



IMPROVING CASH CROP STAND ESTABLISHMENT IN COVER CROP FIELDS

IOWA SOYBEAN ASSOCIATION RESEARCH UPDATE SERIES



COVER CROPS ARE A LONG-TERM PROFITABLE PRACTICE FOR FARMERS

Benefits of cover crops include reducing soil erosion, building organic matter and soil health, suppressing weeds and pathogens and increasing late-season soil water availability. Farmers have sometimes encountered situations where cover crops have reduced yield in the cash crop. In most cases, these yield reductions can be attributed to inability to achieve a full, vigorous stand in the cash crop.

In this bulletin, best practices for crop stand establishment in cover crops are reviewed. The information is based on the experience of farmers that have been profitable in their use of cover crops.

Figure 1: Excellent stands achieved in cover crop system. Note stunted row in corn field due to starter fertilizer plugging (left). Also note dense mat of residue preventing weed emergence in soybeans (right).



Figure 2: Example of a poor stand in a corn field planted into cereal rye. Background is no cover crop, foreground is cereal rye cover crop. Different planter settings would have improved this stand.



ESTABLISHMENT OF THE COVER CROP

The goal of cover cropping is to provide soil cover and living roots to hold soil, build soil health and scavenge nutrients. The most reliable method to establish cover crops is drilling very soon after harvest. Many farmers have good success with broadcasting cover crop seed prior to harvest with high clearance equipment. A less reliable method of establishing cover crops is aerial seeding into the standing cash crop. Aerial or broadcast seeding should ideally occur two to four weeks before harvest before an expected rain.



Management techniques employed at the time of establishing the cover crop can affect stand establishment in the cash crop. For example, too high of a seeding rate for cereal rye can increase costs while creating excessive amounts of residue. For cereal rye ahead of corn, a seeding rate of 30 to 50lbs per acre is recommended. Ahead of soybeans, the recommended seeding rate is 60lbs per acre.

*FigureS 3A & B (Above and right).
Examples of skip row planting of cover crop. Cover crop is established in 15” or 30” rows and cash crop is planted between the cover crop rows.*

*Opposite page:
Figure 4. Example of strip-till cover crop system. Cover crop is established and a strip till bar creates strips in the field with no residue.*





Some farmers are experimenting with skip row or precision planting of their cover crops. In this scenario, a drill row is plugged every 30 inches as a skip row. The cash crop is planted into the skip row with the belief that the absence of cereal rye roots in the planter row will improve stand establishment (Figures 3A & B).

Some farmers have adapted a strip till system with cover crops. After cover crop seeding, they create strips to reduce the amount of residue in the planter row.

In a strip till cover cropping system, the cover crop is established and followed by a strip till machine creating rows of no residue for planting the cash crop. This system has been successful in poorly drained soils without excessive slopes.



TIME OF TERMINATION

For those beginning to use cover crops, the lowest risk system is soybeans planted after a cereal rye cover crop. Many farmers report it is best to terminate over-wintering cover crops as close to soybean planting as possible. This allows for proper planting or drilling of soybeans and keeps the seed trench closed. Also, planting soybeans “green” allows for additional weed control from the cover crop that can help offset the costs of seeding a cover crop.

For corn fields planted following a winter-hardy grass cover crop like cereal rye, several management tips should be considered for the greatest success. If the cereal rye is taller than six inches four weeks before planting, then farmers should plan to kill it as soon as conditions allow. This reduced the immobilized nitrogen effect sometimes seen in corn yields.

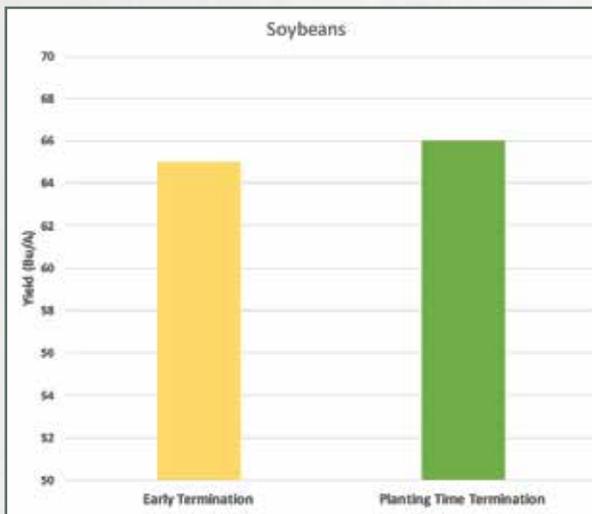


Figure 5. Time of termination did not affect yield in soybeans. Means across 9 locations. Data courtesy of Practical Farmers of Iowa.

allows them to accumulate significantly more biomass contributing to greater gains in organic matter, nutrient sequestration, weed suppression and erosion control.

In corn, time of termination in cover crops seems to matter more. In Figure 6 are results from three studies in Iowa. Note there was a six-bushel reduction for terminating cover crops at planting time in corn. While these studies need to be repeated, the results indicate that the time of termination can affect stand establishment and yield in corn but not in soybeans.

