotation intervals for other crops. Use atrazine restrictions as a guideline.
Sierra	1	-	-	-	9	0	-	-		
Solstice	0	18	18	18	10	18	18			
Sonalan	FY	FY	FY	FY	0	FA	FA			
Sonic	10+	12+	12	10	0	4	30	AL, B, RG	12 mo.	+Corn interval is 18 months if Sonic is applied at 6.45 to 8 oz on soils of 1.5% organic matter or less. Cotton interval is 12 months if use rate was <5 oz/A, on medium to fine soils, pH is <7.2, and more than 15 inches of rainfall and/or irrigation received. Cotton rotation interval is 18 months if these conditions are not met.
Spartan (Midwest areas)	10	30	10	-	0	4	30	AL, B, RG, DB, CL, SF, SC, CA, PT	12 mo. 18 mo. 30 mo.	
Spirit	1+	10	10+	10+	10+	3+	18+	B, O, SC, FG, DB	3 mo. 8 mo. 10 mo.	+Label includes a June-30-last-application date for rotational crop safety; 10-month rotation to soybean south of I-80. IR or IMR corn may be replanted immediately
Starane Ultra	0	4	0	4	4	0	4	B, O	0 mo.	
Statement	10	1	18	10	0	4.5	18	AL	4	
Status	4	4	4	4	4	4	4			<b>Corn:</b> 7 days



**Crop replant and rotation guide for herbicides - continued**

(See end of table for key to abbreviations.)

Herbicide	Corn	Cotton	Grain sorghum	Rice	Soybean	Wheat	Unspecified crops	Other crops	Rotation interval	+Additional precautions and information
	Months between application & planting									
Steadfast	0	10	18+	18+	0.5	4	18+	SF	18 mo+	+ <b>Grain sorghum:</b> 10 months if pH is less than 7.5. + <b>Rice:</b> 10 months if pH is less than 6.5. + <b>Sunflower:</b> 11 months if pH is less than 7.5. + <b>Unspecified crops:</b> 10 months if pH is less than 6.5.
Storm	FY	FY	FY	FY	FY	FA	FA+			<b>Unspecified crops</b> do not include root crops which should not be planted for 18 months following application.
Stout	0	10	10	18	0.5	4	18	AL	10+	+Rotational intervals should be extended to 12 months if drought conditions prevail after application.
Surestart II/TripleFLEX II	0	26	12	26	FY	4	26	SF AL	18 mo. FY	
Surpass NXT	0	+	FY	+	FY	4	+	T	FY	<b>Cotton, rice and unspecified crops:</b> Do not plant the year following application.
Synchrony	9	9	9	15	0	3	17	SG AL, CL	3 mo. 12 mo.	See label for several exceptions depending on the use of chlorimuron-containing products, soil pH and application date.
Touchdown HiTech	0	0	0	0	0	0	-			
Touchdown Total	0	0	0	0	0	0	-			
Treflan	FY	0	FY	FY	0	FA	FY	B	Fall	
Treflan (2X rate)	+	0	+	+	0	+	+			+Do not plant for 2 years.
Trivence	10	18	18	12	4+	4		AL	10	+Replanting soybean immediately is permitted if no additional application of metribuzin-containing product is applied within 4 months.
Typhoon	10	10	18	10	0	4	18	SG	4 mo.	
Ultra Blazer	FY	FY	FY	FY	0	FA	FY+			<b>Root crops</b> (such as carrots, turnips, sweet potatoes, etc.) must not be planted in treated fields for a period of 18 months following treatment.
Valor, 3 oz rate	2	2	2	2	0	2	12	B, DB, RG, SC	4 mo.	
Valor, 2 oz rate	1+	1	1	1	0	1	12	B, DB, RG, SC	4 mo.	+No-till or minimum till corn can be planted 7 days after application.
Valor XLT	10	10	10	10	0	4	30	AL	12 mo.	
Verdict	0	FY	FY	FY	+	4	FY			+Replant intervals for soybean following Verdict is dependent on rate and soil type but ranges from 1 to 4 months. See label for specific report information for soybeans.
Warrant	FY	0	FY	FY	0	4	FY	AL	9 mo.	
Yukon	1	3	2	3	9	2	NI	RY PC AL, CL, DB, PT CA SF	2 mo. 3 mo.+ 9 mo. 15 mo. 18 mo.	+ <b>Seed corn:</b> 2 months
Zidua	0	+	6-12	10-24	0	0-6	18			+Cotton: Consult label for restriction based on rate.
Zorial	16	0	16	16	0	16	16			

**Key to abbreviations**

**Crops**

- AL = Alfalfa
- B = Barley
- CA = Canola (rape)
- CL = Clovers
- DB = Dry beans
- FG = Forage grasses
- FL = Forage legumes
- O = Oats
- PT = Potatoes
- RG = Rye
- SC = Sweet corn/  
Popcorn
- SF = Sunflower
- SG = Small grains
- T = Tobacco

**Timings**

- FA = Fall
- FH = Following harvest
- FY = Following year

**Notes**

This table applies to the major field and forage crops of Missouri. Refer to the herbicide labels for the latest recrop and rotation information for horticultural crops. The University of Missouri does not warrant herbicides and regrets any omissions or errors in this guide. Always refer to product labels before using a pesticide or replanting into treated fields.

A "successful bioassay" where the rotational crop is test planted in soil from the field in question is often required for unlisted crops. A bioassay can be performed in the field or in a container (flower pot) indoors. If possible, similar, untreated soil (such as from an adjoining fence row) should also be planted as a check. A bioassay is also advisable if weather conditions have been unfavorable for herbicide breakdown (cool temperatures and little rainfall) or when you are planting extremely close to the specified rotation interval. Soil sampling should be thorough. Use the same procedures as for fertility samples. If possible, a hypersensitive plant should be planted in addition to the desired crop (for example, a grower who is planting wheat but is concerned with potential atrazine carryover should use both wheat and soybeans as test crops since soybeans are also sensitive to atrazine). Field bioassays, where strips are planted perpendicular to the previous crop rows, are also useful.

## Forage, feed and grazing restrictions for herbicides

Herbicide	Restrictions
2,4-D	Do not forage or feed corn fodder for 7 days following application. Do not permit dairy animals or meat animals being finished for slaughter to forage treated grain fields within 2 weeks after treatment. Do not feed treated straw to livestock if a preharvest or emergency treatment is used. See label for further information.
Accent	Do not graze or feed forage or grain from the treated areas to livestock within 30 days after application.
Achieve	Mature straw and grain may be fed to livestock 45 days after treatment. Immature crops (forage) may be grazed or cut for hay 30 days after treatment.
Afforia	Do not graze treated fields or harvest for forage or hay.
Aim	Product is labeled for use on corn for silage. Do not feed treated soybean forage to livestock. No information on other crops.
Assure II	Do not graze treated fields or harvest for forage or hay.
Atrazine	Do not graze or feed forage from treated areas for 60 days following application, or illegal residues may result.
Authority First	Do not feed treated soybean forage or hay to livestock. Do not harvest soybeans for 65 days after application.
Authority MTZ	Do not graze treated fields or harvest for forage or hay.
Authority XL	Do not feed treated soybean forage or soybean hay to livestock.
Axial XL	Do not graze livestock or harvest forage for hay from treated wheat and barley for a minimum of 30 days following application.
Axiom	No restrictions on corn. Do not graze or feed forage, hay or straw to livestock from treated soybeans.
Axiom AT	No restrictions on corn.
Balance Flexx	No information on label.
Banvel	Do not graze or harvest for livestock feed prior to crop maturity.
Basagran	Do not graze treated fields for at least 21 days after application.
Basis	Do not graze or feed forage, grain or stover from treated areas within 30 days of application.
Beacon	Do not graze or feed forage from treated corn to livestock within 30 days after application.
Bestow	Do not graze, feed forage, grain or fodder (stover) within 30 days of application.
Bicep II Magnum	Do not graze or feed forage from treated areas for 30 days following application.
Bicep Lite II Magnum	Do not graze or feed forage from treated areas for 30 days following application.
Blazer	Do not use treated plants for feed or forage.
Boundary	Soybean plants or hay may be grazed or fed to livestock 40 days after application.
Bronate	Do not graze treated fields for 30 days following application.
Buctril + atrazine	Do not cut crop for feed or graze within 30 days after application.
Buctril	Do not cut for feed or graze within 30 days after application.
Butyrac/Butoxone (2,4-DB)	Do not graze or feed soybean hay within 60 days after application of a 2,4-DB tank-mix application.
Cadet	Do not graze or feed treated soybean forage or hay to livestock. Do not harvest or feed field corn forage until 30 days after the last application.
Callisto	Do not harvest forage, grain or stover within 45 days after application.
Callisto Xtra	Do not graze or feed forage from treated areas for 60 days following applications or illegal residues may result.
Canopy 75DF	Do not graze treated fields or harvest for forage or hay.
Canopy EX	May be grazed 14 dys after application.
Cinch ATZ	Do not graze or feed forage from treated areas for 30 days following application.
Clarity	For lactating dairy animals, do not harvest forage within 37, 51 or 70 days for 1, 2 and 4 pint use rates. No restrictions for other animals.
Classic	Do not graze treated fields or harvest for forage or hay.
Cobra	Do not graze animals on green forage or stubble. Do not use hay or straw for animal feed or bedding.
Command	Do not allow livestock to graze on treated fields or crop residue or feed treated forage to livestock.
Command Xtra	Do not allow livestock to graze on treated soybean vines or feed treated soybean leaves or vine trash to livestock.
Conclude	Do not use treated plants for feed or forage.
Crusher	Do not graze, feed forage, grain or fodder (stover) within 30 days of application.
Dawn	Do not graze treated areas or forage or harvest for forage or hay.
Degree	No information on label.
Degree Xtra	No information on label.
Domain	Do not graze or feed forage, hay or straw to livestock.
Distinct	Do not apply within 32 days of forage harvest. Do not apply within 72 days of corn grain and stover harvest.
Dual II Magnum	Do not graze or feed forage from treated areas for 30 days following application.
Epic	No information on label
Equip	Do not harvest corn grain within 70 days and corn forage within 45 days of an application. Do not graze within 45 days of an application.

Forage, feed and grazing restrictions for herbicides - *continued*

Herbicide	Restrictions
Expert	Do not graze or feed forage from treated areas for 30 days following application.
Extreme	Do not graze or feed treated soybean forage, hay or straw to livestock.
Fierce XLT	Do not graze treated fields or feed treated forage or hay to livestock.
Finesse	No grazing restrictions.
FirstRate	Do not harvest soybeans for forage or hay for 14 days after application.
Flexstar	Do not graze treated areas or harvest for forage or hay. Do not graze rotated small grain crops or harvest for livestock forage or straw.
Frontrow	Do not graze or feed treated soybean forage, hay or straw to livestock.
Fultime NXT	No restrictions on label.
Fusilade DX	Do not graze or harvest for forage or hay.
Fusion	Do not graze or harvest for forage or hay.
Gangster	Do not graze treated fields or feed treated forage or hay to livestock.
Glyphos X-tra	Do not graze corn within 7 days of application. Do not graze soybean within 14 days of application.
Gramoxone SL2.0	Soybean post directed: Do not graze treated areas or feed treated forage to livestock. Corn harvest aid: Do not use on corn grown for fodder or forage. Do not pasture livestock in treated fields. Soybean harvest aid: Do not pasture livestock within 15 days of treatment and remove 30 days before animal harvest.
Halex GT	Do not graze or feed forage from treated areas for 45 days following application.
Harmony Xtra SG	Do not graze or feed forage for 7 days after application. Do not feed hay for 30 days following application. Harvested straw may be used for bedding 45 days between application and harvest.
Harmony GT XP/Unity	Do not graze or feed forage, hay or straw from treated areas to livestock.
Harness	No restrictions on label.
Harness Xtra	No restrictions on label.
Harrow	Do not graze, feed forage, grain, or fodder (stover) within 30 days of application.
Hoelon	Do not allow livestock to graze treated fields. Do not harvest forage, hay or straw from treated fields.
Hornet	No restrictions on label.
Huskie	Do not graze or harvest forage within 25 days, or grain and straw within 60 days after application.
Ignite 280SL	In Liberty Link soybeans if postemergence applications have been made, do not graze the treated crop or cut for hay. In corn, do not apply within 60 days of harvesting corn forage.
Impact/Armezon	Do not apply within 45 days of corn harvest. Do not graze or feed treated corn forage, silage, fodder or grain for at least 45 days after application.
Intrro	Grain sorghum: Do not graze harvest forage for 70 days following application. Soybeans: Do not feed forage, hay or straw. Do not ensile treated soybeans.
Keystone NXT	No information on label.
Laddok S-12	Do not graze treated areas or feed treated forage to livestock for 21 days following application.
Lexar EZ	Do not graze or feed forage from treated areas for 45 days following application.
Liberty 280SL	In Liberty Link soybeans if postemergence applications have been made, do not graze the treated crop or cut for hay. In corn, do not apply within 60 days of harvesting corn forage.
Liberty ATZ	Do not harvest corn forage within 60 days of application. Do not feed treated green immature growing soybean plants to livestock.
Linex	Do not graze treated fields or feed forage from treated areas to livestock. Do not feed gin trash to livestock.
Lumax EZ	Do not graze or feed forage from treated areas for 45 days following application.
Marvel	Do not graze treated areas or harvest for forage or hay. Do not graze rotated small grain crops or harvest for livestock forage or straw.
MCPA	Do not forage or graze meat or dairy animals on treated areas within 7 days of slaughter.
NorthStar	Do not graze or feed forage from NorthStar-treated corn to livestock within 30 days following application. Do not harvest silage within 45 days after application.
Olympus Flex	Wheat may be harvested for forage 30 days after application, or for grain and straw 71 days after application.
OpTill	Do not feed or graze soybeans.
OpTill PRO	Do not graze or feed treated soybean forage, hay or straw to livestock.
Option	Do not harvest corn grain within 70 days and corn forage within 45 days of an application. Do not graze within 45 days of an application.
Osprey	Wheat: Do not apply within 30 days of grazing; 60 days for hay, grain and straw.
Outlook	May be grazed or fed to livestock at 40 or more days after application.
Paramount	No information on label
Peak	Do not graze or feed forage from treated crops until 30 days following application. Do not harvest for silage until 40 days following application.
Permit	Allow 30 days before grazing and harvest of forage or silage.

**Forage, feed and grazing restrictions for herbicides - *continued***

<b>Herbicide</b>	<b>Restrictions</b>
Phoenix	Do not graze animals on green forage or stubble. Do not feed treated soybean silage (ensiled soybeans) to cattle. Do not use hay or straw for animal feed or bedding.
Poast/Poast Plus	Do not graze treated fields and do not feed treated soybean forage (green succulent) or ensilage to livestock. Treated soybean hay may be fed. Do not apply within 60 days of harvest for fodder or 45 days for corn forage/silage.
PowerFlex HL	Do not graze the treated crop within 7 days following application. Do not cut the treated crop for hay within 28 days following application.
Prefix	Do not graze treated areas or harvest for forage or hay.
Prequel	Do not graze or feed forage, grain, or fodder from treated areas to livestock within 30 days of application.
Princep	Do not graze treated areas, or illegal residues may occur.
Prowl H <sub>2</sub> O	Do not graze treated cotton or rice fields. Do not use rice straw for feed or bedding. Livestock can graze or be fed soybean forage from treated corn 21 days following application.
Pursuit	Do not graze or feed treated soybean forage, hay or straw to livestock.
Python	Do not graze or feed treated soybean forage, hay or straw to livestock. No corn information on label.
Raptor	Do not graze treated soybean forage, hay or straw to livestock.
Realm Q	Do not graze, feed forage, grain or fodder (stover) from treated areas to livestock within 45 days of application.
Reflex	Do not graze treated areas or harvest for forage or hay. Do not graze rotated small grain crops or harvest for livestock forage or straw.
Resolve	Do not graze or feed forage for 7 days after application. Do not feed hay for 30 days following application. Harvested straw may be used for bedding 45 days between application and harvest.
Resource	Do not graze animals or green forage or use as a feed fewer than 28 days after application.
Roundup Original Max	Roundup Ready Soybean: Allow a minimum of 14 days between final application and feeding of grain, forage, or hay. Roundup Ready Corn: Do not harvest or feed treated crops for 8 weeks after application. Spot treatment: Allow 14 days following spot treatment or selective equipment before grazing domestic livestock. Corn harvest aid: Allow a minimum of 7 days between application and feeding of treated vegetation. Grain sorghum harvest aid: Allow a minimum of 7 days between application and feeding of treated vegetation. Soybean harvest aid: Do not graze or harvest treated crop for livestock feed within 25 days of last preharvest application. Wheat harvest aid: Wheat stubble may be grazed immediately after harvest.
Select/ Select Max	Do not graze treated fields or feed treated forage or hay to livestock.
Sencor	Treated vines may be grazed or fed to livestock 40 days after application.
Sequence	Do not feed treated soybean forage or hay for 30 days after application.
Sharpen	Soybean forage may be fed or grazed 65 or more days after application.
Shotgun	Do not graze for feed forage from treated areas for 21 days following application.
Sodium chlorate	Grain sorghum: Do not graze treated fields or feed treated fodder, forage or seeds within 14 days of application. Rice: No information on label. Soybeans: Do not graze treated fields or feed treated soybean foliage or fodder.
Solstice	Do not harvest or feed field corn forage until 30 days after the last application. Do not harvest or feed grain or stover (fodder) within 70 days of last application.
Sonic	Do not feed treated soybean forage or hay to livestock. Do not harvest soybeans for 65 days after application of Sonic.
Spartan	No information on label.
Spirit	Do not graze or feed forage from Spirit-treated crops to livestock until 30 days after application.
Starane Ultra	Do not allow livestock to graze treated areas or harvest treated forage within 7 days of application to wheat, barley or oats, 47 days to corn, and 40 days to grain sorghum.
Statement	Do not graze treated areas or harvest for forage or hay.
Status	Do not apply within 32 days of forage harvest. Do not apply within 72 days of corn grain and stover harvest.
Steadfast	Do not graze or feed forage, hay or straw from treated areas to livestock within 30 days of application.
Stellar	Do not graze animals on green forage or stubble. Do not use hay or straw for animal feed or bedding.
Storm	Do not use treated plants for feed or forage.
Stout	Do not graze or feed forage, hay, or straw from treated areas to livestock within 30 days of application.
Surestart II/TripleFLEX II	No restrictions on label.
Surpass NXT	No restrictions on label.
Synchrony	Do not graze treated fields for forage or hay.
Touchdown	Do not graze or harvest treated cover crops for feed.
Touchdown HiTech	Roundup Ready Corn: Allow a minimum of 50 days between postemergence application and harvest of forage. Roundup Ready Soybean: Do not graze or harvest for forage or hay.
Touchdown Total	Roundup Ready Corn: Allow a minimum of 50 days between postemergence application and harvest of forage. Roundup Ready Soybean: Do not graze or harvest for forage or hay.
Treflan	No information on label.
Trivence	Do not graze treated fields or harvest for forage or hay.
Ultra Blazer	Do not use treated plants for feed or forage.

Forage, feed and grazing restrictions for herbicides - *continued*

Herbicide	Restrictions
Valor	Do not graze treated fields or feed treated forage or hay to livestock.
Valor XLT	Do not graze treated fields or feed treated forage or hay to livestock.
Verdict	Corn or popcorn forage and silage can be fed, harvested, or grazed 80 or more days after application. Do not graze or feed soybean forage, hay, or straw to livestock.
Warrant	Do not graze or feed treated soybean or cotton forage to livestock.
Yukon	Following application to forage, corn may be grazed or harvested for feed after the crop reaches the ensilage (milk) stage, at least 30 days after foliar application.
Zemax	Do not graze or feed forage from treated areas for 45 days following application.
Zorial	Do not graze treated cotton fields with livestock or feed treated cotton forage to livestock. Cover crops planted after harvest should be plowed under and not grazed or harvested.

Herbicide compatibility with fertilizers as application carriers\*

Fertilizer			Fertilizer		
Herbicide	Fluid	Dry	Herbicide	Fluid	Dry
<b>Burndown herbicides:</b>			<b>Burndown herbicides:</b>		
2,4-D Amine	No	No	Impact/Armezon	Yes	Yes
2,4-D Ester	Yes	No	Karmex	No	No
Glyphosate	No	No	Keystone NXT/Breakfree ATZ	Yes	Yes
Gramoxone	Yes	No	Lexar EZ	Yes*	No
Harmony Extra	Yes	No	Linex	Yes	Yes
Sharpen	Yes	Yes	Lumax EZ	Yes*	No
Touchdown	No	No	Outlook	Yes	Yes
Verdict	Yes	Yes	Paramount	No	No
<b>Preemergence herbicides:</b>			<b>Preemergence herbicides:</b>		
Atrazine	Yes	No	Prefix	Yes	No
Axiom	Yes	Yes	Prowl H <sub>2</sub> O	Yes	Yes
Axiom AT	Yes	Yes	Pursuit	Yes	No
Balance Flexx	Yes	No	Python	Yes	Yes
Banvel	Yes	No	Ramrod	Yes	No
Bicep II Magnum/Cinch ATZ	Yes	Yes	Sencor	Yes	Yes
Bicep Litell Mag./Cinch Lite ATZ	Yes	Yes	Sonolan	Yes	Yes
Boundary	Yes	Yes	Surpass NXT	Yes	Yes
Callisto	Yes*	No	Treflan	Yes	Yes
Caparol	No	No	Valor	NI	NI
Command	Yes	Yes	Verdict	Yes	Yes
Command Xtra	Yes	No	Zidua	Yes	Yes
Commence	Yes	Yes	Zorial	Yes	Yes
Cotoran	Yes	No	<b>Small grain postemergence herbicides:</b>		
Clarity	Yes	No	2,4-D Amine	No	No
Degree	Yes	Yes	2,4-D Ester	Yes	No
Degree Xtra	Yes	Yes	Achieve	No	No
Domain	No	Yes	Aim	No	No
Dual II/ Magnum/Cinch	Yes	Yes	Banvel	Yes	No
Epic	Yes	Yes	Buctril	Yes	No
Extreme	No	No	Bronate	Yes	No
FirstRate	Yes	Yes	Harmony Extra	Yes	No
Fultime NXT	Yes	Yes	Hoelon	Yes	No
Harness	Yes	Yes	MCPA	No information on label	
Harness Xtra	Yes	Yes	Olympus	Yes	-
Hornet	Yes	Yes	Olympus Flex	Yes	No
			Osprey	No	No
			Peak	Yes	No
			Sencor	Yes	No

**Note:** There are many specific fertilizer incompatibilities and restrictions with most herbicides. Be sure to read the herbicide label for specific mixing or impregnation instructions. Compatibility agents are required for many mixes. A typical compatibility test procedure for mixing herbicides in fluid fertilizers is given in the introductory section of this publication.

NI: No information on label

\*Do not use with suspension fertilizers.

## Rainfall-free periods, preharvest intervals (PHI), and crop safety restrictions for postemergence herbicides

Herbicide	Time before rainfall	PHI (crop safety restriction)
2,4-DB	NI*	Soybeans: 60 days
2,4-D and MCPA	6 to 8 hr	Corn: 7 days (Overtop- 8"; drop nozzles- before tasseling) Grain sorghum: (Overtop- 8"; drop nozzles- 15") Rice: (Before internode exceeds 1/2") Wheat: (Before jointing) Wheat harvest aid: Hard dough
Accent	4 hr	Corn: 30 days (overtop- before 20"/6 collars; drop nozzles-before 36"/10 collars)
Achieve	1 hr	Wheat: 60 days
Aim	1 hr	Corn: (14 collars) Cotton: 7 days Grain sorghum: (6-leaf stage post; harvest aid: 3 days) Rice: 60 days Soybeans: (V3-V10 post; harvest aid: 3 days) Wheat: (Jointing; harvest aid: 3 days)
Assure II	1 hr	Cotton: 80 days Soybeans: 80 days
Atrazine	1 to 2 hr	Corn: (12") Grain sorghum: (12")
Authority MTZ	NI*	Soybeans: 120 days
Banvel	6 to 8 hr	Corn: (1 pt- 5"; 1/2 pt- 36") Grain sorghum: (Overtop- 8"; drop nozzles- 15") Wheat: (Before jointing)
Basagran	8 hr***	Corn: No Restrictions Rice: No Restrictions Soybeans: No restrictions
Basis	4 hr	Corn: (4-leaf)
Beacon	4 hr	Corn: 60 days (overtop- before 20"; drop nozzles- before tassel emergence)
Bicep products	1 to 2 hr	Corn: NA, (5")
Blazer	6 hr	Rice: 50 days (Before boot stage) Soybeans: 50 days
Bronate	NI*	Wheat: NI*
Buctril		Corn: 30 days Sorghum: (Before boot stage) Cotton: 60 days Wheat: NI*
Buctril + Atrazine	1 hr	Corn: NI* Grain sorghum: NI*
Callisto	1 hr	Corn: 45 days (30" or 8-leaf)
Callisto Xtra	1 hr	Corn: Up to 12-inch corn
Clarity	4 hr	Corn: (1 pt- 5"; 1/2 pt- 36") Grain sorghum: (Overtop- 8"; drop nozzles- 15") Wheat: (Before jointing)
Classic	1 hr	Soybeans: 45 days
Clincher	2 hr	Rice: 60 days
Cobra	30 min.	Cotton: 70 days Soybeans: 45 days
Concert	1 hr	Soybeans: 60 days
Conclude Xact	4 hr	Soybeans: 75 days
Dual II Magnum	NA**	Corn: (5")
Extreme	NI*	Soybeans: 85 days (before bloom)
FirstRate	2 hr	Soybeans: 65 days for grain, 14 days for forage (50% flowering)
Flexstar	1 hr	Soybeans: 45 days
Flexstar GT 3.5	1 hr	
Fultime NXT	NA**	Corn: 60 days (11")
Fusilade	1 hr	Cotton: 90 days Soybeans: (First bloom)
Fusion	1 hr	Cotton: 90 days Soybeans: 1st bloom
Frontrow	2 hr	Soybeans: 70 days
Gramoxone	30 min	Burndown: NA** Corn harvest aid: 7 days Soybean harvest aid: 14 days
Halex GT	1 hr	Corn: 45 days

## Rainfall-free periods, preharvest intervals (PHI), and crop safety restrictions for postemergence herbicides - *continued*

Herbicide	Time before rainfall	PHI (crop safety restriction)
Harmony Extra	"Several hours"	Burndown: NA** Wheat: 45 days
Harmony GT XP/Unity	1 hour	Soybeans: 60 days Wheat: Before flag leaf stage
Harness/Degree	NA**	Corn: (11")
Harness Xtra/ Degree Xtra	1 to 2 hr	Corn: NA (11")
Hoelon	1 hr	Wheat: 77 days
Hornet	2 hr	Corn: 85 days (20")
Keystone NXT/Breakfree ATZ	NA**	Corn: 60 days (11")
Laddok S-12	8 hr***	Corn: 21 days (Fifth leaf) Grain sorghum: NI*
Lexar EZ	1 hr	Corn: 60 days (12")
Liberty	4 hr	Corn: 70 days for grain, 60 days for forage (Overtop- 24" or 7 collars, drop nozzles- 36")
Liberty ATZ	4 hr	Corn: 70 days for grain, 60 days for forage (12" corn)
Linex	NI*	Corn: NI* Grain sorghum: NI* Soybeans: 60 days
Lumax EZ	1 hr	Corn: 45 days (5")
NorthStar	4 hr	Corn: 60 days for grain, 45 days for silage (Overtop- 20" or 4 collars, drop nozzles- 36")
Olympus	4 hr	Wheat: 71 days
Olympus Flex	4 hr	Wheat: 71 days
OpTill	1 hr	Applications must be made before crop emergence.
Osprey	4 hr	Wheat hay, grain, and straw: 60 days; Wheat forage: 30 days
Outlook	NA**	Corn: 40 days (8")
Paramount	6 hr	Grain sorghum: (12 inches)
Peak	4 hr	Corn: 60 days (48 inches) Grain sorghum: 60 days (30 inches) Wheat: 60 days (Second node)
Phoenix	30 min.	Soybeans: 45 days
Permit	4 hr	Corn: Forage/Silage- 30 days (grain- lay-by) Grain sorghum: Forage/Silage- 30 days (grain- lay-by) Rice: 28 days (Preflood application only)
Pinnacle	1 hr	Soybeans: 60 days Wheat: Before flag leaf stage
Poast/Poast Plus/ Prestige	1 hr	Corn: Grain- 60 days; Forage/Silage- 45 days Cotton: 40 days Soybeans: 75 days
Prefix	NA**	Soybeans: 90 days
Pursuit	1 hr	Corn: 45 days Soybeans: 85 days (Before bloom)
Raptor	1 hr	Soybeans: 85 days (Before bloom)
Reflex	4 hr	Soybeans: 45 days
Resource	1 hr	Corn: Forage/Silage- 28 days; Grain- 60 days Soybeans: 60 days
Roundup	2 hr (1 hour UltraMax) (30 min WeatherMax)	Burndown: NA** Corn: 50 days (24 inches or 6 collars) Cotton: 7 days (Overtop- 4 leaf; directed- not specified) Soybeans: 14 days Harvest aid (Corn, Cotton, Grain sorghum, Small grain, Soybeans) : 7 days
Select/ Select Max	1 hr	Cotton: 60 days Soybeans: 60 days (40 days for 4-oz red rice seedhead suppression label)
Sencor	NI*	Wheat: 21 days Corn: prior to tasseling
Sharpen	1 hr	Applications must be made before crop emergence.
Shotgun	NI*	Corn: (Overtop- 4 leaf or 8", drop nozzles- 12") Grain sorghum: (Overtop- 4 leaf or 8", drop nozzles- 12")
Spirit	4 hr	Corn: Forage/Silage 40 days; Grain- 60 days (Overtop- 20" or 6 collars, drop nozzles- 24")
Steadfast	4 hr	Corn: 30 days (12inches or 6 collars)
Storm	6 hr	Rice: 50 days (End of tillering) Soybeans: 50 days
Surpass NXT/Breakfree XP	NA**	Corn: (11")

**Rainfall-free periods, preharvest intervals (PHI), and crop safety restrictions for postemergence herbicides - *continued***

<b>Herbicide</b>	<b>Time before rainfall</b>	<b>PHI (crop safety restriction)</b>
Surestart II/TripleFLEX II	NI*	Corn: 85 days
Synchrony STS	1 hr	Soybeans: 60 days
Touchdown HiTech		RR Soybean: 14 days with no more than 20 fl oz/A RR Corn: 7 days with no more than 20 fl oz/A Conventional soybean: 7 days with no more than 3.6 Qts/a Conventional corn: 7 days
Touchdown Total	NI*	Corn and soybeans: 7 days
Ultra Blazer	4 hr	Rice: 50 days Soybeans: 50 days
Valor	1 hr	
Valor XLT	1 hr	No information on label
Verdict	1 hr	Applications must be made before corn emergence.
Yukon	4 hr	Corn: 30 days (36") Grain sorghum: 30 days (Overtop- 8" drop nozzles 15")
Zidua	N/A	Do not harvest sweet corn less than 37 days after application.

\*No information on label.

\*\*Not applicable

\*\*\*Label now states that rainfall soon after application may decrease effectiveness.



## Corn diseases and their management

Corn diseases can and do occur each year in Missouri. Problems with germination and stand establishment that are related to seed decay, damping-off and seedling blights are often encountered in the field. These losses can be costly, especially if replanting is necessary. Diseases may cause leaf spots or leaf blights, wilts or premature death of plants. Corn diseases also can cause harvest losses, affect the quality of the harvested crop and cause storage losses. The extent of the damage due to corn diseases in a given season depends on a number of factors including the susceptibility of the corn hybrid to the specific disease, the level of pathogen inoculum present and the environmental conditions during that season.

To minimize losses due to corn diseases, it is important to correctly identify the disease or diseases present so that appropriate management steps can be taken. The principal diseases of corn in Missouri can be divided into seed rots and seedling diseases, foliage diseases, stalk rots, ear and kernel rots and a few miscellaneous diseases. For more detailed information including color pictures of diseases of corn in Missouri please see University of Missouri publication IPM 1001, *Corn Diseases*.

Finally, although the common diseases of corn are basically the same, regardless of the type of corn being grown; inbreds, some sweet corn hybrids and some specialty corn hybrids may be more susceptible to some of the common corn diseases than field corn. A pesticide label may also designate that the product is to be used on a specific type of corn. The tables included in this manual cover products registered for use on field corn. For other types of corn, always check the pesticide label and follow label specifications.

### Seed rots and seedling blights

Seed rots and seedling blights are caused by a number of different fungal species. Some of these, such as *Pythium* species, *Fusarium* species and *Rhizoctonia solani*, are common soil fungi found wherever corn is grown. Some, such as *Fusarium moniliforme* and *Penicillium oxalicum*, may be either soilborne or seedborne.

Most of the seed rots and seedling blights on corn are more severe in wet soils, in low-lying areas in a field and in soils that have been compacted or remain wet for an extended period of time. Low soil temperatures (below 50–55 degrees F) favor seed rot and seedling blights. Disease severity is also affected by planting depth, soil type, seed quality, mechanical injury to seed, crusting, herbicide injury or other mechanical factors that delay germination and emergence of corn. Residues left on the soil surface may influence the incidence and severity of seedling blight through their effect on soil temperature and soil moisture.

#### Management options for seed rot and seedling blight

- Plant good-quality seed under good seedbed conditions, especially at soil temperatures above 50–55 degrees F.
- Use fungicide-treated seed. Almost all commercial field corn seed comes with a fungicide treatment already applied to the seed. Bags should have labels that list the

products applied to the seed and the rate of each material applied. Occasionally there may be a need to apply additional fungicide treatment or a combination insecticide plus fungicide treatment for added protection. See accompanying table of seed treatment fungicides labeled for use on field corn.

### Seed treatment fungicides for corn

Although seed treatment fungicides can be an effective means of preventing or reducing losses from various seedborne and soilborne microorganisms, there are several important laws or guidelines concerning fungicide-treated seed. Always read the pesticide label and follow all directions and restrictions on the label but in particular for seed treatment fungicides remember the following points.

- Do not use treated seed for food, feed or oil purposes.
- All treated seed must be colored with an EPA-approved dye that imparts an unnatural color to the seed.
- Federal law requires that bags containing treated seed shall be labeled with the following information: “This seed has been treated with (common chemical name of active ingredients) fungicide(s). Do not use treated seed for feed, food or oil purposes. Store away from feeds and food stuffs.”

For years, seed companies have sold corn seed already treated with a seed treatment fungicide. There has also been the option of adding additional fungicide protection with on-farm planter-box products. Over the years the types of fungicides available have changed, and many seed companies or seed treating operations use a combination of several fungicides with varying modes of action to protect the seed from an array of seedborne and soilborne pathogens. More recently seed treatment insecticides have become available. Again, these seed treatment insecticides may be applied by the seed company or seed treating operation, making it possible to purchase seed treated with a fungicide, an insecticide or a combination of fungicide and insecticide.

Most recently, seed treatments providing nematode protection have come on the market. Now corn seed might be treated with a combination of fungicide, insecticide and/or nematode protection product.

Marketing strategies are also changing. Some seed treatment products are widely marketed to seed companies and dealers. Other products may be marketed under an exclusive agreement with a single seed company. That seed company has exclusive rights to the use of the particular product for a specified number of years. That product would not be available to other seed companies, dealers or seed treating operations. Some seed companies are putting together package treatments of fungicides, insecticide and nematode protection product that they are strongly recommending for use on their genetics. This shift to package treatments and exclusive marketing to individual seed companies makes it difficult to compile a table of seed treatment fungicides and nematode protection product labeled for use on corn in Missouri. Check with your seed salesperson to find out what products are on the seed you are purchasing and to find out if the rates of the various active ingredients are appropriate

for disease pressure in the fields in which the seed will be planted.

The following table was prepared using current product labels and manufacturers' Web sites. However, label registrations can change at any time. Before using any agricultural

pesticide, read and follow directions accompanying that product. Product names have been used for clarity. Reference to specific trade names does not imply endorsement by the University of Missouri; discrimination is not intended against similar products not listed.

## Seed treatment fungicides and nematode protection products labeled for use on field corn

Trade name Company	Common chemical name	% active ingredient	Rate	Additional label information
<b>Acceleron DC-309 Fungicide Seed Treatment for Corn</b> Monsanto	metalaxyl	28.35%	0.75 fl oz per 100 lb of seed 0.10 to 0.375 fl oz per 100 lb of seed	For Pythium damping-off control. Reduced rates in combination with other fungicides to aid in the control of seed decay and damping-off caused by <i>Pythium</i> . Apply only in combination with EPA registered rates of broad-spectrum seed treatment fungicides.
<b>Acceleron DC-509 Fungicide Seed Treatment for Corn</b> Monsanto	ipconazole	40.70%	0.085 fl oz per 100 lb of seed	For protection against seedborne and soilborne fungi that cause seed decay, damping-off and seedling blight. Acceleron DC-509 does not provide activity against <i>Pythium</i> spp. To provide best seedling protection against a wide array of fungal pathogens, apply Acceleron DC-509 as a tank mix with Acceleron DE-309.
<b>Acceleron DX-309 Fungicide Seed Treatment for Corn</b> Monsanto	metalaxyl	28.35%	0.75 fl oz per 100 lb of seed 0.10 to 0.375 fl oz per 100 lb of seed	For Pythium damping-off control. Reduced rates in combination with other fungicides to aid in the control of seed decay and damping-off caused by <i>Pythium</i> . Apply only in combination with EPA registered rates of broad-spectrum seed treatment fungicides.
<b>Acceleron DX-709 Fungicide Seed Treatment for Corn</b> Monsanto	trifloxystrobin	22.00%	0.32 to 0.64 fl oz per 100 lb of seed	Provides seed and seedling protection against seedborne fungi, <i>Alternaria</i> spp., <i>Aspergillus</i> spp., <i>Cladosporium</i> spp. and <i>Penicillium</i> spp. causing seed decay and soilborne pathogens, <i>Rhizoctonia solani</i> and <i>Fusarium</i> spp.
<b>Allegiance Dry</b> Chemtura AgroSolutions	metalaxyl	12.50%	1.5 to 2.0 oz per 100 lb of seed	For Pythium damping-off control. For planters with electronic eye monitors, periodically clean them with brushes provided by the planter manufacturer, according to their directions. Treat only those seeds needed for immediate use, minimizing the interval between treatment and planting. Do not carry over excess treated seed to next season. Do not use this product on seed that has been commercially treated with metalaxyl (Allegiance) fungicide. Hopper box seed treatment.
<b>Allegiance-FL</b> Bayer CropScience	metalaxyl	28.35%	0.75 fl oz per 100 lb of seed	For Pythium damping-off control. Allegiance-FL is a systemic fungicide seed dressing specifically for control of downy mildews, <i>Pythium</i> and <i>Phytophthora</i> spp. For control of other soilborne diseases, combination with Bayer CropScience Captan and Vitavax registered formulations are compatible. Do not use with other seed treatment products unless previous experience ensures compatibility. Allegiance-FL may be applied as a water-based slurry with other registered seed treatment insecticides and fungicides through standard slurry or mist-type commercial seed treatment equipment.
<b>Apron XL</b> Syngenta	mefenoxam	33.30%	0.0425 or 0.085 fl oz per 100 lb of seed	For Pythium seed rot and damping-off protection in field corn. If expected Pythium pressure is low to moderate use 0.0425 fl oz per 100 lb of seed. If expected Pythium pressure is high use 0.085 fl oz per 100 lb of seed. For a greater spectrum of seedling disease protection combine Apron XL with Maxim XL, Dynasty, or Maxim FS. Apron XL may be applied as a water-based slurry with other registered seed treatment insecticides and fungicides through standard slurry or mist-type commercial seed treatment equipment.

Seed treatment fungicides and nematode protection products labeled for use on field corn - *continued*

Trade name Company	Common chemical name	% active ingredient	Rate	Additional label information
<b>Avicta Complete Corn</b> Syngenta				Avicta Complete Corn is a promotional combination of separately registered products containing Avicta Duo Corn nematocide/insecticide and one or more of the following Cruiser insecticide, Apron XL, Maxim XL and/or Dynasty fungicide(s).  Avicta Duo Corn is a restricted use pesticide. For use by certified applicators only. Growers planting Avicta Duo Corn treated seed are not required to be certified applicators.
<b>Belmont 2.7 FS</b> Chemtura AgroSolutions	metalaxyl	28.98%	0.75 fl oz per 100 lb of seed	For Pythium damping-off control.  For the control of other soilborne diseases, use in combination with other seed treatment fungicides. Vitavax and RANCONA products are compatible with Belmont 2.7 FS. Do not use in combination with other seed treatment products unless compatibility and safety to crop has been verified.  Belmont 2.7 FS may be applied on its own, as a water-based slurry or in combination with other registered seed treatment insecticides and fungicides through standard slurry or mist-type commercial seed treatment equipment.
<b>Concur</b> Winfield Solutions, LLC	imidacloprid metalaxyl	25.00% 1.00%	1.5 oz per 42 lb of seed	For the protection of seeds and seedlings of field corn against damping-off, seed decay caused by <i>Pythium</i> .  Concur may be used on seed previously treated with a full dosage of protective fungicide to give added protection against Pythium damping-off or seed decay.  Treat only those seeds needed for immediate use, minimizing the interval between treatment and planting. Do not store excess treated seed beyond planting time.  See label for rotational crop restrictions.  Hopper box seed treatment.
<b>Dithane F-45 Rainshield</b> Dow AgroSciences	mancozeb	37.00%	4.3 to 8.6 fl oz per 100 lb of seed	For control of damping-off, seed rots and seedling blights.  May be applied to dry seed with conventional slurry or mist seed treating equipment or as a planter box application.
<b>Dithane M45</b> Dow AgroSciences	mancozeb	80.00%	2.7 to 5.4 oz per 100 lb of seed	
<b>Dyna-Shield Metalaxyl</b> Loveland Products Inc.	metalaxyl	28.35%	0.75 fl oz per 100 lb of seed	For Pythium damping-off control apply at the rate of 0.75 fl oz per 100 lb of seed.  Reduced rate: to aid in the control of seed decay and damping-off caused by <i>Pythium</i> apply Dyna-Shield Metalaxyl Fungicide as a commercial seed treatment at the rate of 0.10 to 0.375 fl oz per 100 lb of seed. Apply only in combination with EPA registered rates of Loveland Products Inc. broad-spectrum seed treatment fungicides.  May be applied as a water-based slurry with other registered seed treatment insecticides and fungicides through standard slurry or mist-type commercial seed treatment equipment.
<b>Dyna-Shield Metalaxyl 318 FS</b> Loveland Products Inc.	metalaxyl	30.14%	0.75 fl oz per 100 lb of seed	For Pythium damping-off control apply at the rate of 0.75 fl oz per 100 lb of seed.  Reduced rate: to aid in the control of seed decay and damping-off caused by <i>Pythium</i> apply Dyna-Shield Metalaxyl 318 FS Fungicide as a commercial seed treatment at the rate of 0.10 to 0.375 fl oz per 100 lb of seed. Apply only in combination with EPA registered rates of Loveland Products Inc. broad-spectrum seed treatment fungicides.  May be applied as a water-based slurry with other registered seed treatment insecticides and fungicides through standard slurry or mist-type commercial seed treatment equipment.
<b>Dynasty</b> Syngenta	azoxystrobin	9.60%	0.153 fl oz per 100 lb of seed	Target diseases: seedborne and soilborne fungi causing decay, damping-off and seedling blight as well as seedling damping-off ( <i>Rhizoctonia</i> spp., <i>Pythium</i> spp., <i>Fusarium</i> spp., and <i>Penicillium</i> spp.). For optimum disease control, use Dynasty in combination with labeled rates of Maxim 4FS, Maxim XL and Apron XL products.  Apply as a water-based slurry using seed treatment application equipment that will provide uniform coverage on the seed surface.
<b>EverGol Energy</b> Bayer CropScience	prothioconazole penflufen metalaxyl	7.18% 3.59% 5.74%	1.0 fl oz per 100 lb of seed	For use against seed rot and damping-off caused by <i>Rhizoctonia</i> , <i>Fusarium</i> and <i>Pythium</i> and seed decay.  Apply using commercial slurry or mist-type seed treatment equipment.

Seed treatment fungicides and nematode protection products labeled for use on field corn - *continued*

Trade name Company	Common chemical name	% active ingredient	Rate	Additional label information
<b>Kernel Guard Supreme</b> Chemtura AgroSolutions	permethrin carboxin	10.42% 14.00%	1.5 oz canister per 42 lb of seed	Kernel Guard Supreme may be used on seed previously treated with a full dosage of protective fungicide, to give added protection against seedling blight, damping-off or seed decay.  Treat only those seed needed for immediate use, minimizing the interval between treatment and planting.  Kernel Guard Supreme is a planter box or hopper box seed treatment for on-farm use only on field corn immediately before planting.
<b>KickStart VP</b> Helena Chemical Company	carboxin permethrin	14.00% 10.42%	1.5 oz per 42 lb of seed	KickStart VP may be used on seed previously treated with a full dosage of protective fungicide to give added protection against seedling blight, damping-off or seed decay.  Apply KickStart VP to seed at planting time with the canister applicator tube system. For best results, fill planter box with seed, add KickStart VP through applicator tube and mix so all seeds are covered. Do not mix with bare hands.  Use only at the recommended rate. Lower amounts may not give desired control. Excessive amounts may cause seed injury.
<b>Kodiak HB</b> Chemtura AgroSolutions (formerly Trace Seed Protection Products)	<i>Bacillus subtilis</i> GB03	0.30%	4.0 oz per 100 lb of seed	For suppression of root diseases caused by <i>Fusarium</i> and <i>Pythium</i> .  Contains bacteria that colonize the developing root system, suppressing disease organisms such as <i>Fusarium</i> and <i>Pythium</i> that attack root systems. When used with a chemical seed treatment, the combination of chemicals and Kodiak provides protection to the root for a much longer time than with chemicals alone.  Kodiak HB is a hopper box seed treatment.
<b>Latitude</b> Chemtura AgroSolutions (formerly Trace Seed Protection Products)	imidacloprid carboxin metalaxyl	25.00% 14.00% 1.00%	1.5 oz per 42 lb of seed	For protection of seeds and seedlings against damping-off, seed decay and seedling blight caused by <i>Pythium</i> and <i>Rhizoctonia</i> .  Latitude may be used on seed previously treated with a full dosage of protective fungicide to give added protection against seedling blight, <i>Rhizoctonia</i> and <i>Pythium</i> damping-off or seed decay.  See label for rotational crop restrictions.  Hopper box seed treatment.
<b>Maxim Quattro</b> Syngenta	fludioxonil mefenoxam azoxystrobin thiabendazole	3.32% 2.65% 1.33% 26.50%	0.39 to 0.53 fl oz per 80,000 kernel count	Target diseases: seedborne and soilborne fungi causing decay, damping-off and seedling blight; seedborne head smut ( <i>Sporisorium reilianum</i> ); and seedling damping-off ( <i>Rhizoctonia</i> spp., <i>Penicillium</i> spp., <i>Pythium</i> spp. and <i>Fusarium</i> spp.).  Apply Maxim Quattro as a water-based slurry using seed treatment application equipment that will provide uniform coverage on the seed surface.  For commercial use only. Do not use in hopper box, planter box, slurry box or other farmer-applied applications.
<b>Maxim 4FS</b> Syngenta	fludioxonil	40.30%	0.08 to 0.16 fl oz per 100 lb of seed	For protection against seedborne and soilborne fungi that cause seed decay, damping-off and seedling blight as well as seedborne head smut ( <i>Sphacelotheca reiliana</i> ). Maxim 4FS is active against <i>Fusarium</i> , <i>Rhizoctonia</i> , <i>Helminthosporium</i> and weakly pathogenic fungi such as <i>Aspergillus</i> and <i>Penicillium</i> . When rate ranges are given, use higher rate when disease pressure is expected to be severe.  For <i>Pythium</i> spp. control use Maxim 4FS in combination with labeled rates of Apron XL and Dynasty.
<b>MetaStar ST</b> Chemtura AgroSolutions (formerly Trace Seed Protection Products)	metalaxyl	29.99%	0.75 fl oz per 100 lb of seed	For <i>Pythium</i> damping-off control.  MetaStar ST is a systemic fungicide seed dressing specifically for control of systemic downy mildews, <i>Pythium</i> and <i>Phytophthora</i> spp. For control of other soilborne diseases, combination of Captan and Vitavax registered formulations are compatible. Do not use with other seed treatment products unless previous experience assures compatibility.  MetaStar ST may be applied as a water-based slurry with other registered seed treatment insecticides and fungicides through standard slurry or mist-type commercial seed treatment equipment.
<b>Penncozeb 4FL</b> United Phosphorus, Inc.	mancozeb	37.00%	4.3 to 8.6 fl oz per 100 lb of seed	For control of damping-off, seed rots and seedling blights.  May be applied to dry seed with conventional slurry or mist seed treating equipment or as a planter box application.
<b>Penncozeb 75DF</b> United Phosphorus, Inc.	mancozeb	75.00%	2.9 to 5.8 oz per 100 lb of seed	
<b>Penncozeb 80WP</b> United Phosphorus, Inc.	mancozeb	80.00%	2.7 to 5.4 oz per 100 lb of seed	

Seed treatment fungicides and nematode protection products labeled for use on field corn - *continued*

Trade name Company	Common chemical name	% active ingredient	Rate	Additional label information
<b>Poncho/VOTiVO</b> Bayer CropScience	clothianidin <i>Bacillus firmus</i> I-1582	40.30% 8.10%	2.7 fl oz per 80,000 seeds	<p>Poncho/VOTiVO is a combination insecticide and biological seed treatment that, when applied to seed, protects the seed and seedling against certain early-season insects and provides early-season protection from listed plant pathogenic nematodes that attack the root system. As a result of the dual protection, there is an improvement in plant vigor, which often results in more uniform plants and greater yields. In areas of high nematode infestation additional control measures may be warranted.</p> <p>For corn the nematode pests include dagger, lance, needle, pin, ring, root knot, root lesion, spiral, sting, stubby root and stunt nematodes.</p> <p>See label for plant-back restrictions.</p> <p>For use only in commercial seed treatment equipment. Not for use in hopper box, planter box, slurry box or other on-farm seed treatment applications.</p>
<b>Prevail</b> Chemtura AgroSolutions	carboxin PCNB metalaxyl	15.00% 15.00% 3.12%	1.5 to 3.0 oz per bushel of seed	<p>For protection against <i>Pythium</i> and <i>Rhizoctonia</i> seedling disease complex. Do not graze or feed livestock on treated areas for six weeks after planting. Prevail may be applied at planting time, using an on-farm mechanical treater to maximize seed coverage.</p>
<b>Raxil 2.6F</b> Bayer CropScience	tebuconazole	28.30%	0.075 to 0.10 fl oz per 100 lb of seed for soilborne and seedborne <i>Fusarium</i> 0.37 to 0.74 fl oz per 100 lb of seed for soilborne and seedborne head smut ( <i>Sphacelotheca</i> <i>reiliana</i> )	<p>Apply as a seed treatment using standard slurry or mist-type seed treatment equipment. Uniform application of seed is necessary to ensure seed safety and best disease protection. Seed should be sound and well-cured before treatment.</p> <p>Product should be diluted with sufficient water to ensure complete seed coverage. Add dye to the resulting slurry.</p> <p>The length of control will vary depending on the rate used.</p> <p>For use only by commercial seed treaters.</p>
<b>Rizolex</b> Valent	tolclofos-methyl	42.00%	0.3 fl oz per 100 lb of seed	<p>Provides protection against <i>Rhizoctonia solani</i> and seed-borne and soil-borne fungal pathogens that cause seed decay, damping-off and seedling blight.</p> <p>Use a <i>Pythium</i>-active fungicide combined with Rizolex Fungicide for protection against <i>Pythium</i> spp. inciting seed rot and seedling dieback. Must be used in accordance with use instructions on the label utilizing mechanical, slurry or mist type seed treating equipment.</p> <p>This product is for both commercial and on-farm application. Do not apply this product in hopper-box or planter-box at planting. Always mix product thoroughly before use.</p>
<b>Sativa 309 FS</b> Nufarm Americas Inc.	tebuconazole	28.30%	0.075 to 0.1 fl oz per 100 lb of seed	<p>For control or suppression of certain designated seed and soilborne diseases of corn including soilborne and seedborne <i>Fusarium</i> and soilborne and seedborne head smut. For head smut use 0.37 to 0.74 fl oz per 100 lb of seed.</p> <p>For use by commercial seed treaters only.</p> <p>Apply this product as a water-based slurry through standard slurry or mist-type commercial seed treatment equipment. Not for use on agricultural establishments in hopper-box, planter-box, slurry-box or other seed treatment applications at or immediately before planting.</p> <p>Uniform application to seed is necessary to ensure seed safety and best disease protection.</p> <p>The length of control will vary depending on the rate used.</p>
<b>Sebring 318 FS</b> Nufarm Americas Inc.	metalaxyl	30.14%	0.75 fl oz per 100 lb of seed	<p>For <i>Pythium</i> damping-off control. For control of other soilborne diseases, combination of captan, and Vitavax registered products are compatible. Do not use with other seed treatment products unless previous experience assures compatibility.</p> <p>May be applied as a water-based slurry with other registered seed treatment insecticides and fungicides through standard slurry or mist-type commercial seed treatment equipment.</p>

Seed treatment fungicides and nematode protection products labeled for use on field corn - *continued*

Trade name Company	Common chemical name	% active ingredient	Rate	Additional label information
<b>Sebring 480 FS</b> Nufarm Americas Inc.	metalaxyl	44.08%	0.50 fl oz per 100 lb of seed	For Pythium damping-off control. For control of other soilborne diseases, combination of captan, thiram and carboxin registered products are compatible. Do not use with other seed treatment products unless previous experience assures compatibility.  Apply at the specified rate and premix with the seed directly in the planter box at planting. May be applied as a water-based slurry with other registered seed treatment insecticides and fungicides through standard slurry or mist-type commercial seed treatment equipment.
<b>Signet 480 FS</b> Nufarm Americas Inc.	thiram	44.00%	1.50 fl oz per bushel of seed	Used according to directions, this product will usually increase stands and yields by reducing losses from seed decay, damping-off and seedling blights caused by many seedborne and soilborne organisms.  This product should be applied with water as a suspension in the slurry-type treater specifically designed and approved for this purpose.  For sale to and use by professional applicators only.
<b>Stamina</b> BASF	pyraclostrobin	18.40%	0.4 to 0.8 fl oz per 100 lb of seed	Target diseases: seed and seedling disease (damping-off) caused by <i>Rhizoctonia solani</i> , seedborne fungi causing seed decay, seedling damping-off as well as suppression of seed and seedling diseases caused by <i>Pythium</i> spp. and <i>Fusarium</i> spp.  Stamina can be used in both commercial seed treatment facilities and on-farm systems. Apply Stamina as a water-based mixture using standard slurry or mist-type seed treatment application equipment.
<b>System<sup>3</sup></b> Helena Chemical Company	PCNB metalaxyl <i>Bacillus subtilis</i>	16.67% 4.25% 0.10%	2.0 to 3.0 oz per bushel of seed	For Pythium and Rhizoctonia seedling disease complex.  Use the higher rate of application in fields with a history of severe disease pressure.  Apply at the specified rate and premix with the seed directly in the planter box at planting.  May be applied at planting time using commercial seed treating equipment to maximize seed coverage.
<b>Trilex</b> Bayer CropScience	trifloxystrobin	22.00%	0.32 to 0.64 fl oz per 100 lb of seed	Provides seed and seedling protection against seedborne fungi causing seed decay and the soilborne pathogen, <i>Rhizoctonia solani</i> and <i>Fusarium</i> spp. The length of control will vary depending on the rate used.  Use in combination with broad spectrum product and/or a product effective against <i>Pythium</i> spp. to improve overall disease control.  Apply as a seed treatment using standard slurry or mist-type seed treatment equipment.
<b>Vibrance</b> Syngenta	sedaxane	43.70%	2.5 to 5.0 grams active ingredient per 100 kg of seed or 20.0 to 40.0 grams active ingredient per 100 kg of seed	Use 2.5 to 5.0 rate for seed decay, seedling blight and damping-off caused by <i>Rhizoctonia solani</i> . Use 20.0 to 40.0 rate for head smut.  Apply as a water-based slurry utilizing standard slurry seed treatment equipment which gives uniform seed coverage.  Vibrance does not control diseases caused by <i>Pythium</i> species. If these diseases are expected to be a problem, apply Vibrance with Apron XL LS or seed treatment products that contain mefenoxam as active ingredients.
<b>VITAFLO-280</b> Chemtura AgroSolutions	carboxin thiram	15.59% 13.25%	4.5 fl oz per 100 lb of seed  8.5 to 11.0 fl oz per 100 lb of seed for protection against head smut ( <i>Sphacelotheca reiliana</i> )	Combination of a systemic fungicide (carboxin) and a contact fungicide (thiram) providing plant protection against seedborne and soilborne seedling diseases including damping-off and seed decay.  8.5 to 11.0 fl oz per 100 lb of seed controls only seedborne head smut.  Do not graze or feed livestock on treated areas for six weeks after planting.  Formulated for both on-farm and commercial use. DO NOT apply VITAFLO-280 as a planter box or hopper box treatment. VITAFLO-280 may be applied with mechanical, slurry, or mist-type seed treating equipment, provided that the equipment can be calibrated to accurately and uniformly apply the product to seed.

Seed treatment fungicides and nematode protection products labeled for use on field corn - *continued*

Trade name Company	Common chemical name	% active ingredient	Rate	Additional label information
<b>Vitavax-34</b> Chemtura AgroSolutions	carboxin	34.00%	2.0 to 4.0 fl oz per 100 lb of seed	2.0 to 4.0 fl oz per 100 lb of seed for <i>Rhizoctonia solani</i> seed rots, damping off and seedling blights. The higher rate will provide increased protection on highly infected seeds. The 4.0 fl oz rate provides systemic control of seedborne head smut.  May be used for application to seed that has been or will be treated with protectant fungicides such as captan or thiram to obtain a wider spectrum of control. Follow the more restrictive labeling of any tank mix partner.  May be applied with mechanical, slurry, or mist-type seed treating equipment provided that the equipment can be calibrated to accurately and uniformly apply the product to the seed.  Do not graze or feed livestock on treated areas for 6 weeks after planting.

## Corn foliage diseases

A number of fungi and a few bacteria can cause foliage diseases of corn. These various foliar pathogens cause leaf spots, leaf blights and similar symptoms on corn. Symptoms may range from the small, oval to elliptical water-soaked lesions of *Holcus* leaf spot to the long, elliptical, grayish-green or tan lesions of northern corn leaf blight. Lesion size, shape and color may vary among hybrids and with environmental conditions.

The fungi that cause most of these corn foliage diseases survive in infested corn residues left on the soil surface. The following growing season, spores are produced during moist periods and are carried by wind currents to susceptible corn leaves where infection may begin. Disease problems tend to be more severe when corn is planted in fields with infested corn residue left on the soil surface. Eventually spores that are produced in initial lesions on leaves are wind blown to other leaves or plants, causing secondary infection.

Common rust and southern rust of corn are two exceptions to this simplified explanation of disease development. The rust fungi do not survive in infested residues left in a field and, in fact, do not survive the winter months in Missouri. Rather, the rust fungi are reintroduced into this area each season when spores are carried on air currents from the southern United States.

Most of these foliage diseases of corn are favored by warm temperatures and wet or humid weather or heavy dews. They tend to start on the lower leaves and, if weather conditions are favorable, move up through the plant.

Generally, if foliage diseases do not become established until six weeks after tasseling, yield losses are minimal. If dis-

ease is established before tasseling or becomes severe within two to three weeks after tasseling and pollination, significant yield losses may occur.

### Management options for corn foliage diseases

- Plant disease-resistant corn hybrids.
- Rotate crops with at least one year between corn crops.
- Manage corn residues. In reduced tillage systems, hybrid selection and crop rotation are especially important.
- Apply foliar fungicides if warranted. Foliar fungicides tend to give the best economic return on specialty corns such as seed corn, white corn or popcorn rather than on field corn. See accompanying table for foliar fungicides labeled for use on field corn.

## Foliar fungicides for corn

In addition to crop rotation, residue management and resistant hybrids, foliar fungicides can be used to control corn foliage diseases. Products labeled for use on field corn are listed in the following table. Fungicide labels do differentiate among field corn, popcorn, seed corn, sweet corn and processing sweet corn. Other products not listed in this table may be labeled for use on other types of corn.

The following table was prepared using current company product labels and manufacturers' Web sites. However, label registrations can change at any time. Before using any agricultural pesticide, read and follow directions accompanying that product. Product names have been used for clarity. Reference to specific trade names does not imply endorsement by the University of Missouri; discrimination is not intended against similar products not listed.

## Foliar fungicides labeled for use on field corn

Trade name Company	Common chemical name	% active ingredient	Rate	Additional label information
<b>Approach</b> DuPont	picoxystrobin	22.50%	3.0 to 4.0 fl oz per acre or 6.0 to 12.0 fl oz per acre	<p>For control or suppression of anthracnose leaf blight and stalk rot, eyespot, gray leaf spot, leaf spots, northern corn leaf blight, northern corn leaf spot, Physoderma brown spot, common rust, southern rust, southern corn leaf blight and yellow leaf blight.</p> <p>Make a single 3.0-4.0 fl oz application between V4 to V7 for early season disease suppression.</p> <p>Make additional 6.0-12.0 fl oz applications at 7 to 14-day intervals. For best results apply between VT to R3 and make applications prior to disease development. Use the higher rate and shorter interval when disease pressure is high.</p> <p>Make no more than 2 sequential applications of Approach before switching to a fungicide with a different mode of action.</p> <p>Do not mix Approach with an adjuvant or crop oil when spraying corn between the V8 and VT stages of growth.</p> <p>The minimum pre-harvest interval between the last application and harvest for grain or ear is 7-days and for forage is 0-days.</p> <p>Do not exceed 36.0 fl oz per acre per crop.</p>
<b>Approach Prima</b> DuPont	picoxystrobin cyproconazole	17.94% 7.17%	3.4 fl oz per acre or 3.4 to 6.8 fl oz per acre	<p>For control or suppression of anthracnose leaf blight and stalk rot, eyespot, gray leaf spot, leaf spots, northern corn leaf blight, northern corn leaf spot, Physoderma brown spot, common rust, southern rust, southern corn leaf blight and yellow leaf blight.</p> <p>For 3.4 fl oz rate apply early season for preventive disease control/suppression. Additional treatments should be made depending on disease pressure and environmental conditions.</p> <p>For 3.4 to 6.8 fl oz rate begin applications prior to disease development. Use the higher rate and shorter interval when disease pressure is high.</p> <p>Apply no more than two sequential applications of a picoxystrobin containing product before switching to a fungicide with a different mode of action. The minimum pre-treatment interval in corn for Approach Prima is 7 days.</p> <p>Do not tank mix Approach Prima with an adjuvant or crop oil when spraying corn between the V8 to VT stages of growth.</p> <p>Minimum time (PHI) between the last application and harvest for grain or ear is 30-days and for silage is 21-days.</p> <p>Do not exceed 6.8 fl oz per acre per crop.</p>
<b>AVARIS</b> Helena Chemical Company	azoxystrobin propiconazole	7.00% 11.70%	7.0 to 14.0 fl oz per acre	<p>Apply 7.0 to 14.0 fl oz per acre for northern corn leaf blight, northern corn leaf spot and southern corn leaf blight.</p> <p>Apply 10.5 to 14.0 fl oz per acre for anthracnose leaf blight, rusts (<i>Puccinia</i> spp.), gray leaf spot and eyespot.</p> <p>Apply AVARIS when disease first appears. If conditions favorable for disease persist, continue to apply on a 14-day schedule. Under heavy disease pressure or if conditions are favorable for diseases, apply the highest labeled rate.</p> <p>Apply no more than 2 applications of AVARIS or any other Group 11 fungicide per year. Do not apply more than 56.0 fl oz per acre per season of AVARIS. Do not apply more than 28.0 fl oz per acre per season for field corn harvested for forage. See label for additional information on resistance management.</p> <p>AVARIS is most effective when applied and allowed to dry before a rainfall.</p> <p>For best results, sufficient coverage is important. Use a higher water volume for aerial application (greater than 2 GPA) if equipment and/or conditions would not provide good coverage.</p> <p>AVARIS may be applied by ground, air or chemigation.</p> <p>AVARIS is extremely toxic to certain apple varieties. Extreme care must be used to prevent injury to apple trees. See label for additional information.</p> <p>Do not apply within 30 days of harvest for forage, grain or stover.</p>



Foliar fungicides labeled for use on field corn - *continued*

Trade name Company	Common chemical name	% active ingredient	Rate	Additional label information
<b>Bumper 41.8 EC</b> Makhteshim Agan of North America, Inc.	propiconazole	41.80%	2.0 to 4.0 fl oz per acre	<p>For control of <i>Helminthosporium</i> leaf blights (<i>Helminthosporium maydis</i>, <i>H. turcicum</i>, and <i>H. carbonum</i>), apply 2.0 to 4.0 fl oz per acre. Apply when disease first appears and continue on a 7- to 14-day schedule. Use the low rate when disease pressure is low. Under heavy disease pressure or when conditions favor disease development, apply the high rate. Apply Bumper 41.8 EC at recommended rates by ground, air or chemigation.</p> <p>For control of rusts (<i>Puccinia</i> spp.), gray leaf spot and eyespot, apply 4.0 fl oz per acre. Apply Bumper 41.8 EC at recommended rates by ground, air or chemigation, when rust pustules first appear and continue on a 7- to 14-day schedule when conditions favor disease development. For best disease control, early applications at initial disease onset perform better.</p> <p>Do not apply more than 16.0 fl oz of Bumper 41.8 EC per acre per season. Do not apply more than 8.0 fl oz of Bumper 41.8 EC per acre per season on field corn harvested for forage.</p> <p>Do not apply within 30 days of harvest for forage, grain and stover.</p>
<b>Bumper ES</b> Makhteshim Agan of North America, Inc.	propiconazole	40.85%	2.0 to 4.0 fl oz per acre or 4.0 fl oz per acre	<p>2.0 to 4.0 fl oz rate for <i>Helminthosporium</i> leaf blights. Apply when disease first appears and continue on a 7 to 14 day schedule. Use the low rate when disease pressure is low. Under heavy pressure or when conditions favor disease development, apply the high rate.</p> <p>4.0 fl oz rate for rusts, gray leaf spot and eyespot. Apply when rust pustules first appear and continue on a 7- to 14-day schedule when conditions favor disease development. For best disease control, early applications at initial disease onset perform best.</p> <p>May be applied by ground, air or chemigation.</p> <p>Do not apply more than 16.0 fl oz of Bumper ES per acre per season.</p> <p>Do not apply within 30 days of harvest for forage, grain or stover.</p> <p>Do not apply more than 8.0 fl oz of Bumper ES per acre per season for field corn harvested for forage.</p>
<b>Custodia</b> Makhteshim Agan of North America, Inc.	azoxystrobin tebuconazole	11.00% 18.35%	9.0 to 12.9 fl oz per acre	<p>Target diseases: northern corn leaf blight, northern corn leaf spot, southern corn leaf blight, anthracnose leaf blight, eyespot, gray leaf spot, <i>Physoderma</i> brown spot, and rusts.</p> <p>For gray leaf spot, apply at the onset of disease. A second application may be required 14-days later if disease pressure persists.</p> <p>For all other diseases apply in a protective spray schedule or when weather conditions are favorable for disease development. Repeat applications at 7- to 14-day intervals or as necessary to maintain control. Shorten the interval under heavy disease pressure.</p> <p>Do not use adjuvants or crop oil after the V8 stage and prior to the VT stage unless specifically recommended on MANA labeling. See label for further use directions and restrictions.</p> <p>Do not apply more than 51.7 fl oz per acre per season.</p> <p>Do not apply within 21 days of harvest for forage and 36 days of harvest for grain or fodder.</p> <p>Restricted-entry interval is 12 hours.</p>
<b>Dithane DF Rainshield</b> Dow AgroSciences	mancozeb	75.00%	1.5 lb per acre	<p>For control of common corn rust and <i>Helminthosporium</i> leaf blight on field corn and hybrid seed corn.</p> <p>Start applications when disease symptoms first appear and, depending on severity of infection, continue on a 4- to 14 day schedule. The addition of Latron CS-7 will improve performance.</p>
<b>Dithane F-45 Rainshield</b> Dow AgroSciences	mancozeb	37.00%	1.2 qt per acre	<p>Amount of product that can be applied over course of season will vary with formulation — see label.</p>
<b>Dithane M45</b> Dow AgroSciences	mancozeb	80.00%	1.5 lb per acre	<p>Do not apply within 40 days of harvest.</p>

**Foliar fungicides labeled for use on field corn - *continued***

Trade name Company	Common chemical name	% active ingredient	Rate	Additional label information
<b>Domark 230 ME</b> Valent	tetraconazole	20.50%	4.0 to 6.0 fl oz per acre	<p>For use against gray leaf spot, common rust, southern rust, anthracnose leaf blight, eye spot, northern corn leaf blight, northern corn leaf spot and southern corn leaf blight.</p> <p>Apply prior to disease onset when conditions favor disease development. Curative applications are most effective when disease incidence does not exceed 5% of the plants at the time of application.</p> <p>Apply as a foliar spray or via chemigation in sufficient water to obtain thorough coverage of plants.</p> <p>Do not make more than one application per year. Do not apply more than 6.0 fl oz of Domark per acre per year.</p> <p>Do not apply Domark after corn growth stage R3 (milk).</p> <p>Do not use adjuvants in sprays made between V8 (8 leaf collar) and VT (lowest branch of tassel visible but silks have not emerged) growth stage. See label for further information.</p>
<b>EVITO 480 SC</b> Arysta LifeScience North America, LLC	fluoxastrobin	40.30%	2.0 to 5.7 fl oz per acre	<p>Disease control of common rust, southern rust, anthracnose leaf blight, gray leaf spot, northern corn leaf blight, northern corn leaf spot, southern corn leaf blight and eyespot.</p> <p>Apply a maximum of two applications preventatively, with the final application no later than the R4 early dough stage.</p> <p>Do not apply more than 11.4 fl oz per acre per year. There is a maximum number of two applications per season, and a minimum interval of 7 days between applications.</p> <p>EVITO 480 SC may be applied by ground, air or chemigation.</p> <p>Do not apply after the R4 stage (early dough).</p> <p>Do not apply within 30 days of harvest.</p>
<b>EVITO T Fungicide</b> Arysta LifeScience North America, LLC	fluoxastrobin tebuconazole	18.00% 25.00%	4.0 to 9.0 fl oz per acre	<p>Disease control of common rust, southern rust, anthracnose leaf blight, gray leaf spot, northern corn leaf blight, northern corn leaf spot, southern corn leaf blight and eyespot.</p> <p>Apply a maximum of two applications preventatively, with the final application no later than the R4 early dough stage.</p> <p>Minimum retreatment interval is 7 days.</p> <p>Do not apply more than 18.0 fl oz per acre per year. There is a maximum number of two applications per season.</p> <p>EVITO T may be applied by ground, air or chemigation.</p> <p>Do not apply after the R4 stage (early dough).</p> <p>Restricted-entry (REI) is 12 hours.</p> <p>EVITO T Fungicide may be applied up to 36 days before harvest of grain or fodder.</p>
<b>Fortix Fungicide</b> Cheminova	fluoxastrobin flutriafol	14.84% 19.30%	4.0 to 6.0 fl oz per acre	<p>For control of common rust, southern rust, anthracnose leaf blight, gray leaf spot, northern corn leaf blight, northern corn leaf spot, southern corn leaf blight and eyespot.</p> <p>Apply a maximum of two applications per season no later than growth stage R4 (early dough stage).</p> <p>For optimum results begin applications when disease first appears and continue as needed on a 7-10 day interval. Use high end of the use rate when disease pressure is high and conditions are favorable for disease development.</p> <p>Do not apply more than 12.0 fl oz per acre per crop season.</p> <p>Do not make more than 2 applications per season.</p> <p>Allow at least 7 days between applications.</p> <p>May be applied by ground or air. Do not apply through chemigation.</p> <p>Do not apply within 80 days of harvest for field or hybrid seed corn forage, stover and grain.</p> <p>Restricted entry interval: for detasseling hybrid seed corn and field corn is 5 days. The REI for all other activities is 12 hours.</p> <p>Do not use an adjuvant after the V8 stage of corn and before the VT stage of corn. An adjuvant may be used at any other growth stage.</p>

Foliar fungicides labeled for use on field corn - *continued*

Trade name Company	Common chemical name	% active ingredient	Rate	Additional label information
<b>Headline</b> BASF	pyraclostrobin	23.60%	6.0 to 9.0 fl oz per acre  or  9.0 to 12.0 fl oz per acre	<p>The 6.0 to 9.0 fl oz per acre rate targets common rust, southern rust and gray leaf spot.</p> <p>The 9.0 to 12.0 fl oz per acre rate targets anthracnose, northern corn leaf blight, northern corn leaf spot, Physoderma brown spot, southern corn leaf blight and yellow leaf blight.</p> <p>For optimal disease control, begin applications of Headline before disease development and continue on a 7- to 14- day interval if conditions are conducive for disease development. Use the higher rate and shorter interval when disease pressure is high. The optimal application timing for Headline in corn is VT through R2 stages (full tassel through blister) and/or the onset of disease.</p> <p>An adjuvant may be used with Headline only after corn reaches the VT stage or later. Do <b>not</b> use adjuvants before the VT stage. Before the VT stage, do <b>not</b> combine other products or additives with Headline. At the VT stage or later, Headline may be mixed with other products. Consult the label for products tank mixed with Headline.</p> <p>See label for information on resistance management.</p> <p>Minimum time from last application to harvest (PHI) is seven days.</p>
<b>Headline AMP</b> BASF	pyraclostrobin metconazole	13.64% 5.14%	10.0 to 14.4 fl oz per acre	<p>Target diseases: anthracnose, eyespot, gray leaf spot, northern corn leaf blight, northern corn leaf spot, Physoderma brown spot, rust (<i>Puccinia</i> spp.) southern corn leaf blight and yellow leaf blight.</p> <p>For optimal disease control, begin applications of Headline AMP before disease development and continue on a 7- to 14-day schedule if conditions for disease development persist. Use the higher rate and shorter interval when disease pressure is high.</p> <p>To limit the potential for development of resistance, do not make more than two sequential applications of Headline AMP before alternating to another fungicide with a different mode of action. See label for additional information on resistance management.</p> <p>Do not use adjuvants after the V8 stage and before the VT stage of corn growth. (The VT stage is defined as when the last branch of the tassel is completely visible outside of the whorl). A compatibility agent, another fungicide or an insecticide may be included in the tank mix, if needed and labeled for use in corn. See label for additional application instructions and restrictions.</p> <p>Do not enter or allow worker entry into treated areas during the restricted-entry interval (REI) of 12 hours.</p> <p>Minimum time from application to harvest (PHI) for field corn grain and field corn stover is 20 days.</p>
<b>Manzate Pro-Stick</b> United Phosphorus, Inc.	mancozeb	75.00%	1.5 lb per acre	<p>For control of common rust, Helminthosporium leaf blight and gray leaf spot on field corn and field corn for hybrid seed production.</p> <p>Use sufficient water for thorough coverage. Start applications when disease first appears and repeat at 4- to 7-day intervals.</p>
<b>Manzate Flowable</b> United Phosphorus, Inc.	mancozeb	37.00%	1.2 qt per acre	<p>Do not apply more than 15 lb or 12 qt per acre per season.</p> <p>Do not feed treated forage to livestock.</p> <p>Do not apply within 40 days of harvest.</p>
<b>Monsoon</b> Loveland Products Inc.	tebuconazole	38.70%	4.0 to 6.0 fl oz per acre	<p>Target diseases: rust (<i>Puccinia</i> spp.), northern leaf blight, southern leaf blight, northern leaf spot and gray leaf spot.</p> <p>Apply Monsoon in a protective spray schedule or when weather conditions are favorable for disease development. Repeat applications at 7- to 14-day intervals, or as necessary to maintain control.</p> <p>For optimum disease control, the lowest labeled rate of a spray surfactant should be tank-mixed with Monsoon. Monsoon must have two to four hours of drying time on corn foliage for the active ingredient to move systemically into plant tissue before rain or irrigation occurs. After this period of time Monsoon will be resistant to weathering.</p> <p>A maximum of 24.0 fl oz (1.5 pt) of Monsoon may be applied per acre per season.</p> <p>Restricted-entry interval (REI) for all corn except sweet corn is 12 hours.</p> <p>For field corn: Monsoon may be applied up to 21 days before the harvest of forage and 36 days before the harvest of grain or fodder.</p>

