SARE Project FNC13-940: Evaluating the Roller-Crimper for Cover Crop Control in Corn and Soybeans on Terraced Ground - 2014 Final Report

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Note: *2013's Annual Report covers some of the basics of setting up and using the roller-crimper. It's available online at:*
http://mysare.sare.org/mySARE/ProjectReport.aspx?do=viewRept&pn=FNC13-940&y=2013&t=0

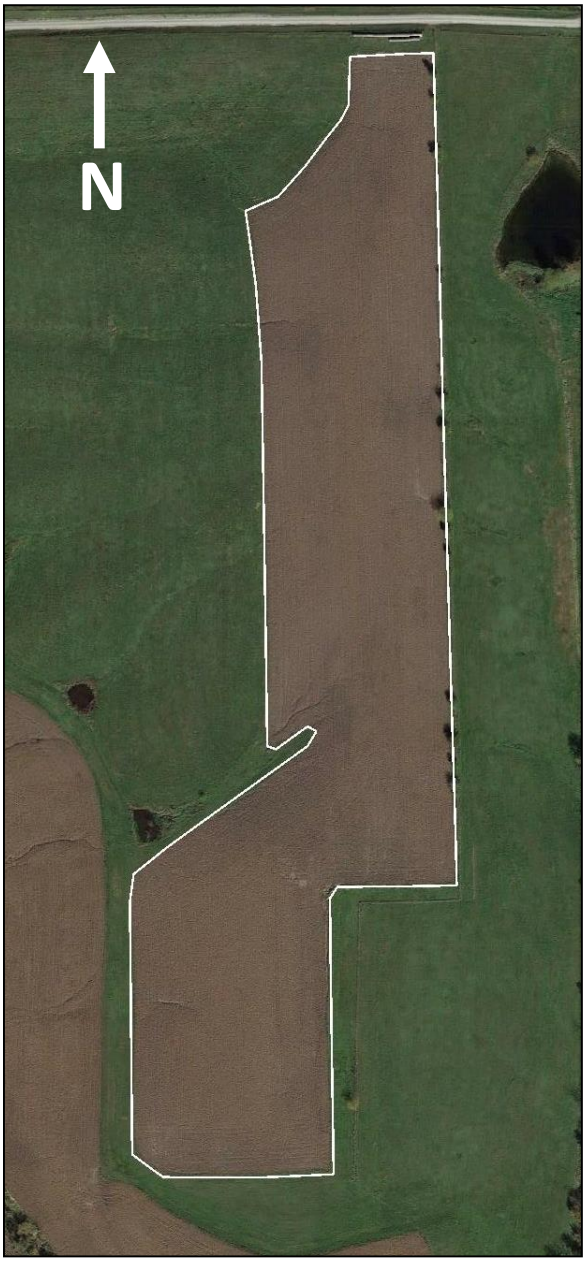

Figure 01: This 17 acre field had a cereal rye cover crop planted September 12, 2013. I planted non-GMO soybeans while rolling and crimping into the cereal rye May 21, 2014. I harvested the soybeans October 28, 2014. (*Aerial photo from Google Earth*)

Summary

This project evaluates the effectiveness of the Rodale roller-crimper in hilly, terraced, and irregularly shaped fields. This report highlights 2014's results and how they compare to 2013's.

Considering the results from 2013's project report, this year's report aims to address these questions:

1. Rolling and crimping when the cover crop (such as cereal rye) is mature ensures better cover crop termination. However, the weather may not cooperate when it's the right time to roll and crimp. How do you manage for this?
2. Some cereal rye that was rolled and crimped in 2013 went to seed. Can the volunteer stand of rye be used for seed production?

Introduction

This report expands upon results from the 2013 report. This project evaluates the effectiveness of the Rodale roller-crimper while planting in hilly, terraced, and irregularly shaped fields.

Planting Setup

On May 21, 2014, I planted non-GMO soybeans into a 17 acre field of cereal rye (*See Figure 01*). The rye was planted at 45 lbs./ac. September 12, 2013, following corn. Soybeans were planted at a rate of about 150,000 seeds/ac. using a John Deere 1590 15' no-till grain drill pulled by a New Holland TM140 tractor. I set the drill to plant 1" deep in the soil beneath the rolled cereal rye. No suitcase weights were added to the back of the drill and the tractor did not have dual tires mounted on it. The 15' 6" I&J Mfg. roller-crimper was mounted to the front of the tractor on a LaForge three-point hitch. I kept the tractor in four-wheel drive the entire time I planted while rolling and crimping. My average speed was 4.5 mph.

