

Soil Compaction, Subsoil Tillage, & Cover Crop Effect on Crop Production

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Objective

To evaluate the effect of soil compaction, cover crops, and subsoil tillage on crop production.

Background

Cooperator:	O.A.R.D.C. NW Branch	Variety:	corn – Beck 5354 HXR
County:	Wood		soybean - Pioneer 93Y10
Nearest Town:	Hoytville	Planting Date:	corn 5-27-10 soybean – 5-29-10
Drainage:	Tile, well-drained	Planting Rate:	corn- 30,000, soybean- 180,000
Soil type:	Hoytville, clay	Row Width:	corn- 30 in, bean- 7.5 in
Tillage:	No-till vs subsoil	Herbicides:	corn – Lexar, 2,4-D, Glyphosate, soybean – Sonic, Glyphosate 2,4-D
Previous Crop:	corn/soybean rotation	Harvest Date:	corn- 10-14-10 bean 10-11-10

Methods

The entries were replicated four times in a randomized complete block design. Plot size- 10 x 50 feet each entry. Harvest data was collected from the center rows. All treatments received the same seed variety, herbicide, and pre-season fertilizer applications.

On November 17 & 18, 2008, a single axle grain cart was used with half full 10 ton/axle weight and full 20 ton/axle weight. Compacted plots were driven over the entire area of those plots once with tractor and grain cart. The same plots were previously compacted in a similar way in 2002 and 2005. On November 20, 2008 subsoil tillage was done on subsoil plots. On November 12, 2009 the same plots received the same subsoil tillage. This tool has a single straight shank spaced 30 in. apart, operated at depth of 12- 18 inches. No further tillage was performed. No-till plots have not received any tillage since 2001.

On September 10, 2009, cover crop seed was hand broadcast into the standing row crop. Cereal rye at 50 lb/acre was broadcast under corn. Annual ryegrass at 30 lb/acre was broadcast under soybeans at yellow leaf drop stage. The hard, dry soil under corn did not allow cereal rye to establish very well. However, the soybean leaves falling on top of the annual ryegrass enhanced germination resulting in a good growth of annual ryegrass. The cover crops were killed with glyphosate on April 14, 2010.

Results

2010 Soybean Yield – bu/ac

Treatment	Compaction	Tillage	Yield - Significance
1	None	No-till	50.5 D
2	None	Fall Subsoil	40.1 BC
3	None	Cover crop	42.0 C
4	10 ton	No-till	48.8 D
5	10 ton	Fall Subsoil	42.4 C
6	10 ton	Cover crop	41.4 BC
7	20 ton	No-till	43.5 C
8	20 ton	Fall Subsoil	35.4 A
9	20 ton	Cover crop	37.8 AB

LSD (.20) = 3.9

2010 Corn Yield – bu/ac

Treatment	Compaction	Tillage	Yield - Significance
1	None	No-till	110.5 CDE
2	None	Fall Subsoil	104.2 BCD
3	None	Cover crop	111.5 DE
4	10 ton	No-till	115.7 E
5	10 ton	Fall Subsoil	101.8 BC
6	10 ton	Cover crop	103.5 BCD
7	20 ton	No-till	97.0 B
8	20 ton	Fall Subsoil	82.7 A
9	20 ton	Cover crop	96.4 B

LSD (.20) = 9.3

Summary

Both the corn and soybean plots, the long-term no compaction, no-till treatments did not have significant difference in yield compared to the 10 ton compaction no-till. However the 20 ton compaction no-till was significantly lower yield compared to 10 ton or no compaction no-till.

Subsoil tillage compared to No-till had significantly lower yields in the corn and soybean plots for both 10 ton and 20 ton compaction. This disadvantage for subsoiling continues a trend since 2003.

Long-term No-till may be able to withstand the compaction pressure due to improved soil structure compared to annual subsoiling. Subsoil tillage did not improve crop yields after compaction has occurred at 20 ton (full grain cart).

The cover crop established in fall 2009 before corn planting in 2010 showed the benefits of compaction correction by significantly increasing corn yield compared to subsoil with 20 ton compaction. Due to lack of fall 2009 cover crop plant growth, soybean yields did not respond to cover crop treatments.

The loosened soil structure created by subsoiling means that heavy axle loads that follow, even months or years later, may compact the soil and reduce yields. Repeating the subsoiling treatment after intentional compaction did not correct the problem.

Late fall subsoil tillage may not be the best time to perform compaction correction, due to wet soil. Planning to subsoil after wheat harvest instead means that soil is more likely to be drier and conducive to good shatter. We have not conducted research to make this comparison.

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