Establishing Profitable Cotton Stands in High Biomass Cover

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A major hurdle in the integration of cover crops into the cotton production system is the establishment of the cotton crop. Planting cotton into soil health cover crop mixtures can result in inadequate stands without properly equipping your planter. Failures can stem from inconsistent seed depth, seed kickouts, hair-pinning of residue within the furrow, and failure to close the furrow (Figure 1). Issues have been noted when planting into terminated and living (green) cover crops. Alternative row cleaner equipment and/or slight modifications to settings can increase the consistency of seed placement, reduce kickouts, eliminate hair-pinning and properly close the furrow. Proper system selection and setup has resulted in successful stand establishment in several fields within Tennessee. In this report we evaluated the ability of seven row cleaner and four double disk opener systems to process multiple-species, high biomass cover crop mixes.

Figure 1: *Failed stands were noted after attempting to plant into a five-way cover crop mixture in Crockett County in the spring of 2017. Moderate quantities of aboveground biomass were present at the time of planting (left). Failure to achieve adequate stands was due to poor seed-to-soil contact because of inconsistent seed depths, hair-pinning, kickouts, and failure to close the furrow (right).*

Approach

To evaluate different planter attachments in high residue conditions, a five-acre field trial was established at the West Tennessee Research and Education Center during the fall of 2019. The field was planted to an NRCS approved 5 species soil health mixture cover. Termination date (at planting or four weeks prior) and termination method (rolled, Figure 2, or left standing) was not randomized throughout the trial. The roller crimper used within the trial was a Harrell Crop Roller Crimper (Harrel Ag Products; Bainbridge, GA). This roller has a staggered sectional blade. For the rolled treatments, this implement was run at approximately 5 mph in a float mode to crimp the cover crop. Two separate four row,

38” planters with John Deere MaxEmerge row units (industry standard) were used to ensure results will easily scale to commercial production.

All planter attachments were evaluated from these planters. A commonly planted, small seeded variety (DP 1725 B2XF, DeltaPine Seed Co., St. Louis, MO) was selected to maximize differences observed between treatments. For all evaluations, the planter was set to maximize placement within the University of Tennessee recommended 0.25 - 0.75” depth range. Note in some conditions such as a dry surface soil, deeper seed placement maybe needed.

Figure 2: *Picture of the implement used for the “roller termination” treatment.*

Double Disk Opener Evaluation

Notched, serrated, smooth double disk openers without a ‘V-slice’ and smooth double disk openers were installed across the width of the planter (Figure 3). Each plot consisted of one row. The same row cleaner system (Farm Specific Technology Flex Crimp Roller Row Cleaner, Jackson, TN) and press wheel system (paired smooth rubber and 15” spike combination) was used for each treatment. Treatments were repeated twice. Double disks treatments evaluated included:

1. Notched
2. Serrated
3. Smooth
4. Smooth plus V slice

***Figure 3**: Smooth (a), Notched (b), and serrated (c) disk openers used.*

Row Cleaner Evaluation

A total of seven different row cleaner systems were evaluated. The planter was set in an adjacent border plot prior to planting. Setup attempted to provide correct seed placement while causing minimal disruption of the soil surface but complete removal of residue from the furrow. The same smooth double disk openers and closing wheel systems (paired smooth rubber and 15" spike combination) were used across all treatments. Each treatment was repeated twice. The row cleaner systems evaluated were:

1. Dawn 1572 Coulter Combination unit
2. Martin Floating Row Cleaner Frame with Spike (Finger) wheels
3. Martin Floating Row Cleaner Frame with Razor wheels
4. Martin Floating Row Cleaner Frame with Spike (Finger) wheels and trailing coulter
5. Martin Floating Row Cleaner Frame with Razor wheels and trailing coulter
6. Coulter
7. No coulter or row cleaner

Table 1 provides photos of the individual components used in the row cleaner evaluation.

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Table 1. Photos of the coulters used in the study (note some treatments included combinations of the coulters and wheels picture – see text on previous page).

Description	Photo	Description	Photo
Trailing Coulter		**No Coulter or Row Cleaner**	
Dawn Coulter Combo		**Razor Wheels**	
Finger Wheels			

Measurements

Furrow Ratings

Furrow ratings were conducted at planting. These ratings captured the ability of the row cleaner to clean the area surrounding the furrow of residue. A rating of 0 represented no movement of residue while a rating of 10 represented complete removal of residue from the furrow. Two examples of rating extremes can be found in Figure 4. Theoretically, a row cleaner which moves more residue away from the seed line (row) should allow the gauge wheels to ride on a more uniform seed bed and thus the depth of seed placement should be more consistent. A row cleaner also should not excessively disturb the soil (i.e., no "tillage" should be occurring).

Kickouts

The number of seeds which had been kicked out of each seed trench were counted across a 10-foot distance. This measurement was repeated three times for each plot. The prevalence of seed kickouts would represent the ultimate failure of the planter attachment, as a seed on the soil surface is unlikely to survive.