Foliar fungicides labeled for use on field corn - *continued*

Trade name Company	Common chemical name	% active ingredient	Rate	Additional label information
<b>Orius 3.6F</b> Makhteshim Agan of North America, Inc.	tebuconazole	38.70%	4.0 to 6.0 fl oz per acre	<p>Target diseases: rust (<i>Puccinia</i> spp.), northern leaf blight, southern leaf blight, northern leaf spot and gray leaf spot.</p> <p>Apply Orius 3.6F in a protective spray schedule or when weather conditions are favorable for disease development. Repeat applications at 7- to 14-day intervals, or as necessary to maintain control.</p> <p>For optimum disease control, the lowest labeled rate of a spray surfactant should be tank-mixed with Orius 3.6F. Orius 3.6F must have two to four hours of drying time on corn foliage for the active ingredient to move systemically into plant tissue before rain or irrigation occurs. After this period of time Orius 3.6F will be resistant to weathering.</p> <p>A maximum of 24.0 fl oz (1.5 pt) of Orius 3.6F may be applied per acre per season.</p> <p>Restricted-entry interval (REI) for all corn except sweet corn is 12 hours.</p> <p>For field corn: Orius 3.6F may be applied up to 21 days before the harvest of forage and 36 days before the harvest of grain or fodder.</p>
<b>Penncozeb 4FL</b> United Phosphorus, Inc.	mancozeb	37.00%	0.8 to 1.2 fl oz per acre	<p>For control of common rust, gray leaf spot and Helminthosporium leaf blight on field corn and corn grown for seed.</p> <p>Start application at the onset of disease and repeat as needed.</p>
<b>Penncozeb 75DF</b> United Phosphorus, Inc.	mancozeb	75.00%	1.0 to 1.5 lb per acre	<p>Amount of product that can be applied over course of season will vary with formulation — see label.</p>
<b>Penncozeb 80WP</b> United Phosphorus, Inc.	mancozeb	80.00%	1.0 to 1.5 lb per acre	<p>Do not apply within 40 days of harvest.</p>
<b>Priaxor Xemium Brand Fungicide</b> BASF	fluxapyroxad pyraclostrobin	14.33% 28.58%	4.0 to 8.0 fl oz per acre	<p>Target diseases: anthracnose, eyespot, gray leaf spot, northern corn leaf blight, northern corn leaf spot, Physoderma brown spot, common rust, southern rust and yellow leaf blight.</p> <p>For optimal disease control, begin applications prior to disease development and continue on a 7 to 14 day interval if conditions are conducive for disease development.</p> <p>DO NOT use adjuvants or crop oil after the V8 stage and prior to the VT stage unless specifically recommended on BASF labeling.</p> <p>Do not apply more than 6.0 fl oz per acre per season. Do not make more than two consecutive applications of Priaxor before alternating to a labeled fungicide with a different mode of action.</p> <p>Do not harvest for forage within 7 days of last application.</p> <p>Minimum time from application to harvest is 21 days.</p>
<b>Proline 480 SC Fungicide</b> Bayer CropScience	prothioconazole	41.00%	5.7 fl oz per acre	<p>Diseases controlled: anthracnose leaf blight, eye spot, gray leaf spot, northern corn leaf blight, northern corn leaf spot, southern corn leaf blight and rusts.</p> <p>Apply at the first sign of disease. Repeat applications as needed on a 7- to 14-day interval if favorable conditions for disease development persist. Application of Proline 480 SC is not recommended at times when corn is under severe environmental stress conditions.</p> <p>May be applied by either ground, aerial or chemigation application equipment.</p> <p>Do not apply more than 22.8 fl oz per acre per season.</p> <p>For field corn do not apply within 14 days of harvest for grain and fodder. Forage may be harvested the same day of application.</p>
<b>Propiconazole 41.8%</b> AmTide LLC	propiconazole	41.80%	2.0 to 4.0 fl oz per acre	<p>2.0 to 4.0 fl oz per acre for Helminthosporium leaf blights.</p> <p>4.0 fl oz per acre for rusts (<i>Puccinia</i> spp.), eyespot and gray leaf spot.</p> <p>Apply by air, ground or chemigation.</p> <p>Best control of disease is obtained when AmTide Propiconazole 41.8% is applied early in the season (when disease is first detected). Reapply every 7 to 14 days if conditions remain favorable for disease development.</p> <p>Use sufficient volumes of water to ensure a thorough, uniform coverage of foliage.</p> <p>For best results allow residues to dry on foliage before a rainfall event.</p> <p>Preharvest interval (PHI) for field corn is 30 days for corn harvested as forage, grain and stover.</p>

Foliar fungicides labeled for use on field corn - *continued*

Trade name Company	Common chemical name	% active ingredient	Rate	Additional label information
<b>PropiMax EC</b> Dow AgroSciences	propiconazole	41.80%	2.0 to 4.0 fl oz per acre	<p>For control of Helminthosporium leaf blights (<i>Helminthosporium maydis</i>, <i>H. turcicum</i> and <i>H. carbonum</i>), rusts (<i>Puccinia</i> spp.), gray leaf spot (<i>Cercospora zeae maydis</i>), and eyespot (<i>Kabatiella zeae</i>), apply PropiMax EC by ground, aerial or chemigation equipment.</p> <p>Helminthosporium leaf blights: apply PropiMax EC at the rate of 2.0-4.0 fl oz per acre when disease first appears. Continue on a 7- to 14-day schedule. Use the low rate when disease pressure is low. Apply the high rate under heavy disease pressure or if conditions are favorable for disease.</p> <p>Rusts, eyespot and gray leaf spot: apply PropiMax EC at the rate of 4.0 fl oz per acre when disease first appears. If conditions favorable for disease persist, continue to apply on a 7- to 14-day schedule. For best disease control, early applications at initial disease onset perform better.</p> <p>Do not apply more than 16.0 fl oz of PropiMax EC per acre per season. Do not apply more than 8.0 fl oz of PropiMax EC per acre per season on field corn harvested for forage.</p> <p>Do not apply within 30 days of harvest for forage, grain and stover.</p>
<b>Quadris</b> Syngenta	azoxystrobin	22.90%	6.2 to 9.0 fl oz per acre	<p>Target diseases: rust (<i>Puccinia sorghi</i>), anthracnose leaf blight, gray leaf spot, northern corn leaf blight, northern corn leaf spot, southern corn leaf blight and eyespot.</p> <p>See label for information on integrated pest management and resistance management.</p> <p>Application directions: for gray leaf spot apply Quadris at the onset of disease. A second application may be required 14 days later if disease pressure persists.</p> <p>For all other diseases, Quadris applications should begin before disease development and may continue throughout the season every 7 to 14 days following the resistance management guidelines.</p> <p>Applications may be made by ground, air or chemigation. An adjuvant may be added at recommended rates.</p> <p>Quadris is extremely toxic to certain apple varieties. See "General Use Instructions" on the label for additional information on safety precautions to avoid injury to apple trees.</p> <p>Do not apply more than 123.0 fl oz per acre per season.</p> <p>Do not apply within seven days of harvest.</p>
<b>Quilt</b> Syngenta	azoxystrobin propiconazole	7.00% 11.70%	7.0 to 14.0 fl oz per acre for northern corn leaf blight, northern corn leaf spot and southern corn leaf blight  10.5 to 14.0 fl oz per acre for rusts ( <i>Puccinia</i> spp.), gray leaf spot and eyespot	<p>For leaf blights apply Quilt when disease first appears. Continue on a 7- to 14-day schedule. Use the low rate when disease pressure is low. Under heavy disease pressure or if conditions are favorable for disease apply the high rate.</p> <p>Apply no more than two applications of Quilt or any other Group 11 fungicide per year.</p> <p>Quilt is most effective when applied and allowed to dry before a rainfall. For best results, sufficient water volume should be used to provide adequate coverage.</p> <p>Quilt may be applied by ground, air or chemigation.</p> <p>Do not apply to field corn and field corn grown for seed after brown silk.</p> <p>Quilt is extremely toxic to certain apple varieties. See "General Use Instructions" on label for additional information on safety precautions to avoid injury to apple trees.</p> <p>Do not apply more than 56.0 fl oz per acre per season of Quilt.</p> <p>Do not apply within 30 days of harvest for forage, grain or stover.</p>

Foliar fungicides labeled for use on field corn - *continued*

Trade name Company	Common chemical name	% active ingredient	Rate	Additional label information
<b>Quilt Xcel</b> Syngenta	azoxystrobin propiconazole	13.50% 11.70%	10.5 to 14.0 fl oz per acre	<p>For rusts (<i>Puccinia</i> spp.), gray leaf spot, eyespot, anthracnose leaf blight, Diplodia ear rot, northern corn leaf blight, northern corn leaf spot and southern corn leaf blight.</p> <p>For gray leaf spot, rusts, anthracnose, ear rot and eyespot, apply 10.5 to 14.0 fl oz per acre when disease first appears. If conditions favorable for disease persist, continue to apply on a 14-day schedule.</p> <p>For leaf blights apply 10.5 to 14.0 fl oz per acre when disease first appears. Continue on a 7- to 14-day schedule. Use the low rate when disease pressure is low. Under heavy disease pressure or if conditions are favorable for disease apply the high rate.</p> <p>Applications before tasseling may impose stress on the plant that could inhibit proper kernel development, especially under environmentally stressful conditions.</p> <p>Do not apply more than 56.0 fl oz per acre per season.</p> <p>Do not apply within 30 days of harvest for forage, grain or stover.</p>
<b>Satori Fungicide</b> Loveland Products	azoxystrobin	22.90%	6.0 to 9.0 fl oz per acre or 6.0 to 15.5 fl oz per acre	<p>6.0 to 9.0 fl oz rate for rust (<i>Puccinia sorghi</i>).</p> <p>6.0 to 15.5 fl oz rate for other target diseases.</p> <p>For gray leaf spot, apply at the onset of disease. A second application may be required 14 days later if disease pressure persists.</p> <p>For all other diseases, begin applications prior to disease development and may continue throughout the season every 7 to 14 days following the resistance management guidelines (see label).</p> <p>Applications may be made by ground, air or chemigation.</p> <p>Do not apply more than 123.0 fl oz of product per acre per season.</p> <p>Do not apply within 7 days of harvest.</p>
<b>Stratego</b> Bayer CropScience	propiconazole trifloxystrobin	11.40% 11.40%	10.0 to 12.0 fl oz per acre	<p>For control of anthracnose leaf blight, rust (<i>Puccinia</i> spp.), eyespot, gray leaf spot, northern corn leaf blight, northern corn leaf spot and southern corn leaf blight.</p> <p>Apply when disease first appears and continue on a 7- to 14- day interval if favorable conditions for disease development persist.</p> <p>Use the higher rates and shorter intervals when disease pressure is severe.</p> <p>Application of Stratego is not recommended at times when corn is under severe environmental stress conditions.</p> <p>Stratego may be applied by ground, air or chemigation.</p> <p>Do not apply more than 24.0 fl oz of Stratego per acre per crop. Do not apply more than two sequential applications of Stratego. Limit the number of Stratego or other Group 11 containing fungicide applications to no more than two per acre per crop.</p> <p>Do not apply within 30 days of harvest for forage, grain and stover.</p>
<b>Stratego YLD Fungicide</b> Bayer CropScience	prothioconazole trifloxystrobin	10.80% 32.30%	4.0 to 5.0 fl oz per acre	<p>For control of anthracnose leaf blight, rust (<i>Puccinia</i> spp.), eyespot, gray leaf spot, northern corn leaf blight, northern corn leaf spot and southern corn leaf blight.</p> <p>Apply Stratego YLD Fungicide when disease first appears and continue on a 7- to 14-day interval if conditions for disease development persist.</p> <p>Use the higher rate and shorter intervals when disease pressure is severe.</p> <p>Use of an adjuvant may enhance the performance of Stratego YLD Fungicide. If utilized, apply the lowest label recommended rate of a NIS adjuvant to enhance disease control.</p> <p>Application is not recommended at times when corn is under severe environmental stress conditions.</p> <p>Stratego YLD Fungicide may be applied by ground, air or chemigation.</p> <p>Do not apply more than 10.0 fl oz per acre per season. Do not apply more than two sequential applications.</p> <p>Forage may be harvested the same day of application. Do not apply within 14 days of harvest for grain and fodder.</p>

Foliar fungicides labeled for use on field corn - *continued*

Trade name Company	Common chemical name	% active ingredient	Rate	Additional label information
<b>TEBU 3.6F</b> AmTide, LLC	tebuconazole	40.53%	4.0 to 6.0 fl oz per acre	<p>For rust (<i>Puccinia</i> spp.), northern leaf blight, southern leaf blight, northern leaf spot and gray leaf spot.</p> <p>Apply TEBU 3.6F Foliar Fungicide in a protective spray schedule or when weather conditions are favorable for disease development. Repeat applications at 7- to 14-day intervals or as necessary to maintain control.</p> <p>For optimum disease control, the lowest label rate of a spray surfactant should be tank-mixed with TEBU 3.6F.</p> <p>TEBU 3.6F must have two to four hours of drying time on corn foliage for the active ingredients to move systemically into plant tissue before rain or irrigation occurs. After this period of time, TEBU 3.6F will be resistant to weathering.</p> <p>A maximum of 24.0 fl oz of TEBU 3.6F may be applied per acre per season.</p> <p>Restricted-entry interval (REI) is 12 hours.</p> <p>Preharvest interval (PHI) for field corn is 21 days for forage and 36 days for grain or fodder.</p>
<b>Tebuzol 3.6F Fungicide</b> United Phosphorus, Inc.	tebuconazole	38.70%	4.0 to 6.0 fl oz per acre	<p>For rust (<i>Puccinia</i> spp.), northern leaf blight, southern leaf blight, northern leaf spot and gray leaf spot.</p> <p>Apply Tebuzol 3.6F in a protective spray or when weather conditions are favorable for disease development. Repeat applications at 7- to 14-day intervals, or as necessary to maintain control.</p> <p>For optimum disease control, the lowest specified rate of a spray surfactant should be tank-mixed with Tebuzol 3.6F.</p> <p>Tebuzol 3.6F must have two to four hours of drying time on corn foliage for the active ingredient to move systemically into plant tissue before rain or irrigation occurs. After this period of time, it will be resistant to weathering.</p> <p>A maximum of 24.0 fl oz of Tebuzol 3.6F may be applied per acre per crop season. Restricted-entry interval (REI) for all corn except sweet corn is 12 hours.</p> <p>On field corn, Tebuzol 3.6F may be applied up to 21 days before harvest of forage and 36 days before the harvest of grain or fodder.</p>
<b>Tilt</b> Syngenta	propiconazole	41.80%	2.0 to 4.0 fl oz per acre	<p>Northern corn leaf blight, northern corn leaf spot and southern corn leaf blight (also known as Helminthosporium leaf blights): 2.0 to 4.0 fl oz per acre. For leaf blights apply Tilt when disease first appears. Continue on a 7- to 14- day schedule. Use the low rate when disease pressure is low. Under heavy disease pressure or if conditions are favorable for disease, apply the high rate.</p> <p>Rusts (<i>Puccinia</i> spp.), gray leaf spot and eyespot: 4.0 fl oz per acre. Apply Tilt when disease first appears. If conditions favorable for disease persist, continue to apply on a 7- to 14-day schedule. For best disease control, early applications (at initial disease onset) perform better.</p> <p>Tilt is most effective when applied and allowed to dry before a rainfall. For best results, sufficient water volume should be used to provide thorough coverage. Tilt may be applied by ground, air or chemigation.</p> <p>Do not apply more than 16.0 fl oz per acre per season of Tilt. Do not apply more than 8.0 fl oz per acre per season of Tilt on field corn harvested for forage.</p> <p>Do not apply within 30 days of harvest for forage, grain and stover.</p>
<b>Toledo</b> Rotam North America, Inc.	tebuconazole	38.70%	4.0 to 6.0 fl oz per acre	<p>For rusts, northern leaf blight, southern leaf blight, northern leaf spot and gray leaf spot.</p> <p>Apply Toledo in a protective spray schedule or when weather conditions are favorable for disease development. Repeat applications at 7-14 day interval, or as necessary to maintain control.</p> <p>For optimum disease control, the lowest labeled rate of a spray surfactant should be tank-mixed with Toledo.</p> <p>Toledo must have two to four hours of drying time on corn foliage for the active ingredient to move systemically into the plant tissue before rain or irrigation occurs. After this period of time, Toledo will be resistant to weathering.</p> <p>Do not apply more than 24.0 fl oz of Toledo per acre per crop season.</p> <p>Restricted-entry interval (REI) for all corn except sweet corn is 12 hours.</p> <p>For field corn Toledo may be applied up to 21 days before harvest of ears or forage and 36 days before the harvest of fodder.</p>

Foliar fungicides labeled for use on field corn - *continued*

Trade name Company	Common chemical name	% active ingredient	Rate	Additional label information
<b>Topguard Fungicide</b> Cheminova	flutriafol	11.80%	7.0 to 14.0 fl oz per acre	For gray leaf spot, southern leaf blight, northern leaf blight, rust ( <i>Puccinia</i> spp.), eyespot and anthracnose. Apply as a broadcast foliar spray. Use the high rate when disease pressure is high and conditions are favorable for disease development. May be tank-mixed with other approved corn fungicides, herbicides or insecticides unless prohibited on the label. Minimum retreatment interval is 7 days. Do not apply more than 28.0 fl oz of product per acre per season. Do not apply more than 2 applications per growing season. A surfactant may be used with Topguard Fungicide prior to the V8 corn growth stage and after the VT corn growth stage. Restricted entry interval: for detasseling field corn and popcorn grown for seed is 5 days. The REI for all other activities is 12 hours. Preharvest interval: do not apply within 80 days of harvest for forage, stover and grain of field corn and popcorn.

***Fungicide efficacy for control of corn diseases***

The Corn Disease Working Group (CDWG) has developed the following information on fungicide efficacy for control of major corn diseases in the United States. Efficacy ratings for each fungicide listed in the table were determined by field testing the materials over multiple years and locations by the members of the committee. Efficacy ratings are based upon level of disease control achieved by product, and are not necessarily reflective of yield increases obtained from product application. Efficacy depends upon proper application timing, rate, and application method to achieve optimum effectiveness of the fungicide as determined by labeled instructions and overall level of disease in the field at the time of application. Differences in efficacy among fungicide

products were determined by direct comparisons among products in field tests and are based on a single application of the labeled rate as listed in the table. ***The following table includes systemic fungicides available that have been tested over multiple years and locations. The table is not intended to be a list of all labeled products (see table note 1).***

Efficacy categories: NR = Not Recommended; P = Poor; F = Fair; G = Good; VG = Very Good; E = Excellent; NL = Not Labeled for use against this disease; U = Unknown efficacy or insufficient data to rank product



Fungicide efficacy for control of corn diseases — April 2014

Fungicide(s)		Product/Trade name	Rate/A (fl oz)	Anthracnose leaf blight	Common rust	Eyespot	Gray leaf spot	Northern leaf blight	Southern rust	Harvest restriction <sup>2</sup>
Class	Active ingredient (%)									
QoI Strobilurins	Azoxystrobin 22.9%	Quadris 2.08 SC	6.0 – 15.5	VG	E	VG	E	G	G	7 days
	Pyraclostrobin 23.6%	Headline 2.09 EC/SC	6.0 – 12.0	VG	E	E	E	VG	E	7 days
	Picoxystrobin	Approach 2.08 SC	3.0 – 12.0	VG	VG-E	VG	F-VG	VG	U	7 days
DMI Triazoles	Propiconazole 41.8%	Tilt 3.6 EC Multiple generics	2.0 – 4.0	NL	VG	E	G	G	G	30 days
	Prothioconazole 41.0%	Proline 480 SC	5.7	U	VG	E	U	VG	G	14 days
	Tebuconazole 38.7%	Folicur 3.6 F Multiple generics	4.0 – 6.0	NL	U	NL	U	VG	U	36 days
Mixed mode of action	Tetraconazole 20.5%	Domark 230 ME	4.0 – 6.0	U	U	U	E	U	G	R3 (milk)
	Azoxystrobin 7.0% Propiconazole 11.7%	Quilt 200 SC	7.0 – 14.0	U	VG-E	E	E	VG	VG	30 days
	Azoxystrobin 13.5% Propiconazole 11.7%	Quilt Xcel 2.2 SE	10.5 – 14.0	VG	VG-E	VG-E	E	VG	VG	30 days
	Pyraclostrobin 13.6% Metconazole 5.1%	Headline AMP 1.68 SC	10.0 – 14.4	U	E	E	E	VG	VG	20 days
	Pyraclostrobin 28.58% Fluxapyroxad 14.33%	Priaxor 4.17 SC	4.0 – 8.0	U	VG	U	VG	U	G	21 days
	Trifloxystrobin 11.4% Propiconazole 11.4%	Stratego 250 EC	10.0 – 12.0	U	VG	E	VG	G	G	30 days
	Trifloxystrobin 32.3% Prothioconazole 10.8%	Stratego YLD 4.18 SC	4.0 – 5.0	VG	E	VG	E	VG	VG	14 days

Notes:

<sup>1</sup>Additional fungicides are labeled for disease on corn, including contact fungicides such as chlorothalonil. Certain fungicides may be available for diseases not listed in the table, including Gibberella and Fusarium ear rot. Applications of Proline 480 SC for use on ear rots requires a FIFRA Section 2(ee) and is only approved for use in Illinois, Indiana, Iowa, Louisiana, Maryland, Michigan, Mississippi, North Dakota, Ohio, Pennsylvania, and Virginia.

<sup>2</sup>Harvest restrictions are listed for field corn harvested for grain. Restrictions may vary for other types of corn (sweet, seed or popcorn, etc.), and corn for other uses such as forage or fodder.

Many products have specific use restrictions about the amount of active ingredient that can be applied within a period of time or the amount of sequential applications that can occur. Please read and follow all specific use restrictions prior to fungicide use. This information is provided only as a guide. It is the responsibility of the pesticide applicator by law to read and follow all current label directions. Reference to products in this publication is not intended to be an endorsement to the exclusion of others that may be similar. Persons using such products assume responsibility for their use in accordance with current directions of the manufacturer. Members or participants in the CDWG assume no liability resulting from the use of these products.

## Corn virus diseases

**Maize dwarf mosaic** is a virus disease of corn that is spread by several species of aphids. Although the symptoms of maize dwarf mosaic are highly variable, the most common symptom is a light green to yellow mottling or mosaic pattern in the leaf tissue.

Scattered, individual plants with symptoms of maize dwarf mosaic may be found in most years. Periodically, weather conditions favor the large-scale movement of virus-carrying aphids from southern regions of the United States. These aphids may then “rain out” or be deposited in large numbers in fields in Missouri or more northern areas of the Corn Belt. Under these conditions, maize dwarf mosaic virus may be prevalent and serious over a significant acreage.

Maize dwarf mosaic is caused by several strains of the maize dwarf mosaic virus (MDMV). Corn and sorghum are the main crop hosts of MDMV; however, johnsongrass and other wild grasses are also hosts. Some strains of MDMV overwinter in johnsongrass and are spread from the johnsongrass to corn by the aphid vectors. More than 15 species of aphids can transmit MDMV.

Many commercial corn hybrids have high levels of tolerance to MDMV.

**Maize chlorotic dwarf** is caused by a virus that is spread by the leafhopper, *Graminella nigrifrons*. Again, symptoms of maize dwarf chlorotic are highly variable. The most characteristic symptom of maize chlorotic dwarf is veinbanding or veinclearing, but other symptoms that may occur include reddening or yellowing of leaf tissue, distortion of leaf tissue and shortening of the upper internodes of the plant.

The maize dwarf chlorotic virus can overwinter in johnsongrass. It is transmitted to corn by its leafhopper vector. Although proso millet, pearl millet, sorghum, Sudan grass and wheat are also hosts of the maize chlorotic dwarf virus, corn appears to be the principal host in the field.

### Management options for corn virus diseases

- Plant resistant or tolerant hybrids.
- Plant early.
- Maintain good weed control, especially of johnsongrass.
- In some cases, control of the insect vectors through application of an appropriate insecticide may be warranted.

## Crazy top of corn

Crazy top of corn is caused by the downy mildew fungus, *Sclerophthora macrospora*. The pathogen is a soilborne fungus that causes infection when corn plants are subjected to saturated soil conditions for 24 to 48 hours from planting to about the five-leaf stage of growth.

The disease causes a deformation of plant tissues, including excessive tillering and rolling or twisting of leaves. On severely infected plants, leaves may be narrow and straplike. There may be a proliferation of the tassel until it resembles a mass of leafy structures. Plants may produce numerous ear shoots. Infected plants are frequently stunted.

In seasons with wet springs, young corn plants subjected to saturated soil conditions may show symptoms of crazy

top. Occasionally a band of affected plants may encircle a drowned out spot in a field. Some hybrids may be more susceptible to crazy top. This disease is seldom severe enough to cause significant losses.

### Management options for crazy top

- Provide good soil drainage.

## Goss's bacterial wilt and leaf blight of corn

Goss's bacterial wilt and leaf blight of corn is caused by the bacterium *Clavibacter michiganensis* subsp. *nebraskensis*. The bacterial pathogen can cause two main types of symptoms, a leaf blight and a systemic wilt. The leaf blight phase of the disease is the most common. Initially, water-soaked streaks may appear in leaf tissue. These water-soaked areas develop into lesions that are gray to light green to light yellow in color, have wavy, irregular edges and run parallel to leaf veins. Small, irregular, dark green to black water-soaked spots (often called freckles) occur within the lesions. Bacterial exudate or ooze may dry on the diseased leaf tissue. This dried exudate will appear shiny or glistening in sunlight. The presence of “freckles” within the lesions and dried bacterial exudate within the lesions are diagnostic features of Goss's leaf blight.

Leaf lesions may expand and kill large portions of the canopy. Severe browning and death of leaves may be confused with leaf scorch associated with drought or hot, drying winds. Goss's leaf blight lesions develop along the margins of the leaves or within the leaves while leaf scorch tends to begin at the leaf tip and move towards the base of the leaf. Yield losses will vary depending on susceptibility of the hybrid, timing of infection (infection early in the season may result in higher yield losses) and environmental conditions during the remainder of the growing season.

The wilt phase of the disease is less common and occurs when the bacteria infects the vascular system of the plant. When the bacteria move into the water-conducting tissues, the xylem tissues will be discolored and then plants will wilt and die. Stalks will exhibit a slimy, stalk rot.

The bacteria which causes Goss's wilt and leaf blight survives in infested corn debris on or near the soil surface. It may be spread by wind-driven rain, splashing rain and heavy rains associated with hail storms. Infection may be primarily through wounds caused by hail, wind, rain, wind-blown sand or soil, or possibly machinery. Development of the disease is favored by warm, wet and humid conditions. Outbreaks may be found after a hail storm or rain storm with strong winds which would wound plants and spread the bacteria.

### Management options for Goss's bacterial wilt and leaf blight

- Plant resistant hybrids.
- Rotate crops.
- Maintain good weed control in and around fields.
- Manage corn residues. In reduced tillage systems, hybrid selection and crop rotation are especially important.

## Stewart's bacterial wilt of corn

Stewart's bacterial wilt of corn is caused by the bacterium *Erwinia stewartii* and is spread by corn flea beetles. Foliage symptoms include linear, pale green to yellow streaks that tend to follow the veins of leaves and originate from feeding marks of the corn flea beetle. These streaks soon become dry and brown and tend to be irregular and vary in size and shape.

The bacterium that causes Stewart's bacterial wilt overwinters in the guts of corn flea beetles. Adult corn flea beetles feed on corn seedlings in late spring and early summer and contaminate the feeding wounds with the bacterium. Warm winter weather conditions favor the survival of the corn flea beetle and disease development the following spring. Cold winters reduce beetle populations and limit disease development and spread.

Although the foliage symptoms of Stewart's bacterial wilt are common on field corn in Missouri, the damage is seldom of economic significance. Stewart's bacterial wilt can be especially destructive on some sweet corn hybrids and corn inbreds.

### Management options for Stewart's bacterial wilt

- Plant resistant hybrids. Most commercial field corn hybrids have good tolerance to Stewart's bacterial wilt.
- Maintain good weed control in and around corn fields.
- Although insecticide applications to control the flea beetle vector may be warranted on sweet corn and corn inbreds, decisions to treat flea beetles on field corn should be based more on direct insect feeding damage than potential damage from Stewart's bacterial wilt.

## Common smut of corn

Common smut caused by the fungus *Ustilago maydis* results in the formation of galls on the aboveground portions of the corn plant. Initially the galls are firm and silver to grayish white in color throughout. As the galls age, the center of the gall turns into a mass of powdery, black spores while the outer covering of the gall remains silver to grayish white.

The black, resting spores (known as chlamydo spores or teliospores) fall from the smut galls to the soil where they overwinter. The spores may be spread by surface drainage water, farm machinery, insects and wind. Under favorable conditions, the resting spores germinate and produce another type of spores (sporidia) which are spread by wind or splashing water to young, actively dividing corn tissues. Moisture is needed for the spores to germinate and penetrate the host, so rainfall or humid conditions are assumed to be critical during this phase of the disease cycle. The spores of the common smut fungus are able to infect only tissue that has been damaged by insects, hail, blowing soil particles, herbicides, detasseling or other factors, or young meristematic tissues (such as young silks, young cob tissues and young developing kernels). Visible galls may develop within a few days of infection.

Common smut usually causes only small yield losses (less than 2 percent), but in rare years it may cause yield

losses of 10 percent or more depending on where gall formation occurs and the number of ears infected.

### Management options for common smut

- Plant tolerant or resistant hybrids.
- Avoid mechanical injury to plants.
- Maintained balanced fertility. Excessive nitrogen tends to increase disease incidence and severity.

## Nematodes that attack corn

Several species of nematodes, or microscopic roundworms, can cause damage on corn. Some corn nematode species spend most of their lives in the soil, while others live mostly in the roots. During feeding nematodes may directly harm plants or they may cause wounds through which fungi and bacteria can enter plants and cause secondary rots.

### Corn nematodes

lesion nematode	<i>Pratylenchus</i> spp.
stunt nematode	<i>Tylenchorhynchus</i> spp.
lance nematode	<i>Hoplolaimus</i> spp.
spiral nematode	<i>Helicotylenchus</i> spp.
ring nematode	<i>Criconemella</i> spp.
dagger nematode	<i>Xiphinema</i> spp.
root-knot nematode	<i>Meloidogyne</i> spp.
stubby-root nematode	<i>Paratrichodorus</i> spp.
needle nematode	<i>Longidorus breviannulatus</i>
sting nematode	<i>Belonolaimus</i> spp.

The presence of nematodes in a field depends on the soil type and its properties, other soil microorganisms, cropping history, tillage, the use of pesticides and climatic factors such as temperature and rainfall. Although damage can occur in any soil type, corn growing in well-drained soils, especially sandy soils, is most susceptible to damage. In poorly drained soils, nematode populations usually increase slowly or may even decline. The extent of nematode damage is often related to the growing conditions of the plant. Corn that is stressed by poor fertility or lack of moisture cannot withstand the additional stress of nematode feeding and will show more pronounced symptoms.

It is difficult to generalize about the symptoms caused by nematodes because they vary with the nematode species, the number of nematodes present and the soil environmental factors. Aboveground symptoms are due to nematode injury to the roots. Early-season symptoms may include stunting or off-color leaves. Symptoms later in the season include a ragged or uneven appearance to the field, lodging, general unthriftiness and reduced yields. Common evidence of nematode feeding on roots includes root pruning, especially of feeder roots, proliferation of fibrous roots, thickening or swelling of the smaller roots, and slight to severe discoloration of roots. Damage may be localized in one part of a field or spread over large areas of a field.

Because nematodes cannot be seen with the naked eye and because symptoms of nematode injury are easily confused with other types of corn production problems, nematode problems should be diagnosed by submitting soil and root samples to a laboratory qualified to run a nematode analysis on the samples.

### Management options for corn nematodes

- Rotate to a crop other than corn in fields with nematode problems. The length of the rotation may vary with nematode species and population levels.
- Maintain good weed control.
- Fertilize according to soil test recommendations, because corn suffering from improper fertility is more susceptible to injury from nematodes.
- Although several soil-applied nematicides are labeled for use on corn, economic and environmental concerns limit their use.
- More recently, seed treatment products have become available to aid in managing some corn nematodes. See preceding seed treatment table.

### Corn stalk rots

Stalk rots are important worldwide and are among the most destructive diseases of corn. A number of different fungi and bacteria cause stalk rots of corn. Although many of these pathogens cause distinctive symptoms, certain general symptoms are common to all stalk rot diseases. Early symptoms, which occur a few weeks after pollination, usually start with premature dying of bottom leaves. Eventually, the entire plant may die and appear light green to gray. Diseased stalks usually begin losing firmness during August. The cells in the interior of the stalk are dissolved, resulting in a loss of stalk firmness and strength. Stalks may then lodge, particularly if harvest is delayed or wind storms occur.

Stalk rots are caused by several different fungi and bacteria that are part of the complex of microorganisms that decompose dead plant material in the soil. They survive from one growing season to the next in soil, in infested corn residues or on seed. Stalk rot pathogens enter the corn plant in a variety of ways. The spores may be blown into the base of the leaf sheath, where they may germinate and grow into the stalk. Spores may enter directly into a plant through wounds made by corn borers, hail or mechanical injury. When fungi are present in soil or infested residue as either spores or mycelium, they may infect the root system, causing root rot early in the growing season and later grow up into the stalk causing stalk rot.

Stalk rot becomes a problem when plants are stressed during the grain filling stage of development. Water shortage, extended periods of cloudy weather, temperature stresses, hail damage, corn borer infestation, low potassium in relation to nitrogen, leaf diseases and other stresses that occur in August and September may be associated with an increase in stalk rot.

Losses from stalk rots vary from season to season and from region to region. Yield losses of 10 to 20 percent may occur on susceptible hybrids. Losses greater than 50 percent have been reported in localized areas. Losses may be direct losses due to poor filling of the ears or lightweight and poorly finished ears or indirect through harvest losses because of stalk breakage or lodging. Harvest losses may be reduced if fields are scouted 40 to 60 days after pollination to check for symptoms of stalk rot. Stalk rot can be detected by either pinching stalks or pushing on stalks. If more than

10 to 15 percent of the stalks are rotted, the field should be harvested as soon as possible.

### Management options for corn stalk rots

- Select hybrids with good stalk strength and lodging characteristics.
- Plant at recommended plant populations for that hybrid.
- Follow proper fertility practices.
- Maintain good insect and weed control.
- If irrigating, try to deliver optimum water from silking to late dough stage.
- Avoid or minimize stress to corn (especially during pollination and grain fill).
- Harvest in a timely manner.

### Ear and kernel rots of corn

A number of fungi can invade and cause damage to corn ears or kernels. Field fungi invade the kernels before harvest while the corn is still in the field. These fungi may affect the appearance and quality of kernels. Usually damage caused by field fungi occurs before harvest, can be detected by routine inspection of corn in the field and does not continue to develop in storage if the grain is stored at proper moisture content and temperature. Some of the field fungi on corn in Missouri include species of *Alternaria*, *Cladosporium*, *Aspergillus*, *Penicillium*, *Diplodia*, *Fusarium* and *Gibberella*. Most of these fungi are more prevalent when rainfall is above normal from silking to harvest. One exception is *Aspergillus flavus*, which is favored by drought stress to corn during pollination and by warm temperatures as kernels mature. For all field fungi, damage tends to be more severe on ears with insect, bird or hail damage. Ears well covered by husks and maturing in a downward position usually have less rot than ears with open husks or ears maturing in an upright position. Some of these fungi, in particular species of *Penicillium* and *Aspergillus*, can also be problems on corn in storage. If grain is not stored at the proper moisture content and temperature, these fungi can cause extensive damage to the stored grain.

### Mycotoxins associated with ear and kernel rots of corn

An additional concern with ear and kernel rots of corn is the possibility of mycotoxin production. Mycotoxins are naturally produced chemicals that in small amounts may be deleterious to animal or human health. Three genera of fungi – *Aspergillus*, *Penicillium* and *Fusarium* (*Gibberella*) – are most frequently involved in cases of mycotoxin contamination in corn. The presence of molds or their spores on or in corn does not necessarily mean that mycotoxins will be produced. Circumstances that favor mold growth may allow production of mycotoxins in some situations but frequently mold growth occurs with little or no mycotoxin production. Once formed, mycotoxins are stable and may remain in grain long after the fungus has died. In general, swine and poultry are more susceptible than ruminants to mycotoxin-induced health problems at an equivalent dosage. Where mycotoxin problems are suspected, a sample should be submitted to a

qualified laboratory for mycotoxin analysis.

Little can be done to prevent or reduce the invasion of corn by field fungi. However, the following recommendations should help minimize damage from field fungi on corn, especially corn going into storage.

#### Management options for corn ear and kernel rots

- Plant locally adapted hybrids with husks that close over ear tips.
- Plant at recommended plant populations for that hybrid and maintain good plant vigor over the growing season.
- Use a balanced fertility program.
- Select planting dates appropriate for your area.
- Follow recommended management practices to limit damage by ear feeding insects.

## Soybean diseases and their management

Soybean diseases can and do occur each year in Missouri. Problems with germination and stand establishment that are related to seed decay, damping-off and seedling blights are often encountered in the field. These losses can be costly, especially if replanting is necessary. Diseases may cause leaf spots or leaf blights, wilts or premature death of plants. Soybean diseases also can affect the quality of the harvested crop and cause storage losses. The extent of the damage due to soybean diseases in a given season depends on a number of factors, including the susceptibility of the soybean variety to the specific disease, the level of pathogen inoculum present and the environmental conditions during that season.

To minimize losses due to soybean diseases, it is important to correctly identify the disease or diseases present so that appropriate management steps can be taken. The soybean diseases most likely to occur in Missouri include early-season seed and seedling diseases, foliage diseases, virus diseases, root and lower stem diseases, and stem, pod and seed diseases. For more detailed information including color pictures of soybean diseases in Missouri please see University of Missouri publication IPM 1002, *Soybean Diseases*.

### Seed and seedling diseases

The early-season soybean diseases include those that cause seed decay, seedling blights and soybean root rots. Most of these early-season soybean diseases are caused by fungi that are found in the soil wherever soybeans are grown. *Pythium*, *Phytophthora*, *Rhizoctonia* and *Fusarium* are the most common of these early-season pathogens, although *Phomopsis* (pod and stem blight fungus) and *Macrophomina* (charcoal rot fungus) may also cause early-season seedling problems. Symptoms of these early-season soybean diseases may range from seed decay to preemergence or postemergence damping-off to wilt and death of established seedlings.

- If irrigating, try to deliver optimum water from silking to late dough stage.
- Harvest in a timely fashion.
- Adjust the harvesting equipment for minimum kernel damage and maximum cleaning.
- Clean the grain and bins thoroughly before storage to remove dirt, dust and other foreign matter, crop debris, chaff and cracked or broken kernels.
- Store grain in watertight structures that are free from insects and rodents.
- Store grain at proper moisture content and temperature.
- Monitor grain on a regular basis throughout storage life to ensure moisture content and temperature are maintained at correct levels.

**Pythium seed decay and damping-off** are generally associated with wet soil conditions. At least three of the *Pythium* species involved in these early-season diseases on soybean have an optimum temperature range for infection of 50 to 59 degrees F. Because of this lower optimum temperature range, these species are more common problems in northern areas or on early-planted soybean. The other *Pythium* species prefer soil temperatures in the range of 86 to 95 degrees F and are more common in southern areas, in late-planted fields or on plants later in the season. Crusting, deep planting, compaction, herbicide injury and similar factors that delay germination and seedling emergence may lead to an increase in incidence and severity of *Pythium* seed decay and damping-off.

#### Management options for Pythium seed decay and damping-off

- Plant good-quality seed with a good germination rate.
- Plant in good seedbed conditions. Delaying planting until soil temperatures are above 59 degrees F may reduce infection by some *Pythium* species.
- *Pythium* diseases may be more likely to develop in low, wet areas or compacted areas of a field. Tiling to improve drainage and taking steps to reduce or prevent compaction may help minimize problems with this disease.
- Fungicide seed treatment or at-planting fungicide treatment may help protect seedlings from this disease. Products containing metalaxyl, mefenoxam, or ethaboxam as an active ingredient are particularly effective against water mold fungi such as *Pythium* species. See accompanying table of seed treatment fungicides labeled for use on soybean.

**Phytophthora seedling blight** is caused by another soil-inhabiting fungus. *Phytophthora* can cause seed decay, preemergence or postemergence damping-off and seedling blight of soybean. This fungus produces structures called oospores, which enable it to survive from year to year in crop residues or in the soil. In the spring, the oospores germinate

to produce sporangia. When soils are flooded or saturated, the sporangia release zoospores, which are attracted to the growing soybean root tip where infection occurs.

Phytophthora root rot is more severe in areas that are low or poorly drained, in compacted areas or in clay or heavy soils, but the disease can appear on plants growing in lighter soils or higher ground if the soil remains wet after planting. Significant rain after planting favors the development of *Phytophthora* in all sites. A dry period after planting drastically reduces this disease. *Phytophthora* may occur at soil temperatures as low as 50 degrees F, but greatest root damage occurs when soil temperatures are 59 degrees F or above.

#### Management options for Phytophthora seedling blight

- Plant varieties with race-specific resistance, tolerance or a combination of race-specific resistance and tolerance in fields with a history of *Phytophthora*. Many races of *Phytophthora sojae* have been identified based on their ability to overcome specific Rps genes or combinations of Rps genes in soybean varieties. Race-specific varieties contain a single gene or combination of genes (i.e., Rps1c, Rps1d, Rps1k or Rps3a) that confer resistance to specific races of *Phytophthora sojae*. Tolerant varieties have a non-race-specific, partial resistance and may also be called field-resistant varieties.
- Plant in good seedbed conditions.
- *Phytophthora* is more likely to occur in low, wet areas, poorly drained areas or compacted areas of a field. Tiling to improve drainage and taking steps to reduce or prevent compaction may help minimize disease problems.
- Avoid the application of high levels of manure or fertilizer (KCl) just before planting.
- Rotate crops to prevent the increase of inoculum levels in a field.
- Use an appropriate fungicide seed treatment or at planting fungicide treatment. Products containing metalaxyl, mefenoxam, or ethaboxam as an active ingredient are particularly effective against water mold fungi such as *Phytophthora sojae*. See accompanying table of seed treatment fungicides labeled for use on soybean.

**Rhizoctonia seedling blight**, caused by *Rhizoctonia solani* another common soil-inhabiting fungus, can result in seed decay and preemergence damping-off of soybean seedlings. The causal fungus can survive well in the absence of host plants because it grows well in the soil, colonizes many types of plant debris and can also survive as resting mycelium or sclerotia in the soil.

*Rhizoctonia solani* can survive under a wide range of soil moistures and soil temperatures. Populations of the fungus may decline when soils are flooded or when soil temperatures are unusually high. Symptoms, especially on above-ground portions of the seedlings, are usually more severe during periods of drying winds or warm to hot weather. During such conditions seedlings may wilt, yellow or die.

Crusting, hardpan layers, herbicide injury, deep planting, poor seed quality, hail damage, insect damage, mechanical injuries, poor fertility or other factors that delay germination and emergence favor the development of *Rhizoctonia*

root rot. *Rhizoctonia* root rot is frequently found in combination with other diseases such as soybean cyst nematode or *Fusarium* root rot. Damage from *Rhizoctonia* may be more severe when it occurs in combination with other diseases.

#### Management options for Rhizoctonia seedling blight

- Plant good-quality seed with a good germination rate.
- Plant in good seedbed conditions.
- Minimize or avoid stresses that delay germination or emergence, i.e., avoid or prevent herbicide injury and insect injury, correct soil compaction and hardpan layer problems, and reduce injury from soybean cyst nematode.
- Use an appropriate fungicide seed treatment. See accompanying table of seed treatment fungicides labeled for use on soybean.

**Fusarium seedling blight** and root rot of soybean may be caused by either *Fusarium oxysporum* or *Fusarium solani*. These two fungi can persist in the soil, colonize various plant residues and survive as chlamydospores (fungal survival structures) or mycelium.

*Fusarium* root rot can occur at any time during the growing season, but it is most common on seedlings and young plants. Disease is most severe when the soil is saturated and soil temperatures are around 57 degrees F. Crusting, hardpan layers, herbicide injury, deep planting, poor seed quality, hail damage, insect damage, mechanical injuries, poor fertility or other factors that delay germination and emergence favor the development of *Fusarium* seedling blight and root rot. *Fusarium* root rot is frequently found in combination with other diseases such as *Rhizoctonia* root rot or soybean cyst nematode. Damage from *Fusarium* may be more severe when it occurs in combination with other diseases or stresses.

#### Management options for Fusarium seedling blight

- Plant good-quality seed with a good germination rate.
- Plant in good seedbed conditions.
- Minimize or avoid stresses that delay germination or emergence, i.e., avoid or prevent herbicide injury and insect injury, correct soil compaction and hardpan layer problems, and reduce injury from soybean cyst nematode.
- Use an appropriate fungicide seed treatment. See accompanying table of seed treatment fungicides labeled for use on soybean.

**Charcoal rot**, caused by the fungus *Macrophomina phaseolina*, occurs worldwide. The fungus is widely distributed in soils and has a wide host range attacking a number of crops, including soybean, corn and sorghum. *Macrophomina phaseolina* produces small survival structures called microsclerotia, which allow it to survive in soil or in host residues for long periods of time.

Charcoal rot may be more commonly recognized as a mid- to late-season disease on maturing soybeans (see charcoal rot in section on Root and Lower Stem Diseases), but it can also occur early in the season on young seedlings. *Macrophomina phaseolina* grows best at temperatures between 82–95 degrees F. Infection of seedlings is most likely to occur

if conditions of high soil temperatures and low soil moisture exist during the first two to three weeks after planting.

### Management options for charcoal rot

- Rotate to cereals, cotton or other non-host crops for one to two years.
- Maintain good crop vigor to reduce losses from charcoal rot.
- In irrigated fields, watering during periods of high temperatures and drought stress when soybean plants are in bloom to pod fill may help reduce charcoal rot.

*Phomopsis longicolla* and the other *Phomopsis* and *Diaporthe* species that cause *Phomopsis* seed decay and pod and stem blight can survive in infested crop residues and in the soil. These fungi can also survive on the seed and *Phomopsis* seedling blight is more likely to be a serious problem if infected seed is planted. *Phomopsis* seedling blight tends to be more severe if weather conditions after planting are cool and wet.

### Management options for *Phomopsis* seedling blight

- Plant disease-free seed with a good germination rate.
- Plant in good seedbed conditions.
- Use an appropriate fungicide seed treatment. See accompanying table of seed treatment fungicides labeled for use on soybean.

## Seed treatment fungicides for soybean

Although seed treatment fungicides can be an effective means of preventing or reducing losses from various seedborne and soilborne microorganisms, there are several important laws or guidelines concerning fungicide-treated seed. Always read the pesticide label and follow all directions and restrictions on the label but in particular for seed treatment fungicides remember the following points.

- Do not use treated seed for food, feed or oil purposes.
- All treated seed must be colored with an EPA-approved dye that imparts an unnatural color to the seed.
- Federal law requires that bags containing treated seed shall be labeled with the following information: "This seed has been treated with (common chemical name of active ingredients) fungicide(s). Do not use treated seed for feed, food or oil purposes. Store away from feeds and food stuffs."

Until recently most soybean seed was not treated prior to sale. Treatment was done at the dealer level or on-farm. However, as the cost of soybean seed increased, companies began either offering soybean seed treatments on their seed or treating seed prior to sale. Over the years, the types of fungicides available have changed and many seed companies or seed treating operations use a combination of several fungicides with varying modes of action to protect the seed from an array of seedborne and soilborne pathogens. More recently, seed treatment insecticides have become available. Again, these seed treatment insecticides may be applied by the seed company or seed treating operation, making it possible to purchase seed treated with a fungicide, an insecticide or a combination of fungicide and insecticide.

Most recently seed treatments for nematode protection have come on the market. Now soybean seed might be treated with a combination of fungicide, insecticide and nematode seed treatment products.

Marketing strategies are also changing. Some seed treatment products are widely marketed to seed companies and dealers. Other products may be marketed under an exclusive agreement with a single seed company. That seed company has exclusive rights to the use of the particular product for a specified number of years. That product would not be available to other seed companies, dealers and seed treating operations. Some seed companies are putting together package treatments of fungicides, insecticide and nematode protection products that they are strongly recommending for use on their genetics. This shift to package treatments and exclusive marketing to individual seed companies makes it difficult to compile a table of seed treatment fungicides and nematode protection products labeled for use on soybean in Missouri. Check with your seed salesperson to find out what products are on the seed you are purchasing and to find out if the rates of the various active ingredients are appropriate for disease pressure in the fields in which the seed will be planted.

The following table was prepared using current company product label books and manufacturers' Web sites. However, label registrations can change at any time. Before using any agricultural pesticide, read and follow directions on the label accompanying that product. Product trade names have been used for clarity. Reference to specific trade names does not imply endorsement by the University of Missouri; discrimination is not intended against similar products not listed.

## Seed treatment fungicides and nematode protection products labeled for use on soybean

Trade name Company	Common chemical name	% active ingredient	Rate	Additional label information
<b>Acceleron DX-109 Fungicide Seed Treatment</b> Monsanto	pyraclostrobin	18.40%	0.4 to 1.5 fl oz per 100 lb of seed	For seed and seedling disease (damping-off) caused by <i>Rhizoctonia solani</i> , seed-borne fungi causing seed decay, seedling damping-off. For suppression of seed and seedling disease caused by <i>Pythium</i> spp., <i>Fusarium</i> spp. and <i>Phomopsis</i> spp.
<b>Acceleron DX-309 Fungicide Seed Treatment</b> Monsanto	metalaxyl	28.35%	0.75 to 1.5 fl oz per 100 lb of seed 0.10 to 0.375 fl oz per 100 lb of seed	For Pythium damping-off and early-season Phytophthora control. Reduced rate in combination with other fungicides to aid in the control of seed decay and damping-off caused by Pythium. Apply in combination with EPA registered rates of broad-spectrum seed treatment fungicides.
<b>Acceleron DX-612</b> Monsanto	fluxapyroxad	28.70%	0.24 to 0.47 fl oz per 100 lb of seed	Seed and seedling disease (damping-of) caused by <i>Rhizoctonia solani</i> . Suppression of seed and seedling disease caused by <i>Fusarium</i> spp.
<b>Allegiance Dry</b> Chemtura AgroSolutions	metalaxyl	12.50%	1.5 to 2.0 oz per 100 lb of seed	For Pythium damping-off and early-season Phytophthora control. For control of other soilborne diseases, such as <i>Rhizoctonia</i> spp., Allegiance Dry should be applied in combination with other registered seed dressing fungicides. Treat only those seeds needed for immediate use, minimizing the interval between treatment and planting. Do not carry over excess treated seed to next season. Do not use this product on seed that has been commercially treated with metalaxyl fungicide. Hopper box treatment.
<b>Allegiance-FL</b> Bayer CropScience	metalaxyl	28.35%	0.75 to 1.5 fl oz per 100 lb of seed	For Pythium damping-off and early-season Phytophthora control. For control of other soilborne diseases, combination with Bayer CropScience Captan and Vitavax registered formulations are compatible. Do not use with other seed treatment products unless previous experience assures compatibility. Allegiance-FL may be applied as a water-based slurry with other registered seed treatment insecticides and fungicides through standard slurry or mist-type commercial seed treatment equipment.
<b>Apron XL</b> Syngenta	mefenoxam	33.30%	0.16 to 0.64 fl oz per 100 lb of seed	For Pythium damping-off and early-season Phytophthora control. For best early-season control of <i>Phytophthora</i> , use the higher rate. For control of other soilborne diseases, such as <i>Rhizoctonia</i> species, Apron XL should be applied in combination with other registered seed dressing fungicides. Apron XL may be applied as a water-based slurry with other registered seed treatment insecticides and fungicides through standard slurry or mist-type commercial seed treatment equipment.
<b>ApronMAXX RFC</b> Syngenta	fludioxonil mefenoxam	2.31% 3.46%	1.5 fl oz per 100 lb of seed	Provides protection against damping-off and seed rots due to <i>Pythium</i> , <i>Phytophthora</i> , <i>Fusarium</i> , <i>Rhizoctonia</i> spp. and early-season Phytophthora root rot and suppresses seedborne <i>Sclerotinia</i> and <i>Phomopsis</i> spp. Additional Apron XL may be necessary depending on the type of pathogen and the level of disease pressure. Use label for further information on use rates. ApronMAXX RFC is especially formulated for on-farm or commercial treatment to be used with liquid rhizobia products, using standard mechanical slurry or mist-type seed treatment equipment.
<b>ApronMAXX RTA</b> Syngenta	mefenoxam fludioxonil	1.10% 0.73%	5.0 fl oz per 100 lb of seed	Seed treatment fungicide that protects against damping-off and seed rots due to <i>Pythium</i> , <i>Phytophthora</i> , <i>Fusarium</i> , <i>Rhizoctonia</i> spp. and early-season Phytophthora root rot. ApronMAXX RTA also suppresses seedborne <i>Sclerotinia</i> and <i>Phomopsis</i> spp. If the target fields have a history of high Phytophthora pressure, then use 5.0 fl oz of ApronMAXX RTA with 0.16 to 0.48 fl oz of Apron XL per 100 lb of seed. ApronMAXX RTA is especially formulated for on-farm treatment, using standard mechanical slurry or mist-type seed treatment equipment.
<b>ApronMAXX RTA + Moly</b> Syngenta	mefenoxam fludioxonil	1.02% 0.68%	5.0 fl oz per 100 lb of seed	Provides protection against damping-off and seed rots due to <i>Pythium</i> , <i>Phytophthora</i> , <i>Fusarium</i> , <i>Rhizoctonia</i> spp. and early-season Phytophthora root rot and suppresses seedborne <i>Sclerotinia</i> and <i>Phomopsis</i> spp. If the target fields have a history of high Phytophthora pressure, then use 5.0 fl oz of ApronMAXX RTA + Moly with 0.16 to 0.48 fl oz of Apron XL per 100 lb of seed. ApronMAXX RTA + Moly is especially formulated for on-farm treatment, using standard mechanical slurry or mist-type seed treatment equipment.
<b>Avicta Complete Beans</b> Syngenta				Avicta Complete Beans is a combination of separately registered products containing Avicta 500 FS nematicide, plus one or more of the following products: CruiserMaxx premix; Cruiser 5FS insecticide, Apron XL fungicide and Maxim 4FS fungicide; or Cruiser 5FS and an ApronMaxx brand fungicide.



Seed treatment fungicides and nematode protection products labeled for use on soybean - *continued*

Trade name Company	Common chemical name	% active ingredient	Rate	Additional label information
<b>Avicta Complete Beans 500</b> Syngenta	abamectin thiamethoxam mefenoxam fludioxonil	22.20% 11.10% 1.67% 0.55%	6.2 fl oz per 100 lb of seed	To protect soybean seedlings from damage caused by these pests/diseases: nematodes (including soybean cyst nematode), insects (see label), and diseases including damping-off and seed-borne rots due to <i>Pythium</i> and <i>Phytophthora</i> , early-season <i>Phytophthora</i> root rot, <i>Fusarium</i> and <i>Rhizoctonia</i> . Avicta Complete Beans 500 also suppresses seed-borne <i>Sclerotinia</i> and <i>Phomopsis</i> species.  Restricted use pesticide.  For use only in Syngenta-certified seed treatment facilities and only in seed treatment equipment with closed transfer and application systems. Not for use in hopper box, planter box, slurry box or other farmer-applied applications.  See label for other precautions.
<b>Bean Guard/ Allegiance</b> Chemtura AgroSolutions	captan carboxin metalaxyl	24.45% 12.50% 3.75%	2.0 oz per bushel of seed	Bean Guard/Allegiance combines the systemic action of carboxin and metalaxyl with the contact action of captan to control certain seed and seedling diseases of soybeans. It is particularly effective against <i>Pythium</i> and <i>Rhizoctonia</i> and shows good activity against <i>Fusarium</i> and <i>Helminthosporium</i> . It also provides 0.2 oz of molybdenum per acre for plant nutrition and nitrogen fixation.  Treat only seed for immediate use, minimizing the interval between treatment and planting. Do not store excess treated seeds beyond planting time.  Hopper box seed treatment.
<b>Belmont 2.7 FS</b> Chemtura AgroSolutions	metalaxyl	28.98%	0.75 to 1.5 fl oz per 100 lb of seed	For <i>Pythium</i> damping-off and early-season <i>Phytophthora</i> control.  For the control of other soilborne diseases, use in combination with other seed treatment fungicides. Vitavax and RANCONA products are compatible with Belmont 2.7 FS. Do not use in combination with other seed treatment products unless compatibility and safety to crop has been verified.  Belmont 2.7 FS may be applied on its own, as a water-based slurry or in combination with other registered seed treatment insecticides and fungicides through standard slurry or mist-type commercial seed treatment equipment.
<b>Clariva pn</b> Syngenta	<i>Pasteuria nishizawae</i>	15.00%	1.0 to 3.0 fl oz per 100 lb of seed	For protection against soybean cyst nematode.  Clariva pn is a biological seed treatment product.  For use only in commercial seed treatment equipment. Not for use in hopper box, planter box, slurry box or other on-farm seed treatment applications.
<b>CruiserMaxx</b> Syngenta	thiamethoxam mefenoxam fludioxonil	22.60% 1.70% 1.12%	3.0 fl oz per 100 lb of seed	CruiserMaxx is a seed treatment product containing the active ingredients thiamethoxam (insecticide) and fludioxonil and mefenoxam (fungicides). It protects against damage from certain early-season insects, soilborne and seedborne diseases including damping-off and seedborne rots due to <i>Pythium</i> , <i>Phytophthora</i> , <i>Fusarium</i> , <i>Rhizoctonia</i> species and early-season <i>Phytophthora</i> root rot. It also suppresses seedborne <i>Sclerotinia</i> and <i>Phomopsis</i> species.  If target fields have a history of high <i>Phytophthora</i> pressure, add additional Apron XL as directed in the rate table on the label.  Apply CruiserMaxx as a water-based slurry using standard slurry seed treatment equipment which provides uniform seed coverage.
<b>CruiserMaxx Advanced</b> Syngenta	thiamethoxam mefenoxam fludioxonil	21.50% 3.21% 1.07%	3.2 fl oz per 100 lb of seed	CruiserMaxx Plus provides protection against damping-off and seedborne rots due to <i>Pythium</i> , <i>Phytophthora</i> , <i>Fusarium</i> , <i>Rhizoctonia</i> species and early-season <i>Phytophthora</i> root rot. CruiserMaxx Advanced also suppresses seedborne <i>Sclerotinia</i> and <i>Phomopsis</i> species.  If target fields have a history of high <i>Phytophthora</i> pressure, add additional Apron XL as directed in the rate table the Apron XL label.  Apply as a water-based slurry using standard slurry seed treatment equipment which provides uniform seed coverage.
<b>CruiserMaxx EZ</b> Syngenta	thiamethoxam mefenoxam fludioxonil	23.10% 3.46% 1.15%	2.94 fl oz per 100 lb of seed	CruiserMaxx EZ provides protection against damping-off and seedborne rots due to <i>Pythium</i> , <i>Phytophthora</i> , <i>Fusarium</i> , <i>Rhizoctonia</i> species and early-season <i>Phytophthora</i> root rot. CruiserMaxx EZ also suppresses seedborne <i>Sclerotinia</i> and <i>Phomopsis</i> species.  If target fields have a history of high <i>Phytophthora</i> pressure add additional Apron XL as directed in the rate table and the Apron XL label.  Apply as a water-based slurry using standard slurry seed treatment equipment which provided uniform seed coverage.
<b>CruiserMaxx Plus</b> Syngenta	thiamethoxam mefenoxam fludioxonil	21.50% 3.21% 1.07%	3.2 fl oz per 100 lb of seed	Provides protection against damping-off and seedborne rots due to <i>Pythium</i> , <i>Phytophthora</i> , <i>Fusarium</i> , <i>Rhizoctonia</i> spp. and early-season <i>Phytophthora</i> root rot. CruiserMaxx Plus also suppresses seedborne <i>Sclerotinia</i> and <i>Phomopsis</i> spp.  If target fields have a history of high <i>Phytophthora</i> pressure, add additional Apron XL as directed in the rate table on the label.  Apply CruiserMaxx Plus as a water-based slurry using standard slurry seed treatment equipment which provides uniform seed coverage.

Seed treatment fungicides and nematode protection products labeled for use on soybean - *continued*

Trade name Company	Common chemical name	% active ingredient	Rate	Additional label information
<b>Dyna-Shield Metalaxyl</b> Loveland Products Inc.	metalaxyl	28.35%	0.75 to 1.5 fl oz per 100 lb of seed	For Pythium damping-off and early-season Phytophthora control. Reduced rate: to aid in control of seed decay and damping-off caused by Pythium, apply Dyna-Shield Metalaxyl Fungicide as a commercial seed treatment at the rate of 0.10 to 0.375 fl oz per 100 lb of seed. Apply in combination with EPA registered rates of broad-spectrum seed treatment fungicides. May be applied as a water-based slurry with other registered seed treatment insecticides and fungicides through standard slurry or mist-type commercial seed treatment equipment.
<b>Dyna-Shield Metalaxyl 318 FS</b> Loveland Products Inc.	metalaxyl	30.14%	0.75 to 1.5 fl oz per 100 lb of seed	For Pythium damping-off and early-season Phytophthora control. Reduced rate: to aid in control of seed decay and damping-off caused by Pythium, apply Dyna-Shield Metalaxyl 318 FS Fungicide as a commercial seed treatment at the rate of 0.10 to 0.375 fl oz per 100 lb of seed. Apply in combination with EPA registered rates of broad-spectrum seed treatment fungicides. May be applied as a water-based slurry with other registered seed treatment insecticides and fungicides through standard slurry or mist-type commercial seed treatment equipment.
<b>Dynasty</b> Syngenta	azoxystrobin	9.60%	0.153 to 0.459 fl oz per 100 lb of seed	Target diseases are seedborne and soilborne fungi causing decay, damping-off and seedling blight; seedling damping-off ( <i>Rhizoctina solani</i> and <i>Pythium</i> spp.) and suppression of white mold ( <i>Sclerotium rolfsii</i> ). It is recommended that Dynasty be combined with a Pythium-active seed treatment such as Apron XL to offer broad-spectrum protection against the seed and seedling disease complex ( <i>Rhizoctonia</i> spp. and <i>Pythium</i> spp.). Apply Dynasty as a water-based slurry using seed treatment application equipment that will provide uniform coverage on the seed surface.
<b>Enhance</b> Chemtura AgroSolutions	captan carboxin	19.55% 20.00%	5.0 oz per 100 lb of seed	Protects soybean seed from seedborne and soilborne fungi that cause seed decay, damping-off and seedling blights (including <i>Fusarium</i> , <i>Rhizoctonia</i> and <i>Pythium</i> ). Do not graze or feed livestock on soybean forage or hay.
<b>Enhance AW</b> Chemtura AgroSolutions (formerly Trace Seed Protection Products)	captan carboxin imidacloprid	19.55% 20.00% 20.00%	5.0 oz per 100 lb of seed	Protects soybean seed from seedborne and soilborne fungi that cause seed decay, damping-off and seedling blights (including <i>Fusarium</i> , <i>Rhizoctonia</i> and <i>Pythium</i> ). Do not graze or feed livestock on soybean forage or hay.
<b>EverGol Energy SB</b> Bayer CropScience	prothioconazole penflufen metalaxyl	7.18% 3.59% 5.74%	1.00 fl oz per 100 lb of seed	Effective against seed rot and damping-off caused by <i>Rhizoctonia</i> , <i>Fusarium</i> and <i>Pythium</i> ; seed decay caused by Phomopsis; and seed decay. Also, effective against early-season Phytophthora; for longer season control add sufficient metalaxyl product, such as Allegiance, to supply a total metalaxyl amount of 15 to 30 gai/100 kg of seed. For use only in commercial seed treatment equipment. Not for use in hopper box, planter box, slurry box or other on-farm seed treatment applications.
<b>Hi Moly/Captan-D</b> Chemtura AgroSolutions (formerly Trace Seed Protection Products)	captan molybdenum	48.92% 10.20%	3.3 oz per 100 lb of seed	To protect against seedborne and soilborne diseases such as seedling blights, damping-off and seed decay. Also provides 0.2 oz of molybdenum per acre for plant nutrition and nitrogen fixation. Treat only those seeds needed for immediate use, minimizing the interval between treatment and planting. Do not store excess treated seed beyond planting time. Hopper box seed treatment.
<b>Inovate Pro with Rizolex System and Sebring</b> Valent	clothianidin ipconazole metalaxyl tolclofos-methyl		3.47 fl oz per 100 lb of seed	Inovate Pro with Rizolex System and Sebring is a combination of Inovate, Rizolex and Sebring with a new lower use rate Inovate product and with added Rhizoctonia protection from Rizolex. Protects against <i>Aspergillus</i> , <i>Fusarium</i> , <i>Penicillium</i> , <i>Phomopsis</i> , <i>Pythium</i> , <i>Rhizoctonia</i> and <i>Sclerotinia</i> .
<b>Inovate Seed Protectant</b> Valent	clothianidin metalaxyl ipconazole	14.340% 1.153% 0.720%	4.74 fl oz per 100 lb of seed	For seed rots (including seed-borne <i>Phomopsis</i> , seed-borne <i>Sclerotinia</i> , seed-borne <i>Fusarium</i> , <i>Penicillium</i> and <i>Aspergillus</i> ), damping off and seedling blights (soil-borne <i>Pythium</i> , <i>Fusarium</i> and <i>Rhizoctonia solani</i> ) as well as certain insect pests. For use only in commercial seed treatment equipment. Not for use in hopper box, planter box, slurry box or other on-farm seed treatment applications. Do not graze or feed soybean forage and hay to livestock.

Seed treatment fungicides and nematode protection products labeled for use on soybean - *continued*

Trade name Company	Common chemical name	% active ingredient	Rate	Additional label information
<b>Intego Solo Fungicide</b> Valent	ethaboxam	34.20%	0.3 to 0.6 fl oz per 100 lb of seed	For protection against <i>Pythium</i> seed decay and seedling dieback and early season <i>Phytophthora</i> root rot.  For best results use Intego Solo Fungicide combined with other Oomycete-active seed treatment fungicides, such as metalaxyl, to broaden the spectrum of activity. In addition, use with a broad-spectrum seed treatment fungicide(s) having activity against <i>Rhizoctonia solani</i> and other fungal pathogens inciting seed and seedling diseases.  Must be used only in accordance with use instructions on the label utilizing mechanical, slurry or mist-type seed treating equipment. This product is for both commercial and on-farm application. Do not apply this product in a hopper-box or planter-box at planting time. Always mix product thoroughly before use.  Do not graze or feed soybean forage and hay to livestock.
<b>Intego Suite</b> Valent	clothianidin ipconazole metalaxyl ethaboxam	24.03% 1.20% 0.97% 34.20%	3.11 fl oz per 100 lb of seed	Intego Suite is a combination of Inovate Pro and Intego Solo.  Protects against <i>Aspergillus</i> , <i>Fusarium</i> , <i>Penicillium</i> , <i>Phomopsis</i> , <i>Phytophthora</i> , <i>Pythium</i> , <i>Rhizoctonia</i> and <i>Sclerotinia</i> as well as certain insect pests.
<b>Kernel Guard Supreme</b> Chemtura AgroSolutions	permethrin carboxin	10.42% 14.00%	3.0 oz per 100 lb of seed	Kernel Guard Supreme may be used on seed previously treated with a full dosage of protective fungicide, to give added protection against seedling blight, damping-off or seed decay.  Treat only those seed needed for immediate use, minimizing the interval between treatment and planting. Do not store excess treated seeds beyond planting time.  Kernel Guard Supreme is a planter box or hopper box seed treatment for on-farm use immediately before planting.
<b>KickStart VP</b> Helena Chemical Company	carboxin permethrin	14.00% 10.42%	1.5 oz per 50 lb of seed	KickStart VP may be used on seed previously treated with a full dosage of protective fungicide to give added protection against seedling blight, damping-off or seed decay.  Apply KickStart VP to seed at planting time with the canister applicator tube system. For best results, fill planter box with seed, add KickStart VP through applicator tube and mix so all seeds are covered. Do not mix with bare hands.  Use only at the recommended rate. Lower amounts may not give desired control. Excessive amounts may cause seed injury.
<b>Kodiak HB</b> Chemtura AgroSolutions (formerly Trace Seed Protection Products)	<i>Bacillus subtilis</i> GB03	0.30%	4.0 to 8.0 oz per 100 lb of seed	For suppression of root diseases caused by <i>Rhizoctonia</i> and <i>Fusarium</i> and for improvement of nodulation by <i>Bradyrhizobium</i> .  Contains bacteria that colonize the developing root system, suppressing disease organisms such as <i>Fusarium</i> and <i>Pythium</i> that attack root systems. When used with a chemical seed treatment, the combination of chemicals and Kodiak provides protection to the root for a much longer time than with chemicals alone.  Kodiak HB is a hopper box seed treatment.
<b>Latitude</b> Chemtura AgroSolutions (formerly Trace Seed Protection Products)	imidacloprid carboxin metalaxyl	25.00% 14.00% 1.00%	4.0 oz per 100 lb of seed	For the protection of seeds and seedlings against seed and seedling diseases caused by <i>Pythium</i> and <i>Rhizoctonia</i> .  Use only at the recommended rate. Lower amounts may not give desired control. Excessive amounts may cause seed injury.  Do not graze or feed livestock on forage and hay on treated areas for six weeks after planting soybeans. Do not graze or feed livestock on vines grown from treated soybean seed.
<b>Maxim XL</b> Syngenta	fludioxonil mefenoxam	21.00% 8.40%	0.167 to 0.334 fl oz per 100 lb of seed	For protection against seedborne and soilborne fungi that cause decay, damping-off and seedling blight, and early-season <i>Phytophthora</i> protection.  See label for specific rate recommendations depending on expected disease pressure.  Apply as a water-based slurry using standard slurry seed treatment equipment that provides uniform seed coverage.
<b>Maxim 4FS</b> Syngenta	fludioxonil	40.30%	0.08 to 0.16 fl oz per 100 lb of seed	For protection against seedborne and soilborne fungi that cause decay, damping-off and seedling blight.  Maxim 4FS does not control diseases caused by <i>Pythium</i> spp. or <i>Phytophthora</i> spp. If these diseases are expected to be a problem, apply Maxim 4FS tank mixed with Apron XL.  Apply as a water-based slurry using standard slurry seed treatment equipment that provides uniform seed coverage.

Seed treatment fungicides and nematode protection products labeled for use on soybean - *continued*

Trade name Company	Common chemical name	% active ingredient	Rate	Additional label information
<b>MetaStar ST</b> Chemtura AgroSolutions (formerly Trace Seed Protection Products)	metalaxyl	29.99%	0.75 to 1.5 fl oz per 100 lb of seed	For Pythium damping-off and early-season Phytophthora control. MetaStar ST is a systemic fungicide seed dressing specifically for control of systemic downy mildews, <i>Pythium</i> and <i>Phytophthora</i> spp. For control of other soilborne diseases, combinations with Captan and Vitavax registered formulations are compatible. Do not use with other seed treatment products unless previous experience assures compatibility. MetaStar ST may be applied as a water-based slurry with other registered seed treatment insecticides and fungicides through standard slurry or mist-type commercial seed treatment equipment.
<b>Poncho/VOTiVO</b> Bayer CropScience	clothianidin <i>Bacillus firmus</i> I-1582	40.30% 8.10%	0.13 mg ai/seed	Poncho/VOTiVO is a combination insecticide and biological seed treatment that, when applied to seed, protects the seed and seedling against certain early-season insects and provides early-season protection from listed plant pathogenic nematodes that attack the root system. As a result of the dual protection, there is an improvement in plant vigor, which often results in more uniform plants and greater yields. In areas of high nematode infestation additional control measures may be warranted. For soybean the nematode pests include reniform, root knot and soybean cyst nematodes. See label for plant-back restrictions. For use only in commercial seed treatment equipment. Not for use in hopper box, planter box, slurry box or other on-farm seed treatment applications. Do not graze or feed soybean forage and hay to livestock
<b>Prevail</b> Chemtura AgroSolutions	carboxin PCNB metalaxyl	15.00% 15.00% 3.12%	2.0 to 4.0 oz per bushel of seed	For protection against Pythium and Rhizoctonia seedling disease complex. Do not graze or feed livestock on hay grown from treated seed. May be used as a planter box treatment or applied at planting time using on farm mechanical treater to maximize seed coverage.
<b>Protector-D</b> Chemtura AgroSolutions (formerly Trace Seed Protection Products)	thiram	35.00%	2.0 oz per bushel of seed	Contains thiram to protect against seedborne and soilborne diseases, such as seedling blights, damping-off and seed decay organisms, as well as 0.2 oz of molybdenum per acre for plant nutrition and to aid in nitrogen fixation. Plant as soon as possible after treating. Hopper box seed treatment.
<b>Protector-L- Allegiance</b> Chemtura AgroSolutions	thiram metalaxyl	14.29% 1.61%	6.7 fl oz per 100 lb of seed	A ready-to-use product combining the action of thiram and metalaxyl to reduce seed rot/seedling blight diseases including <i>Pythium</i> and <i>Rhizoctonia</i> and providing molybdenum to aid in nitrogen fixation. Apply as a pour-on hopper box application or through on-farm seed treatment equipment.
<b>RANCONA Summit</b> Chemtura AgroSolutions	ipconazole metalaxyl	0.902% 1.443%	4.0 fl oz per 100 lb of seed	For protection against seed rot, damping-off and seedling blight including <i>Fusarium</i> (seed and soilborne), <i>Rhizoctonia solani</i> , and seedborne <i>Diaporthe</i> ( <i>Phomopsis</i> ). Also protects against general seed rots caused by saprophytic organisms such as <i>Penicillium</i> and <i>Aspergillus</i> . RANCONA Summit provides control of Pythium and protection against Phytophthora. However, if the target field has a history of high Phytophthora pressure, RANCONA Summit may be applied in combination with a product containing metalaxyl (such as MetaStar ST) at the rate registered for your crop for increased protection. RANCONA Summit may be applied with mechanical, slurry or mist-type seed treating equipment provided that the equipment can be calibrated to accurately and uniformly apply the product to the seed.
<b>RANCONA Xtra</b> Chemtura AgroSolutions	ipconazole metalaxyl	1.029% 1.647%	3.5 fl oz per 100 lb of seed	For protection against seed rot, damping-off and seedling blight including <i>Fusarium</i> (seed and soilborne), <i>Rhizoctonia solani</i> , and seedborne <i>Diaporthe</i> ( <i>Phomopsis</i> ). Also protects against general seed rots caused by saprophytic organisms such as <i>Penicillium</i> and <i>Aspergillus</i> . RANCONA Xtra may be applied with mechanical, slurry or mist-type seed treating equipment provided that the equipment can be calibrated to accurately and uniformly apply the product to the seed. This product is for both commercial and on-farm application. Do not graze or feed livestock soybean forage or hay.
<b>RANCONA 3.8 FS</b> Chemtura AgroSolutions	ipconazole	40.70%	0.085 fl oz per 100 lb of seed	For protection against seed rot, damping-off and seedling blight including <i>Fusarium</i> (seed and soilborne), <i>Rhizoctonia solani</i> , and seedborne <i>Diaporthe</i> ( <i>Phomopsis</i> ). Also protects against general seed rots caused by saprophytic organisms such as <i>Penicillium</i> and <i>Aspergillus</i> . RANCONA 3.8 FS may be applied as a water-based slurry with other registered seed treatment insecticides and fungicides through standard slurry or mist-type commercial seed treatment equipment. Not for use on agricultural establishments in hopper-box, planter-box, slurry-box or other seed treatment applications at or immediately before planting.

Seed treatment fungicides and nematode protection products labeled for use on soybean - *continued*

Trade name Company	Common chemical name	% active ingredient	Rate	Additional label information
<b>Rizolex</b> Valent	tolclofos-methyl	42.00%	0.3 fl oz per 100 lb of seed	Provides protection against <i>Rhizoctonia solani</i> and seed-borne and soil-borne fungal pathogens that cause seed decay, damping-off and seedling blight. Use a Pythium-active fungicide combined with Rizolex Fungicide for protection against <i>Pythium</i> spp. inciting seed rot and seedling dieback. Must be used in accordance with use instructions on the label utilizing mechanical, slurry or mist type seed treating equipment. This product is for both commercial and on-farm application. Do not apply this product in hopper-box or planter-box at planting. Always mix product thoroughly before use.
<b>Sebring 318 FS</b> Nufarm Americas Inc.	metalaxyl	30.14%	0.75 to 1.5 fl oz per 100 lb of seed	For Pythium damping-off and early-season Phytophthora control. For control of other soilborne diseases, combination of captan, thiram and carboxin registered formulations are compatible. Do not use with other seed treatment products unless previous experience assures compatibility. For planter box treatment apply at the specified rate and premix with the seed directly in the planter box at planting. This product may be applied as a water-based slurry with other registered seed treatment insecticides and fungicides through standard slurry or mist-type commercial seed treatment equipment.
<b>Sebring 480 FS Fungicide</b> Nufarm Americas Inc.	metalaxyl	44.08%	0.50 to 1.00 fl oz per 100 lb of seed	For Pythium damping-off and early-season Phytophthora control. For control of other soilborne diseases, combination of captan, thiram and carboxin registered formulations are compatible. Do not use with other seed treatment products unless previous experience assures compatibility. For planter box treatment apply at the specified rate and premix with the seed directly in the planter box at planting. This product may be applied as a water-based slurry with other registered seed treatment insecticides and fungicides through standard slurry or mist-type commercial seed treatment equipment.
<b>Seed Shield Soybean</b> Helena Chemical Company	mefenoxam fludioxonil azoxystrobin thiamethoxam	1.70% 1.12% 0.90% 22.60%	3.0 fl oz per 100 lb of seed	Provides early season protection against damping-off and seed borne rots due to <i>Pythium</i> , <i>Phytophthora</i> , <i>Fusarium</i> , <i>Rhizoctonia</i> species and early-season Phytophthora root rot. Seed Shield Soybean also suppresses seed-borne <i>Sclerotinia</i> and <i>Phomopsis</i> species. If target fields have a history of high <i>Phytophthora</i> pressure, add additional Apron XL as directed in the rate table and the Apron XL label. Apply as a water-based slurry utilizing standard slurry seed treatment equipment which provides uniform seed coverage.
<b>System<sup>3</sup></b> Helena Chemical Company	PCNB metalaxyl <i>Bacillus subtilis</i>	16.67% 4.25% 0.10%	2.0 to 4.0 oz per bushel of seed	For Pythium and Rhizoctonia seedling disease complex and early-season Phytophthora. Use the higher rate of application in fields with a history of severe disease pressure. Apply at the specified rate and premix with seed directly in the planter box at planting. May also be applied at planting time using commercial seed treating equipment to maximize seed coverage.
<b>Thiram 480 DP</b> Chemtura AgroSolutions	thiram	42.00%	2.00 fl oz per 100 lb of seed	Used according to directions, Thiram 480 DP will usually increase stands and yields by reducing losses from seed decay, damping-off and seedling blights caused by many seedborne and soilborne organisms. Intended for use by professional applicators only. Not for sale or use by homeowners/consumers. Apply with mechanical, slurry, or mist-type seed treating equipment provided that the equipment is calibrated to accurately apply the product to seed.
<b>Trilex Flowable Fungicide</b> Bayer CropScience	trifloxystrobin	22.00%	0.32 fl oz per 100 lb of seed	Provides seed and seedling protection against seedborne fungi causing seed decay and the soilborne pathogen <i>Rhizoctonia solani</i> and <i>Fusarium</i> spp. Apply as a seed treatment using standard slurry or mist-type seed treatment equipment. Uniform application of seed is necessary to ensure seed safety and best disease protection. Product should be diluted with sufficient water to ensure complete seed coverage.
<b>Vibrance</b> Syngenta	sedaxane	43.70%	0.075 to 0.16 fl oz per 100 lb of seed	For control of seed decay, seedling blight and damping-off caused by <i>Rhizoctonia solani</i> . Vibrance does not control diseases caused by <i>Pythium</i> spp. or <i>Phytophthora</i> spp. If these diseases are expected to be a problem, apply with Apron XL or seed treatment products that contain mefenoxam as active ingredients. Apply as a water-based slurry using standard slurry seed treatment equipment which provides uniform seed coverage.

