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How Much Crop Residue to Remove

Mahdi Al-Kaisi

Iowa State University, malkaisi@iastate.edu

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Abstract

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How Much Crop Residue to Remove

By Mahdi Al-Kaisi, Department of Agronomy

Crop residue removal—what effect does it have on corn yield and soil quality? That's a question quite often asked these days.

The adoption of no-till and other conservation tillage systems help keep significant amounts of crop residue on the soil surface, which can create management challenges, especially in areas with wet and cold soil conditions. Also, more acres of continuous corn are being grown, which leads to a greater amount of crop residue on fields compared to corn-soybean rotation. These higher levels of crop residue bring more challenges for farmers.

Increased use of no-till and other conservation systems helps sustain the soil quality and improve environmental quality by reducing soil erosion. However, in the near future corn residue could be removed from fields for cellulosic ethanol production in addition to current animal uses. This trend may encourage the switch to continuous corn, which can lead to high N application and more conventional tillage. The increase in conventional tillage coupled with high use of nitrogen fertilizer in continuous corn will present a significant soil and water quality challenge. The trend to more continuous corn, more crop residue removal, higher rates of nitrogen applied and potentially more tillage will present economic and environmental challenges that we need to consider.

The use of corn stover for cellulosic ethanol production or any other use should be weighed against the potential impact on soil productivity, environmental consequences and food availability. That's why researchers are looking at the potential for crops like miscanthus and switchgrass for making cellulosic ethanol. To strike a balance between environmental sustainability and economic viability, alternative perennial biomass sources for cellulosic ethanol production are being explored to combine with corn grain ethanol.



The value of crop residue is obvious.

How much residue to harvest?

The main crop Iowa grows is corn and the crop residue corn produces each year is the most readily available feedstock for making cellulosic ethanol and for animal use. But that residue plays a very important role in sustaining soil

quality which must be kept in mind when deciding how much corn stover to harvest and how much to leave on a field.

Leaving crop residue on the soil surface will improve the cycling of nutrients and ultimately soil quality, both of which increase and sustain soil productivity. Corn residue left on the field after harvest is a critical source of soil organic matter; it provides protection for the soil against water and wind erosion; and it contributes to the improvement of soil and water quality.

Alternative uses of corn residue for various purposes, such as baling the residue for livestock use or for cellulosic ethanol production, needs to be approached carefully. Removal of too much crop residue potentially can have adverse effects on soil and water quality.

How much corn residue can be safely removed from a field? Sustainable stover removal rates depend on several factors such as soil erodibility, surface slope, cultural practices and climate conditions. Recent studies suggest that only 20 to 30 percent of the total stover production could be removed for biofuel, based on ground cover requirements to control soil erosion. However, other studies suggest that residue removal should be lower than 20 percent, especially with conventional tillage, in order to maintain soil quality and nutrient cycling for long-term soil productivity.

Consider long-term effects of residue removal

The impact of crop residue removal on soil productivity and environmental quality is not a short-term outcome, particularly in the Midwest, where high organic matter, high soil productivity and good agriculture production conditions mask the short-term effect of residue removal.

Possible short-term impacts of corn stover removal may include an increase in amount of nitrogen, phosphorus, potassium, calcium, magnesium and other nutrients that need to be applied to replace these nutrients lost due to crop residue removal. Potential deficiencies of nutrients and decline of organic matter in the soil are both the long-term impacts. It was estimated that nutrients replacement cost due to corn residue removal was approximately \$20 per ton of removed corn residue. These nutrients will be permanently lost from the soil system nutrients pool due to lack of replenishment from crop residue and they have to be added to maintain soil productivity.

Keep in mind that when you harvest corn crop residue from a field, a significant amount of carbon, nitrogen, phosphorus and potassium is removed. Using no-till and above agronomic nitrogen fertilizer rate may help in reducing soil organic matter loss in the short-term due to crop residue removal.

Key Points:

- What else do you remove when you harvest corn crop residue from a field?
- A significant amount of carbon, nitrogen, phosphorus and potassium is removed.
- Using no-till and adequate N application rates may minimize soil organic matter loss due to residue removal in the short-term.

Mahdi Al-Kaisi is an associate professor in agronomy with research and extension responsibilities in soil management and environmental soil science. He can be reached at malkaisi@iastate.edu or (515) 294-8304.

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