

Nutrient value of corn residue

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Harvesting crop residue for biomass energy is garnering more interest and could create new economic opportunities for rural Ontario. However, caution must precede these types of operations, as crop residues harbor many hidden ecosystem services. If farmers are to proceed with residue removal, both short and long-term costs must be covered. How much is corn residue actually worth?

Assessing long-term residue removal impacts is difficult, but necessary to ensure sustainability. However, regardless of sustainable residue removal rates, and the quantity of residue removed, there will always be added costs to the farmer practicing residue removal. Besides from residue collection costs, farmers must also account for nutrients exported in residues. This can be substantial. For example, a farmer may need to sell a ton (1000 kg) of corn residue \$68.74/Mg dry matter (DM) to break even based on associated operations and 2010 fertilizer NPK values (Kludze et al. 2010). However, averaged NPK values in 2008 were 36.5% higher and a farmer would need \$80.56/Mg DM to break even. Clearly, the financial viability of residue removal is dictated largely by fertilizer prices and minimizing NPK export in residues is crucial.

Soil N, P, and K dynamics are very different and residue removal has different effects on all three. While there is some P removal in crop residue, N and K are removed at a much larger rate and have higher associated replacement costs. Nitrogen can either be increased or decreased based on a crop's residue carbon:nitrogen (C:N) ratio. Generally, any soil input with a C:N ratio lower than 20:1 will increase N availability and plant uptake, anything above 30:1 will result in microbial immobilization; whereby N is sequestered by bacteria and fungi leading to less available for plant uptake. Eventually this nitrogen may become plant available given a considerable amount of time. Corn residue has a C:N ratio of 60:1, so its incorporation should not be seen as an effective means to enhance soil nitrogen. Indeed, incorporated corn residue may necessitate increased N fertilization to offset the reduced availability of N (Andrews 2006). The value of incorporated corn residue is related more to its ability to add substantial amounts of carbon to the soil and facilitate organic matter buildup. However, residue in various locations can be removed without compromising residue buildup (Kludze et al. 2010). This could facilitate more favourable C:N dynamics in soil and reduce N fertilizer requirements.

Soil-plant K dynamics is often over-looked, but may hold the most potential for increasing the cost efficiency of residue removal. The K content of residues on a weight basis is similar to N (Hoskins et al. 2007). Likewise, replacement costs for soil K is similar to N (Kludze et al. 2010). Unlike N however, soil K availability is directly proportional to the amount removed. Sustained residue removal will lead to soil K deficiencies unless adequate K₂O fertilizer is applied. If K export in corn residues approximates 16 kg/Mg DM (Kludze et al. 2010) this could lead to K replacement costs of up to \$20/Mg DM if corn residue removed. Are there potential ways to reduce this cost? While K is fairly immobile in the soil, it is very mobile in the plant and tends to accumulate in particular areas. Limiting residue harvest to high glucose parts of the plant, such as the cobs, leaves and, husks could minimize K export substantially (Hoskins et al. 2007). However this may require specialized equipment not available to many farmers. An alternative solution is to delay residue harvest till the following spring. This may compromise yields, but it will also likely cause much K to leach out of the plant into the soil.

There are many considerations for farmers interested in pursuing residue removal. Ultimately farmers must at least break-even to continue such practices. Knowledge of the nutrient

value of crop residues is an important aspect to consider, and developing strategies to keep nutrients in the field will be crucial in determining feasibility.

Sources:

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