Soil Physical Properties as affected by Two Years of Tillage, Cover Cropping and Crop Rotation in a Clay-Loam Soil

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INTRODUCTION

The physical properties of the soil are governed by many factors that change vertically with depth, laterally across fields and temporally in response to climate and human activity (Swarowsky, *et al.*, 2011). Human activity affects soil physical properties through agricultural practices of soil tillage, crop rotation and cover cropping. Although tillage benefits in loosening up the soil and increasing soil aeration are established, questions remain concerning its impact on soil water content, bulk density and porosity at depths deeper than tilling one. Several authors have reported little-to-no difference in soil water content between plow and reduced till (Alvarez et al., 2009; Blanco Canqui et al., 2011). There are also conflicting results as to the direct effects of cropping systems on soil water and bulk density. To further clarify this ambiguity and because of the limited literature on changes of soil physical properties below tilling depth in central Missouri, the aim of this study was to investigate soil response to agricultural management practices with the following hypotheses; a) Tillage, cover cropping and crop rotation will affect soil water, and b) Bulk density will not be affected beyond tillage depths.

MATERIALS & METHODS

The study area is Lincoln University's Freeman farm (10 acre plot subdivided into 48 units) in central Missouri with Waldron silty-clay loamy substratum and Booker silty clay soil type. Field treatments included two tillage systems: conventional tillage (CT), and no tillage (NT); four crop rotation systems: continuous maize (CM), continuous soybean (CS), maize-soybean (MS), and soybean-maize (SM); and two cover crop systems: winter rye (*Secale cereale* subsp. cereale) cover crop (CC), and no cover crop. Soil samples were taken at four depths (0-10cm, 10-20cm, 20-40cm and 40-60cm) in each plot, wet weight taken, oven dried at 105^{0}C for 72hrs and dry weight was taken. Soil Bulk density (BDY), Gravimetric water content (GWC), Volumetric water content (VWC), Water filled pore space (WFPS) and Total Pore space (TPS) were calculated.

RESULTS AND DISCUSSION

•BDY, TPS and WFPS were slightly higher in the second year than the first year. GWC and VWC were higher in the first year than second year (attributed to the 19.61% less rainfall in the second year) (Fig 1a).
•Cover crop increased water retention in the soil as a result of the cooling effects it has on the soil. This verifies the second hypothesis. However, TPS was slightly lower with the introduction of cover crop (Fig 1b).
•There was no significant difference in BDY between till and no-till plots beyond tillage depth (Fig. 1c).
•GWC and VWC increased with sample depth. However, they were stable in the first two depths (tillage depths) (Fig 1d).

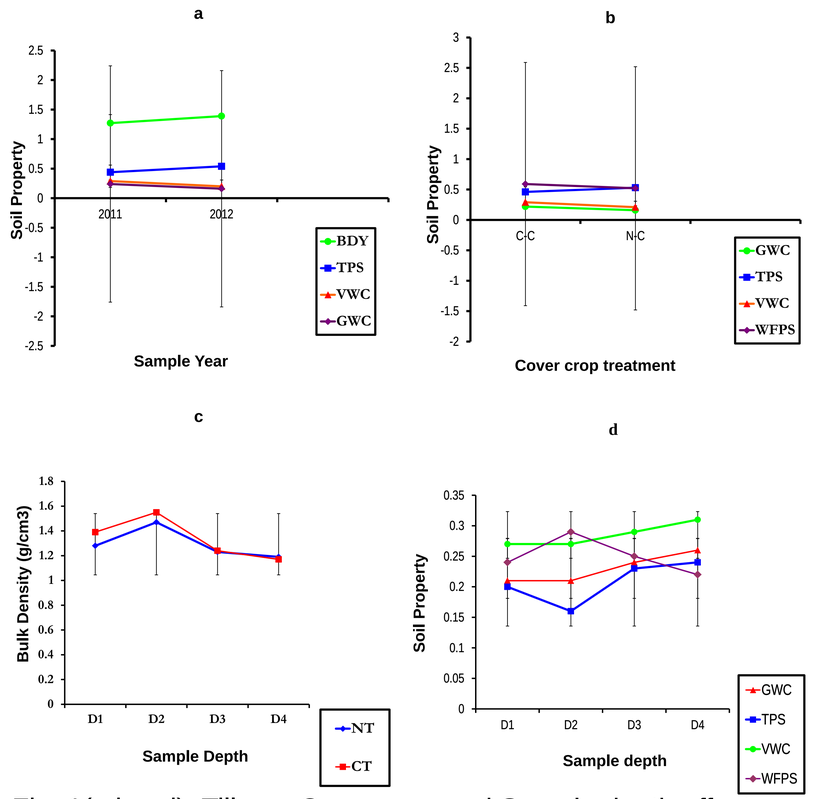

Fig. 1(a,b,c,d). Tillage, Cover crop and Sample depth effects on Soil Physical Properties.

CONCLUSION

•BDY was affected by soil water and tillage, invalidating the first hypothesis.

•Below the tilling depth, bulk density was not affected, verifying the second hypothesis.

•This experiment is still being conducted and so the treatment effects are not fully established.

ACKNOWLEDGEMENTS

The authors will like to thank Heraclite Bikumbu, Jason Williams, Stephanie Sale, Brandon Mebruer, Ashley Meyers and Cole Griffith for their help.

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This research is part of a regional collaborative project supported by the USDA-NIFA, Award No. 2011-68002-30190 "Cropping Systems Coordinated Agricultural Project (CAP): Climate Change, Mitigation, and Adaptation in Corn-based Cropping Systems" sustainablecorn.org

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