Operating the Roller-Crimper in an Irregularly Shaped Field

Since this field didn't have terraces, it was relatively easy to roll and crimp while planting. Most parts of the field had six to eight passes around the outside for a boundary. Once the boundary was complete, I filled in the rest of the field by planting back and forth (*See Figure 02*).

Just like last year, curved parts of the field had to be treated like corners since turning too sharply with the roller-crimper can strain the arms of your front-mounted three-point hitch.

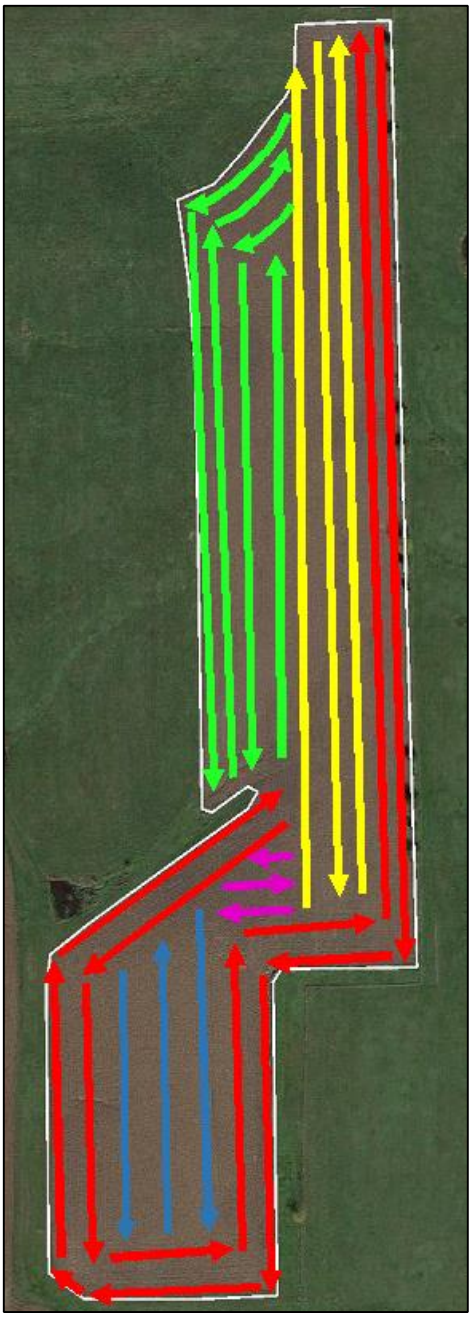

Figure 02: This diagram gives a rough sketch of how I approached this field. Curved arrows show where I could follow the contour of the field. Empty space between arrows shows where I had to make a new pass. My first seven passes (red) made a boundary on the east, south, and southwest sides of the field. I then filled in the southwest rectangle of the field by planting north and south (blue passes). Then I made a few passes going north and south on the east side (yellow) before making a boundary along the west edge of the field (green). I finished the field by filling in the central triangle area with passes going east and west (purple).

Plant Maturity and Cover Crop Control

By May 14, 2014, much of the cereal rye in this field had reached anthesis/pollination (*See Figure 03, next page*). This is the earliest growth stage at which cereal rye can be rolled and crimped (Seidel, 2008, p. 2). Compared to other fields with cereal rye, this one seemed to reach anthesis a little sooner. It even reached anthesis sooner than cereal rye planted as part of a cover crop mix on August 27, 2013, which is almost half of a month earlier than this field's rye planting date.

What would cause this field of cereal rye to reach anthesis sooner? This rye followed a corn crop that averaged 112 bu./ac., even though it was fertilized for a yield goal of 150 bu./ac. Did the untapped fertility cause this crop to mature sooner? The cereal rye planted in the late August cover crop mix had N, P and K spread on it March 18, 2014, so it wasn't lacking fertility, either.