Seed treatment fungicides and nematode protection products labeled for use on soybean - *continued*

Trade name Company	Common chemical name	% active ingredient	Rate	Additional label information
<b>VITAFLO-280</b> Chemtura AgroSolutions	carboxin thiram	15.99% 13.25%	4.0 fl oz per 100 lb of seed	A combination of a systemic fungicide and a contact fungicide to control general seed rot, seedling blight and damping off including <i>Fusarium</i> , <i>Rhizoctonia</i> , <i>Pythium</i> and <i>Phomopsis/Diaporthe</i> (seedborne). Protects from seed rot caused by the seedborne storage fungi <i>Aspergillus</i> and <i>Penicillium</i> .  Formulated both for on-farm and commercial use. DO NOT apply VITAFLO-280 as a planter box or hopper box treatment. VITAFLO-280 may be applied with mechanical, slurry, or mist-type seed treating equipment provided that the equipment can be calibrated to accurately and uniformly apply the product to seed.  Do not graze or feed livestock on treated areas for six weeks after planting.
<b>Vitavax M</b> Helena Chemical Corporation	carboxin thiram molybdenum	5.70% 5.70% 2.90%	12.0 fl oz per 100 lb of seed	For control of various seed and seedling diseases, including <i>Rhizoctonia solani</i> .  Do not graze or feed livestock on forage and hay on treated areas.  Ready-to-use seed treatment for hopper box application.
<b>Vitavax-34</b> Chemtura AgroSolutions	carboxin	34.00%	3.0 to 4.0 fl oz per 100 lb of seed	For control of <i>Rhizoctonia solani</i> seed rots and seedling blight. The higher rate will provide increased protection when high disease pressure is expected.  May be applied with mechanical, slurry, or mist-type seed treating equipment, provided that the equipment can be calibrated to accurately and uniformly apply the product to the seed. DO NOT apply this product as a planter box or hopper box treatment.  Do not graze or feed livestock on forage or hay grown from treated seed.
<b>Warden CZ</b> Winfield Solutions, LLC	thiamethoxam mefenoxam fludioxonil	21.50% 3.21% 1.07%	3.2 fl oz per 100 lb of seed	Provides protection against damping-off and seedborne rots due to <i>Pythium</i> , <i>Phytophthora</i> , <i>Fusarium</i> and <i>Rhizoctonia</i> species and early-season <i>Phytophthora</i> root rot. Warden CZ also suppresses seedborne <i>Sclerotinia</i> and <i>Phomopsis</i> species.  If target fields have a history of high <i>Phytophthora</i> pressure, add additional Apron XL as directed in the rate table or on the Apron XL label.  Apply Warden CZ as a water-based slurry using standard slurry seed treatment equipment.
<b>Warden RTA</b> Winfield Solutions, LLC	mefenoxam fludioxonil	2.15% 0.72%	5.0 fl oz per 100 lb of seed	Protects against damping-off and seed rots due to <i>Pythium</i> , <i>Phytophthora</i> , <i>Fusarium</i> , <i>Rhizoctonia</i> spp. and early-season <i>Phytophthora</i> root rot. Also suppresses seedborne <i>Sclerotinia</i> and <i>Phomopsis</i> spp.  Especially formulated for on-farm treatment, using standard mechanical or mist-type seed treatment equipment.

**Soybean foliage diseases**

Foliage diseases such as Septoria brown spot, bacterial blight, bacterial pustule, frogeye leaf spot, downy mildew, powdery mildew and Asian soybean rust can occur on soybeans in Missouri. Generally these diseases occur in low levels or late in the season and do not cause significant losses. However, under environmental conditions favorable for disease development and especially on susceptible varieties, losses can be serious.

The fungi that cause most of these soybean foliage diseases survive in infested soybean residues left on the soil surface. The following growing season, spores are produced during moist periods and are carried by wind currents to susceptible soybean leaves. Foliage disease problems tend to be more severe when soybeans are planted in fields with infested soybean residue left on the soil surface. Eventually spores that are produced in initial lesions are windblown to other leaves or plants, causing secondary infection.

Asian soybean rust is an exception to this simplified explanation of disease development. The soybean rust fungus does not survive in infested residues left in a field and, in fact, does not survive the winter months in Missouri. Rather, the rust fungus is reintroduced each season when spores are

carried on air currents from the southern United States to Missouri. Whether Asian soybean rust develops in Missouri or not, as well as the severity of the disease if it does develop, depends on when during the season spores are blown into the state and whether weather conditions are favorable for disease development.

Most of the foliage diseases of soybeans are favored by moderate to warm temperatures, wet or humid weather and heavy dews. They tend to start on the lower leaves and, if weather conditions are favorable, move up through the canopy of the plants.

**Management options for soybean foliage diseases**

- Plant disease-free seed.
- Plant resistant varieties.
- Rotate crops with at least one year between soybean crops.
- There are foliar fungicides labeled for use on soybean to control fungal foliage diseases. Use of these foliar fungicides may be more economical on high-value fields or in years when weather is quite favorable for disease development.

When soybean rust was first found in the continental United States, a number of fungicides were granted Section 18 labels (quarantine exemption labels) for use on soybeans only if there was a threat of soybean rust and only for management of soybean rust. All of these Section 18 labels have expired. The products that had Section 18 labels have either received full federal registration and now have Section 3 labels or have been withdrawn from the market.

The following table lists foliar fungicides that have Sec-

tion 3 labels and are labeled for use on soybean. This table was prepared using current company product label books and manufacturers' Web sites. However, label registrations can change at any time. Before using any agricultural pesticide, read and follow label directions accompanying the product. Product names have been used for clarity. Reference to specific trade names does not imply endorsement by the University of Missouri; discrimination is not intended against similar products not listed.

## Foliar fungicides labeled for use on soybean

### Products with Sec. 3 labels (full federal registrations)

Trade name Company	Common chemical name	% active ingredients	Rate	Additional label information
<b>Alto 100SL</b> Syngenta	cyproconazole	8.90%	2.75 to 5.5 fl oz per acre	<p>For soybean rust: Apply 2.75 to 5.5 fl oz per acre before disease development. Repeat at 14 to 28-day interval if conditions persist for rust development. Depending on the conditions, application timing should be R1 (beginning flowering, approximately 50 days after planting) up to the R6 stage (seed fully developed), but could be earlier. Tank mixes with a strobilurin fungicide such as Quadris will optimize performance against rust. Use the 2.75 fl oz per acre rate when disease is present in the vegetative stage.</p> <p>For diseases other than soybean rust including aerial blight, Alternaria leaf spot, anthracnose, Septoria brown spot, Cercospora blight and leaf spot, frogeye leaf spot and pod and stem blight: use 4.0 to 5.5 fl oz per acre. For best results, begin Alto 100SL applications before disease development. Apply a minimum of 4.0 fl oz per acre based on local recommendations for timing and thresholds. Tank mixes with a strobilurin fungicide such as Quadris will enhance performance on these diseases.</p> <p>For maximum performance, Alto 100SL applications should begin before disease development. Use the high rates under conditions favorable for severe disease pressure, dense plant canopies or when disease is present.</p> <p>Application directions: A spreading/penetrator type adjuvant is recommended when used solo or in tank mix. NIS at 0.25% v/v is the recommended adjuvant. Coverage and penetration are important for best results. Use sufficient water volume to provide thorough and uniform plant coverage. Applications may be made by ground, air or chemigation.</p> <p>Resistance management: Do not alternate or tank mix with fungicides to which resistance has developed in the pathogen population.</p> <p>Do not apply more than 11.0 fl oz Alto 100LS per acre per season. Do not apply more than 0.072 lb a.i. per acre per year of cyproconazole containing products.</p> <p>Do not graze forage within 14 days of application. Do not use soybean forage or hay as livestock feed if making more than one application at the 5.5 fl oz per acre rate.</p> <p>Do not apply within 30 days of harvest of soybeans (beans).</p>
<b>Approach</b> DuPont	picoxystrobin	22.50%	6.0 to 12.0 fl oz per acre or 8.0 to 12.0 fl oz per acre	<p>For control or suppression of aerial web blight, anthracnose, Alternaria leaf spot, brown spot, Cercospora blight and leaf spot, purple seed stain, downy mildew, frogeye leaf spot, pod and stem blight, powdery mildew, rust and target spot. Higher rate for control or suppression of Sclerotinia stem rot.</p> <p>For all except Sclerotinia stem rot, begin applications prior to disease development and continue on a 7- to 14-day interval. Use higher rate when disease pressure is high.</p> <p>For Sclerotinia white mold: make initial preventive application at 100% bloom (1 flower blooming on all plants) and follow with 2nd application 7-10 days later at full bloom.</p> <p>Make no more than 2 sequential applications of Approach before switching to a fungicide with a different mode of action.</p> <p>The minimum pre-harvest interval between last application and harvest of grain, forage and hay is 14-days.</p> <p>Do not exceed 12.0 fl oz per acre per crop if grown for forage and hay.</p> <p>Do not exceed 36.0 fl oz per acre per crop if grown for grain (seed).</p>

Foliar fungicides labeled for use on soybean - *continued*

Products with Sec. 3 labels (full federal registrations)

Trade name Company	Common chemical name	% active ingredients	Rate	Additional label information
<b>Approach Prima</b> DuPont	picoxystrobin cyproconazole	17.94% 7.17%	5.0 to 6.8 fl oz per acre	<p>For control or suppression of aerial web blight, anthracnose, Alternaria leaf spot, brown spot, Cercospora blight and leaf spot, purple seed stain, downy mildew, frogeye leaf spot, pod and stem blight, powdery mildew, rust and target spot.</p> <p>Begin applications prior to disease development and continue on a 14 to 28-day interval. Use higher rate and shorter interval when disease pressure is high.</p> <p>Make no more than two sequential applications of picoxystrobin containing product before switching to a fungicide with a different mode of action. The minimum re-treatment interval in soybeans for Approach Prima is 14 days.</p> <p>Minimum time (PHI) between last application and harvest of grain is 30-days, forage and hay is 14-days.</p> <p>Do not exceed 13.6 fl oz per acre per crop.</p> <p>Do not use soybean forage or hay as livestock feed if making more than one application at 6.8 fl oz per acre.</p>
<b>AVARIS</b> Helena Chemical Company	azoxystrobin propiconazole	7.00% 11.70%	14.0 to 20.5 fl oz per acre	<p>Aerial web blight: Apply 14.0 to 20.5 fl oz per acre at first appearance of disease and repeat the application 14-21 days later. Under severe disease conditions use the higher rate and shorter interval.</p> <p>Anthracnose, Septoria brown spot, frogeye leaf spot, Alternaria leaf spot, Cercospora blight and leaf spot and pod and stem blight: Apply 20.5 fl oz per acre at growth stage R3 (early pod set when pods are 1/8 to 1/4 inch long and 14-21 days later at growth stage R5 (pod fill).</p> <p>Soybean rust: Apply 14.0 to 20.5 fl oz per acre at the first indication that disease is in the area. For best control, preventive applications work best. Repeat on a 14-21 day interval. Use higher rate and shorter interval when disease is present in the field and incidence is less than 2% (2 plants in 100 are infected). If incidence is greater than this or if disease is in mid canopy, control will not be acceptable.</p> <p>On certain varieties, AVARIS applications may cause crinkled, smaller and/or greener leaves. Yields of beans displaying these characteristics have not been reduced due to AVARIS treatments.</p> <p>Do not apply more than 42.0 fl oz per acre per season of AVARIS. See label for additional information on resistance management.</p> <p>AVARIS is most effective when applied and allowed to dry before a rainfall.</p> <p>For best results, sufficient coverage is important. Use a higher water volume for aerial application (greater than 2 GPA) if equipment and/or conditions would not provide good coverage.</p> <p>AVARIS may be applied by ground, air or chemigation.</p> <p>AVARIS is extremely toxic to certain apple varieties. Extreme care must be used to prevent injury to apple trees. See label for additional information.</p> <p>Do not apply within 21 days of harvest for seed and 0 days for forage and hay.</p>
<b>Bravo Ultrex</b> Syngenta	chlorothalonil	82.50%	rate varies with diseases targeted for control and application program- see next column	<p>1.4 to 2.2 lb per acre for control of anthracnose, Diaporthe pod and stem rot, frogeye leaf spot, purple seed stain, Cercospora leaf blight and Septoria brown spot with two application program. For determinate varieties, make the first application at R3 stage (early pod set) and the second application at R5. For indeterminate varieties, make the first application when largest pods are 1-1 1/4 inches in length. Make the second application 14 days later.</p> <p>0.9 to 1.4 lb per acre for control of anthracnose, Diaporthe pod and stem rot, frogeye leaf spot, purple seed stain, Cercospora leaf blight and Septoria brown spot with three application program. For determinate varieties, make the first application at the beginning of flowering (R1), the second at early pod set (R3) and the third at beginning of seed formation (R5). For indeterminate varieties, make the first application one week after first flowering and continue applications at 14-day intervals.</p> <p>0.9 lb per acre for control of stem canker. Apply in 10 to 20 gallons of water per acre, as a band treatment directing the spray to provide coverage of entire plant. Make the first application at the time of emergence of the second trifoliolate leaves (V2). If conditions favor stem canker disease make a second and a third application. Make all applications at 14-day intervals.</p> <p>Do not apply more than 5.4 lb Bravo Ultrex per acre during each growing season.</p> <p>Do not apply within 6 weeks of harvest.</p> <p>Do not feed soybean hay or threshings from treated fields to livestock.</p>



Foliar fungicides labeled for use on soybean - *continued*

Products with Sec. 3 labels (full federal registrations)

Trade name Company	Common chemical name	% active ingredients	Rate	Additional label information
<b>Bravo Weather Stik</b> Syngenta	chlorothalonil	54.00%	rate varies with diseases targeted for control and application program-see next column	1.5 to 2.25 pt per acre for control of anthracnose, Diaporthe pod and stem rot, frogeye leaf spot, purple seed stain, Cercospora leaf blight, Septoria brown spot and rust (suppression) with two-application program. For determinate varieties, make the first application at early pod set (R3 stage when majority of pods are 1/8 to 3/8 inch in length) and the second at beginning of seed formation (R5) which occurs about 14 days later. For indeterminate varieties, make the first application when largest pods are 1-1 1/2 inches in length. Make the second application 14 days later.  1.0 to 2.0 pt per acre for control of anthracnose, Diaporthe pod and stem rot, frogeye leaf spot, purple seed stain, Cercospora leaf blight, Septoria brown spot and rust (suppression) with three-application program. For determinate varieties, make the first application at the beginning of flowering (R1), the second at early pod set (R3) and the third at beginning of seed formation (R5). For indeterminate varieties, make the first application one week after first flowering and continue applications at 14 day intervals.  1.0 pt per acre for control of stem canker on determinate varieties. Apply in 10 to 20 gallons of water per acre, as a band treatment directing the spray to provide coverage of entire plant. Make the first application at the time of emergence of the second trifoliolate leaves (V2). If conditions favor stem canker disease make a second and a third application. Make all applications at 14-day intervals.  Check label for other restrictions.
<b>Bumper 41.8 EC</b> Makhteshim Agan of North America, Inc.	propiconazole	41.80%	4.0 to 6.0 fl oz per acre	For control of aerial web blight, anthracnose, Septoria brown spot, frogeye leaf spot and soybean rust.  Applications may be made using ground or aerial application equipment. Use dilution rates found in the "Application Instructions" section of the label. When applying by air, adding an oil-based additive is recommended for improved coverage and penetration.  Aerial web blight: Apply 5.0 to 6.0 fl oz at the first appearance of aerial web blight and repeat the application 14 to 21 days later. Under severe conditions, use the higher rate and shorter interval.  Other foliage diseases: Apply 6.0 fl oz at growth stage R3 (early pod set) when pods are 1/8 to 1/4 inch long and 21 days later at growth stage R5 (pod fill).  Soybean rust: apply 4.0 to 6.0 fl oz at first indication that soybean rust is in the area. For best control, preventative applications work best. Repeat on a 14- to 21-day interval using the higher rate and shorter interval when disease is present in field and incidence is less than 2% (2 plants in 100 infected). If incidence is greater than this or if disease is mid-canopy, control will not be acceptable.  On certain varieties, Bumper 41.8 EC applications may cause crinkled or smaller green leaves. Yields of beans displaying these characteristics have not been reduced due to propiconazole treatments.  Do not apply more than 12.0 fl oz of Bumper 41.8 EC per acre per season. Do not apply more than 0.34 lb a.i. propiconazole per acre per season.  Applications may be made up to growth stage R6.
<b>Bumper ES</b> Makhteshim Agan of North America, Inc.	propiconazole	40.85%	4.0 to 6.0 fl oz per acre	For aerial web blight, anthracnose, brown spot, frogeye leaf spot and soybean rust. Apply 5.0 to 6.0 fl oz at the first appearance of aerial web blight and repeat the application 14 to 21 days later. Under severe conditions, use the higher rate and shorter interval.  For control of other foliage diseases, apply 6.0 fl oz at growth stage R3 (early pod set) when pods are 1/8 to 1/4 inch long and 21 days later at growth stage R5 (pod fill).  Apply 4.0 to 6.0 fl oz at first indication that soybean rust is in the area. See label for further information on control of soybean rust.  Applications may be made by ground, air or chemigation.  On certain varieties, Bumper applications may cause crinkled or smaller greener leaves. Yields of dry beans displaying these characteristics have not been reduced due to propiconazole treatments.  Do not apply more than 12.0 fl oz per acre per season.  Applications may be made up to growth stage R6.

Foliar fungicides labeled for use on soybean - *continued*

Products with Sec. 3 labels (full federal registrations)

Trade name Company	Common chemical name	% active ingredients	Rate	Additional label information
<b>Cercobin</b> Cheminova	thiophanate- methyl	41.30%	10.9 to 21.8 fl oz per acre or 16.3 to 21.8 fl oz per acre or 21.8 fl oz per acre	<p>10.9 to 21.8 fl oz rate for anthracnose, brown spot, frogeye leaf spot, pod and stem blight and purple seed stain. Apply from full bloom to when pods are 1/8 to 1/4 inch in length. Make a second application 14 to 21 days later. Do not make the second application later than 14 days after pods average 1/4 inch in length or when beans form in the pod. Use the high rate under severe disease pressure.</p> <p>16.3 to 21.8 fl oz rate for Sclerotinia white mold. Make one application at early bloom (R1 to R2 stage) followed by a second application 7-14 days later if conditions are favorable for continued disease pressure.</p> <p>21.8 fl oz rate for suppression of aerial blight. Make initial application when disease threatens and repeat 14-21 days later if needed.</p> <p>Do not apply more than 43.6 fl oz of product per acre per year.</p> <p>Pre-harvest interval is 21 days.</p> <p>Do not graze or feed treated vines or hay to livestock.</p>
<b>Custodia</b> Makhteshim Agan of North America, Inc.	azoxystrobin tebuconazole	11.00% 18.35%	8.6 fl oz per acre	<p>Target diseases: aerial web blight, Alternaria leaf spot, anthracnose, brown spot, Cercospora blight and leaf spot, frogeye leaf spot, pod and stem blight, soybean rust and powdery mildew.</p> <p>Apply as a preventive spray prior to disease development. Repeat applications on a 10- to 14- day spray interval if environmental conditions are favorable for continued disease development. Use a shorter interval when disease pressure is severe.</p> <p>Tank mix with the lowest labeled rate of a spray surfactant.</p> <p>Do not apply more than 25.9 fl oz per acre per crop.</p> <p>Applications may not be made within 21 days of harvest.</p> <p>Restricted-entry interval is 12 hours.</p>
<b>Domark 230 ME</b> Valent	tetraconazole	20.50%	4.0 to 5.0 fl oz per acre	<p>Target diseases: Asian soybean rust, Cercospora blight, purple seed stain, frogeye leaf spot, white mold/Sclerotinia stem rot, powdery mildew, Septoria brown spot and anthracnose.</p> <p>Apply prior to disease development when infections are likely to occur. If necessary repeat with a second application before growth stage R6. Curative applications are most effective when disease incidence does not exceed 5% of the soybean plants at time of application.</p> <p>Make application at soybean growth stage R3 (early pod fill) or when conditions are favorable for disease development. Repeat application 15 to 21 days after first application if disease pressure is heavy.</p> <p>Under severe disease conditions the higher rate and shorter spray interval should be used.</p> <p>Apply as a foliar spray or via chemigation in sufficient water to obtain thorough coverage of soybeans.</p> <p>Do not make more than two (2) applications of Domark 230 ME to soybeans per year. Do not apply more than 10 fl oz of Domark 230 ME per acre per season.</p> <p>A restricted entry interval (REI) of 12 hours is to be followed.</p> <p>Do not graze or feed soybean forage or hay to livestock.</p> <p>Do not harvest immature soybeans for consumption once plants are treated with Domark 230 ME. Do not use on vegetable soybean varieties grown for their immature pods.</p> <p>Do not apply Domark 230 ME after soybean growth stage R5 (beginning seed).</p>

Foliar fungicides labeled for use on soybean - *continued*

Products with Sec. 3 labels (full federal registrations)

Trade name Company	Common chemical name	% active ingredients	Rate	Additional label information
<b>Echo 90DF</b> SIPCAM AGRO USA, INC.	chlorothalonil	90.00%	rate varies with diseases targeted for control and application program- see next column	1.25 to 2.0 lb Echo 90 DF per acre, 1.5 to 2.5 pt Echo 720 per acre or 2.0 to 3.5 pt Echo Zn per acre for control of anthracnose, Diaporthe pod and stem rot, frogeye leaf spot, purple seed stain, Cercospora leaf blight, Septoria brown spot and rust with two-application program. For determinate varieties, make the first application at early pod set (R3 stage) and the second seed formation (R5). For indeterminate varieties, make the first application when largest pods are 1 to 1½ inches in length. Make the second application 14 days later.
<b>Echo 720</b> SIPCAM AGRO USA, INC.	chlorothalonil	54.00%	rate varies with diseases targeted for control and application program- see next column	0.875 to 1.625 lb Echo 90 DF per acre, 1.0 to 2.0 pt Echo 720 per acre or 1.5 to 2.75 pt Echo Zn per acre for control of anthracnose, Diaporthe pod and stem rot, frogeye leaf spot, purple seed stain, Cercospora leaf blight, Septoria brown spot and rust with three-application program. For determinate varieties, make the first application at early flowering (R1), the second at early pod set (R3) and the third at beginning of seed formation (R5). For indeterminate varieties, make the first application one week after first flowering and continue applications at 14 day intervals.
<b>Echo Zn</b> SIPCAM AGRO USA, INC.	chlorothalonil	38.50%	rate varies with diseases targeted for control and application program- see next column	0.875 lb Echo 90 DF per acre, 1.0 pt Echo 720 per acre or 1.5 pt Echo Zn per acre for control of stem canker. Apply in 10 to 20 gallons of water per acre, as a band treatment directing the spray to provide coverage of entire plant. Make the first application at the time of emergence of the second trifoliolate leaves (V2). If conditions favor stem canker disease make a second and a third application. Make all applications at 14-day intervals.  Do not feed soybean hay or threshings from treated fields to livestock.  Preharvest interval (PHI) of 42 days.
<b>Equation</b> Cheminova	azoxystrobin	22.80%	6.0 to 15.5 fl oz per acre	Target diseases: aerial blight, Alternaria leaf blight, anthracnose, brown spot, Cercospora blight and leaf spot, frogeye leaf spot, pod and stem blight and rust.  Apply preventatively or when conditions are favorable for disease development. Use the higher rates when environmental conditions are conducive for disease development.  For multiple applications refer to the guidelines under Resistance Management on the label.  Do not apply more than 92.3 fl oz per acre of product per acre per season.  Do not make more than one application of 15.5 fl oz of product per acre to soybean forage and hay.  Restricted entry interval is 4 hours.  Preharvest interval: do not apply within 14 days of harvest of soybeans.  Preharvest interval: may be applied the day of harvest to soybean forage and hay.
<b>Equus DF</b> Makhteshim Agan of North America, Inc.	chlorothalonil	82.50%	rate varies with diseases targeted for control and application program- see next column	1.4 to 2.1 lb Equus DF per acre, 2.1 to 3.4 pt per acre Equus 500 Zn or 1.5 to 2.4 pt per acre Equus 720 SST for control of anthracnose, Diaporthe pod and stem blight, frogeye leaf spot, purple seed stain, Cercospora leaf blight and Septoria brown spot with two-application program. Make the first application at early pod set (R3) stage, when majority of pods are 1/8 to 1/4 inch in length) and the second at beginning of seed formation (R5) which occurs about 14 days later.
<b>Equus 500 Zn</b> Makhteshim Agan of North America, Inc.	chlorothalonil	38.50%	rate varies with diseases targeted for control and application program- see next column	0.9 to 1.4 lb Equus DF, 1.4 to 2.8 pt per acre of Equus 500 Zn per acre or 1.0 or 2.0 pt per acre of Equus 720 SST for control of anthracnose, Diaporthe pod and stem blight, frogeye leaf spot, purple seed stain, Cercospora leaf blight and Septoria brown spot with three-application program. Make the first application at the beginning of flowering (R1), the second at early pod set (R3) and the third at the beginning of seed formation (R5). Make all applications at 14-day intervals.
<b>Equus 720 SST</b> Makhteshim Agan of North America, Inc.	chlorothalonil	54.00%	rate varies with diseases targeted for control and application program- see next column	For control of stem canker apply 0.9 lb Equus DF per acre or 1.0 pt per acre Equus 720 SST on determinate or indeterminate soybean varieties or 1.4 pt per acre of Equus 500 Zn on determinate soybean varieties. Apply in 10 to 20 gallons of water per acre, as a directed band treatment, directing spray to provide coverage of entire plant. Make the first application at the time of emergence of the second trifoliolate leaves (V2). If conditions favor stem canker disease, make a second and a third application. Make all applications at 14-day intervals.  1.25 to 2.2 lb Equus DF per acre or 1.37 to 2.25 pt per acre Equus 720 SST for control of soybean rust. Apply in sufficient water to obtain complete coverage, generally 10 to 20 gallons per acre. Make first application at first sign of disease and retreat at 14-day intervals. For resistance management of rust, alternate with another fungicide registered for soybean rust control.  Do not exceed a total of three applications per season.  Do not apply within 6 weeks of harvest.  Do not feed treated parts to live stock or allow grazing in treated fields.

Foliar fungicides labeled for use on soybean - *continued*

Products with Sec. 3 labels (full federal registrations)

Trade name Company	Common chemical name	% active ingredients	Rate	Additional label information
<b>EVITO 480 SC</b> Arysta LifeScience North America, LLA	fluoxastrobin	40.30%	2.0 to 5.7 fl oz per acre	<p>Diseases controlled: Alternaria leaf spot, anthracnose, Septoria brown spot, Cercospora blight, frogeye leaf spot, pod and stem blight, Rhizoctonia aerial blight and rust.</p> <p>Begin applications preventively and continue as needed on a 14- to 21-day interval. Apply a maximum of two applications per season no later than growth stage R5.</p> <p>May be used in combination with a registered triazole fungicide to increase efficacy for soybean rust.</p> <p>Do not apply more than 11.4 fl oz per acre per year. There is a maximum number of 2 applications per year and a minimum interval of 14 days between applications.</p> <p>May be applied by ground, air or through chemigation.</p> <p>Do not apply after R5. Do not apply within 3 days of forage harvest or 30 days of seed harvest.</p>
<b>EVITO T Fungicide</b> Arysta LifeScience North America, LLC	fluoxastrobin tebuconazole	18.00% 25.00%	4.0 to 6.0 fl oz per acre	<p>Diseases controlled: Alternaria leaf spot, anthracnose, Septoria brown spot, Cercospora blight, frogeye leaf spot, pod and stem blight, Rhizoctonia aerial blight and rust.</p> <p>Begin applications preventively and continue as needed on a 14- to 21-day interval. Apply a maximum of two applications per season no later than growth stage R5. Do not apply more than 12.0 fl oz per acre per crop season.</p> <p>Maximum retreatment interval is 14 days.</p> <p>Do not apply EVITO T Fungicide within 21 days of forage harvest or 30 days of seed harvest.</p>
<b>Fortix Fungicide</b> Cheminova	fluoxastrobin flutriafol	14.84% 19.30%	4.0 to 6.0 fl oz per acre	<p>For control of Alternaria leaf spot, anthracnose, brown spot, Cercospora blight and purple seed stain, frogeye leaf spot, pod and stem blight, powdery mildew, Rhizoctonia aerial blight, rust, Sclerotinia stem rot (white mold) and suppression of southern blight.</p> <p>Begin applications preventatively and continue as needed on a 14 to 21 day interval. Apply a maximum of two applications per season no later than growth stage R5.</p> <p>Do not apply more than 12.0 fl oz per acre per crop season.</p> <p>Do not make more than two applications per season.</p> <p>The minimum retreatment interval is 14 days.</p> <p>Do not apply within 21 days of forage harvest or 30 days of seed harvest.</p> <p>Do not feed forage or hay to animals or permit animals to graze.</p>
<b>Headline</b> BASF	pyraclostrobin	23.60%	6.0 to 12.0 fl oz per acre	<p>Target diseases: Alternaria leaf spot, anthracnose, Septoria brown spot, Cercospora blight, frogeye leaf spot, pod &amp; stem blight, Rhizoctonia aerial blight and Asian soybean rust. The 12.0 fl oz per acre rate is for suppression only of southern blight.</p> <p>For optimal disease control, apply Headline at early flowering (R1-R3 growth stage) or before disease development, whichever is earlier. Make a second application 7 to 21 days later if monitoring shows disease development or if conditions are conducive for disease infection. Use the higher labeled rate and shorter interval when disease pressure is high.</p> <p>Headline may be applied with adjuvants. It may be applied by ground sprayer, aerial equipment or through sprinkler irrigation systems.</p> <p>See label for information on resistance management.</p> <p>Soybean forage may be fed no sooner than 14 days after last application. Soybean hay may be fed no sooner than 21 days after last application.</p> <p>The minimum time from application to harvest (PHI) is 21 days.</p>

Foliar fungicides labeled for use on soybean - *continued*

Products with Sec. 3 labels (full federal registrations)

Trade name Company	Common chemical name	% active ingredients	Rate	Additional label information
<b>Incognito 4.5F Fungicide</b> Makhteshim Agan of North America, Inc.	thiophanate-methyl	46.20%	rate varies with diseases targeted for control and application	10.0 to 20.0 fl oz of Incognito 4.5F Fungicide or 0.4 to 0.8 lb of Incognito 85WDG Fungicide per acre for anthracnose, Septoria brown spot, frogeye leaf spot, stem and pod blight and purple seed stain. Apply from full bloom when pods are 1/8 to 1/4 inch in length. Make a second application 14 to 21 days later. Do not make the second application later than 14 days after pods average 1/4 inch in length or when beans form in the pod. Use the high rate under severe disease pressure.
				Use 15.0 to 20.0 fl oz of Incognito 4.5F Fungicide or 0.6 to 0.8 lb of Incognito 85WDG Fungicide per acre for white mold. Make one application at early bloom (R1 to R2 stage) followed by a second application 14 days later if conditions are favorable for continued disease pressure. Thorough coverage of the flowers, stems and branches is essential for disease control.  Use 20.0 fl oz of Incognito 4.5 F Fungicide or 0.8 lb or Incognito 85WDG per acre for aerial blight suppression. Make initial application when disease threatens (before visual symptoms appear) and repeat 14-21 days later if needed. Applications later than 14 days after pods average 1/4 inch in length are prohibited.  Do not apply more than 40.0 fl oz of Incognito 4.5F Fungicide per acre per year. Do not make more than two applications per year.  Do not graze or feed treated vines or hay to livestock.  The REI is 1 day.  The PHI is 21 days.
<b>Incognito 85WDG Fungicide</b> Makhteshim Agan of North America, Inc.	thiophanate-methyl	85.00%	program-see next column	Use 15.0 to 20.0 fl oz of Incognito 4.5F Fungicide or 0.6 to 0.8 lb of Incognito 85WDG Fungicide per acre for white mold. Make one application at early bloom (R1 to R2 stage) followed by a second application 14 days later if conditions are favorable for continued disease pressure. Thorough coverage of the flowers, stems and branches is essential for disease control.  Use 20.0 fl oz of Incognito 4.5 F Fungicide or 0.8 lb or Incognito 85WDG per acre for aerial blight suppression. Make initial application when disease threatens (before visual symptoms appear) and repeat 14-21 days later if needed. Applications later than 14 days after pods average 1/4 inch in length are prohibited.  Do not apply more than 40.0 fl oz of Incognito 4.5F Fungicide per acre per year. Do not make more than two applications per year.  Do not graze or feed treated vines or hay to livestock.  The REI is 1 day.  The PHI is 21 days.
<b>Initiate 720 Flowable Fungicide</b> Loveland Products Inc.	chlorothalonil	54.00%	rate varies with diseases targeted for control and application program-see next column	1.5 to 2.25 pt per acre for anthracnose, Diaporthe pod and stem blight, frogeye leaf spot, purple seed stain, Cercospora leaf blight, Septoria brown spot soybean rust (suppression) with a two application program. For determinate varieties make the first application at early pod set (R3 stage when majority of pods are 1/8 to 3/8 inch in length) and the second at the beginning of seed formation (R5) which occur about 14 days later. For indeterminate varieties make the first application when largest pods are 1 to 1 1/2 inches in length and make the second application 14 days later.  Use 1.0 to 2.0 pt per acre for anthracnose, Diaporthe pod and stem blight, frogeye leaf spot, purple seed stain, Cercospora leaf blight, Septoria brown spot soybean rust (suppression) with a three application program. For determinate varieties make the first application at the beginning of flowering (R1), the second at early pod set (R3) and the third at the beginning of seed formation (R5). For indeterminate varieties make the first application one week after first flowering and continue applications at 14-day intervals.  Use 1.0 pt per acre for stem canker. For determinate varieties apply in 10 to 20 gallons of water per acre, as a band treatment directing spray to provide coverage of entire plant. Make the first application at the time of emergence of the second trifoliolate leaves (V2). If conditions favor stem canker disease make a second and third application. Make all applications at 10- to 14-day intervals.  Apply in sufficient water to obtain complete coverage, using at least five gallons of water per acre for aerial application. Use the three application program in areas having a history of moderate to severe disease intensity.  Initiate 720 Flowable Fungicide may be applied through sprinkler irrigation equipment- see label for directions.  The minimum re-treatment interval is 14 days.  Do not exceed a total of three applications per season. Do not apply more than 6 pt per acre during each growing season.  Do not feed treated parts to livestock or allow grazing in treated areas.  Do not apply within 6 weeks of harvest.

Foliar fungicides labeled for use on soybean - *continued*

Products with Sec. 3 labels (full federal registrations)

Trade name Company	Common chemical name	% active ingredients	Rate	Additional label information
<b>Initiate ZN Flowable Fungicide</b> Loveland Products Inc.	chlorothalonil	38.50%	rate varies with diseases targeted for control and application program- see next column	<p>2.25 to 3.25 pt per acre for anthracnose, Diaporthe pod and stem blight, frogeye leaf spot, purple seed stain, Cercospora leaf blight, Septoria brown spot soybean rust (suppression) with a two-application program. For determinate varieties make the first application at R3 (early pod set) and the second application at R5 (seed formation). For indeterminate varieties make the first application when largest pods are 1 to 1¼ inches in length and make the second application 14 days later.</p> <p>Use 1.5 to 2.75 pt per acre for anthracnose, Diaporthe pod and stem blight, frogeye leaf spot, purple seed stain, Cercospora leaf blight, Septoria brown spot soybean rust (suppression) with a three-application program. For determinate varieties make the first application at the beginning of flowering (R1), the second at early pod set (R3) and the third at the beginning of seed formation (R5). For indeterminate varieties make the first application one week after first flowering and continue applications at 14-day intervals.</p> <p>Use 1.5 pt per acre for stem canker. Apply in 10 to 20 gallons of water per acre, as a band treatment directing spray to provide coverage of entire plant. Make the first application at the time of emergence of the second trifoliolate leaves (V2). If conditions favor stem canker disease make a second and third application. Make all applications at 10- to14-day intervals.</p> <p>Apply in sufficient water to obtain complete coverage, using at least five gallons of water per acre for aerial application. Use the three application program in areas having a history of moderate to severe disease intensity.</p> <p>Initiate ZN may be applied by ground, air or chemigation.</p> <p>The minimum re-treatment interval is 14 days.</p> <p>Do not apply more than 8.5 pt per acre during each growing season.</p> <p>Do not feed hay or threshings from treated fields to livestock.</p> <p>Do not apply within 6 weeks of harvest.</p>
<b>Laredo EC</b> Dow AgroSciences	myclobutanil	25.00%	4.0 to 8.0 fl oz per acre	<p>For control of soybean rust.</p> <p>Apply using ground or aerial equipment, in an adequate spray volume to achieve good coverage and canopy penetration. For aerial application, apply Laredo EC in a minimum spray volume of 5 gallons per acre. For best results apply preventively or as early as possible after an infection has occurred (a delay in fungicide application after an infection period has already occurred may result in yield loss), and make a subsequent application 14 to 21 days later. For maximum residual activity when used as a preventive treatment or optimum activity on established disease, use the higher rate in the rate range.</p> <p>Do not allow worker entry into treated areas during the restricted entry interval of 24 hours.</p> <p>Do not feed soybean forage or hay to livestock.</p> <p>Do not make more than two applications of myclobutanil-containing products to soybeans per season. Do not apply more than 16.0 fl oz of Laredo EC to soybeans per acre per year.</p> <p>Do not make applications within 28 days of harvest.</p>
<b>Microthiol</b> United Phosphorus, Inc.	sulfur	80.00%	10.0 to 15.0 lb per acre	<p>For leaf spot and powdery mildew. Apply at early leaf stage and repeat at 14-day intervals or as needed.</p>
<b>Monsoon</b> Loveland Products Inc.	tebuconazole	38.70%	3.0 to 4.0 fl oz per acre	<p>For soybean rust and powdery mildew.</p> <p>Apply Monsoon as a broadcast foliar spray, as a preventative spray or at first visible symptoms of disease. Repeat applications on a 10- to14-day spray interval if environmental conditions are favorable for continued disease development.</p> <p>Use of the higher rates and shorter spray interval are recommended when disease pressure is severe. The lowest label recommended rate of a spray surfactant must be tank-mixed with Monsoon.</p> <p>Monsoon should be applied in a minimum of 10 gallons of spray solution per acre by ground sprayer or in a minimum of 5 gallons per acre by aircraft spray equipment.</p> <p>Do not apply more than three applications per season. Do not apply more than 12 fl oz per acre per use season.</p> <p>Restricted-entry interval (REI) is 12 hours.</p> <p>Applications may not be made within 21 days of harvest.</p>

Foliar fungicides labeled for use on soybean - *continued*

Products with Sec. 3 labels (full federal registrations)

Trade name Company	Common chemical name	% active ingredients	Rate	Additional label information
<b>Muscle 3.6F</b> SIPCAM AGRO USA, Inc.	tebuconazole	38.70%	3.0 to 4.0 fl oz per acre	<p>For soybean rust.</p> <p>At the first sign of rust pustules on foliage make a spray application of this product. If environmental conditions are favorable for continued development, make a second application after 10-21 days dependent upon the severity of the disease pressure. Observe fields closely for early disease symptoms.</p> <p>For optimum benefit, the lowest specified rate of a spray surfactant should be tank mixed with this product.</p> <p>Do not apply more than 0.225 fl of the active ingredient, tebuconazole, per acre per year and make no more than three applications of this product per season.</p> <p>Apply this product in a minimum of 10 gallons of spray suspension per acre by ground sprayer or in a minimum of 5 gallons of spray suspension per acre by aircraft.</p> <p>Do not enter the treated fields within 12 hours of application.</p> <p>Preharvest interval (PHI) is 21 days.</p>
<b>Orius 3.6F</b> Makhteshim Agan of North America, Inc.	tebuconazole	38.70%	3.0 to 4.0 fl oz per acre	<p>Soybean rust and powdery mildew.</p> <p>Apply Orius 3.6F as a broadcast foliar spray, as a preventative spray or at first visible symptoms of disease. Repeat applications on a 10- to 14-day spray interval if environmental conditions are favorable for continued disease development. Use of the higher rates and shorter spray intervals are recommended when disease pressure is severe.</p> <p>The lowest labeled rate of a spray surfactant must be tank-mixed with Orius 3.6F.</p> <p>Orius 3.6F should be applied in a minimum of 10 gallons of spray solution per acre by ground sprayer or in a minimum of 5 gallons per acre by aircraft spray equipment.</p> <p>Do not apply more than three applications per season. Do not apply more than 12.0 fl oz per acre per season.</p> <p>Restricted-entry interval (REI) is 12 hours.</p> <p>Applications may not be made within 21 days of harvest.</p>
<b>Priaxor Xemium Brand Fungicide</b> BASF	fluxapyroxad pyraclostrobin	14.33% 28.58%	4.0 to 8.0 fl oz per acre	<p>Target diseases: Alternaria leaf spot, anthracnose, Asian soybean rust, Septoria brown spot, Cercospora blight, frog-eye leaf spot, pod and stem blight and Rhizoctonia aerial blight. For suppression only of Scelrotinia blight and 8.0 fl oz rate for suppression only of southern blight.</p> <p>For optimal disease control, begin applications prior to disease development and continue on a 7- to 14-day interval if conditions are conducive for disease development. Use the higher rate and shorter interval when disease pressure is high. Priaxor may be used with adjuvants.</p> <p>Do not apply more than 16.0 fl oz per acre per season. Do not make more than two consecutive applications of Priaxor before alternating to a labeled fungicide with a different mode of action.</p> <p>Soybean forage may be fed no sooner than 14 days after last application. Soybean hay may be fed no sooner than 21 days after last treatment.</p> <p>Minimum time from application to harvest is 21 days.</p>
<b>Proline 480 SC</b> Bayer CropScience	prothioconazole	41.00%	2.5 to 3.0 fl oz per acre	<p>For control of Asian soybean rust, frog-eye leaf spot and powdery mildew.</p> <p>Apply Proline 480 SC as a broadcast foliar spray, as a preventative spray or at first visible symptoms of disease. Repeat applications on a 10- to 21-day spray interval if environmental conditions are favorable for continued disease development. Use of the higher rate and shorter spray intervals are recommended when disease pressure is severe.</p> <p>Proline 480 SC may be applied by either ground, aerial or chemigation application equipment. For aerial application apply in a minimum spray volume of 2 gallons per acre.</p> <p>Do not apply more than three applications per season. Do not apply more than 9.0 fl oz per use season.</p> <p>Applications may not be made within 21 days of harvest.</p>

Foliar fungicides labeled for use on soybean - *continued*

Products with Sec. 3 labels (full federal registrations)

Trade name Company	Common chemical name	% active ingredients	Rate	Additional label information
<b>Propiconazole 41.8%</b> AmTide LLC	propiconazole	41.80%	4.0 to 6.0 fl oz per acre	<p>For aerial web blight, anthracnose, Septoria brown spot, frogeye leaf spot and soybean rust.</p> <p>Aerial web blight: Time applications to occur when disease first develops and apply 5.0 to 6.0 fl oz per acre. Make one repeat application at 14- to 21-day interval. Use the highest rate and shorter spray interval when disease conditions are severe.</p> <p>Other foliage diseases: Time applications to begin at growth stage R3 (early pod set; pods are 1/8 to 1/4 inch long) and apply 6.0 fl oz per acre. Make one repeat application at 14- to 21-day interval when growth stage in R5 (pod fill).</p> <p>Soybean rust: Time applications to occur when disease has been reported in the area since preventative applications will provide the best results. Use 4.0 to 6.0 fl oz per acre. Make repeat applications at 14- to 21-day intervals. Use the highest rate and shorter spray interval when disease is detected in the field or if less than 2 out of every 100 plants are infected. Control will be less acceptable when more plants are infected or if the disease is mid-canopy.</p> <p>Some varieties may develop crinkled, smaller and/or greener leaves from applications of AmTide Propiconazole 41.8%, however bean yields are not reduced as a result of the applications.</p> <p>Maximum application rate is 12.0 fl oz per acre per season.</p> <p>Do not apply after Stage R6.</p>
<b>Quadris</b> Syngenta	azoxystrobin	22.90%	6.0 to 15.4 fl oz per acre  0.40 to 0.80 fl oz per 1000 row feet for soilborne diseases- southern blight or <i>Rhizoctonia solani</i>	<p>Target diseases include aerial blight, anthracnose, Alternaria leaf spot, Septoria brown spot, Cercospora blight and leaf spot, frogeye leaf spot, pod and stem blight and rust.</p> <p>Quadris applications should begin before disease development. Use the high rates under conditions favorable for disease pressure, dense plant canopies, or when susceptible varieties are planted.</p> <p>Resistance management: Follow the resistance management guidelines in the resistance management section of the Quadris label.</p> <p>Applications may be made by ground, air or chemigation. An adjuvant may be added at recommended rates. Use of a crop oil concentrate or nonionic surfactant with the lower use rate is recommended.</p> <p>Soybean rust: Quadris may be used at 4.0 fl oz per acre when tank mixed with triazole registered for use on soybean rust.</p> <p>Quadris is extremely toxic to certain apple varieties. See "Ground Use Instructions" on label for additional information on safety precautions to avoid injury to apple trees.</p> <p>Do not apply more than 1.5 lb a.i. per acre per season.</p> <p>Do not make more than one application of 15.4 fl oz product/acre to soybean forage and hay.</p> <p>May be applied the day of harvest to soybean forage and hay.</p> <p>Do not apply within 14 days of harvest of soybeans (beans).</p>
<b>Quadris Top</b> Syngenta	azoxystrobin difenoconazole	18.20% 11.40%	8.0 to 14.0 fl oz per acre	<p>Target diseases: Alternaria leaf spot, anthracnose, brown spot, Cercospora blight and leaf spot, frogeye leaf spot, pod and stem blight and powdery mildew.</p> <p>Begin applications prior to disease onset when conditions are conducive for disease. Apply Quadris Top on a 7- to 10-day schedule making no more than 2 sequential applications before alternating to another fungicide with a different mode of action.</p> <p>If disease pressure is high, use the shortest interval and highest rate.</p> <p>Do not apply more than 26.5 fl oz per acre per season.</p> <p>Do not feed soybean hay, forage and silage.</p> <p>Do not apply within 14 days of harvest (14-day PHI).</p>



Foliar fungicides labeled for use on soybean - *continued*

Products with Sec. 3 labels (full federal registrations)

Trade name Company	Common chemical name	% active ingredients	Rate	Additional label information
<b>Quadris Xtra</b> Syngenta	azoxystrobin cyproconazole	18.20% 7.30%	4.0 to 6.8 fl oz per acre	<p>For soybean rust: Apply 4.0 to 6.8 fl oz per acre. Repeat at 14- to 28-day interval, if conditions persist for rust development. Lower use rates may require a shorter spray interval. Depending on the conditions, application timing should be R1 (beginning flowering, approximately 50 days after planting) up to the R6 stage (seed development), but could be earlier.</p> <p>For disease other than soybean rust including aerial blight, Alternaria leaf spot, anthracnose, Septoria brown spot, Cercospora blight and leaf spot, frog-eye leaf spot and pod and stem blight: Apply 5.0 to 6.8 fl oz per acre. For best results begin Quadris Xtra applications before disease development. Use the higher rates under conditions favorable for severe disease pressure, dense plant canopies or when disease is present. An adjuvant may be added at recommended rates to improve coverage.</p> <p>Application directions: Coverage and penetration are important for best results. Use sufficient water volume to provide thorough and uniform plant coverage. Applications may be made by ground, air or chemigation. Addition of an additive with spreading and penetrating qualities will enhance coverage and efficacy.</p> <p>Resistance management: No more than two foliar applications of Quadris Xtra or other strobilurin fungicides should be made per growing season. Do not alternate or tank mix with fungicides to which resistance has developed in the pathogen population.</p> <p>Do not apply more than 13.6 fl oz Quadris Xtra per acre per season. Do not apply more than 0.072 lb a.i. per acre per year of cyproconazole-containing products. Do not apply more than 1.5 lb a.i. per acre per year of azoxystrobin-containing products.</p> <p>Quadris Xtra is extremely toxic to certain apple varieties. See "General Use Instructions" on label for additional information on safety precautions to avoid injury to apple trees.</p> <p>Do not graze forage within 14 days of application. Do not use soybean forage or hay as livestock feed if making more than one application at 6.8 fl oz per acre rate.</p> <p>Do not apply within 30 days of harvest of soybeans (beans).</p>
<b>Quilt</b> Syngenta	azoxystrobin propiconazole	7.00% 11.70%	14.0 to 20.5 fl oz per acre	<p>Target diseases: Aerial web blight (<i>Rhizoctonia solani</i>), anthracnose (<i>Colletotrichum truncatum</i>), brown spot (<i>Septoria glycines</i>), frog-eye leaf spot (<i>Cercospora sojina</i>), soybean rust (<i>Phakopsora pachyrhizi</i>), Alternaria leaf spot (<i>Alternaria</i> spp.) Cercospora blight and leaf spot (<i>Cercospora kickuchii</i>) and pod and stem blight (<i>Diaporthe</i> spp.).</p> <p>Aerial web blight: Apply 14.0 to 20.5 fl oz per acre at the first appearance of disease and repeat the application 14 to 21 days later. Under severe disease conditions use the higher rate and the shorter interval.</p> <p>Other foliar diseases (except rust): apply 20.5 fl oz per acre at growth stage R3 (early pod set when pods are 1/8 to 1/4 inch long) and 14 to 21 days later at growth stage R5 (pod fill).</p> <p>Soybean rust: Apply 14.0 to 20.5 fl oz per acre at first indication that disease is in the area. For best control, preventive applications work best. Repeat on a 14- to 21-day interval. Use the higher rate and shorter interval when disease is present in the field and incidence is less than 2% (2 plants in 100 are infected). If incidence is greater than this or disease is in mid canopy, control will not be acceptable. Scouting for the disease and/or being aware of the proximity of the disease via monitoring systems will aid in the proper timing to maximize the effectiveness of the fungicide applications.</p> <p>On certain varieties, Quilt applications may cause crinkled, smaller and/or greener leaves. Yields of beans displaying these characteristics have not been reduced due to Quilt treatments.</p> <p>Quilt is extremely toxic to certain apple varieties. See "General Use Instructions" on label for additional information on safety precautions to avoid injury to apple trees.</p> <p>Do not apply more than 42.0 fl oz per acre per season of Quilt.</p> <p>Do not apply within 21 days of harvest for seed and 0 days for forage and hay.</p>

Foliar fungicides labeled for use on soybean - *continued*

Products with Sec. 3 labels (full federal registrations)

Trade name Company	Common chemical name	% active ingredients	Rate	Additional label information
<b>Quilt Xcel</b> Syngenta	azoxystrobin propiconazole	13.50% 11.70%	10.5 to 21.0 fl oz per acre	<p>For aerial web blight, anthracnose, Septoria brown spot, frogeye leaf spot, soybean rust, Alternaria leaf spot, Cercospora and pod and stem blight.</p> <p>Foliar diseases (except rust): apply 14.0 to 21.0 fl oz per acre at growth stage R3 (early pod set) when pods are 1/8 to 1/4 inch long and 14-21 days later at growth stage R5 (pod fill). Quilt Xcel may be applied earlier should conditions be conducive for disease.</p> <p>Soybean rust: apply 14.0 to 21.0 fl oz per acre at first indication that disease is in the area. For best control, preventive applications work best. Repeat on a 14-21 day interval. Use higher rate and shorter interval when diseases are present in the field and incidence is less than 2% (2 plants in 100 are infected). If incidence is greater than this or if disease is in mid-canopy, control will not be acceptable.</p> <p>On certain varieties, Quilt Xcel applications may cause crinkled, smaller and/or greener leaves. Yields of beans displaying these characteristics have not been reduced due to Quilt Xcel treatments.</p> <p>Do not apply more than 42.0 fl oz per acre of Quilt Xcel per crop.</p> <p>Apply up to R6 soybean stage of growth.</p>
<b>Satori Fungicide</b> Loveland Products	azoxystrobin	22.90%	6.0 to 15.5 fl oz per acre	<p>Target diseases: aerial blight, Alternaria leaf blight, anthracnose, brown spot, Cercospora blight and leaf spot, frogeye leaf spot, pod and stem blight rust.</p> <p>Begin applications prior to disease development. Use the high rates under conditions favorable for severe disease pressure, dense plant canopies, or when susceptible varieties are planted.</p> <p>Applications may be made by ground, air or chemigation.</p> <p>See label for information and restrictions related to resistance management.</p> <p>Do not apply more than 92.3 fl oz of product per acre per season.</p> <p>Do not make more than one application of 15.5 fl oz per acre to soybean forage and hay.</p> <p>Do not apply within 14 days of harvest of soybeans.</p> <p>May be applied the day of harvest to soybean forage and hay.</p>
<b>Stratego</b> Bayer CropScience	propiconazole trifloxystrobin	11.40% 11.40%	10.0 fl oz per acre	<p>For control of Alternaria leaf spot, anthracnose, Asian soybean rust, Septoria brown spot, Cercospora blight, frogeye leaf spot, pod &amp; stem blight, powdery mildew and Rhizoctonia aerial blight.</p> <p>Apply Stratego as a broadcast foliar spray at early flowering (R1 to R3 growth stage) or before disease development, whichever is earlier. Repeat applications on a 10- to 21-day spray interval if disease monitoring or environmental factors indicate favorable conditions for continued disease development.</p> <p>Use of adjuvants may enhance the performance of Stratego. If utilized, apply the lowest label recommended rate of the adjuvant to enhance disease control.</p> <p>Applications may be made by ground, air or chemigation.</p> <p>Do not apply more than three applications per season. Do not apply more than 30.0 fl oz per acre per season.</p> <p>Do not apply more than two sequential applications of Stratego or any other QoI Group 11 fungicide without alternation with a fungicide from another group.</p> <p>Applications may not be made within 21 days of harvest.</p>
<b>Stratego YLD Fungicide</b> Bayer CropScience	prothioconazole trifloxystrobin	10.80% 32.30%	4.0 to 4.65 fl oz per acre	<p>For control of Alternaria leaf spot, anthracnose, Asian soybean rust, Septoria brown spot, Cercospora blight, frogeye leaf spot, pod &amp; stem blight, powdery mildew and Rhizoctonia aerial blight.</p> <p>Apply Stratego YLD Fungicide as a broadcast foliar spray at early flowering or before disease development, whichever is earlier. Repeat applications on a 10- to 21-day spray interval if disease monitoring or environmental factors indicate favorable conditions for continued disease development. Use of the higher rates and shorter spray intervals are recommended when disease pressure is severe.</p> <p>Stratego YLD Fungicide may be applied by ground, air or chemigation.</p> <p>Do not apply more than three applications per season. Do not apply more than 13.95 fl oz per acre per use season.</p> <p>Do not graze or feed soybean forage or hay. Applications may not be made within 21 days of harvest.</p>

Foliar fungicides labeled for use on soybean - *continued*

Products with Sec. 3 labels (full federal registrations)

Trade name Company	Common chemical name	% active ingredients	Rate	Additional label information
<b>TEBU 3.6F</b> AmTide, LLC	tebuconazole	40.53%	3.0 to 4.0 fl oz per acre	<p>For soybean rust and powdery mildew.</p> <p>Apply TEBU 3.6F as a broadcast foliar spray, as a preventative spray or at first visible symptoms of disease. Repeat applications on a 10 to 14-day spray interval if environmental conditions are favorable for continued disease development.</p> <p>Use of the higher rates and shorter spray intervals are recommended when disease pressure is high.</p> <p>For optimum disease control, the lowest label rate of a spray surfactant should be tank-mixed with TEBU 3.6F.</p> <p>TEBU 3.6F should be applied in a minimum of 10 gallons of spray solution per acre by ground sprayer or in a minimum of 5 gallons per acre by aircraft spray equipment.</p> <p>Do not apply more than 12.0 fl oz per acre per use season. Do not make more than three applications per season.</p> <p>Restricted-entry interval (REI) is 12 hours.</p> <p>Preharvest interval (PHI) is 21 days.</p>
<b>Tebuzol 3.6F Fungicide</b> United Phosphorus, Inc.	tebuconazole	38.70%	3.0 to 4.0 fl oz per acre	<p>For soybean rust and powdery mildew.</p> <p>Apply Tebuzol 3.6F as a broadcast spray, as a preventative spray or at first visible symptoms of disease. Repeat applications on a 10- to 14-day spray interval if environmental conditions are favorable for continued disease development. Use of higher rates and shorter spray intervals are recommended when disease pressure is severe.</p> <p>The lowest label recommended rate of a spray surfactant must be tank-mixed with Tebuzol 3.6F.</p> <p>Tebuzol 3.6 F should be applied in a minimum of 10 gallons of spray solution per acre by ground or in a minimum of 5 gallons of spray solution by aircraft spray equipment.</p> <p>Do not apply more than three applications per season. Do not apply more than 12.0 fl oz per acre use season.</p> <p>Restricted-entry interval (REI) is 12 hours.</p> <p>Applications may not be made within 21 days of harvest.</p>
<b>Thiophanate Methyl 85 WDG</b> Makhteshim Agan of North America, Inc.	thiophanate methyl	85.00%	0.4 to 0.8 lb per acre	<p>For anthracnose, Septoria brown spot, frogeye leaf spot, stem and pod blight and purple seed stain apply 0.4 to 0.8 lb per acre. Apply from full bloom when pods are 1/8 to 1/4 inch in length. Make a second application 14 to 21 days later. Do not make the second application later than 14 days after pods average 1/4 inch in length or when beans form in the pod. Use the high rate under severe disease pressure. For seed beans only make a single application at the high rate when beans form in the pod.</p> <p>For <i>Sclerotinia</i>, apply 0.6 to 0.8 lb per acre. Make one application at early bloom (R1 to R2 stage) followed by a second application 7 to 14 days later if conditions are favorable for continued disease pressure. Use a minimum of five gallons by air.</p> <p>For aerial blight (suppression), apply 0.8 lb per acre. Make initial application when disease threatens and repeat 14 to 21 days later if needed.</p> <p>Do not make more than two applications per year.</p> <p>Do not graze or feed treated vines to livestock.</p>

Foliar fungicides labeled for use on soybean - *continued*

Products with Sec. 3 labels (full federal registrations)

Trade name Company	Common chemical name	% active ingredients	Rate	Additional label information
<b>Tilt</b> Syngenta	propiconazole	41.80%	4.0 to 6.0 fl oz per acre	<p>Target diseases: aerial web blight (<i>Rhizoctonia solani</i>), anthracnose (<i>Colletotrichum truncatum</i>), brown spot (<i>Septoria glycines</i>), frog-eye leaf spot (<i>Cercospora sojina</i>) and soybean rust (<i>Phakopsora pachyrhizi</i>).</p> <p>Aerial web blight: apply 5.0 to 6.0 fl oz per acre at the first appearance of disease and repeat the application 14 to 21 days later. Under severe disease conditions use the higher rate and the shorter interval.</p> <p>Other foliar diseases (except rust): apply 6.0 fl oz per acre at growth stage R3 (early pod set when pods are 1/8 to 1/4 inch long) and 14 to 21 days later at growth stage R5 (pod fill).</p> <p>Soybean rust: apply 4.0 to 6.0 fl oz per acre at first indication that disease is in the area. For best control, preventive applications work best. Repeat on a 14- to 21-day interval. Use the higher rate and shorter interval when disease is present in the field and incidence is less than 2% (2 plants in 100 are infected). If incidence is greater than this or disease is in mid canopy, control will not be acceptable. Scouting for the disease and/or being aware of the proximity of the disease via monitoring systems will aid in the proper timing to maximize the effectiveness of the fungicide applications.</p> <p>On certain varieties, Tilt applications may cause crinkled, smaller and/or greener leaves. Yields of beans displaying these characteristics have not been reduced due to Tilt treatments.</p> <p>Tilt is most effective when applied and allowed to dry before a rainfall. For best results, sufficient water volume should be used to provide thorough coverage. Tilt may be applied by either ground or aerial application. Addition of an oil-based additive is recommended for improved coverage and penetration when applying by air.</p> <p>Do not apply more than 12.0 fl oz per acre per season of Tilt.</p> <p>Apply up to Stage R6.</p>
<b>Toledo</b> Rotam North America, Inc.	tebuconazole	38.70%	3.0 to 4.0 fl oz per acre	<p>For soybean rust and powdery mildew.</p> <p>Apply Toledo as a broadcast foliar spray, as a preventative spray or at first visible symptoms of disease. Repeat applications on a 10- to 14-day spray interval if environmental conditions are favorable for continued disease development.</p> <p>Use of the higher rates and shorter spray interval are recommended when disease pressure is severe.</p> <p>The lowest labeled rate of a spray surfactant must be tank-mixed with Toledo.</p> <p>Toledo should be applied in a minimum of 10 gallons of spray solution per acre by ground sprayer or in a minimum of 5 gallons per acre by aircraft spray equipment. Restricted-entry interval (REI) is 12 hours.</p> <p>Do not apply more than three applications per season. Do not apply more than 12 fl oz per acre per use season.</p> <p>Applications may not be made within 21 days of harvest.</p>

Foliar fungicides labeled for use on soybean - *continued*

Products with Sec. 3 labels (full federal registrations)

Trade name Company	Common chemical name	% active ingredients	Rate	Additional label information
<b>TOPGUARD</b> Chemnova	flutriafol	11.80%	7.0 to 14.0 fl oz per acre	<p>For soybean rust: apply TOPGUARD as a broadcast foliar spray when conditions are favorable for development of soybean rust. Repeat after first application if environmental conditions are favorable for continued disease development.</p> <p>May be tank mixed with other approved fungicides, herbicides or insecticides unless prohibited on the label of the tank mix partner.</p> <p>21 to 35 days minimum retreatment interval.</p> <p>For frogeye leaf spot, Cercospora blight and leaf spot, Septoria brown spot and powdery mildew: apply as a broadcast foliar spray to soybean plants in R3 growth stage (early pod fill) or when environmental conditions are favorable for disease development. Apply second application if conditions are conducive for heavy disease development.</p> <p>Use the higher rate and the shorter spray interval under severe sustained disease pressure.</p> <p>14 to 21 days minimum retreatment interval.</p> <p>Apply in a minimum of 10 gallons of spray solution per acre by ground sprayer or in a minimum of 5 gallons per acre by aircraft equipment.</p> <p>A surfactant may be used with Topguard fungicide.</p> <p>See label for rotation restrictions.</p> <p>Do not feed forage or hay to animals or permit animals to graze.</p> <p>Restricted entry interval is 12 hours.</p> <p>Do not apply more than 28.0 fl oz per acre per season. Do not apply more than three applications per growing season.</p> <p>Apply only to soybeans harvested for dry seed.</p> <p>Preharvest interval: do not apply within 21 days of harvest.</p>
<b>Topsin M 70WP</b> United Phosphorus, Inc.	thiophanate-methyl	70.00%	rate varies with diseases targeted for control and application program-see next column	<p>0.5 to 1.0 lb of Topsin M 70WP, Topsin M 70WDG or Topsin M WSB or 10.0 to 20.0 fl oz per acre of Topsin 4.5FL per acre for anthracnose, Septoria brown spot, frogeye leaf spot, pod and stem blight and purple seed stain. Apply from full bloom to when pods are 1/8 to 1/4 inch in length. Make a second application 14 to 21 days later.</p> <p>Do not make the second application later than 14 days after pods average 1/4 inch in length or when beans form in the pod. Use the high rate under severe disease pressure.</p> <p>For seed beans only: for seed quality, make a single application at the high rate when beans form in the pod.</p> <p>0.75 to 1.0 lb of Topsin M 70WP, Topsin M 70WDG or Topsin M WSB or 15.0 to 20.0 fl oz of Topsin 4.5FL per acre for white mold (<i>Sclerotinia</i>). Make one application at early bloom (R1 to R2 stage) followed by a second application 7 to 14 days later if conditions are favorable for continued disease pressure. Use a minimum of 5 gallons of water by air.</p> <p>1.0 lb of Topsin M 70WP, Topsin M 70WDG or Topsin M WSB or 20.0 fl oz of Topsin 4.5FL per acre for suppression of aerial blight. Make initial application when disease threatens and repeat 14 to 21 days later if needed.</p> <p>Preharvest interval: 21 days.</p> <p>Do not make more than two applications per year.</p> <p>Do not graze or feed treated vines or hay to livestock.</p>
<b>Topsin M 70WDG</b> United Phosphorus, Inc.	thiophanate-methyl	70.00%		
<b>Topsin M WSB</b> United Phosphorus, Inc.	thiophanate-methyl	70.00%		
<b>Topsin 4.5FL</b> United Phosphorus, Inc.	thiophanate-methyl	45.00%		
<b>Topsin XTR</b> United Phosphorus, Inc.	thiophanate-methyl tebuconazole	37.50% 7.50%	20.0 fl oz per acre	<p>Target diseases: aerial blight, Asian soybean rust, anthracnose, Septoria brown spot, frogeye leaf spot, pod &amp; stem blight, powdery mildew, purple seed stain and white mold.</p> <p>Closely observe soybean fields beginning at the early reproductive growth stages, scouting for early disease symptoms especially when conditions favor disease development.</p> <p>Apply Topsin XTR either as a preventative application or at first visible symptoms of disease as a broadcast foliar application for control of leaf and pod diseases.</p> <p>For control of white mold begin applications at R1-R2.</p> <p>For control of Asian soybean rust, begin Topsin XTR applications at R3 (beginning pod growth) or pre/early post ASR infection.</p> <p>Repeat applications on a 14-day interval if environmental conditions favor disease development.</p> <p>Applications later than 14 days after pods average 1/4 inch in length are prohibited.</p> <p>Do not graze or feed treated vines or hay to livestock.</p> <p>Pre-harvest interval (PHI): 21 days.</p>

## Soybean virus diseases

Bean pod mottle, soybean mosaic, tobacco ringspot, bean yellow mosaic, and soybean vein necrosis are among several viruses that occur on soybean in Missouri. These virus diseases tend to cause green to yellow mottling of leaf tissue, stunting of plant growth and deformation of plant tissues. Symptoms of bean pod mottle and soybean mosaic are similar and difficult to distinguish in the field. Also, these viruses may occur in combination. Laboratory tests are the only means of accurately identifying which virus or combination of viruses is present in infected plants.

**Bean pod mottle** causes a green to yellow mottling of young leaves in the upper canopy. This virus is sap-transmissible and vectored by beetle species such as the bean leaf beetle. The host range of bean pod mottle virus is limited to legumes. In addition to soybean, other possible hosts are lespedeza, alfalfa and clover. The bean pod mottle virus is not considered to be seedborne at very high levels.

**Soybean mosaic** causes a green to yellow mottling or mosaic pattern on leaf tissue as well as puckering and distortion of the leaf shape. Soybean mosaic virus is sap-transmissible and vectored by several aphid species. Soybean mosaic virus may also be seedborne. Infected seed may show a bleeding hilum symptom or a brown to black mottling of the seed coat. However, seed coat discoloration is not a definite indication of seed infection because infected seed can be symptomless and seed coat discoloration can be caused by factors other than soybean mosaic virus.

When bean pod mottle and soybean mosaic occur in combination in the same plant, symptoms are more severe and yield losses higher than those caused by either virus alone.

**Soybean budblight**, caused by the tobacco ringspot virus, results in the curving of the terminal in the shape of a crook. Plants are usually stunted with a bushy appearance, leaves are rugose and rolled and pods may be poorly developed or aborted. Plants tend to remain green after uninfected plants have matured and turned in color. Tobacco ringspot virus is readily sap-transmissible. Although no efficient insect vector has yet been discovered, thrips are implicated in the spread of the virus. The soybean budblight virus has a wide host range including a number of weed species. Pastures or uncultivated areas containing other hosts for tobacco ringspot virus may serve as sources of inoculum for nearby soybean fields. The virus may also be seedborne.

**Soybean yellow mosaic** is caused by the bean yellow mosaic virus. The leaves exhibit brilliant yellow mosaic patches. The virus has a wide host range and is transmitted by several aphids. Seed transmission has not been reported.

**Soybean vein necrosis** is caused by the soybean vein necrosis virus. Initially, small light-green to yellow patches develop near main leaf veins. These patches then develop a mottled light green-yellow-brown pattern. The veins in these areas of the leaflet may become clear to almost translucent which is referred to as vein clearing. As the disease progresses these areas turn reddish-brown with a browning of the veins. The reddish-brown areas may have a scaly or

scabby appearance. On more susceptible varieties the brown areas may expand killing larger areas of leaf tissue and giving a scorched appearance to the leaves.

The virus which causes soybean vein necrosis belongs to a group of viruses called tospoviruses which are spread by thrips. At this point the disease is still a relatively new disease and there are more questions about it than answers. It appears that the virus is spread from soybean to soybean by thrips but which species(s) of thrips is unknown. Other hosts, especially weed hosts, have not been confirmed.

### Management options for soybean virus diseases

- Plant disease-free seed.
- Plant varieties resistant to soybean mosaic virus.
- Maintain good weed control.
- In some situations, the control of insect vectors may be warranted.

## Soybean cyst nematode (SCN)

The soybean cyst nematode, *Heterodera glycines*, is a serious problem throughout the state and in most soybean-producing areas of the United States. Symptoms of soybean cyst nematode (SCN) range from no obvious symptoms to subtle differences in plant height and vigor or unexpected decreases in yield to severe stunting and discoloration of plants. Plants with SCN may have poorly developed root systems. If plants are carefully dug up, females may be evident on the roots. The females appear as tiny (smaller than nitrogen-fixing nodules), whitish to yellow to brownish, lemon-shaped structures on the roots. Symptom expression may be more severe if plants are subjected to other stresses such as moisture stress, nutrient deficiencies or herbicide injury.

The cysts are the bodies of the dead female nematodes. The cysts are actually protective egg cases, which contain up to 250 SCN eggs. Eggs in cysts may survive in the soil for extended periods even in the absence of soybean crops. Anything that moves cyst-infested soil can spread SCN including machinery, animals, migratory birds, people, wind, water and soil peds associated with seed. Once in a field, SCN may take several years to build up to damaging levels.

For more detailed information on SCN, soil sampling for SCN and strategies for managing SCN, please refer to MU publication G4450, *Soybean Cyst Nematode: Diagnosis and Management*.

### Management options for soybean cyst nematode

- Employ a program of soil sampling to identify problem fields and to determine the extent and severity of the problem in the field.
- Select resistant varieties. If at all possible, it is important to rotate sources of genetic resistance to SCN in soybean varieties grown.
- Rotate to non-host crops (the length of time out of susceptible soybean varieties will depend on population levels of the soybean cyst nematode in a given field).
- Maintain good plant vigor.
- Although several soil-applied nematicides are labeled

for use on soybean, economic and environmental concerns limit their use.

- More recently seed treatment products have become available to aid in managing some soybean nematodes. See preceding seed treatment table.

### **Sudden death syndrome (SDS)**

In Missouri, sudden death syndrome (SDS) tends to be a continual problem in river bottom fields in the central and eastern portions of the state. However, the pathogen, *Fusarium virguliforme* (formerly known as *Fusarium solani* f. sp. *glycines*), appears to be present in soybean-producing areas throughout the state. In years when environmental conditions are favorable for infection and symptom development, SDS may be found in most areas of the state.

SDS has been associated with maximum yield potential soybean production, i.e., fields with optimum fertility, irrigation and lime application. Field observations suggest that SDS is more likely to occur and to be more severe with high soil moisture, whether that is supplied by rainfall or by irrigation. High soil moisture during vegetative stages of soybean growth seems to be the most conducive to disease development. The onset of SDS symptoms frequently is associated with wet conditions and below normal temperatures at or near bloom.

#### **Management options for sudden death syndrome**

- Plant varieties that have performed well where sudden death syndrome has been a problem.
- Improve drainage in poorly drained fields and avoid compacting soils.
- Stagger planting dates and delay planting until soils are warm and dry.
- Avoid continuous cropping soybean.
- Maintain good crop vigor and avoid crop stress including stress from soybean cyst nematode.
- Harvest fields with sudden death syndrome in a timely fashion.

### **Charcoal rot**

Charcoal rot may cause a seedling infection, but is more commonly considered a mid- to late-season soybean disease. Symptoms typically begin to develop as plants move into reproductive stages of growth.

The fungus that causes charcoal rot, *Macrophomina phaseolina*, is a common soil fungus in Missouri. Corn and grain sorghum are also hosts of the charcoal rot fungus. Charcoal rot is favored by hot, dry weather, so symptoms usually appear when temperatures are in the range of 82 to 95 degrees F.

#### **Management options for charcoal rot**

- Rotate to cereals, cotton or other non-hosts for one or two years; with corn or grain sorghum a rotation of three years may be necessary.
- Maintain good crop vigor to help reduce losses from charcoal rot.

- Irrigate properly from just before bloom to pod fill.

### **Sclerotium blight (southern blight)**

Sclerotium blight, also called southern blight or white mold, is caused by the fungus *Sclerotium rolfsii*. This disease tends to be a problem primarily in the southeastern part of Missouri. *Sclerotinia rolfsii* produces small, tan to brown sclerotia (small survival structures) that allow it to survive for extended periods of time in the soil.

#### **Management options for Sclerotium blight**

- Rotate crops with at least one year between soybean crops. If Sclerotium blight has been severe, a three- to four-year rotation may be necessary.

### **Sclerotinia stem rot (white mold)**

Sclerotinia stem rot or white mold, caused by *Sclerotinia sclerotiorum*, is a problem for soybean farmers in Michigan, Wisconsin, Minnesota, northern Iowa and northern Illinois. It has been reported in Missouri but has not been a widespread or serious problem in the state's soybean crop. The disease appears to be favored by moderate temperatures in the canopy (less than 82 degrees F) and frequent rainfalls especially as the crop begins to flower and set pods. When those conditions occur during the growing season, Sclerotinia white mold certainly may occur in Missouri soybean fields.

This fungus has a wide host range including dry beans, potatoes, canola, sunflower, peas and many broadleaf weeds. *Sclerotinia sclerotiorum* produces small, black survival structures called sclerotia. These sclerotia can survive in the soil for years.

#### **Management options for Sclerotinia stem rot**

- Plant resistant varieties.
- Rotate crops with at least one year between soybean crops and do not plant soybean after common bean, sunflower or other susceptible crops.
- Plant disease-free seed that is free of sclerotia.
- Maintain good weed control.

### **Brown stem rot**

Although brown stem rot has been reported in Missouri, it is not a widespread or serious problem in the state. When brown stem rot is found in Missouri, it tends to be in the northern part of the state. Brown stem rot is caused by the fungus *Phialophora gregata*, which survives in infested crop residues and in the soil.

Development of brown stem rot is favored by temperatures in the range of 59 to 81 degrees F. As air temperatures increase above 81 degrees F, both incidence and severity of brown stem rot decrease. Leaf symptoms are most pronounced if cool weather occurs as the crop enters the reproductive stages of growth. Internal browning of stem tissues is greatly reduced at higher temperatures.

**Management options for brown stem rot**

- Plant resistant varieties.
- Rotate crops with at least one year between soybean crops. Longer rotations may be necessary in fields with established brown stem rot problems.

**Pod and stem blight and *Phomopsis* seed decay**

*Phomopsis longicolla* and the other *Diaporthe* and *Phomopsis* species that cause pod and stem blight and *Phomopsis* seed decay can survive in infested crop residues, in the soil and in seed. Symptoms usually develop on stems of plants during later reproductive stages of growth.

Prolonged periods of warm, wet weather during flowering and pod fill favor the development of pod and stem blight. If wet weather continues through harvest, levels of *Phomopsis* seed decay may be high.

**Management options for pod and stem blight**

- Rotate crops with at least one year out of soybeans.
- Use disease-free seed (pathogen may survive on infested seed and cause seedling blights if that seed is planted the next year).
- Use an appropriate fungicide seed treatment. See accompanying table of seed treatment fungicides labeled for use on soybean.
- Use of a foliar fungicide during the growing season is seldom warranted, except in seed production fields in seasons favorable for pod infection.

**Anthracnose**

*Colletotrichum truncatum* and several other *Colletotrichum* species cause anthracnose of soybean. Typically, anthracnose develops as a stem and pod disease on soybean plants during later reproductive stages of growth. However, in some seasons anthracnose may cause a tip blight on plants in early pod filling stages of growth.

Anthracnose is favored by warm, wet weather. Symptoms on the stems will be more severe if wet weather continues through harvest. The tip blight phase tends to occur when warm to hot weather mid season is followed by a period of rainy weather.

**Management options for anthracnose**

- Rotate crops with at least one year between soybean crops.
- Plant disease-free seed (pathogen may survive on infested seed and cause seedling blights if that seed is planted the next year).
- Use an appropriate fungicide seed treatment. See accompanying table of seed treatment fungicides labeled for use on soybean.
- Use of a foliar fungicide during the growing season is seldom warranted, except in seed production fields in seasons favorable for pod infection.

***Cercospora* blight, leaf spot and purple seed stain**

*Cercospora kikuchii* can infect soybean seeds, pods, stems and leaves but is most commonly found on the seed. The pathogen survives in infested crop residues and on seed.

Warm, humid weather favors disease development. Yields are not usually reduced, but a high percentage of seed stain may be evident at harvest. Heavily infected seed, if planted, could produce diseased seedlings resulting in stand problems.

**Management options for *Cercospora* blight, leaf spot and purple seed stain**

- Rotate crops with at least one year between soybean or other legumes.
- If infected seed must be planted, use an appropriate fungicide seed treatment. See accompanying table of seed treatment fungicides labeled for use on soybean.

**Stem canker**

Although stem canker can occur in Missouri, this disease is usually not widespread or serious in the state. *Diaporthe phaseolina*, the fungus that causes stem canker, survives in infested residues. Infection by the stem canker pathogen is favored by extended periods of rainy weather during early vegetative stages of soybean growth. However, symptoms may not be evident until later in the season.

**Management options for stem canker**

- Rotate crops with at least one year between soybean crops.
- Plant resistant varieties.



## Winter wheat diseases and their management

Wheat diseases can and do occur each year in Missouri. Problems with germination and stand establishment that are related to seed decay, damping-off and seedling blights may be encountered in the field. Diseases may cause leaf spots or leaf blights, wilts or premature death of plants. Wheat diseases can also cause harvest losses, affect the quality of the harvested crop and cause storage losses. The extent of the damage due to wheat diseases in a given season depends on a number of factors, including the susceptibility of the wheat variety to the specific diseases, the level of the pathogen inoculum present and the environmental conditions during that season.

To minimize losses due to wheat diseases, it is important to correctly identify the disease or diseases present so that appropriate management steps can be taken. The principal diseases of wheat in Missouri are of five types: (1) seedling diseases, (2) virus diseases, (3) foliage diseases, (4) root, crown and wilt diseases, and (5) head diseases. For more detailed information including color pictures of winter wheat diseases in Missouri, see University of Missouri publication IPM 1022, *Management of Soft Red Winter Wheat*.