Figure 4: *Furrow ratings captured the ability of the row cleaner to clean the area surrounding the furrow of residue. A rating of 0 represents no movement of residue (pictured left) and a rating of 8 represents significant movement of residue (pictured right).*

Hairpin Ratings

Failure of the double disk opener to remove residue from the seed trench results in hairpinned residue and subsequently reduced seed to soil contact (Figure 5). Immediately after planting, each plot was visually rated based on the quantity of biomass hairpinned in the furrow. Ratings of 0 would represent no residue within the furrow while a rating of 10 would represent residue present throughout the furrow.

Figure 5: *Hairpin ratings captured the ability of the double disk openers to prevent residue from being deposited within the seed trench. A rating of 0 represents no residue with the furrow (pictured center). Residue hairpinned within the seed trench can be seen in the left and right images.*

Findings

- Seed placement often varied considerably from one termination treatment to the next (rolled or standing).
- Maintaining proper seeding depth was challenging, but easier in terminated residue.
- The weight of the planter alone occasionally did not provide enough down pressure to adequately penetrate the residue but the addition of approximately 200 lb per row added to the toolbar generated more consistent seed placement.

Row Cleaner Evaluations

- The finger and finger plus coulter row cleaners generated a better furrow rating (i.e., cleaner seed trench) but were also associated with the highest levels of kickouts, regardless of termination treatment.
- The coulter and no row cleaner treatments did not generate large numbers of kickouts but generated the poorest furrow ratings.
- The Razor, Dawn, and Razor plus coulter treatments performed very well and consistently across rolled and standing terminated cover crops.
- The Razor with Coulter treatment resulted in the greatest furrow ratings across all treatments (Figure 6).
- Both the Finger and Finger plus coulter treatments occasionally carried or bound with residue (Figure 7). It is suspected that partial binding may have led to the larger number of kickouts observed in the finger and finger plus coulter treatments.

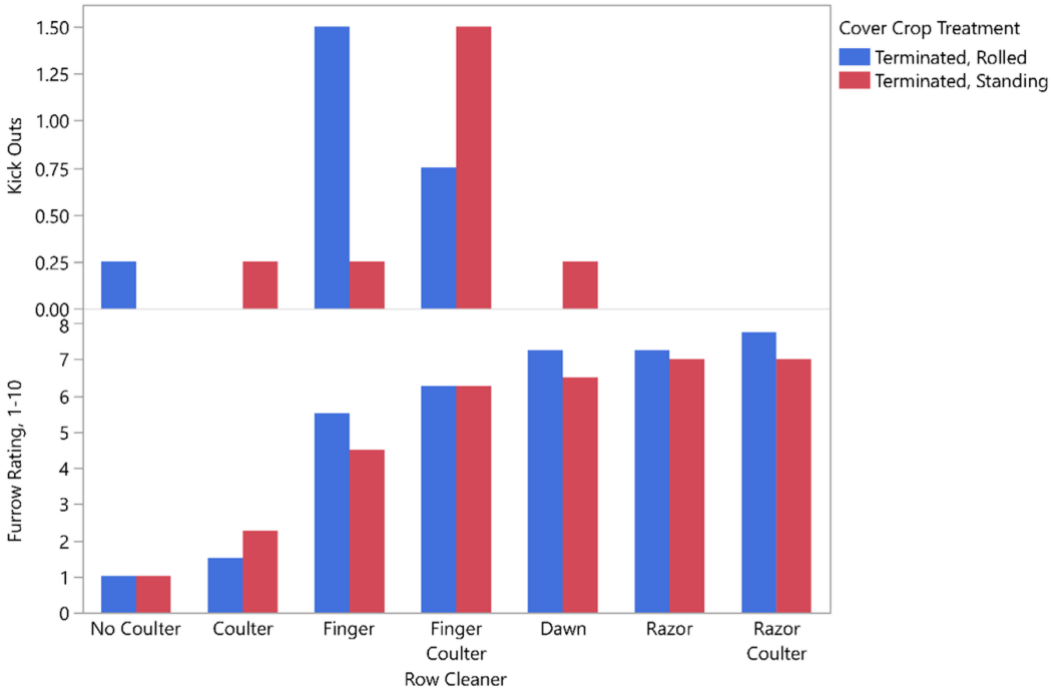

Figure 6: *Kickout counts and furrow ratings collected immediately after planting the 2020 row cleaner study. A rating of 0 represents no movement of residue away from the furrow and a rating of 10 represents a residue-free furrow.*

Figure 7: *Complete failure of the row cleaner units were occasionally observed (image from 2019); finger type row cleaners frequently failed in the green cover crop treatments, whether rolled or left standing. Green residue accumulated on the row units and had to be manually removed.*

Double Disc Openers Findings

- Kickout numbers averaged between 3 and 6 per 10 feet regardless of treatment across 10 ft of row.
- Termination 4 weeks prior to planting resulted in the fewest kickouts (Figure 8).
- Treatment differences were slight, but the smooth plus v slice appeared to result in the fewest number of kickouts and very low hairpin ratings.
- The notched row cleaners resulted in more residue in the furrow than all other double disk treatments (quantified in the hairpin rating data, Figure 8).
- Field observations suggested the serrated double disks did a superior job of slicing residue, but substantial differences were not noted in the kickout or hairpin data.