This field had cattle grazing on it over the winter. They were pulled off of the field March 1, 2014. There were a few other fields near this one that had cereal rye where cows grazed over the winter, and they also reached anthesis at a similar time. Fields of cereal rye where we didn't have cows winter grazing didn't reach anthesis as soon. Does winter grazing affect when the cereal rye reaches anthesis?

Fertility and Cover Crop Control

The roller-crimper did a better job controlling cereal rye that had higher fertility. In this field, areas where cows dropped manure created areas with very high fertility. The rye in these areas laid over much better than surrounding areas that didn't get a high concentration of manure (*See Figure 04, next page*). Other research shows adequate fertility improves control with the roller-crimper (Lawrence, 2006, p. 6). Cereal rye in particularly low-fertility areas, like sideslopes, were shorter and had tougher stems. These plants would often spring back up after being rolled over with the roller-crimper. Plants in spots with higher fertility had larger, lusher growth that rolled and crimped very easily.

This is similar to the outcome I had last year on cereal rye that had nitrogen fertilizer applied. Even though that rye was planted later, it reached anthesis around the same time. It also did a better job of staying flattened after rolling and crimping compared to unfertilized rye at a similar maturity stage.

Figure 03 (left): This picture was taken May 14, 2014. This cereal rye plant reached anthesis/pollination. Most of the other plants in the field were at the same growth stage. This is the earliest growth stage for rolling and crimping, but waiting for the cereal rye to get closer to maturity results in better control (Lawrence, 2006, p. 5).

Figure 04 (right): The spot circled in red had lusher growth compared to surrounding plants. There were multiple "hot spots" like this in the field. I assume these areas occurred due to uneven manure distribution. Cereal rye in these "hot spots" flattened much better than rye in surrounding areas that didn't appear to be as fertile. Plants that seemed to suffer from a lack of fertility sprang back up after being rolled over by the roller-crimper.

Weed Control After Rolling and Crimping

Since many areas of rye didn't flatten well with the roller-crimper, I had to spray herbicides. I finished planting the field while rolling and crimping the evening of May 21, 2014. Overnight, it rained about .4 inches. I sprayed a preemergence application of glyphosate and a residual herbicide on May 23, 2014. Despite the soil still being a little wet from the rain, the sprayer didn't cut ruts in the field or pick up much mud on the tires. If I were spraying in a field without cover crops with this level of soil moisture, then I'm sure the sprayer would have cut ruts. That's something to keep in mind when using the roller-crimper; even if you get unsatisfactory control you can still do a pre-emergence application of herbicides even in less-than-ideal field conditions thanks to the large amount of cover crop biomass.

The Roller-Crimper's Effect on Yield

This field was harvested October 28, 2014. Its average yield was 53.5 bu./ac. This was comparable to other fields on this farm that were planted on the same day without using the roller-crimper.

Last year, I noticed overlapping passes with the roller crimper laid cereal rye over previously flattened rye, making a much thicker mat of residue. This appeared to stunt soybean emergence. This was most noticeable at the corners of the field, where passes would intersect perpendicularly. This year, the central area in the field where several roller-crimper passes converged had an unusually low yield (*See Figure 05, next page*). Though I didn't go to this particular point in the field to visually confirm that emergence was slower in this spot during the growing season, the fact that multiple passes overlapped at this point would indicate that this area also experienced stunted emergence due to excessively thick residue cover.

Assuming this area had lower yield due to overlapping swaths of cereal rye residue, I figured what the amount of lost revenue would be. This area equaled about 1 acre. By selecting the values of all the yield points in this area from the yield map, adding them up, and averaging them, I came to an average yield for this area of 36 bushels. If this area would have yielded the field average of 53.5, then that would be an extra 17.5 bushels added to the field's total, raising the field's average yield to 54.5 bu./ac. If soybean prices are $10.00/bu., then this resulted in $175 in lost revenue for this field. Overall, this amounted to a 1.8% drop in yield for this field.

Another possibility is that excessive field traffic at the ends of turn rows lowered yield in this area. Whether overlapping residue or excessive traffic lowered yield, a good approach for any field

would be to plan out your passes so they ran parallel to each other rather than perpendicular as much as possible. For this field, I could have made a pass from the north end of the field all the way to the south end rather than splitting the field into two rectangles and leaving an unplanted triangle shaped area that had to be filled in at the end.

