Winnebago County Agriculture Community Based Research Summary

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No-till Corn Roots Deeper, Successful in Dry Year

Background

There are many strong opinions on planting crops using no-till practices. No-till soybeans have been adopted widely across the county while the acceptance of no-till in corn has been slower. No-till corn planting has widespread use across the county in many soils and climates, yet concerns about yield reductions in corn have slowed adoption of this practice.

Tillage plays a large role in the management of water on agricultural land. No-till is known to help improve water infiltration and reduce evaporation. In environments or years where precipitation is in deficit of what crops use, no-till can help make more water available from the soil profile.

Objective

To determine the effects of no-till management on corn rooting depth and consequent yields in Winnebago County soils and conditions.

Local Research and Demonstration Methods

Retired USDA Soil Science researcher and Oshkosh resident, Doral Kemper, identified two farms west of Oshkosh to participate in this study. Two fields with similar soils, directly across the road from one another, were compared for plant growth, rooting depth and yield. Data was also collected on a third nearby farm and from multiple spots on the no-till farm. All fields were managed as production fields within the plans of the participating farmers. Specific treatment protocols were not imposed on these producers, rather measurements were taken from fields with their typical corn growing practices. Participating farmers selected their own hybrids, planting date, and fertilizer rates.

To determine maximum rooting depth in the fields, pits were dug in the fields after the corn matured. Soil was inspected for the presence of corn roots, earthworms, and macropores. The depth of roots and earthworm tunnels were measured. Emergence, height and yield data was collected from small areas within the fields.

Rooting Data Collection and Observations

In the long-term no-till soil, there was a substantial population of night crawler earthworms (10 to 40 per square yard) and most of their holes extended vertically to depths of one to two yards. Rooting depth and night crawler activity from five locations in Winnebago County are presented in Table 1. It was noted that earthworm holes extend to approximately the same depth as plant roots in the subsoil. Worms need organic matter from which they can gain energy to continue their activity. Earthworm holes and crop rooting depth are synergistic as plant roots grow deeper down worm holes, encountering little resistance compared to that in the surrounding high clay soils. Paired comparisons made of rooting depths of corn under long term no-till management and those under tilled management in Winnebago County clay loam soils found rooting depth under no-till was 86 to 100% greater than those under tillage. Night crawlers middens (small stacks of crop residue) pulled together at the top of the burrow, are abundant in the no-till fields.

About a fifth of the worm holes were inhabited by one or more crop roots.
No-till locations had a minimum of eight years without tillage.

Figure 1. Shows the relationship between yield and rooting depth found in the paired tilled and no-tilled fields. A third field within the same watershed but managed with higher fertility, 20” row spacing, and tillage had a similar pattern from four locations in that field. In the third field we found locations with rooting depth of 23”, 36”, 40”, and 42” and yields of 126, 239, 220, and 245 bu/acre respectively. Due to only a single year of data, it is important not to draw conclusions; however the relationship between rooting depth and crop yield looks encouraging.

Yield measurements have an error of +/- 5% due to the moisture tester accuracy.

Summary

Insufficient water is one of the most common factors limiting crop production. Cropping systems, such as no-till, that encourage more water infiltration and later transpiration are especially beneficial during dry growing seasons. Undisturbed earthworm tunnels create macropores and are excellent conduits for water infiltration and plant root penetration. Access to additional water stored in the soil profile enables crops to continue growth better in drought periods, potentially resulting in higher yields.