

## Introduction

- Char, a by-product from the sugarbeet industry, could be a potential soil amendment (Fig. 1)
- It contains 30% C in addition to essential macro- and micro-nutrients
- Biochar can improve soil properties although it has higher C content (70-80%) than char
- Because char has similar properties to biochar, it could improve soil properties when used as a soil amendment
- Char benefits on soil properties have not been studied



Fig. 1. Pile of char at the Western Sugar Cooperative factory in Scottsbluff, NE

## Objective

- To determine the impact of char produced by the Western Sugar Cooperative on soil physical and chemical properties

## Methods

- We studied char applied to a degraded and non-degraded sandy loam soil near Sidney, NE (Fig. 2)
- Char was applied at six rates (0, 11, 22, 34, 45, and 67 Mg ha<sup>-1</sup>) in quadruplicate in April, 2016 (Figs. 3 and 4)
- Soil was sampled to 0-10 cm depth in spring 2017
- Penetration resistance and shear strength were determined for the 0-10 cm depth
- Samples were analyzed for bulk density, cation exchange capacity, total C, organic C, and nutrients



Fig. 2. Degraded soil in Sidney, NE (photo taken in late July, 2017)  
Foreground: Char plot under fallow  
Background: Char plot under corn



Fig. 3. Char was spread onto fields and rototilled into 15 cm depth of soil in April 2016



Fig. 4. Char incorporated in field strips

## Results and Discussion

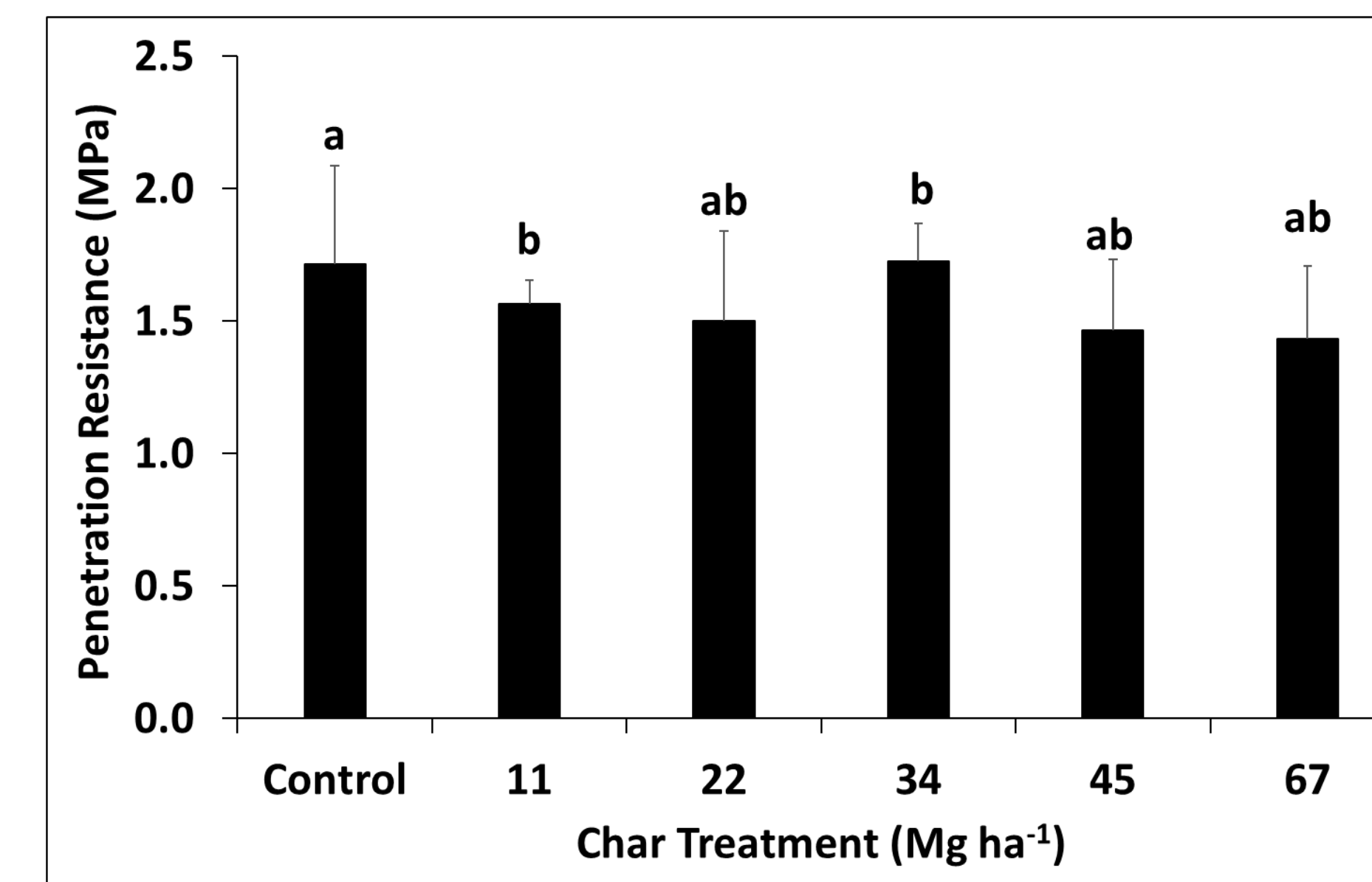


Fig. 5. Changes in penetration resistance with char amount in a non-degraded soil, Sidney, NE. Bars with the same letter do not differ in Figs. 5, 6, and 7