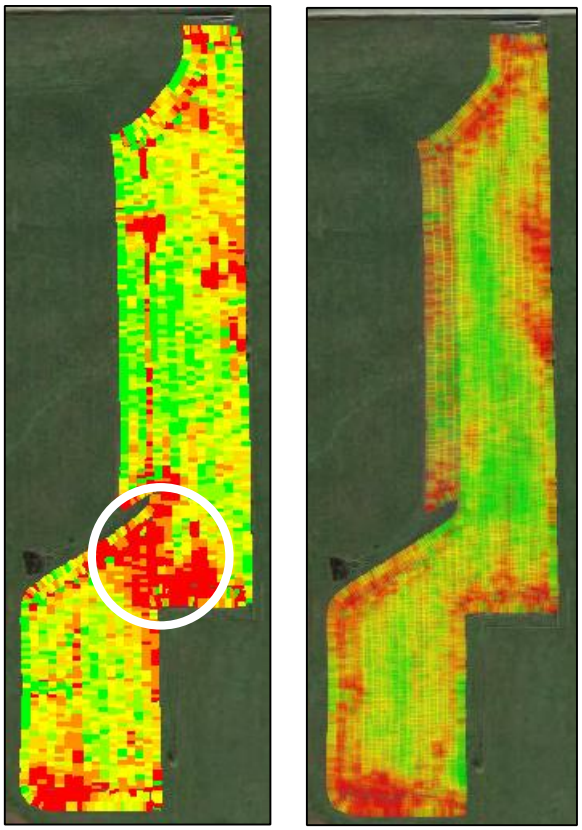

Figure 05: 2014's yield map is to the left with the unusually low-yielding area circled. Soybean yields from 2012, 2010, 2008, and 2006 are combined into a single map on the right. In these years this area had an average soybean yield. One reason this area might have yielded less is that multiple passes over cereal rye were laid over each other, creating an overly thick thatch that inhibited emergence. Another possibility is that higher traffic in all the turn rows in this area increased compaction, lowering yield.

2013 Follow-Up: Volunteer Cereal Rye

Last year, I rolled and crimped a field of cereal rye while planting soybeans. The rye in this field was near the dough stage; the immature seeds popped like blisters when you poked them with your thumbnail.

By August, I noticed volunteer rye plants coming up. They didn't make harvesting the soybeans difficult, and they left ample ground cover for the winter. I decided to keep the volunteer stand of cereal rye intact and harvest it for seed in 2014. I harvested it July 10, 2014.

I fertilized half of the field with 40 lbs. N as urea in early April when the rye was greening up. The other half I left unfertilized to see if growing side-by-side with the soybeans early on would have provided it enough N.

After cleaning the rye seed, this field yielded about 17 bu./ac. The fertilized area averaged 24.4 bu./ac. while the unfertilized area averaged 10.9 bu./ac. In the better spots, it yielded 35 bu./ac. One of the main reasons this field yielded so poorly was because it had several bare spots where there was little to no rye growing. I drilled about 20 lbs./ac. of rye over the entire field after harvesting in 2013 to fill in areas that didn't have a sufficient stand of volunteer rye, but bare spots were still a problem in 2014.

Overall, I wouldn't recommend keeping a volunteer stand of rye for seed production. Grazing it would be a good option. It could also be treated as a cover crop, but it should be sprayed instead of rolled and crimped. Due to all the bare spots, volunteer rye wouldn't provide the thick, uniform stand that ensures good weed control from rolling and crimping.

Conclusions

- Fertility appeared to play a big role in ensuring the cereal rye flattened well with the roller-crimper. Rye in lower fertility areas was shorter and had tougher stems, causing them to spring back up after the roller-crimper rolled over the rye.
- If the cereal rye didn't flatten well when rolling and crimping while planting, it's still possible to spray the field afterwards even in less-than-ideal field conditions. The high amount of residue protects the soil from rutting.
- If rolled and crimped cereal rye from the previous season goes to seed, it's best to not harvest that volunteer stand of rye for seed production since you'll likely have an uneven stand.

Other Questions for Further Research

- Cereal rye grazed over the winter seemed to reach anthesis sooner. In 2013, rye that was fertilized reached anthesis before rye that didn't get fertilizer. Can grazing and fertility be managed to help rye reach maturity sooner, meaning an earlier date for rolling and crimping?

REFERENCES

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