For Immediate Release
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Limitations of Crop Residue Removal
By Wilma Trujillo

The adoption of no-till and other conservation tillage practices help keep significant amounts of crop residue on the soil surface, which can create some management challenges. These can include slow soil warming in spring, delayed planting due to reduced soil drying, interference with planter operations, poor soil-seed contact, and increased pests and diseases. A strategy to address these challenges is the removal of crop residue. However, removal of crop residues should be weighed against the potential impact on soil productivity, environmental consequences and food availability. Crop residue removal affects soil nutrient availability, soil organic matter, wind and water erosion potential, soil water availability, yield and economics.

In Eastern Colorado, corn and sorghum residues are often grazed by livestock or baled as animal feed. While crop residue grazing usually results in little nutrient or organic material removal, mechanical harvest removes nutrients and organic material critical to maintaining soil productivity. Crop residue plays a very important role in sustaining soil quality which must be kept in mind when deciding how much corn residue to harvest and how much to leave on a field.

How much corn or sorghum residue can be safely removed from a field? This is not an easy question to answer. Sustainable crop residue removal rates depend on several factors such as soil erodibility, surface slope, cultural practices and climate conditions. Tillage, crop rotation and yield level are also important factors dictating how much crop residue can be harvested and still ensure sustainability of the system.

Recent studies suggest that only 20 to 30 percent of the total crop residue could be removed, 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. Research has shown a minimum of 2.4 tons/acre of residue is necessary to maintain soil organic carbon in no-till systems.

Removal of crop residue has short- and long-term impacts. A possible short-term impact is an increase in the amount of nitrogen, phosphorus, potassium and other nutrients that need to be applied to replace the nutrients lost due to crop residue removal.

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The concentration of nutrients in crop residues varies with season, management practice, time of harvest, and location. The typical nutrient contents are about 17 lb N, 4 lb P_2O_5, 34 lb K_2O, and 3 lb S per ton of dry corn or sorghum residue. These nutrients will be permanently lost from the soil nutrient pool due to lack of replenishment from crop residue. These nutrients must be added to maintain soil productivity. Nutrient replacement cost is estimated at $20 - $30 per ton of crop residue removed.

Potential deficiencies of nutrients and decline of organic matter in the soil are both long-term impacts. Diminishing organic carbon contents will also result in negative impacts on soil physical, chemical, and biological properties. Maintenance of soil organic matter is important to nutrient supply and to soil physical properties that are critical to soil tilth, water infiltration, and water-holding capacity.

Crop residue affects soil water by reducing evaporation, catching snow, reducing runoff, and enhancing infiltration. Soil water loss associated with increased crop residue removal may be the greatest short-term cost of crop residue removal, especially under dryland conditions in drought-prone areas. The reduction in available soil water due to crop residue removal could often result in a significant yield decrease the following year. In one study conducted in Nebraska, corn yield declined by 2 bushels per acre for each ton of crop residue removed. In irrigated situations, water applications and pumping costs will be increased to replace the water lost to evaporation when crop residues are removed.

A number of practices have been suggested to overcome some of the negative effects of crop residue removal. Potential practices include planting of cover crops and forages and manure applications. Planting forages and cover crops before or after crop residue removal could replace the organic material lost with crop residue removal. Forages and cover crops reduce wind erosion by covering the soil and by improving soil properties through above and belowground biomass input. Performance of forages and cover crops depends on management and climate. In water-limited areas, forages and cover crops use is limited due to concerns of reduction in soil water available for subsequent crops.

Manure application after crop residue removal can be an important practice to mitigate negative effects of crop residue removal on soil fertility. It also valuable for improving soil physical, chemical, and biological properties that will result in improved water infiltration, reduced runoff, and reduced erosion.

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