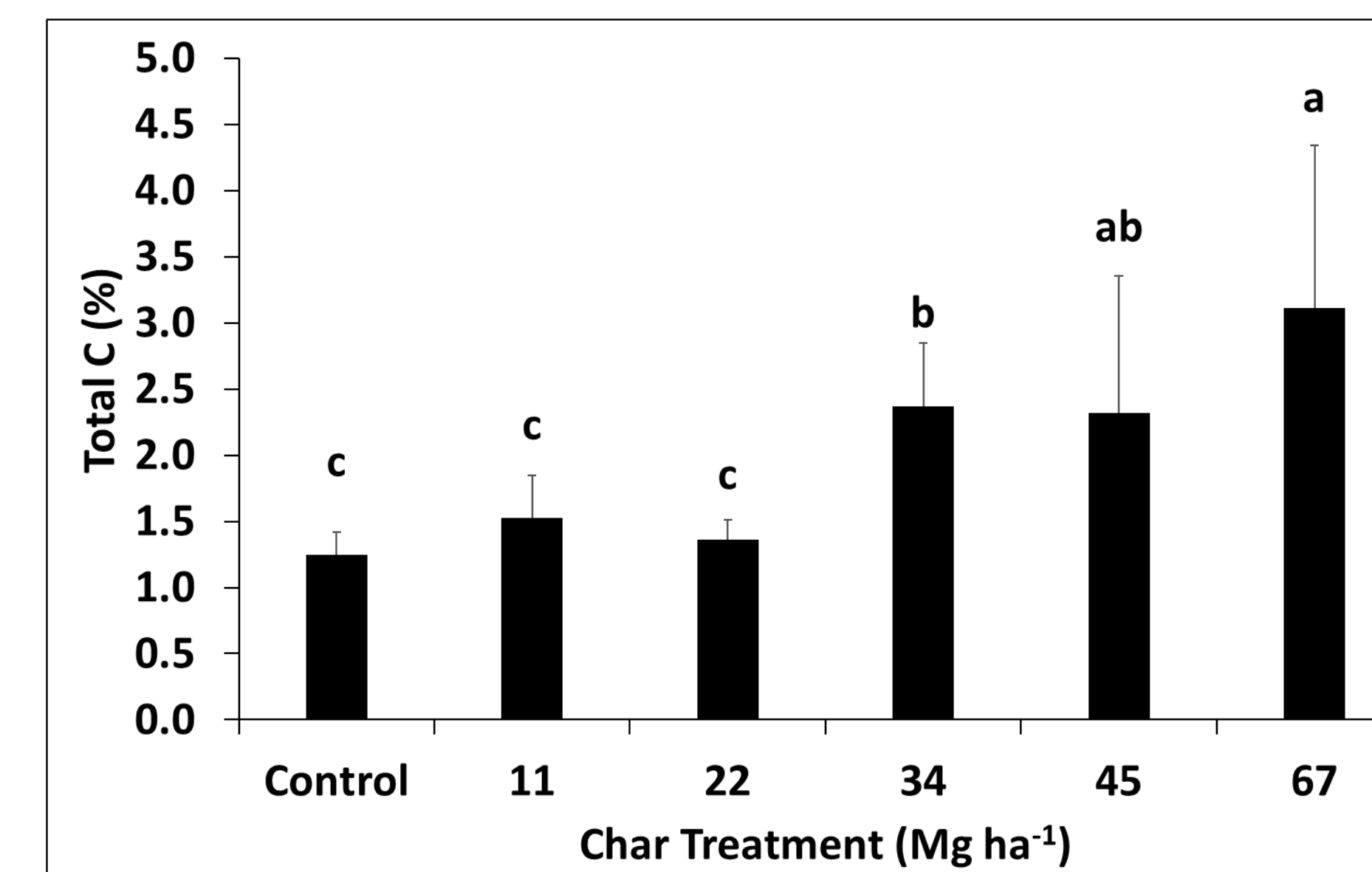


Fig. 6. Relationship between total C and char amount in a degraded soil, Sidney, NE

