



Does cattle grazing of cover crops compact soil? An analysis of existing literature and short-term data

Rebecca Clay¹, Humberto Blanco², Sabrina Ruis², Manbir Rakkar², Aaron Stalker², Mary Drewnoski² and Gary Lesoing², (1)Iowa State University (2)University of Nebraska - Lincoln

Introduction

- Cover crops (CCs) can provide a number of ecosystem services.
- Grazing CCs could provide direct economic incentive (Fig. 1).
- However, the impact of grazing CCs on soil compaction, soil properties, and crop yields has not been widely documented.

Objectives

Our specific objective was to assess whether grazing CCs causes soil compaction.



Figure 1: Cattle graze cereal rye CC near Tecumseh, NE on April 9, 2016.

Methods

Literature Review

Collected and analyzed existing literature on the impacts of grazing CCs on soil compaction and crop yield.

Field Experiments

- Studied ongoing four CC experiment under corn silage across Nebraska (Fig. 2)
- Treatments were: 1) Control (no CC), 2) Non-grazed CC, and 3) Grazed CC.
- Measured compaction parameters (bulk density and cone index) for the 0-10 and 10-20 cm depths in year 1 (Fig. 3).



Fig. 2. Map of Nebraska showing the four locations (North Platte, Mead, Firth, and Tecumseh, NE).



Fig. 3. Rebecca Clay collecting soil samples at the Mead site.

Results: Literature Review

- Only three studies on CC grazing and compaction were available (Table 1).
- The three studies found that CC grazing slightly increased penetration resistance.
- One study found increased bulk density due to CC grazing.
- Crop yield increased with CC grazing in one study.

Table 1: Published studies on CC grazing effects on penetration resistance, bulk density, and crop yields. Significant differences ($p \leq 0.05$) are indicated with an asterisk(*).

Location, treatments analyzed, and reference	Pana, Illinois Continuous corn (non-grazed) vs. rotation of corn and oat-winter CC (grazed) Maughan et al. (2009)	Guárico, Venezuela Non grazed vs. grazed corn with CC of dictyoneura or macrocarpum Lozano et al. (2010)	Watkinsville, Georgia (US) Not grazed vs. grazed corn or grain sorghum with CC of cereal rye Franzluebbers and Stuedemann (2008)
Does grazing CC increase penetration resistance?	YES*	YES*	YES*
Does grazing CC increase bulk density?	N/A	NO	YES*
Does grazing CC reduce subsequent crop yield?	NO	N/A	N/A

Results: First Year Data from the Four Sites in Nebraska

- Cover crop grazing did not significantly increase cone index at any site (Table 2).
- Similarly, CC grazing did not significantly increase bulk density (Fig. 4 and 5).

