Western Illinois University/ School of Agriculture

2019 Blind Cultivation & Soybean Variety Study

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Introduction:

Blind cultivation is an early season mechanical weed control strategy designed to accomplish 2 main goals: a) termination of very young weeds (primarily between germination and emergence) when seedlings are most sensitive to mechanical disturbance and b) creation of a loose soil surface environment that is unfavorable for germination until the next rain.

Blind cultivation generally disturbs the entire field surface and thus is not targeted (i.e., blind), in contrast with row-crop cultivation that primarily disturbs soil between crop rows.

The tools farmers use for blind cultivation vary with respect to intensity of soil disturbance and compatibility with surface residues. Rotary hoes are more compatible with surface residues but generally fracture the soil surface less completely while tine weeders and drag harrows are less compatible with surface residues but tend to be more aggressive tools.

Blind cultivation is typically performed multiple times between planting and first row cultivation, sometimes as soon as the same day as planting. Some organic farmers perform blind cultivation approximately every 3-4 days for 3-4 weeks as long as the soil is not excessively wet.

This study compared 2 methods of blind cultivation (rotary hoeing vs tine weeding) and 2 soybean varieties (34A7 and 35DC2) from Blue River Organic Seed. 34A7 is a tall leafy variety that has been a top performer at the WIU Organic Research Farm most years for over a decade whereas 35DC2 is a shorter relatively new variety. Both varieties are a mid-group 3 maturity.

Methods/Field Activities:

The study occurred in field 1B (~12 acres with an east/west orientation) and had a complete randomized block design with 4 treatments and 3 replications. The 12 research plots were 30 feet wide (12 x 30” rows) and 1260’ long and were bordered by equally sized buffer plots on the north and south edges of the field. The previous crop was corn and no fall tillage occurred.

Data collected from the plots included weed counts, stand counts, and grain yields.

<u>Specific field operations are summarized below:</u>

4/19/19: Application of a residue digester program from SoilBiotics across the entire field at the following approximate rates: (2 gal/a of eFISHnt, 2 qts/a of Growth Boost, 1 pt/a of SB 5500, 12 gal/a of water)

4/23: Shallow tillage (~2") with a McFarlane Incite vertical tillage tool to size corn stalks

6/13: Shallow tillage with a 25’ Soil Finisher tool (field cultivator with disk harrow)

6/18: Shallow tillage with a 31’ field cultivator

6/30: Shallow tillage with a 31’ field cultivator to prepare for planting soybeans

7/1: Planting of soybeans with a JD 12-row air vac planter at ~1.75" deep (34A7 @ ~170,000/a & 35DC2 @ ~167,000/a)

7/8: Rotary hoeing of plots with IDs 1 and 1.1 using a 15’ M&W rotary hoe at ~10 mph, soybeans were ~ 1" tall.

7/9: Tine weeding of plots with IDs 2 and 2.2 using a 15’ Einbock Aerostar tine weeder at ~4.6 mph, soybeans were ~1" tall.

7/19: Rotary hoeing of plots with IDs 1 and 1.1 using a 15’ M&W rotary hoe at ~10 mph, soybeans were ~ 2-3" tall.

7/19: Tine weeding of plots with IDs 2 and 2.2 using a 15’ Einbock Aerostar tine weeder at ~ 5+ mph, soybeans were ~2-3" tall.

7/25: Row crop cultivation of all soybean plots with a modified IH 153 cultivator, soybeans were ~4-5" tall.

8/2: Weed counts (primarily waterhemp, small amounts of giant foxtail, redroot pigweed, and velvetleaf) in the middle 4 rows of each plot for a distance of 100'

8/5: Soybean stand counts (5 x 1 row x 5’) within each plot, small plants with minimal pods were not counted.

11/25: Harvesting of soybeans with a JD STS combine using a 25' wide grain head, a weigh wagon was used to weigh some of the plots. Most of the yield data was derived from yield monitor data with correction factors applied based on the four weigh wagon weights.

Table 1.