### Seedling diseases of winter wheat

There are a number of seedborne and soilborne pathogens that can cause seedling diseases in wheat. Seed may be rotted before germination or developing seedlings may be infected before or after emergence. Stands may be thin or uneven. Seedlings may be yellow and stunted. Root systems may be poorly developed with root and crown tissue brown to black in color and soft or rotted. Seedling diseases tend to be more severe if poor quality or diseased seed is used and if conditions at planting are not favorable for quick germination and stand establishment. Planting good-quality, disease-free seed is the most effective means of preventing problems from seedborne pathogens. If seed contaminated with a seedborne pathogen must be used for planting, it is

important to clean the seed lot thoroughly to remove as much of the small, damaged seed as possible, to have a germination test done on the cleaned seed lot and to consider the use of a fungicide seed treatment.

### Management options for wheat seedling diseases

- Plant good-quality, disease-free seed under good seed-bed conditions.
- Use a fungicide seed treatment. See accompanying table of seed treatment fungicides labeled for use on winter wheat.

### Seed treatment fungicides labeled for use on winter wheat

Although seed treatment fungicides can be an effective means of preventing or reducing losses from various seed- and soilborne microorganisms, there are several important laws or guidelines concerning fungicide-treated seed. Always read the pesticide label and follow all directions and restrictions on the label, but in particular for seed treatment fungicides remember the following points:

- Do not use treated seed for food, feed or oil purposes.
- All treated seed must be colored with an EPA-approved dye that imparts an unnatural color to the seed.
- Federal law requires that bags containing treated seed shall be labeled with the following information: "This seed has been treated with (common chemical name of active ingredients) fungicide(s). Do not use treated seed for feed, food or oil purposes. Store away from feeds and food stuffs."

The following table was prepared using current company product labels and manufacturers' Web sites. However, label registrations can change at any time. Before using any agricultural pesticide, read and follow directions accompanying that product. Product names have been used for clarity. Reference to specific trade names does not imply endorsement by the University of Missouri; discrimination is not intended against similar products not listed.

## Seed treatment fungicides labeled for use on winter wheat

Trade name Company	Common chemical name	% active ingredient	Rate	Additional label information
<b>Allegiance Dry</b> Chemtura AgroSolutions	metalaxyl	12.50%	1.5 to 2.0 oz per 100 lb of seed	For Pythium damping-off control.  Treat only those seeds needed for immediate use, minimizing the interval between treatment and planting. Do not carry over excess treated seed to next season.  Do not use this product on seed that has been commercially treated with metalaxyl (Allegiance) fungicide.  Hopper box seed treatment.
<b>Allegiance-FL</b> Bayer CropScience	metalaxyl	28.35%	0.75 fl oz per 100 lb of seed	Allegiance-FL is a systemic fungicide seed dressing specifically for control of downy mildews, <i>Pythium</i> and <i>Phytophthora</i> spp. For control of other soilborne diseases, combination of Bayer CropScience Captan and Vitavax registered formulations are compatible. Do not use with other seed treatment products unless previous experience assures compatibility.  Allegiance-FL may be applied as a water-based slurry with other registered seed treatment insecticides and fungicides through standard slurry or mist-type commercial seed treatment equipment.
<b>Apron XL</b> Syngenta	mefenoxam	33.30%	0.0425 to 0.085 fl oz per 100 lb of seed	For Pythium damping-off protection in wheat when applied in combination with Dividend or other seed treatment products labeled for disease control in this crop: apply Apron XL as a seed treatment at 0.0425 to 0.085 fl oz per 100 lb of seed.  Apron XL may be applied as a water-based slurry with other registered seed treatment insecticides and fungicides through standard slurry or mist-type commercial seed treatment equipment.
<b>Belmont 2.7 FS</b> Chemtura AgroSolutions	metalaxyl	28.98%	0.75 fl oz per 100 lb of seed	For Pythium damping-off control.  For the control of other soilborne diseases, use in combination with other seed treatment fungicides. Vitavax and RANCONA products are compatible with Belmont 2.7 FS. Do not use in combination with other seed treatment products unless compatibility and safety to crop has been verified.  Belmont 2.7 FS may be applied on its own, as water-based slurry or in combination with other registered seed treatment insecticides and fungicides through standard slurry or mist-type commercial seed treatment equipment.
<b>CruiserMaxx Cereals</b> Syngenta	thiamethoxam mefenoxam difenoconazole	2.80% 0.56% 3.36%	5.0 fl oz per 100 lb of seed	For winter wheat diseases, including general seed rots, seedling blight, root rot and damping-off caused by seedborne and soilborne <i>Fusarium</i> and soilborne <i>Pythium</i> , common and dwarf bunt and loose smut. Diseases suppressed include common root rot, <i>Fusarium</i> crown and foot rot and take-all.  For additional <i>Pythium</i> protection, add 0.0425 fl oz of Apron XL per 100 lb of seed.  CruiserMaxx Cereals is a ready-to-use water-based formulation for use in commercial seed treatment facilities utilizing closed-system application techniques. In addition, CruiserMaxx Cereals may also be applied by on-site/on-farm applications.
<b>CruiserMaxx Vibrance Cereals</b> Syngenta	sedaxane difenoconazole mefenoxam thiamethoxam	0.72% 3.34% 0.86% 2.78%	5.0 to 10.0 fl oz per 100 lb of seed	For protection against seed, soil and early season foliar disease of wheat. Diseases controlled include: seedling blight, root rot and damping-off caused by seed- and soilborne <i>Fusarium</i> and <i>Rhizoctonia</i> and soilborne <i>Pythium</i> . Also controlled are bunt, smut and <i>Septoria</i> diseases. Diseases suppressed include common root rot ( <i>Cochliobolus</i> spp.), <i>Fusarium</i> crown and foot rot and take-all.  Early season foliar disease protection for first 4 weeks after planting. For full season protection, apply a foliar fungicide according to label directions.  CruiserMaxx Vibrance Cereals may be applied by professionals at commercial seed treatment facilities according to label instructions.
<b>Dithane M45</b> Dow AgroSciences	mancozeb	80.00%	2.2 to 3.3 oz. per 100 lb of seed	For control of bunt, damping-off, seed rots and seedling blights.  May be applied to dry seed with conventional slurry or mist seed treating equipment or as a planter box application.

Seed treatment fungicides labeled for use on winter wheat - *continued*

Trade name Company	Common chemical name	% active ingredient	Rate	Additional label information
<b>Dividend XL</b> Syngenta	difenoconazole mefenoxam	16.50% 1.38%	1.0 fl oz per 100 lb of seed	Dividend XL is a combination of Dividend and Apron XL. The Apron XL provides Pythium damping-off activity and the Dividend provides activity on the remaining diseases claimed on the label.
			or  2.0 fl oz per 100 lb of seed	The 1.0 fl oz rate of Dividend XL is for control of common bunt, dwarf bunt, flag smut, seedborne Septoria, loose smut, general seed rots, Fusarium seed scab and Pythium damping-off and for early-season control of common root rot and Rhizoctonia root rot.  The 2.0 fl oz rate of Dividend XL is for control of common bunt, dwarf bunt, flag smut, seedborne Septoria, loose smut, general seed rots, Fusarium seed scab and Pythium damping-off and for early-season control of common root rot, Fusarium root rot, Fusarium crown rot, take-all and Rhizoctonia root rot as well as fall season powdery mildew, leaf rust and Septoria leaf blotch. Dividend XL provides control of the fall season foliage diseases for the first six weeks after planting.  Green wheat forage may not be grazed until 55 days after planting.  Apply Dividend XL as a water-based slurry through standard slurry or mist-type seed treatment equipment.
<b>Dividend Extreme</b> Syngenta	difenoconazole mefenoxam	7.73% 1.93%	Rate varies with diseased targeted; see next column.	Use 1.0 fl oz per 100 lb of seed for control of common bunt and loose smut.
				Use 2.0 fl oz per 100 lb of seed for control of common bunt, dwarf bunt, karnal bunt, flag smut, seedborne Septoria, loose smut, general seed rots, Fusarium seed scab and Pythium damping-off as well as early-season control of common root rot and Rhizoctonia root rot.  Use 4.0 fl oz per 100 lb of seed for control of common bunt, karnal bunt, dwarf bunt, loose smut, flag smut, seedborne Septoria, general seed rots, Fusarium seed scab and Pythium damping-off. Also for fall season control of powdery mildew, leaf rust and Septoria leaf blotch. Control of early-season common root rot, Fusarium root rot, Fusarium crown rot, take-all and Rhizoctonia root rot.  Dividend Extreme provides control of fall season powdery mildew, fall season leaf rust and fall season Septoria leaf blotch in winter wheat for the first 6 weeks after planting. For full season control of these foliar diseases, use Tilt fungicide according to label directions.  Apply Dividend Extreme as a water-based slurry using standard slurry treatment equipment which provides uniform seed coverage.
<b>Dividend XL RTA</b> Syngenta	difenoconazole mefenoxam	3.21% 0.27%	Rate varies with diseased targeted; see next column.	Use 2.5 fl oz per 100 lb of seed for control of common bunt and loose smut.
				Use 5.0 fl oz per 100 lb of seed for control of common bunt, dwarf bunt, flag smut, seedborne Septoria, loose smut, general seed rots, Fusarium seed scab and Pythium damping-off as well as for partial control of common root rot and Rhizoctonia root rot.  Use 10.0 fl oz per 100 lb of seed for control of common bunt, dwarf bunt, loose smut, flag smut, seedborne Septoria, general seed rots, Fusarium seed scab and Pythium damping-off. Also for fall season control of powdery mildew, leaf rust and Septoria leaf blotch. For partial control of early-season common root rot, Fusarium root rot, Fusarium crown rot, take-all and Rhizoctonia root rot.  Dividend XL RTA provides control of fall season powdery mildew, fall season leaf rust and fall season Septoria leaf blotch in winter wheat for the first 6 weeks after planting. For full season control of these foliar diseases, use Tilt fungicide according to label directions.
<b>Dyna-Shield Foothold</b> Loveland Products Inc.	tebuconazole metalaxyl	0.499% 0.699%	5.0 to 6.5 fl oz per 100 lb of seed	Aids in the control or suppression of the following seed, seedling or soilborne diseases of wheat: stinking smut, flag smut, loose smut, early-season Septoria disease complex, general seed rots, Pythium damping-off, early-season Rhizoctonia root rot, early-season common root rot, seedborne Fusarium scab, early-season Fusarium foot rot and early-season suppression of powdery mildew and rust.  Uniform application to seed is necessary to ensure seed safety and best disease control.  This product is for commercial or on-farm application. Applications should be made using standard slurry or mist-type seed treatment equipment. This product is not intended for direct application into a planter box.  Wheat green forage may not be grazed or harvested until 31 days after seeding.

Seed treatment fungicides labeled for use on winter wheat - *continued*

Trade name Company	Common chemical name	% active ingredient	Rate	Additional label information
<b>Dyna-Shield Foothold Extra</b> Loveland Products Inc.	tebuconazole metalaxyl imidacloprid	0.455% 0.607% 11.374%	3.4 to 5.0 fl oz per 100 lb of seed	Disease control: early-season disease control of <i>Pythium</i> damping-off, stinking smut, flag smut, loose smut, early-season <i>Septoria</i> disease complex, early-season <i>Rhizoctonia</i> root rot, early-season common root rot, early-season <i>Fusarium</i> foot rot, early-season suppression of powdery mildew and early-season suppression of wheat leaf rust.  Apply before planting as a slurry treatment. This product is to be used in liquid or slurry treaters. Ensure thorough coverage.  Do not graze or feed livestock on treated areas for 45 days after planting.
<b>Dyna-Shield Metalaxyl</b> Loveland Products Inc.	metalaxyl	28.35%	0.75 fl oz per 100 lb of seed	For <i>Pythium</i> damping-off control.  Reduced rate: to aid in the control of seed decay and damping-off caused by <i>Pythium</i> apply Dyna-Shield Metalaxyl Fungicide as a commercial seed treatment at the rate of 0.10 to 0.375 fl oz per 100 lb of seed. Apply only in combination with EPA registered rates of Loveland Products Inc. broad-spectrum seed treatment fungicides.  May be applied as a water-based slurry with other registered seed treatment insecticides and fungicides through standard slurry or mist-type commercial seed treatment equipment.
<b>Dyna-Shield Metalaxyl 318 FS</b> Loveland Products Inc.	metalaxyl	30.14%	0.75 fl oz per 100 lb of seed	For <i>Pythium</i> damping-off control.  Reduced rate: to aid in the control of seed decay and damping-off caused by <i>Pythium</i> apply Dyna-Shield Metalaxyl 318 FS Fungicide as a commercial seed treatment at the rate of 0.10 to 0.375 fl oz per 100 lb of seed. Apply only in combination with EPA registered rates of Loveland Products Inc. broad-spectrum seed treatment fungicides.  May be applied as a water-based slurry with other registered seed treatment insecticides and fungicides through standard slurry or mist-type commercial seed treatment equipment.
<b>Dyna-Shield Small Grains Fungicide</b> Loveland Products Inc.	tebuconazole metalaxyl	0.48% 0.64%	5.0 to 6.5 fl oz per 100 lb of seed	Aids in the control or suppression of the following seed, seedling or soilborne diseases of wheat: stinking smut, flag smut, loose smut, early-season <i>Septoria</i> disease complex, general seed rots, <i>Pythium</i> damping-off, early-season <i>Rhizoctonia</i> root rot, early-season common root rot, seedborne <i>Fusarium</i> scab, early-season <i>Fusarium</i> foot rot and early-season suppression of powdery mildew and rust.  Uniform application to seed is necessary to ensure seed safety and best disease control.  This product is for commercial or on-farm application. Applications should be made using standard slurry or mist-type seed treatment equipment. This product is not intended for direct application into a planter box.
<b>Dynasty</b> Syngenta	azoxystrobin	9.60%	0.153 to 0.382 fl oz per 100 lb of seed	Target diseases: seedborne and soilborne fungi causing decay, damping-off and seedling blight; seedling damping-off caused by <i>Rhizoctonia solani</i> , dwarf bunt and common bunt.  Where appropriate, use Dynasty in combination with Dividend Extreme and/or Maxim seed treatment products.  Apply as a water-based slurry using seed treatment application equipment that will provide uniform coverage on the seed surface.
<b>Enhance</b> Chemtura AgroSolutions	captan carboxin	19.55% 20.00%	4.0 oz per 100 lb of seed	Enhance Seed Protectant is a formulation specifically designed for treatment of wheat on the farm at planting time. It controls covered smut ( <i>Tilletia caries</i> and <i>Tilletia foetida</i> ) and loose smut ( <i>Ustilago nuda</i> ) on wheat.  Apply as a planter-box treatment (including air and vacuum planters), mixing thoroughly with the seed before planting. For best results, follow application directions on label.  Do not graze or feed livestock on treated areas for 45 days after planting.
<b>Enhance AW</b> Chemtura AgroSolutions (formerly Trace Seed Protection Products)	captan carboxin imidacloprid	19.55% 20.00% 20.00%	4.0 oz per 100 lb of seed	Enhance Seed Protectant is a formulation specifically designed for treatment of wheat on the farm at planting time. It controls covered smut ( <i>Tilletia caries</i> and <i>Tilletia foetida</i> ) and loose smut ( <i>Ustilago nuda</i> ) on wheat. Protects against seedborne and soilborne fungi that cause seed decay, damping-off and seedling blights (including <i>Fusarium</i> , <i>Cochliobolus sativus</i> , <i>Rhizoctonia</i> and <i>Pythium</i> ).  Apply as a planter-box treatment (including air and vacuum planters), mixing thoroughly with the seed before planting. For best results, follow application directions on label.  Do not graze or feed livestock on treated areas for 45 days after planting.
<b>EverGol Energy</b> Bayer CropScience	prothioconazole penflufen metalaxyl	7.18% 3.59% 5.74%	1.0 fl oz per 100 lb of seed	Effective against early season <i>Rhizoctonia</i> , <i>Fusarium</i> , <i>Pythium</i> , leaf stripe, cereal smuts and common bunt; also early season suppression of rust, <i>Septoria</i> and powdery mildew.  For use only in commercial seed treatment equipment. Not for use in hopper box, planter box, slurry box or other on-farm seed treatment equipment.

Seed treatment fungicides labeled for use on winter wheat - *continued*

Trade name Company	Common chemical name	% active ingredient	Rate	Additional label information
<b>Gauche XT</b> Bayer CropScience	imidacloprid metalaxyl tebuconazole	12.70% 0.82% 0.62%	3.4 fl oz per 100 lb of seed	<p>Early-season disease control of <i>Pythium</i> damping-off, stinking smut, flag smut, loose smut, early-season <i>Septoria</i> disease complex, early-season <i>Rhizoctonia</i> root rot, early-season common root rot, early-season <i>Fusarium</i> root rot, early-season suppression of powdery mildew and early-season suppression of leaf rust.</p> <p>Do not graze or feed livestock on treated areas for 45 days after planting.</p> <p>See label for rotational crop restrictions.</p> <p>Apply as a slurry treatment prior to planting.</p>
<b>Grain Guard</b> Chemtura AgroSolutions	mancozeb	50.00%	3.3 oz per bushel of seed	<p>For control of bunt of wheat, and damping-off and seedling blights.</p> <p>Treat only those seeds needed for immediate use, minimizing the interval between treatment and planting. Do not store excess treated seeds beyond planting time.</p> <p>Apply as a drill-box treatment mixing thoroughly so all seeds are covered.</p>
<b>Incentive RTA</b> Winfield Solutions, LLC	difenoconazole mefenoxam	3.21% 0.27%	2.5 fl oz per 100 lb of seed or 5.0 fl oz per 100 lb of seed or 10.0 fl oz per 100 lb of seed	<p>Incentive RTA is a combination of Incentive and Apron XL. The Apron XL provides <i>Pythium</i> damping-off activity, and the Incentive provides activity on the remaining diseases claimed on the label.</p> <p>The 2.5 fl oz rate of Incentive RTA is for control of common bunt and loose smut.</p> <p>The 5.0 fl oz rate of Incentive RTA is for control of common bunt, dwarf bunt, flag smut, seedborne <i>Septoria</i>, loose smut, general seed rots, <i>Fusarium</i> seed scab and <i>Pythium</i> damping-off and for partial control of common root rot and <i>Rhizoctonia</i> root rot.</p> <p>The 10.0 fl oz rate of Incentive RTA is for control of common bunt, dwarf bunt, flag smut, seedborne <i>Septoria</i>, loose smut, general seed rots, <i>Fusarium</i> seed scab and <i>Pythium</i> damping-off and for partial control of common root rot, <i>Fusarium</i> root rot, <i>Fusarium</i> crown rot, take-all and <i>Rhizoctonia</i> root rot as well as fall season powdery mildew, leaf rust and <i>Septoria</i> leaf blotch. Incentive RTA provides control of the fall season foliage diseases for the first six weeks after planting.</p> <p>Green wheat forage may not be grazed until 55 days after planting.</p> <p>Incentive RTA is especially formulated for on-farm treatment, using standard mechanical slurry or mist-type seed treatment equipment.</p>
<b>Kodiak HB</b> Chemtura AgroSolutions (formerly Trace Seed Protection Products)	<i>Bacillus subtilis</i> GB03	0.30%	4.0 to 8.0 oz per 100 lb of seed	<p>For suppression of root diseases caused by <i>Fusarium</i> and <i>Pythium</i>.</p> <p>Contains bacteria that colonize the developing root system, suppressing disease organisms such as <i>Fusarium</i> and <i>Pythium</i> that attack root systems. When used with a chemical seed treatment, the combination of chemicals and Kodiak provides protection to the root for a much longer time than with chemicals alone.</p> <p>Kodiak HB is a hopper-box seed treatment.</p>
<b>ManKocide</b> DuPont	mancozeb copper hydroxide	15.00% 46.10%	4.0 oz per 100 lb of seed	<p>Target diseases: <i>Pseudomonas syringae</i>, <i>Xanthomonas translucens</i> and <i>Tilletia caries</i>.</p> <p>ManKocide may be applied to dry seed with conventional slurry or mist seed treating equipment or as a planter-box application.</p>
<b>Manzate Pro-Stick</b> United Phosphorus, Inc. <b>Manzate Flowable</b> United Phosphorus, Inc.	mancozeb mancozeb	75.00% 37.00%	2.2 to 3.3 oz per 100 lb of seed 3.5 to 5.2 fl oz per 100 lb of seed	<p>For protection against bunt, covered smut, damping-off, seed rots and seedling blights.</p> <p>For commercial seed treatments, seeds should be clean and well-cured before treatment. Apply to dry seed with conventional slurry or mist seed treating equipment.</p> <p>Manzate Pro-Stick may also be applied as planter-box applications.</p>
<b>Maxim XL</b> Syngenta	fludioxonil mefenoxam	21.00% 8.40%	0.167 to 0.334 fl oz per 100 lb of seed	<p>For protection against damping-off caused by <i>Fusarium</i> spp., <i>Rhizoctonia</i> spp. and <i>Pythium</i> spp. and general seed rots caused by <i>Aspergillus</i> spp. and <i>Penicillium</i> spp. and for protection against <i>Tilletia</i> (common bunt).</p> <p>Maxim XL at the 0.084 fl oz may be combined with labeled rates of Dividend XL for a broader spectrum of seedling disease protection.</p> <p>Apply Maxim XL as a water-based slurry using standard slurry seed treatment equipment that provides uniform coverage.</p>
<b>Maxim 4FS</b> Syngenta	fludioxonil	40.30%	0.08 to 0.16 fl oz per 100 lb of seed	<p>For protection against seedborne and soilborne fungi that cause seed decay, damping-off and seedling blight.</p> <p>Cereal forage may not be grazed until 30 days after planting.</p> <p>Apply Maxim 4FS as a water-based slurry using standard slurry seed treatment equipment.</p>

Seed treatment fungicides labeled for use on winter wheat - *continued*

Trade name Company	Common chemical name	% active ingredient	Rate	Additional label information
<b>MetaStar ST</b> Chemtura AgroSolutions (formerly Trace Seed Protection Products)	metalaxyl	29.99%	0.75 fl oz per 100 lb of seed	For Pythium damping-off control.  MetaStar ST is a systemic fungicide seed dressing specifically for control of systemic downy mildews, <i>Pythium</i> and <i>Phytophthora</i> spp. For control of other soilborne diseases, combination of Captan and Vitavax registered formulations are compatible. Do not use with other seed treatment products unless previous experience assures compatibility.  MetaStar ST may be applied as a water-based slurry with other registered seed treatment insecticides and fungicides through standard slurry or mist-type commercial seed treatment equipment.
<b>Nipsit Suite Cereals OF</b> Valent	clothianidin metalaxyl metconazole	2.93% 0.88% 0.44%	5.0 fl oz per 100 lb of seed	Nipsit Suite Cereals OF contains three Valent components including an insecticide and two fungicides, in addition to a polymer and colorant.  The fungicides protect against Rhizoctonia root rot and damping off, Fusarium seed/seedling dieback, smuts and bunt and other seed-decay fungi.  Ready-to-use formulation for commercial or on farm use. Apply as a water-based slurry using seed treatment application equipment that will provide uniform coverage of the seed surface.  See label for additional restrictions.
<b>Penncozeb 75DF</b> United Phosphorus, Inc.	mancozeb	75.00%	2.3 to 3.5 oz per 100 lb of seed	For control of bunt, damping off, seed rots and seedling blights.  For planter-box treatment only.
<b>Penncozeb 80WP</b> United Phosphorus, Inc.	mancozeb	80.00%	2.2 to 3.3 oz per 100 lb of seed	
<b>Prevail</b> Chemtura AgroSolutions	carboxin PCNB metalaxyl	15.00% 15.00% 3.12%	1.5 to 3.0 oz. per bushel of seed	For protection against Pythium and Rhizoctonia seedling disease complex and loose smut and common bunt or stinking smut.  Do not graze or feed livestock on treated areas for six weeks after planting.  Prevail may be applied at planting time, using an on-farm mechanical treater to maximize seed coverage.
<b>Proceed Concentrate</b> Bayer CropScience	prothioconazole tebuconazole metalaxyl	6.88% 1.38% 2.75%	1.0 to 1.5 fl oz per 100 lb of seed	Aids in the control or suppression of the following: seed, seedling and soilborne diseases: stinking smut, flag smut, loose smut, covered smut, early-season Septoria disease complex, general seed rots, Pythium damping-off, early-season Rhizoctonia root rot, early-season common root rot, seedborne Fusarium scab, early-season Fusarium foot rot.  Early-season suppression of powdery mildew and rust.  Wheat green forage may be grazed or harvested for hay 31 days after seeding.  Dilute with sufficient water to achieve uniform application to seed, which is necessary to ensure seed safety and best disease control.  This product is for commercial or on-farm application. Applications must be made using standard slurry or mist-type seed treatment equipment. Do not apply this product with a hopper box, planter box, slurry box or any other at-plant methods.
<b>RANCONA Apex</b> Chemtura AgroSolutions	ipconazole	0.44%	5.0 to 8.33 fl oz per 100 lb of seed	For control of general seed rots (such as those caused by <i>Aspergillus</i> and <i>Penicillium</i> ), seed rot, damping off and seedling blight caused by seed- and soilborne <i>Fusarium</i> and <i>Cochliobolus sativus</i> , early-season root rot ( <i>Rhizoctonia</i> ), loose smut and common bunt as well as for suppression of common root rot ( <i>Cochliobolus sativus</i> ) and crown and foot rot ( <i>Fusarium</i> ).  For Pythium protection, use RANCONA Apex in combinations with a product that contains metalaxyl at the label rate registered for your crop and disease complex.  RANCONA Apex is for both commercial and on-farm application.
<b>RANCONA Crest</b> Chemtura AgroSolutions	ipconazole metalaxyl imidacloprid	0.421% 0.562% 14.100%	5.0 to 8.33 fl oz per 100 lb of seed	For general seed rots (including those caused by <i>Penicillium</i> and <i>Aspergillus</i> ), seed rot, damping-off and seedling blight (seed- and soilborne <i>Fusarium</i> , <i>Pythium</i> and <i>Cochliobolus sativus</i> ), loose smut, common bunt and early-season root rot ( <i>Rhizoctonia</i> ) as well as suppression of common root rot ( <i>Cochliobolus sativus</i> ) and crown and foot rot ( <i>Fusarium</i> ).  RANCONA Crest is formulated both for commercial and for on-farm applications. Do not apply this product as a planter box or hopper box treatment. Apply RANCONA Crest with mechanical, slurry or mist-type seed treating equipment, provided that the equipment can be calibrated to accurately and uniformly apply the product to the seed.  Do not graze or feed livestock on treated areas for 45 days after planting.

Seed treatment fungicides labeled for use on winter wheat - *continued*

Trade name Company	Common chemical name	% active ingredient	Rate	Additional label information
<b>RANCONA Crest WR</b> Chemtura AgroSolutions	ipconazole metalaxyl imidacloprid	0.439% 0.585% 2.950%	5.0 to 8.33 fl oz per 100 lb of seed	<p>For general seed rots (including those caused by <i>Penicillium</i> and <i>Aspergillus</i>), seed rot, damping-off and seedling blight (seed- and soilborne <i>Fusarium</i>, <i>Pythium</i> and <i>Cochliobolus sativus</i>), loose smut, common bunt and early-season root rot (<i>Rhizoctonia</i>) as well as suppression of common root rot (<i>Cochliobolus sativus</i>) and crown and foot rot (<i>Fusarium</i>).</p> <p>RANCONA Crest WR is formulated both for commercial and for on-farm applications. Do not apply this product as a planter box or hopper box treatment. Apply RANCONA Crest WR with mechanical, slurry or mist-type seed treating equipment, provided that the equipment can be calibrated to accurately and uniformly apply the product to the seed.</p> <p>Do not graze or feed livestock on treated areas for 45 days after planting.</p>
<b>RANCONA Pinnacle</b> Chemtura AgroSolutions	ipconazole metalaxyl	0.434% 0.578%	5.0 to 8.33 fl oz per 100 lb of seed	<p>For general seed rots (including those caused by <i>Penicillium</i> and <i>Aspergillus</i>), seed rot, damping-off and seedling blight (seed- and soilborne <i>Fusarium</i>, <i>Pythium</i> and <i>Cochliobolus sativus</i>), loose smut, common bunt and early-season root rot (<i>Rhizoctonia</i>) as well as suppression of common root rot (<i>Cochliobolus sativus</i>) and crown and foot rot (<i>Fusarium</i>).</p> <p>Use the higher rate when disease pressure is expected to be high, or when there is a history of high disease levels in the field.</p> <p>RANCONA Pinnacle is formulated both for commercial and for on-farm applications. Apply RANCONA Pinnacle with mechanical, slurry or mist-type seed treating equipment, provided that the equipment can be calibrated to accurately and uniformly apply the product to the seed.</p>
<b>RANCONA 3.8 FS</b> Chemtura AgroSolutions	ipconazole	40.70%	0.051 to 0.085 fl oz per 100 lb of seed	<p>For general seed rots (including those caused by <i>Penicillium</i> and <i>Aspergillus</i>), seed rot, damping-off and seedling blight (seed- and soilborne <i>Fusarium</i>, <i>Pythium</i> and <i>Cochliobolus sativus</i>), loose smut, common bunt and early-season root rot (<i>Rhizoctonia</i>) as well as suppression of common root rot (<i>Cochliobolus sativus</i>) and crown and foot rot (<i>Fusarium</i>).</p> <p>RANCONA 3.8 FS may be applied with mechanical, slurry or mist-type seed treating equipment, provided that the equipment can be calibrated to accurately and uniformly apply the product to the seed.</p> <p>Not for use on agricultural establishments in hopper-box, planter-box, slurry-box or other seed treatment applications at or immediately before planting.</p>
<b>Raxil MD</b> Bayer CropScience	tebuconazole metalaxyl	0.48% 0.64%	5.0 to 6.5 fl oz per 100 lb of seed	<p>Aids in the control or suppression of the following seed, seedling and soilborne diseases of wheat: stinking smut, flag smut, loose smut, early-season Septoria disease complex, general seed rots, Pythium damping-off, early-season Rhizoctonia root rot, early-season common root rot, seedborne Fusarium scab, early-season Fusarium foot rot, early-season suppression of powdery mildew and rust.</p> <p>Wheat green forage may be grazed or harvested for hay 31 days after seeding.</p> <p>Applications should be made using standard slurry or mist-type seed treatment equipment. This product is for commercial or on-farm application. This product is not intended for direct application into a planter box.</p>
<b>Raxil XT Wettable Powder</b> Bayer CropScience	tebuconazole metalaxyl	15.00% 20.00%	0.16 to 0.20 oz per 100 lb of seed	<p>Targeted diseases: Stinking smut, flag smut, loose smut, early-season Septoria disease complex, early-season Rhizoctonia root rot, early-season common root rot, early-season Fusarium foot rot, early-season suppression of powdery mildew, early-season suppression of wheat leaf rust, seedborne Fusarium scab, general seed rots and Pythium damping-off.</p> <p>Wheat green forage may be grazed or harvested for hay 31 days after seeding.</p> <p>The pouches of Raxil XT are water soluble. Applications should be made using standard slurry or mist-type seed treatment equipment.</p>
<b>Sativa IM Max</b> Nufarm Americas Inc.	tebuconazole metalaxyl imidacloprid	0.455% 0.607% 11.374%	3.4 to 5.0 fl oz per 100 lb of seed	<p>Early-season disease control of Pythium damping-off, stinking smut, flag smut, loose smut, early-season Septoria disease complex, early-season Rhizoctonia root rot, early-season common root rot, early-season Fusarium foot rot, early-season suppression of powdery mildew and early-season suppression of wheat leaf rust.</p> <p>Apply before planting as a slurry treatment. This product is to be used in liquid or slurry treaters.</p> <p>Do not graze or feed livestock on treated areas for 45 days after planting.</p>

Seed treatment fungicides labeled for use on winter wheat - *continued*

Trade name Company	Common chemical name	% active ingredient	Rate	Additional label information
<b>Sativa IM RTU Seed Treatment</b> Nufarm Americas Inc.	tebuconazole metalaxyl imidacloprid	0.474% 0.632% 1.581%	5.0 fl oz per 100 lb of seed	Aids in the control or suppression of stinking smut, flag smut, loose smut, early-season Septoria disease complex, general seed rots, Pythium damping-off, early-season Rhizoctonia root rot, early-season common root rot, seedborne Fusarium scab, early-season Fusarium foot rot, early-season suppression of powdery mildew and rust.  Apply using standard slurry or mist-type seed treatment equipment. This product is for commercial or on-farm applications. This product is not intended for direct application into a planter box.  Do not graze or feed livestock on treated areas for 45 days after planting.
<b>Savita M Seed Treatment</b> Nufarm Americas Inc.	tebuconazole metalaxyl	0.614% 1.832%	5.0 fl oz per 100 lb of seed	Aids in the control or suppression of stinking smut, flag smut, loose smut, early-season Septoria disease complex, general seed rots, Pythium damping-off, early-season Rhizoctonia root rot, early-season common root rot, seedborne Fusarium scab, early-season Fusarium foot rot, early-season suppression of powdery mildew and rust.  Apply using standard slurry or mist-type seed treatment equipment. This product is for commercial or on-farm applications. This product is not intended for direct application into a planter box.
<b>Savita M RTU Seed Treatment</b> Nufarm Americas Inc.	tebuconazole metalaxyl	0.499% 0.668%	5.0 to 6.5 fl oz per 100 lb of seed	Aids in the control or suppression of stinking smut, flag smut, loose smut, early-season Septoria disease complex, general seed rots, Pythium damping-off, early-season Rhizoctonia root rot, early-season common root rot, seedborne Fusarium scab, early-season Fusarium foot rot, early-season suppression of powdery mildew and rust.  Apply using standard slurry or mist-type seed treatment equipment. This product is for commercial or on-farm applications. This product is not intended for direct application into a planter box.
<b>Savita 309 FS Fungicide</b> Nufarm Americas Inc.	tebuconazole	28.30%	0.80 to 0.10 fl oz per 100 lb of seed	Aids in the control or suppression of stinking smut, flag smut, loose smut, early-season Septoria disease complex, general seed rots, Pythium damping-off, early-season Rhizoctonia root rot, early-season common root rot, seedborne Fusarium scab, early-season Fusarium foot rot, early-season suppression of powdery mildew and early-season suppression of wheat leaf rust.  Apply this product as a water-based slurry through standard slurry or mist-type commercial seed treatment equipment.  For use only by commercial seed treaters.
<b>Sativa 318 FS Fungicide</b> Nufarm Americas Inc.	tebuconazole	28.30%	0.08 to 0.10 fl oz per 100 lb of seed	Aids in the control or suppression of stinking smut, flag smut, loose smut, early-season Septoria disease complex, general seed rots, Pythium damping-off, early-season Rhizoctonia root rot, early-season common root rot, seedborne Fusarium scab, early-season Fusarium foot rot, early-season suppression of powdery mildew and early-season suppression of wheat leaf rust.  Apply this product as a water-based slurry through standard slurry or mist-type commercial seed treatment equipment.  For use only by commercial seed treaters.
<b>Sebring 318 FS</b> Nufarm Americas Inc.	metalaxyl	30.14%	0.75 fl oz per 100 lb of seed	For Pythium damping-off control.  For control of other of other soilborne diseases, combination of captan, thiram and carboxin registered formulations are compatible. Do not use with other seed treatment products unless previous experience assures compatibility.  This product may be applied as a water-based slurry with other registered seed treatment insecticides and fungicides through standard slurry or mist-type commercial seed treatment equipment.  As a planter box treatment apply at the specified rate and premix with the seed directly in the planter box at planting.
<b>Sebring 480 FS</b> Nufarm Americas Inc.	metalaxyl	44.08%	0.50 fl oz per 100 lb of seed	For Pythium damping-off control.  For control of other of other soilborne diseases, combination of captan, thiram and carboxin registered formulations are compatible. Do not use with other seed treatment products unless previous experience assures compatibility.  This product may be applied as a water-based slurry with other registered seed treatment insecticides and fungicides through standard slurry or mist-type commercial seed treatment equipment.  As a planter-box treatment apply at the specified rate and premix with the seed directly in the planter box at planting.



Seed treatment fungicides labeled for use on winter wheat - *continued*

Trade name Company	Common chemical name	% active ingredient	Rate	Additional label information
<b>Signet 480 FS Seed Treatment</b> Nufarm Americas Inc.	thiram	44.00%	2.0 fl oz per bushel of seed	Used according to label directions, this product will usually increase stands and yields by reducing losses from seed decay, damping-off and seedling blights caused by many seedborne and soilborne organisms. This product will usually control covered smuts or bunts of wheat. This product should be applied with water as a suspension in the slurry-type treater specifically designed and approved for this purpose. Plant treated wheat seed a minimum of 1 inch deep. For sale to and use by professional applicators only.
<b>Stamina</b> BASF	pyraclostrobin	18.40%	0.4 to 0.8 fl oz per 100 lb of seed	Target diseases include seed and seedling disease (damping-off) caused by <i>Rhizoctonia solani</i> , seedborne fungi causing seed decay and seedling blight. Also suppression of common root rot, Fusarium seed rot and seedling blight, dry seed decay ( <i>Penicillium</i> spp.), common bunt and seedling damping-off ( <i>Pythium</i> spp.). Stamina can be used both in commercial seed treatment facilities and on-farm systems. Apply Stamina as a water-based mixture using standard slurry or mist-type seed treatment application equipment.
<b>Stamina F<sup>3</sup> Cereals</b> BASF	pyraclostrobin triticonazole metalaxyl	1.59% 1.59% 0.93%	4.6 fl oz per 100 lb of seed	For control of common bunt, common root rot, dry seed decay, Fusarium seed rot, Fusarium seedling blight, loose smut, Pythium damping off and Rhizoctonia root rot and suppression of Fusarium crown rot and Fusarium root rot. For commercial and on-farm use. Direct application into a planter box is prohibited.
<b>Stamina F<sup>3</sup> HL</b> BASF	pyraclostrobin triticonazole metalaxyl	7.57% 7.57% 4.54%	1.0 fl oz 100 lb of seed	Stamina F <sup>3</sup> HL is a liquid seed treatment used for control or suppression of certain seedborne and soilborne diseases of wheat. Stamina F <sup>3</sup> HL will generally increase emergence and plant stands by controlling or suppressing these diseases. Diseases controlled: common bunt, common root rot, dry seed decay, flag smut, Fusarium seed rot, Fusarium seedling blight, loose smut Pythium damping-off and Rhizoctonia root rot. Diseases suppressed: Fusarium crown rot and Fusarium root rot. Stamina F <sup>3</sup> HL fungicide seed treatment is for use at commercial seed treatment facilities using standard commercial seed treatment equipment (such as, but not limited to, slurry or mist-type equipment). Not for use on farm.
<b>System<sup>3</sup></b> Helena Chemical Company	PCNB metalaxyl <i>Bacillus subtilis</i>	16.67% 4.25% 0.10%	2.0 to 3.0 oz per bushel of seed	Pythium and Rhizoctonia seedling disease complex, common smut or bunt. Use the higher rate of application in fields with a history of severe disease pressure. Apply at the specified rate and premix with the seed directly in the planter box at planting. May be applied at planting time utilizing commercial seed treating equipment to maximize seed coverage.
<b>Thiram 480 DP</b> Chemtura AgroSolutions	thiram	42.00%	3.3 fl oz per 100 lb of seed	Used according to directions, Thiram 480 DP will usually increase stands and yields by reducing losses from seed decay, damping-off and seedling blights caused by many seedborne and soilborne organisms. Thiram 480 DP will usually control covered smuts or bunts of wheat. Intended for use by professional applicators only. Not for sale or use by homeowners/consumers. Apply with mechanical, slurry or mist-type seed treating equipment, provided that the equipment can be calibrated to accurately apply the product to seed. Plant treated wheat seed a minimum of 1 inch deep.
<b>Vibrance</b> Syngenta	sedaxane	43.70%	0.08 to 0.16 fl oz per 100 lb of seed	For control of seed decay, seedling blight and damping-off caused by <i>Rhizoctonia solani</i> and of loose smut caused by <i>Ustilago tritici</i> . Use the low rate for control of pre-emergent damping-off, seed decay or seedling blight. For extended control of post-emergent damping-off and seedling blight or high disease pressure due to short cropping rotations, or high levels of seedborne infections like smuts, use the high rate. Tank mix when a problem is expected with the diseases that are not controlled by Vibrance. Vibrance does not control diseases caused by <i>Pythium</i> spp. or <i>Phytophthora</i> spp. If these diseases are expected apply with Apron XL or seed treatment products that contain mefenoxam as active ingredients. Apply as a water-based slurry using standard slurry seed treatment equipment which provides uniform seed coverage.

Seed treatment fungicides labeled for use on winter wheat - *continued*

Trade name Company	Common chemical name	% active ingredient	Rate	Additional label information
<b>Vibrance Extreme</b> Syngenta	sedaxane	1.22%	2.8 to 5.6 fl oz per	For protection against general seed rots; seedling blight, root rot and damping-off caused by seed- and soilborne <i>Fusarium</i> spp. or <i>Rhizoctonia</i> spp.; seedling blight, root rot and damping-off caused by soilborne <i>Pythium</i> spp.; seedborne <i>Septoria</i> ; <i>Septoria</i> leaf blotch; common bunt; dwarf bunt; karnal bunt; flag smut; <i>Fusarium</i> seed scab and loose smut, as well as suppression of common root rot ( <i>Cochliobolus</i> spp.), <i>Fusarium</i> crown and foot or root rot and take-all.  For <i>Septoria</i> leaf blotch provides early season foliar disease protection for the first 4 weeks after planting. For full season protection, apply a foliar fungicide according to label directions.  Apply <i>Vibrance Extreme</i> as a water-based slurry using standard slurry treatment equipment which provides uniform seed coverage.
	difenoconazole	5.86%	100 lb of seed	
	mefenoxam	1.46%		
<b>Vitaflo-280</b> Chemtura AgroSolutions	carboxin	15.59%	3.5 to 5.0 fl oz per	Combination of a systemic fungicide (carboxin) and a contact fungicide (thiram) providing control of loose smut ( <i>Ustilago tritici</i> ) and common bunt as well as general seed rot, seedling blight and damping off including <i>Fusarium</i> , <i>Cochliobolus sativus</i> and <i>Pythium</i> . Also protects from seed rot caused by the seed borne storage fungi <i>Aspergillus</i> , <i>Alternaria</i> and <i>Penicillium</i> .  Use the high rate for control of loose smut of wheat. The low rate will provide partial control of loose smut of wheat. The high rate will provide increased protection on highly infected seed.  Formulated both for on-farm and commercial use. DO NOT apply <i>Vitaflo-280</i> as a planter-box or hopper-box treatment. <i>Vitaflo-280</i> may be applied with mechanical, slurry, or mist-type seed treating equipment, provided that the equipment can be calibrated to accurately and uniformly apply the product to the seed.  Plant wheat seed a minimum of 1 inch deep.  Do not graze or feed livestock on treated areas for six weeks after planting.
	thiram	13.25%	100 lb of seed	
<b>Vitaflo-280C</b> Chemtura AgroSolutions	carboxin	15.59%	3.5 to 5.0 fl oz per	Combination of a systemic fungicide (carboxin) and a contact fungicide (thiram) providing control of loose smut ( <i>Ustilago tritici</i> ) and common bunt as well as general seed rot, seedling blight and damping off including <i>Fusarium</i> , <i>Cochliobolus sativus</i> and <i>Pythium</i> . Also protects from seed rot caused by the seed borne storage fungi <i>Aspergillus</i> , <i>Alternaria</i> and <i>Penicillium</i> .  Use the high rate for control of loose smut of wheat. The low rate will provide partial control of loose smut of wheat. The high rate will provide increased protection on highly infected seed.  Formulated both for on-farm and commercial use. DO NOT apply <i>Vitaflo-280C</i> as a planter-box or hopper-box treatment. <i>Vitaflo-280C</i> may be applied with mechanical, slurry, or mist-type seed treating equipment, provided that the equipment can be calibrated to accurately and uniformly apply the product to the seed.  Plant wheat seed a minimum of 1 inch deep.  Do not graze or feed livestock on treated areas for six weeks after planting.
	thiram	13.25%	100 lb of seed	
<b>Vitavax M</b> Helena Chemical Corporation	carboxin	5.70%	9.0 to 12.0 fl oz per	Provides control of loose smut and common bunt. Use the higher rate under conditions of expected heavy disease pressure. Also contains the micronutrient molybdenum.  Do not graze or feed livestock on treated area for six weeks after planting.  Ready-to-use seed treatment for hopper-box application.
	thiram	5.70%	100 lb of seed	
	molybdenum	2.90%		
<b>Vitavax-34</b> Chemtura AgroSolutions	carboxin	34.00%	2.0 to 3.0 fl oz per 100 lb of seed	For control of loose smut ( <i>Ustilago tritici</i> ), common bunt ( <i>Tilletia caries</i> , <i>T. foetida</i> ), flag smut ( <i>Urocystis agropyri</i> ), seed rots, damping off and seedling blight caused by <i>Cochliobolus sativus</i> .  The higher rate will provide increased protection on highly inflected seed.  May be applied with mechanical, slurry, or mist-type seed treating equipment, provided that the equipment can be calibrated to accurately and uniformly apply the product to seed. DO NOT apply this product as a planter-box or hopper-box treatment.  Do not graze or feed livestock on treated areas for six weeks after planting.

Seed treatment fungicides labeled for use on winter wheat - *continued*

Trade name Company	Common chemical name	% active ingredient	Rate	Additional label information
<b>Warden Cereals</b> Winfield Solutions, LLC	ipconazole metalaxyl	0.434% 0.579%	5.0 to 8.33 fl oz per 100 lb of seed	For control of general seed rots (including those caused by <i>Penicillium</i> and <i>Aspergillus</i> ), seed rot, damping off and seedling blight (seed- and soilborne <i>Fusarium</i> , <i>Pythium</i> and <i>Cochliobolus sativus</i> ), loose smut ( <i>Ustilago tritici</i> ), common bunt ( <i>Tilletia caries</i> , <i>T. foetida</i> ) and early season root rot ( <i>Rhizoctonia</i> ). For suppression of common root rot ( <i>Cochliobolus sativus</i> ) and crown and foot rot ( <i>Fusarium</i> ).  Use the higher rate when disease pressure is expected to be high, or when there is a history of high disease levels in the field.  Both for commercial and for on-farm application. It may be applied with mechanical, slurry, or mist-type seed treating equipment, provided that equipment can be calibrated to accurately and uniformly apply the product to seed.
<b>Warden Cereals HR</b> Winfield Solutions, LLC	ipconazole metalaxyl imidacloprid	0.421% 0.562% 14.100%	5.0 to 8.33 fl oz per 100 lb of seed	A systemic and contact broad spectrum fungicide plus systemic insecticide for seed treatment that protects against a wide variety of listed diseases and insects.  For control of general seed rots (including those caused by <i>Penicillium</i> and <i>Aspergillus</i> ), seed rot, damping off and seedling blight (seed- and soilborne <i>Fusarium</i> , <i>Pythium</i> and <i>Cochliobolus sativus</i> ), loose smut ( <i>Ustilago tritici</i> ), common bunt ( <i>Tilletia caries</i> , <i>T. foetida</i> ) and early-season root rot ( <i>Rhizoctonia</i> ). For suppression of common root rot ( <i>Cochliobolus sativus</i> ) and crown and foot rot ( <i>Fusarium</i> ).  Use the higher rate when disease pressure is expected to be high, or when there is a history of high disease levels in the field.  Both for commercial and for on-farm application. DO NOT apply this product as a planter-box or hopper-box treatment. It may be applied with mechanical, slurry, or mist-type seed treating equipment, provided that equipment can be calibrated to accurately and uniformly apply the product to seed.  Do not graze or feed livestock on treated areas for 45 days after planting.
<b>Warden Cereals WR</b> Winfield Solutions, LLC	ipconazole metalaxyl imidacloprid	0.439% 0.585% 2.950%	5.0 to 8.33 fl oz per 100 lb of seed	A systemic and contact broad spectrum fungicide plus systemic insecticide for seed treatment that protects against a wide variety of diseases and wireworms.  For control of general seed rots (including those caused by <i>Penicillium</i> and <i>Aspergillus</i> ), seed rot, damping off and seedling blight (seed- and soilborne <i>Fusarium</i> , <i>Pythium</i> and <i>Cochliobolus sativus</i> ), loose smut ( <i>Ustilago tritici</i> ), common bunt ( <i>Tilletia caries</i> , <i>T. foetida</i> ) and early-season root rot ( <i>Rhizoctonia</i> ). For suppression of common root rot ( <i>Cochliobolus sativus</i> ) and crown and foot rot ( <i>Fusarium</i> ).  Use the higher rate when disease pressure is expected to be high, or when there is a history of high disease levels in the field.  Both for commercial and for on-farm application. DO NOT apply this product as a planter-box or hopper-box treatment. It may be applied with mechanical, slurry, or mist-type seed treating equipment, provided that equipment can be calibrated to accurately and uniformly apply the product to seed.  Do not graze or feed livestock on treated areas for 45 days after planting.

**Virus diseases of winter wheat**

The virus diseases most likely to occur on winter wheat in Missouri are wheat spindle streak mosaic, wheat soilborne mosaic, barley yellow dwarf and wheat streak mosaic. Symptoms of barley yellow dwarf may be evident on young wheat plants in the fall, may show up on young plants early in the spring or may be evident later in the season primarily on the flag leaves of plants. Symptoms of wheat spindle streak mosaic and wheat soilborne mosaic typically show up during spring green-up and are most pronounced when air temperatures are around 50 degrees F. Wheat streak mosaic symptoms tend to become obvious as air temperatures increase later in the spring.

Both **wheat spindle streak mosaic** and **wheat soilborne mosaic** are vectored or spread by the soilborne organism *Polymyxa graminis*. This vector prefers wet condi-

tions and is most likely to infect wheat roots during wet falls.

Symptoms of wheat spindle streak mosaic appear in early spring as yellow green streaks or mottling on the dark green background of the leaves. These lesions usually run parallel to the leaf veins and tend to be tapered at the ends giving the lesions a spindle-shaped appearance. Plants may be slightly stunted, off-color and have fewer tillers than normal.

Wheat soilborne mosaic causes light green to yellow green to bright yellow mosaic patterns in leaf tissues. Symptoms of wheat soilborne mosaic are not always distinctive and might occur as a more general yellowing, similar to that caused by nitrogen deficiency. Infected plants may be stunted and slow to green up in the spring.

Plants infected in the fall usually show symptoms the following spring. Spring infections may occur during wet springs but usually spring infections occur too late to cause

significant injury. In most years the symptoms of these two wheat virus diseases are evident as the wheat crop is green-up and tend to fade as air temperatures increase. In years with late, cool springs, symptoms may be evident much later in the season, even on plants that have headed.

**Barley yellow dwarf** (also called yellow dwarf and red leaf) is an extremely widespread virus disease of cereals. Symptoms include leaf discoloration ranging from a light-green or yellowing to a red or purple discoloration of leaf tissue. Symptoms are most pronounced when temperatures are in the range of 50-65 degrees F. The barley yellow dwarf virus persists in small grains, corn and perennial and annual weed grasses. More than 20 species of aphids can transmit the barley yellow dwarf virus. Symptoms may be more severe and yield losses higher if plants are infected in the fall or early in the spring. Infections developing in late spring or summer may cause discoloration of upper leaves but little stunting of plants or yield loss.

**Wheat streak mosaic** is the other virus disease likely to occur on winter wheat in Missouri. It causes a light-green to yellow-green mottling and streaking of leaves. The wheat streak mosaic virus is spread by the wheat curl mite. Symptoms are frequently found along the edges of fields where the mite vector first entered the field. Both the wheat streak mosaic virus and the wheat curl mite survive in susceptible crop and weed hosts including winter and spring wheat, barley, corn, rye, oats and a number of perennial grasses. Thus, the destruction of volunteer wheat and grass weed control are important management options for wheat streak mosaic.

Mixed infections of wheat viruses in the same field or even the same plant are common in Missouri. When plants are infected with more than one virus disease, it may not be possible to identify the specific viruses present by symptoms. It may be necessary to submit a plant sample to a plant diagnostic laboratory for virus testing.

Most of the management options for virus diseases in wheat are preventative measures such as planting resistant or tolerant wheat varieties, avoiding continuous wheat production, destroying volunteer wheat and weed grasses near wheat production fields, delaying wheat planting until all corn is harvested and avoiding early fall planting of wheat. Proper fertility may help reduce the impact of virus diseases on wheat.

#### Management options for virus diseases of wheat

- Plant good-quality seed of resistant varieties.
- Avoid planting too early in the fall to minimize opportunity for vectors to transmit viruses to young wheat plants.
- Destroy volunteer wheat and control weed grasses that may be hosts of the virus pathogens or insect vectors.
- Rotate crops.
- Maintain good plant vigor with adequate fertility.
- For barley yellow dwarf, insecticide applications (either as a seed treatment or foliar application) to control the aphid vectors may be warranted.

### Foliage diseases of winter wheat

Many different fungi and bacteria can cause foliage diseases on wheat. These pathogens cause a wide range of leaf

spots, leaf blights and similar symptoms on wheat. Foliage diseases that can cause significant injury to wheat in Missouri include Septoria leaf blotch, Stagonospora glume blotch, tan spot, leaf rust, stem rust, stripe rust, powdery mildew and bacterial stripe or black chaff.

The fungi that cause most of these wheat foliage diseases survive in infested wheat residues left on the soil surface. The next growing season spores are produced during moist periods and are carried by wind currents to susceptible wheat leaves, where infection may begin. Disease problems tend to be more severe when wheat is planted in fields with infested wheat residue left on the soil surface. Eventually spores that are produced in the initial lesions on plants are wind blown to other leaves or other plants causing secondary infection.

Leaf rust, stem rust and stripe rust are exceptions to this simplified explanation of disease development. The rust fungi do not survive in infested residue left in a field and, in fact, do not survive the winter months in this area at all. Rather, the rust fungi are reintroduced into this area each season when spores are carried up on air currents from the southern United States.

Most of the foliage diseases of wheat are favored by warm, wet or humid weather. Frequently infection begins on the lower portion of the plant. If weather conditions are favorable for disease development, the disease may move up through the plant. Severely infected leaves may yellow and die prematurely. Yield losses tend to be highest when the flag leaves are heavily infected.

There are several fungicides that are labeled for use on wheat to control fungal foliage diseases. It is important to scout wheat fields and determine which leaf diseases are occurring as well as the level of their severity before making a decision to apply a foliar fungicide. In particular be on the lookout for Septoria leaf blotch, Stagonospora glume blotch, tan spot, leaf rust and stripe rust. When scouting fields, try to identify the disease or diseases that are present, determine the average percent of infection on a leaf and the number of leaves showing infection and determine the stage of growth of the crop.

Generally, the profitable use of foliar fungicides on wheat depends on a number of factors, including varietal resistance, disease severity, effectiveness of the specific fungicides and timing of fungicide application. The greatest increases in yield are usually obtained when fungicides are applied to disease-susceptible varieties with high-yield potential at the early boot to head emergence growth stage when the flag leaf is in danger of severe infection. Fungicide applications are seldom beneficial if applied after flowering or after the flag leaf is already severely infected. It is also important to read the fungicide label for specific information on rates, recommended timing of application, frequency of applications, preharvest intervals and grazing restrictions.

#### Management options for foliage diseases of wheat

- Plant disease-free seed of varieties with resistance to diseases likely to occur in your area.
- Rotate with non-host crops.

- Manage residues: if tillage system is a conservation tillage system, particular care should be given to rotation and variety selection.
- Maintain good plant vigor with adequate fertility.
- Use foliar fungicides if warranted. See table of foliar fungicides labeled for use on winter wheat.

Black chaff (also called bacterial stripe) is a bacterial disease which produces symptoms on both leaves and heads. Water-soaked lesions that turn into reddish-brown to brown to brownish black streaks develop on the leaves. Glumes and awns show brown-black blotches or streaks. The bacterium that causes this disease, *Xanthomonas campestris* pv. *translu-cens*, is seedborne; therefore the use of disease-free seed is a primary control measure. Use of resistant or tolerant vari-

eties and crop rotation should also reduce the incidence of bacterial stripe and black chaff.

**Foliar fungicides labeled for use on winter wheat**

The following table was prepared using current company product labels and manufacturers’ Web sites. However, label registrations can change at any time. Before using any agricultural pesticide, read and follow directions accompanying that product. Product names have been used for clarity. Reference to specific trade names does not imply endorsement by the University of Missouri; discrimination is not intended against similar products not listed.

**Foliar fungicides labeled for use on winter wheat**

Trade name Company	Common chemical name	% active ingredient	Rate	Additional label information
<b>Absolute 500 SC</b> Bayer CropScience	tebuconazole trifloxystrobin	22.63% 22.63%	5.0 fl oz per acre	Diseases controlled: glume blotch, Septoria leaf blight, powdery mildew, rusts and tan spot. Begin applications preventatively when conditions are favorable for disease development. Early season leaf disease suppression: apply 3.0 to 4.0 fl oz per acre for suppression of tan spot, leaf blight and powdery mildew. May be applied by ground, aerial or chemigation. Do not apply more than 5.0 fl oz per season. Do not allow livestock to graze within the treated area within 30 days after application, and do not harvest the treated crop for forage within 30 days after application or for hay and wheat straw within 45 days after application. Restricted entry interval (REI) = 12 hours. Do not apply within 35 days of harvest.
<b>Approach</b> DuPont	picoxystrobin	22.50%	3.0 to 4.0 fl oz per acre or 6.0 to 12.0 fl oz per acre	For control or suppression of black point, leaf and glume blotch, powdery mildew, rusts, spot blotch and tan spot. For suppression of scab. For 3.0 to 4.0 fl oz rate make a single application between tillering through jointing for early season disease control/suppression. Starting no sooner than 7-days later, additional 6.0 fl oz to 12.0 fl oz treatments can be made depending on disease pressure and environmental conditions. For 6.0 to 12.0 fl oz rate begin applications prior to disease development and continue on a 7- to 14-day interval depending on the targeted diseases. Use higher rate and shorter interval when disease pressure is high. To optimize yields in cereals, it is important to protect the flag leaf from foliar diseases. For optimizing yield and flag leaf disease control, apply at Feekes 9, “flag leaf out.” Apply no later than the beginning of flowering (Feekes 10.5). Make no more than 2 sequential applications of Approach before switching to a fungicide with a different mode of action. For grain, apply no later than the beginning of flowering (Feekes 10.5). The minimum pre-harvest interval between the last application and harvest for grain is 45 days, 7-days for forage and 14-days for hay. Do not exceed 36.0 fl oz per acre per crop.

Foliar fungicides labeled for use on winter wheat - *continued*

Trade name Company	Common chemical name	% active ingredient	Rate	Additional label information
<b>Approach Prima</b> DuPont	picoxystrobin cyproconazole	17.94% 7.17%	3.4 fl oz per acre or 3.4 to 6.8 fl oz per acre	<p>3.4 fl oz rate for control or suppression of leaf and glume blotch, powdery mildew and tan spot.</p> <p>3.4 to 6.8 fl oz rate for control or suppression of black point, leaf and glume blotch, powdery mildew, rusts, spot blotch and tan spot and for suppression of scab.</p> <p>For 3.4 fl oz rate apply early season for preventive disease control/suppression. Additional treatments should be made depending on disease pressure and environmental conditions.</p> <p>For 3.4 to 6.8 fl oz rate begin applications prior to disease development. Use the higher rate when disease pressure is high. To optimize yields in cereals, it is important to protect the flag leaf from foliar diseases. For optimizing yield and flag leaf disease control, apply Approach Prima at Feekes 9, "flag leaf out."</p> <p>Apply no more than two sequential applications of picoxystrobin containing product before switching to a fungicide with a different mode of actions. The minimum re-treatment interval in cereals is 14 days.</p> <p>Minimum time (PHI) between the last application and harvest for grain is 45-days and for forage or hay is 21-days.</p> <p>Do not exceed 6.8 fl oz per acre per crop.</p>
<b>AVARIS</b> Helena Chemical Company	azoxystrobin propiconazole	7.00% 11.70%	7.0 to 14.0 fl oz per acre	<p>Use 7.0 to 14.0 fl oz per acre for early-season suppression of powdery mildew, Septoria leaf blight, glume blotch and tan spot. Apply AVARIS in the spring for suppression of early-season diseases and follow up with a second application for full season control.</p> <p>Use 10.5 to 14.0 fl oz per acre for control of leaf diseases including rust (<i>Puccinia</i> spp.), powdery mildew, Septoria leaf blight, glume blotch, tan spot, Helminthosporium leaf blight, and Alternaria kernel blight. Protecting the flag leaf is important for maximizing the potential yield. Highest yields are normally obtained when AVARIS is applied when the flag leaf is 50% to fully emerged. If disease pressure is low, 10.5 fl oz per acre may be applied.</p> <p>Applications may be made no closer than a 14-day interval.</p> <p>AVARIS can be applied through full head emergence (Feekes growth stage 10.5). Do not apply after this stage to avoid possible illegal residues.</p> <p>Use 14.0 fl oz per acre for foot rot/eyespot. Apply full rate of AVARIS plus half the rate recommended of other EPA registered fungicides such as Topsin M. Apply at tillering but before elongation has occurred.</p> <p>Apply no more than two applications of AVARIS or any other Group 11 fungicide per year. Do not apply more than 28.0 fl oz per acre per season of AVARIS. See label for additional information on resistance management.</p> <p>AVARIS is most effective when applied and allowed to dry before a rainfall.</p> <p>For best results, sufficient coverage is important. Use a higher water volume for aerial application (greater than 2 GPA) if equipment and/or conditions would not provide good coverage.</p> <p>AVARIS may be applied by ground, air or chemigation.</p> <p>AVARIS is extremely toxic to certain apple varieties. Extreme care must be used to prevent injury to apple trees. See label for additional information.</p> <p>Under certain environmental conditions, tank mixes of AVARIS plus herbicides and/or fertilizers may cause crop injury.</p> <p>Do not apply within 30 days of harvest for forage or hay.</p> <p>Do not apply after Feekes growth stage 10.5.</p>

Foliar fungicides labeled for use on winter wheat - *continued*

Trade name Company	Common chemical name	% active ingredient	Rate	Additional label information
<b>Bumper 41.8 EC</b> Makhteshim Agan of North America, Inc.	propiconazole	41.80%	4.0 fl oz per acre	<p>Use 4.0 fl oz per acre for control of rust (<i>Puccinia</i> spp.), powdery mildew (<i>Blumeria</i> spp., <i>Erysiphe</i> spp.), leaf blight (<i>Septoria tritici</i>) glume blotch (<i>Stagonospora nodorum</i>), tan spot (<i>Pyrenophora tritici-repentis</i>), Helminthosporium leaf blight (<i>Drechslera tritici-repentis</i>), spot blotch (<i>Bipolaris sorokiniana</i>) and net blotch (<i>Pyrenophora teres</i>).</p> <p>Protecting the flag leaf is important for maximizing yield. When Bumper 41.8 EC is applied at 50% to fully emerged, the highest yields are normally obtained. Applications may be made at no closer than at 14-day intervals. The use of an oil-based adjuvant may improve spray coverage.</p> <p>Use 2.0 to 4.0 fl oz per acre for early season suppression of powdery mildew (<i>Blumeria</i> spp., <i>Erysiphe</i> spp.), leaf blight (<i>Septoria tritici</i>), glume blotch (<i>Stagonospora nodorum</i>) and tan spot (<i>Pyrenophora tritici-repentis</i>). Apply in the spring. Make a second application up to Feekes growth stage 10.5 for season-long control. Applications may be made no closer than at 14-day intervals.</p> <p>Use 4.0 fl oz per acre for suppression only of Fusarium head blight. Apply at approximately 50% flowering. Addition of a penetrating type adjuvant may increase Fusarium head blight suppression.</p> <p>Application may be made using ground, air or chemigation equipment.</p> <p>Do not apply more than 8.0 fl oz of Bumper 41.8 EC per acre per season. Do not apply more than 4.0 fl oz per acre per season if forage or hay will be harvested.</p> <p>Do not apply after Feekes growth stage 10.5 in wheat.</p>
<b>Bumper ES</b> Makhteshim Agan of North America, Inc.	propiconazole	40.85%	4.0 fl oz per acre or 2.0 to 4.0 fl oz per acre	<p>2.0 to 4.0 fl oz for early season suppression of powdery mildew, leaf blight, glume blotch or tan spot. Apply early in the spring. Make a second application up to Feekes growth stage 10.5 for season long control. Applications may be made no closer than at 14-day intervals.</p> <p>4.0 fl oz rate for rusts, powdery mildew, leaf blight, glume blotch, tan spot, Helminthosporium leaf blight, spot blotch and net blotch.</p> <p>Protecting the flag leaf is important for maximizing yield. When applied at 50% to fully emerged, the highest yields are normally obtained.</p> <p>Applications may be made no closer than at 14-day intervals.</p> <p>The use of an oil-based adjuvant may improve spray coverage.</p> <p>4.0 fl oz rate for foot rot.</p> <p>Apply Bumper ES per acre plus half rates of other EPA-registered fungicides such as thiophanate methyl. Apply at tillering but before elongation has occurred.</p> <p>4.0 fl oz rate for suppression only of Fusarium head blight. Apply at approximately 50% flowering. Addition of a penetrating type of adjuvant may increase Fusarium head blight suppression.</p> <p>Do not apply within 30 days of harvest for forage or hay.</p> <p>Do not apply more than 8.0 fl oz of Bumper ES per acre per season.</p> <p>Do not apply more than 4.0 fl oz per acre per season if forage or hay will be harvested.</p> <p>Do not apply after Feekes growth stage 10.5.</p>
<b>Caramba</b> BASF	metconazole	8.60%	10.0 to 17.0 fl oz per acre	<p>Target diseases: black point, powdery mildew, rust, Septoria leaf and glume blotch and tan spot 10.0 to 14.0 fl oz per acre.</p> <p>For optimum disease control, begin applications of Caramba before disease development. To maximize yields in cereals, it is important to protect the flag leaf. For diseases other than head scab, apply Caramba immediately after flag leaf emergence for optimum results.</p> <p>Suppression only of head scab (<i>Fusarium</i> spp.): 13.5 to 17.0 fl oz per acre. For optimum suppression of Fusarium head blight, apply Caramba at the beginning of anthesis. When head blight is a concern, growers should manage this disease with fungicides that are labeled for and effective in managing this disease and with cultural practices like crop rotation and plowing to reduce crop residues that serve as an inoculum source.</p> <p>Rates up to 17.0 fl oz per acre of Caramba may be used under severe disease pressure. The minimum treatment interval is 6 to 8 days.</p> <p>Resistance management: To limit the potential for development of resistance, do not make more than two applications of Caramba or other DMI (Group 3) fungicides per season.</p> <p>Maximum number of applications per season is two. Maximum product rate per season is 34 fl oz per acre.</p> <p>No livestock feeding restrictions.</p> <p>Minimum time from application to harvest is 30 days.</p>

Foliar fungicides labeled for use on winter wheat - *continued*

Trade name Company	Common chemical name	% active ingredient	Rate	Additional label information
<b>Custodia</b> Makhteshim Agan of North America, Inc.	azoxystrobin tebuconazole	11.00% 18.35%	6.4 to 8.6 fl oz per acre	<p>Target diseases: Septoria leaf, glume blotch, powdery mildew, leaf rust, stem rust, stripe rust, tan spot and suppression of head blight or scab.</p> <p>Should be applied prior to disease development up to late head emergence (Feekes 10.5 or Zadok's 59). Do not apply after this stage to avoid possible illegal residues.</p> <p>Rusts: apply at the earliest sign of rust pustules on foliage.</p> <p>Fusarium head blight: optimal timing for Fusarium head blight suppression is the beginning of flowering on main stem heads (Feekes 10.5).</p> <p>For optimum disease control, tank mix with the lowest specified rate of a spray adjuvant.</p> <p>Do not apply more than 1 application per acre per year.</p> <p>Do not apply to wheat after Feekes growth stage 10.5.</p> <p>Do not apply more than 8.6 fl oz per acre per season.</p> <p>Do not apply within 14 days of harvest for forage and hay and 45 days of harvest for grain and straw.</p> <p>Restricted-entry interval is 12 hours.</p>
<b>Dithane DF Rainshield</b> Dow AgroSciences	mancozeb	75.00%	2.1 lb per acre	<p>For control of Helminthosporium leaf spot, leaf rust, Septoria glume blotch, Septoria leaf spot and tan spot.</p> <p>Start applications at the onset of disease or when plants are in the tillering to jointing stage and repeat at 7- to 10-day intervals. The addition of Latron CS-7 to spray solutions will improve performance.</p> <p>Do not make more than three applications during the season.</p> <p>Do not apply after Feekes growth stage 10.5 or heading, but not less than 26 days of harvest.</p> <p>Do not graze livestock in treated area before harvest.</p>
<b>Dithane F-45 Rainshield</b> Dow AgroSciences	mancozeb	37.00%	1.6 qt per acre	<p>Do not make more than three applications during the season.</p> <p>Do not apply after Feekes growth stage 10.5 or heading, but not less than 26 days of harvest.</p> <p>Do not graze livestock in treated area before harvest.</p>
<b>Dithane M45</b> Dow AgroSciences	mancozeb	80.00%	2.0 lb per acre	<p>Do not graze livestock in treated area before harvest.</p>
<b>Equation</b> Cheminova	azoxystrobin	22.80%	4.0 to 12.0 fl oz per acre or 7.5 to 11.0 fl oz per acre	<p>4.0 to 12.0 fl oz rate for leaf rust, Septoria leaf and glume blotch, stem rust, stripe rust and tan spot.</p> <p>7.5 to 11.0 rate for powdery mildew.</p> <p>Apply preventatively or when conditions are favorable for disease development. Repeat as necessary if conditions are favorable for disease development.</p> <p>Apply no later than Feekes 10.54.</p> <p>A crop oil concentrate may be added at 1.0% v/v to enhance efficacy.</p> <p>For multiple applications refer to the guidelines under Resistance Management on the label.</p> <p>Do not apply more than 24.0 fl oz of product per acre per season.</p> <p>Restricted entry interval is 4 hours.</p> <p>Preharvest interval: do not apply within 14 days of grazing or harvest.</p> <p>Preharvest interval: do not apply within 7 days for forage and hay.</p>
<b>EVITO T</b> Arysta LifeScience North America, LLC	fluoastrobilin tebuconazole	18.00% 25.00%	4.0 to 6.0 fl oz per acre	<p>For control of leaf rust, stripe rust, stem rust, Septoria leaf and glume blotch and tan spot.</p> <p>For optimum results, apply the first application at approximately Feekes growth stage 5 (Zadok's 31) and a second application no later than Feekes growth stage 10.5</p> <p>Do not apply more than 12.0 fl oz per acre per crop season. There is a maximum of two applications per crop season.</p> <p>Restricted-entry interval (REI) is 12 hours.</p> <p>Do not apply after Feekes growth stage 10.5.</p> <p>Do not apply within 40 days of harvest for grain and straw. Do not apply within 7 days of harvest for forage or hay. Do not allow livestock to graze or feed on green forage within 7 days after treatment with EVITO T.</p>



Foliar fungicides labeled for use on winter wheat - *continued*

Trade name Company	Common chemical name	% active ingredient	Rate	Additional label information
<b>EVITO 480 SC</b> Arysta LifeScience North America, LLC	fluoxastrobin	40.30%	2.0 to 4.0 fl oz per acre	<p>For control of leaf rust, stripe rust, stem rust, Septoria leaf and glume blotch and tan spot.</p> <p>For powdery mildew control use 2.5 to 4.0 fl oz per acre.</p> <p>For optimum results, begin applications preventively and continue as needed on a 14- to 21-day interval. Use the higher rates and shorter interval when disease pressure is high.</p> <p>Apply prior to disease development from Feekes 5 (Zadok's 31) up to late head emergence at Feekes 10.5 (Zadok's 59).</p> <p>Do not apply more than 8.0 fl oz per acre per year. There is a maximum number of two applications per season, and a minimum interval of 14 days between applications.</p> <p>May be applied by ground, air or through chemigation.</p> <p>Do not apply within 40 days of harvest for grain and straw. Do not apply within 7 days of harvest for forage and hay. Make no more than one application before harvest of wheat forage.</p> <p>Do not apply later than Feekes growth stage 10.5.</p>
<b>Headline</b> BASF	pyraclostrobin	23.60%	6.0 to 9.0 fl oz per acre	<p>For control of leaf rust, powdery mildew, Septoria leaf and glume blotch, spot blotch, stem rust, stripe rust and tan spot.</p> <p>For optimal disease control, begin Headline applications before disease development. To maximize yields in cereals it is important to protect the flag leaf. Apply Headline immediately after flag leaf emergence for optimum results.</p> <p>Headline does not control Fusarium head blight (head scab) or prevent the reductions in grain quality that can result from this disease.</p> <p>Resistance management: To limit the potential for development of resistance, do not make more than two applications of Headline or other strobilurin fungicides per season.</p> <p>Do not harvest wheat hay or feed green-chopped wheat within 14 days after last application.</p> <p>Apply no later than the beginning of flowering (Feekes 10.5, Zadok's 59).</p>
<b>Kocide 2000</b> DuPont	copper hydroxide	53.80%	1.0 to 1.5 lb per acre	<p>Target diseases: Helminthosporium spot blotch, powdery mildew suppression, Stagonospora leaf and glume blotch and stem rust.</p>
<b>Kocide 3000</b> DuPont	copper hydroxide	46.10%	0.5 to 0.75 lb per acre	<p>Make applications for early-season disease control through heading. Minimum retreatment interval is 10 days.</p> <p>Use higher rates when conditions favor disease.</p> <p>Addition of adjuvants is recommended.</p>
<b>Koverall Fungicide</b> Cheminova	mancozeb	75.00%	2.0 lb per acre	<p>For Helminthosporium leaf spot, leaf rust, Septoria glume blotch, Septoria leaf spot and tan spot.</p> <p>Start applications at onset of disease or when plants are in the tillering to jointing stage and repeat at 7- to 10-day intervals.</p> <p>Do not make more than three applications during the season.</p> <p>PHI: do not apply after Feekes growth stage 10.5 (typically 35-45 days) but no less than 26 days before harvest.</p> <p>Do not graze livestock on treated areas prior to harvest.</p> <p>Do not apply more than 6.0 lb per acre per crop.</p>
<b>Kumulus DF</b> Arysta Life Science North America, LLC	sulfur	80.00%	6.0 to 15.0 lb per acre	<p>For the control of powdery mildew.</p> <p>Apply when disease first appears and repeat as necessary or with the regularly scheduled insecticide program.</p>
<b>ManKocide</b> DuPont	mancozeb copper hydroxide	15.00% 46.10%	2.0 to 2.5 lb per acre	<p>Helminthosporium leaf spot, Septoria leaf spot and glume blotch.</p> <p>Make first application at early heading and follow with second spray 10 days later.</p> <p>Use higher rates when conditions favor disease.</p> <p>Maximum rate per season in 32 lb per acre.</p> <p>Do not graze livestock in treated areas before harvest.</p> <p>Do not apply within 26 days of harvest.</p>

Foliar fungicides labeled for use on winter wheat - *continued*

Trade name Company	Common chemical name	% active ingredient	Rate	Additional label information
<b>Manzate Pro-Stick</b> United Phosphorus, Inc.	mancozeb	75.00%	2.0 lb per acre	For control of Helminthosporium leaf spot, leaf rust, Septoria glume blotch, Septoria leaf spot and tan spot. Start applications at the onset of disease or when plants are in the tillering to jointing stage and repeat at 7- to 10-day intervals. Do not make more than three applications during the season. Do not apply more than 6 lb or 4.8 qt per acre per crop. Do not graze livestock in treated areas before harvest. Do not apply within 26 days of harvest.
<b>Manzate Flowable</b> United Phosphorus, Inc.	mancozeb	37.00%	1.6 qt per acre	For leaf, stem and stripe rusts ( <i>Puccinia</i> spp.), and suppression of Fusarium head blight or scab ( <i>Fusarium</i> spp.), apply 4.0 fl oz per acre. Wheat fields should be observed closely for early disease symptoms, particularly when susceptible varieties are planted and/or under prolonged conditions favorable for disease development. Rusts: Apply Monsoon at the earliest sign of rust pustules on foliage. Fusarium head blight: optimal timing of Monsoon for Fusarium head blight suppression is the beginning of flowering on main stem heads (Feekes 10.51). Apply Monsoon in a minimum of 10 gallons of spray solution per acre by ground or in a minimum of 5 gallons of spray solution per acre by air. For optimum disease control, the lowest specified rate of a spray surfactant should be tank-mixed with Monsoon. Monsoon must have two to four hours of drying time on plant foliage for active ingredient to move systemically into plant tissue before rain or irrigation occurs. After this period of time, Monsoon will be resistant to weathering. A maximum of 4.0 fl oz of Monsoon may be applied per acre per crop season. Straw may be fed or used for bedding. Do not allow livestock to graze or feed green forage to livestock prior to six days after treatment with Monsoon. Restricted-entry interval (REI) is 12 hours. Do not apply within 30 days of harvest.
<b>Monsoon</b> Loveland Products Inc.	tebuconazole	38.70%	4.0 fl oz per acre	For leaf, stem and stripe rusts ( <i>Puccinia</i> spp.), and suppression of Fusarium head blight or scab ( <i>Fusarium</i> spp.). Rusts: Make an application of this product at the first sign of rust pustules on the foliage. Fusarium head blight: The best time to apply this product to suppress Fusarium head blight is at the beginning of anthesis (flowering) of the main head. Feekes growth stage 10.51. Apply this product in a minimum of 10 gallons of spray suspension per acre by ground sprayer or in a minimum of 5 gallons of spray suspension per acre by aircraft. The plant will absorb the active ingredient systemically after two to four hours following application prior to irrigation or rain, after which, this product will resist weathering. Maximum 4.0 fl oz per acre per crop season for this product. Do not allow livestock to graze or feed green forage to livestock for 6 days after application of this product. Straw cut after harvest may be fed to livestock or used for bedding. Preharvest interval (PHI) is 30 days.
<b>Muscle 3.6F</b> SIPCAM AGRO USA, Inc.	tebuconazole	38.70%	4.0 fl oz per acre	For leaf, stem and stripe rusts ( <i>Puccinia</i> spp.), and suppression of Fusarium head blight or scab ( <i>Fusarium</i> spp.). Rusts: Make an application of this product at the first sign of rust pustules on the foliage. Fusarium head blight: The best time to apply this product to suppress Fusarium head blight is at the beginning of anthesis (flowering) of the main head. Feekes growth stage 10.51. Apply this product in a minimum of 10 gallons of spray suspension per acre by ground sprayer or in a minimum of 5 gallons of spray suspension per acre by aircraft. The plant will absorb the active ingredient systemically after two to four hours following application prior to irrigation or rain, after which, this product will resist weathering. Maximum 4.0 fl oz per acre per crop season for this product. Do not allow livestock to graze or feed green forage to livestock for 6 days after application of this product. Straw cut after harvest may be fed to livestock or used for bedding. Preharvest interval (PHI) is 30 days.

