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News Column
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SOIL HEALTH AND CARBON

Leaving crop residue on the soil surface will improve nutrient cycling and, ultimately, soil quality that will increase and sustain soil productivity. Conservation practices that include balanced residue management and soil fertility, environmental quality can be enhanced. By retaining crop residue on the soil surface, soil organic carbon (SOC) and nutrient-holding capacity increase while protecting the soil from wind and water erosion. Recent large rainfall conditions in the state demonstrate the value of leaving crop residue on the soil surface to reduce surface runoff, sediment loss, and associated nutrient losses. On the contrary, alternative uses of corn residues for various purposes, such as baling residue for animal use or for ethanol production from lignocellulosic biomass, potentially have adverse effects on soil and water quality.

The reduced nutrient supply associated with corn stover removal represents an economic loss in the short term, but it will have a long-term negative effect on soil quality, water quality, and agriculture sustainability. The loss of nutrients from stover removal depends on residue type, amount of residue, soil type, climate, soil organic matter, rate of residue decomposition, tillage, and other management practices. If unsustainable amounts of stover are removed from the field, wind and water soil erosion will intensify while accelerating the loss of SOC and other nutrient levels and potentially can reduce future yields. Residue removal in Iowa may have a small effect on soil productivity in the short term due to rich organic matter soils; however, this will not be a sustainable practice in the long term as demonstrated by many studies where the acceleration of soil and nutrient losses were significant. In a normal rainfall, raindrops 6 millimeters in diameter hit the ground at 20 miles per hour. The cumulative impact of raindrops can be incredible, dislodging soil particles and "splashing" them up to 3-5 feet away. The splashed particles clog soil pores, effectively sealing off the soil surface and leading to soil crust and poor water infiltration.

Instead of soaking into the soil, water collects and moves down-slope in sheet or rill erosion, forming gullies and carrying soil particles to rivers and streams. Corn stover nutrient removal based on different harvest scenarios results in the loss has short-term impacts in loss of nitrogen (N), phosphorus (P), and potassium (K) fertilization to replace harvested stover nutrients lost and nutrient deficiencies in the long term. The value of these losses ranges from $8 to 18 per acre depending on the amount of residue removed.

Regardless of tillage system, residue removal increased surface runoff and nutrient loss due to soil erosion. Even with no-tillage or reduced tillage, lack of residue cover has led to significant nutrient losses with higher concentrations of nutrients at the soil surface. It also was reported that one long-term effect of corn residue removal, especially with a no-tillage system, is the increase in K deficiency over time because of exposure of high K soil surface concentration to soil erosion. In general, the impact that residue removal has on nutrient cycling is highly affected by the amount of residue removed, which ultimately leads to higher nutrient cost input in the short term and reduction in soil quality and productivity in the long term. In addition to the amount of residue left on the soil surface, the manner in which residue is harvested and the uniformity of residue distribution on the soil surface to prevent potential soil erosion must be considered.

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