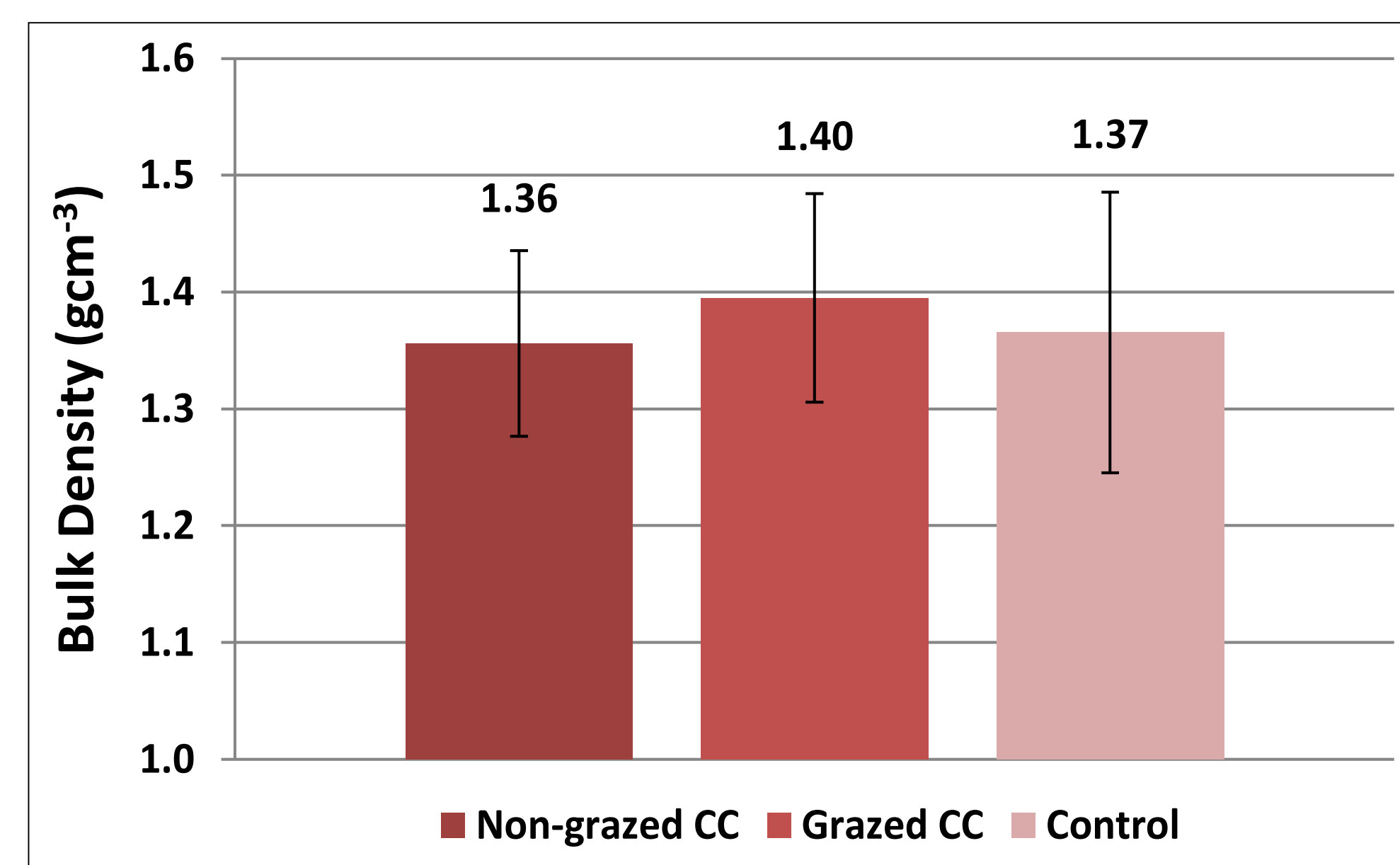


Figure 4: Average bulk density of 0-10 cm for the four sites.



Fig. 5. Steers were reaching mature weight at the Mead site but did not cause increased bulk density in first year.

Table 2: Cone Index (CI) readings for three treatments across four sites. Patterns are significant at $p \leq 0.05$, meaning no patterns are significant for the first year.

Cone Index (MPa)					
Location	Treatment			P-value	
Firth	Control	Non grazed CC	Grazed CC	0.07	
	0-10 cm	2.36	1.68		1.65
	10-20 cm	2.77	2.26		1.93
Mead	Control	Non grazed CC	Grazed CC	0.16	
	0-10 cm	2.33	2.79		2.43
	10-20 cm	1.55	1.71		1.55
North Platte	Control	Non grazed CC	Grazed CC	0.33	
	0-10 cm	2.37	3.13		3.14
	10-20 cm	2.88	3.13		3.28
Tecumseh	Control	Non grazed CC	Grazed CC	0.26	
	0-10 cm	1.18	1.04		1.16
	10-20 cm	1.36	1.30		1.39

Discussion/Conclusion

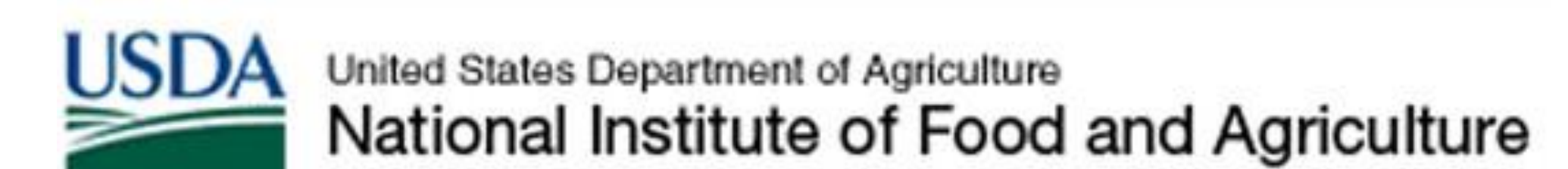
- Literature review showed that, in general, CC grazing increases soil compaction.
- However, the level of compaction was not severe enough to reduce crop yield (Fig. 6).
- The lack of significant changes in bulk density and cone index at the Nebraska sites is consistent with literature in which few significant changes were observed in the first few years of the study.
- Additional research data are needed to comprehensively assess how CC grazing affects soils, crop production, and other soil ecosystem services.



Fig. 6: The force of a steer's hoof when grazing CC can cause visible changes to the soil as observed in this photo taken at the North Platte site. These changes might be temporary and have no effect on the soil's ability to provide ecosystem services and sustain crop production.

Acknowledgements

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References

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