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Cover Crop Management Effects on Soil Physical and Biological Properties

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Abstract

Cover crops have been known to reduce soil erosion, among other benefits, and increase water infiltration, organic matter and soil microbial activity. This study was conducted at Lincoln University's Freeman farm during 2011 and 2012 to assess the effects of cover crop management on soil physical and biological properties. The soil of the experimental site was a Waldron silt loam soil (Fine, smectitic, calcareous, mesic Aeric Fluvaquents). The field was 4.05 ha in size and subdivided into 48 plots, each measuring 12.2 m x 21.3 m. The cropping pattern for the plots was a corn (*Zea mays* L.)/soybean (*Glycine max*) rotation. The cover crop of choice was cereal rye (*Secale cereale*). Half of the total plots had cover crop management while the other half had no-cover crop. Soil samples were collected at four depths; 0-10, 10-20, 20-40 and 40-60 cm. Samples were oven dried at 105°C for 72 h for soil physical properties analysis. Air dried soil samples were also sent to a commercial laboratory for analysis of soil biological properties. Results showed a significant effect ($p < 0.05$) of cover crop on the selected soil physical and biological properties. A 3.5% decrease was also observed in soil bulk density in cover crop plots as compared with no-cover crop plots. The carbon to nitrogen (C/N) ratio decreased with increasing sampling depth for the first three depths and increased slightly in the fourth depth ($p < 0.05$). C/N ratio also showed a 5.6% increase in no-cover crop plots as compared with cover crop plots. The cover crop used in this study was capable of significantly improving soil physical and biological properties.

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References

1. Arshad MA, Martin S. Identifying critical limits for soil quality indicators in agro-ecosystems. In "Soil health as an indicator of sustainable management". *Agric Ecosyst Environ* 2002; **88**: 153–160.
2. Blanco-Canqui H, Mikha MM, Presley DR, Claassen MM. Addition of cover crops enhances no-till potential for improving soil physical properties. *Soil Sci Soc Am J* 2011; **75**: 1471-1482.
3. Campbell RB, Karlen DL, Sojka DE. Conservation tillage for maize production in the U.S southern coastal plain. *Soil Tillage Research* 1984a; **4**:511-529.
4. Campbell RB, Sojka DE, Karlen DL. Conservation tillage for soybean production in the U.S southern coastal plain. *Soil Tillage Research* 1984b; **4**:531-541.
5. Dapaah HK, Vyn TJ. Nitrogen fertilization and cover crop effects on soil structural stability and corn performance. *Commun Soil Sci Plant Anal* 1998; **29**: 2557–2569.
6. Doran JW, Zeiss MR. Soil health and sustainability: managing the biotic component of soil quality. In "Managing the biotic component of soil quality, a special issue. *Appl Soil Ecol* 2000; **15**: 3–11.
7. Ewing RP, Waggener MG, Denton HP. Tillage and cover crop management effects on soil water and corn yield. *Soil Sci Soc. Am J* 1991; **55**:1081-1085
8. Folorunso OA, Rolston DE, Prichard T, Loui DT. Soil surface strength and infiltration rate as affected by winter cover crops. *Soil Technol* 1992; **5**: 189–197.
9. Janzen HH, Campbell CA, Brandt SA, Lafond GP, Townley-Smith L. Light-fraction organic matter in soils from long-term crop rotations. *Soil Sci Soc Am J* 1992; **56**, 1799-1806.
10. Joyce BA, Wallender WW, Mitchell JP, Huyck LM, Temple SR, Brostrom PN, Hsiao TC. Infiltration and soil water storage under winter cover cropping in California's Sacramento Valley. *Trans ASAE* 2002; **45**: 315–326.
11. Karlen DL, Mausbach MJ, Doran JW, Cline RG, Harris RF, Schuman GE. Soil Quality: A concept, definition, and framework for evaluation (A guest editorial). *Soil Sci Soc Am J* 1997; **61**: 4-10.
12. Keisling TC, Scott HD, Waddle BA, Williams W, Frans RE. Winter cover crop influence on cotton yield and selected soil properties. *Comm Soil Sci Pl Anal* 1994; **25**:3087-3100.
13. Lu YC, Watkins KB, Teasdale JR, Abdul-Baki AA. Cover Crops in Sustainable Food Production. *Food Rev Int* 2000; **16**: 121–157.
14. Palm C, Sanchez P, Ahamed S, Awiti A. Soils: A Contemporary Perspective. *Annu Rev Environ Resour* 2007; **32**: 99–129