Research has been conducted on the timing of cover crop termination in soybeans. In Figure 5 are results from a nine-location study where soybean yields were compared from cover crops terminated at planting compared to cover crops terminated two weeks prior to planting. These results indicate there is no yield loss for letting cover crops grow until the time of planting. Allowing the cover crops to grow until planting

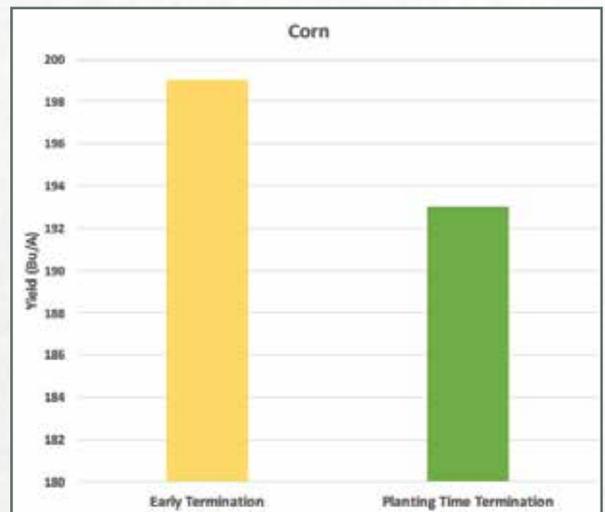


Figure 6. Time of termination can affect stand establishment and yield in corn but not in soybeans. Means three locations for corn.

PLANTER SET UP

One of the most important parts of cash crop stand establishment in cover crop fields is planter set up and operation. The following are some tips gleaned from experienced cover crop farmers and research trials.

IS THE PLANTER RUNNING LEVEL?

Everyone thinks their planter is running level, and yet closer inspection shows that at least half of them are still running a degree or two nose-down. A slight adjustment here can dramatically affect seed placement, because it changes how vertical the seed tube is – which affects how far forward the seed is dropping between the blades. This affects whether the seeds are all in the bottom of the furrow, or if pieces of sidewall get in ahead of the seed. A couple degrees nose-up on the planter helps tremendously. It also gives more downforce on the row unit if springs are used, and more toe-out on the closing wheels.

ROW CLEANERS

Row cleaners can be used to help manage the amount of residue in the row; generally, it's desirable to keep most of the mulch in the row to prevent erosion down the slope and prevent drying of the seed. If the planter opener blades are sharp and have sufficient downforce on them, they can cut through a large amount of residue and enable good seed placement. This is especially true in long-term no-till where the soil has regained structure so that the opener blade has something solid to push against when cutting. However, if the residue is damp or poorly distributed, there may be issues cutting. This is where row cleaners are of benefit. It also is sometimes beneficial to hasten the warming and drying of the soil in the row area by removing some (not all) of the residue with row cleaners – this is more important for corn than soybeans.

Row cleaner wheels that have broader, shorter teeth usually work better than the older designs with long, slender teeth (Figure 7). Row cleaners shouldn't be dished (concave on leading edge) because these are more difficult to control and will scoop soil out of the furrow. Row cleaners should barely be touching the soil; even if they aren't turning continuously, they are still



Figure 7. Examples of row cleaners appropriate for seeding into cover crops.

combing the residue and arranging it to be more easily cut. When the old plant material is standing, it's easier to deal with because the opener blades don't have to cut through it. Don't attempt to move much of the cover crop residue out of the row. Attempts to move the residue will result in a deep gouge in the soil that will collect water and be unhealthy for seedlings. Too much residue removal also may allow weed seeds to germinate and allow water erosion along the length of the row.

Farmers have a choice between floating versus rigid row cleaners. The floating ones should primarily be set with stops to prevent them from going too deep (or with pneumatic or hydraulic cylinders to do this), and the 'floating' feature is only used to prevent damage when they hit an obstacle. Trying to push a floating row cleaner linkage and letting the wheel set the depth often results in moving too much residue, and soil, out of the row.

COULTERS

Coulters ahead of the row unit are generally not recommended for planting into cover crops in Iowa. Coulters can reduce sidewall compaction, but this depends upon the planter and soil conditions.

CONDITION OF OPENER

Opener blades should be sharp. Usually these stay sharp enough, but there are some 4mm thick blades with shallower bevels that penetrate very poorly.

Ensure that the seed-tube guard is wide enough to prevent opener blades from flexing too much inward and making a furrow so pinched that seeds can't get to the bottom. Replace seed tube guards often enough that they never get to more than 0.3" narrower than new. For many people, this is every year for the softer cast guards.

