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SOIL WATER RETENTION IN RESPONSE TO LONG-TERM MANURE AND INORGANIC FERTILIZER N APPLICATION

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INTRODUCTION

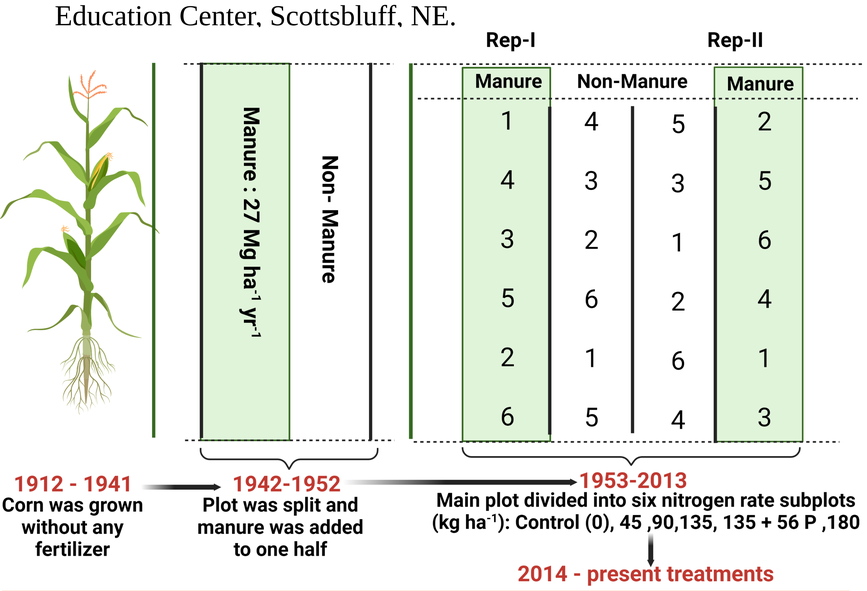
- Soil management practices that supply additional carbon (C) inputs to soil from biomass or manure have the potential to increase soil organic carbon (SOC) and enhance water retention.
- Application of cattle manure and inorganic fertilizer (N) to croplands is an important management strategy to recycle C and nutrients while improving soil productivity.
- Long-term application (>77 years) of manure and fertilizer N can improve our understanding of the extent to which such applications can modify soil physical properties such as soil water retention and plant available water (PAW).
- However, little information is available about the long-term application of manure and inorganic fertilizer on soil water retention and availability in semiarid soil.

OBJECTIVE

- To evaluate the effect of long-term (>77 years) application of manure and inorganic fertilizer N on soil water retention, plant available water, and their relationships with SOC in a calcareous soil of western Nebraska.

MATERIALS AND METHODS

- **Study site:** 100-year-old Knorr-Holden Plot, University of Nebraska-Lincoln (UNL) Panhandle Research, Extension, & Education Center, Scottsbluff, NE.



Treatment	Manure (67 Mg ha^{-1})	Non-manure
1	0	0
2	56	56
3	112	112
4	168	168
5	Predictive N (0 – 140)	225
6	Reactive N (80 – 125)	280

Fig. 1. Dynamic split-plot design of the historic Knorr-Holden Plot.

