

Matching Tillage with Residue Management

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The interactions between tillage and residue management are not cut and dry. Questions such as, how do yields for no-till (with residue removed) compare to those for tillage (with some residue left on the surface) are often raised and are challenging to answer. There are many factors that influence corn yields when considering the tillage-residue management interactions.

Many residue management practices influence yields both directly and indirectly. Conservation tillage systems (especially no-till) result in surface accumulation of crop residues which may increase carbon (C) sequestration, soil microbial biomass, and nutrient cycling in the upper layers of the soil profile. Conventional tillage can move the residue deeper into the soil profile slowing the breakdown of residue and making it less pronounced. Salinas-Garcia *et al.* (2001) determined that higher levels of Soil Organic Carbon (SOC), microbial biomass (C) and nitrogen (N), inorganic and total N and extractable phosphorous (P) in the soil were directly related to leaving residues on the surface. The increase in organic matter was the most important effect of leaving the residue on the surface because it directly leads to yield benefits. Karlen *et al.* (1994) agreed that in the absence of tillage, maintaining or adding residue improves biological, chemical, and physical characteristics of soils.

Soil moisture seems to have one of the largest influences on whether or not surface residues enhance or decrease corn yields. In general, higher moisture content in the soil profile results in higher yields, especially in dry years. Wilhelm *et al.* (1986) determined that the total available water in the soil profile accounted for 70% of the yield variation associated with residue treatment. The researchers noted that for each Mg/ha of residue removed there was a 0.1 Mg/ha reduction in grain yields. In addition, 81% of the yield variation was associated with the quantity of residue applied. Linden *et al.* (2000) compared tillage and residue management over several years and observed how precipitation influenced yields. In general, during dry years, treatments with residue yielded 22% more than those without. This can be attributed to how residue helps to maintain water in the soil profile. During a wet year, residues incorporated with tillage treatments (either chisel plow or moldboard plow) resulted in higher yields than no-residue tillage treatments. Perhaps these findings were due to the benefits of extra C and available moisture. The no-till with residue removed treatment resulted in greater yield than when the residue was left on the surface treatment. This particular finding could be due to soil temperature differences. Residue left on the surface with adequate moisture results in a cooler soil and perhaps less than desirable germination. Wilhelm *et al.* (1986) noted that soil temperature also accounted for 80% of the variation in yield during their study.

The amount of residue returned can influence grain yields regardless of tillage. Maskina *et al.* (1993) found that corn grain yields were 16% higher for 150% residue returned compared to the no residue returned treatments under no-till. The researchers attributed the differences to increased mineralization and uptake of N from the enlarged soil organic N pool. Soil water data confirmed that the residue treatments had higher soil moisture levels which likely resulted in better N availability and uptake by the corn crop. Karlen *et al.* (1994) had similar results in their experiment. They noted that grain yields were 8.1, 8.4, and 8.0 Mg/ha for removal, normal and

double residue treatments, respectively. The researchers indicated that differences in rainfall amounts and distribution resulted in the greatest yield differences over the period of the study.

Considering the above information it is hard to say whether one should plow down residue or no-till and remove the residue. It will depend on the precipitation and soil in your area. One procedure is certain, during dry years; residue will help hold moisture in the soil profile which will result in greater yields. In wet years, perhaps removing some residue won't hurt. Also, in Ontario conditions, on imperfectly and poorly drained soils reducing surface residue cover will increase rates of spring dry-down and improve planting timeliness which may often contribute more towards higher yield potential than retention of residue for soil moisture conservation.

Notes:

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