CHANGES IN SOIL PROPERTIES AS INFLUENCED BY LONG-TERM NO-TILL

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Abstract

Conservation tillage systems increase surface crop residue, alter soil physical properties and can affect biochemical transformation and nutrient availabilities. Understanding the effect of long-term soil management practices on these factors is essential to adjustment of soil test recommendations and improved fertilizer management. Nutrient stratification in no-till (NT) and minimum till (MT) systems can be of concern in soils with limited hydraulic conductivities. This study was initiated on a Victoria clay soil (fine, hyperthermic montmorillonitic Pellusterts) to compare three tillage intensities for effects on profile distribution of P, K, Zn, Fe and Mn. Soil pH was also determined. Tillage variables included NT, MT and conventional tillage (CT). Another study (Experiment II) was conducted on an Orelia sandy clay loam soil (hyperthermic Typic Ochraqualf) with emphasis on soil physical properties. Increased size and water stability of the aggregates are generally a function of decreased tillage and can affect soil porosity and consequently plant root proliferation. The objective of this study was to evaluate effects of long-term variable tillage intensities on certain soil physical properties including soil aggregation, soil bulk densities and soil water retention. Zero-till (NT) and MT were compared with CT and deep (30 cm.) moldboard tillage (MLB) following eighteen years of tillage treatments. Fertilizer N and P were applied at soil test recommended rates of 90 N and 20 P kg ha^{-1} in both experiments. Both nutrients were band applied as dry, granular ammonium nitrate and triple superphosphate in preplant applications. In Experiment I, no-tillage and MT were compared with CT after the management practices had been in place for 13 years. Without fertilization, soil pH generally remained unchanged due to tillage but decreased slightly in NT with nutrient application. Extractable P was considerably higher in surface 0-2.5 and 2.5 - 7.5 cm depths for NT compared to CT soil. Exchangeable K varied with tillage intensity with NT indicating higher K in the surface. Aggregate size and aggregate coalescence were substantially improved with no tillage (Experiment II, sandy clay loam). Penetrometer readings usually increased with reduced tillage and peaked with NT. Soil bulk densities generally followed penetrometer readings. Soil water retention in surface 7.5 cm. at matrix potential of 0.01 M Pa was significantly higher for NT soil compared to CT.

Reprinted from the *Proceedings of the Beltwide Cotton Conference*
Volume 1:589-589 (2001)
National Cotton Council, Memphis TN