1986

Estimating Residue Cover

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Estimating Residue Cover

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This NebGuide describes using line-transect, photo comparison, and calculation methods for estimating the percentage of residue cover on the soil surface.

Crop residue management through conservation tillage is one of the best and most efficient methods farmers have to control soil erosion. Each year about 140 million tons of topsoil are eroded from Nebraska farmlands. Recent research shows that farmers can greatly reduce this loss by maintaining a residue cover of at least 20 to 30 percent after all tillage and planting operations. Leaving this amount of residue can reduce water-caused erosion by 50 percent of what it would be from a cleanly tilled field, while leaving more residue will reduce soil losses even further. Conservation tillage and residue management can save soil, labor, fuel, and money — all of which are important to both individual producers and the farm economy.

Conservation tillage is best defined by the amount of residue cover remaining after planting, rather than by the tillage implement or operations used. For example, two disking operations in dryland corn residue will usually leave about a 20 percent residue cover and could be classified as a conservation tillage system. However, just one disking in soybean residue cannot be classified as conservation tillage because too much of the fragile residue is destroyed.

In addition to being the least expensive method of erosion control, conservation tillage is also the most efficient means because evenly distributed residue limits soil loss over the entire field. Rainfall, while essential for crop growth, dislodges soil particles upon impact and allows them to be washed away. Uniformly distributed crop residue shields the soil surface from raindrop impact, reducing soil particle detachment and eventual erosion. Residue also creates small dams which slow the rate of runoff, allowing more time for water to infiltrate into the soil. The slower runoff rate and reduced volume of runoff mean less soil will be removed from the field. Residue also helps trap snow to retain more moisture after spring thaws. All of these can help reduce irrigation requirements or “save” a dryland crop in a year having lower rainfall amounts.

Residue can also protect the soil from the erosive forces of wind. However, standing residue may be more effective than flattened residue in reducing wind erosion. Thus, mass of residue in addition to percent cover may be needed to evaluate wind erosion control potential.

Estimating Residue Cover

Residue cover estimates can be useful in planning field operations to maintain erosion control. Measurements of residue cover may also be required to determine whether adequate residue remains to qualify for federal, state, or local conservation programs.

Three methods can be used to estimate the percent of residue cover. Two of these are easily accomplished with field observations. The third is less accurate and requires generalizations and calculations that are helpful, but provide only approximations.

The Line-Transect Method

The line-transect method is an easy, reliable way to determine percent cover. This method involves stretching a 50- or 100-foot tape diagonally across the crop rows, and then checking at every foot mark to see if that point touches a piece of residue. When using a 100-foot tape, the percentage of residue cover is the number of times residue touches the points checked. If a 50-foot tape is used, double the figure to arrive at the proper percentage of residue cover.

While checking, a good question to consider is: “If a raindrop falls at this point, will it hit residue or bare
Photographs for Estimating Percent Residue Cover

Corn

Grain

Sorghum

Wheat

Soybean

25

50

75

90
losses would reduce the cover to 86 percent.

The initial residue cover for irrigated corn is 95 percent; winter weathering remains. Assume that a tillage and planting system used on a field of irrigated corn residue has three operations: 1) chisel plowing with straight points, 2) disking 6 inches deep, and 3) planting with no coulter. The initial residue cover for irrigated corn is 95 percent; winter weathering losses would reduce the cover to 86 percent.

**Photo Comparison Method**

Residue cover can also be estimated by comparing actual field conditions to photographs of known covers. Photographs of corn, grain sorghum, wheat, and soybean residue covers are shown on pages 2 and 3. This method provides a quick estimate, but is less accurate than the line-transect method. To use the photo comparison method, stand in the field, look straight down, and compare the observed residue cover with that in the photographs. Scanning the field from the road is not adequate and results in overestimating the percentage of residue cover because exposed, bare soil behind the residue is hidden from view.

**Calculation Method**

The third, and least preferable, method is to use calculations to estimate the amount of residue cover remaining after weathering and individual tillage operations.

