Long-Term No-Till and Reduced Till Systems Reduce Soil's Susceptibility to Compaction

Raihanah Hassim, Humberto Blanco, Charles A. Shapiro, and Paul Jasa
University of Nebraska-Lincoln (UNL), Lincoln, NE

INTRODUCTION

- Conservation tillage such as no-till could cause soil compaction under modern agriculture.
- However, a few studies have reported that no-till farming could reduce soil's susceptibility to compaction known as soil compactibility (Thomas et al., 1996; Blanco-Canqui et al., 2009).
- More experimental data from different soils, cropping systems, and climatic regions are needed to ascertain the benefits of no-till for reducing soil compactibility.

OBJECTIVE AND HYPOTHESIS

We determined the impact of no-till, disk, and moldboard plow management on soil compactibility under two long-term experiments in Nebraska (>32 yr).

METHODS

- We collected soil samples from 0 to 15 and 15 to 30 cm depths in late spring 2017 from two different experiments located at Haskell Agricultural Laboratory near Concord, NE (northeastern Nebraska), and Rogers Memorial Farm Lincoln, NE (eastern Nebraska).
- The soil at both sites is silty clay loam (<2% slope).
- The experimental treatments were no-till, disk, and moldboard plow.
- We determined soil compactibility using the Proctor test (Blanco-Canqui et al., 2009).
- Maximum bulk density was computed from the Proctor test data and correlations performed against soil organic C concentration.

Experiment in northeastern Nebraska

Experiment in eastern Nebraska

RESULTS

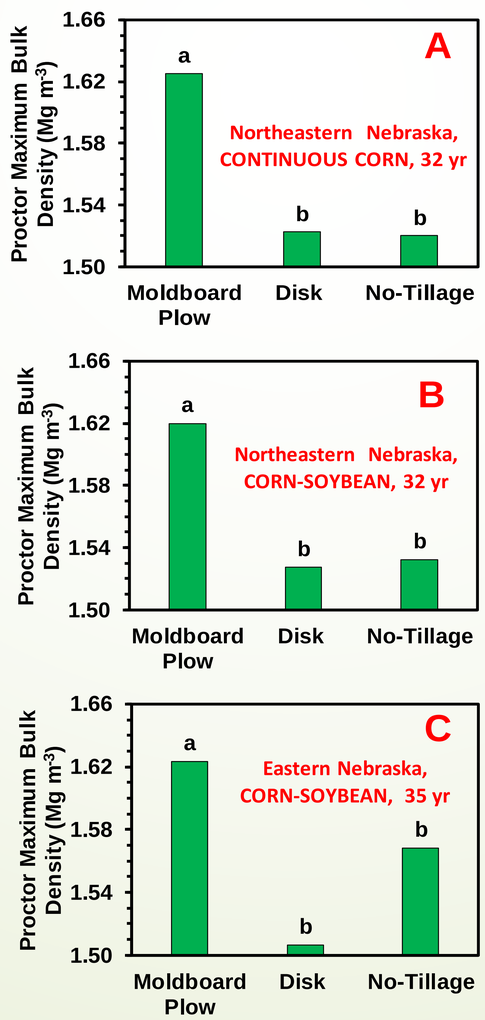

Fig. 1. Soil compactibility expressed as maximum bulk density. Bars with different letters are different at the 0.05 probability level.

- No-till and disk management systems reduced maximum bulk density of the soil for all cropping systems and sites (Fig. 1A-C).
- No-till and disk reduced maximum bulk density by about 6%.
- No-till did not differ from disk.
- Maximum bulk density decreased as soil organic C concentration increased under continuous corn in northeastern Nebraska (Fig. 2).

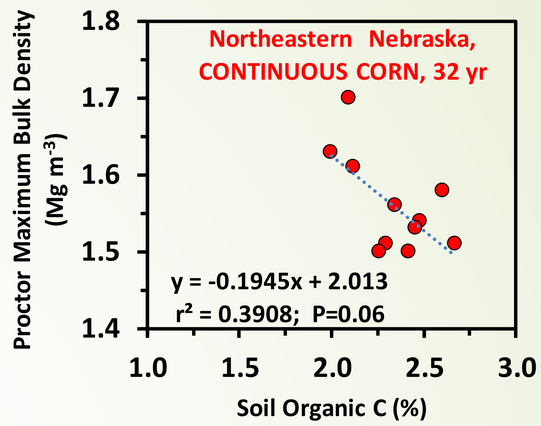

Fig. 2. Relationship between soil compactibility and soil organic C concentration

DISCUSSION

- Results indicate that no-till and disk can reduce soil compactibility as compared with moldboard plow in the long-term.
- Increased soil organic C concentration under no-till and reduced till can be partly responsible for the reduced soil compactibility in conservation tillage (Fig. 2).
- Results further corroborate the findings from the few previous studies, which have suggested that no-till can reduce soil compactibility (Thomas et al., 1992; Blanco-Canqui et al., 2009).

CONCLUSIONS

- Our study suggests that conservation tillage can reduce the soil's susceptibility to compaction.
- Conservation tillage appears to increase soil resilience and resistance to compaction by increasing soil organic C concentration.
- Results have positive implications for managing soil compaction under modern agriculture, which relies on the use of heavy field equipment.

ACKNOWLEDGEMENT

We thank the University of Nebraska-Lincoln's Institute of Agriculture and Natural Resources, Agricultural Research Division, Undergraduate Student Research Program for funding this project and providing valuable research experience to the first author.

REFERENCES

1. Thomas, G.W., G.R. Hazler, and R.L. Blevins. 1996. The effects of organic matter and tillage on maximum compactibility of soils using the Proctor test. Soil Sci. 161:502–508.
2. Blanco-Canqui, H., L.R. Stone, A.J. Schlegel, D.J. Lyon, M.F. Vigil, M. Mikha, and P.W. Stahlman. 2009. No-till induced increase in organic carbon reduces maximum bulk density of soils. Soil Sci. Soc. Am. J. 73:1871-1879.