

# Estimating the Nutrient Value in Corn and Soybean Stover

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This publication provides a few simple steps in calculating an estimated value for the nutrients removed in the harvest of corn and soybean stover. To estimate the feed value of corn stover see ISU Extension publication FM-1867, *Estimating a Price for Corn Stalks*.

## CORN

### Step 1. Estimate the amount of above ground corn stover residue per acre.

On average, above ground corn plant dry matter has 50% of the dry matter weight in the grain and 50% in the stover (stalk, leaf, cob, shank, and husk). Multiply the bushels per acre yield by 56 pounds to get an estimate of the corn residue dry matter per acre. Example: 140 bushels per acre times 56 pounds = 7,840 pounds per acre of stover, or 3.9 tons per acre. As we increase yields above 140 bushels per acre this calculation tends over estimate the quantity of stover, and as yields drop below 100 bushels per acre this calculation tends to under estimate the quantity of stover. For “good” yields (>140 bushels per acre), 8,000 pounds of stover per acre is a commonly used number. This is just an approximation in lieu of actually weighing the harvested corn stover.

### Step 2. Estimate the actual amount of stover removed from the field.

Multiply the number in Step 1 by the appropriate number in Table 1.

**Table 1. The amount of stover removed depends on how it was harvested.**

Harvest method	Approximate amount harvested, %
Shredding and raking	80
Raking only	65
Combine windrow only	50
Cattle grazing	25

### Step 3. Estimate the Nutrient Value of Corn Stover.

The type of hybrid, soil fertility, growing conditions, and residue harvest date affect the nutrient value of corn stover. Corn stover in the field ranges between 65-90% dry matter. The following table estimates the fertilizer value of stover (100% dry matter basis) produced from 140 bu./acre corn. This value still needs to be corrected based on the amount of residue harvested (Step 2).

**Table 2. Estimated value of corn stover residue.**

Fertilizer	Estimated fertilizer value	Average amount of nutrients in stover	Estimated stover value
	<i>\$/lb</i>	<i>lb/ton</i>	<i>\$/ton</i>
Nitrogen (N)	0.17	15.0	2.50
Phosphate (P <sub>2</sub> O <sub>5</sub> )	0.22	5.9	1.30
Potash (K <sub>2</sub> O)	0.13	25.0	3.25
Other nutrients*			0.50
Organic matter*			0.30

\*University of Minnesota

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The nitrogen value should not be taken into account if the field is going to be rotated to soybeans next year. About 50% of the nitrogen will be tied up in the residue, although it would eventually become available through normal decomposition of organic matter. The nitrogen release rate would increase with tillage and above normal rainfall.

### Grazing

Very little fertilizer would leave the field if cattle graze the corn stover. Cattle will only consume about 25% of the available stover. About 98% of the nitrogen, phosphorus, and potassium nutrients that are consumed would be excreted back onto the field.

### Soil Erosion

Removing too much stover will increase the potential of soil erosion. Most conservation plans request at least 30% crop residue cover after planting to qualify as conservation tillage. Removing too much crop residue could increase soil erosion. A ton of soil contains about \$8.00 worth of nitrogen, phosphorus, and potassium.

### Organic Matter (O.M.)

One ton of corn stover contains about 13% carbon after microbial degradation and microbial respiration has occurred.  $2,000 \text{ lbs.} \times 13\% = 260 \text{ lbs.}$  of carbon. The upper 6 inches of topsoil (plow layer) = about 2,000,000 lbs./acre. If a soil has 3% O.M., the top 6 inches of soil = 60,000 lbs. of O.M./acre. Thus, a 3% O.M. soil contains 30 ton of O.M./acre. O.M. contains 60% carbon, so a ton of O.M. = 1,200 lbs. of carbon. A 3% O.M. soil would contain  $30 \times 1,200 = 36,000 \text{ lbs.}$  of carbon. The removal of one ton of stover from a 3% O.M. soil would equate to  $260 / 36,000 = 0.007\%$  less carbon added to the soil plow layer.

The University of Minnesota estimates the value of organic matter in corn stover at \$0.30/ton. The above calculations also demonstrate the importance of conserving O.M., since it is so difficult to increase O.M. under a continuous cropping environment.

### Step 4. Final calculations.

Using steps 1, 2 and 3, an example field situation is summarized as follows:

**Table 3. Calculate estimated stover value (corn-soybean rotation, without N value).**

Grain yield x 56/2,000 = bu/acre	Estimated stover tons/acre	x	Harvest method from Table 1 %	x	Nutrient value = from Table 2 \$/ton	= Value of stover \$/acre
> 140	4.0		0.80		5.35	17.12
140	3.9		0.80		5.35	16.69
125	3.5		0.80		5.35	14.98

## SOYBEANS

For soybeans, we assume that only the stems are removed. On average, stems are about 29% of the total dry weight produced by a soybean plant is harvested seed and 17% is stems. Nutrient concentrations in soybean stems are approximately 0.60% N, 0.09% P<sub>2</sub>O<sub>5</sub>, and 0.36% K<sub>2</sub>O.

Example calculations of the value of nutrients in soybean stover for 50 bushel per acre soybeans.

- 50 bu. x 60 lbs per bushel seed weight = 3,000 lbs of seed.
- 3,000 lbs of seed ÷ 0.29 = 10,345 lbs of total dry matter produced.
- 10,345 x 0.17 = 1,759 lbs of stem dry matter produced.

	Fertilizer values, \$/lb, from Table 2	Stover value, \$/ac.
4. 1,759 x 0.006 = 10.55 lbs of N removed per acre.	0.17	1.80
1,759 x 0.0009 = 1.58 lbs of P <sub>2</sub> O <sub>5</sub> removed per acre.	0.25	0.40
1,759 x 0.0036 = 6.33 lbs of K <sub>2</sub> O removed per acre.	0.13	0.80
		3.00

We do not have harvest removal estimates for soybean stover as we do for corn stover in Table 1. The amount of residue removed would have to be a “best guess” estimate, or else weigh the harvested material.

The estimated value for “other nutrients” and organic matter should be similar to the \$0.80/ton listed in Table 2.