Foliar fungicides labeled for use on winter wheat - *continued*

Trade name Company	Common chemical name	% active ingredient	Rate	Additional label information
<b>Orius 3.6F</b> Makhteshim Agan of North America, Inc.	tebuconazole	38.70%	4.0 fl oz per acre	<p>For leaf, stem and stripe rusts (<i>Puccinia</i> spp.), and suppression of Fusarium head blight or scab (<i>Fusarium</i> spp.), apply 4.0 fl oz per acre.</p> <p>Wheat fields should be observed closely for early disease symptoms, particularly when susceptible varieties are planted and/or under prolonged conditions favorable for disease development.</p> <p>Rusts: Apply Orius 3.6F at the earliest sign of rust pustules on foliage.</p> <p>Fusarium head blight: Optimal timing of Orius 3.6F for Fusarium head blight suppression is the beginning of flowering on main stem heads (Feekes 10.51).</p> <p>Apply Orius 3.6F in a minimum of 10 gallons of spray solution per acre by ground or in a minimum of 5 gallons of spray solution per acre by air. For optimum disease control, the lowest specified rate of a spray surfactant should be tank-mixed with Orius 3.6F.</p> <p>Orius 3.6F must have two to four hours of drying time on plant foliage for active ingredient to move systemically into plant tissue before rain or irrigation occurs. After this period of time, Orius 3.6F will be resistant to weathering.</p> <p>A maximum of 4.0 fl oz of Orius 3.6F may be applied per acre per crop season.</p> <p>Straw may be fed or used for bedding. Do not allow livestock to graze or feed green forage to livestock prior to six days after treatment with Orius 3.6F.</p> <p>Do not apply within 30 days of harvest.</p>
<b>Penncozeb 4FL</b> United Phosphorus, Inc.	mancozeb	37.00%	0.8 to 1.6 qt per acre	<p>For control of Helminthosporium leaf spot, Septoria leaf spot, Septoria glume blotch, leaf rust and tan spot.</p> <p>Start application at the onset of disease or when plants are in tillering to jointing stage and repeat at 7- to 10-day intervals.</p>
<b>Penncozeb 75DF</b> United Phosphorus, Inc.	mancozeb	75.00%	1.0 to 2.0 lb per acre	<p>Do not apply more than three applications in one season. Do not apply more than 6.4 lb Penncozeb 75DF or 6.0 lb Penncozeb 80WP per acre per crop.</p> <p>Do not apply within 26 days of harvest.</p>
<b>Penncozeb 80WP</b> United Phosphorus, Inc.	mancozeb	80.00%	1.0 to 2.0 lb per acre	<p>Do not graze livestock in treated areas before harvest.</p> <p>Do not apply after heading (around Feekes 10.5).</p>
<b>Priaxor Xemium Brand Fungicide</b> BASF	fluxapyroxad pyraclostrobin	14.33% 28.58%	4.0 to 8.0 fl oz per acre	<p>Target diseases: black point, leaf rust, powdery mildew, Septoria leaf and glume blotch, spot blotch, stem rust, stripe rust and tan spot. For suppression only of eyespot (6.0 to 8.0 fl oz per acre).</p> <p>Priaxor does not control Fusarium head blight (head scab) or prevent the reductions in grain quality that can result from this disease.</p> <p>For early season-control of Septoria leaf and glume blotch, spot blotch and tan spot when conditions favor disease development, apply 2.0 to 4.0 fl oz per acre of Priaxor either in combination with a herbicide application or when conditions favor disease development. When the 2.0 to 4.0 fl oz early-season application is used, a second application of Priaxor may be required to protect the emerged flag leaf. Environmental conditions for disease or current disease pressure at the time of flag-leaf emergence should be used to determine the rate for the second application. For high disease pressure, use the higher rate.</p> <p>Do not apply more than 16.0 fl oz per acre per season. Do not make more than two consecutive applications before alternating to a labeled fungicide with a different mode of action.</p> <p>Do not harvest wheat hay or feed green-chopped wheat within 14 days after last application.</p> <p>Apply no later than the beginning of flowering (Feekes 10.5, Zadok's 59).</p>
<b>Proline 480 SC</b> Bayer CropScience	prothioconazole	41.0%	4.3 to 5.7 fl oz per acre	<p>Leaf and stem diseases including powdery mildew, rusts, Septoria leaf and glume blotch, Stagonospora blotch and tan spot: 4.3 to 5.0 fl oz per acre. Apply Proline 480 SC as a preventative foliar spray when the earliest disease symptoms appear on the leaves or stems. Wheat fields should be observed closely for early disease symptoms, particularly when susceptible varieties are planted and/or under prolonged conditions favorable for disease development.</p> <p>Fusarium head blight (suppression only): apply 5.0 to 5.7 fl oz per acre. The optimal time to apply Proline 480 SC Fungicide is as a preventative foliar spray at early flower (Feekes Growth Stage 10.51). Spray equipment must be set up to provide good coverage to wheat heads- see label for details.</p> <p>Apply up to two applications of Proline 480 SC per year. Repeat applications using a 14-day spray interval if conditions remain favorable for continued or increased disease development.</p> <p>Applications may be made by ground or aerial spray equipment.</p> <p>A maximum of 9.37 fl oz of Proline 480 SC may be applied per acre per year. Do not apply two applications at 5.7 fl oz per acre per year.</p> <p>Do not apply within 30 days of harvest.</p>

**Foliar fungicides labeled for use on winter wheat - *continued***

Trade name Company	Common chemical name	% active ingredient	Rate	Additional label information
<b>Propiconazole 41.8%</b> AmTide LLC	propiconazole	41.80%	2.0 to 4.0 fl oz per acre	<p>Use 2.0 to 4.0 fl oz per acre for early season suppression of powdery mildew, leaf blight, glume blotch and tan spot.</p> <p>Apply by air, ground or chemigation. For season-long control make application in the spring and make one repeat application up to Feekes growth stage 10.5. Use sufficient volumes of water to ensure thorough coverage.</p> <p>Use 4.0 fl oz per acre for control of leaf diseases including rust, powdery mildew, leaf blight, glume blotch and tan spot as well as foot rot and suppression of Fusarium head blight.</p> <p>Apply by air, ground or chemigation. Use sufficient volumes of water to ensure a thorough, uniform coverage of foliage, especially the flag leaf. Optimum yields are obtained when AmTide Propiconazole is applied when the flag leaf is between 50% to 100% emerged. For best results allow residues to dry on foliage before a rainfall event. Improved spray coverage and canopy penetration is achieved using an oil-based adjuvant.</p> <p>Suppression of Fusarium head blight: apply close to 50% flowering. Increased suppression may result by adding a penetrating-type adjuvant.</p> <p>Maximum application rate per season is 4.0 fl oz per acre per season when forage or hay is harvested.</p> <p>Minimum days between treatments is 14 days.</p> <p>Preharvest interval (PHI) is 30 days for forage, 40 days for grain and straw and 45 days for hay.</p>
<b>PropiMax EC</b> Dow AgroSciences	propiconazole	41.80%	2.0 to 4.0 fl oz per acre	<p>Early-season suppression of powdery mildew, Septoria leaf blight, Stagonospora glume blotch and tan spot: Apply 2.0 to 4.0 fl oz per acre.</p> <p>Apply in the spring. Follow up with a second application up to Feekes growth stage 10.5 for season-long control. Applications may be made no closer than a 14-day interval.</p> <p>Control of leaf diseases including rust, powdery mildew, Septoria leaf blight, Stagonospora glume blotch and tan spot: Apply 4.0 fl oz per acre.</p> <p>Protecting the flag leaf is important for maximizing the potential yield. Highest yields are normally obtained when PropiMax EC is applied when the flag leaf is 50% to fully emerged. Applications may be made no closer than a 14-day interval. The use of oil-base adjuvant may improve the spray coverage and canopy penetration.</p> <p>Foot rot: Apply 4.0 fl oz per acre. Apply PropiMax EC plus half rates of other EPA registered fungicides such as thiophanate-methyl. Apply at tillering, but before elongation has occurred.</p> <p>Fusarium head blight suppression: 4.0 fl oz per acre. Apply PropiMax EC at approximately 50% flowering. Addition of a penetrating type adjuvant may increase Fusarium head blight suppression.</p> <p>Do not apply more than 8.0 fl oz per acre per season of PropiMax EC. Do not apply more than 4.0 fl oz of PropiMax EC per acre per season if forage or hay will be harvested.</p> <p>Do not apply within 30 days of harvest for forage, 40 days before harvest for grain and straw and 45 days before harvest for hay.</p>
<b>Prosaro 421 SC</b> Bayer CropScience	prothioconazole tebuconazole	19.0% 19.0%	6.5 to 8.2 fl oz per acre	<p>Leaf and stem diseases including powdery mildew, rusts, Septoria leaf and glume blotch, Stagonospora blotch and tan spot.</p> <p>Apply Prosaro 421 SC as a preventive foliar spray when the earliest disease symptoms appear on the leaves and stems. Wheat fields should be observed closely for early disease symptoms, particularly when susceptible varieties are planted and/or under prolonged conditions favorable for disease development.</p> <p>Fusarium head blight (suppression only): The optimal time to apply is as a preventative foliar spray at early flower (Feekes Growth Stage 10.51). Spray equipment must be set up to provide good coverage to wheat heads- see label for details.</p> <p>For optimum disease control the lowest labeled rate of a spray surfactant must be tank mixed with Prosaro 421 SC.</p> <p>Applications may be made by ground or aerial spray equipment. Chemigation use is allowed only for application made before early flower.</p> <p>A maximum of 8.2 fl oz of Prosaro 421 SC may be applied per acre per crop year.</p> <p>Straw may be fed or used for bedding. Do not allow livestock to graze or feed green forage to livestock prior to 6 days after treatment with Prosaro 421 SC.</p> <p>Do not apply within 30 days of harvest.</p>

Foliar fungicides labeled for use on winter wheat - *continued*

Trade name Company	Common chemical name	% active ingredient	Rate	Additional label information
<b>Quadris</b> Syngenta	azoxystrobin	22.90%	4.0 to 12.0 fl oz per acre or 7.5 to 11.0 fl oz per acre	<p>Use 4.0 to 12.0 fl oz per acre for leaf rust, stripe rust, stem rust, Septoria leaf and glume blotch and tan spot.</p> <p>Use 7.5 to 11.0 fl oz per acre for powdery mildew.</p> <p>Quadris should be applied before disease development up to late head emergence (Feekes 10.5 or Zadok's 59).</p> <p>Applications may be made by ground, air or chemigation.</p> <p>A crop oil concentrate adjuvant may be added at 1.0% v/v to optimize efficacy.</p> <p>Resistance Management: Follow the resistance management guidelines in the resistance management section of the Quadris label.</p> <p>Quadris is extremely toxic to certain apple varieties. See "General Use Instructions" on label for additional information on safety precautions to avoid injury to apple trees.</p> <p>For wheat only: do not apply later than Feekes growth stage 10.5 (Zadok's growth stage 59).</p>
<b>Quilt</b> Syngenta	azoxystrobin propiconazole	7.00% 11.70%	7.0 to 14.0 fl oz per acre	<p>7.0 to 14.0 fl oz per acre for early-season suppression of powdery mildew, Septoria leaf blotch, Stagonospora glume blotch and tan spot.</p> <p>14.0 fl oz per acre for control of leaf diseases (rusts, powdery mildew, Septoria leaf blotch, Stagonospora glume blotch and tan spot).</p> <p>Protecting the flag leaf is important for maximizing the potential yield. Highest yields are obtained when Quilt is applied when the flag leaf is 50% to fully emerged.</p> <p>Applications may be made no closer than a 14-day interval.</p> <p>For wheat only, Quilt may be applied through full head emergence (Feekes growth stage 10.5). Do not apply after this stage to avoid illegal residues.</p> <p>Quilt is most effective when applied and allowed to dry before a rainfall. For best results, sufficient water volume should be used to provide thorough coverage.</p> <p>Quilt may be applied by ground, air or chemigation.</p> <p>Under certain environmental conditions, tank mixes of Quilt plus herbicides and/or fertilizers may cause crop injury in barley, triticale and wheat.</p> <p>Quilt may be extremely toxic to certain apple varieties. See "General Use Instructions" on label for additional information on safety precautions to avoid injury to apple trees.</p> <p>Do not apply more than two applications per acre per year. Do not apply more than 28.0 fl oz per acre per season.</p> <p>Do not apply within 30 days for forage or hay.</p> <p>Do not apply after Feekes 10.5</p>
<b>Quilt Xcel</b> Syngenta	azoxystrobin propiconazole	13.50% 11.70%	7.0 to 14.0 fl oz per acre	<p>7.0 to 14.0 fl oz per acre for early-season suppression of powdery mildew, Septoria leaf blight, glume blotch and tan spot. Apply Quilt Xcel in the spring for suppression of early-season diseases. Follow up with a second application (see below) for full season control.</p> <p>10.5 to 14.0 fl oz per acre for control of leaf diseases including rust (<i>Puccinia</i> spp.), powdery mildew, Septoria leaf blight, glume blotch, tan spot, Helminthosporium leaf blight and spot blotch.</p> <p>Protecting the flag leaf is important for maximizing the potential yield. Highest yields are normally obtained when Quilt Xcel is applied when the flag leaf is 50% to fully emerged.</p> <p>Applications may be made no closer than a 14-day interval.</p> <p>Do not apply more than two applications per acre per year. Do not apply more than 28.0 fl oz per acre per season.</p> <p>Do not apply to wheat after Feekes growth stage 10.5.</p>

Foliar fungicides labeled for use on winter wheat - *continued*

Trade name Company	Common chemical name	% active ingredient	Rate	Additional label information
<b>Regalia</b> Marrone Bio Innovations	extract of <i>Reynoutria</i> <i>sachalinensis</i>	5.00%	2.0 to 4.0 qt per acre	<p>For powdery mildew, rust, smut, bacterial blight and streak, leaf spots, smuts and Septoria leaf spot apply 2.0 to 4.0 qt of Regalia.</p> <p>Regalia is an extract from the plant <i>Reynoutria</i> spp. (knotweed). Regalia applied to actively growing plants (see label for directions for use) will help make the treated leaves and buds resistant to certain plant diseases. The extract increases the plant's natural defense system due to a fivefold increase in phenolics. This induced resistance against some important diseases is not systemic, but there is some translaminar protection. Repeat applications at 7- to 14-day intervals to protect new plant growth. The resistance induction takes place in one to two days. Use Regalia as a preventative rather than a curative application. Apply before disease infestation to protect the growing leaf tissue.</p> <p>Can be used in organic production.</p> <p>Apply Regalia preventatively in 50-100 gallons of water per acre when the first disease symptoms are visible.</p> <p>When plants are under high disease pressure, tank mix Regalia with another registered fungicide for more effective control. Repeat applications in 7-14 day intervals depending upon crop growth and disease pressure.</p> <p>Regalia has a pre-harvest interval (PHI) of zero days.</p>
<b>Satori Fungicide</b> Loveland Products	<i>azoxystrobin</i>	22.90%	4.0 to 12.0 fl oz per acre or 7.5 to 11.0 fl oz per acre	<p>Target diseases: leaf rust, Septoria leaf and glume blotch, stem rust, stripe rust, tan spot and powdery mildew.</p> <p>7.5 to 11.0 fl oz rate for powdery mildew.</p> <p>4.0 to 12.0 fl oz rate for other targeted diseases.</p> <p>Apply prior to disease development up to late head emergence (Feekes 10.5 or Zadok's 59).</p> <p>Applications may be made by ground, air or chemigation.</p> <p>See label for further information on resistance management.</p> <p>Do not apply later than Feekes growth stage 10.5.</p> <p>Do not apply within 14 days of harvest for forage and hay.</p> <p>Do not apply within 14 days of grazing.</p> <p>Do not apply within 45 days of harvest for grain and straw.</p>
<b>Stratego</b> Bayer CropScience	propiconazole trifloxystrobin	11.40% 11.40%	10.0 fl oz per acre	<p>For control of glume blotch, leaf blight, powdery mildew, rusts and tan spot.</p> <p>Begin applications preventively when conditions are favorable for disease development. A second application (minimum interval of 14 days) may be made if needed.</p> <p>Early-season leaf disease suppression: Apply 6.0 to 8.0 fl oz per acre of Stratego for suppression of tan spot, Septoria and powdery mildew.</p> <p>Do not apply more than two applications per season.</p> <p>Do not apply Stratego after Feekes growth stage 10.5 (full head emergence).</p> <p>See label for grazing restrictions.</p> <p>Do not apply Stratego within 35 days of harvest.</p>
<b>Stratego YLD Fungicide</b> Bayer CropScience	prothioconazole trifloxystrobin	10.80% 32.30%	4.0 fl oz per acre	<p>Disease controlled: Stagonospora blotch, Septoria blotch, powdery mildew, rusts and tan spot.</p> <p>Begin applications preventatively when conditions are favorable for disease development. A second application (minimum interval of 14 days) may be made if needed.</p> <p>Early season leaf disease control/suppression: apply 2.0 to 4.0 fl oz per acre of Stratego YLD Fungicide for control of early season tan spot, Septoria, Stagonospora and powdery mildew and suppression of rusts.</p> <p>May be applied by ground, air or chemigation.</p> <p>Do not apply more than two applications per season.</p> <p>See label for grazing restrictions.</p> <p>Do not apply after Feekes growth stage 10.5 (full head emergence). Do not apply within 35 days of harvest.</p>

Foliar fungicides labeled for use on winter wheat - *continued*

Trade name Company	Common chemical name	% active ingredient	Rate	Additional label information
<b>TEBU 3.6F</b> AmTide LLC	tebuconazole	40.53%	4.0 fl oz per acre	<p>For leaf, stem and stripe rusts (<i>Puccinia</i> spp.), suppression of head blight or scab (<i>Fusarium</i> spp.).</p> <p>Rusts: Apply at the earliest sign of rust pustules on foliage.</p> <p>Fusarium head blight: Optimal timing of TEBU 3.6F for Fusarium head blight suppression is the beginning of flowering on main stem heads (Feekes 10.51).</p> <p>For optimum disease control, the lowest recommended rate of a spray surfactant should be tank-mixed with TEBU 3.6F.</p> <p>Apply TEBU 3.6F in a minimum of 10 gallons of spray solution per acre by ground or in a minimum of 5 gallons of spray solution by air.</p> <p>Straw may be fed or used for bedding. Do not allow livestock to graze or feed green forage to livestock prior to 6 days after treatment with TEBU 3.6F.</p> <p>A maximum of 4.0 fl oz may be applied per acre per crop season.</p> <p>Restricted-entry interval (REI) is 12 hours.</p> <p>Preharvest interval (PHI) is 30 days.</p>
<b>Tebuzol 3.6F Fungicide</b> United Phosphorus, Inc.	tebuconazole	38.70%	2.0 to 4.0 fl oz per acre	<p>For leaf, stem and stripe rusts (<i>Puccinia</i> spp.), suppression of head blight or scab (<i>Fusarium</i> spp.), Septoria glume blotch (<i>Stagonospora nordorum</i>) and powdery mildew use 4.0 fl oz per acre rate. For tan spot and Septoria leaf spot use 2.0 to 4.0 fl oz per acre rate.</p> <p>Wheat fields should be observed closely for early disease symptoms, particularly when susceptible varieties are planted and/or under prolonged conditions favorable for disease development.</p> <p>Rusts: apply Tebuzol 3.6F at the earliest sign of rust pustules on foliage.</p> <p>Fusarium head blight: optimal timing of Tebuzol 3.6F for Fusarium head blight suppression is the beginning of flowering on the main stem heads (Feekes 10.51).</p> <p>For control of Septoria glume blotch, apply what at least 75% of wheat heads on the main stem are fully emerged to when 50% of the heads on the main stem are in flower.</p> <p>A maximum of 4.0 fl oz of Tebuzol 3.6F may be applied per acre per crop season.</p> <p>Straw may be fed or used for bedding. Do not allow livestock to graze or feed green forage to livestock prior to 6 days after treatment.</p> <p>Restricted-entry interval (REI) is 12 hours.</p> <p>Do not apply within 30 days of harvest (PHI = 30 days).</p>
<b>Tilt</b> Syngenta	propiconazole	41.80%	2.0 to 4.0 fl oz per acre	<p>For early-season suppression of powdery mildew, Septoria leaf blight, Stagonospora glume blotch and tan spot: Apply 2.0 to 4.0 fl oz per acre. Apply in the spring. Follow up with a second application up to Feekes growth stage 10.5 for season-long control.</p> <p>For control of leaf diseases including rust, powdery mildew, Septoria leaf blight, Stagonospora glume blotch and tan spot: apply 4.0 fl oz per acre.</p> <p>Protecting the flag leaf is important for maximizing the potential yield. Highest yields are normally obtained when Tilt is applied when the flag leaf is 50% to fully emerged.</p> <p>Applications may be made no closer than a 14-day interval.</p> <p>The use of oil-base adjuvant may improve the spray coverage and canopy penetration.</p> <p>Foot rot: Apply 4.0 fl oz per acre. Apply Tilt plus half rates of other EPA registered fungicides such as thiophanate-methyl. Apply at tillering, but before elongation has occurred.</p> <p>Fusarium head blight suppression: 4.0 fl oz per acre. Apply Tilt at approximately 50% flowering. Addition of a penetrating type adjuvant may increase Fusarium head blight suppression.</p> <p>Do not apply more than 8.0 fl oz per acre per season of Tilt. Do not apply more than 4.0 fl oz per acre per season of Tilt if forage or hay will be harvested.</p> <p>Do not apply within 7 days of harvest for forage or hay.</p> <p>Do not apply after Feekes 10.54 in wheat.</p>

Foliar fungicides labeled for use on winter wheat - *continued*

Trade name Company	Common chemical name	% active ingredient	Rate	Additional label information
<b>Toledo</b> Rotam North America, Inc.	tebuconazole	38.70%	4.0 fl oz per acre	<p>For leaf, stem and stripe rusts and suppression only of head blight or scab (<i>Fusarium</i> spp.).</p> <p>Wheat fields should be observed closely for early disease symptoms, particularly when susceptible varieties are planted and/or under prolonged conditions favorable for disease development.</p> <p>Rusts: Apply Toledo at the earliest sign of rust pustules on foliage.</p> <p>Fusarium head blight: Optimum timing of Toledo for Fusarium head blight suppression is the beginning of flowering on the main stem heads (Feekes 10.5).</p> <p>For optimum disease control, the lowest specified rate of a spray surfactant should be tank mixed with Toledo.</p> <p>Toledo must have two to four hours of drying time on plant foliage for the active ingredient to move systemically into plant tissue before rain or irrigation occurs. After this period of time Toledo will be resistant to weathering.</p> <p>A maximum of 4.0 fl oz of Toledo may be applied per acre per season.</p> <p>Do not allow livestock to graze or feed green forage to livestock prior to 6 days after treatment with Toledo. Straw may be fed or used for bedding.</p> <p>Do not apply within 30 days of harvest.</p>
<b>TwinLine</b> BASF	pyraclostrobin metconazole	12.00% 7.40%	7.0 to 9.0 fl oz per acre	<p>Target diseases: black point, powdery mildew, rust, Septoria leaf and glume blotch and tan spot. TwinLine is not labeled for the suppression of Fusarium head scab.</p> <p>For optimum disease control, begin applications of TwinLine before disease development. To maximize yields in cereals, it is important to protect the flag leaf. For diseases other than head scab, apply TwinLine immediately after flag leaf emergence for optimum results. Do not apply after Feekes growth stage 10.5</p> <p>Rates up to 9.0 fl oz per acre of TwinLine may be used for severe disease pressure. The minimum retreatment interval (RTI) is 6 to 8 days after the first application.</p> <p>Use the higher rate and shorter interval when disease pressure is high.</p> <p>Resistance management: To limit the potential for development of resistance, do not make more than two applications of TwinLine per season.</p> <p>Apply no later than the beginning of flowering (Feekes 10.5 or Zadok's 59).</p>

**Fungicide efficacy for control of wheat diseases**

The North Central Regional Committee on Management of Small Grain Diseases (NCERA-184) has developed the following information on fungicide efficacy for control of certain foliar diseases of wheat for use by the grain production industry in the United States. Efficacy ratings for each fungicide listed in the following table were determined by field testing the materials over multiple years and locations by the members of the committee. Efficacy is based on proper application timing to achieve optimum effectiveness

of the fungicide as determined by labeled instructions and overall level of disease in the field at the time of application. Differences in efficacy among fungicide products were determined by direct comparisons among products in field tests and are based on a single application of the labeled rate as listed in the table. ***The following table includes most widely marketed products, and is not intended to be a list of all labeled products.***



## Fungicide Efficacy for Control of Wheat Diseases (Revised 4-8-14)

Efficacy of fungicides for wheat disease control based on appropriate application timing

Fungicide(s)		Rate/A (fl. oz)	Product	Powdery mildew	Stagonospora leaf/glume blotch	Septoria leaf blotch	Tan spot	Stripe rust	Leaf rust	Stem rust	Head scab	Harvest restriction
Class	Active ingredient											
Strobilurin	Picoxystrobin 22.5%	6.0 – 12	Aproach SC	G <sup>1</sup>	--	VG	VG	E <sup>2</sup>	VG	VG	NR	Feekes 10.5 and 45 days
	Fluoxastrobin 40.3%	2.0 – 4.0	Evito 480 SC	G	--	--	VG	--	VG	--	NL	Feekes 10.5 and 40 days
	Pyraclostrobin 23.6%	6.0 – 9.0	Headline SC	G	VG	VG	E	E <sup>2</sup>	E	G	NL	Feekes 10.5
Triazole	Metconazole 8.6%	10.0 – 17.0	Caramba 0.75 SL	VG	VG	--	VG	E	E	E	G	30 days
	Propiconazole 41.8%	4.0	Tilt 3.6 EC <sup>3</sup>	VG	VG	VG	VG	VG	VG	VG	P	Feekes 10.5
	Prothioconazole 41%	5.0 – 5.7	Proline 480 SC	--	VG	VG	VG	--	VG	VG	G	30 days
	Tebuconazole 38.7%	4.0	Folicur 3.6 F <sup>3</sup>	G	VG	VG	VG	E	E	E	F	30 days
	Prothioconazole 19% Tebuconazole 19%	6.5 – 8.2	Prosaro 421 SC	G	VG	VG	VG	E	E	E	G	30 days
Mixed mode of action <sup>4</sup>	Metconazole 7.4% Pyraclostrobin 12%	7.0 – 9.0	TwinLine 1.75 EC	G	VG	VG	E	E	E	VG	NL	Feekes 10.5
	Fluxapyroxad 14.3% Pyraclostrobin 2	4.0 – 8.0	Priaxor	G	VG	VG	E	VG	VG	G	NL	Feekes 10.5
	Propiconazole 11.7% Azoxystrobin 7.0%	10.5 – 14.0	Quilt 200 SC <sup>3</sup>	VG	VG	VG	VG	E	E	VG	NL	Feekes 10.5
	Propiconazole 11.7% Azoxystrobin 13.5%	10.5 – 14.0	Quilt Xcel 2.2 SE	VG	VG	VG	VG	E	E	VG	NL	Feekes 10.5
	Prothioconazole 10.8% Trifloxystrobin 32.3%	4.0	Stratego YLD	G	VG	VG	VG	VG	VG	VG	NL	Feekes 10.5 35 days
Cyproconazole 7.17% Picoxystrobin 17.94%	3.4 – 6.8	Aproach Prima SC	G	--	VG	VG	E	VG	VG	NR	45 days	

**Notes:**

<sup>1</sup>Efficacy categories: NL = Not Labeled; NR = Not Recommended; P = Poor; F = Fair; G = Good; VG = Very Good; E = Excellent; -- = Insufficient data to make statement about efficacy of this product.  
<sup>2</sup>Efficacy may be significantly reduced if solo strobilurin products are applied after stripe rust infection has occurred.

<sup>3</sup>Multiple generic products containing the same active ingredients also may be labeled in some states. Products including tebuconazole include: Embrace, Monsoon, Muscle 3.6 F, Onset, Ortus 3.6 F, Tebucan 3.6 F, Tebustar 3.6 F, Tebuzol 3.6 F, Tegrrol, and Toledo. Products containing propiconazole include: Bumper 41.8 EC, Fitness, Propiconazole E-AG, and PropiMax 3.6 EC. Products containing propiconazole + azoxystrobin include: Avaris 200 SC.

<sup>4</sup>Products with mixed modes of action generally combine triazole and strobilurin active ingredients. Priaxor is an exception to this general statement and combines carboxamide and strobilurin active ingredients.

## Root, crown and wilt diseases of winter wheat

Several soilborne fungi can cause root and crown diseases of wheat. Affected plants may be stunted or less vigorous than healthy plants. Plants may yellow, wilt and die prematurely. Dead plants may have a bleached or white appearance. When affected plants are dug up, root systems may be poor with roots and crown tissues discolored and deteriorated.

**Cephalosporium stripe** had not been a significant problem on wheat in most of Missouri. With recent wet seasons, shorter rotations between wheat crops, and reduced tillage, this disease has become more common in the northern part of the state. Foliage symptoms are most evident during jointing and heading. Light green to yellow-green longitudinal stripes develop on the leaves of infected plants. The stripes run parallel to the leaf midrib and may extend the entire length of the leaf. Older lesions are predominantly yellow or even brown. Severely infected plants may be stunted, produce few tillers and die prematurely. The fungus that causes this disease, *Cephalosporium gramineum*, persists in association with wheat residues and may also be soilborne. Fungicides are not effective in controlling *Cephalosporium stripe*, and resistant varieties are not available for Missouri.

### Management options for cephalosporium stripe

- Crop rotation to corn or legumes for at least two years.
- Residue management.
- Proper fertility.
- Proper weed control.

**Take-all** is one of the more common root and crown rot diseases of wheat in Missouri. The fungus that causes this disease may infect seedlings in the fall. Symptoms are usually most evident after heading as white heads on wheat plants. Infected plants are also stunted, slightly yellow, have few tillers and ripen prematurely. A shiny, black discoloration of the lower stem and crown may be evident if the lowest leaf sheath is scraped off with a knife or fingernail.

Take-all of wheat is caused by the fungus *Gaeumannomyces graminis* var. *tritici*. This fungus survives in infected host plants (wheat, barley, rye and weed grasses such as smooth brome grass, quackgrass and bentgrass) and in infested host debris. Infection occurs when the fungus penetrates the young roots of a living host plant. Infection can occur throughout the growing season but is more severe when the temperature is between 54 and 64 degrees F. Because the take-all fungus is more active in wet soils, the disease is typically most severe in wet areas or years or in irrigated fields. Root infections in the fall and early spring are most likely to progress to the crown and foot of the plant. Hot, dry weather after heading increases the water stress on plants infected with take-all and may lead to the sudden development of white heads on plants that were actually infected earlier in the season or the previous fall.

Take-all is favored by continuous cropping of wheat. It is also more severe in lighter, alkaline, infertile and poorly drained soils. Plant nutrients offer increased resistance to

take-all and a greater capacity to tolerate infections by producing more roots. It is important to maintain good levels of available nitrogen, phosphorus and potassium. Soil pH also affects the development of this disease. Disease damage is usually worse as soil pH approaches 7.0.

### Management options for take-all

- Plant good-quality seed of adapted, disease-resistant varieties.
- Plant in well-drained sites under good seedbed conditions.
- Rotate with non-host crops for one to three years.
- Control weed grass hosts and volunteer wheat.
- Use seed treatment fungicides. See the preceding table of seed treatment fungicides labeled for use on winter wheat.
- Maintain good plant vigor with adequate fertility.

## Head diseases of winter wheat

Diseases such as smuts, bunts and scab affect primarily the head of the wheat plant. Smut and bunt diseases such as stinking smut or loose smut tend to replace the normal kernels in the head with galls that contain masses of powdery black spores. The scab fungus can colonize heads, producing kernels that are shrunken, shriveled and discolored.

**Loose smut** is obvious as heads emerge from the boot. All portions of the head except the rachis are converted to masses of dusty black spores. The fungus that causes loose smut, *Ustilago tritici*, survives within the embryo of wheat seeds; therefore planting disease-free seed and using systemic fungicide seed treatments are important management tools. Stinking smut (also called covered smut or common bunt) is not as obvious as loose smut. The kernels are replaced with smut galls, but the pericarp covering the smut gall remains intact masking the smut gall. At harvest the pericarps are broken releasing clouds of dark spores. Grain contaminated with stinking smut has a strong fishy odor and a darkened appearance. The fungus that causes stinking smut can survive on wheat seed and in the soil. Disease development is favored by cool, wet conditions.

### Management options for smut and bunt diseases

- Plant disease-free seed.
- Use a systemic fungicide seed treatment. See the preceding table of seed treatment fungicides labeled for use on winter wheat.

**Scab** or *Fusarium* head blight of wheat is characterized by premature bleaching of a portion of the head or the entire head. Superficial mold growth, usually pink or orange in color, may be evident at the base of the diseased spikelets. Bleached spikelets are usually sterile or contain shriveled or discolored seed.

Scab is caused by the fungus *Fusarium graminearum*. This fungus overwinters on host residues such as wheat stubble, corn stalks and grass residues. Wind currents carry spores to wheat heads from the residues on which they have survived. If environmental conditions are favorable, i.e.,

warm and moist, the spores germinate and invade flower parts, glumes and other portions of the spike. Scab infection occurs when the wheat crop is in the flowering to early grain fill stages. Infection is dependent on environmental conditions while wheat is in susceptible stages of growth. Moderate temperatures in the range of 77 to 86 degrees F, frequent rain, overcast days, high humidity and prolonged dews favor infection and development of the scab fungus.

An additional concern with wheat scab is the possibility of mycotoxin production in the infected grain. Mycotoxins are naturally produced chemicals that in small amounts may be deleterious to animal or human health. The fungus that causes wheat scab may produce several different mycotoxins, including vomitoxin (deoxynivalenol or DON) and zearalenone. This is a primary concern where grain is fed to non-ruminant animals. Ruminants are fairly tolerant of these two mycotoxins. Swine and poultry may refuse to eat grain containing high levels of these mycotoxins. In cases where mycotoxin problems are suspected, a sample should be submitted to a qualified laboratory for mycotoxin analysis.

Selecting varieties with tolerance or resistance to scab and planting disease-free seed are important management options to reduce the potential for scab or Fusarium head blight. Since corn is a host of *Fusarium graminearum*, planting wheat into corn residue can increase the risk of scab developing in the wheat crop. Rotating to a crop other than

corn or small grains or managing corn residues should reduce this risk. Recently several of the wheat foliar fungicides have had label expansions to include the suppression of Fusarium head blight or scab. Typically these fungicides are applied at the beginning of flowering (Feekes growth stage 10.51) on main stem heads or Feekes growth stage 10.51. It is important to understand that the labels state suppression, not control, of scab or Fusarium head blight. There are also several fungicide labels that specifically state that those products are not effective against scab or Fusarium head blight.

#### Management options for wheat scab

- Plant adapted varieties with tolerance to scab.
- Rotate to nonhost crops (corn is also a host, so rotation should be to crops other than small grains or corn).
- Manage residues.
- Plant disease-free seed. (If planting seed from a field that had scab, clean seed thoroughly before planting, have a germination test done on the lot, and use a fungicide seed treatment to minimize seedling blight problems caused by seedborne *Fusarium*).
- If conditions are favorable for the development of scab, consider applying one of the foliar fungicides that may aid in the suppression of this disease. See preceding table of foliar fungicides labeled for use on winter wheat.

## Insect management for field corn

Insect pests can cause substantial damage to field corn throughout the growing season, but especially during early stages of plant growth. Insect problems are best managed through the use of integrated pest management (IPM) programs where all viable control strategies are considered and appropriate strategies are selected for use against specific insect pests. Control strategies used in an IPM program may include chemical, cultural, mechanical, biological and genetic options. It is essential that proper identification of target insects and knowledge about pest biologies be considered when making management decisions.

In recent years additions to available management strategies for insect control in field corn include the introductions of (1) commercially applied seed treatments, (2) transgenic insect-resistant corn hybrids, (3) nontraditional types of insecticides, and (4) formulations that contain two or more complementary insecticides.

Several different commercially applied seed treatments are labeled for field corn and are included within the recommendations list for each insect. Benefits derived from seed treatments include general control or suppression of several

seedling corn pests, easy handling and reduced pesticide exposure to users.

Transgenic insect-resistant corn hybrids continue to be introduced for control of insects that consistently cause excessive economic losses and are often difficult to control with traditional management strategies. See Table 1 for a list of registered transgenic products and their traits currently labeled for field corn. Be sure to follow specific Bt corn refuge requirements and resistance management protocols for transgenic corn hybrids. Following these requirements and protocols is essential to prevent the development of insect resistance for these control strategies.

Scouting and proper insect identification are still important components in any insect pest management program. Although seed treatments and Bt transgenic hybrids are effective at controlling many insect pests of field corn, there are other insects they only suppress or do not target. To protect against economic loss from insects not controlled by these management strategies, producers are encouraged to scout crop fields often throughout the growing season. Monitoring and proper pest identification are essential activities of all integrated pest management programs.

**Corn, Table 1. Transgenic corn hybrids and Bt traits - 2015**

Product trade name	Bt protein	Insects controlled (boldface) or suppressed ( <i>italics</i> )	Refuge (%)	Refuge location	Herbicide tolerance
For above-ground Lepidopterous moths and caterpillars					
Agrisure CB/LL	Cry1Ab	<b>ECB, SWCB, CEW, FAW, SB</b>	20%	within 1/2 mile	LL
Agrisure GT/CB/LL	Cry1Ab	<b>ECB, SWCB, BCW, CEW, FAW, SB</b>	20%	within 1/2 mile	GT, LL
Agrisure Viptera 3110	Vip3A + Cry1Ab	<b>ECB, SWCB, CEW, FAW, SB, WBCW</b>	20%	within 1/2 mile	GT, LL
Agrisure Viptera 3220 E-Z Refuge	Cry1Ab + Cry1F + Vip3A	<b>ECB, SWCB, BCW, CEW, FAW, SB</b>	5%	in bag	GT
Herculex I (HX1)	Cry1F	<b>ECB, SWCB, BCW, FAW, WBCW, CEW, SB</b>	20%	within 1/2 mile	LL, RR2, (most)
Optimum AcreMax (AM-R)	Cry1F + Cry1Ab	<b>ECB, SWCB, BCW, FAW, WBC, CEW, SB</b>	5%	in bag	RR2
Optimum Intrasect	Cry1F + Cry1Ab	<b>ECB, SWCB, BCW, FAW, WBC, CEW, SB</b>	5%	within 1/2 mile	LL, RR2
Genuity VT Double Pro	Cry1A.105 + Cry2Ab2	<b>ECB, SWCB, CEW, FAW</b>	20%	within 1/2 mile	RR2
Genuity VT Double PRO RIB Complete (GENVT2P)	Cry1A.105 + Cry2Ab2	<b>ECB, SWCB, CEW, FAW</b>	5%	in bag	RR2
For below-ground rootworms beetles					
Agrisure RW	mCry3A	<b>CRW</b>	20%	in field, adjacent	none
Agrisure GT/RW	mCry3A	<b>CRW</b>	20%	in field, adjacent	GT
Herculex RW (HXRW)	Cry34/35Ab1	<b>CRW</b>	20%	in field, adjacent	LL, RR2, (most)
*Optimum AcreMax RW (AMRW-R)	Cry34/35Ab1	<b>CRW</b>	10%	in bag	RR2
<b>Notes:</b>					
* denotes "refuge in a bag" product that uses seed mixtures to prevent development of insect resistance.					
<b>Be sure to follow specific refuge restrictions which apply to these transgenic hybrids.</b>					
<b>Abbreviations: Insects:</b> ECB = European corn borer; SWCB = southwestern corn borer; BCW = black cutworm; CEW = corn earworm; FAW = fall armyworm; SB = stalk borer; WBC = western bean cutworm.					
<b>Herbicide traits:</b> GT = glyphosate tolerant; LL = Liberty Link / glufosinate tolerant; RR2 = Roundup Ready / glyphosate tolerant. Be sure to follow specific refuge restrictions that apply to these transgenic hybrids.					
Table 1 was developed using information provided by Dr. Eileen Cullen (University of Wisconsin - Madison) and Dr. Chris DiFonzo (Michigan State University).					

<b>Product trade name</b>	<b>Bt protein</b>	<b>Insects controlled (boldface) or suppressed (<i>italics</i>)</b>	<b>Refuge (%)</b>	<b>Refuge location</b>	<b>Herbicide tolerance</b>
For above-ground lepidopterous moths and caterpillars and below-ground rootworm beetles					
Agrisure CB/LL/RW	Cry1Ab + mCry3A	<b>ECB, SWCB, CRW, CEW, FAW, SB</b>	20%	in field, adjacent	LL
Agrisure 3000GT	Cry1Ab + mCry3A	<b>ECB, SWCB, CRW, CEW, FAW, SB</b>	20%	in field, adjacent	GT, LL
Agrisure Artesian 3011A	Cry1AB + mCry3	<b>ECB, SWCB, CRW, CEW, FAW, SB</b>	20%	in field, adjacent	GT, LL
Agrisure Viptera 3111	Vip3A + Cry1Ab + mCry3A	<b>ECB, SWCB, BCW, CEW, CRW, FSW, SB</b>	20%	in field, adjacent	GT, LL
Agrisure 3122 E-Z Refuge	Cry1Ab + Cry1F + mCry3A + Cry34/35Ab1	<b>ECB, SWCB, BCW, FAW, WBC, CRW, CEW, SB</b>	5%	in bag	GT
Agrisure Duracade 5122 E-Z Refuge	Cry1Ab + Cry1F + mCry3A + eCry3.1Ab	<b>ECB, SWCB, FAW, WCB, CRW, CEW, SB</b>	5%	in bag	GT
Agrisure Duracade 5222 E-Z Refuge	Cry1Ab + Cry1F + Vip3A + mCry3A + eCry3.1Ab	<b>ECB, SWCB, BCW, FAW, CRW, SB, WBC</b>	5%	in bag	GT
Herculex Xtra (HXX)	Cry1F + Cry34/35Ab1	<b>ECB, SWCB, BCW, FAW, WBC, CRW, CEW, SB</b>	20%	in field, adjacent	LL, RR2, (most)
Optimum AcreMax 1 (AM1)	Cry1F + Cry34/35Ab1	<b>ECB, SWCB, BCW, FAW, WBC, CRW, CEW</b>	10%	in bag	LL, RR2
Optimum AcreMax Xtra (AMX-R)	Cry1F + Cry1Ab + Cry34/35Ab1	<b>ECB, SWCB, BCW, FAW, WBC, CRW, CEW, SB</b>	10%	in bag	RR2
Optimum AcreMax Xtreme (AMXT-R)	Cry1F + Cry1Ab + mCry3A + Cry34/35Ab1	<b>ECB, SWCB, BCW, FAW, WBC, CRW, CEW, SB</b>	5%	in bag	RR2
Optimum Intersect Xtra	Cry1F + Cry1Ab + Cry34/35Ab1	<b>ECB, SWCB, BCW, FAW, CRW, CEW, SB</b>	20%	in field, adjacent	LL, RR2
Optimum Intersect Xtreme	Cry1F + Cry1Ab + mCry3A + Cry34/35Ab1	<b>ECB, SWCB, BCW, FAW, WBC, CRW, CEW, SB</b>	5%	in field, adjacent	LL, RR2
Optimum TRIssect	Cry1F + mCry3A	<b>ECB, SWCB, BCW, FAW, WBC, CRW, CEW, SB</b>	20%	in field, adjacent	LL, RR2
YieldGard VT Triple	Cry1Ab + Cry3Bb1	<b>ECB, SWCB, CRW, CEW, FAW, SB</b>	20%	in field, adjacent	RR2
Genuity VT Triple Pro	Cry1A.105 + Cry2Ab2 + Cry3Bb1	<b>ECB, SWCB, CEW, FAW, CRW</b>	20%	in field, adjacent	RR2
Genuity SmartStax	Cry1A.105 + Cry2Ab2 + Cry1F + Cry3Bb1 + Cry34/35Ab1	<b>ECB, SWCB, BCW, CEW, CRW, FAW, SB, WBC</b>	5%	in field, adjacent	LL, RR2
YieldGard VT Triple PRO RIB Complete (GENVT3P)	Cry1A.105 + Cry2Ab2 + Cry3Bb1	<b>ECB, SWCB, CEW, FAW, CRW</b>	10%	in bag	RR2
Genuity SmartStax RIB Complete	Cry1A.105 + Cry2Ab2 + Cry1F + Cry3Bb1 + Cry34/35Ab1	<b>ECB, SWCB, BCW, CEW, CRW, FAW, SB, WBC</b>	5%	in bag	LL, RR2
Refuge Advanced Powered Smartstax	Cry1A.105 + Cry2Ab2 + Cry1F + Cry3Bb1 + Cry34/35Ab1	<b>ECB, SWCB, BCW, CEW, CRW, FAW, SB, WBC</b>	5%	in bag	LL, RR2

**Comments:** Management of several insect pests of corn may be accomplished by using corn hybrids that have been genetically engineered to produce *Bacillus thuringiensis* (Bt) and certain insect toxins. Bt hybrid events and their toxins target specific insect pests. Be sure to match these hybrids to pests requiring control. Follow all refuge requirements associated with these Bt hybrids.

**Notes:**

\* denotes "refuge in a bag" product that uses seed mixtures to prevent development of insect resistance.

**Be sure to follow specific refuge restrictions which apply to these transgenic hybrids.**

**Abbreviations: Insects:** ECB = European corn borer; SWCB = southwestern corn borer; BCW = black cutworm; CEW = corn earworm; FAW = fall armyworm; SB = stalk borer; WBC = western bean cutworm.

**Herbicide traits:** GT = glyphosate tolerant; LL = Liberty Link / glufosinate tolerant; RR2 = Roundup Ready / glyphosate tolerant. Be sure to follow specific refuge restrictions that apply to these transgenic hybrids.

Table 1 was developed using information provided by Dr. Eileen Cullen (University of Wisconsin - Madison) and Dr. Chris DiFonzo (Michigan State University).

Insecticides for field corn

Insect	Insecticides		Amount of product per acre	Placement	REI (hours)	Preharvest interval (days)
	Common name	Trade name				
<b>Armyworm, "True"</b> <i>Mythimnaunipuncta</i> , formerly <i>Pseudaletia unipuncta</i> (Haworth)  <b>Comments:</b> Treat seedling corn when 25% or more of plants are being damaged and one or more 0.75 inch long or shorter larvae are present per damaged plant. On more mature corn, control is justified after pollen shed if leaves above the ear zone are being consumed by larvae. Optimal control by Tracer is best achieved when the insecticide is applied at peak egg hatch or when larvae are small.	permethrin	*Ambush 25 WP	6.4 to 12.8 fl oz	foliage	12	30 (grain or stover), 0 (forage)
	permethrin	*Ambush 2E Insecticide	6.4 to 12.8 fl oz	foliage	12	30 (grain or stover), 0 (forage)
	permethrin	*multiple products	see specific label	foliage	12	see specific label
	esfenvalerate	*Asana XL	5.8 to 9.6 fl oz	foliage	12	21 (grain)
	cyfluthrin	*Baythroid XL	1.6 to 2.8 fl oz (for 1st & 2nd larvae only)	foliage	12	21 (grain or fodder) 0 (green forage)
	flubendiamide	*Belt SC	2.0 to 3.0 fl oz	foliage	12	1 (green forage and silage) 28 (grain or stover)
	lambda-cyhalothrin	*Besiege	6 to 10 fl oz (before larvae enter stalk)	foliage	24	21 (grain, ears, forage, fodder) 1 (feed or graze forage)
	bifenthrin	*Brigade 2EC	2.1 to 6.4 fl oz	foliage	12	30 (grain, fodder, graze)
	chlorpyrifos + lambda-cyhalothrin	*Cobalt Advanced	11 to 26 fl oz	foliage	24	21 (grain, ears, forage, fodder) 1 (feed or graze forage)
	chlorpyrifos + gamma-cyhalothrin	*Cobalt	13 to 26 fl oz	foliage	24	21 (grain, ears, forage, fodder) 1 (feed or graze forage)
	gamma-cyhalothrin	*Declare	1.02 to 1.54 fl oz	foliage	24	21 (grain) 1 (feed or graze forage)
	deltamethrin	*Delta Gold 1.5EC	1.5 to 1.9 fl oz	foliage	12	21 (grain, fodder) 12 (cut forage or graze)
	alpha-cypermethrin	*Fastac EC	3.2 to 3.8 fl oz	foliage	12	30 (grain, stover) 60 (forage)
	zeta-cypermethrin + bifenthrin	*Hero	4.0 to 10.3 fl oz	foliage	12	30 (grain, stover, graze) 60 (forage)
	methoxyfenozide	Intrepid 2F	4.0 to 8.0 fl oz	foliage	4	21 (grain)
	methomyl	*Lannate SP	1/4 to 1/2 lb	foliage	48	0 (ears), 3 (forage), 21 (fodder)
	methomyl	*Lannate LV	3/4 to 1 1/2 pt	foliage	48	0 (ears), 3 (forage), 21 (fodder)
	chlorpyrifos	*Lorsban Advanced	1 to 2 pt	foliage	24	21 (grain, ears, forage, fodder)
	chlorpyrifos	*Lorsban 4E	1 to 2 pt	foliage	24	21 (grain, ears, forage, fodder)
	zeta-cypermethrin	*Mustang Maxx	3.2 to 4.0 fl oz	foliage	12	30 (grain, stover) 60 (forage)
zeta-cypermethrin	*Mustang Max	3.2 to 4.0 fl oz	foliage	12	30 (grain, stover) 60 (forage)	
chlorpyrifos	*Nufos 4E	1 to 2 pt	foliage	24	21 (grain or ears)	
permethrin	*Pounce 3.2EC	4 to 6 fl oz/A	foliage	12	30 (grain or stover), 0 (forage)	
carbaryl	Sevin 4F	2 to 4 pt	foliage	12	48 (grain or fodder) 14 (feed or graze forage/ silage)	
carbaryl	Sevin XLR	2 to 4 pt	foliage	24	48 (grain or fodder) 14 (feed or graze forage/ silage)	
spinosad	Tracer 4SC	1.0 to 3.0 fl oz	foliage	1	28 (grain), 3 (fodder or forage)	
lambda-cyhalothrin	*Warrior II	1.28 to 1.92 fl oz	foliage	24	21 (grain), 1 (graze, forage) 21 (treated feed or fodder)	

**Note:** See Table 1 for listing of (Bt) transgenic traits.

**\*Designates a restricted-use pesticide. Use is restricted to certified applicators only.** Read the label and follow all insecticide rate information, directions, precautions and restrictions.

Insecticides for field corn - *continued*

Insect	Insecticides		Amount of product per acre	Placement	REI (hours)	Preharvest interval (days)	
	Common name	Trade name					
<p><b>Billbugs</b> <i>Sphenophorus maidis</i> (Chittenden)</p> <p>Primarily maize billbug plus claycolored and southern corn billbug species damage corn in Missouri.</p> <p><b>Comments:</b> No specific thresholds are available, but a general rule is that the economic threshold is reached when 5% or more of plants are damaged in an acceptable stand and billbugs are present in the field. Insecticide sprays are most effective if applied at rate of 20 to 40 gallons per acre of formulated material directed over the row on corn less than 6-inches tall or directed at plants for taller corn seedlings. Billbug infestations generally associated with bottomland fields supporting infestations of yellow nutsedge. Use of Accent or Beacon herbicides following Counter 15G applications may cause severe crop damage. Certain herbicides are incompatible with Counter 15G and Counter 20G. See specific Counter label.</p>	chlorpyrifos + lambda-cyhalothrin	*Cobalt Advanced	32 to 42 fl oz	spray at base of plants	21	(grain, ears, forage, fodder) 1 (feed or graze forage)	
	chlorpyrifos + gamma-cyhalothrin	*Cobalt	38 to 42 fl oz	spray at base of plants	24	21 (grain, ears, forage, fodder) 1 (feed or graze forage)	
	chlorpyrifos	*Lorsban Advanced	2 pt	spray at base of plants	24	21 (grain, ears, forage, fodder)	
	chlorpyrifos	*Lorsban 4E	1 to 2 pt	foliage	24	21 (grain, ears, forage, fodder)	
	chlorpyrifos	*Nufos 4E	2 pt	spray at base of plants	24	21 (grain or ears)	
	<b>Preplant, at-plant, preemergence applications</b>						
	chlorpyrifos	*Lorsban 15G	8 to 16 oz/1000 ft row	broadcast or 7-inch band over row	24		
	terbufos	*Counter 15G (Lock'nLoad system) (Smartbox)	6 to 8 oz/1000 ft row 6 to 8 oz/1000 ft row	band, furrow see specific label see specific label	48		
	terbufos	*Counter 20G (Lock'nLoad system) (Smartbox)	4.5 to 6 oz/1000 ft row 4.5 to 6 oz/1000 ft row	band, furrow see specific label	48		
	tefluthrin	*Force 3G (Lock'nLoad system) (Smartbox)	4 to 5 oz/1000 ft row 4 to 5 oz/1000 ft row	band, furrow see specific label	0 0		
tefluthrin	*Force CS (suppression only)	0.46 to 0.57 oz/1000 ft row	band, furrow	12			
chlorethoxyfos	*Fortress 2.5G	6.0 to 9.0 oz/1000 ft row	band, furrow	See label	48		
chlorethoxyfos	*Fortress 5G (Lock'nLoad system) (Smartbox)	3.75 to 4.5 oz/1000 ft row 3.75 to 4.5 oz/1000 ft row	band, furrow	See label			
<b>Seed treatments</b>							
thiamethoxam	Avicta Complete-Corn	1.250 mg ai/kernel	commercial on seed				
thiamethoxam	Cruiser 5FS (250)	0.250 mg ai/kernel	commercial on seed				
thiamethoxam	Cruiser Extreme 250	0.250 mg ai/kernel	commercial on seed				
thiamethoxam	Cruiser Extreme 1250	1.250 mg ai/kernel	commercial on seed				
clothianidin	Poncho 250	0.250 mg ai/kernel	commercial on seed				
clothianidin	Poncho 500	0.500 mg ai/kernel	commercial on seed				
clothianidin	Poncho 600 (250)	0.250 mg ai/kernel	commercial on seed				
clothianidin	Poncho 600 (1250)	1.250 mg ai/kernel	commercial on seed				
clothianidin	Poncho 1250	1.250 mg ai/kernel	commercial on seed				
clothianidin	Poncho/Votivo	0.500 mg ai/kernel	commercial on seed				
clothianidin	Poncho 1250/Votivo	1.250 mg ai/kernel	commercial on seed				

**Note:** See Table 1 for listing of (Bt) transgenic traits.

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**Insecticides for field corn - *continued***

Insect	Insecticides		Amount of product per acre	Placement	REI (hours)	Preharvest interval (days)
	Common name	Trade name				
<b>Black cutworm</b> <i>Agrotis ipsilon</i> (Hufnagel) and other cutworms species	permethrin	*Ambush 25WP	6.4 to 12.8 fl oz	foliage	12	30 (grain or stover), 0 (forage)
	permethrin	*Ambush 2E	6.4 to 12.8 fl oz	foliage	12	30 (grain or stover), 0 (forage)
<b>Comments:</b> Apply as postemergent rescue treatment when 1–2% or more of plants are cut below ground or 2–3% or more of plants have been cut above ground and larvae are present. Corn planted late into fields supporting winter annual weeds such as henbit and chickweed is at greatest risk.	permethrin	*multiple products	see specific labels	foliage	12	see specific label
	esfenvalerate	*Asana XL	5.8 to 9.6 fl oz	foliage	12	21 (grain)
	cyfluthrin	*Baythroid XL	0.8 to 1.6 fl oz	foliage	12	21 (grain or fodder) 0 (green forage)
	flubendiamide	*Belt SC	2.0 to 3.0 fl oz	foliage	12	1 (green forage and silage) 28 (grain or stover)
	lambda-cyhalothrin	*Besiege	5 to 10 fl oz	foliage	24	21 (grain, ears, forage, fodder)
	bifenthrin	*Brigade 2EC	2.1 to 6.4 fl oz	foliage	12	30 (grain, fodder, graze)
	chlorpyrifos + lambda-cyhalothrin	*Cobalt Advanced	11 to 26 fl oz	foliage		21 (grain, ears, forage, fodder) 1 (feed or graze forage)
	chlorpyrifos + gamma-cyhalothrin	*Cobalt	13 to 26 fl oz	foliage	24	21 (grain, ears, forage, fodder) 1 (feed or graze forage)
	gamma-cyhalothrin	*Declare	0.77 to 1.28 fl oz	foliage	24	21 (grain) 1 (feed or graze forage)
	deltamethrin	*Delta Gold 1.5EC	1.0 to 1.5 fl oz	foliage	12	21 (grain, fodder) 12 (cut forage or graze)
	alpha-cypermethrin	*Fastac EC	1.3 to 2.8 fl oz	foliage	12	30 (grain, stover) 60 (forage)
	zeta-cypermethrin + bifenthrin	*Hero	2.6 to 6.1 fl oz	foliage	12	30 (grain, stover, graze) 60 (forage)
	chlorpyrifos	*Lorsban Advanced	1 to 2 pt	foliage	24	21 (grain, ears, forage, fodder)
	zeta-cypermethrin	*Mustang Max	1.28 to 2.8 fl oz	foliage	12	30 (grain, stover) 60 (forage)
	chlorpyrifos	*Nufos 4E	1 to 2 pt	foliage	24	21 (grain or ears)
	carbaryl	Sevin 4F	4 pt	foliage	12	48 (grain or fodder) 14 (harvest or graze forage)
chlorpyrifos + bifenthrin	*Stallion	3.75 to 11.75 fl oz	foliage	24	30 (grain, stover) 60 (forage)	
cyfluthrin	Tombstone Helios	0.8 to 1.6 fl oz	foliage	12	21 (grain or fodder), 0 (forage)	
lambda-cyhalothrin	*Warrior II	0.96 to 1.6 fl oz	foliage	24	21 (grain), 1 (graze, forage) 21 (treated feed or fodder)	
<b>At-plant soil-applied insecticide applications</b>						
permethrin	*Ambush 2E Insecticide	0.5 fl oz/1000 ft row	In-furrow, T-band, see label	12	30 (grain or stover), 0 (forage)	
permethrin	*Ambush 2E Insecticide	6.4 to 12.8 fl oz	Preplant, pre-emergence. See specific label	12	30 (grain or stover), 0 (forage)	
bifenthrin	*Brigade 2EC	0.15 to 0.30 fl oz per 1000 ft row	7 inch T-band see specific label	12	30 (grain, grazing, feed)	
bifenthrin	*Brigade 2EC	2.56 fl oz	preemergence	12	30 (grain, fodder, graze)	
bifenthrin	*Brigade 2EC	3 to 4 fl oz	preplant incorporate	12	30 (grain, fodder, graze)	
bifenthrin	*Capture LFR	3.4 to 6.8 fl oz	At-plant broadcast, 5-7 inch. T-band or in-furrow	12	30 (grain or stover), 60 (forage) 30 (graze or feed)	
bifenthrin	*Capture LFR	4 to 5.3 fl oz 3.4 fl oz	preplant incorporate preemergence	12	21 (grain, ears, forage, fodder) 1 (feed or graze forage)	

**Note:** See Table 1 for listing of (Bt) transgenic traits.

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Insecticides for field corn - *continued*

Insect	Insecticides		Amount of product per acre	Placement	REI (hours)	Preharvest interval (days)
	Common name	Trade name				
<b>Black cutworm - <i>continued</i></b>	chlorpyrifos + lambda-cyhalothrin	*Cobalt Advanced	11 to 38 fl oz	At-plant, T-band, see specific labels	24	21 (grain, ears, forage, fodder) 1 (feed or graze forage)
	chlorpyrifos + gamma-cyhalothrin	*Cobalt	13 to 38 fl oz	At-plant, T-band	24	21 (grain or ears) 14 (graze or silage harvest)
	zeta-cypermethrin + bifenthrin	*Hero	4.0 to 10.3 fl oz	At plant broadcast or 5-7 inch T-band on soil surface	12	30 (grain, stover, graze) 60 (forage)
	chlorpyrifos	*Lorsban Advanced	1 to 2 pt	Preplant, At-plant, See specific label.	24	21 (grain, ears, forage, fodder)
	zeta-cypermethrin	*Mustang Max	0.16 fl oz/1000 ft row	At-plant, T-band	12	30 (grain, stover) 60 (forage)
	chlorpyrifos	*Nufos 4E	1 to 2 pt	Preplant, at-plant, pre-emergence	24	21 (grain or ears)
	<b>Seed treatments</b>					
	thiamethoxam	Avicta Complete-Corn	1.250 mg ai/kernel	commercial on seed		
	thiamethoxam	Cruiser 5FS (250)	0.250 mg ai/kernel	commercial on seed		
	thiamethoxam	Cruiser Extreme 250	0.250 mg ai/kernel	commercial on seed		
	thiamethoxam	Cruiser Extreme 1250	1.250 mg ai/kernel	commercial on seed		
	clothianidin	Poncho 250	0.250 mg ai/kernel	commercial on seed		
	clothianidin	Poncho 500	0.500 mg ai/kernel	commercial on seed		
	clothianidin	Poncho 600 (250)	0.250 mg ai/kernel	commercial on seed		
	clothianidin	Poncho 600 (1250)	1.250 mg ai/kernel	commercial on seed		
	clothianidin	Poncho 1250	1.250 mg ai/kernel	commercial on seed		
	clothianidin	Poncho/Votivo	0.500 mg ai/kernel	commercial on seed		
	clothianidin	Poncho 1250/Votivo	1.250 mg ai/kernel	commercial on seed		

**Note:** See Table 1 for listing of (Bt) transgenic traits.

**\*Designates a restricted-use pesticide. Use is restricted to certified applicators only.** Read the label and follow all insecticide rate information, directions, precautions and restrictions.

**Insecticides for field corn - *continued***

Insect	Insecticides		Amount of product per acre	Placement	REI (hours)	Preharvest interval (days)
	Common name	Trade name				
<b>Chinch bug</b> <i>Blissus leucopterus</i> (Say)	esfenvalerate	*Asana XL	5.8 to 9.6 fl oz	foliage	12	21 (grain)
	cyfluthrin	*Baythroid XL	1.6 to 2.8 fl oz	foliage	12	21 (grain or fodder) 0 (green forage)
	lambda-cyhalothrin	*Besiege	10 fl oz	foliage	24	21 (grain, ears, forage, or fodder)
	bifenthrin	*Brigade 2EC	2.1 to 6.4 fl oz	foliage	12	30 (grain, fodder, graze)
	chlorpyrifos + lambda-cyhalothrin	*Cobalt Advanced	16 to 38 fl oz	broadcast over row or base of plant (see label)	24	21 (grain or ears) 14 (graze or silage harvest)
	chlorpyrifos + gamma-cyhalothrin	*Cobalt	16 to 38 fl oz	foliage	24	21 (grain, ears, forage, or fodder) 1 (feed or graze forage)
	gamma-cyhalothrin	*Declare 1.25SC	1.54 fl oz	foliage	24	21 (grain) 1 (feed or graze forage)
	deltamethrin	*Delta Gold 1.5EC	1.5 to 1.9 fl oz	foliage	12	21 (grain, fodder) 12 (cut forage or graze)
	alpha-cypermethrin	*Fastac EC	3.2 to 3.8 fl oz	foliage	12	30 (grain, stover) 60 (forage)
	zeta-cypermethrin + bifenthrin	*Hero	4.0 to 10.3 fl oz	foliage	12	30 (grain, stover, graze) 60 (forage)
	chlorpyrifos	*Lorsban Advanced	1 to 2 pt	foliage	24	21 (grain, ears, forage, fodder)
	chlorpyrifos	*Lorsban 4E	1 to 2 pt	foliage	24	21 (grain, ears, forage, fodder)
	zeta-cypermethrin	*Mustang Maxx	3.2 to 4.0 fl oz	spray larvae when migrating broadcast on foliage	12	30 (grain, stover) 60 (forage)
	zeta-cypermethrin	*Mustang Max	3.2 to 4.0 fl oz	foliage	12	30 (grain, stover) 60 (forage)
	chlorpyrifos	*Nufos 4E	1 to 2 pt	foliage	24	21 (grain or ears)
	carbaryl	Sevin 4F	2 to 4 pt	foliage	12	48 (grain or fodder) 14 (harvest or graze forage)
	chlorpyrifos + bifenthrin	*Stallion	9.25 to 11.75 fl oz	foliage	24	30 (grain, stover) 60 (forage)
	cyfluthrin	*Tombstone Helios	1.6 to 2.8 fl oz	foliage	12	21 (grain or fodder), 0 (forage)
	lambda-cyhalothrin	*Warrior II	1.92 fl oz	foliage	24	21 (grain), 1 (graze, forage) 21 (treated feed or fodder)
	<b>Seed treatments</b>					
thiamethoxam	Avicta Complete-Corn		1.250 mg ai/kernel	commercial on seed		
thiamethoxam	Cruiser 5FS (250)		0.250 mg ai/kernel	commercial on seed		
thiamethoxam	Cruiser Extreme 250		0.250 mg ai/kernel	commercial on seed		
thiamethoxam	Cruiser Extreme 1250		1.250 mg ai/kernel	commercial on seed		
clothianidin	Poncho 250		0.250 mg ai/kernel	commercial on seed		
clothianidin	Poncho 500		0.500 mg ai/kernel	commercial on seed		
clothianidin	Poncho 600 (250)		0.250 mg ai/kernel	commercial on seed		
clothianidin	Poncho 600 (1250)		1.250 mg ai/kernel	commercial on seed		
clothianidin	Poncho 1250		1.250 mg ai/kernel	commercial on seed		
clothianidin	Poncho/Votivo		0.500 mg ai/kernel	commercial on seed		
clothianidin	Poncho 1250/Votivo		1.250 mg ai/kernel	commercial on seed		

**Note:** See Table 1 for listing of (Bt) transgenic traits.

**\*Designates a restricted-use pesticide. Use is restricted to certified applicators only.** Read the label and follow all insecticide rate information, directions, precautions and restrictions.

Insecticides for field corn - *continued*

Insect	Insecticides		Amount of product per acre	Placement	REI (hours)	Preharvest interval (days)
	Common name	Trade name				
<b>Corn earworm</b> <i>Helicoverpa (=Heliothis) zea</i> (Boddie)	permethrin	*Ambush 25WP	6.4 to 12.8 fl oz	foliage	12	30 (grain or stover), 0 (forage)
	permethrin	*Ambush 2E Insecticide	6.4 to 12.8 fl oz	foliage	12	30 (grain or stover), 0 (forage)
<b>Comments:</b> Timing of insecticide applications are critical if optimal control of larvae is to be achieved before larvae enter ear tips. Best results are achieved when sprays are directed toward ear zone. Optimal control from Success or Tracer is best achieved when the insecticide is applied at peak egg hatch or when larvae are small.	permethrin	*multiple products	see specific label	foliage	12	see specific label
	esfenvalerate	*Asana XL	5.8 to 9.6 fl oz	foliage	12	21 (grain)
	cyfluthrin	*Baythroid XL	1.6 to 2.8 fl oz	foliage	12	21 (grain or fodder) 0 (green forage)
	flubendiamide	*Belt SC	2.0 to 3.0 fl oz	foliage	12	1 (green forage and silage) 28 (grain or stover)
	lambda-cyhalothrin	*Besiege	5.0 to 10 fl oz	foliage	24	21 (grain, ears, forage, fodder)
	bifenthrin	*Brigade 2EC	2.1 to 6.4 fl oz	foliage	12	30 (grain, fodder, graze)
	chlorpyrifos + lambda-cyhalothrin	*Cobalt Advanced	11 to 26 fl oz	foliage	24	21 (grain, ears, forage, fodder) 1 (feed or graze forage)
	chlorpyrifos + gamma-cyhalothrin	*Cobalt	19 to 38 fl oz	foliage	24	21 (grain, ears, forage, fodder) 1 (feed or graze forage)
	gamma-cyhalothrin	*Declare 1.25SC	0.77 to 1.28 fl oz	foliage	24	21 (grain) 1 (feed or graze forage)
	deltamethrin	*Delta Gold 1.5EC	1.5 to 1.9 fl oz	foliage	12	21 (grain, fodder) 12 (cut forage or graze)
	alpha-cypermethrin	*Fastac EC	1.8 to 3.8 fl oz	foliage	12	30 (grain, stover) 60 (forage)
	zeta-cypermethrin + bifenthrin	*Hero	4.0 to 10.3 fl oz		12	30 (grain, stover, graze) 60 (forage)
	methomyl	*Lannate SP	1/4 to 1/2 lb	foliage (ovicide/ larvacide)	48	0 (ears), 3 (forage), 21 (fodder)
	methomyl	*Lannate LV	3/4 to 1.5 pt	foliage (ovicide/ larvacide)	48	0 (ears), 3 (forage), 21 (fodder)
	chlorpyrifos	*Lorsban Advanced	1 to 2 pt	foliage	24	21 (grain, ears, forage, fodder)
	zeta-cypermethrin	*Mustang Max	1.76 to 4.0 fl oz	foliage	12	30 (grain, stover) 60 (forage)
	chlorpyrifos	*Nufos 4E	1.5 to 2 pt	foliage	24	21 (grain or ears)
	chlorantraniliprole	*Prevathon	14 to 20 fl oz	foliage	4	14 (harvest or graze forage)
carbaryl	Sevin 4F	2 to 4 pt	foliage	12	48 (grain or fodder) 14 (harvest or graze forage)	
chlorpyrifos + bifenthrin	*Stallion	9.25 to 11.75 fl oz	foliage	24	30 (grain, stover) 60 (forage)	
cyfluthrin	*Tombstone Helios	1.6 to 2.8 fl oz	foliage	12	21 (grain or fodder), 0 (forage)	
spinosad	Tracer 4SC	2.0 to 3.0 fl oz	foliage	1	28 (grain), 3 (fodder or forage)	
lambda-cyhalothrin	*Warrior II	0.96 to 1.6 fl oz	foliage	24	21 (grain), 1 (graze, forage) 21 (treated feed or fodder)	
<b>Seed treatments</b>						
thiamethoxam	Avicta Complete-Corn	1.25 mg ai/kernel	commercial on seed			
thiamethoxam	Cruiser Extreme 1250	1.250 mg ai/kernel	commercial on seed			
clothianidin	Poncho 1250	1.250 mg ai/kernel	commercial on seed			

**Note:** See Table 1 for listing of (Bt) transgenic traits.

**\*Designates a restricted-use pesticide. Use is restricted to certified applicators only.** Read the label and follow all insecticide rate information, directions, precautions and restrictions.

**Insecticides for field corn - *continued***

Insect	Insecticides		Amount of product per acre	Placement	REI (hours)	Preharvest interval (days)
	Common name	Trade name				
<b>Corn leaf aphids</b> <i>Rhopalosiphum maidis</i> (Fitch)	esfenvalerate	*Asana XL	5.8 to 9.6 fl oz	foliage	12	21 (grain)
	lambda-cyhalothrin	*Besiege	6 to 10 fl oz	foliage	24	21 (grain, ears, forage, fodder)
	bifenthrin	*Brigade 2EC	2.1 to 6.4 fl oz	foliage	12	30 (grain, fodder, graze)
	chlorpyrifos + lambda-cyhalothrin	*Cobalt Advanced	11 to 26 fl oz	foliage	24	21 (grain, ears, forage, fodder) 1 (feed or graze forage)
	chlorpyrifos + gamma-cyhalothrin	*Cobalt	13 to 26 fl oz	foliage		21 (grain, ears, forage, fodder) 1 (feed or graze forage)
	gamma-cyhalothrin	*Declare 1.25SC	1.02 to 1.54 fl oz	foliage	24	21 (grain) 1 (feed or graze forage)
	deltamethrin	*Delta Gold 1.5EC	1.5 to 1.9 fl oz (suppression only)	foliage	12	21 (grain, fodder) 12 (cut forage or graze)
	dimethoate	Dimethoate 4E	2/3 - 1 pt	foliage	48	28 (grain) 14 (forage)
	alpha-cypermethrin	*Fastac EC	2.7 to 3.8 fl oz	foliage	12	30 (grain, stover) 60 (forage)
	zeta-cypermethrin + bifenthrin	*Hero	4.0 to 10.3 fl oz	foliage	12	30 (grain, stover, graze) 60 (forage)
	methomyl	*Lannate SP	1/4 to 1/2 lb	foliage	48	0 (ears), 3 (forage), 21 (fodder)
	methomyl	*Lannate LV	3/4 to 1.5 pt	foliage	48	0 (ears), 3 (forage), 21 (fodder)
	chlorpyrifos	*Lorsban Advanced	1 to 2 pt	foliage	24	21 (grain, ears, forage, fodder)
	chlorpyrifos	*Lorsban 4E	1 to 2 pt	foliage	24	21 (grain, ears, forage, fodder)
	zeta-cypermethrin	*Mustang Max	2.72 to 4.0 fl oz	foliage	12	30 (grain, stover) 60 (forage)
	chlorpyrifos	*Nufos 4E	1 to 2 pt	foliage	24	21 (grain or ears)
chlorpyrifos + bifenthrin	*Stallion	9.25 to 11.75 fl oz	foliage	24	30 (grain, stover) 60 (forage)	
lambda-cyhalothrin	*Warrior II	1.28 to 1.92 fl oz (suppression only)	foliage	24	21 (grain), 1 (graze, forage) 21 (treated feed or fodder)	
<b>Corn rootworm adults - Western corn rootworm</b> <i>Diabrotica virgifera virgifera</i>	permethrin	*Ambush 25WP	6.4 to 12.8 fl oz	foliage	12	30 (grain or stover), 0 (forage)
	permethrin	*Ambush 2E Insecticide	6.4 to 12.8 fl oz	foliage	12	30 (grain or stover), 0 (forage)
and <b>Northern corn rootworm</b> <i>Diabrotica barberi</i>	permethrin	*multiple products	see specific label	foliage	12	see specific label
<b>Comments:</b> Beetles may reduce pollination by early silk clipping. Treatment is justified if pollination is not complete, silks are being clipped, and there are five or more beetles present per plant.	esfenvalerate	*Asana XL	5.8 to 9.6 fl oz	foliage	12	21 (grain)
	cyfluthrin	*Baythroid XL	1.6 to 2.8 fl oz	foliage	12	21 (grain or fodder) 0 (green forage)
	lambda-cyhalothrin	*Besiege	6 to 10 fl oz	foliage	24	21 (grain, ears, forage, fodder)
	bifenthrin	*Brigade 2EC	2.1 to 6.4 fl oz	foliage	12	30 (grain, fodder, graze)
	chlorpyrifos + lambda-cyhalothrin	*Cobalt Advanced	11 to 26 fl oz	foliage		21 (grain, ears, forage, fodder) 1 (feed or graze forage)
	chlorpyrifos + gamma-cyhalothrin	*Cobalt	13 to 26 fl oz	foliage	24	21 (grain, ears, forage, fodder) 1 (feed or graze forage)
	gamma-cyhalothrin	*Declare 1.25SC	1.02 to 1.54 fl oz	foliage	24	21 (grain) 1 (feed or graze forage)
	deltamethrin	*Delta Gold 1.5EC	1.5 to 1.9 fl oz	foliage	12	21 (grain, fodder) 12 (cut forage or graze)
	dimethoate	Dimethoate 4E	2/3 - 1 pt	foliage	48	28 (grain) 14 (forage)
	alpha-cypermethrin	*Fastac EC	2.7 to 3.8 fl oz	foliage	12	30 (grain, stover) 60 (forage)
	zeta-cypermethrin + bifenthrin	*Hero	4.0 to 10.3 fl oz	foliage	12	30 (grain, stover, graze) 60 (forage)
	methomyl	*Lannate SP	1/4 to 1/2 lb	foliage	48	0 (ears), 3 (forage), 21 (fodder)

**Note:** See Table 1 for listing of (Bt) transgenic traits.

**\*Designates a restricted-use pesticide. Use is restricted to certified applicators only.** Read the label and follow all insecticide rate information, directions, precautions and restrictions.

