

# **2009/2010 Tillage System Study at the WIU/Allison Farm**

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## **Introduction**

For most of the last 150 years, row crop production in the Midwest was very tillage intensive with multiple pre-plant tillage operations (frequently beginning in the fall) to prepare a weed free and largely residue free seed bed. In addition, multiple cultivations took place during the growing season to control weeds. During recent decades however, tillage intensity has diminished in conventional agriculture (conventional tillage acres decreased from 45% in 1990 to < 30% in 2008 and no-till acres increased from 6% to >25%) whereas tillage intensity has remained high on most organic farms.

With increasing fuel prices, heightened concerns about the negative effects of tillage on soil quality and challenging weather conditions for tillage, growing numbers of organic farmers and researchers are exploring options for reducing tillage intensity. At the WIU/Allison Organic Farm, we began evaluating no-till planting of soybeans into rolled cereal rye in the 2008/2009 season and continued with larger scale plots in the 2009/2010 season. Results for the 2008/2009 season have been previously reported. This report discusses the 2009/2010 season.

## **Methods:**

A complete block tillage system experiment was established in fall 2009 with 2 treatments (no-till vs. ridge-till) and 3 replications. The no-till plots (30' x ~1200') were planted to '*Aroostock*' cereal rye (~ 98 lbs/ac) on August 30<sup>th</sup>, 2009 using a conventional John Deere 10' drill. The preceding crop was winter wheat with frost seeded red clover and the red clover was incorporated using a Howard Rotavator two weeks prior to drilling the rye. The ridge-till plots were ridged using a 4 row Buffalo cultivator set for maximum soil movement into the row. June 1<sup>st</sup> 2010, the ridge-till plots were rotavated, due to excessive weed growth on and between the ridges, thus changing the treatment to conventional-till.

On June 7<sup>th</sup>, the no-till rye plots were about 2 weeks past anthesis, but had not been rolled to due to excessive wetness. We decided to drill directly into the standing rye because it had not rained for several days, but more rain was expected. Blue River Hybrid soybeans 34A7 were drilled in an easterly direction using a 15' John Deere no-till drill (7.5" rows) at a rate of ~230,000 seeds/ac. Our intention was to roll soon after planting, but this was not possible due to excessive wetness.

The tillage plots were rotavated again on July 3<sup>rd</sup> and then BRH 34A7 beans were planted on July 4<sup>th</sup> using a Buffalo 4-row planter at a rate of ~170,000/ac and a depth of 1 ½". The no-till soybeans were in the 3<sup>rd</sup> trifoliolate stage at this time. Weed control for the conventional-till plots consisted of rotary hoeing twice on July 16<sup>th</sup> and row cultivations on July 17<sup>th</sup>, August 4<sup>th</sup>, and August 24<sup>th</sup>. In addition, the beans were walked in early September and most broadleaf weeds (primarily waterhemp) taller than the soybeans were pulled.

All plots were harvested on November 5<sup>th</sup>, 2010 using a John Deere 9510 combine with a 25' grain table flex head. A weigh wagon was used to obtain grain weights for each plot.

**Results:**

The no-till soybean plots averaged 44.4 bu/a, while the conventional-till plots averaged 37.0 bu/a, but they were not significantly different with alpha = 0.05 (table 1). The no-till plot in rep 1 was the highest yielding plot (51.9 bu/a). The highest yielding tillage plot (41.8 bu/a) was in rep 2 just north of the top yielding no-till plot (map 1).

Table 1: Variation of soybean mean yields in tillage systems

Treatment	Soybean Yield (bu/a)
No-Till	44.4
Conventional-Till	37.0
	LSD (alpha 0.05) = 12.4

Map 1: Tillage experiment map with plot yields (Field 1B)

N↑

<p><b>No-Till</b> 40.7 bu/a (south half drilled shallow and north half drilled deep)</p>	Rep 3
<p><b>Conventional-Till</b> 34.4 bu/a</p>	
<p><b>No-Till</b> 40.6 bu/a (drilled shallow for full 30' width)</p>	Rep 2
<p><b>Conventional-Till</b> 41.8 bu/a*</p>	
<p><b>No-Till</b> 51.9 bu/a* (south half drilled shallow 1X and deep 1X; and north half drilled shallow)</p>	Rep 1
<p><b>Conventional-Till</b> 34.7 bu/a</p>	

\* Top yielding plots for each treatment

Each plot represented in map above was planted 30' wide for full length of field.

### Discussion:

The 2010 growing season was one of the wettest in history, which created very challenging conditions for field operations and introduced some confounding variables (e.g., a 4 week difference in planting date between the no-till and tillage plots. This obviously gave a growing season advantage to the no-till plots but it should be noted that conditions were far from optimal when the no-till plots were planted. The drill units accumulated mud and rye residue (that had to be removed between plots) and the seeding depth fluctuated significantly (we decreased the depth 2 times to reduce wrapping of rye). Variation in seeding depth is one variable that we hope to avoid in research, but became an issue due to undesirable field conditions (map 1). In rep 3, most of the seed slots did not close, leaving seed uncovered by soil but under lodged rye residue.

If the season had been dry these seeds would probably not have survived. On the other hand, it was nearly impossible to plant at our standard 1 ½- 1 ¾” depth because of rye wrapping on the drill units. This illustrates the importance of checking the planting depth of seed more than once and considering the weather forecast when planting a no-till organic crop.

The abundant rain (~300% of normal in May, June and July) and warm conditions (~ 300 GDD above average) were ideal for weed germination and growth. The no-till plots had moderate pressure from foxtail, but very few broadleaf weeds. The tillage plots had high broadleaf weed pressure and moderate foxtail pressure but most were removed by 3 row cultivations and hand rouging.

### **Conclusion:**

Overall, both treatments performed well considering the extreme weather conditions. The excellent stand establishment in the no-till plots is particularly noteworthy despite thick rye residue, not rolling the rye, shallow seed placement, and lack of seed slot closure. Low broadleaf weed pressure is another noteworthy component of the no-till plots. It is not really possible to compare the impact of tillage system on yield because of the very different planting dates. We are pleased that both treatments produced respectable yields despite extraordinarily wet conditions and plan to continue our investigation of no-till soybean production in 2011.

See photos below of the study!



October 2009 - plots for tillage system study in 2010

December 2009 – cereal rye preceding no-till soybeans in 2010



December 2009 – plot intended for ridge-till soybeans in 2010



June 7, 2010 – planting soybeans into standing cereal rye with a JD 750 no-till drill



June 7, 2010 – appearance of no-till plot after planting



Mid-June 2010 – soybeans emerging through rye partially knocked down during planting



Mid-June 2010 – soybeans emerging through successfully knocked down rye residue



Late June 2010 – flooding on east end of plots



July 4, 2010 – no-till soybeans at 3<sup>rd</sup> trifoliolate; adjacent conventional-till plots have finally been planted!





Early September 2010 – no-till plot with some foxtail but very few broadleaf weeds



Mid-September 2010 – conventional -till plot



November 5, 2010 – harvesting a no-till plot



December 2010 – appearance of no-till plot after harvest