DOWNFORCE PRESSURE AND ACHIEVING GOOD PLANTING DEPTH - OPTIMAL DOWNFORCE PRESSURE IS CRITICAL

Improper adjustment of downforce pressure is often the culprit of poor seedling placement and stand. This cannot be emphasized enough: Make sure you have enough downforce on the row unit. Excess downforce causes sidewall compaction, so that's no good either. But enough downforce is needed to hold depth consistently. One way to adjust the downforce is to start out with excessive pressure, and go through a soft spot, then measure how deep the furrow is on a couple different rows. This is the bottom of the cut, not where the seed is located. Then, go out into what will be the hardest spot of the field, usually an eroded hilltop. Run the planter again, and go across some old combine and sprayer tracks. The depth should be about the same as before. Now keep decreasing downforce in 30-lb increments until the depth of the furrow is starting to get shallower and inconsistent - then set it back up to the next-to-last setting. This may change based on the amount of residue and soil type as everything gradually dries out day by day, or if it rains. Holding consistent depth is crucial for corn yield, but far less for soybeans. However, inconsistent depth of the furrow cut means that the gauge wheels are riding up and not providing consistent pressure on the sidewalls to hold them together until the seed gets to

the bottom of the furrow. For this reason, it's generally not recommended to use RID (indented) gauge tires, but this also depends on the planter style.

Many farmers think they run enough pressure, but closer inspection usually reveals about 80 percent of farmers don't have enough downforce pressure in no-till.

SEED FIRMERS

The sliding firmers that run along the bottom of the furrow directly on top of the seed are useful in improving the consistency of seed-to-soil contact. If these have sufficient pressure on them, they will wipe themselves clean against the furrow sidewall. There sometimes can be very minor dragging of seeds (+/-0.75"), but this is trivial when compared to the gains in uniformity of emergence timing, which is four times more important for yield in corn than is uniform spacing.

CLOSING WHEELS

There are many after-market options for closing wheels. Finding the best option requires on-farm testing. The purpose of closing wheels is to close the trench without creating side wall compaction. In many cases, standard rubber tires can be insufficient in no-till conditions. Beveled cast (smooth) tires are an improvement, especially if toe-out is created. Spoked closing wheels are usually a further step up, but need to be designed so that they don't dig seeds out or excessively pack the soil. Again, adding toe-out to them helps. When using spike-type closing wheels, consider drag chains to assure trench closure.

In Figure 8 are examples of planters properly equipped for planting into cover crops. This is conceptually only, and we do not endorse one planter brand over another.



Figure 8: Planters equipped for planting into cover crops.

PLANTING TIME NITROGEN

Cereal (grass) cover crops tie up (immobilize) a lot of nutrients for a long time - but they have more durable residue, so they're important for preventing erosion and building soil organic matter. Best results in cover crop fields are achieved when anywhere from 30-60 lbs of nitrogen are applied with starter fertilizer on the planter. Side-band openers can accomplish this, but often cause problems with seed placement unless they are running shallowly (no deeper than seed depth) and at least four inches away from the seed row. Note that it's undesirable to have these side-band openers mounted onto the front of the row unit, because they rob downforce away from the seed opener, and create other issues. It's agronomically acceptable to stream or band the fertilizer on the soil surface instead of running a side-band opener.

It's not just nitrogen that's tied up by cereal rye cover crops, but also phosphorous and micronutrients. All 17 essential nutrients for plants, can be tied up in cover crop residue, with the exception of K because most of it is held in the cytoplasm inside cells, and leaks out soon after the plant dies. So, if cash crops were barely getting enough of certain nutrients before adding cover crops, they will really have trouble now. Supplying some fertilizer containing these 'missing ingredients' early on in the crop's life can be the difference between a great yield and a merely mediocre yield.

Generally, it's preferred to apply nutrients where the young plant can access them at the time it needs them, which is very early stages. Some of the nitrogen, phosphorous and zinc could be applied as a pop-up in the seed row for corn, unless soil fertility tests are very high (such as when manure is applied). No nitrogen-containing pop-up is used for soybeans because they're so sensitive to urea solutions. Again noted in Figure 1, differences in stand vigor can be dramatic when no nitrogen is applied at planting.

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TIED UP, BUT ALSO PHOSPHOROUS
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PLANTING TIME

Depending on weather, fields planted to cover crops can be drier or wetter compared to no cover crops. Excessive rain after early cover crop termination can create conditions where the field stays wetter compared to no cover crops. Conversely, due to cover crop water use, fields planted to cover crops can be fit sooner than fields without cover crops. The key is to recognize that cover crops affect the time of fitness for planting compared to no cover crops. Check your fields. A little extra patience in waiting a few days for a cover crop field to dry out can dramatically improve stands and yield when planting into cover crops (Figure 9).



Figure 9. Example of two fields planted too early. Excess moisture created sidewall compaction or caused the trench row to open.



INSECT CONTROL

Cover crops can sometimes provide habitat for insect pests. Experienced cover crop users will scout their fields for presence of army worms, wireworms and other insect pests of corn and apply foliar or in-furrow insecticides as necessary.



TO SUMMARIZE

Cover cropping can be profitable in the long-term provided best management practices are developed and applied. One of the most critical aspects of successfully using cover crops is working to ensure optimum cash crop stands in cover cropped fields. Poor stands in a cover crop system will result in poor cash crop yields. As with any commercial planter, small tweaks in the settings can add up to large yield advantages.

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