LONG-TERM TILLAGE EFFECTS ON SELECTED SOIL PROPERTIES AND WATER RETENTION

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INTERPRETIVE SUMMARY

Soil properties and crop yields can be influenced by tillage practices through their effects on soil organic matter, soil aggregation, aggregate stability, and soil compaction. Increased size and water stability of aggregates are generally a function of decreased tillage and can affect soil porosity and, consequently, plant root proliferation. This study was conducted to determine the effects of long-term variable tillage intensities on selected soil physical properties and soil water retention.

The experiment site was located at the Texas A&M University Research Farm in southern Texas on an Orelia sandy clay loam (fine-loamy, mixed, hyperthermic, Typic Ochraqualfs). Zero-till (NT) and minimum till (MT) were compared with conventional tillage (CT) and deep moldboard tillage (12 inches, MLB) following 18 years of treatments. Conventional tillage was performed at maximum tillage depth of 6 inches with tillage operations totaling 10 to 11 inches per annum. In the MT treatment, maximum tillage depth was 3 inches with five or less tillage operations. Glyphosphate and Gramoxone Extra were used as needed for fall and winter weed control in the NT and MT systems.

Tillage treatments were evaluated as major blocks and arranged in a randomized complete block design. Corn *(Zea mays* L.) and cotton *(Gossypium hirsutum* L.) were studied in split-plots in 4-year rotations in each of the tillage blocks. All treatments were replicated four times. Data are presented for the last year of corn rotation.

Degree of aggregation and aggregate coalescence were substantially improved with no tillage. Soil bulk densities and compaction were approximately 15% higher on NT compared with CT, but corn rooting in the surface 6 inches was highest in NT soil. Moisture retention was generally highest in NT at -0.01 MPa in the surface layers.

Net aggregate stability was higher in 0 to 3 inches and 3 to 6 inches depths in NT compared with CT and MLB tilled soils. However, tillage effect became less pronounced with increased profile depth. Soil aggregate size was inversely related to tillage intensity. Soil quality of Coastal Prairie soils as measured by physical attributes of degree of aggregation and aggregate stability may be improved by use of conservation tillage.