RESULTS

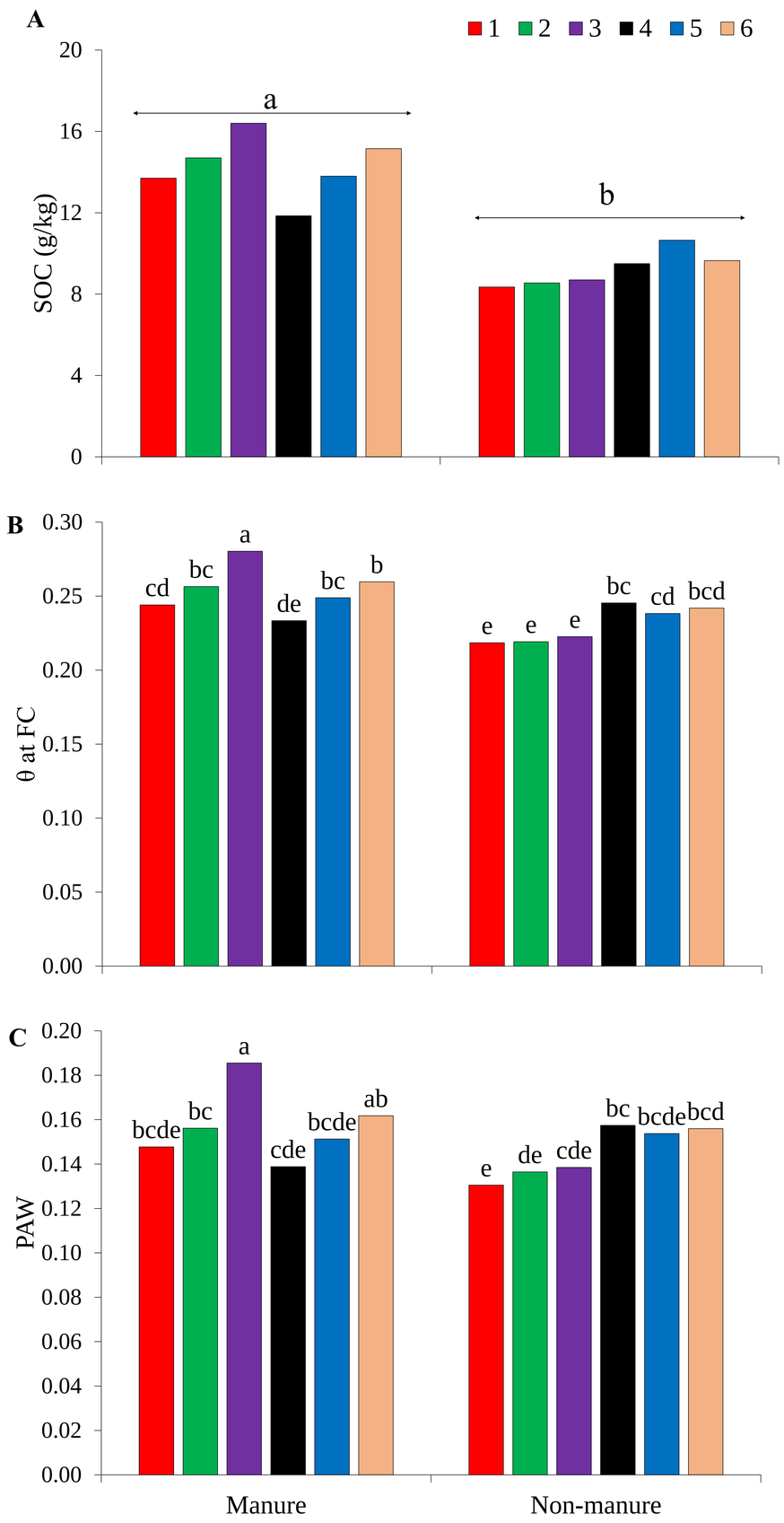


Fig. 2. Interaction effect of manure and fertilizer N rates on [A] SOC, [B] volumetric water content at field capacity (θ at FC) and [C] plant available water (PAW). Different letters above bar indicate significant differences at p<0.05.

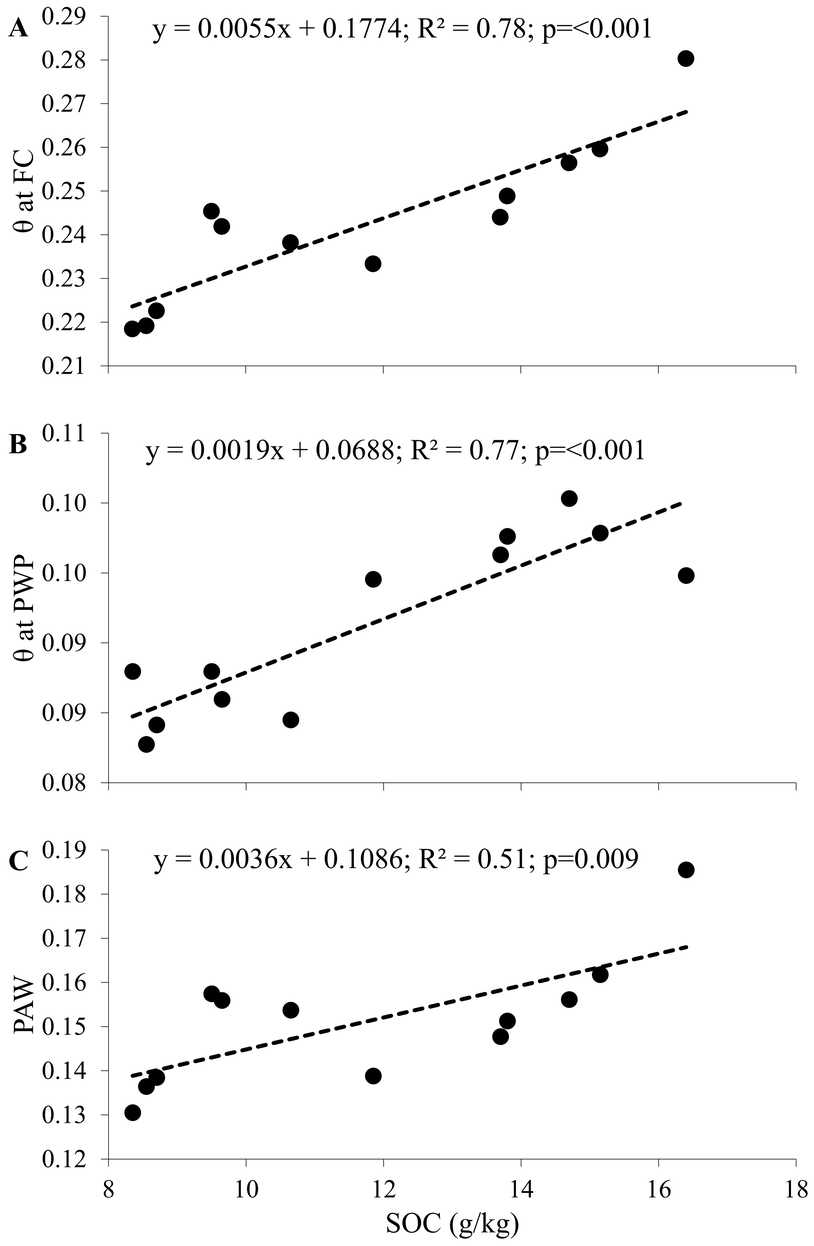


Fig. 3. Relationship between SOC and [A] volumetric water content at field capacity (θ at FC) and [B] permanent wilting point (θ at PWP), and [C] plant available water (PAW).

CONCLUSION

- Across N levels, manure application increased SOC by 55% compared to non-manure.
- Increase in SOC significantly improved plant water retention and availability in semiarid calcareous soil.
- While N rates <=112 kg ha^{-1} showed higher water retention in manure than in non-manure treatment, 168 kg ha^{-1} had greater effect in non-manure.
- Manure and inorganic N management can be optimized to improve drought resilience in regions facing water limitations.