

FORAGER



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NO-TILLAGE MAKES MORE CORN-AFTER-CORN

Visiting a farm machinery show recently, I came away with the impression that tillage machinery manufacturers see corn-after-corn as a marketing opportunity, assuming that corn-after-corn growers are afraid of corn residues. Long-term research at the University of Kentucky shows that corn-after-corn yields are significantly greater with no-tillage soil management, where residues from the previous corn crop are left on the soil surface.

The results of two long-term continuous-corn tillage trials are shown below. Both experiments are located on Maury silt loam soils, and involve both choices of primary tillage system and fertilizer nitrogen (N) rates. The first trial, comparing no-tillage and moldboard plowing, was started in 1970. In the second trial, begun in 1983, a large heavy disk, the chisel plow, and the moldboard plow were compared to no-tillage. In these two trials, a winter cereal (wheat, rye or triticale) cover crop was seeded over the entire plot area after corn harvest in the fall.

Early pre-plant weed control, using a combination of burndown and soil-residual herbicides, was applied to both experiments in the second or third week in April. Both were planted in late April-early May at a rate of 27,000 insecticide-treated seeds/acre, using a no-till corn planter equipped with row cleaners. Fertilizer N, as 34-0-0 (ammonium nitrate), was broadcast over the soil surface at planting. Post-emergence weed management was done if problems were identified.

For both experiments, yield results were averaged over the 2000 through 2006 growing seasons. In the first experiment, there is a strong positive response to fertilizer N in both tillage systems. There is a strong negative response to tillage. No-till averaged 8 bu/acre/year *more* than moldboard plowing, across all fertilizer N rates, and 16 bu/acre/year *more* at 150 lb N/acre/year, the optimum N rate. In the second experiment, there is again a strong positive response to fertilizer N in all four tillage systems and a negative response to tillage. Primary disc tillage was especially negative, averaging nearly 17

bu/acre/year less than no-till at the two highest N rates (135 and 200 lb N/acre/year). Chisel and moldboard plowing were less of a problem than disking, averaging 8 bu/acre/year less than no-till, but were more responsive (+11 bu/acre/year) to the greatest N rate. No-till corn yield increased only 4 bu/acre/year when fertilizer N was raised from 135 to 200 lb N/acre/year. *With more tillage, more fertilizer N was needed, to get less corn.* Tillage lowered corn yield potential on this soil.

Why were these results observed? 1) Crop residues are not the problem we often think they are. In a mild fall-winter-spring climate, corn residues tend to break down. Residues from a 175-bushel corn crop in the fall become more like those from a 125-bushel corn crop by spring planting time. 2) However, 125-bushel corn residues can be a problem if your planter does not leave you with the desired plant population. In these two experiments, planter adjustment/row cleaners resulted in equal plant populations at harvest (23,600 to 24,100 plants/acre), regardless of primary tillage system. There was no loss of plants in the no-till system. 3) "Rain makes grain", but adequate rainfall can be poorly distributed. Until the crop canopy closes over the soil, crop residues slow evaporation and conserve soil moisture, buffering the crop against moisture stress between rainfall events. Tillage can reduce crop residue levels to the point that evaporative soil moisture losses become yield-limiting. 4) Soil structure is conserved in the no-till system. Better-structured soils retain more soil moisture after a rain, further buffering the crop against moisture stress, and long after the crop canopy has closed.

Taken altogether, crop residues are "not your enemy" in corn-after-corn production. No-tillage soil management is the key to optimal corn productivity in this "rotation".

- Corn-after-corn yields better in no-till
- Tillage required higher fertilizer N, to get less yield, than no-till

(edited from an article by John H. Grove, Plant & Soil Science, U of KY)

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