Insecticides for field corn - *continued*

Insect	Insecticides		Amount of product per acre	Placement	REI (hours)	Preharvest interval (days)
	Common name	Trade name				
<b>Corn rootworm adults - continued</b>	methomyl	*Lannate LV	3/4 to 1.5 pt	foliage	48	0 (ears), 3 (forage), 21 (fodder)
	chlorpyrifos	*Lorsban Advanced	1 to 2 pt	foliage	24	21 (grain, ears, forage, fodder)
	chlorpyrifos	*Lorsban 4E	1 to 2 pt	foliage	24	21 (grain, ears, forage, fodder)
	zeta-cypermethrin	*Mustang Max	2.72 to 4.0 fl oz	foliage	12	30 (grain, stover) 60 (forage)
	chlorpyrifos	*Nufos 4E	1 to 2 pt	foliage	24	21 (grain or ears)
	carbaryl	Sevin 4F	2 to 4 pt	foliage	12	48 (grain or fodder) 14 (harvest or graze forage)
	chlorpyrifos + bifenthrin	*Stallion	9.25 to 11.75 fl oz	foliage	24	30 (grain, stover) 60 (forage)
	cyfluthrin	*Tombstone Helios	1.6 to 2.8 fl oz	foliage	12	21 (grain or fodder), 0 (forage)
	lambda-cyhalothrin	*Warrior II	1.28 to 1.92 fl oz	foliage	24	21 (grain), 1 (graze, forage) 21 (treated feed or fodder)
<b>Corn rootworm larvae - Western corn rootworm</b> <i>Diabrotica virgifera virgifera</i> , and <b>Northern corn rootworm</b> <i>Diabrotica barberi</i>	<b>Nonfoliar insecticide applications</b>					
	cyfluthrin	*Aztec 2.1G	6.7 oz/1000 ft row	7-inch T-band, or in furrow	48	
	cyfluthrin	*Aztec 4.67 (Smartbox)	3 oz/1000 ft row	Band, furrow with incorporation (for smartbox use)	48	
	bifenthrin	*Brigade 2EC	0.15 to 0.30 fl oz/1000 ft row	7 inch T-band	12	
	bifenthrin	*Brigade 2EC	2.56 fl oz	preemergence	12	
	bifenthrin	*Brigade 2EC	3 to 4 fl oz	preplant incorporate	12	
	bifenthrin	*Capture LFR	3.4 to 6.8 fl oz	At-plant broadcast, 5-7 inch T-band or in-furrow	12	
	bifenthrin	*Capture LFR	4 to 5.3 fl oz	preplant incorporate	12	
			3.4 fl oz	preemergence	12	
	chlorpyrifos + lambda-cyhalothrin	*Cobalt Advanced	32 to 42 fl oz	7-inch band at cultivation targeting plant base see specific label	21	
	chlorpyrifos + gamma-cyhalothrin	*Cobalt	38 to 42 fl oz	7-inch band at cultivation targeting plant base see specific label	21	
	terbufos	*Counter 15G (Lock'nLoad system) (Smartbox)	6 to 8 oz/1000 ft row	band, furrow see specific label	48	
			6 to 8 oz/1000 ft row	see specific label		
	terbufos	*Counter 20G (Lock'nLoad system) (Smartbox)	4.5 to 6 oz/1000 ft row	band, furrow see specific label	48	
			4.5 to 6 oz/1000 ft row	see specific label	48	
	tefluthrin	*Force 3G	4 to 5 oz/1000 ft row	band, furrow	0	
	tefluthrin	*Force 3G(Smartbox)	4 to 5 oz/1000 ft row	see specific label	0	
	tefluthrin	*Force CS	0.46 to 0.57 oz/1000 ft row	band, furrow	12	
	chlorethoxyfos	*Fortress 2.5G	7.5 to 9.0 Oz/1000 ft row	band, furrow See label	48	
	chlorethoxyfos	*Fortress 5G (Lock'nLoad system) (Smartbox)	3.75 to 4.5 oz/1000 ft row	band, furrow See label	72	
			3.75 to 4.5 oz/1000 ft row	See label		
	zeta-cypermethrin + bifenthrin	*Hero	4.0 to 10.3 fl oz	At-plant broadcast or 5-7 inch T-band on soil surface	12	

**Note:** See Table 1 for listing of (Bt) transgenic traits.

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**Insecticides for field corn - *continued***

Insect	Insecticides		Amount of product per acre	Placement	REI (hours)	Preharvest interval (days)	
	Common name	Trade name					
<b>Corn rootworm larvae - <i>continued</i></b>	chlorpyrifos	*Lorsban Advanced	1 to 2 pt	Soil broadcast at-plant or soil cultivation post-emerge	24		
	chlorpyrifos	*Lorsban 15G	8 oz/1000 ft row	At-plant in-furrow or band	24		
	chlorpyrifos	*Lorsban 15G	8 oz/1000 ft row	Spray soil at base of plant at cultivation	24		
	chlorpyrifos	*Nufos 4E	1 to 2 pt	Soil broadcast at-plant or soil cultivation post-emerge	24		
	chlorpyrifos	*Nufos 15G		At-plant in-furrow or band	24		
	chlorethoxyfos + bifenthrin	Smart Choice 5G	3.0 to 3.5 oz/1000 ft row	in- furrow at planting	48		
	<b>Seed treatments</b>						
			Avicta Complete-Corn	1250 mg ai/kernel	seed		
		thiamethoxam	Cruiser Extreme 1250	1250 mg ai/kernel	seed		
		clothianidin	Poncho 600 (1250)	1250 mg ai/kernel	seed		
	clothianidin	Poncho 1250	1250 mg ai/kernel	seed			
	clothianidin	Poncho 1250/ Votivo	1250 mg ai/kernel	seed			
	tefluthrin	Proshield with Force ST	see product label	seed			
<b>European corn borer, 1st gen</b> <i>Ostrinia nubilalis</i> (Hübner)	permethrin	*Ambush 25WP	6.4 to 12.8 fl oz	foliage	12	30 (grain or stover), 0 (forage)	
	permethrin	*Ambush 2E Insecticide	6.4 to 12.8 fl oz	foliage	12	30 (grain or stover), 0 (forage)	
	permethrin	*multiple products	see specific label	foliage	12	see specific label	
	esfenvalerate	*Asana XL	7.8 to 9.6 fl oz	foliage	12	21 (grain)	
	cyfluthrin	*Baythroid XL	1.6 to 2.8 fl oz	foliage (for 1st & 2nd instars only)	12	21 (grain or fodder) 0 (green forage)	
	flubendiamide	*Belt SC	2.0 to 3.0 fl oz	foliage	12	1 (green forage and silage) 28 (grain or stover)	
	lambda-cyhalothrin	*Besiege	6 to 10 fl oz	foliage	24	21 (grain, ears, forage, fodder)	
	bifenthrin	*Brigade 2EC	2.1 to 6.4 fl oz	foliage	12	30 (grain, fodder, graze)	
	chlorpyrifos + gamma-cyhalothrin	*Cobalt	19 to 38 fl oz	foliage	24	21 (grain, ears, forage, fodder) 1 (feed or graze forage)	
	chlorpyrifos + lambda-cyhalothrin	*Cobalt Advanced	11 to 26 fl oz	foliage	24	21 (grain, ears, forage, fodder) 1 (feed or graze forage)	
	gamma-cyhalothrin	*Declare 1.25SC	1.02 to 1.54 fl oz	foliage	24	21 (grain) 1 (feed or graze forage)	
	deltamethrin	*Delta Gold 1.5EC	1.5 to 1.9 fl oz	foliage	12	21 (grain, fodder) 12 (cut forage or graze)	
	alpha-cypermethrin	*Fastac EC	2.7 to 3.8 fl oz	foliage	12	30 (grain, stover) 60 (forage)	
	zeta-cypermethrin + bifenthrin	*Hero	4.0 to 10.3 fl oz	foliage	12	30 (grain, stover, graze) 60 (forage)	
	methoxyfenozide	Intrepid 2F	4.0 to 8.0 fl oz	over whorl	4	21 (grain)	
	methomyl	*Lannate SP	1/4 to 1/2 lb	ears	48	0 (ears), 3 (forage), 21 (fodder)	
	methomyl	*Lannate LV	3/4 to 1.5 pt	ears	48	0 (ears), 3 (forage), 21 (fodder)	

**Comments:**  
Treat corn for first-generation ECB larvae when 50% of the plants show leaf feeding and live larvae are present. Sprays applied by ground equipment should be directed over the row to increase insecticide performance. Granular formulations applied by air generally perform better than spray formulations applied by air. Optimal control from Tracer is best achieved when the insecticide is applied at peak egg hatch. Larval control from most insecticides is best achieved before larvae burrow into plants.

**Note:** See Table 1 for listing of (Bt) transgenic traits.

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Insecticides for field corn - *continued*

Insect	Insecticides		Amount of product per acre	Placement	REI (hours)	Preharvest interval (days)	
	Common name	Trade name					
<b>European corn borer, 1st gen. - continued</b>	chlorpyrifos	*Lorsban Advanced	1 to 2 pt	over whorls	24	21 (grain, ears ,forage, fodder)	
	chlorpyrifos	*Lorsban 4E	1 1/2 to 2 pt	over whorls	24	21 (grain, ears, forage, fodder)	
	chlorpyrifos	*Lorsban 15G	5 to 6.5 lb aerial application	over whorls - aerial	24	21 (grain or ears)	
	zeta-cypermethrin	*Mustang Max	2.72 to 4.0 fl oz	foliage	12	30 (grain, stover) 60 (forage)	
	chlorpyrifos	*Nufos 4E	1 to 2 pt	over whorls	24	21 (grain or ears)	
	chlorpyrifos	*Nufos 15G	5 to 6.5 lb aerial application	over whorls - aerial	24	21 (grain or ears)	
	permethrin	*Pounce 3.2EC	4 to 8 fl oz/A	foliage	12	30 (grain or stover), 0 (forage)	
	carbaryl	Sevin 4F	3 to 4 pt	foliage	12	48 (grain or fodder) 14 (harvest or graze forage)	
	chlorpyrifos + bifenthrin	*Stallion	9.25 to 11.75 fl oz	foliage	24	30 (grain, stover) 60 (forage)	
	cyfluthrin	*Tombstone Helios	1.6 to 2.8 fl oz	foliage	12	21 (grain or fodder), 0 (forage)	
	spinosad	Tracer 45C	1.0 to 3.0 fl oz	foliage, over whorls	1	28 (grain), 3 (fodder or forage)	
	lambda-cyhalothrin	*Warrior II	1.28 to 1.92 fl oz	foliage	24	21 (grain), 1 (graze, forage) 21 (treated feed or fodder)	
	<b>Bacillus thuringiensis</b>						
	Bt formulations:	Agree, Biobit, Condor, Delivery, Lepinox, Javelin, Xentari, others.	see specific labels	Broadcast			
	<b>European corn borer, 2nd gen</b>	permethrin	*Ambush 25WP	6.4 to 12.8 fl oz	foliage	12	30 (grain or stover), 0 (forage)
permethrin		*Ambush 2E Insecticide	6.4 to 12.8 fl oz	foliage	12	30 (grain or stover), 0 (forage)	
permethrin		*multiple products	see specific label	foliage	12	see specific label	
esfenvalerate		*Asana XL	7.8 to 9.6 fl oz	foliage	12	21 (grain)	
cyfluthrin		*Baythroid XL	1.6 to 2.8 fl oz	foliage (for 1st & 2nd instars only)	12	21 (grain or fodder) 0 (green forage)	
flubendiamide		*Belt SC	2.0 to 3.0 fl oz	foliage	12	1 (green forage and silage) 28 (grain or stover)	
lambda-cyhalothrin		*Besiege	6 to 10 fl oz	foliage	24	21 (grain, ears, forage, fodder)	
bifenthrin		*Brigade 2EC	2.1 to 6.4 fl oz	foliage	12	30 (grain, fodder, graze)	
chlorpyrifos + lambda-cyhalothrin		*Cobalt Advanced	22 to 38 fl oz	foliage		21 (grain, ears, forage, fodder) 1 (feed or graze forage)	
chlorpyrifos + gamma-cyhalothrin		*Cobalt	19 to 38 fl oz	foliage	24	21 (grain, ears, forage, fodder) 1 (feed or graze forage)	
gamma-cyhalothrin		*Declare 1.25SC	1.02 to 1.54 fl oz	foliage	24	21 (grain) 1 (feed or graze forage)	
deltamethrin		*Delta Gold 1.5EC	1.5 to 1.9 fl oz	foliage	12	21 (grain, fodder) 12 (cut forage or graze)	
alpha-cypermethrin		*Fastac EC	2.7 to 3.8 fl oz	foliage	12	30 (grain, stover) 60 (forage)	
zeta-cypermethrin + bifenthrin		*Hero	4.0 to 10.3 fl oz	foliage	12	30 (grain, stover, graze) 60 (forage)	
methoxyfenozide		Intrepid 2F	4.0 to 8.0 fl oz	foliage	4	21 (grain)	
methomyl	*Lannate SP	1/4 to 1/2 lb	ears	48	0 (ears), 3 (forage), 21 (fodder)		

**Comments:**  
For second-generation ECB larvae, treat when 50% of plants have egg masses and/or larvae on the first leaf above and below the ear. Optimal control from Success or Tracer is best achieved when the insecticide is applied at peak egg hatch or when larvae are small.

**Note:** See Table 1 for listing of (Bt) transgenic traits.  
**\*Designates a restricted-use pesticide. Use is restricted to certified applicators only.** Read the label and follow all insecticide rate information, directions, precautions and restrictions.

**Insecticides for field corn - *continued***

Insect	Insecticides		Amount of product per acre	Placement	REI (hours)	Preharvest interval (days)	
	Common name	Trade name					
<b>European corn borer, 2nd gen. - <i>continued</i></b>	methomyl	*Lannate LV	3/4 to 1 1/2 pt	ears	48	0 (ears), 3 (forage), 21 (fodder)	
	chlorpyrifos	*Lorsban Advanced	1 to 2 pt	over whorls	24	21 (grain, ears, forage, fodder)	
	chlorpyrifos	*Lorsban 4E	1 1/2 to 2 pt	over whorls	24	21 (grain, ears, forage, fodder)	
	chlorpyrifos	*Lorsban 15G	6.5 lb aerial application	over whorls - aerial		21 (grain or ears)	
	zeta-cypermethrin	*Mustang Max	2.72 to 4.0 fl oz	foliage	12	30 (grain, stover) 60 (forage)	
	chlorpyrifos	*Nufos 4E	1 to 2 pt	over whorls	24	21 (grain or ears)	
	chlorpyrifos	*Nufos 15G	5 to 6.5 lb aerial application	over whorls - aerial		21 (grain or ears)	
	chlorantraniliprole	*Prevathon	14 to 20 fl oz	foliage	4	14 (harvest or graze forage)	
	carbaryl	Sevin 4F	3 to 4 pt	foliage	12	48 (grain or fodder) 14 (harvest or graze forage)	
	chlorpyrifos + bifenthrin	*Stallion	9.25 to 11.75 fl oz	foliage	24	30 (grain, stover) 60 (forage)	
	cyfluthrin	*Tombstone Helios	1.6 to 2.8 fl oz	foliage	12	21 (grain or fodder), 0 (forage)	
	spinosad	Tracer 4SC	1.0 to 3.0 fl oz	foliage, over whorls	1	28 (grain), 3 (fodder or forage)	
	lambda-cyhalothrin	*Warrior II	1.28 to 1.92 fl oz	foliage	24	21 (grain), 1 (graze, forage) 21 (treated feed or fodder)	
	<b>Bacillus thuringiensis</b>						
		Bt formulations:	Agree, Biobit, Condor, Delivery, Dipel, Lepinox, Javelin, Xentari and others	see specific labels	Broadcast		
<b>Fall armyworm</b> <i>Spodoptera frugiperda</i> J.E. Smith	permethrin	*Ambush 25WP	6.4 to 12.8 fl oz	foliage	12	30 (grain or stover), 0 (forage)	
	permethrin	*Ambush 2E Insecticide	6.4 to 12.8 fl oz	foliage	12	30 (grain or stover), 0 (forage)	
	cyfluthrin	*Baythroid XL (1st and 2nd instars only)	2.8 fl oz	foliage (for 1st & 2nd instars only)	12	21 (grain or fodder) 0 (green forage)	
	flubendiamide	*Belt SC	2.0 to 3.0 fl oz	foliage	12	1 (green forage and silage) 28 (grain or stover)	
	lambda-cyhalothrin	*Besiege	6.0 to 10 fl oz	foliage	24	21 (grain, ears, forage, fodder)	
	bifenthrin	*Brigade 2EC	2.1 to 6.4 fl oz	foliage	12	30 (grain, fodder, graze)	
	chlorpyrifos + gamma-cyhalothrin	*Cobalt	13 to 26 fl oz	foliage	24	21 (grain, ears, forage, fodder) 1 (feed or graze forage)	
	chlorpyrifos + lambda-cyhalothrin	*Cobalt Advanced	11 to 26 fl oz	foliage		21 (grain, ears, forage, fodder) 1 (feed or graze forage)	
	gamma-cyhalothrin	*Declare 1.25SC	1.02 to 1.54 fl oz	foliage	24	21 (grain) 1 (feed or graze forage)	
	deltamethrin	*Delta Gold 1.5EC	1.5 to 1.9 fl oz	foliage	12	21 (grain, fodder) 12 (cut forage or graze)	
	alpha-cypermethrin	*Fastac EC	3.2 to 3.8 fl oz	foliage	12	30 (grain, stover) 60 (forage)	
	zeta-cypermethrin + bifenthrin	*Hero	4.0 to 10.3 fl oz	foliage	12	30 (grain, stover, graze) 60 (forage)	
	methomyl	*Lannate SP	1/4 to 1/2 lb	foliage	48	0 (ears), 3 (forage), 21 (fodder)	
methomyl	*Lannate LV	3/4 to 1.5 pt	foliage	48	0 (ears), 3 (forage), 21 (fodder)		

**Note:** See Table 1 for listing of (Bt) transgenic traits.

**\*Designates a restricted-use pesticide. Use is restricted to certified applicators only.** Read the label and follow all insecticide rate information, directions, precautions and restrictions.



Insecticides for field corn - *continued*

Insect	Insecticides		Amount of product per acre	Placement	REI (hours)	Preharvest interval (days)
	Common name	Trade name				
<b>Fall armyworm - <i>continued</i></b>	chlorpyrifos	*Lorsban Advanced	1 to 2 pt	foliage	24	21 (grain, ears ,forage, fodder)
	chlorpyrifos	*Lorsban 4E	1 to 2 pt	foliage	24	21 (grain, ears, forage, fodder)
	zeta-cypermethrin	*Mustang Max	3.2 to 4.0 fl oz	foliage	12	30 (grain, stover) 60 (forage)
	chlorpyrifos	*Nufos 4E	1 to 2 pt	foliage	24	21 (grain or ears)
	chlorantraniliprole	*Prevathon	14 to 20 fl oz	foliage	4	14 (harvest or graze forage)
	carbaryl	Sevin 4F	2 to 4 pt	foliage	12	48 (grain or fodder) 14 (harvest or graze forage)
	chlorpyrifos + bifenthrin	*Stallion	9.25 to 11.75 fl oz	foliage	24	30 (grain, stover) 60 (forage)
	cyfluthrin	*Tombstone Helios	2.8 fl oz	foliage	12	21 (grain or fodder), 0 (forage)
	spinosad	Tracer 4SC	1.0 to 3.0 fl oz	foliage	1	28 (grain), 3 (fodder or forage)
	lambda-cyhalothrin	*Warrior II	1.28 to 1.92 fl oz	foliage	24	21 (grain), 1 (graze, forage) 21 (treated feed or fodder)
<b>Corn flea beetle</b> <i>Chaetocnema pulicaria</i> and flea beetle complex, including the <b>Red headed flea beetle</b> , <i>Systena frontalis</i>	permethrin	*Ambush 25WP	6.4 to 12.8 fl oz	foliage	12	30 (grain or stover), 0 (forage)
	permethrin	*Ambush 2E Insecticide	6.4 to 12.8 fl oz	foliage	12	30 (grain or stover), 0 (forage)
	esfenvalerate	*Asana XL	5.8 to 9.6 fl oz	foliage	12	21 (grain)
	cyfluthrin	*Baythroid XL	0.8 to 1.6 fl oz	foliage	12	21 (grain or fodder) 0 (green forage)
	lambda-cyhalothrin + chlorantraniliprole	*Besiege	6.0 to 9.0 fl oz	foliage	24	21 (grain or fodder)
	bifenthrin	*Brigade 2EC	2.1 to 6.4 fl oz	foliage	12	30 (grain, fodder, graze)
	chlorpyrifos + gamma-cyhalothrin	*Cobalt	13 to 26 fl oz	foliage	24	21 (grain or ears) 14 (graze or silage harvest)
	chlorpyrifos + gamma-cyhalothrin	*Cobalt Advanced	13 to 26 fl oz	foliage	24	21 (grain or ears) 14 (graze or silage harvest)
	gamma-cyhalothrin	*Declare	1.02 to 1.54 fl oz	foliage	24	21 (harvest)
	deltamethrin	*Delta Gold 1.5EC	1.0 to 1.5 fl oz	foliage	12	21 (grain, fodder) 12 (cut forage or graze)
	zeta-cypermethrin + bifenthrin	*Hero	2.6 to 6.1 fl oz	foliage	12	30 (grain, stover, graze) 60 (forage)
	methomyl	*Lannate SP	1/4 to 1/2 lb	foliage	48	0 (ears), 3 (forage), 21 (fodder)
	methomyl	*Lannate LV	3/4 to 1.5 pt	foliage	48	0 (ears), 3 (forage), 21 (fodder)
	chlorpyrifos	*Lorsban Advanced	1 to 2 pt	foliage	24	21 (grain, ears ,forage, fodder)
	chlorpyrifos	*Lorsban 4E	1 to 2 pt	foliage	24	21 (grain, ears, forage, fodder)
	zeta-cypermethrin	*Mustang Max	2.72 to 4.0 fl oz	foliage	12	30 (grain, stover) 60 (forage)
	zeta-cypermethrin	*Mustang Maxx	2.72 to 4.0 fl oz	foliage	12	30 (grain, stover) 60 (forage)
	chlorpyrifos	*Nufos 4E	1 to 2 pt	foliage	24	21 (grain or ears)
carbaryl	Sevin 4F	2 to 4 pt	foliage	12	48 (grain or fodder) 14 (harvest or graze forage)	
carbaryl	Seven XLR Plus	2 to 4 pt	foliage	12	48 (grain or fodder) 14 (harvest or graze forage)	
chlorpyrifos + bifenthrin	*Stallion	9.25 to 11.75 fl oz	foliage	24	30 (grain, stover) 60 (forage)	
cyfluthrin	*Tombstone Helios	0.8 to 1.6 fl oz	foliage	12	21 (grain or fodder), 0 (forage)	

**Note:** See Table 1 for listing of (Bt) transgenic traits.

**\*Designates a restricted-use pesticide. Use is restricted to certified applicators only.** Read the label and follow all insecticide rate information, directions, precautions and restrictions.

**Insecticides for field corn - *continued***

Insect	Insecticides		Amount of product per acre	Placement	REI (hours)	Preharvest interval (days)	
	Common name	Trade name					
<b>Corn flea beetle, - <i>continued</i></b>	lambda-cyhalothrin	*Warrior II	1.28 to 1.92 fl oz	foliage	24	21 (grain), 1 (graze, forage) 21 (treated feed or fodder)	
	<b>Seed treatments (for corn flea beetle only):</b>						
	thiamethoxam	Avicta Complete-Corn	1.250 mg ai/kernel	commercial on seed			
	thiamethoxam	Cruiser 5FS (250)	0.250 mg ai/kernel	commercial on seed			
	thiamethoxam	Cruiser Extreme 250	0.250 mg ai/kernel	commercial on seed			
	thiamethoxam	Cruiser Extreme 1250	1.250 mg ai/kernel	commercial on seed			
	clothianidin	Poncho 600 (250)	0.250 mg ai/kernel	commercial on seed			
	clothianidin	Poncho 1250	1.250 mg ai/kernel	commercial on seed			
	clothianidin	Poncho/Votivo	0.500 mg ai/kernel	commercial on seed			
	tefluthrin	Proshield with Force ST	see label	commercial on seed			
<b>Grasshopper complex</b>	esfenvalerate	*Asana XL	5.8 to 9.6 fl oz	foliage	12	21 (grain)	
	cyfluthrin	*Baythroid XL	1.6 to 2.8 fl oz	foliage	12	21 (grain or fodder) 0 (green forage)	
	lambda-cyhalothrin	*Besiege	6.0 to 10 fl oz	foliage	24	21 (grain, ears, forage, fodder)	
	bifenthrin	*Brigade 2EC	2.1 to 6.4 fl oz	foliage	12	30 (grain, fodder, graze)	
	chlorpyrifos + lambda-cyhalothrin	*Cobalt Advanced	6 to 13 fl oz	foliage		21 (grain, ears, forage, fodder) 1 (feed or graze forage)	
	chlorpyrifos + gamma-cyhalothrin	*Cobalt	7 to 13 fl oz	foliage	24	21 (grain, ears, forage, fodder) 1 (feed or graze forage)	
	gamma-cyhalothrin	*Declare 1.25SC	1.02 to 1.54 fl oz	foliage	24	21 (grain) 1 (feed or graze forage)	
	deltamethrin	*Delta Gold 1.5EC	1.0 to 1.5 fl oz	foliage	12	21 (grain, fodder) 12 (cut forage or graze)	
	dimethoate	Dimethoate 4E	1 pt	foliage	48	28 (grain) 14 (forage)	
	alpha-cypermethrin	*Fastac EC	2.7 to 3.8 fl oz	foliage	12	30 (grain, stover) 60 (forage)	
	zeta-cypermethrin + bifenthrin	*Hero	2.6 to 6.1 fl oz	foliage	12	30 (grain, stover, graze) 60 (forage)	
	chlorpyrifos	*Lorsban Advanced	1/2 to 1 pt	foliage	24	21 (grain, ears, forage, fodder)	
	chlorpyrifos	*Lorsban 4E	1/2 to 1 pt	foliage	24	21 (grain, ears, forage, fodder)	
	zeta-cypermethrin	*Mustang Max	2.72 to 4.0 fl oz	foliage	12	30 (grain, stover) 60 (forage)	
	chlorpyrifos	*Nufos 4E	1/2 to 1 pt	foliage	24	21 (grain or ears)	
	chlorpyrifos + bifenthrin	*Stallion	9.25 to 11.75 fl oz	foliage	24	30 (grain, stover) 60 (forage)	
cyfluthrin	*Tombstone Helios	2.1 to 2.8 fl oz	foliage	12	21 (grain or fodder), 0 (forage)		
lambda-cyhalothrin	*Warrior II	1.28 to 1.92 fl oz	foliage	24	21 (grain), 1 (graze, forage) 21 (treated feed or fodder)		

**Comments:**  
Control grasshoppers when they are small by applying spot treatments to hatching sites in field borders and grass waterways. Treatment is justified in corn field when seven or more grasshoppers per square yard are present and foliage is being severely damaged. After pollen shed, control may be necessary if grasshoppers are damaging foliage above ear zone. Dimethoate should not be applied to corn during pollen-shed.

**Note:** See Table 1 for listing of (Bt) transgenic traits.

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Insecticides for field corn - *continued*

Insect	Insecticides		Amount of product per acre	Placement	REI (hours)	Preharvest interval (days)
	Common name	Trade name				
<b>Japanese beetle adults</b> <i>Popillia japonica</i> Newman	esfenvalerate	*Asana XL	5.8 to 9.6 fl oz	foliage	12	21 (grain)
	cyfluthrin	*Baythroid XL	1.6 to 2.8 fl oz	foliage	12	21 (grain or fodder) 0 (green forage)
	lambda-cyhalothrin	*Besiege	6 to 10 fl oz	foliage	24	21 (grain, ears, forage, fodder)
	bifenthrin	*Brigade 2EC	2.1 to 6.4 fl oz	foliage	12	30 (grain, fodder, graze)
	chlorpyrifos + lambda-cyhalothrin	*Cobalt Advanced	32 to 42 fl oz	foliage		21 (grain, ears, forage, fodder) 1 (feed or graze forage)
	chlorpyrifos + gamma-cyhalothrin	*Cobalt	38 to 42 fl oz	foliage	24	21 (grain, ears, forage, fodder) 1 (feed or graze forage)
	gamma-cyhalothrin	*Declare 1.25SC	1.02 to 1.54 fl oz	foliage	24	21 (grain) 1 (feed or graze forage)
	deltamethrin	*Delta Gold 1.5EC	1.5 to 1.9 fl oz	foliage	12	21 (grain, fodder) 12 (cut forage or graze)
	alpha-cypermethrin	*Fastac EC	2.7 to 3.8 fl oz	foliage	12	30 (grain, stover) 60 (forage)
	zeta-cypermethrin + bifenthrin	*Hero	4.0 to 10.3 fl oz	foliage	12	30 (grain, stover, graze) 60 (forage)
	zeta-cypermethrin	*Mustang Max	2.72 to 4.0 fl oz	foliage	12	30 (grain, stover) 60 (forage)
	carbaryl	Sevin 4F	2 to 4 pt	foliage	12	48 (grain or fodder) 14 (harvest or graze forage)
	chlorpyrifos + bifenthrin	*Stallion	9.25 to 11.75 fl oz	foliage	24	30 (grain, stover) 60 (forage)
	cyfluthrin	*Tombstone Helios	1.6 to 2.8 fl oz	foliage	12	21 (grain or fodder), 0 (forage)
	lambda-cyhalothrin	*Warrior II	1.28 to 1.92 fl oz	foliage	24	21 (grain), 1 (graze, forage) 21 (treated feed or fodder)
<b>Seedcorn maggot</b> <i>Delia platura</i> (Meigen)	cyfluthrin	*Aztec 2.1G	6.7 oz/1000 ft row	7-inch band, or in furrow	48	
<b>Seedcorn beetle</b> <i>Stenolophus lecontei</i>	cyfluthrin	*Aztec 4.67 (for smartbox use)	3 oz/1000 ft row	7-inch band, or in furrow	48	
<b>Slender seedcorn beetle</b> <i>Clivinia impressitrons</i> LeConte	beta-cyfluthrin	*Baythroid XL	0.12 to 0.16 oz/1000 ft row (30-inch row spacing)	In-furrow at planting (apply w water or fertilizer)	12	21 (grain or fodder) 0 (green forage)
	bifenthrin	*Brigade 2EC	0.15 to 0.30 fl oz/1000 ft row with 30-inch row spacing	In-furrow at planting (apply w water or fertilizer)	12	30 (grain, fodder, graze)
	bifenthrin	*Capture LFR	0.2 to 0.39 fl oz/1000 ft row	Band or furrow at planting (LFR applied with fertilizer)	12	30 (grain or stover), 60 (forage) 30 (graze or feed)
	terbufos	*Counter 15G (Lock'nLoad system) (Smartbox)	6 to 8 oz/1000 ft row 6 to 8 oz/1000 ft row	band, furrow see specific label see specific label	48	
	terbufos	*Counter 20G (Lock'nLoad system) (Smartbox)	4.5 to 6 oz/1000 ft row 4.5 to 6 oz/1000 ft row	band, furrow see specific label see specific label	48 48	
	tefluthrin	*Force 3G (Lock'nLoad system) (Smartbox)	4 to 5 oz/1000 ft row 4 to 5 oz/1000 ft row	band, furrow see specific label	0 0	

**Note:** See Table 1 for listing of (Bt) transgenic traits.

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**Insecticides for field corn - *continued***

Insect	Insecticides		Amount of product per acre	Placement	REI (hours)	Preharvest interval (days)	
	Common name	Trade name					
<b>Seedcorn maggot, - <i>continued</i></b>	tefluthrin	*Force CS	0.46 to 0.57 oz/1000 ft row	Band, furrow	12		
	chlorothoxyfos	*Fortress 2.5G	6.0 to 9.0 Oz/1000 ft row	band, furrow See label	48		
	chlorothoxyfos	*Fortress 5G (Lock'nLoad system) (Smartbox)	3.7 3.75 to 4.5 oz/1000 ft row 5 to 4.5 oz/1000 ft row	band, furrow See label			
	chlorpyrifos	*Lorsban 15G	8 oz/1000 ft row	Band or furrow at planting	24		
	cholpyrifos	*Nufos 15G	8 oz/1000 ft row	Band or furrow at planting	24		
	chlorothoxyfos + bifenthrin	Smart Choice 5G	3.0 to 3.5 oz/1000 ft row	in- furrow at planting	48	30 (harvest, fodder, graze)	
	<b>Seed treatments:</b>						
	thiamethoxam	Cruiser 5FS (250)	0.250 mg ai/kernel	commercial on seed			
	thiamethoxam	Cruiser Extreme 250	0.250 mg ai/kernel	commercial on seed			
	thiamethoxam	Cruiser Extreme 1250	1.250 mg ai/kernel	commercial on seed			
clothianidin	Poncho 600 (250)	0.250 mg ai/kernel	commercial on seed				
clothianidin	Poncho 1250	1.250 mg ai/kernel	commercial on seed				
clothianidin	Poncho/Votivo	0.500 mg ai/kernel	commercial on seed				
permethrin	Kernel Guard Supreme	1.5 oz/42 lbs of seed	planter box or hopper				
<b>Southern corn leaf beetle</b> <i>Cyphus denticollis</i>	cyfluthrin	*Baythroid XL	1.6 to 2.8 fl oz	broadcast	12	21 (grain or fodder) 0 (green forage)	
	bifenthrin	*Brigade 2EC	2.1 to 6.4 fl oz	broadcast	12	30 (grain, fodder, graze)	
	chlorpyrifos + lambda-cyhalothrin	*Cobalt Advanced	11 to 26 fl oz	foliage		21 (grain, ears, forage, fodder) 1 (feed or graze forage)	
	chlorpyrifos + gamma-cyhalothrin	*Cobalt	13 to 26 fl oz	broadcast	24	21 (grain, ears, forage, fodder) 1 (feed or graze forage)	
	gamma-cyhalothrin	*Declare 1.25SC	1.54 fl oz	foliage	24	21 (grain) 1 (feed or graze forage)	
	alpha-cypermethrin	*Fastac EC	2.7 to 3.8 fl oz	foliage	12	30 (grain, stover) 60 (forage)	
	zeta-cypermethrin + bifenthrin	*Hero	4.0 to 10.3 fl oz	broadcast	12	30 (grain, stover, graze) 60 (forage)	
	chlorpyrifos	*Lorsban Advanced	1/2 to 1 pt	foliage	24	21 (grain, ears ,forage, fodder)	
	chlorpyrifos	*Lorsban 4E	1 to 2 pt	broadcast	24	21 (grain, ears ,forage, fodder)	
	zeta-cypermethrin	*Mustang Max	2.72 to 4.0 fl oz	broadcast	12	30 (grain, stover) 60 (forage)	
	chlorpyrifos	*Nufos 4E	1 to 2 pt	broadcast	24	21 (grain or ears)	
	chlorpyrifos + bifenthrin	*Stallion	9.25 to 11.75 fl oz	foliage	24	30 (grain, stover) 60 (forage)	
	cyfluthrin	*Tombstone Helios	1.6 to 2.8 fl oz	foliage	12	21 (grain or fodder), 0 (forage)	

**Note:** See Table 1 for listing of (Bt) transgenic traits.

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Insecticides for field corn - *continued*

Insect	Insecticides		Amount of product per acre	Placement	REI (hours)	Preharvest interval (days)
	Common name	Trade name				
<b>Southwestern corn borer 2nd generation</b>	permethrin	*Ambush 25WP	6.4 to 12.8 fl oz	foliage	12	30 (grain or stover), 0 (forage)
	permethrin	*Ambush 2E Insecticide	6.4 to 12.8 fl oz	foliage	12	30 (grain or stover), 0 (forage)
	esfenvalerate	*Asana XL	5.8 to 9.6 fl oz	foliage	12	21 (grain)
	cyfluthrin	*Baythroid XL	1.6 to 2.8 fl oz	foliage (for 1st & 2nd instars only)	12	21 (grain or fodder) 0 (green forage)
	lambda-cyhalothrin	*Besiege	6.0 to 10 fl oz	foliage	24	21 (grain, ears, forage, fodder)
	flubendiamide	*Belt SC	2.0 to 3.0 fl oz	foliage	12	1 (green forage and silage) 28 (grain or stover)
	bifenthrin	*Brigade 2EC	2.1 to 6.4 fl oz	foliage	12	30 (grain, fodder, graze)
	chlorpyrifos + gamma-cyhalothrin	*Cobalt	19 to 38 fl oz	foliage	24	21 (grain, ears, forage, fodder) 1 (feed or graze forage)
	chlorpyrifos + lambda-cyhalothrin	*Cobalt Advanced	16 to 38 fl oz	foliage		21 (grain, ears, forage, fodder) 1 (feed or graze forage)
	gamma-cyhalothrin	*Declare 1.25SC	1.02 to 1.54 fl oz	foliage	24	21 (grain) 1 (feed or graze forage)
	deltamethrin	*Delta Gold 1.5EC	1.5 to 1.9 fl oz	foliage	12	21 (grain, fodder) 12 (cut forage or graze)
	alpha-cypermethrin	*Fastac EC	2.7 to 3.8 fl oz	foliage	12	30 (grain, stover) 60 (forage)
	zeta-cypermethrin + bifenthrin	*Hero	4.0 to 10.3 fl oz	foliage	12	30 (grain, stover, graze) 60 (forage)
	methoxyfenozide	Intrepid 2F	4.0 to 8.0 fl oz	foliage	4	21 (grain)
	chlorpyrifos	*Lorsban Advanced	1 1/2 to 2 pt	over whorls	24	21 (grain, ears ,forage, fodder)
	chlorpyrifos	*Lorsban 4E	1 1/2 to 2 pt	over whorls	24	21 (grain, ears, forage, fodder)
	chlorpyrifos	*Lorsban 15G	6.5 lb aerial application	over whorls - aerial	24	21 (grain or ears)
	zeta-cypermethrin	*Mustang Max	2.72 to 4.0 fl oz	foliage	12	30 (grain, stover) 60 (forage)
	chlorpyrifos	*Nufos 4E	1 1/2 to 2 pt	over whorls	24	21 (grain or ears)
	chlorpyrifos	*Nufos 15G	6.5 lb aerial application	over whorls - aerial	24	21 (grain or ears)
	chlorantraniliprole	*Prevathon	14 to 20 fl oz	foliage	4	14 (harvest or graze forage)
	carbaryl	Sevin 4F	2 to 4 pt	foliage	12	48 (grain or fodder) 14 (harvest or graze forage)
	chlorpyrifos + bifenthrin	*Stallion	9.25 to 11.75 fl oz	foliage	24	30 (grain, stover) 60 (forage)
cyfluthrin	*Tombstone Helios	1.6 to 2.8 fl oz	foliage	12	21 (grain or fodder), 0 (forage)	
spinosad	Tracer 4SC	2.0 to 3.0 fl oz	foliage , over whorls	1	28 (grain), 3 (fodder or forage)	
lambda-cyhalothrin	*Warrior II	1.28 to 1.92 fl oz	foliage	24	21 (grain), 1 (graze, forage) 21 (treated feed or fodder)	
<b>Bacillus thuringiensis</b>						
Bt formulations:	Agree, Biobit, Conдор, Delivery, Dipel, Lepinox, Javelin, Xentari & others.	see specific labels	broadcast			

**Note:** See Table 1 for listing of (Bt) transgenic traits.  
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**Insecticides for field corn - *continued***

Insect	Insecticides		Amount of product per acre	Placement	REI (hours)	Preharvest interval (days)
	Common name	Trade name				
<b>Stalk borer</b> <i>Papaipema nebris</i> Guenee	permethrin	*Ambush 25WP	6.4 to 12.8 fl oz	foliage	12	30 (grain or stover), 0 (forage)
	permethrin	*Ambush 2E Insecticide	6.4 to 12.8 fl oz	foliage	12	30 (grain or stover), 0 (forage)
<b>Comments:</b> Apply postemergence sprays when young larvae are moving from weed hosts to corn.	esfenvalerate	*Asana XL	5.8 to 9.6 fl oz	foliage	12	21 (grain)
	cyfluthrin	*Baythroid XL	1.6 to 2.8 fl oz	foliage	12	21 (grain or fodder) 0 (green forage)
	lambda-cyhalothrin	*Besiege	6.0 to 10 fl oz	foliage	24	21 (grain, ears, forage, fodder)
	bifenthrin	*Brigade 2EC	2.1 to 6.4 fl oz	foliage	12	30 (grain, fodder, graze)
	bifenthrin	*Capture LFR	3.4 to 6.8 fl oz	At plant broadcast	12	
	bifenthrin	*Capture LFR	0.2 to 0.39 fl oz/ 1000 ft row	At plant band, in furrow		
	bifenthrin	*Capture LFR	3.4 fl oz	preemerge broadcast		
	chlorpyrifos + lambda-cyhalothrin	*Cobalt Advanced	16 to 38 fl oz	foliage		21 (grain, ears, forage, fodder) 1 (feed or graze forage)
	chlorpyrifos + gamma-cyhalothrin	*Cobalt	38 to 42 fl oz	foliage	24	21 (grain, ears, forage, fodder) 1 (feed or graze forage)
	gamma-cyhalothrin	*Declare 1.25SC	1.02 to 1.54 fl oz	foliage	24	21 (grain) 1 (feed or graze forage)
	deltamethrin	*Delta Gold 1.5EC	1.5 to 1.9 fl oz	foliage	12	21 (grain, fodder) 12 (cut forage or graze)
	alpha-cypermethrin	*Fastac EC	2.7 to 3.8 fl oz	foliage	12	30 (grain, stover) 60 (forage)
	zeta-cypermethrin + bifenthrin	*Hero	2.6 to 6.1 fl oz	foliage	12	30 (grain, stover, graze) 60 (forage)
	chlorpyrifos	*Lorsban Advanced	2 pt	foliage	24	21 (grain, ears, forage, fodder)
chlorpyrifos	*Lorsban 4E	2 pt	foliage	24	21 (grain, ears, forage, fodder)	
zeta-cypermethrin	*Mustang Max	2.72 to 4.0 fl oz	foliage	12	30 (grain, stover) 60 (forage)	
chlorpyrifos	*Nufos 4E	2 pt	foliage	24	21 (grain or ears)	
chlorpyrifos + bifenthrin	*Stallion	9.25 to 11.75 fl oz	foliage	24	30 (grain, stover) 60 (forage)	
cyfluthrin	*Tombstone Helios	1.6 to 2.8 fl oz	foliage	12	21 (grain or fodder), 0 (forage)	
lambda-cyhalothrin	*Warrior II	1.28 to 1.92 fl oz	foliage	24	21 (grain), 1 (graze, forage) 21 (treated feed or fodder)	

**Note:** See Table 1 for listing of (Bt) transgenic traits.

**\*Designates a restricted-use pesticide. Use is restricted to certified applicators only.** Read the label and follow all insecticide rate information, directions, precautions and restrictions.

Insecticides for field corn - *continued*

Insect	Insecticides		Amount of product per acre	Placement	REI (hours)	Preharvest interval (days)
	Common name	Trade name				
<b>Stink bugs</b>  <b>Comments:</b> Apply as postemergence rescue treatment. Stink bug problems in field corn often occur initially in border rows located adjacent to areas supporting woody shrubs and trees. Corn seedlings most at risk of stink bug damage during two weeks following emergence and later in the season during early development of corn ears. No economic thresholds exist for stink bugs found on corn, but thresholds of 2-3% of seedling plants damaged are appropriate. Stink bugs often feed during early morning and can often be found on plant stems near to the soil surface.	cyfluthrin	*Baythroid XL	1.6 to 2.8 fl oz	foliage	12	21 (grain or fodder) 0 (green forage)
	lambda-cyhalothrin	*Besiege	6.0 to 10 fl oz	foliage	24	21 (grain, ears, forage, fodder)
	bifenthrin	*Brigade 2EC	2.1 to 6.4 fl oz	foliage	12	30 (grain, fodder, graze)
	chlorpyrifos + gamma-cyhalothrin	*Cobalt	19 to 38 fl oz	foliage	24	21 (grain, ears, forage, fodder) 1 (feed or graze forage)
	chlorpyrifos + lambda-cyhalothrin	*Cobalt Advanced	16 to 38 fl oz	foliage		21 (grain, ears, forage, fodder) 1 (feed or graze forage)
	gamma-cyhalothrin	*Declare 1.25SC	1.02 to 1.54 fl oz	foliage	24	21 (grain) 1 (feed or graze forage)
	deltamethrin	*Delta Gold 1.5EC	1.5 to 1.9 fl oz	foliage	12	21 (grain, fodder) 12 (cut forage or graze)
	alpha-cypermethrin	*Fastac EC	2.7 to 3.8 fl oz	foliage	12	30 (grain, stover) 60 (forage)
	zeta-cypermethrin + bifenthrin	*Hero	4.0 to 10.3 fl oz	foliage	12	30 (grain, stover, graze) 60 (forage)
	zeta-cypermethrin	*Mustang Max	2.72 to 4.0 fl oz	foliage	12	30 (grain, stover) 60 (forage)
	chlorpyrifos + bifenthrin	*Stallion	9.25 to 11.75 fl oz	foliage	24	30 (grain, stover) 60 (forage)
	cyfluthrin	*Tombstone Helios	1.6 to 2.8 fl oz	foliage	12	21 (grain or fodder), 0 (forage)
	lambda-cyhalothrin	*Warrior II	1.28 to 1.92 fl oz	foliage	24	21 (grain), 1 (graze, forage) 21 (treated feed or fodder)
<b>Twospotted spider mites</b> <i>Tetranychus urticae</i> Koch  <b>Comments:</b> Treatment is justified if high mite numbers are causing yellowing or browning of lower plant leaves before dent growth stage of field corn. Do not apply dimethoate during pollen-shed.	bifenthrin	*Brigade 2EC	5.12 to 6.4 fl oz	foliage	12	30 (grain, fodder, graze)
	propargite	*Comite	32 to 48 fl oz	foliage	13 days	30 (grain, stover, graze)
	dimethoate	Dimethoate 4EC	2/3 to 1 pt	broadcast	48	28 (grain) 14 (forage)
	zeta-cypermethrin + bifenthrin	*Hero	10.3 fl oz	broadcast	12	30 (grain, stover, graze) 60 (forage)

**Note:** See Table 1 for listing of (Bt) transgenic traits.

**\*Designates a restricted-use pesticide. Use is restricted to certified applicators only.** Read the label and follow all insecticide rate information, directions, precautions and restrictions.

**Insecticides for field corn - *continued***

Insect	Insecticides		Amount of product per acre	Placement	REI (hours)	Preharvest interval (days)
	Common name	Trade name				
<b>Webworms</b>  <b>Comments:</b> Many webworm species readily feed on grass and occasionally become pests of field corn. Sod webworm is an occasional pest of seedling field corn. Larvae often feed at the base of seedling plants where they typically damage roots and plant stems. Heavy infestations of this pest may result in ragged plant foliage, twisted plants, and destruction of the plant growing point. Corn fields most at risk include those planted into sod or grass pastures. Other species of webworm occasionally attack the foliage of seedling corn plants where they spin webbing and feed on leaf tissue. Economic thresholds are lacking for most webworm species, but producers often treat when webworm damage is severe and live larvae present. Some seed treatments may help control this pest group, although trial data is lacking. See specific insecticide labels for proper insecticide placement and management of webworms in corn.	cyfluthrin	*Baythroid XL	1.6 to 2.8 fl oz	foliage	12	21 (grain or fodder) 0 (green forage)
	lambda-cyhalothrin	*Besiege	6.0 to 10 fl oz	foliage	24	21 (grain, ears, forage, fodder)
	bifenthrin	*Brigade 2EC	2.1 to 6.4 fl oz	foliage	12	30 (grain, fodder, graze)
	chlorpyrifos + gamma-cyhalothrin	*Cobalt	13 to 26 fl oz	foliage	24	21 (grain, ears, forage, fodder) 1 (feed or graze forage)
	chlorpyrifos + lambda-cyhalothrin	*Cobalt Advanced	11 to 26 fl oz	broadcast on foliage or soil surface, light		21 (grain, ears, forage, fodder) 1 (feed or graze forage)
	gamma-cyhalothrin	*Declare 1.25SC	1.02 to 1.54 fl oz	foliage	24	21 (grain) 1 (feed or graze forage)
	deltamethrin	*Delta Gold 1.5EC	1.5 to 1.9 fl oz	foliage	12	21 (grain, fodder) 12 (cut forage or graze)
	alpha-cypermethrin	*Fastac EC	2.7 to 3.8 fl oz	foliage	12	30 (grain, stover) 60 (forage)
	zeta-cypermethrin + bifenthrin	*Hero	4.0 to 10.3 fl oz	foliage	12	30 (grain, stover, graze) 60 (forage)
	chlorpyrifos	*Lorsban Advanced	1 to 2 pt	foliage	24	21 (grain, ears, forage, fodder)
	chlorpyrifos	*Lorsban 4E	1 to 2 pt	foliage	24	21 (grain, ears, forage, fodder)
	zeta-cypermethrin	*Mustang Max	2.72 to 4.0 fl oz	foliage	12	30 (grain, stover) 60 (forage)
	chlorpyrifos	*Nufos 4E	1 to 2 pt	foliage	24	21 (grain or ears)
	chlorpyrifos + bifenthrin	*Stallion	9.25 to 11.75 fl oz	foliage	24	30 (grain, stover) 60 (forage)
	cyfluthrin	*Tombstone Helios	1.6 to 2.8 fl oz	foliage	12	21 (grain or fodder), 0 (forage)
	lambda-cyhalothrin	*Warrior II	1.28 to 1.92 fl oz	foliage	24	21 (grain), 1 (graze, forage) 21 (treated feed or fodder)
<b>Western bean cutworm</b>  <b>Comments:</b> Scout from first tassel until silks brown. Scout for round, white eggs in groups of a few to 200 located on upper surface of leaves above ear zone. Pale larvae have light-brown stripe running the length of back. Treat when 95% of corn is tasseled and contains 8% or more of plants with eggs or larvae present. Control is difficult once larvae enter corn ears. Optimal control from Success or Tracer is best achieved when the insecticide is applied at peak egg hatch or when larvae are small.	permethrin	*Ambush 2E Insecticide	3.2 to 6.4 fl oz	foliage	12	30 (grain or stover), 0 (forage)
	esfenvalerate	*Asana XL	2.9 to 5.8 fl oz	foliage	12	21 (grain)
	cyfluthrin	*Baythroid XL	1.6 to 2.8 fl oz	foliage	12	21 (grain or fodder) 0 (green forage)
	flubendiamide	*Belt SC	2.0 to 3.0 fl oz	foliage	12	1 (green forage and silage) 28 (grain or stover)
	lambda-cyhalothrin	*Besiege	5.0 to 10 fl oz	foliage	24	21 (grain, ears, forage, fodder)
	bifenthrin	*Brigade 2EC	2.1 to 6.4 fl oz	foliage	12	30 (grain, fodder, graze)
	chlorpyrifos + gamma-cyhalothrin	*Cobalt	13 to 26 fl oz	foliage	24	21 (grain, ears, forage, fodder) 1 (feed or graze forage)
	chlorpyrifos + lambda-cyhalothrin	*Cobalt Advanced	11 to 26 fl oz	foliage		21 (grain, ears, forage, fodder) 1 (feed or graze forage)
	gamma-cyhalothrin	*Declare 1.25SC	0.77 to 1.28 fl oz	foliage	24	21 (grain) 1 (feed or graze forage)
	alpha-cypermethrin	*Fastac EC	1.3 to 2.8 fl oz	foliage	12	30 (grain, stover) 60 (forage)
	zeta-cypermethrin + bifenthrin	*Hero	2.6 to 6.1 fl oz	foliage	12	30 (grain, stover, graze) 60 (forage)
	methoxyfenozide	Intrepid 2F	4.0 to 8.0 fl oz	foliage	4	21 (grain)
	chlorpyrifos	*Lorsban Advanced	1 to 2 pt	foliage	24	21 (grain, ears, forage, fodder)

**Note:** See Table 1 for listing of (Bt) transgenic traits.

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Insecticides for field corn - *continued*

Insect	Insecticides		Amount of product per acre	Placement	REI (hours)	Preharvest interval (days)	
	Common name	Trade name					
<b>Western bean cutworm - continued</b>	chlorpyrifos	*Lorsban 4E	1 to 2 pt	foliage	24	21 (grain, ears, forage, fodder)	
	zeta-cypermethrin	*Mustang Max	1.76 to 4.0 fl oz	foliage	12	30 (grain, stover) 60 (forage)	
	chlorpyrifos	*Nufos 4E	1 to 2 pt	foliage	24	21 (grain or ears)	
	chlorantraniliprole	*Prevathon	14 to 20 fl oz	foliage	4	14 (harvest or graze forage)	
	carbaryl	Sevin 4F	4 pt	foliage	12	48 (grain or fodder) 14 (harvest or graze forage)	
	chlorpyrifos + bifenthrin	*Stallion	5.0 to 11.75 fl oz	foliage	24	30 (grain, stover) 60 (forage)	
	spinosad	Tracer 4SC	2 to 3 fl oz	foliage	1	28 (grain), 3 (fodder or forage)	
	lambda-cyhalothrin	*Warrior II	0.96 to 1.6 fl oz	foliage	24	21 (grain), 1 (graze, forage) 21 (treated feed or fodder)	
<b>White grubs</b>  <b>Comments:</b> Corn planted into pastures, grasslands, weedy fields and river bottom fields bordered by willows, sycamore, cottonwood and other wetland trees may be at greater risk of grub damage. hatch or when larvae are small.	cyfluthrin	*Aztec 4.67 (Smartbox)	3 oz/1000 ft row	Band, furrow incorporation (for smartbox use)	48		
	cyfluthrin	*Baythroid XL	0.14 to 0.16 fl oz/1000 ft row	soil applied, see label	12	21 (grain or fodder) 0 (green forage)	
	bifenthrin	*Brigade 2EC	3 to 4 fl oz	preplant incorporate	12		
	bifenthrin	*Brigade 2EC	0.15 to 0.3 fl oz/1000 ft row	Band, furrow	12		
	bifenthrin	*Capture LFR	3.4 to 6.8 fl oz 0.2 to 0.39 fl oz/1000 ft row 4 to 5.3 fl oz	At-plant broadcast T-band or in-furrow preplant incorporate	12 12 12		
	terbufos	*Counter 20G (Lock'nLoad system) (Smartbox)	4.5 to 6 oz/1000 ft row 4.5 to 6 oz/1000 ft row	band, furrow see specific label	48 48		
	chlorpyrifos + lambda-cyhalothrin	*Cobalt Advanced	2.87 fl oz/1000 ft row	7-inch band or in furrow	24	21 (grain, ears, forage, fodder) 1 (feed or graze forage)	
	chlorpyrifos + gamma-cyhalothrin	*Cobalt	2.87 fl oz/1000 ft row	Band incorporate, see label	24		
	tefluthrin	*Force 3G (Lock'nLoad system) (Smartbox)	4 to 5 oz/1000 ft row 4 to 5 oz/1000 ft row	At-plant in-furrow see specific label	0 0		
	tefluthrin	*Force CS	0.46 to 0.57 oz/1000 sq ft	At-plant in-furrow	12		
	chlorethoxyfos	*Fortress 2.5G	6.0 to 7.5 oz/1000 ft row	At-plant in-furrow	48		
	chlorethoxyfos	*Fortress 5G	3 to 3.75 oz/1000 ft row	Furrow (for smartbox use)	48		
	chlorpyrifos	*Lorsban 15G	8.0 oz/1000 ft row	Band, in-furrow	24		
	chlorpyrifos	*Nufos 15G	8 to 16 oz/1000 ft row	Band, in-furrow	24		
	chlorethoxyfos + bifenthrin	*Smart Choice 5G	3.0 to 3.5 oz/1000 ft row	in- furrow at planting	48		
	spinosad	*Tombstone Helios	0.14 to 0.16 fl oz/1000 ft row	Furrow or fertilizer at-plant	12		
	lambda-cyhalothrin	*Warrior II with Zeon	0.33 fl oz/1000 ft row	At-plant band or in-furrow	24		
	<b>Seed treatments:</b>						
	thiamethoxam	Avicta Complete-Corn	1.250 mg ai/kernel	commercial on seed			

**Note:** See Table 1 for listing of (Bt) transgenic traits.

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**Insecticides for field corn - *continued***

Insect	Insecticides		Amount of product per acre	Placement	REI (hours)	Preharvest interval (days)
	Common name	Trade name				
<b>White grubs - <i>continued</i></b>	thiamethoxam	Cruiser 5FS (250)	0.250 mg ai/kernel	commercial on seed		
	thiamethoxam	Cruiser Extreme 250	0.250 mg ai/kernel	commercial on seed		
	thiamethoxam	Cruiser Extreme 1250	1.250 mg ai/kernel	commercial on seed		
	clothianidin	Poncho 250	0.250 mg ai/kernel	commercial on seed		
	clothianidin	Poncho 500	0.500 mg ai/kernel	commercial on seed		
	clothianidin	Poncho 600 (250)	0.250 mg ai/kernel	commercial on seed		
	clothianidin	Poncho 600 (1250)	1.250 mg ai/kernel	commercial on seed		
	clothianidin	Poncho 1250	1.250 mg ai/kernel	commercial on seed		
	clothianidin	Poncho/Votivo	0.500 mg ai/kernel	commercial on seed		
	clothianidin	Poncho 1250/Votivo	1.250 mg ai/kernel	commercial on seed		
<b>Wireworm</b>	cyfluthrin	*Aztec 4.67	3 oz/1000 ft row	Band, furrow incorporation	48	
	bifenthrin	*Brigade 2EC	3 to 4 fl oz	preplant incorporate	12	30 (grain, fodder, graze)
	bifenthrin	*Brigade 2EC	0.15 to 0.3 fl oz/1000 ft row	Band, furrow	12	
	bifenthrin	*Capture LFR	3.4 to 6.8 fl oz	At plant broadcast	12	
		*Capture LFR	0.2 to 0.39 fl oz/1000 ft row	T-band or in furrow	12	
		*Capture LFR	4 to 5.3 fl oz	pre-plant incorporate	12	
	terbufos	*Counter 20G (Lock'nLoad system) (Smartbox)	4.5 to 6 oz/1000 ft row	band, furrow	48	
			4.5 to 6 oz/1000 ft row	see specific label	48	
	tefluthrin	*Force 3G (Lock'nLoad system) (Smartbox)	4 to 5 oz/1000 ft row	band, furrow	0	
			4 to 5 oz/1000 ft row	see specific label	0	
	tefluthrin	*Force CS	0.46 to 0.57 oz/1000 sq ft	At-plant in-furrow	12	
	chlorethoxyfos	*Fortress 2.5G	6.0 to 7.5 oz/1000 ft row	At-plant in-furrow	48	
	chlorethoxyfos	*Fortress 5G	3 to 3.75 oz/1000 ft row	Furrow (for smartbox use)	48	
	chlorpyrifos	*Lorsban 15G	8.0 oz/1000 ft row	At-plant in-furrow	24	
	chlorpyrifos	*Nufos 15G	8 to 16 oz/1000 ft row	At-plant in-furrow	24	
	spinosad	*Tombstone Helios	0.14 to 0.16 fl oz/1000 ft row	Furrow or fertilizer at-plant	12	
	lambda-cyhalothrin	*Warrior II with Zeon	0.33 fl oz/1000 ft row	At-plant band or in-furrow	24	
<b>Seed treatments:</b>						
thiamethoxam	Avicta Complete-Corn	1.250 mg ai/kernel	commercial on seed			
thiamethoxam	Cruiser 5FS (250)	0.250 mg ai/kernel	commercial on seed			

**Comments:**  
Treatment is justified if field has chronic history of wireworm problems or if the number of wireworm larvae collected from solar bait stations exceed the economic threshold (average of one or more per trap).

**Note:** See Table 1 for listing of (Bt) transgenic traits.  
**\*Designates a restricted-use pesticide. Use is restricted to certified applicators only.** Read the label and follow all insecticide rate information, directions, precautions and restrictions.

Insecticides for field corn - *continued*

Insect	Insecticides		Amount of product per acre	Placement	REI (hours) Preharvest interval (days)
	Common name	Trade name			
<b>Wireworm - <i>continued</i></b>	thiamethoxam	Cruiser Extreme 250	0.250 mg ai/kernel	commercial on seed	
	thiamethoxam	Cruiser Extreme 1250	1.250 mg ai/kernel	commercial on seed	
	clothianidin	Poncho 250	0.250 mg ai/kernel	commercial on seed	
	clothianidin	Poncho 500	0.500 mg ai/kernel	commercial on seed	
	clothianidin	Poncho 600 (250)	0.250 mg ai/kernel	commercial on seed	
	clothianidin	Poncho 600 (1250)	1.250 mg ai/kernel	commercial on seed	
	clothianidin	Poncho 1250	1.250 mg ai/kernel	commercial on seed	
	clothianidin	Poncho/Votivo	0.500 mg ai/kernel	commercial on seed	
	clothianidin	Poncho 1250/Votivo	1.250 mg ai/kernel	commercial on seed	

**Note:** See Table 1 for listing of (Bt) transgenic traits.

**\*Designates a restricted-use pesticide. Use is restricted to certified applicators only.** Read the label and follow all insecticide rate information, directions, precautions and restrictions.

***Insect management for cotton***

From emergence until harvest, various pests attack the roots, leaves, stems or fruit (squares, blooms and bolls) of cotton. Growers and their field scouts must be vigilant in locating these pest outbreaks so that timely control measures can be undertaken. Economic threshold levels have been established for many cotton pests. A threshold infestation is the point at which control measures are needed to prevent the target pest from reaching its economic injury level (when control costs equal damage caused by the pest). The goal should be to suppress pest populations, not annihilate them. Missing the opportunity to control threshold infestations and targeting the pests' earlier growth stages can lead to a greater number of pesticide applications. This increases production costs and yield losses, secondary pest outbreaks,

and pest resistance to future chemical control measures. Growers are encouraged to use all practical integrated pest management (IPM) practices to maximize crop production while minimizing economic and environmental costs. The philosophy of IPM is to incorporate different control practices and avoid relying on just one control method.

Missouri cotton growers generally have less pest pressure than growers in more southern states. Because of the unpredictable occurrence of various pest species, the type and severity of economic outbreaks will vary from year to year. The following table lists potential cotton pests, possible time frames for infestations, and cotton growth stages susceptible to damage.

**Insecticides for cotton**

Insect	Insecticides		Formulation per acre	Application rate (lb a.i. per acre)	Comments
	Common name	(Trade name)			
Cutworms	acephate	(Orthene 90S)	1.0 lb	0.9	Sprays most effective when applied toward base and lower portion of plant.
		(Orthene 97G)	0.93 lb	0.9	
	beta-cyfluthrin	(Baythroid XL 1EC)	0.8-1.6 oz	0.007-0.013	
	bifenthrin	(Brigade 2 EC)	2.4-6.4 oz	0.04-0.1	High-risk fields (i.e. no-till fields, fields with cover crops and/or heavy spring weed pressure, or history of cutworms) should consider a preventative pyrethroid applications for cutworm using a 1/3 band applicator behind the planter.
	cyfluthrin	(Tombstone 2 EC)	0.8-1.6 oz	0.013-0.025	
	cypermethrin	(Ammo 2.5E)	1.3-5.0 oz	0.025-0.1	
	esfenvalerate	(Asana XL 0.66E)	3.2-9.6 oz	0.016-0.05	
	gamma-cyhalothrin	(Prolex 1.25CS)	1.02-1.54 oz	0.01-0.015	
	lambda-cyhalothrin	(Karate 2.08CS)	1.28-1.92oz	0.02-0.03	
	thiodicarb	(Larvin 3.2F)	24 oz	0.6	
	zeta-cypermethrin	(Mustang Max)	1.28-1.92 oz	0.008-0.012	

**Comments:** The primary species that attack cotton are: black, granulated and variegated cutworms. Because cutworms can inhabit and establish in existing vegetation, it is recommended to destroy any winter cover vegetation 3 to 4 weeks prior to planting. Elimination of this cover vegetation increases the larva's risk of starvation and predation. If cutworms are already established and vegetation cannot be destroyed 3 to 4 weeks prior to planting, the use of pyrethroids as a ground treatment applied at planting are highly effective and do not contribute to increased resistance in tobacco budworms. By the way, Bt cotton will not control cutworms. Cutworm larvae actively feed at night and hide during the day in underground burrows or beneath dirt clods or leaf trash. To scout for cutworm infestations, look for wilted plants or ones cut at the ground level and dig beneath dirt clods to locate the larvae. This process should be repeated at 10 locations within a field.

**Threshold:** Treat if cutworm infestations threaten to reduce stand below 35,000 plants/acre (3 plants/row foot) in a field or part of a field. Area considered is smallest area a producer will treat. Repeat treatment if needed.

Thrips	In furrow		Formulation per acre	Application rate	Comments
	Common name	(Trade name)			
	acephate	(Orthene 90IFS)	0.83-1.1 lb	0.75-1.0	Orthene-treated seed may require one or more foliar treatments for thrips control
		(Orthene 97IFS)	0.77-1.03 lb		
		(Orthene 90S IFS)	0.83-1.1 lb		
		Orthene-treated seed	Commercially available		
	aldicarb	(Temik 15 G)	3.5 lb	0.5	
	imidacloprid		12.8 oz per 100 lb seed		
	Gaicho 600		2.144-2.88 oz	Seed	
	imidacloprid_thiodicarb	(Aeris)	0.75 mg ai/seed	Seed	
	thiamethoxam	(Cruiser 5F)	7.65 oz/100 lb seed	Seed	
	Avicta Complete Cotton		see label	Seed	

Pesticides listed in this table were only registered for prescribed uses when printed. Should registration of a recommended pesticide be canceled, the University of Missouri will no longer recommend it. Use of trade or brand names in this publication is for clarity and information purposes. It does not imply approval of the product to the exclusion of others with similar composition, nor does it guarantee the standard of the product.

Insecticides for cotton - *continued*

Insect	Insecticides		Formulation per acre	Application rate (lb a.i. per acre)	Comments
	Common name	(Trade name)			
Western flower thrips	Foliar sprays				
	acephate	(Acephate 90S)	0.22 lb	0.2	Do not apply more than 3.2 oz of Bidrin pre-bloom
		(Orthene 97)	0.21 lb		
	dicrotophos	(Bidrin 8 EC)	3.2 oz	0.2	
	dimethoate	(Dimethoate 4 EC)	6.4 oz	0.2	
	acephate	(Acephate 90 S)	0.56 lb	0.5	
		(Orthene 97)	0.52 lb		
	aldicarb	(Temik 15 G)	3.5 lb	0.5	
	spinetoram	(Radiant 1 SC)	1.5 - 3.0 oz	0.0117-0.0234	

**Comments:** Treatment should be made when at least 100 thrips are found per bloom plus some damage. Populations may resurge to treatment levels 10d after treatment. Treat with foliar sprays when 1st or 2nd leaf emerges with noticeable damage from thrips. On larger seedlings, treat for an average of 5 thrips per plant and damage that may cause delayed growth or stunting of plants. Use Radiant for early-season suppression. DO NOT use without an adjuvant.

**To minimize control failures associated with plant bug resistance, rotate insecticide chemistries after two applications.**

Several different species of thrips (flower, soybean, tobacco and western flower) may attack cotton.

Thrips injury usually ceases once plants reach the third or fourth leaf stage. A preventive, in-furrow insecticide application or seed treatment are the preferred methods of control. But preventive control measures are not always effective when cool, wet weather slows the seedling's uptake of insecticide treatments or during years of above average infestations. In these situations a foliar insecticide application also may be required.

Threshold: Treat with foliar sprays when 1st or 2nd true leaf emerges with noticeable damage from thrips. On larger seedlings, treat for an average of 5 thrips per plant and damage that may cause delayed growth or stunting of plants.

Cotton aphid	acetamiprid	(Intruder 70WP)	0.8-1.1 oz	0.035-0.05
	flonicamid	(Carbine 50 WG)	1.41-2.02 oz	0.044-0.063
	sulfoxaflor	(Transform 50 MG)	0.75-1.0 oz	0.023-0.031

**Comments:** When choosing chemical control, keep in mind that your least used aphicide may offer you better control. Cotton aphids have a history of insecticide resistance in Missouri and throughout the Cotton Belt. Since these insects reproduce so quickly, they are more likely to become physically tolerant of, or resistant to, an insecticide. Because these insects reproduce so quickly, they are more likely to become physically tolerant of, or resistant to, an insecticide so be sure to rotate modes of action to keep incidence of resistance to a minimum. Control may be improved by making a second application 4 to 7 days after the initial treatment.

**Thresholds:** Consider treatment when spots of high aphid populations are causing heavy localized honeydew accumulation, aphid numbers are increasing over the remainder of the field, and no signs of diseased aphids are present. Under heavy infestations, use highest labeled rates.

When treating aphids, try to get good coverage, particularly to undersides of leaves. Insecticides should be applied at maximum volume (five gallons by air and as many gallons as possible with ground rigs) with hollow-cone nozzles. The high water volume is necessary for thorough coverage of lower leaf surfaces where aphids feed.

Adapted from: Catchot, A. 2014. 2014 Insect Control Guide for Agronomic Crops. Mississippi State University. Pub #2471.

Tarnished plant bugs	acephate	(Orthene 90S)	0.56-0.83 lb	0.5-0.75	Treat for plant bugs as squaring begins:
		(Orthene 97G)	0.31-0.77 lb		
	dicrotophos	(Bidrin 8E)	4.8-8.0 oz	0.3-0.5	Square set is 75% or less & TPB are present
	dimethoate	(4E)	8 oz	0.25	Avoid using Ops prior to bloom
	flonicamid	(Carbine 50WG)	1.7-2.85 oz	0.053-0.089	Rotate your Modes of Action
	imidacloprid	(Admire Pro)	1.7 oz; 2.0 oz	0.062; 0.062	Tank mix different classes of insecticides for broad spectrum control
	imidacloprid 4 F				
	oxamyl	(Vydate C-LV 3.77)	10.5-17 oz	0.31-0.5	Terminate sprays for plant bugs after NAWF = 5 + 250 heat units
	thiamethoxam	(Centric 40WG)	1.75-2.5 oz	0.044-0.0625	
	imidacloprid	Alias/Couraze 4F	2.0 oz	0.062	
	imidacloprid	Couraze 2F	4.0 oz	0.0625	
		Couraze 1.6F	5.0 oz		
	sulfoxaflor	(Transform 50WG)	1.5-2.25 oz	0.047-0.071	
	thiamethoxam	(Centric 40 WG)	1.75-2.25 oz	0.044-0.0625	

**Comments:** Some broad spectrum insecticides (i.e. pyrethroids) provide control of plant bug when at low or moderate populations, but insecticides with greater specificity towards plant bugs may be necessary when populations are high. Furthermore, resistance to pyrethroids and organophosphates has been documented in field populations, so use of alternative chemicals (see below) may be necessary. Because one spray per season is not likely to control plant bug populations, be sure to rotate modes of actions of chemicals when spraying.

**Thresholds:** Emergence to first square: Treat if you find one plant-bug-flagged plant and one or more plant bugs per 10 row feet. Multiple applications applied at 4- to 5-day intervals may be required in such cases.

Treat for 3 plant bugs per 5 row feet on normal fruiting fields. If small square set is less than 75%, treat for 1 plant bug per 3 row feet.

To minimize control failures associated with plant bug resistance, rotate insecticide chemistries after two applications.

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**Insecticides for cotton - *continued***

Insect	Insecticides		Formulation per acre	Application rate (lb a.i. per acre)	Comments
	Common name	(Trade name)			
<b>Cotton bollworm</b>	Carbamates:				
	methomyl	(Lannate 90 SP) (Lannate 2.4 LV)	0.5-0.75 lb 1.5-2.14 pt	0.45-0.675	Lannate may redden cotton. Alternate with other insecticides. Use as an occasional spray but not more than every 10 days
	thiodicarb	(Larvin 3.2F)	1.75-2.14 pt	0.7-0.9	
	Pyrethroids:				
	beta-cyfluthrin	(Baythroid XL 1 EC)	1.6 - 2.6 oz	0.012-0.013	
	bifenthrin	(Brigade 2 EC)	2.56-6.4 oz	0.04-0.1	
	cyfluthrin	(Tombstone 2 EC)	1.6-2.6 oz	0.025-0.041	
	cypermethrin	(Ammo 2.5E)	2.0-5.0 oz	0.04-0.1	
	esfenvalerate	(Asana XL 0.66E)	5.8 - 9.6 oz	0.03-0.05	
	flubendiamide	(Belt 4 SC)	2.0-3.0 oz	0.062-0.094	DO NOT apply Belt more than three times per season
	gamma-cyhalothrin	(Prolex 1.25CS)	1.28-2.05 oz	0.125-0.02	
	lambda-cyhalothrin	(Karate Z 2.08 CS)	1.6-2.56 oz	0.025-0.04	Terminate sprays for bollworm control after NAWF = 5 + 350 heat unites or 350 heat units past the last effective boll date for your area
	zeta-cypermethrin 0.8 EC	(Mustang Max 0.8E)	2.65-4.0 oz	0.0165-0.025	DO NOT use an adjuvant with Prevathon
	Other classes:				
	spinosad	(Tracer 4SC)	2.144-2.88 oz	0.067-0.09	
	chlorantraniliprole	(Prevathon 0.43 SC)	14.0-27.0 oz	0.045-0.088	
emamectin benzoate	(Denim 0.16 EC)	8.0-12.0 oz	0.01-0.015		
indoxacarb	(Steward 1.25 SC)	9.2-11.3 oz	0.09-0.11		
<b>Comments:</b> Treat for 7,000 (1 per 2 row feet) small larvae (<0.25inch) per acre (non-Bt cotton). If larger larvae(>0.25inch) begin develop in fields, treat 14,000 damaged squares (1 per row foot) plus eggs and small larvae, time insecticide applications to egg hatch.					
<b>Tobacco budworm</b>	Carbamates:				
	methomyl	(Lannate 90 SP)	0.5-0.75 lb	0.45-0.675	Lannate may redden cotton. Alternate with other insecticides. Use as an occasional spray but not more than every 10 days
	methomyl	(Lannate 2.4 LV)	1.5-2.14 pt		
	thiodicarb	(Larvin 3.2F)	1.75-2.14 pt	0.7-0.9	
	Other classes:				
	emamectin benzoate	(Denim 0.16E)	8.0-12.0 oz	0.01-0.015	
	indoxacarb	(Steward 1.25SC)	11.3 oz	0.11	
	spinosad	(Tracer 4SC)	2.144-2.88 oz	0.067-0.09	
	chlorantraniliprole	(Prevathon 0.43 SC)	14.0-27.0 oz	0.045-0.088	DO NOT use an adjuvant with Prevathon
	flubendiamide	(Belt 4 SC)	2.0-3.0 oz	0.062-0.094	DO NOT apply Belt more than 3X per season
<i>Bacillus thuringiensis</i>					

**Comments:** For tobacco budworm, time insecticide application to egg hatch. Under heavy pressure, do not reduce rates. Treat for 7,000 (1 per 2 row feet) small larvae (less than ¼ inch) per acre. If larger larvae begin to develop in fields, treat for 3,500 (1 per 4 row feet) larvae.

When damage to squares occurs, treat 14,000 damaged squares (1 per row foot) plus eggs and small larvae.

Often multiple species of worms are present in a cotton field, and identification of the primary species will lead to choice and use of the most effective chemical. Obtain information from counts of moth flushing and pheromone traps to help with your decision making.

**Bt Cotton:** Bt-transgenic cotton primarily targets control of tobacco budworms and bollworms and should initially provide good to excellent control of these pests. However, high populations of bollworms may require an additional foliar spray. Scout for larvae in blooms, bolls, and terminal area.

**Dual Toxin Bt Cotton:** Varieties of Bt cotton that express two Bt toxins are more effective against bollworms than are single toxin Bt cottons. They may still require supplemental treatments because of unusually high insect populations or compromised toxin expression.

CAUTION: Transgenic Bt cotton is available in several varieties. Efficacy of Bt cotton may vary, depending on seed source and variety.

**Thresholds:**

**Non-Bt cotton:** Before bloom: Treat when population reaches or exceeds 8 larvae/100 plants.

After bloom: Treat when counts reach or exceed 4 larvae/100 plants.

After cutout: Treat when counts reach or exceed 8 larvae/100 plants. Apply treatments before larvae are a half-inch long.

**Bt cotton:** Before bloom: Treat when damaged fruit counts exceed 5 percent or the number of larvae about one-eighth inch long exceeds 8 larvae/100 plants.

After bloom: Treat when larvae one-eighth inch long or longer exceed 4 larvae/100 plants (or 8 larvae/100 plants after “cutout”).

Regardless of size of larvae, treatment may be warranted if damaged-boll counts exceed 2 percent and significant numbers of larvae are present and continuing to cause damage.

Terminate sprays for tobacco budworm control after NAWF = 5+ 350 heat units or 350 heat units past the last effective boll date for your area

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Insecticides for cotton - *continued*

Insect	Insecticides		Formulation per acre	Application rate (lb a.i. per acre)	Comments
	Common name	(Trade name)			
Spider mites	abamectin	(Agri-mek 0.15 EC)	4.0-16.0 oz	0.0046-0.00188	Use lower rates of Agri-mek when cotton is small. DO NOT use greater than 32 oz OR more than two applications per ac of Agri-mek in any growing season.
	dicofol	(Dicofol 4E)	1.5 - 3 pt	0.75-1.5	
	fenpyroximate	(Portal 0.4EC)	0.75 - 2.0 pt	0.0375-0.1	DO NOT apply more than 2 pints per season.
	bifenthrin	(Brigade 2EC)	3.8-6.4 oz	0.06-0.1	Overuse flares spider mite populations.
	etoxazole	(Zeal)	0.66 - 1.0 oz	0.03-0.045	
	propargite	(Comite 6.55)	1.5 - 2.0 pt	1.23-1.65	DO NOT apply Comite until cotton is 12in tall. When mite populations are high, two applications at a 5- to 7-day interval are required using 25-40 gal. water by ground and 5 - 15 gal. by air
	spiromesifan	(Oberon 2 SC)	8.0-16.0 pt	0.125-0.25	

**Comments:** Similar to aphids, spider mite populations often increase during hot, dry conditions and frequently establish themselves around field borders and ditch banks. Removal of winter annuals and other secondary hosts well in advance of planting may reduce risk of spider mite infestation.

**Thresholds:** Miticide treatments are essential when 40 to 50 percent or more of plants are infested and populations are increasing.

Spot treating hot spots within a field with miticides can help reduce the risk of more widespread infestations.

A second application within the next seven days is usually necessary because spider mite eggs are not killed by miticides. To obtain maximum control of spider mites, a miticide must be thoroughly applied to both sides of a leaf. Because spider mites are easily distributed from infested areas to non-infested ones by natural (animals, people, wind) or mechanical means, growers should maintain a vegetation-free zone of 10 to 20 feet in width between the cotton and border vegetation to minimize spider mite infestations. Preserving beneficial insects (e.g., big-eyed bug, minute pirate bug) can help minimize spider mite infestations.

Armyworms	chlorantraniliprole	(Prevathon 0.43 SC)	14.0 - 27.0 oz	0.045-0.09
	emamectin benzoate	(Denim 0.16E)	8.0-12.0 oz	0.01-0.015
	flubendiamide	(Belt 4 SC)	2.0-3.0 oz	0.063-0.094
	indoxacarb	(Steward 1.25SC)	9.2-11.3 oz	0.09-0.11
	methomyl	(Lannate 2.4L)	1.5-2.25 pt	0.45-0.675
	methomyl	(Lannate 90SP)	0.50-0.75 lb	
	methoxyfenozide	(Intrepid 2F)	4.0-10.0 oz	0.06-0.16
	novaluron	(Diamond/Mayhem 0.83 EC)	6.0-12.0 oz	0.039-0.078
	profenofos	(Curacron 8E)	0.75-1.0 pt	0.75-1.0
	spinosad	(Tracer 4SC)	2.144-2.88 oz	0.067-0.09
	thiodicarb	(Larvin 3.2F)	1.5-2.25 pt	0.6-0.9

**Comments:** Yellowstriped armyworms are seedling pests; whereas beet (foliage) and fall (boll) armyworms are more late-season pests.

**Control decisions**

Treat for 10-20 fall armyworms per 100 plants.

**Dual Toxin Bt Cotton:** While varieties of Bt cotton that express two toxins rather than one are considered to be more effective in fall armyworm control, additional treatment sprays may still be necessary if high populations are present or resistant/tolerant individuals exist.

**Threshold:** Insecticide treatments are recommended when four or more larvae per 100 bolls or blooms are present. Time applications against young larvae and maximize coverage deep within the plant canopy by increasing spray volume and pressure.

