Agronomy Guide

Purdue University Cooperative Extension Service

SOILS (TILLAGE) AY-269-W

Estimating Corn and Soybean Residue Cover

Kenneth J. Eck, Purdue Conservation Program Specialist
Darrell E. Brown, USDA Natural Resources Conservation Service Agronomist

Crop residue management through conservation tillage is one of the best and most efficient methods of controlling soil erosion. Each year, about 30 million tons of topsoil are eroded from Indiana croplands. Research shows that this can be greatly reduced by maintaining a crop residue cover on the soil surface of at least 30% after all tillage and planting operations. Leaving that amount will cut water-caused erosion to about half of what it would be if the field was clean-tilled; a higher percentage left reduces soil losses even more.

Line-transect method using a beaded line for estimating percent residue cover.

Conservation tillage and residue management not only save soil, labor, and fuel, but also help improve soil and water quality–all of which are important to the agricultural producer.

Conservation tillage is defined as any tillage-planting system that leaves at least 30% of the field surface covered with crop residue after planting has been completed. For example, two diskings in corn residue that left a 40% cover would be classified as a conservation tillage system, whereas just one disking in soybean residue resulting in less than 20% cover could not be considered conservation tillage because too much of the fragile residue is destroyed.

Conservation tillage is one of the most effective means of cropland erosion control. Uniformly distributed residue shields the soil surface from rainfall impact, thus reducing soil particle detachment and eventual erosion. Also, the residue creates small dams which slow the rate of runoff, allowing more time for water to infiltrate into the soil. A slower rate and reduced volume of runoff means less soil removed from the field.

Residue can also protect soil from the erosive forces of wind. To what extent, however, depends on the amount of residue present and its orientation (i.e., whether upright or flat). Standing residue is more effective than flattened residue in reducing wind erosion.

Methods for Estimating Residue Cover

Cropland residue cover estimation is not only useful in planning field operations to maintain erosion control, but is sometimes needed to determine if a particular field qualifies for certain federal, state, or local conservation programs.

Following are three methods for estimating percent of residue cover. The first two, the line-transect and photo-comparison methods, are accomplished with field observations; the third, the calculation method, requires generalizations and calculations and is primarily used for conservation planning purposes.

Line-Transect Method

The line-transect method is an easy, reliable way to determine residue cover. It involves stretching a 50-foot measuring tape, line or rope (knotted, beaded or otherwise marked at six inch intervals) diagonally across the crop rows (see Figure 1). Percent of cover is then determined by counting the number of marks that intersect or lie directly over a piece of residue. The source of the plant residue (i.e. previous field crop, weeds, animal bedding, etc.) does not matter.

The key to accuracy with this method is avoiding over- or underestimation. To do that, look straight down on each mark and take all readings on the same side of the tape or rope, asking yourself, "If a raindrop falls at this point, would it hit residue or bare soil?" In general, the size of residue should be 3/32 inch (roughly the size of a healthy wheat straw) in diameter or larger. If there is any doubt at all, do not count it.

Take at least five measurements at sites typical of the entire field, and average them to obtain the residue estimate. Do not take measurements in end rows or small areas of the field that have been affected by flooding, drought, compaction, weed or insect infestations, or other factors that may have influenced crop residue levels.

Photo-Comparison Method

Residue cover can also be estimated by comparing actual field conditions to photographs of known percentages of cover (see corn and soybean residue cover photos below). This method provides a quick estimate, but is less accurate than the line-transect and should be used for general comparisons only.

To use the photo-comparison method, go to a site typical of the field, look straight down, and compare what you see with what the photographs show; then estimate your percentage of residue cover based on that comparison. Repeat the procedure at four other typical sites, and average your estimates.

Scanning a field from the road or field boundary is not adequate. You will tend to overestimate the percentage of cover because the exposed soil behind the residue is hidden from view.