Estimates of residue remaining after various tillage operations are shown in Table 1. For a given implement, the actual percent of residue remaining is a result of several factors, including speed, depth of tillage operation, and the condition of the soil and residue. The lower end of the percentage range listed in the table corresponds to fragile residue such as soybeans, while the upper end of the range corresponds to irrigated corn residue.

A rough estimate of the residue cover remaining after tillage and planting can be obtained by multiplying the initial cover by the percentages for each operation with regard to the conditions typical of that particular field. Corn, grain sorghum, and small grains generally leave about 95 percent of the soil surface covered with residue after harvest, assuming it is uniformly spread behind the combine. Following soybean harvest, an 80 to 85 percent residue cover generally remains.

The following examples illustrate how to use information from Table 1 to estimate residue cover by calculation. Assume that a tillage and planting system used on a field of irrigated corn residue has three operations: 1) chisel plowing with straight points, 2) disking 6 inches deep, and 3) planting with no coulter. The initial residue cover for irrigated corn is 95 percent; winter weathering losses would reduce the cover to 86 percent.

\[
\text{95\% initial} \times \text{90\% weathering} = \text{86\% spring residue cover}
\]

Tillage and planting operations would further reduce the residue cover to about 37 percent.

\[
\text{86\% spring residue cover} \times 75\% \text{ chisel disk 60\% plant} = 37\% \text{ final residue cover}
\]

Using the same tillage and planting operations in soybean residue would result in about an 8 percent residue cover.

\[
\text{85\% initial weathering} \times 70\% \text{ chisel 50\% disk 30\% plant} = 8\% \text{ final residue cover}
\]

Consider this method to be a rough estimate since the variables involved prevent accurate determination of residue cover. However, the table values can be useful in planning tillage operations by offering a general idea of how much residue will remain after specific tillage and planting operations.

**Table 1. Influence of field operations on surface residue.**

<table>
<thead>
<tr>
<th>Tillage and Planting Implements</th>
<th>Percent of Residue Remaining After Each Operation*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moldboard Plow</td>
<td>3 to 5</td>
</tr>
<tr>
<td>Chisel Plow</td>
<td></td>
</tr>
<tr>
<td>Straight shovel points</td>
<td>50 to 75</td>
</tr>
<tr>
<td>Twisted shovel points</td>
<td>30 to 60</td>
</tr>
<tr>
<td>Knife-Type Fertilizer Applicator</td>
<td>50 to 80</td>
</tr>
<tr>
<td>Disk (Tandem or Offset)</td>
<td></td>
</tr>
<tr>
<td>3&quot; deep</td>
<td>40 to 70</td>
</tr>
<tr>
<td>6&quot; deep</td>
<td>30 to 60</td>
</tr>
<tr>
<td>Field Cultivator</td>
<td>50 to 80</td>
</tr>
<tr>
<td>Planters</td>
<td></td>
</tr>
<tr>
<td>No coulter or smooth coulter</td>
<td>90 to 95</td>
</tr>
<tr>
<td>Narrow ripple coulter (less than 1.5&quot; flutes)</td>
<td>85 to 90</td>
</tr>
<tr>
<td>Wide fluted coulter (greater than 1.5&quot; flutes)</td>
<td>80 to 85</td>
</tr>
<tr>
<td>Sweeps or double disk furrowsers (till-plant)</td>
<td>60 to 80</td>
</tr>
<tr>
<td>Drills</td>
<td></td>
</tr>
<tr>
<td>Disk openers</td>
<td>90 to 95</td>
</tr>
<tr>
<td>Hoe openers</td>
<td>50 to 80</td>
</tr>
<tr>
<td>Winter Weathering</td>
<td>70 to 90</td>
</tr>
</tbody>
</table>

*Use higher values for irrigated corn residue; use lower values for fragile residue such as from soybeans.

File under: FIELD CROPS

G-14, Cropping Practices

Issued June 1986, 12,000

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Issued in furtherance of Cooperative Extension work, Acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture. Leo E. Lucas, Director of Cooperative Extension, University of Nebraska, Institute of Agriculture and Natural Resources.