DO NOT apply Belt more than 3 times per season. Lannate may redden cotton. If excessive, alternate with other insecticides. With profenofos - cont. agitation during mixing, filling, and application is required. Pyrethroids at max labeled rates will provide control if timed to egg lay and small larvae

Beet armyworm	chlorantraniliprolfe	(Prevathon 0.43 SC)	14.0 - 27.0 oz	0.045-0.09
	emamectin benzoate	(Denim 0.16E)	6.0-8.0 oz	0.0075-0.01
	flubendiamide	(Belt 4 SC)	2.0 - 3.0 oz	0.063-0.094
	indoxacarb	(Steward 1.25SC)	9.2-11.3 oz	0.09-0.11
	methoxyfenozide	(Intrepid 2F)	4.0-10.0 oz	0.06-0.16
	spinosad	(Tracer 4SC)	2.144 - 2.88 oz	0.067-0.09

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**Insecticides for cotton - *continued***

Insect	Insecticides		Formulation per acre	Application rate (lb a.i. per acre)	Comments
	Common name	(Trade name)			

**Comments:** Production of an early crop and preservation of beneficial insects are the most important factors in reducing risks of beet armyworm (BAW) outbreaks. Certain organophosphate and pyrethroid insecticides are particularly damaging to the beneficial insects that help control BAW. Prior to bloom, use short residual organophosphates and other nonpyrethroid materials only when necessary to control other pests. Reserve use of pyrethroids until midseason in order to help minimize reliance on organophosphates at this time. Established populations of BAW can be difficult and expensive to control. Late-season foliage-feeders cause less damage than do midseason fruit-feeders. Cotton nearing maturity can tolerate relatively higher populations without losing yield. When treating BAW, multiple, close-interval applications (3 to 5 days) may be needed against high populations. Apply treatments against hatching to one-fourth inch long larvae. Maximize coverage to undersides of leaves. Increasing spray volume and pressure may improve control when treating by ground.

**Bt Cotton:** Bollgard cotton provides only limited suppression of beet armyworms.

**Threshold:** During early to midseason, if beneficial insect numbers are low and risk factors favorable to development of BAW outbreaks are present, initiate treatment at two to five "hits" (egg masses and/or clusters of small larvae) per 100 feet of row before Aug. 15, and this threshold doubles after Aug. 15. The best control is achieved when applications are timed to coincide with egg hatch or small larvae. Mixtures may increase activity. Adding 1 qt of crop oil may aid in control. Beet armyworm infestations are difficult to control, and the listed insecticides may only give suppression.

DO NOT use an adjuvant with Prevathon. DO NOT apply Belt more than three times per season. DO NOT apply more than 6 oz of Tracer per year.

Whiteflies	acephate	(Orthene 90S)	0.56-1.1 lb	0.5 - 1.0	
	acephate	(Orthene 97)	0.52-1.1 lb		
	acetamiprid	(Intruder 70WP)	1.7- 2.3 oz	0.75- 0.1	
	bifenthrin	(Brigade 2 EC)	3.8- 6.4 oz	0.06-0.1	
	thiamethoxam	(Centric 40WG)	2 oz	0.05	DO NOT apply Centric within 45 days of neonicotinoid seed treatment (Cruiser, Gaucho, Aeri, Avicta); DO NOT exceed a total of 5 oz of Centric/ac during growing season. At least 5 days between applications.

**Comments:** Whiteflies can be difficult to control and can rebound quickly following treatment. Two to three applications may be necessary to control heavy infestations.

**Threshold:** Insecticide treatments are recommended when 50 percent or more of the plant terminals are infested. Early-season spot treatments may be beneficial in preventing spread of mites across the field. Coverage of the entire plant canopy is necessary for adequate whitefly control.

European corn borer	Bollgard II	(seed, various)			CryIA(c) and Cry2A(b) genes in Bollgard II produce two <i>Bacillus thuringiensis</i> (Bt) delta endotoxins. High activity against all pest caterpillar species on cotton except cutworms. No activity against insects other than caterpillars.
	WideStrike	(seed, various)			CryIA(c) and CryIF genes in WideStrike produce two <i>Bacillus thuringiensis</i> (Bt) delta endotoxins. Good to high activity against budworms and European corn borers; high activity against all pest caterpillar species on cotton except cutworms. No activity against insects other than caterpillars.
	bifenthrin	(Brigade, Fanfare, Declare, Discipline, Sniper and others) 2 EC	3.2 oz	0.05	
	cyfluthrin	(Baythroid) 2 EC	1.8 to 2.1 oz	0.028 to 0.033	
	cypermethrin	(Ammo) 2.5 EC	3.1 to 4.1 oz	0.06 to 0.08	
	lambda-cyhalothrin	(Karate Z) 2.08 CS	1.6 oz	0.025	
		(Karate, Silencer) 1 EC	3.2 to 5.12 oz	0.025 to 0.04	
	zetamethrin	(Mustang Max) 0.8 EC	2.9 to 3.55 oz	0.018 to 0.025 oz	

**Comments:** Currently, Missouri has no established threshold for this pest on cotton. In North Carolina, a recommended threshold is 3 – 5 percent or more of the boll sample are infested with young live larvae or if 10% of the bolls are damaged.

European corn borers are generally more of a problem in rank, non-Bt cotton. Other bollworm materials may provide some control.

Recommended chemicals for European corn borers, rates, and miscellaneous management notes. Table 5.5A of the 2013 North Carolina Agricultural Chemicals Manual, published by the North Carolina Cooperative Extension Service, College of Agriculture and Life Sciences, N.C. State University, Raleigh, N.C.

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Insecticides for cotton - *continued*

Insect	Insecticides		Formulation per acre	Application rate (lb a.i. per acre)	Comments
	Common name	(Trade name)			
Cabbage loopers	chlorantraniliprole	(Prevathon 0.43 SC)	20-29 oz	0.067-0.097	DO NOT use an adjuvant with Prevathon
	emamectin benzoate	(Denim 0.16 EC)	8-12 oz	0.01-0.015	
Soybean loopers	flubendiamide	(Belt 4 SC)	2-3 oz	0.062-0.094	DO NOT apply Belt more than three times per season
	indoxacarb	(Steward 1.25 SC)	6.2-9.2 fl oz	0.065-0.09	
	methoxyfenozide	(Intrepid 2 F)	4-8 oz	0.065-0.09	
	spinosad	(Tracer 4 SC)	2.14-2.9 oz	0.067-0.085	
	thiodicarb	(Larvin 3.2F)	1.5-2.25	0.6-0.9	

**Comment:** DualToxin Bt Cotton: While varieties of Bt cotton that express two toxins rather than one are considered to be more effective in fall armyworm control, additional treatment sprays may still be necessary if high populations are present or resistant/tolerant individuals exist.

To scout for looper infestations, examine five plants at each of 10 locations per field for defoliation damage. Premature defoliation by loopers is rare because diseases and natural enemies usually suppress looper infestations.

**Threshold:** Treat only when populations threaten premature defoliation; i.e.; when defoliation damage reaches 25 percent and developing bolls are still present. Economic damage seldom occurs.

Green stink bug	acephate	(Acephate 90)	0.83 lb	0.75	Terminate sprays for stink bugs after NAWF = 5 + 450 heat units.
		(Orthene 97)	0.77 lb	0.75	
Southern stink bugs	beta-cyfluthrin	(Baythroid 2 EC)	1.6-2.6 oz	0.013-0.021	DO NOT graze after applying Baythroid, Karate, Respect, Mustang Max, Asana XL or Adjourn
	bifenthrin	(Brigade 2 EC)	3.8-6.4 oz	0.06-0.1	
	cyfluthrin	(Tombstone 2 EC)	1.6-2.6 oz	0.025-0.041	
	dicrotophos	(Bidrin 8 EC)	4.8-8.0 oz	0.3-0.05	DO NOT apply more than 16 oz Bidrin per season during bloom. DO NOT make applications of Bidrin closer than 14 days apart.
	esfenvalerate	(Asana XL 0.66 EC)	5.8-9.6 oz	0.03-0.05	
	lambda-cyhalothrin	(Karate Z 2.08 CS)	1.6-2.56 oz	0.025-0.04	
	oxamyl	(Vydate 3.77 CLV)	13.6 oz	0.4	
	zeta-cypermethrin 0.8EC	(Mustang Max/Respect)	2.64-3.6 oz	0.016-0.022	

**Comments:** Treat when stink bugs exceed one bug per 6 row feet or when 20% of medium bolls display internal signs of feeding and stink bugs are observed. Check at least 25-50 bolls per 40 acres. Many pyrethroids, at bollworm rates, will provide good control of "green" species, but "brown" species are less susceptible to insecticides, specifically pyrethroids.

Brown stink bug	acephate	(Orthene 90 S)	0.83 lb	0.75	Terminate sprays for stink bugs after NAWF = 5 + 450 heat units
		(Orthene 97)	0.77 lb		
	bifenthrin	(Brigade 2 EC)	3.8-6.4 oz	0.06-0.1	
	dicrotophos	(Bidrin 8 EC)	8 oz	0.5	

**Comments:** Treat when stink bugs exceed one bug per 60 row feet or when 20% of medium bolls display internal signs of feeding and stink bugs are observed. Check at least 25-50 bolls per 40 acres.

Before treatment for brown stink bug, recall spined soldier bugs are beneficial stink bugs that look similar and may occur in high numbers in fields with caterpillar pests.

**Bt Cotton:** Stink bugs and plant bugs are more likely to occur in Bt cotton because of the reduction in mid- to late- season treatments targeting budworms/bollworms. Intensify scouting for these pests in Bt cotton.

**Thresholds:** *Visual:* Average of five or more adults and/or large nymphs (one-fourth inch or greater) per 100 plants.

*Drop cloth:* Average of one adult or large nymph per 6 feet of row (one-fourth inch or greater).

*Damaged bolls:* Treat when 15 to 20 percent or more bolls show internal signs of stink bug feeding and stink bugs are present.

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**Insecticides for cotton - *continued***

Insect	Insecticides		Formulation per acre	Application rate (lb a.i. per acre)	Comments
	Common name	(Trade name)			
Multiple pests	bifenthrin + avermectin	(Athena 0.87 E)	10-17 oz	0.068	DO NOT graze.
	chloryrifos + lambda-cyhalothrin	(Cobalt Advanced 2.63)	16-38 oz	0.33-0.76	For control of multiple pests exceeding thresholds, including but not limited to the following: bollworms, aphids, plant bugs and stink bugs.
	dicrotophos/bifenthrin	(Bidrin XP II)	8-12.8 oz	0.31-0.5	
	imidacloprid/beta-cyfluthrin	(Leverage 360 SC)	2.8-3.2 oz	0.067-0.075	
	imidacloprid/bifenthrin	(Brigadier 2 SC)	3.8-7.7 oz	0.06-0.12	
		(Swagger 1 SC)	7.6-15.4 oz	0.06-0.12	
	gamma-cyhalothrin + spinosad	(Consero 5.25 SC)	7.6-15.4 oz	0.06-0.12	
	lambda-cyhalothrin + chlorantraniliprole	(Besiege 1.25)	6.5-12.5 oz	0.417-0.835	
	lambda-cyhalothrin + thiamethoxam	(Endigo 2.06 ZC)	4.5-5.5 oz	0.072-0.09	
	methoxyfenozide + spinetoram	(Intrepid Edge 3 F)	4-8 oz	0.094-0.188	DO NOT apply closer than 4-day intervals and no more than six applications per year
	zeta-cypermethrin + bifenthrin + imidacloprid	(Triple Crown 2.25)	4.5-6.4 oz	0.076-0.112	DO NOT graze.

**Secondary pests of cotton**

Cotton is host to many other plant-feeding insects and invertebrates (e.g., flea beetles, leafrollers, saltmarsh caterpillar, slugs, yellowstriped armyworm) that are rarely considered a pest of cotton. However, they have the potential to become pests under special circumstances. Flea beetles are small, shiny, dark-colored insects that have a third pair of legs enlarged for jumping. The variegated leafroller is one of several species of leafroller that may infest cotton fields. The variegated leafroller has an apple-green coloration on top and is amber green on the bottom. The saltmarsh caterpillar larva is covered in long hairs (red or black) and its body is initially gray after hatching; then it turns yellow to black as it matures. Slugs are soft-bodied, legless invertebrates without shells and leave a slime trail as they move about in the field. Yellow-striped armyworm larvae have two rows of black, triangular spots along the back between thin yellow lines.

**Misc pest control decisions**

No threshold exists for flea beetles because economic infestations of this insect are rare; however, insecticide oversprays for cutworms in no-till fields also should control any flea beetles feeding in those same fields. Leafroller infestations only occur in non-Bt fields, and insecticide oversprays are not recommended unless early-season terminal damage reaches 20 percent in presquaring cotton. The saltmarsh caterpillar is another pest primarily found in no-till fields. No threshold exists for saltmarsh caterpillars, and late-season foliar damage should be pooled with similar damage caused by loopers. Beneficial insects typically control these late-season saltmarsh caterpillar infestations. There is no threshold for yellow-striped armyworms in cotton because economic infestations are rare; however, insecticide oversprays for other early-season (e.g., cutworms) and late-season (e.g., bollworm) pest infestations also should control yellow-striped armyworm infestations.

**Terminating insecticide applications**

In a normal, healthy crop, "cutout" is the point when Node Above White Flower averages 5 (NAWF = 5). In other words, cutout is the point when terminal growth slows to the point that the first position white flower is at the fifth node below the first "unfurled" leaf in the terminal. An unfurled leaf is about the size of a quarter. Sample at least ten plants per site from four representative sites per field to determine average NAWF. Begin monitoring NAWF at weekly intervals shortly after first bloom. Shift to twice weekly monitoring as NAWF counts begin to decline toward five. Begin monitoring daily heat unit (DD60s) accumulation on the day the crop reaches NAWF = 5.

Recent research has shown that growth and development in a normal, healthy crop are such that the last population of bolls that will effectively contribute to yield will be represented by those white blooms that are present at cutout (when the crop reaches NAWF = 5). Research has also shown that when these bolls accumulate 350 to 400 heat units (HU), or DD60s, they have a low probability of sustaining economic damage **from tarnished plant bugs (nymphs or adults) or from budworm/bollworm larvae that emerge after this point**. Therefore, control of tarnished plant bugs and budworms/bollworms can generally be terminated at **NAWF = 5 + 350-400 HU (DD60s)**.

Note, however, that threshold populations of larvae hatching before this point in the development of the crop should be controlled. Also note that this guideline for terminating insecticide treatments applies primarily to bollworms and tobacco budworms and tarnished plant bugs.

Control of **stinkbugs** can be terminated at **NAWF = 5 + 450 HU**.

Control of **fall armyworms** can be terminated at **NAWF = 5 + 500-550 HU**.

Leaves help bolls mature, so protect the crop from excessive defoliation from pests such as loopers beyond the point of **NAWF = 5 + 350 - 400 HUs**.

**NOTE:** This technique for deciding when to end cotton insect control has not been tested under all weather and crop conditions, especially where early stress or insect damage results in poor square set or any other condition that causes late maturity. Growers and consultants must monitor crop maturity and insect populations carefully on a **field by field basis** and use all available informed status to decide when to end insecticide treatments.

Pesticides listed in this table were only registered for prescribed uses when printed. Should registration of a recommended pesticide be canceled, the University of Missouri will no longer recommend it. Use of trade or brand names in this publication is for clarity and information purposes. It does not imply approval of the product to the exclusion of others with similar composition, nor does it guarantee the standard of the product.

## Insect management for grain sorghum (milo)

Several insect pests of field corn, along with the green-bug, sorghum midge and sorghum webworm, may cause severe damage to grain sorghum. Management of these insect pests is best achieved through the use of an integrated pest management (IPM) program. In such a program, all available management strategies are reviewed, and appropriate ones are selected and implemented depending on

the specific target insect. Control strategies may consist of cultural, mechanical, biological or chemical options. An individual control strategy or a combination of several control strategies may be used to achieve effective pest control. Proper identification of pest species and knowledge of pest biologies are essential when making management decisions.

## Insecticides for grain sorghum

### Foliar sprays

Insect	Insecticides		Rate of formulated material per acre	Placement	REI (hours)	Preharvest interval (days)	
	Common name	Trade name					
<b>Chinch bug</b> <i>Blissus leucopterus</i> (Say)  <b>Comments:</b> Use ground equipment to treat border rows when insects begin migration from small grains or native grass stands to grain sorghum (milo). Risk of economic infestations is greatest in corn or grain sorghum (milo) planted into wheat stubble or native grass stands. Considered an occasional pest in Missouri, chinch bug adults and nymphs move to field corn or grain sorghum (milo) fields in early summer after wheat plants dry. A majority of feeding by this pest occurs when plant juices are sucked from plant roots.	esfenvalerate	*Asana XL	5.8 to 9.6 fl oz	spray toward base of plants	12	21 (grain)	
	cyfluthrin	*Baythroid XL	2.0 to 2.8 fl oz	spray toward base of plants	12	14 (grain or graze)	
	chlorpyrifos + gamma-cyhalothrin	*Cobalt	13 to 38 fl oz	spray toward base of plants	24	30 (grain, forage, fodder, hay, or silage up to 26 fl oz rate, or 60 days above 26 fl oz rate)	
	chlorpyrifos + gamma-cyhalothrin	*Cobalt Advanced	11 to 38 fl oz	spray toward base of plants	24	30 (grain, forage, fodder, hay, or silage up to 26 fl oz rate, or 60 days above 26 fl oz rate)	
	gamma-cyfluthrin	*Declare/Prolex	1.54 fl oz	spray toward base of plants	24	30 (grain)	
	deltamethrin	*Delta Gold 1.5EC	1.3 to 1.9 fl oz	spray toward base of plants	12	14 (grain, cut or graze forage)	
	alpha-cypermethrin	*Fastac EC	3.2 to 3.9 fl oz	spray toward base of plants	12	14 (grain, stover) 45 (forage)	
	chlorpyrifos	*Lorsban Advanced (see specific label for chemical injury risk information)	1 to 2 pt	spray toward base of plants	24	30 (grain, forage, fodder, hay, or silage up to 1 pt rate, or 60 days above 1 pt rate).	
	chlorpyrifos	*Lorsban 4E (see specific label for chemical injury risk information)	1 to 2 pt	spray toward base of plants	24	30 (grain, forage, fodder, hay, or silage up to 1 pt rate, or 60 days above 1 pt rate).	
	zeta-cypermethrin	*Mustang Max	3.2 to 4.0 fl oz	spray toward base of plants	12	30 (grain, stover) 45 (forage)	
	zeta-cypermethrin	*Mustang Maxx	3.2 to 4.0 fl oz	spray toward base of plants	12	30 (grain, stover) 45 (forage)	
	chlorpyrifos	*Nufos 4E	1 to 2 pt	spray toward base of plants	24	30 (grain, forage, fodder, hay, or silage up to 1 pt rate, or 60 days above 1 pt rate).	
	gamma-cyfluthrin	*Proaxis	3.84 fl oz	spray toward base of plants	24	30 (grain)	
	carbaryl	Sevin 80S	1.25 to 2.5 lb	spray toward base of plants	12	21 (grain or fodder) 14 (harvest or graze forage)	
	carbaryl	Sevin XLR Plus	2 to 3 pt	spray toward base of plants	12	14 (grain or straw)	
	chlorpyrifos + bifenthrin	*Stallion	9.25 to 11.75 fl oz	spray toward base of plants	24	30 (grain, stover) 45 (forage)	
	cyfluthrin	*Tombstone Helios	2.0 to 2.8 fl oz	spray toward base of plants	12	14 (harvest or graze forage)	
	lambda-cyhalothrin	*Warrior II	1.28 to 1.92 fl oz	spray toward base of plants	24	30 (grain), 7 (graze) 30 (straw fed to livestock)	
	<b>Granular products</b>						
	chlorpyrifos	*Saurus (15% granule) (suppression only)	8.0 ounces/1000 ft row (30" row spacing)	6-8 inch T-band over open seed furrow	24	30 (grain, stover) 45 (forage)	

\*Designates a restricted-use pesticide. Use is restricted to certified applicators only. Read the label and follow all insecticide rate information, directions, precautions and restrictions.

**Insecticides for grain sorghum - *continued***

Insect	Insecticides		Rate of formulated material per acre	Placement	REI (hours)	Preharvest interval (days)
	Common name	Trade name				
	Seed treatments					
	thiamethoxam	Cruiser 5FS	5.1 fl oz/100 lb. of seed	commercial on seed	12	
	imadacloprid	Gaucho 5FS	6.4 fl oz/100 lb of seed	commercial on seed	12	
	imadacloprid	Gaucho 600	6.4 fl oz/100 lb of seed	commercial on seed	12	
	clothianidin	Poncho 600	5.1 to 6.4 fl oz/100 lbs seed	commercial on seed	12	
	clothianidin	NipSit Inside 5F	5.1 to 6.4 fl oz/100 lbs seed	commercial on seed	12	
	Note: All seed treatments listed provide early season suppression for chinch bugs.					
<b>Corn earworm (sorghum headworm)</b> <i>Helicoverpa (=Heliiothis) zea</i> (Boddie)	esfenvalerate	*Asana XL	5.8 to 9.6 fl oz	grain head, foliage	12	21 (grain)
	cyfluthrin	*Baythroid XL	1.3 to 2.8 fl oz	grain head, foliage	12	14 (grain or graze)
	flubendiamide	*Belt SC	2.0 to 4.0 fl oz	broadcast on foliage	12	3 (forage) 14 (grain or stover)
	chlorpyrifos + gamma-cyhalothrin	*Cobalt	19 to 38 fl oz	grain head, foliage	24	30 (grain, forage, fodder, hay, or silage up to 26 fl oz rate, or 60 days above 26 fl oz rate)
	chlorpyrifos + gamma-cyfluthrin	*Cobalt Advanced	16 to 38 fl oz	grain head, foliage	24	30 (grain, forage, fodder, hay, or silage up to 26 fl oz rate, or 60 days above 26 fl oz rate)
	gamma-cyfluthrin	*Declare/Prolex	1.02 to 1.54 fl oz	grain head, foliage	24	30 (grain)
	deltamethrin	*Delta Gold 1.5EC	1.0 to 1.5 fl oz	grain head, foliage	12	14 (grain, cut or graze forage)
	alpha-cypermethrin	*Fastac EC	1.3 to 3.8 fl oz	grain head, foliage	12	14 (grain, stover) 45 (forage)
	methomyl	*Lannate SP	1/4 to 1/2 lb	grain head, foliage	48	14 (feeding or cutting for hay)
	methomyl	*Lannate LV	3/4 to 1 1/2 pt	grain head, foliage	48	14 (feeding or cutting for hay)
	chlorpyrifos	*Lorsban Advanced	2 pt	grain head, foliage	24	30 (grain, forage, fodder, hay, or silage up to 1 pt rate, or 60 days above 1 pt rate).
	chlorpyrifos	*Lorsban 4E	2 pt	grain head, foliage	24	30 (grain, forage, fodder, hay, or silage up to 1 pt rate, or 60 days above 1 pt rate).
	zeta-cypermethrin	*Mustang Max	1.76 to 4.0 fl oz	grain head, foliage	12	30 (grain, stover) 45 (forage)
	zeta-cypermethrin	*Mustang Maxx	1.76 to 4.0 fl oz	grain head, foliage	12	30 (grain, stover) 45 (forage)
	chlorpyrifos	*Nufos 4E	2 pt	grain head, foliage	24	30 (grain, forage, fodder, hay, or silage up to 1 pt rate, or 60 days above 1 pt rate).
	gamma-cyfluthrin	*Proaxis	2.56 to 3.84 fl oz (apply before larvae enter stalk)	grain head, foliage	24	30 (grain)
	carbaryl	Sevin 80S	1 1/4 to 2 1/2 lb	grain head, foliage	12	21 (grain or fodder) 14 (harvest or graze forage)
	carbaryl	Sevin XLR Plus	2 to 3 pts	grain head, foliage	12	21 (grain or fodder) 14 (harvest or graze forage)
	chlorpyrifos + bifenthrin	*Stallion	5.0 to 11.75 fl oz	grain head, foliage	24	30 (grain, stover) 45 (forage)
	cyfluthrin	*Tombstone Helios	1.3 to 2.8 fl oz	grain head, foliage	12	14 (harvest or graze forage)
spinosad	Tracer 4SC	2.0 to 3.0 fl oz	foliage	1	28 (grain), 3 (fodder or forage)	
lambda-cyhalothrin	*Warrior II	1.28 to 1.92 fl oz	grain head, foliage	24	30 (grain), 7 (graze) 30 (straw fed to livestock)	

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Insecticides for grain sorghum - *continued*

Insect	Insecticides		Rate of formulated material per acre	Placement	REI (hours)	Preharvest interval (days)	
	Common name	Trade name					
<b>Corn leaf aphids</b> <i>Rhopalosiphum maidis</i> (Fitch)	chlorpyrifos + gamma-cyhalothrin	*Cobalt Advanced	6 to 13 fl oz	foliage, over row	24	21 (grain or ears) 14 (graze or silage harvest)	
	chlorpyrifos + gamma-cyhalothrin	*Cobalt	7 to 13 fl oz	foliage, over row	24	21 (grain or ears)	
	dimethoate	Dimethoate 4E	1/2 to 1 pt	foliage, over row	48	28 (grain) 14 (forage)	
	alpha-cypermethrin	*Fastac EC	3.2 to 3.9 fl oz	foliage, over row	12	14 (grain, stover) 45 (forage)	
	chlorpyrifos	*Lorsban 4E (see specific label for chemical injury risk information)	1/2 to 1 pt	foliage, over row	24	30 (grain, forage, fodder, hay, or silage)	
	chlorpyrifos	*Lorsban Advanced (see specific label for chemical injury risk information)	1/2 to 1 pt	foliage, over row	24	30 (grain, forage, fodder, hay, or silage)	
	zeta-cypermethrin	*Mustang Max	3.2 to 4.0 fl oz	foliage, over row	12	30 (grain, stover) 45 (forage)	
	zeta-cypermethrin	*Mustang Maxx	3.2 to 4.0 fl oz	foliage, over row	12	30 (grain, stover) 45 (forage)	
	chlorpyrifos	*Nufos 4E	1/2 to 1 pt	foliage, over row	24	30 (grain, forage, fodder, hay, or silage)	
	chlorpyrifos + bifenthrin	*Stallion	9.25 to 11.75 fl oz	foliage, over row	24	30 (grain, stover) 45 (forage)	
	<b>Cutworm spp.</b>	esfenvalerate	*Asana XL	5.8 to 9.6 fl oz	grain head, foliage	12	21 (grain)
		cyfluthrin	*Baythroid XL	1.0 to 1.3 fl oz	grain head, foliage	12	14 (grain or graze)
flubendiamide		*Belt SC	2.0 to 4.0 fl oz	broadcast on foliage	12	3 (forage) 14 (grain or stover)	
chlorpyrifos + gamma-cyhalothrin		*Cobalt Advanced	11 to 38 fl oz	grain head, foliage	24	30 (grain, forage, fodder, hay, or silage)	
chlorpyrifos + gamma-cyhalothrin		*Cobalt	13 to 38 fl oz	grain head, foliage	24	30 (grain, forage, fodder, hay, or silage)	
gamma-cyfluthrin		*Declare/Prolex	0.77 to 1.02 fl oz	grain head, foliage	24	30 (grain)	
deltamethrin		*Delta Gold 1.5EC	1.0 to 1.5 fl oz	grain head, foliage	12	14 (grain, cut or graze forage)	
alpha-cypermethrin		*Fastac EC	1.3 to 3.8 fl oz	grain head, foliage	12	14 (grain, stover) 45 (forage)	
chlorpyrifos		*Lorsban Advanced (see specific label for chemical injury risk information)	1 to 2 pt	grain head, foliage	24	30 (grain, forage, fodder, hay, or silage up to 1 pt rate, or 60 days above 1 pt rate).	
chlorpyrifos		*Lorsban 4E (see specific label for chemical injury risk information)	1 to 2 pt	grain head, foliage	24	30 (grain, forage, fodder, hay, or silage up to 1 pt rate, or 60 days above 1 pt rate).	
zeta-cypermethrin		*Mustang Max	1.28 to 4.0 fl oz	grain head, foliage	12	30 (grain, stover) 45 (forage)	
zeta-cypermethrin		*Mustang Maxx	1.28 to 4.0 fl oz	grain head, foliage	12	30 (grain, stover) 45 (forage)	
chlorpyrifos		*Nufos 4E	1 to 2 pt	grain head, foliage	24	30 (grain, forage, fodder, hay, or silage up to 1 pt rate, or 60 days above 1 pt rate).	
gamma-cyfluthrin		*Proaxis	1.92 to 2.56 fl oz	grain head, foliage	24	30 (grain)	
carbaryl		Sevin 80S	2.5 lb	grain head, foliage	12	21 (grain or fodder)	
carbaryl		Sevin XLR Plus	4 pt	grain head, foliage	12	21 (grain or fodder) 14 (harvest or graze forage)	
chlorpyrifos + bifenthrin		*Stallion	3.75 to 11.75 fl oz	foliage with sufficient water to wet soil surface	24	30 (grain, stover) 45 (forage)	

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**Insecticides for grain sorghum - *continued***

Insect	Insecticides		Rate of formulated material per acre	Placement	REI (hours)	Preharvest interval (days)
	Common name	Trade name				
<b>Cutworm - <i>continued</i></b>	cyfluthrin	*Tombstone Helios	1.0 to 1.3 fl oz	grain head, foliage	12	14 (harvest or graze forage)
	lambda-cyhalothrin	*Warrior II	0.96 to 1.28 fl oz	grain head, foliage	24	30 (grain), 7 (graze) 30 (straw fed to livestock)
<b>Fall armyworm</b> <i>Spodoptera frugiperda</i> J.E. Smith  <b>Comments:</b> Treat when larvae average two or more larvae per head. Leaf and whorl damage rarely economic in Missouri.	cyfluthrin	*Baythroid XL	1.3 to 2.8 fl oz 1st & 2nd instars only	grain head, over row	12	14 (grain or graze)
	flubendiamide	*Belt SC	2.0 to 4.0 fl oz	grain head, foliage	12	3 (forage) 14 (grain or stover)
	chlorpyrifos + gamma-cyhalothrin	*Cobalt Advanced	11 to 38 fl oz	grain head, foliage	24	30 (grain, forage, fodder, hay, or silage up to 26 fl oz rate, or 60 days above 26 fl oz rate)
	chlorpyrifos + gamma-cyhalothrin	*Cobalt	13 to 38 fl oz	grain head, over row	24	30 (grain, forage, fodder, hay, or silage)
	gamma-cyfluthrin	*Declare/Prolex	1.02 to 1.54 fl oz	grain head, foliage	24	30 (grain)
	deltamethrin	*Delta Gold 1.5EC	1.3 to 1.9 fl oz	grain head, foliage	12	14 (grain, cut or graze forage)
	alpha-cypermethrin	*Fastac EC	1.3 to 3.8 fl oz	grain head, foliage	12	14 (grain, stover) 45 (forage)
	methomyl	*Lannate SP	1/4 to 3/8 lb	grain head, foliage	48	14 (feeding or cutting for hay)
	methomyl	*Lannate LV	3/4 to 1.5 pt	grain head, foliage	48	14 (feeding or cutting for hay)
	chlorpyrifos	*Lorsban Advanced (see specific label for chemical injury risk information)	1 to 2 pt	grain head, foliage	24	30 (grain, forage, fodder, hay, or silage up to 1 pt rate, or 60 days above 1 pt rate).
	chlorpyrifos	*Lorsban 4E (see specific label for chemical injury risk information)	1 to 2 pt	grain head, foliage	24	30 (grain, forage, fodder, hay, or silage up to 1 pt rate, or 60 days above 1 pt rate).
	zeta-cypermethrin	*Mustang Maxx	1.76 to 4.0 fl oz	grain head, foliage	12	30 (grain, stover) 45 (forage)
	zeta-cypermethrin	*Mustang Max	1.76 to 4.0 fl oz	grain head, foliage	12	30 (grain, stover) 45 (forage)
	gamma-cyfluthrin	*Proaxis	2.56 to 3.84 fl oz	grain head, foliage	24	30 (grain)
	carbaryl	Sevin 80S	1.25 to 2.5 lb	grain head, foliage	12	21 (grain or fodder) 14 (harvest or graze forage)
	carbaryl	Sevin XLR Plus	2 to 4 pts	grain head, foliage	12	21 (grain or fodder) 14 (harvest or graze forage)
chlorpyrifos + bifenthrin	*Stallion	9.25 to 11.75 fl oz	foliage	24	30 (grain, stover) 45 (forage)	
cyfluthrin	*Tombstone Helios	1 to 1.3 fl oz 1st & 2nd instars only	grain head, foliage	12	14 (harvest or graze forage)	
lambda-cyhalothrin	*Warrior II	1.28 to 1.92 fl oz	grain head, foliage	24	30 (grain), 7 (graze) 30 (straw fed to livestock)	
<b>Grasshopper spp.</b>  <b>Comments:</b> Control grasshoppers when they are small by applying spot treatments to hatching sites in field borders and grass waterways. Treatment in field is justified when seven or more grasshoppers per square yard are present.	cyfluthrin	*Baythroid XL	2 to 2.8 fl oz	grain head, foliage	12	14 (grain or graze)
	chlorpyrifos + gamma-cyhalothrin	*Cobalt	7 to 13 fl oz	grain head, foliage	24	30 (grain, forage, fodder, hay, or silage)
	chlorpyrifos + gamma-cyhalothrin	*Cobalt Advanced	6 to 13 fl oz	grain head, foliage	24	30 (grain, forage, fodder, hay, or silage up to 26 fl oz rate, or 60 days above 26 fl oz rate)
	gamma-cyfluthrin	*Declare/Prolex	1.02 to 1.54 fl oz	grain head, foliage	24	30 (grain)
	deltamethrin	*Delta Gold 1.5EC	1 to 1.5 fl oz	grain head, foliage	12	14 (grain, cut or graze forage)

\*Designates a restricted-use pesticide. Use is restricted to certified applicators only. Read the label and follow all insecticide rate information, directions, precautions and restrictions.

Insecticides for grain sorghum - *continued*

Insect	Insecticides		Rate of formulated material per acre	Placement	REI (hours)	Preharvest interval (days)
	Common name	Trade name				
<b>Grasshopper - <i>continued</i></b>	dimethoate	Dimethoate 4E	1/2 to 1 pt	grain head, foliage	48	28 (grain) 14 (forage)
	alpha-cypermethrin	*Fastac EC	3.2 to 3.9 fl oz	grain head, foliage	12	14 (grain, stover) 45 (forage)
	chlorpyrifos	*Lorsban Advanced (see specific label for chemical injury risk information)	1/2 to 1 pt	grain head, foliage	24	30 (grain, forage, fodder, hay, or silage)
	chlorpyrifos	*Lorsban 4E (see specific label for chemical injury risk information)	1/2 to 1 pt	grain head, foliage	24	30 (grain, forage, fodder, hay, or silage)
	zeta-cypermethrin	*Mustang Max	3.2 to 4.0 fl oz	grain head, foliage	12	30 (grain, stover) 45 (forage)
	zeta-cypermethrin	*Mustang Maxx	3.2 to 4.0 fl oz	grain head, foliage	12	30 (grain, stover) 45 (forage)
	chlorpyrifos	*Nufos 4E	1/2 to 1 pt	grain head, foliage	24	30 (grain, forage, fodder, hay, or silage)
	gamma-cyfluthrin	*Proaxis	2.56 to 3.84 fl oz	grain head, foliage	24	30 (grain)
	chlorpyrifos + bifenthrin	*Stallion	9.25 to 11.75 fl oz	foliage	24	30 (grain, stover) 45 (forage)
	cyfluthrin	*Tombstone Helios	2 to 2.8 fl oz	grain head, foliage	12	14 (harvest or graze forage)
	lambda-cyhalothrin	*Warrior II	1.28 to 1.92 fl oz	grain head, foliage	24	30 (grain), 7 (graze) 30 (straw fed to livestock)
	<b>Greenbug</b> <i>Schizaphis graminum</i> Rondani	chlorpyrifos + gamma-cyhalothrin	*Cobalt	13 to 38 fl oz	foliage, over row	24
chlorpyrifos + gamma-cyhalothrin		*Cobalt Advanced	11 to 38 fl oz	foliage, over row	24	30 (grain, forage, fodder, hay, or silage up to 26 fl oz rate, or 60 days above 26 fl oz rate)
dimethoate		Dimethoate 4E	1/2 to 1 pt	foliage, over row	48	28 (grain) 14 (forage)
alpha-cypermethrin		*Fastac EC	3.2 to 3.9 fl oz	foliage, over row	12	14 (grain, stover) 45 (forage)
chlorpyrifos		*Lorsban 4E (see specific label for chemical injury risk information)	1/2 to 1 pt	foliage, over row	24	30 (grain, forage, fodder, hay, or silage)
chlorpyrifos		*Lorsban Advanced (see specific label for chemical injury risk information)	1/2 to 1 pt	foliage, over row	24	30 (grain, forage, fodder, hay, or silage)
chlorpyrifos		*Nufos 4E	1/2 to 1 pt	foliage, over row	24	30 (grain, forage, fodder, hay, or silage)
chlorpyrifos + bifenthrin		*Stallion	9.25 to 11.75 fl oz	foliage, over row	24	30 (grain, stover) 45 (forage)
<b>Sorghum midge</b> <i>Contarinia sorghicola</i>	esfenvalerate	*Asana XL	2.9 to 5.8 fl oz	grain head, foliage	12	21 (grain)
	cyfluthrin	*Baythroid XL	1 to 1.3 fl oz	grain head, foliage	12	14 (grain or graze)
	chlorpyrifos + gamma-cyhalothrin	*Cobalt	7 to 13 fl oz	grain head, foliage	24	30 (grain, forage, fodder, hay, or silage)
	chlorpyrifos + gamma-cyhalothrin	*Cobalt Advanced	6 to 13 fl oz	grain head, foliage	24	30 (grain, forage, fodder, hay, or silage up to 26 fl oz rate, or 60 days above 26 fl oz rate)
	gamma-cyfluthrin	*Declare/Prolex	0.77 to 1.02 fl oz	grain head, foliage	24	30 (grain)
	deltamethrin	*Delta Gold 1.5EC	1.3 to 1.9 fl oz	grain head, foliage	12	14 (grain, cut or graze forage)
	dimethoate	Dimethoate 4E	1/4 to 1/2 pt	foliage, over row	48	28 (grain) 14 (forage)
	alpha-cypermethrin	*Fastac EC	1.3 to 3.8 fl oz	grain head, foliage	12	14 (grain, stover) 45 (forage)
	malathion	*Fyfanon ULV Ag	6 to 8 fl oz	grain head, foliage	12	7 (grain)

\*Designates a restricted-use pesticide. Use is restricted to certified applicators only. Read the label and follow all insecticide rate information, directions, precautions and restrictions.

**Insecticides for grain sorghum - *continued***

Insect	Insecticides		Rate of formulated material per acre	Placement	REI (hours)	Preharvest interval (days)	
	Common name	Trade name					
<b>Sorghum midge - <i>continued</i></b>	methomyl	*Lannate SP	1/4 to 1/2 lb	grain head, foliage	48	14 (feeding or cutting for hay)	
	methomyl	*Lannate LV	3/4 to 1.5 pt	grain head, foliage	48	14 (feeding or cutting for hay)	
	chlorpyrifos	*Lorsban Advanced (see specific label for chemical injury risk information)	1/2 pt	grain head, foliage	24	30 (grain, forage, fodder, hay, or silage up to 1 pt rate, or 60 days above 1 pt rate).	
	chlorpyrifos	*Lorsban 4E (see specific label for chemical injury risk information)	1/2 pt	grain head, foliage	24	30 (grain, forage, fodder, hay, or silage up to 1 pt rate, or 60 days above 1 pt rate).	
	zeta-cypermethrin	*Mustang Max	1.28 to 4.0 fl oz	grain head, foliage	12	30 (grain, stover) 45 (forage)	
	zeta-cypermethrin	*Mustang Maxx	1.28 to 4.0 fl oz	grain head, foliage	12	30 (grain, stover) 45 (forage)	
	chlorpyrifos	*Nufos 4E	1/2 pt	grain head, foliage	24	30 (grain, forage, fodder, hay, or silage up to 1 pt rate, or 60 days above 1 pt rate).	
	gamma-cyfluthrin	*Proaxis	1.92 to 2.56 fl oz	grain head, foliage	24	30 (grain)	
	chlorpyrifos + bifenthrin	*Stallion	3.75 to 11.75 fl oz	foliage	24	30 (grain, stover) 45 (forage)	
	cyfluthrin	*Tombstone Helios	1 to 1.3 fl oz	grain head, foliage	12	14 (harvest or graze forage)	
	lambda-cyhalothrin	*Warrior II	0.96 to 1.28 fl oz	grain head, foliage	24	30 (grain), 7 (graze) 30 (straw fed to livestock)	
	<b>Sorghum webworm</b> <i>Nola sorghiella</i>	cyfluthrin	*Baythroid XL	1.3 to 2.8 fl oz	grain head, foliage	12	14 (grain or graze)
		flubendiamide	*Belt SC	2.0 to 4.0 fl oz	grain head, foliage	12	3 (forage) 14 (grain or stover)
chlorpyrifos + gamma-cyhalothrin		*Cobalt Advanced	16 to 38 fl oz	grain head, foliage	24	30 (grain, forage, fodder, hay, or silage up to 26 fl oz rate, or 60 days above 26 fl oz rate)	
chlorpyrifos + gamma-cyhalothrin		*Cobalt	19 to 38 fl oz	grain head, foliage	24	30 (grain, forage, fodder, hay, or silage)	
gamma-cyfluthrin		*Declare/Prolex	1.02 to 1.54 fl oz	grain head, foliage	24	30 (grain)	
deltamethrin		*Delta Gold 1.5EC	1 to 1.5 fl oz	grain head, foliage	12	14 (grain, cut or graze forage)	
alpha-cypermethrin		*Fastac EC	1.3 to 3.8 fl oz	grain head, foliage	12	14 (grain, stover) 45 (forage)	
methomyl		*Lannate SP	1/2 lb	grain head, foliage	48	14 (feeding or cutting for hay)	
methomyl		*Lannate LV	1.5 pt	grain head, foliage	48	14 (feeding or cutting for hay)	
chlorpyrifos		*Lorsban Advanced (see specific label for chemical injury risk information)	1 pt	grain head, foliage	24	30 (grain, forage, fodder, hay, or silage up to 1 pt rate, or 60 days above 1 pt rate).	
chlorpyrifos		*Lorsban 4E (see specific label for chemical injury risk information)	1 pt	grain head, foliage	24	30 (grain, forage, fodder, hay, or silage up to 1 pt rate, or 60 days above 1 pt rate).	
zeta-cypermethrin		*Mustang Max	1.76 to 4.0 fl oz	grain head, foliage	12	30 (grain, stover) 45 (forage)	
zeta-cypermethrin		*Mustang Maxx	1.76 to 4.0 fl oz	grain head, foliage	12	30 (grain, stover) 45 (forage)	
chlorpyrifos		*Nufos 4E	1 pt	grain head, foliage	24	30 (grain, forage, fodder, hay, or silage up to 1 pt rate, or 60 days above 1 pt rate).	
gamma-cyfluthrin		*Proaxis	1.92 to 2.56 fl oz	grain head, foliage	24	30 (grain)	
carbaryl		Sevin 80S	1.25 to 2.5 lb	grain head, foliage	12	21 (grain or fodder) 14 (harvest or graze forage)	

\*Designates a restricted-use pesticide. Use is restricted to certified applicators only. Read the label and follow all insecticide rate information, directions, precautions and restrictions.



Insecticides for grain sorghum - *continued*

Insect	Insecticides		Rate of formulated material per acre	Placement	REI (hours)	Preharvest interval (days)
	Common name	Trade name				
<b>Sorghum webworm - <i>continued</i></b>	chlorpyrifos + bifenthrin	*Stallion	5.0 to 11.75 fl oz	grain head, foliage	24	30 (grain, stover) 45 (forage)
	cyfluthrin	*Tombstone Helios	1.3 to 2.8 fl oz	grain head, foliage	12	14 (harvest or graze forage)
	lambda-cyhalothrin	*Warrior II	1.28 to 1.92 fl oz	grain head, foliage	24	30 (grain), 7 (graze)
<b>Yellow sugarcane aphid</b> <i>Sipha flava</i> (Forbes)  <b>Comments:</b> Treat seedling sorghum when an average of 5 to 10 or more aphids are present per plant.	chlorpyrifos + gamma-cyhalothrin	*Cobalt	7 to 13 fl oz	grain head, foliage	24	30 (grain, forage, fodder, hay, or silage)
	chlorpyrifos + gamma-cyhalothrin	*Cobalt Advanced	7 to 13 fl oz	grain head, foliage	24	30 (grain, forage, fodder, hay, or silage up to 26 fl oz rate, or 60 days above 26 fl oz rate)
	alpha-cypermethrin	*Fastac EC	3.2 to 3.9 fl oz	grain head, foliage	12	14 (grain, stover) 45 (forage)
	chlorpyrifos	*Lorsban Advanced (see specific label for chemical injury risk information)	1/2 to 1 pt	grain head, foliage	24	30 (grain, forage, fodder, hay, or silage up to 1 pt rate, or 60 days above 1 pt rate).
	chlorpyrifos	*Lorsban 4E (see specific label for chemical injury risk information)	1/2 to 1 pt	grain head, foliage	24	30 (grain, forage, fodder, hay, or silage up to 1 pt rate, or 60 days above 1 pt rate).
	zeta-cypermethrin	*Mustang Max	3.2 to 4.0 fl oz	grain head, foliage	12	30 (grain, stover) 45 (forage)
	zeta-cypermethrin	*Mustang Maxx	3.2 to 4.0 fl oz	grain head, foliage	12	30 (grain, stover) 45 (forage)
	chlorpyrifos	*Nufos 4E	1/2 to 1 pt	grain head, foliage	24	30 (grain, forage, fodder, hay, or silage up to 1 pt rate, or 60 days above 1 pt rate).
	chlorpyrifos + bifenthrin	*Stallion	9.25 to 11.75 fl oz	foliage	24	30 (grain, stover) 45 (forage)

**“White” sugarcane aphid**  
*Melanaphis sacchari*

**Comment:** The sugarcane aphid, *Melanaphis sacchari*, is an important traditional pest of sugarcane and sorghum grown in many tropical and subtropical regions of Asia, Africa, Australia, Central America, and South America. First found North America in 1977 (Florida) and again in 1999 (Louisiana), this aphid became a major pest of sugarcane in several southern states. Beginning In 2013, populations of this pest began damaging certain varieties of grain and forage sorghum as well as sorghum x sudan crosses and Johnsongrass. Sugarcane aphid populations can quickly build to economic levels, especially on many grain sorghum varieties. Economic damage to grain sorghum by this pest insect quickly moved through most southern and some southwestern states during the past two years and was first reported in Missouri in 2014. Young sorghum plants may be killed from the removal of plant juices by the piercing-sucking mouthparts of this aphid. Leaf tissue of dead and surviving plants will become desiccated and change from green to an array of yellow, red, or brown colors. Because this aphid species produces large amounts of sticky “honeydew” which covers plant stems, foliage, and sometimes heads, harvest equipment problems are often encountered. Similar to seedlings, more mature plants also express changes in leaf color and reduced size of sorghum heads if economic aphid populations are present. According to field trials in Texas and Louisiana, economic damage may result in yield losses of up to 50% in many sorghum varieties.

Several species of beneficial insects will attack aphids during the growing season in Missouri and provide some control if pest aphid numbers are low to moderate. High populations of this aphid will require insecticide applications to achieve satisfactory control. At present, no insecticides are labeled for this pest, although temporary Section 18 Emergency Exemption Insecticide Labels were issued for Transform WG insecticide in certain states for use against “white” sugarcane aphid, *Melanaphis sacchari*, infestations. Rates of Transform insecticide by state range from 0.75 to 1.0 ounces of product per acre with up to three applications during the season allowed with a limit of 3 total ounces applied per season. If sorghum midge is present along with the white sugarcane aphid, then Transform WG tank mixed with a pyrethroid insecticide is recommended. The effectiveness of Dimethoate 4EC at the 1.0 pint per acre rate on white sugarcane aphid infestations in grain sorghum vary significantly by state.

It is unknown if this pest will be able to survive Missouri winter conditions or utilize migratory white sugarcane aphids from more southern states to infest sorghum in Missouri. The lack of sugarcane production in Missouri may also result in few sugarcane aphids being present early season to infest grain sorghum.

**\*Designates a restricted-use pesticide. Use is restricted to certified applicators only.** Read the label and follow all insecticide rate information, directions, precautions and restrictions.

## Insect management for rice

Many different insects may inhabit rice fields, but *only a few* are considered pest species. In general, insect problems in Missouri rice fields are much less severe than those in other rice-producing areas of the United States. The most common insect pest of rice in Missouri is the rice water weevil followed by the rice stink bug and grasshoppers. Several other insects (e.g., armyworms, chinch bugs) rarely build to economic infestations.

Management recommendations presented in this guide

are based on work conducted in Missouri and other rice-producing states (i.e., Arkansas, Louisiana and Texas). These recommendations are designed to provide economical pest control while minimizing production costs, disruption of beneficial arthropod populations, and environmental pollution. Timely, regular scouting of fields will help determine when economic pest infestations are present to warrant insecticide applications. The following table lists insecticides recommended for controlling rice pests in Missouri.

## Insecticides for rice

Insect	Insecticides		Formulation per acre	Application rate (lb a.i. per acre)	Comments
	Common name	(Trade name)			
<b>Rice seed midge</b>	currently none				
<b>Comments:</b>					
Currently, there are no chemical solutions to control rice seed midge. Cultural means of avoiding midge infestations include: pre-germinated seed, time planting when conditions are present for rapid seedling growth, seed fields within two days of the permanent flood, and avoid seeding during cool weather.					
<b>Grape colaspis</b>	clothianidin	(NipSit Inside 5 FS)	1.92 oz/100 lb seed	0.075/100 lb seed	Use only on dry-seeded rice. DO NOT spray crop with another neonic insecticide after using NipSit Inside. DO NOT use near fish or crawfish farms.
	thiamethoxam	(Cruiser 5 FS)	0.03 mg ai/seed		DO NOT plant or sow Cruiser-treated seed by aerial application. Cruiser is NOT labeled for use in water-seeded rice. DO NOT use treated fields for aquaculture of edible fish or crustaceans. DO NOT exceed 120 lb seed per acre.
<b>Chinch bugs</b>	carbaryl	(Sevin 80S)	1.25-1.88 lb	1.0-1.5	
		(Sevin XLR or 4F)	2-3 pt		
	gamma-cyhalothrin	(Prolex 1.25CS)	1.28-2.05 oz	0.0125-0.02	
		(Proaxis 0.5 CS)	3.2-5.12 oz		
		(Mustang Max 0.8 EC)	2.64-4.0 oz	0.0165-0.025	
lambda-cyhalothrin	(Karate Z 2.08 CS)	1.6-2.56 oz	0.025-0.04		
<b>Comments:</b>					
Flooding or flushing will help control this pest, but an additional insecticide spray may be necessary. Because the insects hide under the soil or in the leaf sheaths during the day, applying insecticides in the early morning or late in the day will be more successful.					
<b>Rice water weevil adults</b>	gamma-cyhalothrin	(Prolex 1.25CS)	1.28-2.05 oz	0.0125-0.02	
		(Proaxis 0.5 CS)	3.2-5.12 oz		
	lambda-cyhalothrin	(Karate Z2.08 CS)	1.6-2.56 oz	0.025-0.04	
	zeta-cypermethrin	(Mustang Max 0.8E)	3.2-4.0 oz	0.02-0.025	
	chlothianidin	(Belay 2.13)	4.5 oz	0.075	

**Comments:**

Karate Z and Mustang Max can be safely applied before or after herbicide applications. **Drill seeded:** Apply Karate Z, Prolex, Proaxis, Declare, and Mustang Max within 10 days after permanent flood when adults are present. **Water seeded:** Apply Karate Z, Prolex, Proaxis, Declare and Mustang Max within 7 days after permanent flood when adults are present; a second application may be necessary 5-7 days later. Karate Z, Prolex, Proaxis, Declare and Mustang Max prevent adults from laying eggs. Treat based on leaf scar treatment threshold using Karate for drill or water seeded.

References to commercial products are included for instructional purposes only. It is not the intention of the University of Missouri to endorse any product listed here.

Insecticides for rice - *continued*

Insect	Insecticides		Formulation per acre	Application rate (a.i. per acre)	Comments
	Common name	(Trade name)			
Rice water weevil eggs	diflubenzuron	(Dimilin 2L)	12.0-16.0 oz	0.125-0.25	<b>Drill seeded:</b> Apply Dimilin within 10 days after permanent flood when adults are present. <b>Water seeded:</b> Apply Dimilin within 7 days after permanent flood.
Rice water weevil larvae	chlorantraniliprole	(Dermacor X-100)	1.5-6.0 oz/100 lb seed		
	clothianidin	(NipSit Inside 5 FS)	1.92oz/100 lb seed		Use only on dry-seeded rice. DO NOT spray crop with another neonic insecticide after using NipSit Inside. DO NOT use near fish or crawfish farms.
	thiamethoxam x	(NipSit Inside 5 FS)	0.03 mg ai/seed; 3.3oz/10 lb seed		DO NOT plant or sow Cruiser-treated seed by aerial application. Cruiser is NOT labeled for use in water-seeded rice. DO NOT use treated fields for aquaculture of edible fish or crustaceans. DO NOT exceed 120 lb seed per acre

**Comments:**

In drilled-seeded rice with chronic rice water weevil infestations or in water-seeded rice fields, Cruiser, Dermacor, Dimilin, and NipSit provide good residual control of the weevils.

A foliar insecticide application may be preferable when rice fields are infrequently infested with the rice water weevil. Apply Karate Z, Prolex, Proaxis, Declare, and Mustang Max within 7 days after permanent flood. A second application may be necessary 5 to 7 days later. Only Dimilin is recommended to control the egg stage. Foliar insecticide applications are most effective when applied 7 to 10 days after permanent flood in drilled-seeded rice. Timing is even more crucial with water-seeded rice. In Arkansas, the recommended application timing is when approximately 50% of the plants are just above the water surface; whereas, in Louisiana, the recommended application timing is when adults, leaf damage, and favorable egg-laying conditions (water in the field) are present.

Armyworms (True and Fall)	gamma-cyhalothrin	(Prolex 1.25CS)	1.28-2.05 oz	0.0125-0.02	
		(Proaxis 0.5 EC)	3.2-5.12 oz		
	lambda-cyhalothrin	(Karate Z 2.08CS)	1.6-2.56 oz	0.025-0.04	
	zeta-cypermethrin	(Mustang Max 0.8E)	3.2-4.0 oz	0.02-0.025	

**Control:**

Treat when you find an average of five or more worms per 10 sweeps or when you see considerable damage. If insecticide is applied before propanil, check herbicide recommendations for alternative control methods. TRT will be most successful in late afternoon. Later in the season, treat when fall armyworms are present and damaging the flag leaf. Monitor rice fields adjacent to wheat for movement of true armyworms into seedling rice

Rice stalk borer	lambda-cyhalothrin	(Karate Z 2.08 CS)	1.92-2.56 oz	0.03-0.04	
	gamma-cyhalothrin	(Prolex, Declare 1.25 CS)	1.28-2.05 oz	0.0125-0.02	
		(Proaxis 0.5 CS)	3.2-5.12 oz		

**Control:**

Reduce overwintering borer populations by destroying crop residues following harvest. Plant early in areas with a history of borer infestations because it allows crops to mature before moths begin to migrate from adjoining crops and fields. Time insecticide sprays with egg laying and larval emergence, so that larvae are killed prior to entering stalks.

Application at boot stage and/or at panicle emergence for suppression of white heads. Rice stalk borer is seldom a pest.

Grasshopper	gamma-cyhalothrin	(Prolex 1.25CS)	1.28-2.05 oz	0.0125-0.02	Karate Z, Prolex, Proaxis, Declare, and Mustang Max can be safely applied before or after herbicide applications
		(Proaxis 0.5 CS)	3.2-5.12 oz		
	lambda-cyhalothrin	(Karate Z 2.08CS)	1.6-2.56 oz	0.025-0.04	
	zeta-cypermethrin	(Mustang Max 0.8 EC)	3.2-4.0 oz	0.02-0.025	

**Threshold:**

Treatments should be made when you find an average of five grasshoppers in 10 sweeps during the first two weeks of heading. After the field is completely headed and most of the heads are in the milk stage, treatments should be made when you find an average of 10 grasshoppers in 10 sweeps.

References to commercial products are included for instructional purposes only. It is not the intention of the University of Missouri to endorse any product listed here.

**Insecticides for rice - *continued***

Insect	Insecticides		Formulation per acre	Application rate (a.i. per acre)	Comments
	Common name	(Trade name)			
Rice stink bugs	carbaryl	(Sevin XLR or 4F)	2.0-3.0 pt	1.0-1.5	
		(Sevin 80S)	1.25-1.88 lb		
	malathion	(57% EC)	1.0-1.5 pt	0.625-0.94	
		gamma-cyhalothrin	(Prolex, Declare 1.25CS)		1.28-2.05 oz
	lambda-cyhalothrin		(Proaxis 0.5 CS)	3.2-5.12 oz	0.025-0.04
zeta-cypermethrin		(Karate Z 2.08CS)	1.6-2.56 oz		
		(Mustang Max 0.8E)	2.64-4.0 oz	0.0165-0.025	

**Comments:**

Apply insecticide when two stink bugs are found/sq yard, when five or more stink bugs per 10 sweeps are present during the first two weeks after fields initially reach 75% panicle emergence, or when three stink bugs are found/sq yard or more than 10 stink bugs/10 sweeps are present thereafter. Sample between 8-10 am and 6-8 pm. Repeat treatments when necessary. Apply Karate Z in min of 5 gal of water/ac. DO NOT release flood water within 7 days after application of Karate Z, Prolex, Proaxis, Declare, or Mustang Max.

**Threshold:**

An insecticide application is recommended when more than five stink bugs per 10 sweeps are collected during the first two weeks after 75% panicle emergence. For the remainder of the year, the threshold doubles to more than 10 stink bugs per 10 sweeps.

**Damage:**

"pecky" rice

**Precautions:**

All insecticides listed in this guide are poisons. These products must be handled and applied with caution. Follow all clothing and safety precautions printed on the container label. Workers reentering treated fields should follow reentry procedures provided on the insecticide label.

Do not apply long residual or highly toxic insecticides immediately next to or over fish-bearing waters. Leave an insecticide-free zone of 50-100 feet between any body of water and the treated rice field. Preharvest intervals for all recommended insecticides are listed in the *Quick Reference Insecticide Spray Guide: Rice*, MU Extension publication g7118.

References to commercial products are included for instructional purposes only. It is not the intention of the University of Missouri to endorse any product listed here.

## Insect management for soybean

In recent years the bean leaf beetle, *Dectes* stem borer, green cloverworm, Japanese beetle, southern corn rootworm, soybean aphid, soybean podworm, stink bugs, and webworms have all increased in importance as soybean insect pests in Missouri. These pests offer new management challenges to Missouri's soybean producers. Management of these insect pests is best achieved through the use of an integrated pest management (IPM) program. In such a program, all available management strategies are reviewed

and appropriate ones selected and implemented depending on the specific target insect. Control strategies may consist of cultural, mechanical, biological or chemical options. An individual control strategy or a combination of several control strategies may be used to achieve effective pest control. Commercially applied insecticide seed treatments introduced for early-season pest insect management continue to gain in popularity. Proper identification of pest species and knowledge about pest biologies are essential when making management decisions.

## Insecticides for soybean

Insect	Insecticides		Rate of formulated material per acre	Placement	REI (hours)	Preharvest interval (days)
	Common name	Trade name				
<b>Bean leaf beetle</b> <i>Certoma trifurcata</i> (Forster)  <b>Comments:</b> Treatment of seedling soybean is rarely needed, although foliage and pod feeding later in the growing season may cause substantial yield loss. If treatment of seedling soybean is needed, treat when five or more beetles are present per foot of row and one or more plants per foot of row are destroyed. Cold, dry growing conditions may lead to increased bean leaf beetle problems on emerging and small seedling soybean. Before bloom treat when five or more beetles are present per foot of row and defoliation exceeds 30%. At growth stages from bloom to pod fill, treat when defoliation reaches 20% and beetles average 10 or more per foot of row for 30-inch rows or one to three beetles for 7-inch rows. During pod fill to beginning senescence, treat when 5%-10% of pods are damaged, plants are still green, and beetles are numerous in the field.	permethrin	*Ambush Insecticide (2EC)	3.2 to 6.4 fl oz	foliage	12	60(harvest)
	esfenvalerate	*Asana XL	5.8 to 9.6 fl oz	foliage	12	21 (grain) Do not graze or feed livestock
	cyfluthrin	*Baythroid XL	1.6 to 2.8 fl oz	foliage	12	45 (grain, feeding dry vines) 15 (green forage)
	clothianidin	*Belay	3.0 to 6.0 fl oz	foliage	12	21 (harvest)
	lambda-cyhalothrin + chlorantraniliprole	*Besiege	5.0 to 8.0 fl oz	foliage	24	30 (grain) Do not graze or feed livestock
	bifenthrin	*Brigade 2EC	2.1 to 6.4 fl oz	foliage	12	18 (grain)
	chlorpyrifos + gamma-cyhalothrin	*Cobalt	19 to 38 fl oz	foliage	24	30 (grain) Do not graze or feed livestock
	chlorpyrifos + lambda-cyhalothrin	*Cobalt Advanced	16 to 38 fl oz	foliage	24	21 (grain or ears) 14 (graze or silage harvest)
	gamma-cyhalothrin	*Declare	0.77 to 1.28 fl oz	foliage	24	30 (harvest) Do not graze or feed livestock
	deltamethrin	*Delta Gold 1.5EC	1.5 to 1.9 fl oz	foliage	12	21 (grain) Do not graze or feed livestock
	dimethoate (several products)	Dimethoate 4EC	1pt (see specific labels)	foliage	48	21 (grain) 5 (graze, hay)
	lambda-cyhalothrin + thiamethoxam	*Endigo ZC	4.0 to 4.5 fl oz	foliage	24	30 (grain) Do not graze or feed livestock
	alpha-cypermethrin	*Fastac EC	2.8 to 3.8 fl oz	foliage	12	21 (grain) Do not graze or feed livestock
	zeta-cypermethrin + bifenthrin	*Hero	2.6 to 6.1 fl oz	foliage	12	21 (grain) Do not graze or feed livestock
	acetamiprid + bifenthrin	*Justice	2.5 to 3.0 fl oz	foliage	12	30 (grain) Do not graze or feed livestock
	methomyl	*Lannate SP *Lannate LV	1/4 to 3/8 lb 3/4 to 1 pt	foliage	48	14 (grain) 3 (forage), 12 (hay)
	imidacloprid + cyfluthrin	*Leverage 2.7	3.8 fl oz	foliage	12	45 (grain, feeding dry vines) 15 (green forage)
	imidacloprid + beta cyfluthrin	*Leverage 360	2.8 fl oz	foliage	12	21 (grain) 15 (hay, green forage)
	chlorpyrifos	*Lorsban Advanced	1 to 2 pt	foliage	24	28 (grain) Do not graze or feed livestock
	chlorpyrifos	*Lorsban 4E	1 to 2 pt	foliage	24	28 (grain) Do not graze or feed livestock
zeta-cypermethrin	*Mustang Maxx	2.8 to 4.0 fl oz	foliage	12	21 (grain) Do not graze or feed livestock	
zeta-cypermethrin	*Mustang Max	2.8 to 4.0 fl oz	foliage	12	21 (grain) Do not graze or feed livestock	
chlorpyrifos	*Nufos 4E	1 to 2 pt	foliage	24	28 (grain) Do not graze or feed livestock	
acephate	Orthene 97	3/4 to 1 lb	foliage	24	14 (grain) Do not graze or feed livestock	
permethrin	*Pounce 3.2EC	2 to 4 fl oz/A	foliage	12	60 (harvest)	

\*Designates a restricted-use pesticide. Use is restricted to certified applicators only. Read the label to determine appropriate insecticide rates. Be sure to follow all directions, precautions and restrictions.

**Insecticides for soybean - *continued***

Insect	Insecticides		Rate of formulated material per acre	Placement	REI (hours)	Preharvest interval (days)	
	Common name	Trade name					
<b>Bean leaf beetle - <i>continued</i></b>	sulfoxaflor + lambda-cyhalothrin	*Seeker with Isoclast active	1.6 to 2.6 fl oz	foliage	24	30 (grain) Do not graze or feed livestock	
	carbaryl	Sevin 4F	1 to 2 pt	foliage	12	21 (dry grain or hay) 14 (graze or forage)	
	carbaryl	Seven XLR Plus	1 to 2 pt	foliage	12	21 (harvest) 14 (harvest or graze forage)	
	chlorpyrifos + bifenthrin	*Stallion	9.25 to 11.75 fl oz	foliage	24	28 (grain) Do not graze or feed livestock	
	cyfluthrin	*Tombstone Helios	1.6 to 2.8 fl oz	foliage	12	45 (grain, feeding dry vines) 15 (green forage)	
	zeta-cypermethrin + bifenthrin + imadacloprid	*Triple Crown	3.5 to 4.8 fl oz	foliage	12	21 (grain) Do not graze or feed livestock	
	lambda-cyhalothrin	*Warrior II with Zeon	0.96 to 1.6 fl oz	foliage	24	30 (grain) Do not graze or feed livestock	
	<b>Seed treatments</b>						
		thiamethoxam	Cruiser 5FS	0.756-0.1512 mg/kernel	commercial on seed		
		imadacloprid	Gaucho 600	1.6-3.2 oz/100 lb seed	commercial on seed		
	clothianidin	NipsIt Inside	1.28 fl oz/100 lbs seed	commercial on seed			
<b>Blister beetle</b> <i>Epicata</i> spp.	cyfluthrin	*Baythroid XL	1.6 to 2.8 fl oz	foliage	12	45 (grain, feeding dry vines) 15 (green forage)	
	clothianidin	*Belay	3.0 to 6.0 fl oz	foliage	12	21 (harvest)	
	lambda-cyhalothrin + chlorantraniliprole	*Besiege	8.0 to 10.0 fl oz	foliage	24	30 (grain) Do not graze or feed livestock	
	chlorpyrifos + lambda-cyhalothrin	*Cobalt Advanced	11 to 26 fl oz	foliage	24	21 (grain or ears) 14 (graze or silage harvest)	
	chlorpyrifos + gamma-cyhalothrin	*Cobalt	13 to 26 fl oz	foliage	24	30 (grain) Do not graze or feed livestock	
	gamma-cyhalothrin	*Declare	1.28 to 1.54 fl oz	foliage	24	30 (harvest) Do not graze or feed livestock	
	lambda-cyhalothrin + thiamethoxam	*Endigo ZC	4.0 to 4.5 fl oz	foliage	24	30 (grain) Do not graze or feed livestock	
	alpha-cypermethrin	*Fastac EC	2.8 to 3.8 fl oz	foliage	12	21 (grain) Do not graze or feed livestock	
	zeta-cypermethrin + bifenthrin	*Hero	4.0 to 10.3 fl oz	foliage	12	21 (grain) Do not graze or feed livestock	
	zeta-cypermethrin	*Mustang Max	2.8 to 4.0 fl oz	foliage	12	21 (grain) Do not graze or feed livestock	
	zeta-cypermethrin	*Mustang Maxx	2.8 to 4.0 fl oz	foliage	12	21 (grain) Do not graze or feed livestock	
	carbaryl	Sevin 4F	1 to 2 pt	foliage	12	21 (dry grain or hay) 14 (graze or forage)	
	chlorpyrifos + bifenthrin	*Stallion	5.0 to 11.75 fl oz	foliage	24	28 (grain) Do not graze or feed livestock	
	cyfluthrin	*Tombstone Helios	1.6 to 2.8 fl oz	foliage	12	45 (grain, feeding dry vines) 15 (green forage)	
	zeta-cypermethrin + bifenthrin + imadacloprid	*Triple Crown	4.8 fl oz	foliage	12	21 (grain) Do not graze or feed livestock	
lambda-cyhalothrin	*Warrior II with Zeon	1.60 to 1.92 fl oz	foliage	24	30 (grain) Do not graze or feed livestock		

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Insecticides for soybean - *continued*

Insect	Insecticides		Rate of formulated material per acre	Placement	REI (hours)	Preharvest interval (days)
	Common name	Trade name				
<b>Corn earworm / soybean pod worm</b> <i>Helicoverpa zea</i> (Boddie)	permethrin	*Ambush Insecticide (2EC)	6.4 to 12.8 fl oz	foliage	12	60(harvest)
	esfenvalerate	*Asana XL	5.8 to 9.6 fl oz	foliage	12	21 (grain) Do not graze or feed livestock
	cyfluthrin	*Baythroid XL	1.6 to 2.8 fl oz	foliage	12	45 (grain, feeding dry vines) 15 (green forage)
	flubendiamide	*Belt SC	2.0 to 3.0 fl oz	foliage	12	14 (grain) 3 (forage and hay)
	lambda-cyhalothrin + chlorantraniliprole	*Besiege	5.0 to 8.0 fl oz	foliage	24	30 (grain) Do not graze or feed livestock
	bifenthrin	*Brigade 2EC	2.1 to 6.4 fl oz	foliage	12	18 (grain)
	chlorpyrifos + gamma-cyhalothrin	*Cobalt	19 to 38 fl oz	foliage	24	30 (grain) Do not graze or feed livestock
	chlorpyrifos + lambda-cyhalothrin	*Cobalt Advanced	16 to 38 fl oz	foliage	24	21 (grain or ears) 14 (graze or silage harvest)
	gamma-cyhalothrin	*Declare	0.77 to 1.28 fl oz	foliage	24	30 (harvest) Do not graze or feed livestock
	lambda-cyhalothrin + thiamethoxam	*Endigo ZC	3.5 to 4.0 fl oz	foliage	24	30 (grain) Do not graze or feed livestock
	alpha-cypermethrin	*Fastac EC	2.8 to 3.8 fl oz	foliage	12	21 (grain) Do not graze or feed livestock
	zeta-cypermethrin + bifenthrin	*Hero	2.6 to 6.1 fl oz	foliage	12	21 (grain) Do not graze or feed livestock
	acetamiprid + bifenthrin	*Justice	2.5 to 3.0 fl oz	foliage	12	30 (grain) Do not graze or feed livestock
	methomyl	*Lannate SP *Lannate LV	1/4 to 1/2 lb 3/4 to 1 1/2 pt	foliage	48	14 (grain) 3 (forage) 12 (hay)
	imidacloprid + cyfluthrin	*Leverage 2.7	3.8 fl oz	foliage	12	45 (grain, feeding dry vines) 15 (green forage)
	imidacloprid + beta cyfluthrin	*Leverage 360	2.8 fl oz	foliage	12	21 (grain) 15 (hay, green forage)
	chlorpyrifos	*Lorsban Advanced	1 to 2 pt	foliage	24	28 (grain) Do not graze or feed livestock
	chlorpyrifos	*Lorsban 4E	1 to 2 pt	foliage	24	28 (grain) Do not graze or feed livestock
	zeta-cypermethrin	*Mustang Maxx	2.8 to 4.0 fl oz	foliage	12	21 (grain) Do not graze or feed livestock
	zeta-cypermethrin	*Mustang Max	2.8 to 4.0 fl oz	foliage	12	21 (grain) Do not graze or feed livestock
	chlorpyrifos	*Nufos 4E	1 to 2 pt	foliage	24	28 (grain) Do not graze or feed livestock
	permethrin	*Pounce 3.2EC	4 to 8 fl oz/A	foliage	12	60 (harvest)
	chlorantraniliprole	*Prevathon	14 to 20 fl oz	foliage	4	1 (grain)
	sulfoxaflor + lambda-cyhalothrin	*Seeker with Isoclast active	1.6 to 2.6 fl oz	foliage	24	30 (grain) Do not graze or feed livestock
	carbaryl	Sevin 4F	1 to 3 pt	foliage	12	21 (dry grain or hay) 14 (graze or forage)
	chlorpyrifos + bifenthrin	*Stallion	9.25 to 11.75 fl oz	foliage	24	28 (grain) Do not graze or feed livestock
	cyfluthrin	*Tombstone Helios	1.6 to 2.8 fl oz	foliage	12	45 (grain, feeding dry vines) 15 (green forage)
	spinosad	Tracer Naturalyte	1.5 to 2 fl oz	foliage	4	28 (grain) Do not graze or feed livestock
	zeta-cypermethrin + bifenthrin + imadacloprid	*Triple Crown	4.8 fl oz	foliage	12	21 (grain) Do not graze or feed livestock
	lambda-cyhalothrin	*Warrior II with Zeon	0.96 to 1.60 fl oz	foliage	24	30 (grain) Do not graze or feed livestock

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**Insecticides for soybean - *continued***

Insect	Insecticides		Rate of formulated material per acre	Placement	REI (hours)	Preharvest interval (days)
	Common name	Trade name				
<b>Cutworm Complex</b>  <b>Comments:</b> Scout emerging plants and treat if cutting reaches or exceeds 20% and cutworms are present.	permethrin	*Ambush Insecticide (2EC)	3.2 to 6.4 fl oz	foliage	12	60(harvest) Do not graze or feed livestock
	esfenvalerate	*Asana XL	5.8 to 9.6 fl oz	foliage	12	21 (grain) Do not graze or feed livestock
	cyfluthrin	*Baythroid XL	1.6 to 2.8 fl oz	foliage	12	45 (grain, feeding dry vines) 15 (green forage)
	flubendiamide	*Belt SC	2.0 to 3.0 fl oz	foliage	12	14 (grain) 3 (forage and hay)
	lambda-cyhalothrin + chlorantraniliprole	*Besiege	5.0 to 8.0 fl oz	foliage	24	30 (grain) Do not graze or feed livestock
	bifenthrin	*Brigade 2EC	2.1 to 6.4 fl oz	foliage	12	18 (grain)
	chlorpyrifos + gamma-cyhalothrin	*Cobalt	13 to 26 fl oz	foliage	24	30 (grain) Do not graze or feed livestock
	chlorpyrifos + lambda-cyhalothrin	*Cobalt Advanced	11 to 26 fl oz	foliage	24	21 (grain or ears) 14 (graze or silage harvest)
	gamma-cyhalothrin	*Declare	0.77 to 1.28 fl oz	foliage	24	30 (harvest) Do not graze or feed livestock
	deltamethrin	*Delta Gold	1.0 to 1.5 fl oz	foliage	12	21 (grain or ears) Do not graze or feed livestock
	lambda-cyhalothrin + thiamethoxam	*Endigo ZC	3.5 to 4.0 fl oz	foliage	24	30 (grain) Do not graze or feed livestock
	alpha-cypermethrin	*Fastac EC	1.3 to 3.8 fl oz	foliage	12	21 (grain) Do not graze or feed livestock
	zeta-cypermethrin + bifenthrin	*Hero	2.6 to 6.1 fl oz	foliage	12	21 (grain) Do not graze or feed livestock
	acetamiprid + bifenthrin	*Justice	3.0 to 5.0 fl oz	foliage	12	30 (grain) Do not graze or feed livestock
	imidacloprid + beta cyfluthrin	*Leverage 360	2.8 fl oz	foliage	12	21 (grain) 15 (hay, green forage)
	chlorpyrifos	*Lorsban Advanced	1 to 2 pt	foliage	24	21 (grain) Do not graze or feed livestock
	chlorpyrifos	*Lorsban 4E	1 to 2 pt	foliage	24	28 (grain) Do not graze or feed livestock
	zeta-cypermethrin	*Mustang Maxx	1.28 to 4.0 fl oz	foliage	12	21 (grain) Do not graze or feed livestock
	zeta-cypermethrin	*Mustang Max	1.28 to 4.0 fl oz	foliage	12	21 (grain) Do not graze or feed livestock
	chlorpyrifos	*Nufos 4E	1 to 2 pt	foliage	24	28 (grain) Do not graze or feed livestock
	permethrin	*Pounce 3.2EC	2 to 4 fl oz/A	foliage	12	60 (harvest)
	sulfoxaflor + lambda-cyhalothrin	*Seeker with Isoclast active	1.6 to 2.6 fl oz	foliage	24	30 (grain) Do not graze or feed livestock
	chlorpyrifos + bifenthrin	*Stallion	3.75 to 11.75 fl oz	foliage	24	28 (grain) Do not graze or feed livestock
cyfluthrin	*Tombstone Helios	0.8 to 1.6 fl oz	foliage	12	45 (grain, feeding dry vines) 15 (green forage)	
zeta-cypermethrin + bifenthrin + imadacloprid	*Triple Crown	3.5 to 4.8 fl oz	foliage	12	21 (grain) Do not graze or feed livestock	
lambda-cyhalothrin	*Warrior II with Zeon	0.96 to 1.60 fl oz	foliage	24	30 (grain) Do not graze or feed livestock	

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Insecticides for soybean - *continued*