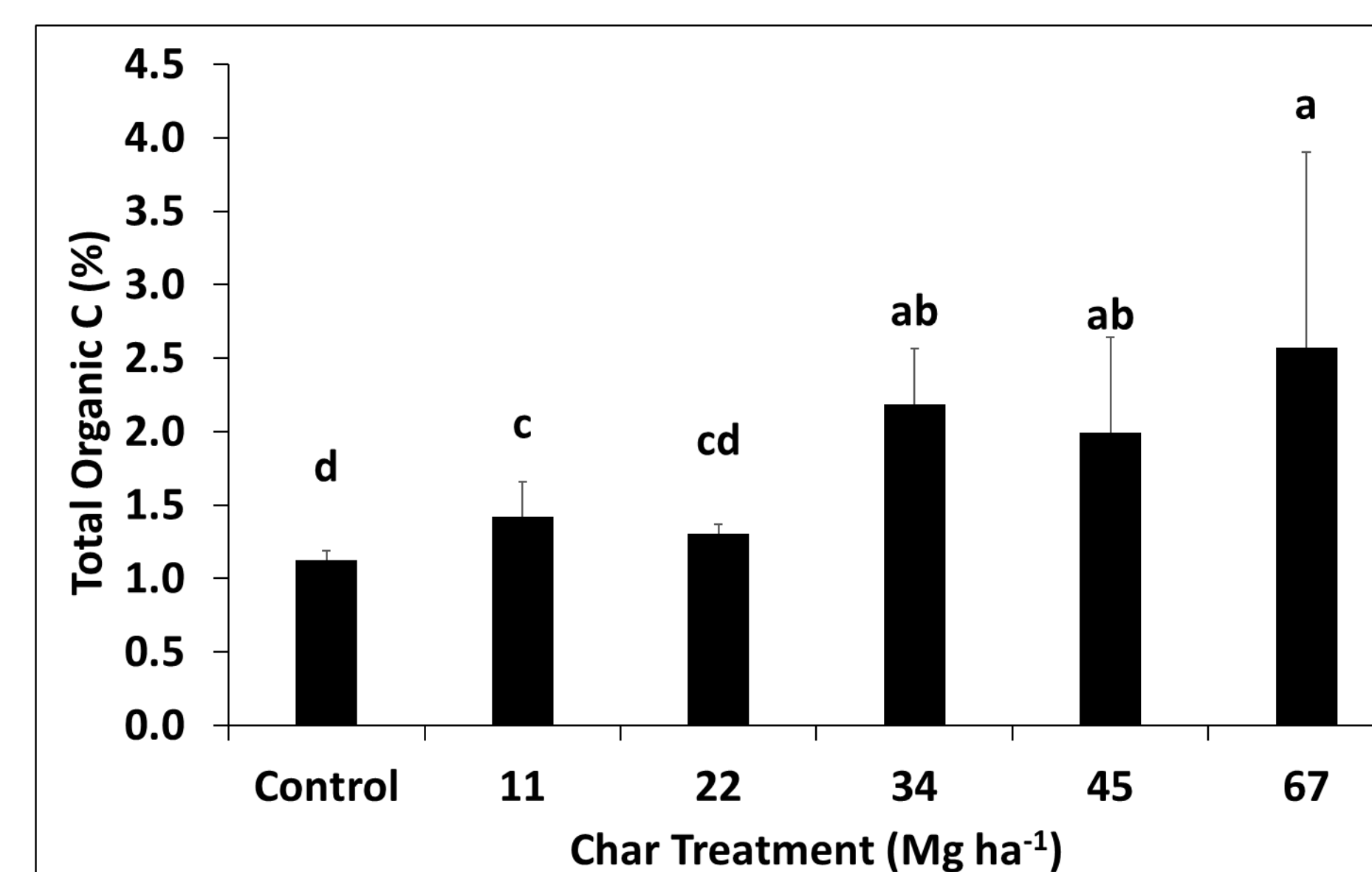


Fig. 7. Relationship between total organic C and char amount in a degraded soil, Sidney, NE

- Char did not affect bulk density and shear strength
- Char did not reduce bulk density unlike in biochar studies (Blanco-Canqui, 2017)
- Char tended to reduce penetration resistance (Fig. 5)
- Char did not affect soil fertility, which somewhat contrasts with findings from biochar studies (Ding et al., 2016)
- Char increased cation exchange capacity at the degraded site at  $p < 0.10$
- Concentration of total C increased by 90% with 34 Mg ha<sup>-1</sup> and 149% with 67 Mg ha<sup>-1</sup> of char application (Fig. 6)
- Concentration of organic C increased by 23% with 11 Mg ha<sup>-1</sup> and by 128% with 67 Mg ha<sup>-1</sup> of char application (Fig. 7)
- The increase in soil C with char use could benefit low C soils
- Our study reports first year results
- Char may require more time to improve soil properties

## Conclusion

- Soil compaction tended to decrease with char application
- Char increased total C and total organic C content in degraded soils
- Char could be used as a possible soil amendment, but more long-term studies are needed

## References

- Blanco-Canqui, H. (2017). Biochar and soil physical properties. *Soil Sci. Soc. Am. J.*, In press.
- Ding, Y., Liu, Y., Liu, S., Li, Z., Tan, X., Huang, X., Zeng, G., Zhou, L., Zheng, B. (2016). Biochar to improve soil fertility. A review. *Agron. Sustain. Dev.*, 36, 1-18.

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