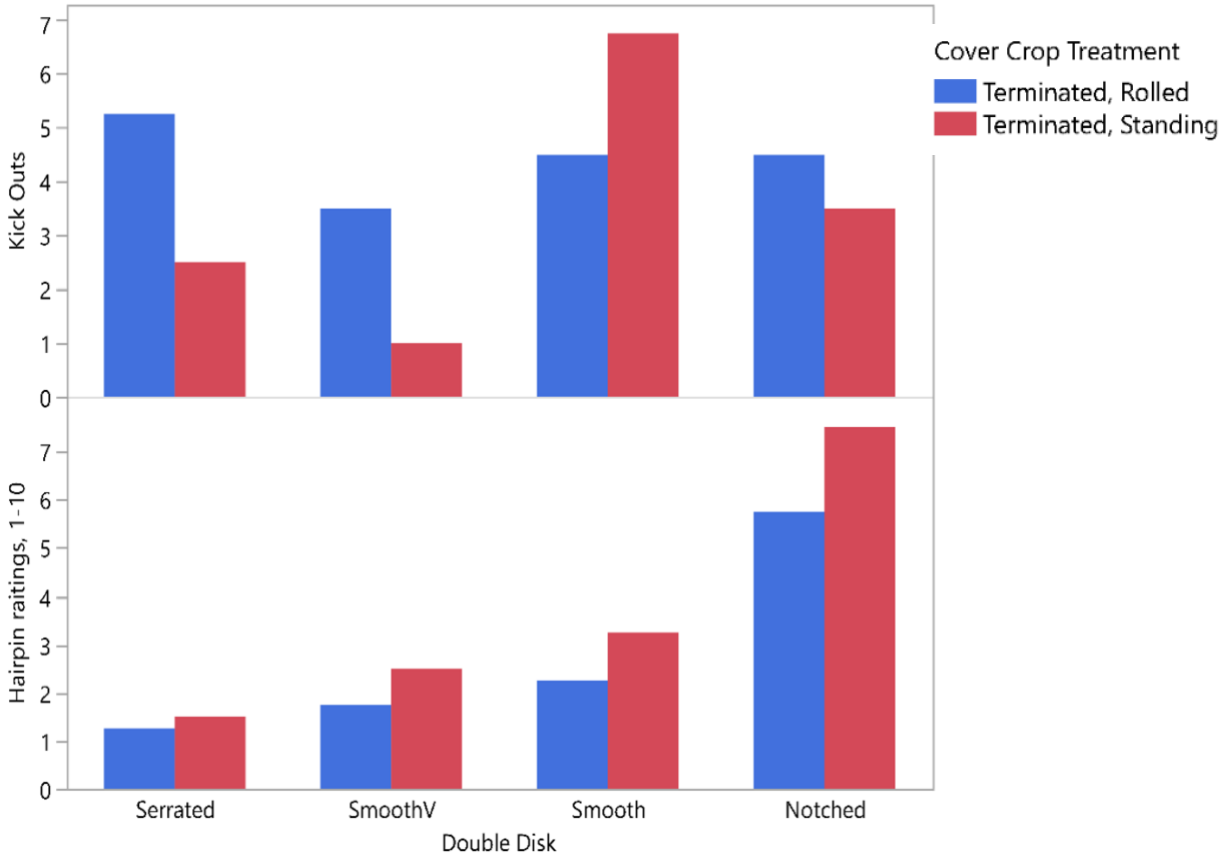

Figure 8: *Kickout counts and hairpin ratings collected immediately after planting the double disk opener study. A rating of 0 represents no hairpinned residue in the furrow and a rating of 100 represents hairpinned residue throughout the furrow.*

Figure 9: *While the serrated double disk performed well during 2018, significant decreases in hairpin ratings were not noted from this treatment during 2019 (pictured on left). The razor wheel performed extremely well during 2018 and 2019 (pictured on right).*

Planter Attachment Conclusions

- The Razor-wheel row cleaner coupled with or without a coulter and smooth double disk openers with or without V-slice furrow-firmers represent a solid starting point for those interested in planting cotton in high biomass situations.
- Although this system accumulated very little residue, it is absolutely necessary to continuously monitor planter settings and seed placement during planting; as moisture of the residue, soil type and biomass changes, adjustments will likely need to be made, even with the best performing attachments.
- Finger-style row cleaners, the most common style row cleaner in no-till systems in west TN, were unable to process the large quantities of biomass without accumulating biomass and binding.

Producers interested in planting into high-biomass cover crops have a large number of planter attachments to choose from and it is possible, with the correct conditions, to generate a profitable stand with a number of different combinations. A few overarching themes did emerge through three years of researching these combinations. First, residue movement away from the furrow was beneficial in proper seed placement and early season growth. Second, seeding rates should be increased in high-biomass situations. Finally, dry, terminated residue was easier for planter attachments to process than semi-terminated or green residue.

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