



Conservation Tillage

Adjustment and operation of tillage equipment in systems with high levels of surface residue

Many producers want to leave greater amounts of crop residue on the soil surface. Crop residue helps maintain long-term productivity of soils susceptible to water erosion and cuts production costs by limiting field operations. This bulletin suggests adjustment to your tillage operations that may leave an additional 10 to 15 percent surface residue beyond what your current practices leave with a chisel plow or disk system. Keep in mind, however, that other variables—such as weather and the condition of the soil and residue—can greatly affect the amount of residue.

Producers often have much of the field equipment needed to establish a crop in a tillage system with higher levels of surface residue. Decisions on the purchase of any additional equipment or the operational settings for existing equipment are easier once you decide the amount of residue to be left on the surface at planting.

Machine operation and soil/residue conditions can cause a great amount of variability in the residue remaining after a field operation. U.S. Department of Agriculture researchers in Iowa found that a chisel plow operating in previously undisturbed cornstalks left an average of 39 percent of the soil surface covered with residue. One-third of the time, however, the amount of residue remaining was less than 25 percent or more than 53 percent. Likewise, a disk operating in undisturbed cornstalks left an average of 58 percent residue cover, but one-third of the observations were less than 42 percent or more than 74 percent cover. A chisel plow operating in undisturbed soybean stubble left an average of only 17 percent residue cover.

Because so little soybean residue remains after harvest, you may need to leave your tillage implement parked in the machine shed in order to leave an adequate amount of surface residue in soybean stubble. Even in cornstalks, you will probably need to reduce the number of tillage operations to increase the amount of residue left on the surface at planting.

Successful residue management begins at harvest by using a straw spreader on the combine. A separate

chaff spreader also may be desirable, particularly on combines with wide grain platforms.

If you are purchasing tillage equipment, select implements with as much vertical clearance as possible between the soil surface and implement frame or tool-mounting brackets. Also evaluate the horizontal clearance between soil-engaging tools and around transport wheels. During field operations, level the implement frame both fore-and-aft and laterally to improve uniform depth and action of the soil-engaging tools.

Depth and speed of operation can influence the amount of residue left on the surface. Scientists with Deere & Co. Technical Center operating a chisel plow in undisturbed

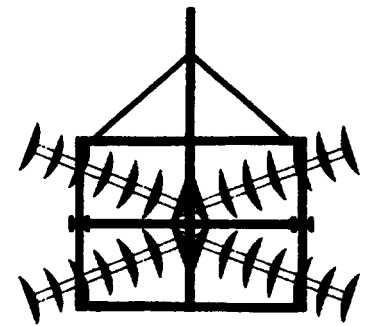


Figure 1. Disk gang angle.

cornstalks found that more residue remained on the surface when operating depth was 4 and 6 inches than when depth was 8 or 10 inches. Percentage of residue remaining was about constant at field speeds of 4.5 to 6 miles per hour (mph), but increased when field speed was lowered to 1.5 mph.

Other adjustments include changing the configuration of the implement. The Deere & Co. researchers found that raising the disk gang in front of the chisel plow left 9 percent more corn residue and 13 percent more soybean residue on the surface. When they tried different soil-engaging tools on the shanks of the chisel plow, the amount of surface residue remaining after tillage generally was greater with a straight point than with a twisted shovel. They also found that 16-inch wide, low or medium crown sweeps (mounted on shanks spaced at 15 inches) generally left more surface residue and a more level surface than chisel points.

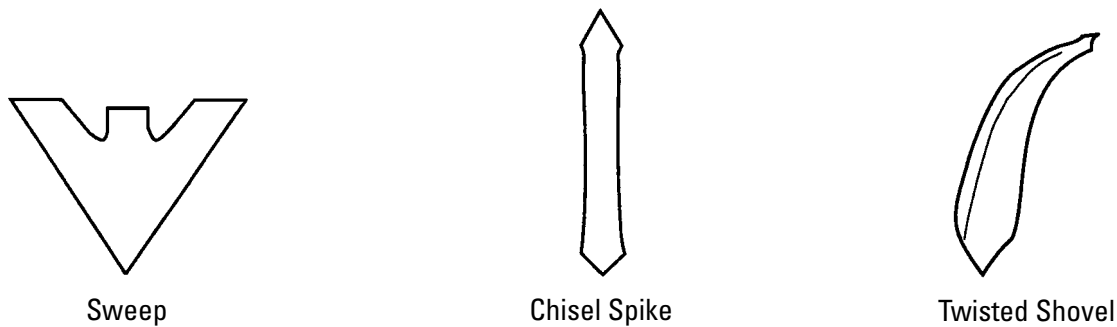


Figure 2. General types of soil engaging tools used on a chisel plow.

Configuration of some disks may be altered by changing the angle of the disk gangs. A less aggressive angle, with disc blades nearly parallel to the direction of travel, may leave more surface residue.

If you want a specific minimum level of surface residue after planting, check residue levels following a given field operation after only a few passes of the implement. This allows you to make adjustments before excessive residue burial occurs. USDA researchers observed that the level of residue remaining after tillage could be quite different from field to field even though the same tillage tool was set and operated in the same manner.

General conclusions from research

- Be cautious when tilling soybean residue. Most tillage operations will bury large amounts of soybean residue.
- Tillage in undisturbed residue virtually always buries some surface residue.
- Most secondary tillage operations bury residue. Light soil manipulation with sweeps (e.g., a field cultivator) or a planter sometimes increases surface residue if it has been previously buried.
- Variables under control of the operator such as depth, speed, and configuration of the soil-engaging components may allow an increased amount of residue to remain on the soil surface.
- Leaving larger amounts of surface residue requires the elimination of some tillage passes.

- If you are purchasing equipment, evaluate its effects on residue burial and residue clearance around the soil-engaging tools.
- **Most important**, before tilling an entire field, check the amount of residue remaining in a small test area. The total amount of surface residue remaining is affected by the amount and condition of residue lying on the surface before tillage as well as by equipment adjustment and operation.

References

Colvin, T. S., E. C. Berry, D. C. Erbach, and J. M. Laffen. 1986. Tillage implement effects on corn and soybean residue. *Transactions of the Amer. Soc. of Ag. Engineers* 29(1):56-59.

Johnson, R. R. 1988. Soil engaging tool effects on surface residue and roughness with chisel-type implements. *Soil Science Society of Amer. Journal* 52:237-243.

For more information on conservation tillage system, see the following publications available at your county extension office.

PM 1096 *Controlling Corn Diseases in Conservation Tillage*

PM 1176 *Weed Management in Conservation Tillage*

Prepared by Mark Hanna, extension agricultural and biosystems engineer, and Richard Pope, extension program specialist - entomology.

File: Engineering 3