Insect	Insecticides		Rate of formulated material per acre	Placement	REI (hours)	Preharvest interval (days)
	Common name	Trade name				
<b>Fall armyworm</b>  <b>Comments:</b> Fall armyworm larval numbers have increased in soybean for the past several years. Larvae are foliage feeders causing minor damage in most years. A rescue insecticide application may become necessary if numbers of other defoliating caterpillars are also elevated during soybean pod fill.	cyfluthrin	*Baythroid XL	1.6 to 2.8 fl oz	foliage	12	45 (grain, feeding dry vines) 15 (green forage)
	flubendiamide	*Belt SC	2.0 to 3.0 fl oz	foliage	12	14 (grain) 3 (forage and hay)
	lambda-cyhalothrin + chlorantraniliprole	*Besiege	8.0 to 10.0 fl oz	foliage	24	30 (grain) Do not graze or feed livestock
	bifenthrin	*Brigade 2EC	2.1 to 6.4 fl oz	foliage	12	18 (grain)
	gamma-cyhalothrin	*Declare	1.28 to 1.54 fl oz	foliage	24	30 (harvest) Do not graze or feed livestock
	lambda-cyhalothrin + thiamethoxam	*Endigo ZC	4.0 to 4.5 fl oz	foliage	24	30 (grain) Do not graze or feed livestock
	alpha-cypermethrin	*Fastac EC	3.2 to 3.8 fl oz	foliage	12	21 (grain) Do not graze or feed livestock
	zeta-cypermethrin + bifenthrin	*Hero	4.0 to 10.3 fl oz	foliage	12	21 (grain) Do not graze or feed livestock
	acetamiprid + bifenthrin	*Justice	3.0 to 5.0 fl oz	foliage	12	30 (grain) Do not graze or feed livestock
	methomyl	*Lannate SP *Lannate LV	3/8 to 1/2 lb 1 to 1.5 pt	foliage	48	14 (grain) 3 (forage) 12 (hay)
	imidacloprid + beta cyfluthrin	*Leverage 360 (1st & 2nd instars only)	2.8 fl oz	foliage	12	21 (grain) 15 (hay, green forage)
	chlorpyrifos	*Lorsban Advanced	1 to 2 pt	foliage	24	28 (grain) Do not graze or feed livestock
	chlorpyrifos	*Lorsban 4E	1 to 2 pt	foliage	24	28 (grain) Do not graze or feed livestock
	zeta-cypermethrin	*Mustang Maxx	3.2 to 4.0 fl oz	foliage	12	21 (grain) Do not graze or feed livestock
	zeta-cypermethrin	*Mustang Max	3.2 to 4.0 fl oz	foliage	12	21 (grain) Do not graze or feed livestock
	chlorpyrifos	*Nufos 4E	1 to 2 pt	foliage	24	28 (grain) Do not graze or feed livestock
	chlorantraniliprole	*Prevathon	14 to 20 fl oz	foliage	4	1 (grain)
	sulfoxaflor + lambda-cyhalothrin	*Seeker with Isoclast active	1.6 to 2.6 fl oz	foliage	24	30 (grain) Do not graze or feed livestock
	chlorpyrifos + bifenthrin	*Stallion	9.25 to 11.75 fl oz	foliage	24	28 (grain) Do not graze or feed livestock
	spinosad	Tracer Naturalyte	1.5 to 2 fl oz	foliage	4	28 (grain) Do not graze or feed livestock
cyfluthrin	*Tombstone Helios	1.60 to 2.8 fl oz	foliage	12	45 (grain, feeding dry vines) 15 (green forage)	
lambda-cyhalothrin	*Warrior II with Zeon	1.60 to 1.92 fl oz	foliage	24	30 (grain) Do not graze or feed livestock	
<b>Grasshopper Complex</b>  <b>Comments:</b> Treat when defoliation reaches 30% before bloom, 20% bloom to pod fill, or when 5% to 10% of pods are damaged and hoppers are present. Treat when grasshoppers are small for optimal control.	esfenvalerate	*Asana XL	5.8 to 9.6 fl oz	foliage	12	21 (grain) Do not graze or feed livestock
	cyfluthrin	*Baythroid XL	2.0 to 2.8 fl oz	foliage	12	45 (grain, feeding dry vines) 15 (green forage)
	lambda-cyhalothrin + chlorantraniliprole	*Besiege	8.0 to 10.0 fl oz	foliage	24	30 (grain) Do not graze or feed livestock
	bifenthrin	*Brigade 2EC	2.1 to 6.4 fl oz	foliage	12	18 (grain)
	chlorpyrifos + gamma-cyhalothrin	*Cobalt	7 to 13 fl oz	foliage	24	30 (grain) Do not graze or feed livestock
	chlorpyrifos + lambda-cyhalothrin	*Cobalt Advanced	6 to 13 fl oz	foliage	24	21 (grain or ears) 14 (graze or silage harvest)
	gamma-cyhalothrin	*Declare	1.28 to 1.54 fl oz	foliage	24	30 (harvest) Do not graze or feed livestock
	deltamethrin	*Delta Gold 1.5EC	1.5 to 1.9 fl oz	foliage	12	21 (grain) Do not graze or feed livestock
	dimethoate (several products)	Dimethoate 4EC	1 pt (see specific labels)	foliage	48	21 (grain)

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**Insecticides for soybean - *continued***

Insect	Insecticides		Rate of formulated material per acre	Placement	REI (hours)	Preharvest interval (days)
	Common name	Trade name				
<b>Grasshopper - <i>continued</i></b>	lambda-cyhalothrin + thiamethoxam	*Endigo ZC	4.0 to 4.5 fl oz	foliage	24	30 (grain) Do not graze or feed livestock
	alpha-cypermethrin	*Fastac EC	3.2 to 3.8 fl oz	foliage	12	21 (grain) Do not graze or feed livestock
	zeta-cypermethrin + bifenthrin	*Hero	2.6 to 6.1 fl oz	foliage	12	21 (grain) Do not graze or feed livestock
	imidacloprid + cyfluthrin	*Leverage 2.7	3.8 fl oz	foliage	12	45 (grain, feeding dry vines) 15 (green forage)
	imidacloprid + beta cyfluthrin	*Leverage 360	2.8 fl oz	foliage	12	21 (grain) 15 (hay, green forage)
	chlorpyrifos	*Lorsban Advanced	1 to 2 pt	foliage	24	28 (grain) Do not graze or feed livestock
	chlorpyrifos	*Lorsban 4E	1/2 to 1 pt	foliage	24	28 (grain) Do not graze or feed livestock
	zeta-cypermethrin	*Mustang Maxx	3.2 to 4.0 fl oz	foliage	12	21 (grain) Do not graze or feed livestock
	zeta-cypermethrin	*Mustang Max	3.2 to 4.0 fl oz	foliage	12	21 (grain) Do not graze or feed livestock
	chlorpyrifos	*Nufos 4E	1/2 to 1 pt	foliage	24	28 (grain) Do not graze or feed livestock
	acephate	Orthene 97	1/4 to 1/2 lb	foliage	24	14 (grain) Do not graze or feed livestock
	chlorpyrifos + bifenthrin	*Stallion	5.0 to 11.75 fl oz	foliage	24	28 (grain) Do not graze or feed livestock
	cyfluthrin	*Tombstone Helios	2.0 to 2.8 fl oz	foliage	12	45 (grain, feeding dry vines) 15 (green forage)
	zeta-cypermethrin + bifenthrin + imadacloprid	*Triple Crown	4.8 fl oz	foliage	12	21 (grain) Do not graze or feed livestock
	lambda-cyhalothrin	*Warrior II with Zeon	1.60 to 1.92 fl oz	foliage	24	30 (grain) Do not graze or feed livestock
	<b>Green cloverworm</b> <i>Hypena scabra</i> (Fabricius)	permethrin	*Ambush Insecticide (2EC)	3.2 to 6.4 fl oz	foliage	12
esfenvalerate		*Asana XL	2.9 to 5.8 fl oz	foliage	12	21 (grain) Do not graze or feed livestock
cyfluthrin		*Baythroid XL	0.8 to 1.6 fl oz	foliage	12	45 (grain, feeding dry vines) 15 (green forage)
flubendiamide		*Belt SC	2.0 to 3.0 fl oz	foliage	12	14 (grain) 3 (forage and hay)
lambda-cyhalothrin + chlorantraniliprole		*Besiege	5.0 to 8.0 fl oz	foliage	24	30 (grain) Do not graze or feed livestock
bifenthrin		*Brigade 2EC	2.1 to 6.4 fl oz	foliage	12	18 (grain)
chlorpyrifos + gamma-cyhalothrin		*Cobalt	7 to 13 fl oz	foliage	24	30 (grain) Do not graze or feed livestock
chlorpyrifos + lambda-cyhalothrin		*Cobalt Advanced	6 to 13 fl oz	foliage	24	21 (grain or ears) 14 (graze or silage harvest)
gamma-cyhalothrin		*Declare	0.77 to 1.28 fl oz	foliage	24	30 (harvest) Do not graze or feed livestock
deltamethrin		*Delta Gold 1.5EC	1.5 to 1.9 fl oz	broadcast on foliage	12	21 (grain) Do not graze or feed livestock
lambda-cyhalothrin + thiamethoxam		*Endigo ZC	3.5 to 4.0 fl oz	foliage	24	30 (grain) Do not graze or feed livestock
alpha-cypermethrin		*Fastac EC	2.8 to 3.8 fl oz	foliage	12	21 (grain) Do not graze or feed livestock
zeta-cypermethrin + bifenthrin		*Hero	2.6 to 6.1 fl oz	foliage	12	21 (grain) Do not graze or feed livestock
methomyl		*Lannate SP *Lannate LV	1/4 to 1/2 lb 3/4 to 1.5 pt	foliage	48	14 (grain) 3 (forage) 12 (hay)
imidacloprid + cyfluthrin		*Leverage 2.7	3.8 fl oz	foliage	12	45 (grain, feeding dry vines) 15 (green forage)
imidacloprid + cyfluthrin		*Leverage 360	2.8 fl oz	foliage	12	21 (grain) 15 (hay, green forage)

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Insecticides for soybean - *continued*

Insect	Insecticides		Rate of formulated material per acre	Placement	REI (hours)	Preharvest interval (days)	
	Common name	Trade name					
Green cloverworm - <i>continued</i>	chlorpyrifos	*Lorsban Advanced	1/2 to 1 pt	foliage	24	28 (grain) Do not graze or feed livestock	
	chlorpyrifos	*Lorsban 4E	1/2 to 1 pt	foliage	24	28 (grain) Do not graze or feed livestock	
	zeta-cypermethrin	*Mustang Maxx	2.8 to 4.0 fl oz	foliage	12	21 (grain) Do not graze or feed livestock	
	zeta-cypermethrin	*Mustang Max	2.8 to 4.0 fl oz	foliage	12	21 (grain) Do not graze or feed livestock	
	chlorpyrifos	*Nufos 4E	1/2 to 1 pt	foliage	24	28 (grain) Do not graze or feed livestock	
	acephate	Orthene 97	3/4 to 1 lb	foliage	24	14 (grain) Do not graze or feed livestock	
	permethrin	*Pounce 3.2EC	2 to 4 fl oz/A	foliage	12	60 (harvest)	
	sulfoxaflor + lambda-cyhalothrin	*Seeker with Isoclast active	1.6 to 2.6 fl oz	foliage	24	30 (grain) Do not graze or feed livestock	
	carbaryl	Sevin 4F	2 to 3 pt	foliage	12	21 (dry grain or hay) 14 (graze or forage)	
	carbaryl	Seven XLR Plus	1 to 2 pt	foliage	12	21 (harvest)	
	chlorpyrifos + bifenthrin	*Stallion	5.0 to 11.75 fl oz	foliage	24	28 (grain) Do not graze or feed livestock	
	spinosad	Tracer Naturalyte	1 to 2 fl oz	foliage	4	28 (grain) Do not graze or feed livestock	
	cyfluthrin	*Tombstone Helios	0.8 to 1.6 fl oz	foliage	12	45 (grain, feeding dry vines) 15 (green forage)	
	zeta-cypermethrin + bifenthrin + imadacloprid	*Triple Crown	3.5 to 4.8 fl oz	foliage	12	21 (grain) Do not graze or feed livestock	
	lambda-cyhalothrin	*Warrior II with Zeon	0.96 to 1.60 fl oz	foliage	24	30 (grain) Do not graze or feed livestock	
	Japanese beetle adults <i>Popillia japonica</i> Newman	permethrin	*Ambush Insecticide (2EC)	6.4 to 12.8 fl oz	foliage	12	60(harvest)
		esfenvalerate	*Asana XL	5.8 to 9.6 fl oz	foliage	12	21 (grain) Do not graze or feed livestock
		cyfluthrin	*Baythroid XL	1.6 to 2.8 fl oz	foliage	12	45 (grain, feeding dry vines) 15 (green forage)
		clothianidin	*Belay	3.0 to 6.0 fl oz	foliage	12	21 (harvest)
		lambda-cyhalothrin + chlorantraniliprole	*Besiege	8.0 to 10.0 fl oz	foliage	24	30 (grain) Do not graze or feed livestock
bifenthrin		*Brigade 2EC	2.1 to 6.4 fl oz	foliage	12	18 (grain)	
gamma-cyhalothrin		*Declare	1.28 to 1.54 fl oz	foliage	24	30 (harvest) Do not graze or feed livestock	
chlorpyrifos + gamma-cyhalothrin		*Cobalt	19 to 38 fl oz	foliage	24	30 (grain) Do not graze or feed livestock	
chlorpyrifos + lambda-cyhalothrin		*Cobalt Advanced	16 to 38 fl oz	foliage	24	21 (grain or ears) 14 (graze or silage harvest)	
lambda-cyhalothrin + thiamethoxam		*Endigo ZC	4.0 to 4.5 fl oz	foliage	24	30 (grain) Do not graze or feed livestock	
alpha-cypermethrin		*Fastac EC	2.8 to 3.8 fl oz	foliage	12	21 (grain) Do not graze or feed livestock	
zeta-cypermethrin + bifenthrin		*Hero	4.0 to 10.3 fl oz	foliage	12	21 (grain) Do not graze or feed livestock	
acetamiprid + bifenthrin		*Justice	3.0 to 5.0 fl oz	foliage	12	30 (grain) Do not graze or feed livestock	
imidacloprid + cyfluthrin		*Leverage 2.7	3.8 fl oz	foliage	12	45 (grain, feeding dry vines) 15 (green forage)	
imidacloprid + beta cyfluthrin		*Leverage 360	2.8 fl oz	foliage	12	21 (grain) 15 (hay, green forage)	
zeta-cypermethrin		*Mustang Maxx	2.8 to 4.0 fl oz	foliage	12	21 (grain) Do not graze or feed livestock	
zeta-cypermethrin		*Mustang Max	2.8 to 4.0 fl oz	foliage	12	21 (grain) Do not graze or feed livestock	
permethrin		*Pounce 3.2EC	2 to 4 fl oz	foliage	12	60 (grain)	

\*Designates a restricted-use pesticide. Use is restricted to certified applicators only. Read the label to determine appropriate insecticide rates. Be sure to follow all directions, precautions and restrictions.

**Insecticides for soybean - *continued***

Insect	Insecticides		Rate of formulated material per acre	Placement	REI (hours)	Preharvest interval (days)
	Common name	Trade name				
<b>Japanese beetle - <i>continued</i></b>	sulfoxaflor + lambda-cyhalothrin	*Seeker with Isoclast active	2.6 to 3.1 fl oz	foliage	24	30 (grain) Do not graze or feed livestock
	carbaryl	Sevin 4F	1 to 2 pt	foliage	12	21 (dry grain or hay)
	carbaryl	Sevin XLR Plus	1 to 2 pt	foliage	12	21 (grain) 14 (harvest or graze forage)
	chlorpyrifos + bifenthrin	*Stallion	5.0 to 11.75 fl oz	foliage	24	28 (grain) Do not graze or feed livestock
	cyfluthrin	*Tombstone Helios	0.8 to 1.6 fl oz	foliage	12	45 (grain, feeding dry vines) 15 (green forage)
	zeta-cypermethrin + bifenthrin + imadacloprid	*Triple Crown	4.8 fl oz	foliage	12	21 (grain) Do not graze or feed livestock
	lambda-cyhalothrin	*Warrior II with Zeon	1.60 to 1.92 fl oz	foliage	24	30 (grain) Do not graze or feed livestock
	<b>Mexican bean beetle</b> <i>Epilachna varivestis</i> Mulsant	permethrin	*Ambush Insecticide (2EC)	3.2 to 6.4 fl oz	foliage	12
esfenvalerate		*Asana XL	5.8 to 9.6 fl oz	foliage	12	21 (grain) Do not graze or feed livestock
cyfluthrin		*Baythroid XL	1.6 to 2.8 fl oz	foliage	12	45 (grain, feeding dry vines) 15 (green forage)
lambda-cyhalothrin + chlorantraniliprole		*Besiege	5.0 to 8.0 fl oz	foliage	24	30 (grain) Do not graze or feed livestock
bifenthrin		*Brigade 2EC	2.1 to 6.4 fl oz	foliage	12	18 (grain)
chlorpyrifos + gamma-cyhalothrin		*Cobalt	19 to 38 fl oz	foliage	24	30 (grain) Do not graze or feed livestock
gamma-cyhalothrin		*Declare	0.77 to 1.28 fl oz	foliage	24	30 (harvest) Do not graze or feed livestock
dimethoate		Dimethoate 4EC	1 pt	foliage	48	21 (grain)
lambda-cyhalothrin + thiamethoxam		*Endigo ZC	3.5 to 4.0 fl oz	foliage	24	30 (grain) Do not graze or feed livestock
alpha-cypermethrin		*Fastac EC	2.8 to 3.8 fl oz	foliage	12	21 (grain) Do not graze or feed livestock
zeta-cypermethrin + bifenthrin		*Hero	4.0 to 10.3 fl oz	foliage	12	21 (grain) Do not graze or feed livestock
acetamiprid + bifenthrin		*Justice	2.5 to 3.0 fl oz	foliage	12	30 (grain) Do not graze or feed livestock
methomyl		*Lannate SP *Lannate LV	1/4 to 1/2 lb 3/4 to 1.5 pt	foliage	48	14 (grain) 3 (forage) 12 (hay)
imidacloprid + cyfluthrin		*Leverage 2.7	3.8 fl oz	foliage	12	45 (grain) 15 (hay, green forage)
imidacloprid + beta cyfluthrin		*Leverage 360	2.8 fl oz	foliage	12	21 (grain) 15 (hay, green forage)
chlorpyrifos		*Lorsban Advanced	1 to 2 pt	foliage	24	28 (grain) Do not graze or feed livestock
chlorpyrifos		*Lorsban 4E	1 to 2 pt	foliage	24	28 (grain) Do not graze or feed livestock
zeta-cypermethrin		*Mustang Maxx	2.8 to 4.0 fl oz	foliage	12	21 (grain) Do not graze or feed livestock
zeta-cypermethrin		*Mustang Max	2.8 to 4.0 fl oz	foliage	12	21 (grain) Do not graze or feed livestock
chlorpyrifos		*Nufos 4E	1 to 2 pt	foliage	24	28 (grain) Do not graze or feed livestock
acephate		Orthene 97	3/4 to 1 lb	foliage	24	14 (grain) Do not graze or feed livestock
permethrin	*Pounce 3.2EC	2 to 4 fl oz/A	foliage	12	60 (harvest)	
sulfoxaflor + lambda-cyhalothrin	*Seeker with Isoclast active	1.6 to 2.6 fl oz	foliage	24	30 (grain) Do not graze or feed livestock	
carbaryl	Sevin 4F	1 to 2 pt	foliage	12	21 (dry grain or hay) 14 (graze or forage)	
chlorpyrifos + bifenthrin	*Stallion	5.0 to 11.75 fl oz	foliage	24	28 (grain) Do not graze or feed livestock	
cyfluthrin	*Tombstone Helios	1.6 to 2.8 fl oz	foliage	12	45 (grain, feeding dry vines) 15 (green forage)	

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Insecticides for soybean - *continued*

Insect	Insecticides		Rate of formulated material per acre	Placement	REI (hours)	Preharvest interval (days)
	Common name	Trade name				
<b>Mexican bean beetle - continued</b>	zeta-cypermethrin + bifenthrin + imadacloprid	*Triple Crown	4.8 fl oz	foliage	12	21 (grain) Do not graze or feed livestock
	lambda-cyhalothrin	*Warrior II with Zeon	0.96 to 1.60 fl oz	foliage	24	30 (grain) Do not graze or feed livestock
<b>Potato leafhopper <i>Empoasca fabae</i> (Harris)</b>	permethrin	*Ambush Insecticide (2EC)	3.2 to 6.4 fl oz	foliage	12	60 (harvest)
	esfenvalerate	*Asana XL	2.9 to 5.8 fl oz	foliage	12	21 (grain) Do not graze or feed livestock
<b>Comments:</b> Treat when potato leafhopper numbers (adults + nymphs) average six or more per plant at bloom, or 13 or more per plant at seed set and edges of leaves appear wrinkled and burned. Soybeans with none or few hairs on stem and leaflet surfaces are at greater risk of damage from this pest than soybean leaflets with numerous hairs or pubescence present. The hairs physically hold leafhoppers away from plant surfaces preventing these insects from probing inside plant tissues where they suck up plant juices with their piercing-sucking mouthparts.	cyfluthrin	*Baythroid XL	0.8 to 1.6 fl oz	foliage	12	45 (grain, feeding dry vines) 15 (green forage)
	clothianidin	*Belay	3.0 to 6.0 fl oz	foliage	12	21 (harvest)
	lambda-cyhalothrin + chlorantraniliprole	*Besiege	5.0 to 8.0 fl oz	foliage	24	30 (grain) Do not graze or feed livestock
	bifenthrin	*Brigade 2EC	2.1 to 6.4 fl oz	foliage	12	18 (grain)
	chlorpyrifos + gamma-cyhalothrin	*Cobalt	19 to 38 fl oz	foliage	24	30 (grain) Do not graze or feed livestock
	chlorpyrifos + lambda-cyhalothrin	*Cobalt Advanced	16 to 38 fl oz	foliage	24	21 (grain or ears) 14 (graze or silage harvest)
	gamma-cyhalothrin	*Declare	0.77 to 1.28 fl oz	foliage	24	30 (harvest) Do not graze or feed livestock
	dimethoate (several products)	Dimethoate 4EC	1 pt (see specific labels)	foliage	48	21 (grain)
	lambda-cyhalothrin + thiamethoxam	*Endigo ZC	3.5 to 4.0 fl oz	foliage	24	30 (grain) Do not graze or feed livestock
	alpha-cypermethrin	*Fastac EC	2.8 to 3.8 fl oz	foliage	12	21 (grain) Do not graze or feed livestock
	zeta-cypermethrin + bifenthrin	*Hero	4.0 to 10.3 fl oz	foliage	12	21 (grain) Do not graze or feed livestock
	acetamiprid + bifenthrin	*Justice	2.5 to 3.0 fl oz	foliage	12	30 (grain) Do not graze or feed livestock
	methomyl	*Lannate SP *Lannate LV	1/4 to 1/2 lb 3/4 to 1.5 pt	foliage	48	14 (grain) 3 (forage) 12 (hay)
	imidacloprid + cyfluthrin	*Leverage 2.7	3.8 fl oz	foliage	12	45 (grain, feeding dry vines) 15 (green forage)
	imidacloprid + beta cyfluthrin	*Leverage 360	2.8 fl oz	foliage	12	21 (grain) 15 (hay, green forage)
	chlorpyrifos	*Lorsban Advanced	1 to 2 pt	foliage	24	28 (grain) Do not graze or feed livestock
	chlorpyrifos	*Lorsban 4E	1 to 2 pt	foliage	24	28 (grain) Do not graze or feed livestock
	zeta-cypermethrin	*Mustang Maxx	2.8 to 4.0 fl oz	foliage	12	21 (grain) Do not graze or feed livestock
zeta-cypermethrin	*Mustang Max	2.8 to 4.0 fl oz	foliage	12	21 (grain) Do not graze or feed livestock	
chlorpyrifos	*Nufos 4E	1 to 2 pt	foliage	24	28 (grain) Do not graze or feed livestock	
acephate	Orthene 97	3/4 to 1 lb	foliage	24	14 (grain)	
permethrin	*Pounce 3.2EC	2 to 4 fl oz/A	foliage	12	60 (harvest)	
sulfoxaflor + lambda-cyhalothrin	*Seeker with Isoclast active	1.6 to 2.6 fl oz	foliage	24	30 (grain) Do not graze or feed livestock	
chlorpyrifos + bifenthrin	*Stallion	5.0 to 11.75 fl oz	foliage	24	28 (grain) Do not graze or feed livestock	
cyfluthrin	*Tombstone Helios	1.6 to 2.8 fl oz	foliage	12	45 (grain, feeding dry vines) 15 (green forage)	
lambda-cyhalothrin	*Warrior II with Zeon	0.96 to 1.60 fl oz	foliage	24	30 (grain) Do not graze or feed livestock	

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**Insecticides for soybean - *continued***

Insect	Insecticides		Rate of formulated material per acre	Placement	REI (hours)	Preharvest interval (days)
	Common name	Trade name				
<b>Silverspotted skipper</b> <i>Epagyreus clarus</i> is a butterfly of the family Hesperidae.  <b>Comment:</b> Found throughout North America, in Missouri larvae of this insect are rare to occasional pest of soybean. Damage results when larvae defoliate soybean plants at levels of 30% or more prior to bloom and 20% or more from bloom through podfill.	cyfluthrin	*Baythroid XL	1.6 to 2.8 fl oz	foliage	12	45 (grain, feeding dry vines) 15 (green forage)
	flubendiamide	*Belt SC	2.0 to 3.0 fl oz	foliage	12	14 (grain) 3 (forage and hay)
	lambda-cyhalothrin + chlorantraniliprole	*Besiege	8.0 to 10.0 fl oz	foliage	24	30 (grain) Do not graze or feed livestock
	bifenthrin	*Brigade 2EC	2.1 to 6.4 fl oz	foliage	12	18 (grain)
	chlorpyrifos + lambda-cyhalothrin	*Cobalt Advanced	11 to 26 fl oz	foliage	24	21 (grain or ears) 14 (graze or silage harvest)
	chlorpyrifos + gamma-cyhalothrin	*Cobalt	13 to 26 fl oz	foliage	24	30 (grain) Do not graze or feed livestock
	imidacloprid + cyfluthrin	*Leverage 2.7	3.8 fl oz	foliage	12	45 (grain, feeding dry vines) 15 (green forage)
	imidacloprid + beta cyfluthrin	*Leverage 360	2.8 fl oz	foliage	12	21 (grain) 15 (hay, green forage)
	zeta-cypermethrin	*Mustang Maxx	1.28 to 4.0 fl oz	foliage	12	21 (grain) Do not graze or feed livestock
	zeta-cypermethrin	*Mustang Max	1.28 to 4.0 fl oz	foliage	12	21 (grain) Do not graze or feed livestock
	chlorpyrifos + bifenthrin	*Stallion	3.75 to 11.75 fl oz	foliage	24	28 (grain) Do not graze or feed livestock
	sulfoxaflor + lambda-cyhalothrin	*Seeker with Isoclast active	2.6 to 3.1 fl oz	foliage	24	30 (grain) Do not graze or feed livestock
	cyfluthrin	*Tombstone Helios	1.6 to 2.8 fl oz	foliage	12	45 (grain, feeding dry vines) 15 (green forage)
	lambda-cyhalothrin	*Warrior II with Zeon	1.60 to 1.92 fl oz	foliage	24	30 (grain)
	<b>Southern corn rootworm beetle (adult)</b> <i>Diabrotica undecimpunctata</i> , also known as the spotted cucumber beetle. In recent years, high beetle populations have caused economic levels of damage to soybean leaves and occasionally flowers.	cyfluthrin	*Baythroid XL	1.6 to 2.8 fl oz	foliage	12
flubendiamide		*Belt SC	2.0 to 3.0 fl oz	foliage	12	14 (grain) 3 (forage and hay)
lambda-cyhalothrin + chlorantraniliprole		*Besiege	5.0 to 8.0 fl oz	foliage	24	30 (grain) Do not graze or feed livestock
bifenthrin		*Brigade 2EC	2.1 to 6.4 fl oz	foliage	12	18 (grain)
chlorpyrifos + lambda-cyhalothrin		*Cobalt Advanced	16 to 38 fl oz	foliage	24	21 (grain or ears) 14 (graze or silage harvest)
chlorpyrifos + gamma-cyhalothrin		*Cobalt	19 to 38 fl oz	foliage	24	30 (grain) Do not graze or feed livestock
gamma-cyhalothrin		*Declare	0.77 to 1.28 fl oz	foliage	24	30 (harvest) Do not graze or feed livestock
lambda-cyhalothrin + thiamethoxam		*Endigo ZC	3.5 to 4.0 fl oz	foliage	24	30 (grain) Do not graze or feed livestock
acetamiprid + bifenthrin		*Justice	2.5 to 3.0 fl oz	foliage	12	30 (grain) Do not graze or feed livestock
imidacloprid + cyfluthrin		*Leverage 2.7	3.8 fl oz	foliage	12	45 (grain, feeding dry vines) 15 (green forage)
imidacloprid + beta cyfluthrin		*Leverage 360	2.8 fl oz	foliage	12	21 (grain) 15 (hay, green forage)
zeta-cypermethrin		*Mustang Maxx	2.8 to 4.0 fl oz	foliage	12	21 (grain) Do not graze or feed livestock
zeta-cypermethrin		*Mustang Max	2.8 to 4.0 fl oz	foliage	12	21 (grain) Do not graze or feed livestock
chlorpyrifos + bifenthrin		*Stallion	5.0 to 11.75 fl oz	foliage	24	28 (grain) Do not graze or feed livestock
sulfoxaflor + lambda-cyhalothrin		*Seeker with Isoclast active	1.6 to 2.6 fl oz	foliage	24	30 (grain) Do not graze or feed livestock
cyfluthrin		*Tombstone Helios	1.6 to 2.8 fl oz	foliage	12	45 (grain, feeding dry vines) 15 (green forage)
lambda-cyhalothrin		*Warrior II with Zeon	0.96 to 1.60 fl oz	foliage	24	30 (grain) Do not graze or feed livestock

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Insecticides for soybean - *continued*

Insect	Insecticides		Rate of formulated material per acre	Placement	REI (hours)	Preharvest interval (days)
	Common name	Trade name				
<b>Soybean aphid</b> <i>Aphis glycines</i> Matsumura  <b>Comments:</b> Treat when 250 or more aphids are present per plant when soybean plants are in the R1 through R5 growth stages. Larger yield responses will be realized when the insecticide is applied closer to the R1 stage of growth as compared to later growth stages. In Missouri, beneficial insects are very important and can often control light to moderate soybean aphid infestations if give an opportunity to do so.	esfenvalerate	*Asana XL	5.8 to 9.6 fl oz	foliage	12	21 (grain) Do not graze or feed livestock
	cyfluthrin	*Baythroid XL	2.0 to 2.8 fl oz	foliage	12	45 (grain, feeding dry vines) 15 (green forage)
	clothianidin	*Belay	3.0 to 6.0 fl oz	foliage	12	21 (harvest)
	bifenthrin	*Brigade 2EC	2.1 to 6.4 fl oz	foliage	12	18 (grain)
	lambda-cyhalothrin + chlorantraniliprole	*Besiege	5.0 to 8.0 fl oz	foliage	24	30 (grain) Do not graze or feed livestock
	chlorpyrifos + gamma-cyhalothrin	*Cobalt	13 to 26 fl oz	foliage	24	30 (grain) Do not graze or feed livestock
	chlorpyrifos + gamma-cyhalothrin	*Cobalt Advanced	11 to 26 fl oz	foliage	24	30 (grain) Do not graze or feed livestock
	gamma-cyhalothrin	*Declare	0.77 to 1.28 fl oz	foliage	24	30 (harvest) Do not graze or feed livestock
	deltamethrin	*Delta Gold 1.5EC	1.5 to 1.9 fl oz	foliage	12	21 (grain) Do not graze or feed livestock
	dimethoate (several products)	Dimethoate 4EC	1 pt (see specific labels)	foliage	48	21 (grain)
	lambda-cyhalothrin + thiamethoxam	*Endigo ZC	3.5 to 4.0 fl oz	foliage	24	30 (grain) Do not graze or feed livestock
	alpha-cypermethrin	*Fastac EC	2.8 to 3.8 fl oz	foliage	12	21 (grain) Do not graze or feed livestock
	zeta-cypermethrin + bifenthrin	*Hero	4.0 to 10.3 fl oz	foliage	12	21 (grain) Do not graze or feed livestock
	acetamiprid + bifenthrin	*Justice	2.5 to 3.0 fl oz	foliage	12	30 (grain) Do not graze or feed livestock
	imidacloprid + cyfluthrin	*Leverage 2.7	3.8 fl oz	foliage	12	45 (grain, feeding dry vines) 15 (green forage)
	imidacloprid + beta cyfluthrin	*Leverage 360	2.8 fl oz	foliage	12	21 (grain) 15 (hay, green forage)
	chlorpyrifos	*Lorsban Advanced	1 to 2 pt	foliage	24	28 (grain) Do not graze or feed livestock
	chlorpyrifos	*Lorsban 4E	1 to 2 pt	foliage	24	28 (grain) Do not graze or feed livestock
	zeta-cypermethrin	*Mustang Maxx	2.8 to 4.0 fl oz	foliage	12	21 (grain) Do not graze or feed livestock
	zeta-cypermethrin	*Mustang Max	2.8 to 4.0 fl oz	foliage	12	21 (grain) Do not graze or feed livestock
	chlorpyrifos	*Nufos 4E	1 to 2 pt	foliage	24	28 (grain) Do not graze or feed livestock
	acephate	Orthene 97	3/4 to 1 lb	foliage	24	14 (grain)
	permethrin	*Pounce 3.2EC	4 to 8 fl oz/A	foliage	12	60 (harvest)
	sulfoxaflor + lambda-cyhalothrin	*Seeker with Isoclast active	1.6 to 2.6 fl oz	foliage	24	30 (grain) Do not graze or feed livestock
	chlorpyrifos + bifenthrin	*Stallion	5.0 to 11.75 fl oz	foliage	24	28 (grain) Do not graze or feed livestock
	cyfluthrin	*Tombstone Helios	2.0 to 2.8 fl oz	foliage	12	45 (grain, feeding dry vines) 15 (green forage)
	sulfoxaflor	*Transform WG	0.75 to 1.0 oz	foliage	24	7 (grain, forage, hay)
	zeta-cypermethrin + bifenthrin + imadacloprid	*Triple Crown	3.5 to 4.8 fl oz	foliage	12	21 (grain) Do not graze or feed livestock
lambda-cyhalothrin	*Warrior II with Zeon	0.96 to 1.60 fl oz	foliage	24	30 (grain) Do not graze or feed livestock	

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**Insecticides for soybean - *continued***

Insect	Insecticides		Rate of formulated material per acre	Placement	REI (hours)	Preharvest interval (days)
	Common name	Trade name				
<b>Soybean looper</b> <i>Pseudoplusia includens</i> (Walker)  <b>Comments:</b> Treat when defoliation reaches 30% before bloom and 20% from bloom to pod fill. The soybean looper is the most common looper found in soybean, although at least four other looper species also may occur in Missouri soybean fields.	permethrin	*Ambush Insecticide (2EC)	6.4 to 12.8 fl oz	foliage	12	60(harvest)
	flubendiamide	*Belt SC	2.0 to 3.0 fl oz	foliage	12	14 (grain) 3 (forage and hay)
	lambda-cyhalothrin + chlorantraniliprole	*Besiege	10.0 fl oz	foliage	24	30 (grain) Do not graze or feed livestock
	bifenthrin	*Brigade 2EC	2.1 to 6.4 fl oz	foliage	12	18 (grain)
	gamma-cyhalothrin	*Declare (suppression only)	1.54 fl oz	foliage	24	30 (harvest) Do not graze or feed livestock
	alpha-cypermethrin	*Fastac EC	2.8 to 3.8 fl oz	foliage	12	21 (grain) Do not graze or feed livestock
	zeta-cypermethrin + bifenthrin	*Hero	4.0 to 10.3 fl oz	foliage	12	21 (grain) Do not graze or feed livestock
	acetamiprid + bifenthrin	*Justice	5.0 fl oz	foliage	12	30 (harvest) Do not graze or feed livestock
	zeta-cypermethrin	*Mustang Maxx	3.2 to 4.0 fl oz	foliage	12	21 (grain) Do not graze or feed livestock
	zeta-cypermethrin	*Mustang Max	3.2 to 4.0 fl oz	foliage	12	21 (grain) Do not graze or feed livestock
	acephate	Orthene 97	3/4 to 1 lb	foliage	24	14 (grain)
	microencapsulated methyl parathion	*PennCap-M	2 to 3 pt	foliage	96	20 (grain)
	permethrin	*Pounce 3.2EC	4 to 8 fl oz/A	foliage	12	60 (harvest)
	chlorpyrifos + bifenthrin	*Stallion	9.25 to 11.75 fl oz	foliage	24	28 (grain) Do not graze or feed livestock
	sulfoxaflor + lambda-cyhalothrin	*Seeker with Isoclast active (suppression only)	3.1 fl oz	foliage	24	30 (grain) Do not graze or feed livestock
	cyfluthrin	*Tombstone Helios	2.8 fl oz	foliage	12	45 (grain, feeding dry vines) 15 (green forage)
	spinosid	Tracer Naturalyte	1 to 2 fl oz	foliage	4	28 (grain) Do not graze or feed livestock
	zeta-cypermethrin + bifenthrin + imadacloprid	*Triple Crown	4.8 fl oz	foliage	12	21 (grain) Do not graze or feed livestock
	lambda-cyhalothrin	*Warrior II with Zeon	1.92 fl oz	foliage	24	30 (grain) Do not graze or feed livestock
	<b>Stink bug complex</b>	esfenvalerate	*Asana XL	5.8 to 9.6 fl oz	foliage	12
Green stink bug <i>Acrosternum hilare</i> (Say)	cyfluthrin	*Baythroid XL	1.6 to 2.8 fl oz	foliage	12	45 (grain, feeding dry vines) 15 (green forage)
<b>Comments:</b> Treat when adult stink bugs or large nymphs average one or more per foot of row during pod fill. In Missouri, "delayed senescence" of soybean has been attributed to heavy feeding by green stink bug during soybean reproductive growth stages.	clothianidin	*Belay	3.0 to 6.0 fl oz	foliage	12	21 (harvest)
	lambda-cyhalothrin + chlorantraniliprole	*Besiege	8.0 to 10.0 fl oz	foliage	24	30 (grain) Do not graze or feed livestock
	bifenthrin	*Brigade 2EC	2.1 to 6.4 fl oz	foliage	12	18 (grain)
	chlorpyrifos + gamma-cyhalothrin	*Cobalt	19 to 38 fl oz	foliage	24	30 (grain) Do not graze or feed livestock
	chlorpyrifos + lambda-cyhalothrin	*Cobalt Advanced	16 to 38 fl oz	foliage	24	21 (grain or ears) 14 (graze or silage harvest)
	gamma-cyhalothrin	*Declare	1.28 to 1.54 fl oz	foliage	24	30 (harvest) Do not graze or feed livestock
	deltamethrin	*Delta Gold 1.5EC	1.5 to 1.9 fl oz	foliage	12	21 (grain) Do not graze or feed livestock
	lambda-cyhalothrin + thiamethoxam	*Endigo ZC	4.0 to 4.5 fl oz	foliage	24	30 (grain) Do not graze or feed livestock
	alpha-cypermethrin	*Fastac EC	3.2 to 3.8 fl oz	foliage	12	21 (grain) Do not graze or feed livestock
	zeta-cypermethrin + bifenthrin	*Hero	4.0 to 10.3 fl oz	foliage	12	21 (grain) Do not graze or feed livestock
acetamiprid + bifenthrin	*Justice	5.0 fl oz	foliage	12	30 (grain) Do not graze or feed livestock	

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Insecticides for soybean - *continued*

Insect	Insecticides		Rate of formulated material per acre	Placement	REI (hours)	Preharvest interval (days)	
	Common name	Trade name					
<b>Stink bug complex - <i>continued</i></b>	imidacloprid + cyfluthrin	*Leverage 2.7	3.8 fl oz	foliage	12	45 (grain, feeding dry vines) 15 (green forage)	
	imidacloprid + beta cyfluthrin	*Leverage 360	2.8 fl oz	foliage	12	21 (grain) 15 (hay, green forage)	
	zeta-cypermethrin	*Mustang Maxx	3.2 to 4.0 fl oz	foliage	12	21 (grain) Do not graze or feed livestock	
	zeta-cypermethrin	*Mustang Max	3.2 to 4.0 fl oz	foliage	12	21 (grain) Do not graze or feed livestock	
	acephate	Orthene 97	1/2 to 1 lb	foliage	24	14 (grain)	
	carbaryl	Sevin 4F	2 to 3 pt	foliage	12	21 (dry grain or hay) 14 (graze or forage)	
	sulfoxaflor + lambda-cyhalothrin	*Seeker with Isoclast active	2.6 to 3.1 fl oz	foliage	24	30 (grain) Do not graze or feed livestock	
	chlorpyrifos + bifenthrin	*Stallion	9.25 to 11.75 fl oz	foliage	24	28 (grain) Do not graze or feed livestock	
	cyfluthrin	*Tombstone Helios	1.6 to 2.8 fl oz	foliage	12	45 (grain, feeding dry vines) 15 (green forage)	
	zeta-cypermethrin + bifenthrin + imadacloprid	*Triple Crown	4.8 fl oz	foliage	12	21 (grain) Do not graze or feed livestock	
	lambda-cyhalothrin	*Warrior II with Zeon	1.60 to 1.92 fl oz	foliage	24	30 (grain) Do not graze or feed livestock	
	<b>Thistle caterpillar</b> <i>Vanessa cardui</i>	permethrin	*Ambush Insecticide (2EC)	3.2 to 6.4 fl oz	foliage	12	60(harvest)
		lambda-cyhalothrin + chlorantraniliprole	*Besiege	5.0 to 8.0 fl oz	foliage	24	30 (grain) Do not graze or feed livestock
		chlorpyrifos + lambda-cyhalothrin	*Cobalt Advanced	11 to 26 fl oz	foliage	24	21 (grain or ears) 14 (graze or silage harvest)
		chlorpyrifos + gamma-cyhalothrin	*Cobalt	13 to 26 fl oz	foliage	24	30 (grain) Do not graze or feed livestock
gamma-cyhalothrin		*Declare	0.77 to 1.28 fl oz	foliage	24	30 (harvest) Do not graze or feed livestock	
lambda-cyhalothrin + thiamethoxam		*Endigo ZC	3.5 to 4.0 fl oz	foliage	24	30 (grain) Do not graze or feed livestock	
alpha-cypermethrin		*Fastac EC	1.3 to 3.8 fl oz	foliage	12	21 (grain) Do not graze or feed livestock	
zeta-cypermethrin + bifenthrin		*Hero	2.6 to 6.1 fl oz	foliage	12	21 (grain) Do not graze or feed livestock	
chlorpyrifos		*Lorsban Advanced	1 to 2 pt	foliage	24	28 (grain) Do not graze or feed livestock	
chlorpyrifos		*Lorsban 4E	1 to 2 pt	foliage	24	28 (grain) Do not graze or feed livestock	
zeta-cypermethrin		*Mustang Maxx	1.28 to 4.0 fl oz	foliage	12	21 (grain) Do not graze or feed livestock	
zeta-cypermethrin		*Mustang Max	1.28 to 4.0 fl oz	foliage	12	21 (grain) Do not graze or feed livestock	
chlorpyrifos		*Nufos 4E	1 to 2 pt	foliage	24	28 (grain) Do not graze or feed livestock	
permethrin		*Pounce 3.2EC	2 to 4 fl oz/A	foliage	12	60 (harvest)	
sulfoxaflor + lambda-cyhalothrin		*Seeker with Isoclast active	1.6 to 2.6 fl oz	foliage	24	30 (grain) Do not graze or feed livestock	
carbaryl	Sevin 4F	3 pt	foliage	12	21 (dry grain or hay) 14 (graze or forage)		
carbaryl	Sevin XLR Plus	3 pt	foliage	12	21 (harvest) 14 (harvest or graze forage)		
chlorpyrifos + bifenthrin	*Stallion	3.75 to 11.75 fl oz	foliage	24	28 (grain) Do not graze or feed livestock		
zeta-cypermethrin + lambda-cyhalothrin	*Triple Crown	3.5 to 4.8 fl oz	foliage	12	21 (grain)		
lambda-cyhalothrin	*Warrior II with Zeon	0.96 to 1.60 fl oz	foliage	24	30 (grain) Do not graze or feed livestock		

**Comments:**  
Treat when defoliation reaches 30% before bloom and 20% from bloom to pod fill. Adult stage is the Painted Lady butterfly.

\*Designates a restricted-use pesticide. Use is restricted to certified applicators only. Read the label to determine appropriate insecticide rates. Be sure to follow all directions, precautions and restrictions.

**Insecticides for soybean - *continued***

Insect	Insecticides		Rate of formulated material per acre	Placement	REI (hours)	Preharvest interval (days)
	Common name	Trade name				
<b>Thrips</b> complex	cyfluthrin	*Baythroid XL	0.8 to 1.6 fl oz	foliage	12	45 (grain, feeding dry vines) 15 (green forage)
Soybean thrips <i>Sericothrips variabilis</i> Beach	lambda-cyhalothrin + chlorantraniliprole	*Besiege (does not include western flower thrips)	5.0 to 8.0 fl oz	foliage	24	30 (grain) Do not graze or feed livestock
<b>Comments:</b> Treat when serious injury and some mortality of seedling plants occur and thrips are present.	bifenthrin	*Brigade 2EC	2.1 to 6.4 fl oz	foliage	12	18 (grain)
	chlorpyrifos + gamma-cyhalothrin	*Cobalt	19 to 38 fl oz	foliage	24	30 (grain) Do not graze or feed livestock
	chlorpyrifos + lambda-cyhalothrin	*Cobalt Advanced	16 to 38 fl oz	foliage	24	21 (grain or ears) 14 (graze or silage harvest)
	gamma-cyhalothrin	*Declare (does not include western flower thrips)	0.77 to 1.28 fl oz	foliage	24	30 (harvest) Do not graze or feed livestock
	lambda-cyhalothrin + thiamethoxam	*Endigo ZC	3.5 to 4.0 fl oz	foliage	24	30 (grain) Do not graze or feed livestock
	alpha-cypermethrin	*Fastac EC	3.2 to 3.8 fl oz	foliage	12	21 (grain) Do not graze or feed livestock
	zeta-cypermethrin + bifenthrin	*Hero	4.0 to 10.3 fl oz	foliage	12	21 (grain) Do not graze or feed livestock
	methomyl	*Lannate SP *Lannate LV	1/4 to 1/2 lb 3/4 to 1 1/2 pt	foliage	48	14 (grain) 3 (forage) 12 (hay)
	imidacloprid + cyfluthrin	*Leverage 2.7	3.8 fl oz	foliage	12	45 (grain, feeding dry vines) 15 (green forage)
	imidacloprid + beta cyfluthrin	*Leverage 360	2.8 fl oz	foliage	12	21 (grain) 15 (hay, green forage)
	chlorpyrifos	*Lorsban Advanced	1 to 2 pt	foliage	24	28 (grain) Do not graze or feed livestock
	chlorpyrifos	*Lorsban 4E	1 to 2 pt	foliage	24	28 (grain) Do not graze or feed livestock
	zeta-cypermethrin	*Mustang Maxx	3.2 to 4.0 fl oz	foliage	12	21 (grain) Do not graze or feed livestock
	zeta-cypermethrin	*Mustang Max	3.2 to 4.0 fl oz	foliage	12	21 (grain) Do not graze or feed livestock
	acephate	Orthene 97	1/4 to 1/2 lb	foliage	24	14 (grain)
	sulfoxaflor + lambda-cyhalothrin	*Seeker with Isoclast active	1.6 to 2.6 fl oz	foliage	24	30 (grain) Do not graze or feed livestock
carbaryl	Sevin 4F	2 pt	foliage	12	21 (dry grain or hay) 14 (graze or forage)	
carbaryl	Sevin XLR Plus	2 pt	foliage	12	21 (harvest) 14 (harvest or graze forage)	
chlorpyrifos + bifenthrin	*Stallion	9.25 to 11.75 fl oz	foliage	24	28 (grain) Do not graze or feed livestock	
cyfluthrin	*Tombstone Helios	0.8 to 1.6 fl oz	foliage	12	45 (grain, feeding dry vines) 15 (green forage)	
zeta-cypermethrin + bifenthrin + imadacloprid	*Triple Crown	4.8 fl oz	foliage	12	21 (grain) Do not graze or feed livestock	
lambda-cyhalothrin	*Warrior II with Zeon	0.96 to 1.60 fl oz	foliage	24	30 (grain) Do not graze or feed livestock	

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Insecticides for soybean - *continued*

Insect	Insecticides		Rate of formulated material per acre	Placement	REI (hours)	Preharvest interval (days)	
	Common name	Trade name					
<b>Two spotted spider mite</b> <i>Tetranychus urticae</i> Koch  <b>Comments:</b> Treat when leaf stippling and live mites are present and before initiation of leaf yellowing or leaf drop. Symptoms resulting from Two Spotted Spider Mite feeding often continue to develop. Spider mite infestations are often associated with drought conditions.	lambda-cyhalothrin + chlorantraniliprole	*Besiege (suppression only)	10.0 fl oz	foliage	24	30 (grain) Do not graze or feed livestock	
	bifenthrin	*Brigade 2EC	5.12 to 6.4 fl oz	foliage	12	18 (grain)	
	chlorpyrifos + gamma-cyhalothrin	*Cobalt	13 to 26 fl oz	foliage	24	30 (grain) Do not graze or feed livestock	
	chlorpyrifos + lambda-cyhalothrin	*Cobalt Advanced	11 to 26 fl oz	foliage	24	21 (grain or ears) 14 (graze or silage harvest)	
	gamma-cyhalothrin	*Declare (suppression only)	1.54 fl oz	foliage	24	30 (harvest) Do not graze or feed livestock	
	dimethoate (several products)	Dimethoate 4EC	1 pt (see specific labels)	foliage	48	21 (grain)	
	lambda-cyhalothrin + thiamethoxam	*Endigo ZC (suppression only)	4.5 fl oz	foliage	24	30 (grain) Do not graze or feed livestock	
	zeta-cypermethrin + bifenthrin	*Hero	4.0 to 10.3 fl oz	foliage	12	21 (grain) Do not graze or feed livestock	
	chlorpyrifos	*Lorsban Advanced	1/2 to 1 pt	foliage	24	28 (grain) Do not graze or feed livestock	
	chlorpyrifos	*Lorsban 4E	1/2 to 1 pt	foliage	24	28 (grain) Do not graze or feed livestock	
	chlorpyrifos	*Nufos 4E	1/2 to 1 pt	foliage	24	28 (grain) Do not graze or feed livestock	
	sulfoxaflor + lambda-cyhalothrin	*Seeker with Isoclast active (suppression only)	3.1 fl oz	foliage	24	30 (grain) Do not graze or feed livestock	
	lambda-cyhalothrin	*Warrior II with Zeon	1.92 fl oz	foliage	24	30 (grain) Do not graze or feed livestock	
	<b>Webworm complex</b> <i>Loxostege</i> spp.  <b>Comments:</b> Treat when 10% to 12% of plants show heavy webbing on top leaflets or when defoliation reaches 30% before bloom or 20% from bloom to pod fill. Be sure that webworm larvae are still present in webbing mass when treating.	permethrin	*Ambush Insecticide (2EC)	6.4 to 12.8 fl oz	foliage	12	60(harvest)
		cyfluthrin	*Baythroid XL	1.6 to 2.8 fl oz	foliage	12	45 (grain, feeding dry vines) 15 (green forage)
flubendiamide		*Belt SC	2.0 to 3.0 fl oz	foliage	12	14 (grain) 3 (forage and hay)	
lambda-cyhalothrin + chlorantraniliprole		*Besiege	8.0 to 10.0 fl oz	foliage	24	30 (grain) Do not graze or feed livestock	
bifenthrin		*Brigade 2EC	2.1 to 6.4 fl oz	foliage	12	18 (grain)	
chlorpyrifos + gamma-cyhalothrin		*Cobalt	13 to 26 fl oz	foliage	24	30 (grain) Do not graze or feed livestock	
chlorpyrifos + lambda-cyhalothrin		*Cobalt Advanced	11 to 26 fl oz	foliage	24	21 (grain or ears) 14 (graze or silage harvest)	
gamma-cyhalothrin		*Declare	1.28 to 1.54 fl oz	foliage	24	30 (harvest) Do not graze or feed livestock	
lambda-cyhalothrin + thiamethoxam		*Endigo ZC	4.0 to 4.5 fl oz	foliage	24	30 (grain) Do not graze or feed livestock	
alpha-cypermethrin		*Fastac EC	2.8 to 3.8 fl oz	foliage	12	21 (grain) Do not graze or feed livestock	
zeta-cypermethrin + bifenthrin		*Hero	4.0 to 10.3 fl oz	foliage	12	21 (grain) Do not graze or feed livestock	
zeta-cypermethrin		*Mustang Max	2.8 to 4.0 fl oz	foliage	12	21 (grain) Do not graze or feed livestock	
zeta-cypermethrin		*Mustang Maxx	2.8 to 4.0 fl oz	foliage	12	21 (grain) Do not graze or feed livestock	
permethrin		*Pounce 3.2EC	4 to 8 fl oz/A	foliage	12	60 (harvest)	
sulfoxaflor + lambda-cyhalothrin		*Seeker with Isoclast active	2.6 to 3.1 fl oz	foliage	24	30 (grain) Do not graze or feed livestock	
carbaryl		Sevin 4F	2 to 3 pt	foliage	12	21 (dry grain or hay) 14 (graze or forage)	
carbaryl		Sevin XLR Plus	3 pt	foliage	12	21 (harvest) 14 (harvest or graze forage)	
chlorpyrifos + bifenthrin	*Stallion	5.0 to 11.75 fl oz	foliage	24	28 (grain) Do not graze or feed livestock		

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**Insecticides for soybean - *continued***

Insect	Insecticides		Rate of formulated material per acre	Placement	REI (hours)	Preharvest interval (days)
	Common name	Trade name				
<b>Webworm complex - <i>continued</i></b>	cyfluthrin	*Tombstone Helios	1.6 to 2.8 fl oz	foliage	12	45 (grain, feeding dry vines) 15 (green forage)
	lambda-cyhalothrin	*Warrior II with Zeon	1.6 to 1.92 fl oz	foliage	24	30 (grain) Do not graze or feed livestock
<b>Woollybear caterpillar</b> <i>Pyrrharctia isabella</i>	esfenvalerate	*Asana XL	2.9 to 5.8 fl oz	foliage	12	21 (grain) Do not graze or feed livestock
	cyfluthrin	*Baythroid XL	1.6 to 2.8 fl oz	foliage	12	45 (grain, feeding dry vines) 15 (green forage)
<b>Comments:</b> Treat when defoliation reaches 30% before bloom and 20% from bloom to pod fill. The adult stage of this insect is the Isabella tiger moth.	flubendiamide	*Belt SC	2.0 to 3.0 fl oz	foliage	12	14 (grain) 3 (forage and hay)
	lambda-cyhalothrin + chlorantraniliprole	*Besiege	5.0 to 8.0 fl oz	foliage	24	30 (grain) Do not graze or feed livestock
	chlorpyrifos + lambda-cyhalothrin	*Cobalt Advanced	11 to 26 fl oz	foliage	24	21 (grain or ears) 14 (graze or silage harvest)
	chlorpyrifos + gamma-cyhalothrin	*Cobalt	13 to 26 fl oz	foliage	24	30 (grain) Do not graze or feed livestock
	gamma-cyhalothrin	*Declare	0.77 to 1.28 fl oz	foliage	24	30 (harvest) Do not graze or feed livestock
	lambda-cyhalothrin + thiamethoxam	*Endigo ZC	3.5 to 4.0 fl oz	foliage	24	30 (grain) Do not graze or feed livestock
	alpha-cypermethrin	*Fastac EC	2.8 to 3.8 fl oz	foliage	12	21 (grain) Do not graze or feed livestock
	zeta-cypermethrin + bifenthrin	*Hero	4.0 to 10.3 fl oz	foliage	12	21 (grain) Do not graze or feed livestock
	chlorpyrifos	*Lorsban Advanced	1 to 2 pt	foliage	24	28 (grain) Do not graze or feed livestock
	chlorpyrifos	*Lorsban 4E	1 to 2 pt	foliage	24	28 (grain) Do not graze or feed livestock
	zeta-cypermethrin	*Mustang Maxx	2.8 to 4.0 fl oz	foliage	12	21 (grain) Do not graze or feed livestock
	zeta-cypermethrin	*Mustang Max	2.8 to 4.0 fl oz	foliage	12	21 (grain) Do not graze or feed livestock
	chlorpyrifos	*Nufos 4E	1 to 2 pt	foliage	24	28 (grain) Do not graze or feed livestock
	permethrin	*Pounce 3.2EC	2 to 4 fl oz/A	foliage	12	60 (harvest)
	sulfoxaflor + lambda-cyhalothrin	*Seeker with Isoclast active	1.6 to 2.6 fl oz	foliage	24	30 (grain) Do not graze or feed livestock
	carbaryl	Sevin 4F	3 pt	foliage	12	21 (dry grain or hay) 14 (graze or forage)
	carbaryl	Sevin XLR Plus	3 pt	foliage	12	21 (harvest) 14 (harvest or graze forage)
	chlorpyrifos + bifenthrin	*Stallion	5.0 to 11.75 fl oz	foliage	24	28 (grain) Do not graze or feed livestock
	cyfluthrin	*Tombstone Helios	1.6 to 2.8 fl oz	foliage	12	45 (grain, feeding dry vines) 15 (green forage)
	zeta-cypermethrin + bifenthrin + imadacloprid	*Triple Crown	4.8 fl oz	foliage	12	21 (grain) Do not graze or feed livestock
lambda-cyhalothrin	*Warrior II with Zeon	0.96 to 1.60 fl oz	foliage	24	30 (grain) Do not graze or feed livestock	

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## Insect management for wheat

Wheat acreage in Missouri is once again on the rise after several years in which the number of acres in wheat declined. This trend may continue as grain prices for wheat increase worldwide. Although wheat has few severe insect pests, one group of insects generating controversy is the aphid complex. This complex consists of greenbug, bird cherry-oat aphid, English grain aphid, corn leaf aphid, yellow sugarcane aphid and possibly others. Changes in wheat varieties, tillage practices, fertility levels, pest pressure and other factors all

affect economic threshold numbers. Traditional economic thresholds developed for these pests now seem outdated with the adoption of “high performance wheat production systems.” Research in Missouri suggests that aphid threshold levels may need to be more conservative to better protect loss of potential yield. An important goal in this state is to assess and modify economic thresholds for aphids and other wheat insect pests to better reflect Missouri field conditions.

## Insecticides for wheat

Insect	Insecticides		Rate of formulated material per acre	Placement	REI (hours)	Preharvest interval (days)
	Common name	Trade name				
<b>Greenbug aphid</b> <i>Schizaphis graminum</i> (Rodani)	cyfluthrin	*Baythroid XL	1.8 to 2.4 fl oz	foliage	12	30 (grain) 3 (grazing or forage)
<b>Bird cherry-oat aphid</b> <i>Rhopalosiphum padi</i> (L.)	lambda-cyhalothrin + chlorantraniliprole	*Besiege	6.0 to 10.0 fl oz	foliage	24	30 (grain, straw) 7 (forage)
<b>English grain aphid</b> <i>Sitobion avenae</i> (Fabricius)	gamma-cyhalothrin	*Declare/ Prolex	1.54 fl oz	foliage	24	30 (grain, straw) 7 (forage)
<b>Corn leaf aphid</b> <i>Rhopalosiphum</i> (Fitch)	dimethoate	Dimethoate 4EC (several products)	0.5 to 0.75 pt. (Greenbug only)	foliage	48	35 (grain) 14 (grazing or forage)
<b>Yellow sugarcane aphid</b> <i>Sipha flava</i> (Forbes)	alpha-cypermethrin	*Fastac EC	3.2 to 3.9 fl oz	foliage	12	14 (grain, forage, hay)
	methomyl	*Lannate SP	1/4 to 1/2 lb	foliage	48	35 (grain) 14 (grazing)
	zeta-cypermethrin	*Mustang Max	3.2 to 4.0 fl oz	foliage	12	14 (grain, forage, hay)
	zeta-cypermethrin	*Mustang Maxx	3.2 to 4.0 fl oz	foliage	12	14 (grain, forage, hay)
	chlorpyrifos	*Nufos 4E	1/2 to 1 pt	foliage	24	30 (grain, straw) 7 (forage)
	sulfoxaflor + lambda-cyhalothrin	*Seeker with Isoclast active	2.1 to 3.1 fl oz	foliage	24	14 (forage or hay)
	chlorpyrifos + bifenthrin	*Stallion	5.0 to 11.75 fl oz	foliage	24	28 (grain or straw) 14 (forage, hay)
	cyfluthrin	*Tombstone Helios	1.8 to 2.4 fl oz	foliage	12	30 (grain) 7 (grazing)
	lambda-cyhalothrin	*Warrior II with Zeon	1.28 to 1.92 fl oz	foliage	24	30 (grain, hay, straw) 7 (hay or forage)
<b>Seed treatments</b> - Neonicotinoid compounds label for use in reducing aphid numbers and levels of barley yellow dwarf virus following emergence of seedling plants and development of 1 or 2 tillers.						
	imidacloprid	Gaucho	See product label	Commercially on seed		
	imidacloprid	Gaucho XT	3.4 fl oz/100 lb seed	Commercially on seed		
	imidacloprid	Gaucho 600	0.8 fl oz.100 lb seed	Commercially on seed		
	thiamethoxam	Cruiser	see product label	Commercially on seed		
	thiamethoxam	Cruiser 5FS	0.75 to 1.33 fl oz/100 lb seed	Commercially on seed		
	thiamethoxam	CruiserMaxx Cereal	5.0 fl oz/100 lb seed	Commercially on seed		

### Comments:

**Greenbug aphids** tend to be occasional pests on winter wheat in Missouri. In most years greenbugs build throughout summer into fall, when they often feed on seedling wheat plants. Greenbugs may overwinter in wheat fields, but the predominant aphid found in Missouri wheat during winter is the bird cherry-oat aphid. Although low numbers of greenbugs are present during some winters, economic infestations are rarely found until spring. In spring, greenbugs may again migrate to Missouri fields from more southern locations. The greenbug aphid damages wheat in three ways including removal juices from plants using their piercing-sucking mouthparts, injection of a plant toxin during feeding, and transmission of the barley yellow dwarf virus to wheat plants if the aphids were previously infected. The traditional economic threshold at which treatment is justified requires 25 to 50 or more greenbug aphids present per linear foot of row. The greenbug is a vector of barley yellow dwarf virus with risk of infection highest on wheat seedling from fall plant emergence through late fall.

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Insecticides for wheat - *continued*

Insect	Insecticides		Rate of formulated material per acre	Placement	REI (hours)	Preharvest interval (days)
	Common name	Trade name				

Comments - *continued*

**Bird cherry-oat aphid** has increased in importance in Missouri wheat during the past few years. This aphid is capable of overwintering in most wheat fields and often can be found in low numbers throughout the wheat growing seasons. Similar to greenbug, numbers of the bird cherry-oat aphid often build during summer into fall, during warm winter periods, and again in the spring. Bird cherry-oat aphids damage wheat by sucking plant juices and by the transmission of barley yellow-dwarf virus by previously infected aphids. A majority of feeding damage and transmission of barley yellow dwarf virus typically occur wheat plants for the first 60 days following seedling emergence. Feeding and virus transmission may occur during other periods, but to a much lower level than present during the early wheat seedling stages of growth. Trials conducted in Missouri in past years suggest that both fall and spring reductions in bird cherry-oat aphid number result in higher wheat yields in most years. Based on these data, the economic threshold for bird cherry-oat aphids is to treat when 12 to 25 aphids or more are present per linear foot of row from the time of seedling emergence in the fall to heading during the following spring. Due to the increasing presence of barley yellow dwarf virus in Missouri in recent years and higher commodity value for wheat, the economic threshold may again need to be adjusted for bird cherry-oat aphid and other wheat aphids capable of vectoring barley yellow dwarf virus. Another factor to consider when determining economic thresholds for this aphid include the difficulty of estimating accurate numbers of bird cherry-oat aphids present in wheat fields. Three factors contribute to difficulty in finding this aphid when scouting wheat. They include the dark olive color of the aphid, its preference to live individually or in very small colonies on the plants, and a preference to feed and hide on lower leaves and plant stems near the soil surface. Estimates of scouting efficiency for the bird cherry-oat aphid on wheat suggest that approximately 50% of the aphids present in a specific area are found during normal scouting activities. The bird cherry-oat aphid is an efficient vector of barley yellow dwarf virus. The greenbug and bird cherry-oat aphids are the most important aphids found in Missouri wheat fields.

**English grain aphid** can be found in Missouri wheat where it occasionally damages wheat plants by removing plant juices and transmission of barley yellow dwarf virus. The English grain aphid is usually found in low numbers when present in Missouri wheat fields. The economic threshold for this aphid is to treat when populations of 100 or more aphids per tiller are present.

**Corn leaf aphids** and **yellow sugarcane aphids** rarely reach damaging levels due to heavy mortality of these aphids from biological control agents. Corn leaf aphids are capable of transmitting the barley yellow dwarf pathogen.

<p><b>True armyworm</b> <i>Pseudaletia unipuncta</i> (Haworth)</p> <p><b>Comments:</b> <b>True armyworm</b> is an occasional severe pest of wheat and grass pastures. Treatment is justified when an average of 4 or more half-grown or larger worms per square foot are present during late spring and before more than 2% to 3% of heads are cut from stems. Scout at dusk, dawn, or at night as small larvae feed on foliage at night and remain in plant debris near ground during day. Optimal control from Success and Tracer insecticides is best achieved when they are applied at peak egg hatch or when larvae are small.</p>	cyfluthrin	*Baythroid XL	1.8 to 2.4 fl oz	foliage 1st & 2nd instars only	12	30 (grain) 3 (grazing or forage)
	lambda-cyhalothrin + chlorantraniliprole	*Besiege	6.0 to 10.0 fl oz	foliage	24	30 (grain, straw) 7 (forage)
	gamma-cyhalothrin	*Declare/ Prolex	1.02 to 1.54 fl oz	foliage	24	30 (grain, straw) 7 (forage)
	alpha-cypermethrin	*Fastac EC	1.8 to 3.8 fl oz	foliage	12	14 (grain, forage, hay)
	methomyl	*Lannate SP	1/4 to 1/2 lb	foliage	48	7 (grain) 10 (grazing or feeding)
	zeta-cypermethrin	*Mustang Max	1.76 to 4.0 fl oz	foliage	12	14 (grain, forage, hay)
	zeta-cypermethrin	*Mustang Maxx	1.76 to 4.0 fl oz	foliage	12	14 (grain, forage, hay)
	chlorpyrifos	*Nufos 4E	1 pt	foliage	24	28 (grain or straw) 14 (forage or hay)
	sulfoxaflor + lambda-cyhalothrin	*Seeker with Isoclast active	2.1 to 3.1 fl oz	foliage	24	30 (grain, straw) 7 (forage)
	carbaryl	Sevin 80S	1 1/4 to 1 7/8 lb	foliage	12	21 (grain or straw) 7 (hay or forage)
	chlorpyrifos + bifenthrin	*Stallion	9.25 to 11.75 fl oz	foliage	24	28 (grain or straw) 14 (forage, hay)
	cyfluthrin	*Tombstone Helios	1.8 to 2.4 fl oz	foliage	12	30 (grain) 7 (grazing)

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Insecticides for wheat - *continued*

Insect	Insecticides		Rate of formulated material per acre	Placement	REI (hours)	Preharvest interval (days)	
	Common name	Trade name					
<b>Fall armyworm</b> <i>Spodoptera frugiperda</i> (J. E. Smith)  <b>Comments:</b> <b>Fall armyworm</b> is a rare pest in the fall of the year on early-planted wheat. Treat fields when 30% or more of plants show "window pane" feeding on foliage and plant stand is decreasing. Best to spray at night when larvae are actively feeding on foliage and air temperature remains above 55 degrees F. Optimal control from Success and Tracer insecticides is best achieved when they are applied at peak egg hatch or when larvae are small.	cyfluthrin	*Baythroid XL	1.8 to 2.4 fl oz	foliage 1st & 2nd instars only	12	30 (grain) 3 (grazing or forage)	
	lambda-cyhalothrin + chlorantraniliprole	*Besiege	6.0 to 10.0 fl oz	foliage	24	30 (grain, straw) 7 (forage)	
	gamma-cyhalothrin	*Declare/ Prolex	1.02 to 1.54 fl oz	foliage	24	30 (grain, straw) 7 (forage)	
	alpha-cypermethrin	*Fastac EC	3.2 to 3.9 fl oz	foliage	12	14 (grain, forage, hay)	
	methomyl	*Lannate SP	1/4 to 1/2 lb	foliage	48	7 (grain) 10 (grazing or feeding)	
	zeta-cypermethrin	*Mustang Max	1.76 to 4.0 fl oz	foliage	12	14 (grain, forage, hay)	
	zeta-cypermethrin	*Mustang Maxx	1.76 to 4.0 fl oz	foliage	12	14 (grain, forage, hay)	
	chlorpyrifos	*Nufos 4E	1 pt	foliage	24	28 (grain or straw) 14 (forage or hay)	
	sulfoxaflor + lambda-cyhalothrin	*Seeker with Isoclast active	2.1 to 3.1 fl oz	foliage	24	30 (grain, straw) 7 (forage)	
	carbaryl	Sevin 80S	1 1/4 to 1 7/8 lb	foliage	12	21 (grain or straw) 7 (hay or forage)	
	chlorpyrifos + bifenthrin	*Stallion	9.25 to 11.75 fl oz	foliage	24	28 (grain or straw) 14 (forage, hay)	
	cyfluthrin	*Tombstone Helios	1.8 to 2.4 fl oz	foliage	12	30 (grain) 7 (grazing)	
	spinosad	Tracer naturalyte	1.5 to 3.0 fl oz	foliage, timing important	4	21 (grain or straw) 14 (forage or hay)	
	lambda-cyhalothrin	*Warrior II with Zeon	1.28 to 1.92 fl oz	foliage	24	30 (grain or straw)	
	<b>Cereal leaf beetle</b> <i>Oulema melanopus</i>  <b>Comments:</b> <b>Cereal leaf beetle</b> is an occasional pest in years with dry springs. Treat when an average of one or more larvae are present per flag leaf or stem. Optimal control from Success and Tracer insecticides is best achieved when they are applied at peak egg hatch or when larvae are small.	cyfluthrin	*Baythroid XL	1.0 to 1.8 fl oz	foliage	12	30 (grain) 3 (grazing or forage)
		lambda-cyhalothrin + chlorantraniliprole	*Besiege	6.0 to 10.0 fl oz	foliage	24	30 (grain, straw) 7 (forage)
gamma-cyhalothrin		*Declare/ Prolex	1.02 to 1.54 fl oz	foliage	24	30 (grain, straw) 7 (forage)	
alpha-cypermethrin		*Fastac EC	1.8 to 3.8 fl oz	foliage	12	14 (grain, forage, hay)	
methomyl		*Lannate SP	1/4 to 1/2 lb	foliage	48	7 (grain) 7 (hay or forage)	
malathion		Fyfanon ULV	4 to 8 fl oz	foliage	12	7 (grain, forage, hay)	
zeta-cypermethrin		*Mustang Max	1.76 to 4.0 fl oz	foliage	12	14 (grain, forage, hay)	
zeta-cypermethrin		*Mustang Maxx	1.76 to 4.0 fl oz	foliage	12	14 (grain, forage, hay)	
chlorpyrifos		*Nufos 4E	1 pt	foliage	24	14 (grain, forage, hay) 28 (grain or straw)	
sulfoxaflor + lambda-cyhalothrin		*Seeker with Isoclast active	2.1 to 3.1 fl oz	foliage	24	7 (hay or forage) 30 (grain, straw) 7 (forage)	
carbaryl		Sevin 80S	1.25 lb	foliage	12	21 (grain or straw) 7 (hay or forage)	
chlorpyrifos + bifenthrin		*Stallion	5.0 to 11.75 fl oz	foliage	24	28 (grain or straw) 14 (forage, hay)	
cyfluthrin		*Tombstone Helios	1.0 to 1.8 fl oz	foliage	12	30 (grain)	
spinosad		Tracer 4SC	1.0 to 3.0 fl oz	foliage	4	21 (grain or straw) 14 (forage or hay)	
lambda-cyhalothrin		*Warrior II with Zeon	1.28 to 1.92 fl oz	foliage	24	30 (grain or straw) 7 (hay or forage)	

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**Insecticides for wheat - *continued***

Insect	Insecticides		Rate of formulated material per acre	Placement	REI (hours)	Preharvest interval (days)	
	Common name	Trade name					
<b>Grass sawfly</b> <i>Pachynematus</i> sp.  <b>Comments:</b> Occasional pest found on flag leaves or wheat heads where it generally causes minor defoliation and occasionally cuts wheat heads. This insect rarely builds to levels requiring management with a pesticide. This insect is easily identified by its opaque green color and 9 or more pairs of abdominal prolegs.	cyfluthrin	*Baythroid XL	1.8 to 2.4 fl oz	foliage	12	30 (grain) 3 (grazing or forage)	
	lambda-cyhalothrin + chlorantraniliprole	*Besiege	8.0 to 10.0 fl oz	foliage	24	30 (grain, straw) 7 (grazing, forage)	
	gamma-cyhalothrin	*Declare/Prolex	1.28 to 1.54 fl oz	foliage	24	30 (grain, straw) 7 (grazing, forage)	
	alpha-cypermethrin	*Fastac EC	3.2 to 3.9 fl oz	foliage	12	14 (grain, forage, hay)	
	malathion	Fyfanon ULV	4 to 8 fl oz	foliage	12	7 (grain, forage, hay)	
	zeta-cypermethrin	*Mustang Max	3.2 to 4.0 fl oz	foliage	12	14 (grain, forage, hay)	
	zeta-cypermethrin	*Mustang Maxx	3.2 to 4.0 fl oz	foliage	12	14 (grain, forage, hay)	
	sulfoxaflor + lambda-cyhalothrin	*Seeker with Isoclast active	2.6 to 3.1 fl oz	foliage	24	30 (grain, straw) 7 (forage)	
	chlorpyrifos + bifenthrin	*Stallion	5.0 to 11.75 fl oz	foliage	24	28 (grain or straw) 14 (forage, hay)	
	cyfluthrin	*Tombstone Helios	1.8 to 2.4 fl oz	foliage	12	30 (grain)	
	lambda-cyhalothrin	*Warrior II with Zeon	1.6 to 1.92 fl oz	foliage	24	30 (grain or straw) 7 (hay or forage)	
	<b>Grasshoppers</b> (numerous species)  <b>Comments:</b> Treat when eight or more adults per square yard are present within crop. Barrier treatments in border areas may be required to prevent migration into the crop if more than 20 adults per square yard are present in field margins.	cyfluthrin	*Baythroid XL	1.8 to 2.4 fl oz	foliage	12	30 (grain) 3 (grazing or forage)
		lambda-cyhalothrin + chlorantraniliprole	*Besiege	6.0 to 10.0 fl oz	foliage	24	30 (grain, straw) 7 (forage)
gamma-cyhalothrin		*Declare/Prolex	1.02 to 1.54 fl oz	foliage	24	30 (grain, straw) 7 (forage) 30 (grain)	
dimethoate		Dimethoate 4EC (several products)	0.75 pt (Greenbug only)	foliage	48	35 (grain) 14 (grazing or forage)	
alpha-cypermethrin		*Fastac EC	3.2 to 3.9 fl oz	foliage	12	14 (grain, forage, hay)	
zeta-cypermethrin		*Mustang Max	3.2 to 4.0 fl oz	foliage	12	14 (grain, forage, hay)	
zeta-cypermethrin		*Mustang Maxx	3.2 to 4.0 fl oz	foliage	12	14 (grazing)	
chlorpyrifos		*Nufos 4E	1 pt	foliage	24	14 (grain, forage, hay) 28 (grain or straw)	
sulfoxaflor + lambda-cyhalothrin		*Seeker with Isoclast active	2.1 to 3.1 fl oz	foliage	24	30 (grain, straw) 7 (forage)	
chlorpyrifos + bifenthrin		*Stallion	5.0 to 11.75 fl oz	foliage	24	28 (grain or straw) 14 (forage, hay)	
cyfluthrin		*Tombstone Helios	1.8 to 2.4 fl oz	foliage	12	30 (grain) 3 (forage or graze)	
lambda-cyhalothrin		*Warrior II with Zeon	1.28 to 1.92 fl oz	foliage	24	30 (grain or straw) 7 (hay or forage)	

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Insecticides for wheat - *continued*

Insect	Insecticides		Rate of formulated material per acre	Placement	REI (hours)	Preharvest interval (days)
	Common name	Trade name				
<b>Wheat curl mite</b> <i>Aceria tosichella</i> Keifer	<b>Wheat curl mite - <i>Aceria tosichella</i> Keifer</b>					
	<p><b>Comments:</b> Control of this pest best achieved by alternative pest strategies. Alternative strategies may include destruction of volunteer grass and wheat plants approximately two weeks before planting, control grassy weeds in waterways and field borders, use resistant varieties if available. Insecticide applications usually not feasible for this pest.</p> <p><b>Note:</b> At this time no foliar rescue insecticide is labeled for control of wheat curl mite. To reduce numbers of wheat curl mite, the destruction of volunteer wheat before planting and use of resistant wheat varieties are recommended.</p>					
<b>Winter grain mite</b> <i>Penthaleeus major</i> (Duges)	<b>Winter grain mite - <i>Penthaleeus major</i> (Duges)</b>					
	<p><b>Comments:</b> Winter grain mite is a know pest of small grains and grasses. These mites possess black to dark brown bodies and red to reddish orange legs. The pest produces two generations annually in September/October and March/April, and eggs survive the summer months by aestivation or slowed development. Mite populations are favored by cool temperatures being most active from 40 to 70 degrees F. Moist conditions also favor mite activity as mites move into the soil during hot or dry periods. Winter grain mites are an occasional problem in Missouri wheat during late winter periods when moist conditions and mild winter temperatures prevail.</p> <p>At this time no foliar rescue insecticides are labeled for control of the winter grain mite.</p>					
<b>White grub</b> (numerous species)	<b>Seed treatments - Neonicotinoid compounds</b>					
	imidacloprid	Gaucho	See product label	Commercially on seed		
	thiamethoxam	Cruiser	see product label	Commercially on seed		
	<p><b>Comments:</b> White grub in wheat often cause seedling damage during fall which results in stand loss and replacement by weed species. Damage is often observed as yellowing of seedling foliage and plant mortality when damage is severe. Grubs feed on roots, but some species will surface feed if wet conditions exist. If grubs are present before planting, consider either a soil incorporated insecticide or insecticide treated seed.</p>					
<b>Wireworms</b> (several species)	<b>Seed treatments - Neonicotinoid compounds</b>					
	imidacloprid	Gaucho	See product label	Commercially on seed		
<b>Comments:</b> Wireworm in wheat may cause seedling damage during fall and spring resulting in damaged plants and stand loss. Root and stem damage to wheat plants in fall may result in plant mortality. In spring plant roots may be fed upon by wireworm, but damage is rarely observed on large wheat plants.	imidacloprid	Gaucho XT	3.4 fl oz/100 lbs. seed	Commercially on seed		
	imidacloprid	Gaucho 600	0.8 fl oz.100 lbs. seed	Commercially on seed		
	thiamethoxam	Cruiser	see product label	Commercially on seed		
	thiamethoxam	Cruiser 5FS	0.75 to 1.33 fl oz/100 lbs seed	Commercially on seed		
	thiamethoxam	CruiserMaxx Cereal	5.0 fl oz/100 lbs seed	Commercially on seed		
	clothianidin	NipsIt SUITE Cereals	5.0 to 7.5 fl oz/100 lbs seed	Commercially on seed		

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