

IS FALL TILLAGE FOLLOWING SOYBEAN HARVEST NECESSARY?

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Introduction

As growers look for opportunities to enhance profit margins, the need for fall tillage following soybean harvest is questioned. Although situations and soil types vary across farms, several factors might be considered in addressing this issue.

Benefits of Higher Residue

The benefits of farming with higher crop residue are numerous. Fewer trips across the field saves time, fuel, machinery wear and maintenance. Soil productivity can also be improved with reduced erosion, improved water infiltration and less water evaporation in dry years (USDA NRCS and UWEX, 2000).

Residue Characteristics

When compared to corn residue, soybean residue is more fragile. It breaks down quicker with weather, provides less residue cover initially and is easily destroyed with most any fall tillage. If erosion is a concern, maintaining 30% residue after planting next spring is highly unlikely with fall tilled soybean ground.

Effect of Rotation and Tillage on Surface Crop Residue

Rotation and tillage also impact surface crop residue measured after planting (Wolkowski, 2001). A long-term rotation/tillage study was started at the University of Wisconsin's Arlington Agricultural Research Station in 1997. The study compared continuous corn and a corn-soybean rotation. The corn-soybean rotation was set up so that corn followed soybean and soybean followed corn in each year. Tillage treatments were superimposed on each rotation.

A chisel treatment consisted of fall coulters chisel plowing (3" twisted shank coulters) followed by a single spring pass with a Krause field cultivator (leading set of coulters followed by 6" sweeps and a rolling basket). Other chisel points are available that bury less residue. A no-till treatment featured slot planting with a Kinze planter (soil engagement was by fertilizer and seed coulters). A strip-till treatment used a Kinze planter with Yetter row cleaners. Data were collected in 2000 after planting using the line/transect method.

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Chiseling reduced residue substantially where soybean residue was fall plowed (SbC). Residue remained higher where corn was fall chisel plowed (CC and CSb rotation). More residue was found in continuous corn (CC). Residue clearing reduced overall residue an average of 10 to 12% with the greatest reduction in CC where residue was highest in no-till.

Effect of four years of rotation and tillage on surface crop residue measured after planting, Arlington, WI, 2000.*

Crop rotation*	Chisel	No-till	Strip-till	Average
	-----%-----			
CC	45	88	70	68
CSb	32	75	69	59
SbC	18	68	58	48
Average	32	77	66	

LSD 0.05 = 12 for rotation and tillage; CC = continuous corn, CSb = corn-soybean, SbC = soybean-corn.

Soil Characteristics

Erosion potential depends mostly on the length and steepness of slope and soil texture. Highly erodible land (HEL) requires 30% residue cover after planting for conservation compliance and LDP payments. Although flat fields have lower erosion potential, sediment loss can still be a problem. Intense rainfall events can easily trigger soil detachment and runoff. Open tile inlets or other channels serve as direct conduits for sediment-laden runoff water to quickly reach drainage ditches, streams, lakes or other surface water bodies.

Poorly drained soils typically warm up more slowly in spring and usually require more tillage than do well drained soils. Level of residue remaining in spring influences this factor and again there is a less residue with soybeans vs. corn. Field tiling also helps these soils to warm quicker in spring.

Soil fertility levels also need consideration. Fields testing low in phosphorous (P) and potassium (K) should be brought to higher soil test fertility levels for best results with reduced tillage systems. A small amount of row applied P and K in a band near the row is also important for corn production with high residue systems. Also remember to adjust the soil pH by liming if recommended by soil test.

Field activities conducted under wet harvest conditions can result in surface compaction. Primary fall tillage may be needed where these situations occur on susceptible soil types.

Nutrient Management

Soybean fields that receive fall manure applications following harvest present a dilemma. Liquid manure can be injected or knifed in leaving some residue but these operations are more costly than surface spreading when applied by custom operators. With surface applied manure, liquid or solid, incorporation is recommended to maximize nitrogen values and minimize runoff risks. Exposing bare soil with tillage to incorporate manure may lead to a greater loss of total phosphorous.

Herbicide Program

Reduced tillage and increased levels of crop residue may increase weed pressure and cause a shift over time to different weed species. However, with today's wide choice of herbicides, excellent control with little or no tillage is highly feasible, often at little or no additional weed control cost compared to conventional tillage.

Planting Equipment: Type and Age

Matching planting equipment with the desired tillage system is important. Planter mounted row cleaners are advisable for planting corn into plant residues. A good goal for corn is less than 10% cover over the row. Monitor seed depth when planting as untilled soil conditions may require more down pressure.

Long-Term Tillage Research

Long-term tillage experiments on corn-soybean rotations have been conducted at the University of Minnesota agricultural experiment stations at Lamberton, Morris and Waseca (Randall et al., 1993). Soil types may vary somewhat with those found across Wisconsin but insights can be drawn from this data. Glacial till soils are formed from loess and would be similar to the soils of south central Wisconsin. Lacustrine soils are formed from lake sediments and would be similar to the soils of eastern Wisconsin.

Five tillage systems were compared. A *moldboard plow* system included fall moldboard plowing followed by one or two secondary tillage operations before planting. A *chisel plow-plus* system included fall chisel plowing plus spring secondary tillage. A *one or two pass system* used no fall primary tillage with a single pass in spring with a field cultivator before planting corn. A single or double pass with a tandem disk was used before planting soybeans. *Ridge-till* and *no-till* systems were also included for comparison. With the *ridge-till* system, tillage was limited to that performed by the planter (ridge-leveling) and one or two in-season cultivations (ridge-building). With the *no-till system*, all seedbed preparation was performed by the planter. Starter fertilizer

placement and clearing residue from the rows usually was done with the planter for corn. It may be done separately in combination with anhydrous ammonia injection or other fertilizer injected into a band.

Residue management and yield performance indicators were established as follows: 1) *Inadequate Residue to Minimize Erosion* (less than 30 % of surface covered after planting). Highest yield may be obtained, however, on poorly drained, fine textured, high organic matter soils. 2) *Recommended with Good Management*. No yield penalty is expected if the farmer observes all relevant recommended management practices for high residue systems. 3) *Excellent Management Required*. Slight yield penalty is possible, even if all recommended management practices are observed. Above average crop management will be needed to ensure good performance. 4) *Reduced Yield Potential*. The potential exists for substantially reduced yields especially on poorly drained soils in wet years.

Summary comments suggest that field slope, soil test levels, condition of the field following soybeans and previous years' tillage need consideration when choosing a tillage system for corn after soybeans. On flat, poorly drained, fine textured soils, a one-pass secondary tillage system is usually best. No-tillage can be used on those landscapes with 0 to 8 percent slopes, but management is generally more critical for this system to perform consistently well.

Performance indicators for corn following soybean on glacial till and lacustrine soils under high (>28") and low (<28") annual precipitation in the Minnesota River Basin.*

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Tillage System	Glacial till		Lacustrine	
	Rainfall			
	High	Low	High	Low
Moldboard plow	1	1	1	1
Chisel plow	2/1	1	2/1	1
One pass	2	2	2	2
Ridge-till	2	2	3	3
No-till	3/2	2	3	3

*Performance indicators: 1 – inadequate residue to minimize erosion, 2 – recommended with good management, 3 – excellent management required.

Conclusion

Choosing the “right” tillage system for a particular field is sometimes not a simple process. A final decision will likely be based on net return, erosion reduction potential and eligibility for government programs. Consideration of the factors outlined in this paper may prove useful (Hill, 2000).

References

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