CORN RESIDUE COVER

10%

30%

50%

90%

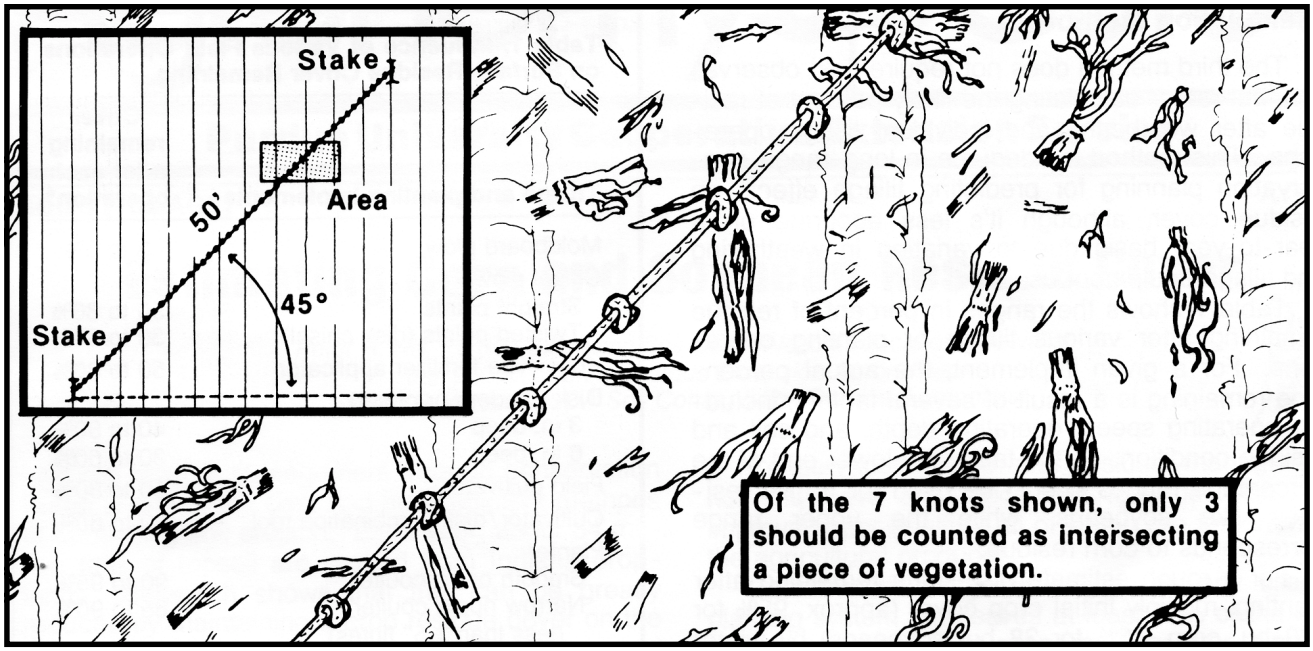


Figure 1. Overview (inset) and close-up of the line-transect method. (Source: Illinois Cooperative Extension Service.)

SOYBEAN RESIDUE COVER

10%

30%

50%

90%

Calculation Method

The third method does not require field observation, but rather calculating the likely percent of residue after weathering and individual tillage operations. This method is adequate in long-range conservation planning for predicting tillage effects on residue cover, although it is less accurate on a year-to-year basis due to variation in weathering and tillage equipment use.

Table 1. Influence of Various Field Operations on Surface Residue Cover Remaining.

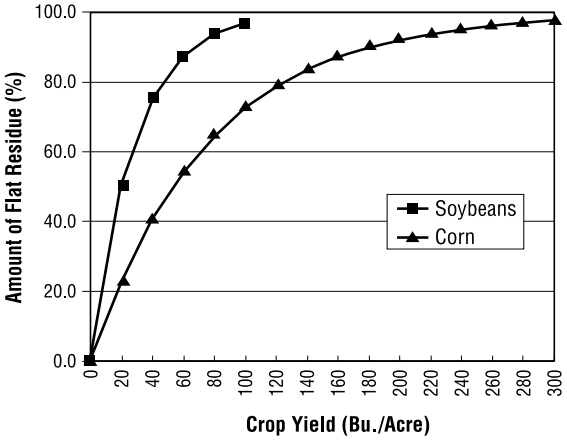
Tillage and planting implements	Cover remaining after each operation*
Moldboard plow	3 to 5%
Chisel plow	
Straight points	50 to 80%
Twisted points (disk chisel)	30 to 60%
Knife-type fertilizer applicator	50 to 80%
Disk (tandem or offset)	
3 inch deep	40 to 80%
6 inch deep	30 to 60%
Field cultivator	50 to 80%
Cultivator / disk combination tool	30 to 60%
Planter	
Smooth or no coulter	90 to 95%
Narrow ripple coulter (less than 1.5 inch flutes)	85 to 90%
Wide fluted coulter (greater than 1.5 inch flutes)	80 to 85%
Sweeps or double disk furrowers	60 to 80%
Drills	
Disk openers	90 to 95%
Hoe openers	50 to 80%
Winter weathering	75 to 85%

* Use higher values for corn residue and lower values for fragile residue, such as from soybeans.

Table 1 shows the ranges in percent of residue remaining after various tillage or planting operations. For a given implement, the actual percentage remaining is a result of several factors, including operating speed, operating depth, and soil and residue condition. In the table, the lower end of the percentage ranges should be used for fragile residues like soybeans, while the upper range corresponds to corn residue.

For a rough estimate of residue remaining after planting, multiply initial crop cover (approx. 90% for 180-bu. corn, 80% for 45-bu. soybeans; refer to Figure 2 for additional crop cover estimates) by winter weathering loss (if not fall moldboard plowed) and then by the appropriate percentage for each operation that makes up your tillage-planting system.

Figure 2. Residue Levels for Corn and Soybeans Based on Yield



Source: Stott, Alberts, and Weltz, 1995

For example, assume the system used on a field of corn residue includes three operations: (1) spring chisel plowing with straight points, (2) disking 3 inches deep, and (3) planting with narrow ripple no-till coulters. To calculate final residue cover, multiply the following percentages from Table 1:

initial	x	weathering	x	chisel	x	disk	x	plant	=	final
90%		85%		80%		80%		90%		44%

In this example for corn residue, the three operations listed would fit the definition of a conservation tillage system. But they would not fit for soybean residue, as the following calculations show:

initial	x	weathering	x	chisel	x	disk	x	plant	=	final
80%		75%		50%		40%		85%		10%

The calculation method provides only rough estimates since the variables involved prevent accurate determination of residue cover. However, Table 1 can be helpful in comparing tillage systems because it gives a general idea of how much residue will remain after specific tillage and planting operations. ***For an expanded listing of tillage machinery and remaining residue levels after usage refer to AY-280 "Managing Crop Residue with Farm Machinery."***

Adapted from Nebraska Extension publication G86-793, "Estimating Residue Cover," by E. C. Dickey, P. J. Jasa, and D. P. Shelton.

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