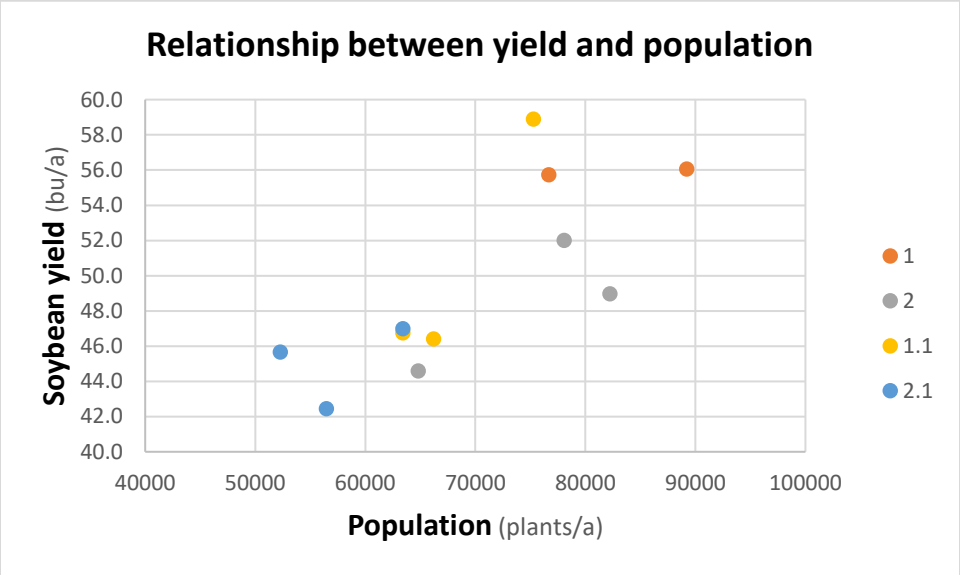
Treatment ID #	Treatment Description	Grain yield (bu/a)	Soybean population (#/a)	Weed abundance (#/a)
1	34A7 soybeans w/ rotary hoeing	51.0 a	82,009 a	1,917 ab
2	34A7 soybeans w/ tine weeding	48.5 a	75,039 ab	450 b
1.1	35DC2 soybeans w/ rotary hoeing	50.7 a	68,302 b	2,773 a
2.1	35DC2 soybeans w/ tine weeding	45.0 a	57,383 c	465 b
	Least Significant Difference (α = 0.05)	*11.3*	*10,086*	*1,892*

Results and Discussion:

Grain yields, stand counts and weed counts are reported in table 1.

No statistically significant differences in whole plot grain yields were identified but the numerical differences shown in Table 1 suggest that rotary hoed plots tended to have higher yields than tine weeded plots and this effect is likely to have been more distinct with more replication or intensive analysis of subplot data.

The tendency for rotary hoed plot yields to have higher yields is likely related to stand. Rotary hoed plots had higher populations than tine weeded plots and grain yield was positively related to stand count.



Treatment 1 only has 2 data points because the plot that accidentally received the wrong treatment is not shown

Tine weeding reduced the stand of both soybean varieties (relative to rotary hoeing) but appeared to have a greater effect on 35DC2 (10,919 plants/a, 16.0% reduction) than 34A7 (6,970 plants/a, 8.5% reduction).

In addition, tine weeding reduced weed counts relative to rotary hoeing in both soybean varieties (450/a vs 1917/a in 34A7 and 465/a vs 2773/a in 35DC2) for an average reduction of ~500%.

The more aggressive effects of tine weeding observed in this study (relative to rotary hoeing) are partly a result of differences in tool design but also how the tools were set and operated.

A significant portion (~ 50%) of the soybeans were lightly covered with soil during the first tine weeding when the soybeans were only ~ 1” tall. Many of the soybeans emerged from this burial but this is when much of the stand loss associated with tine weeding occurred and it may have been beneficial to set the tine weeder less aggressively for this first pass.

Negative effects of early tine weeding on soybean stand appear to vary with variety, with 34A7 less sensitive to tine weeding than 35DC2. In addition to measured effects on stand reported in Table 1, qualitative visual observations revealed 34A7 plots to have a more robust appearance and stand compared to 35DC2 plots.

Overall, grain yields for all treatments were good (averaging 48.8 bu/a) considering how late the soybeans were planted (7/1) and the excessive precipitation. The 2019 season was one of the wettest seasons in decades reducing opportunities for timely field operations and vigorous crop growth and increasing opportunities for weed germination.

It should be noted that treatment ID 1, rep 1 (34A7 with rotary hoeing) was accidentally tine weeded on 7/19. This error occurred during the second blind cultivation and thus may have had less impact on plot performance than if it had occurred during the first blind cultivation but this was the lowest yield plot.

Conclusion:

A rotary hoe has been the standard blind cultivation tool for over 2 decades at the WIU Organic Research Farm. In contrast, we began using an Einbock Aerostar tine weeder in 2016 and still have questions that need to be answered regarding the most effective ways to set and operate the tool in row crops.

This study showed that tine weeding can provide superior weed control compared with rotary hoeing but can also have more negative effects on soybean stand (especially for more sensitive varieties like 35DC2) most likely contributing to reduced grain yield.

Additional studies are needed that specifically evaluate the impact of tine weeder setting and operation (more vs. less aggressive) during the first pass when soybeans are small, integrate tools (e.g., rotary hoeing for 1st blind cultivation followed by tine weeding for 2nd blind cultivation) or compare more soybean varieties. These types of studies can help identify blind cultivation practices that provide good weed control while reducing loss of crop stand (and potentially yield). We have observed 34A7 to be a large leafy high yielding variety in many trials over the last decade but this study identified a specific valuable trait, tolerance of aggressive blind cultivation.

First tine weeding on 7/9

Second tine weeding on 7/19