



# Do Cover Crops and Grazing Harm Soil Properties?

David Karki | SDSU Extension Agronomy Field Specialist  
Anthony Bly | SDSU Extension Soils Field Specialist  
Jashanjeet Dhaliwal | Graduate Research Assistant  
Sandeep Kumar | Associate Professor



**SOUTH DAKOTA STATE  
UNIVERSITY EXTENSION**

Department of **Agronomy, Horticulture & Plant Science**  
College of **Agriculture, Food & Environmental Sciences**

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No-till (NT) has been in the rise in recent years in South Dakota (SD). In 2019, half of cultivated crop acres in SD were under no-till systems (NRCS-SD) with more than 900,000 acres planted to cover crops that same year. Many producers and researchers have found that cropping system practices that greatly reduce tillage and/or no-till (NT), include crop rotations (more than two crops), incorporate cover crops, and use livestock grazing can be effective tools for improving soil health and enhancing overall agro ecosystem benefits. Among others, healthy soils have many beneficial attributes such as higher soil organic matter (carbon), improved soil water infiltration, greater soil porosity, and water holding capacity that will build and sustain resilient farming systems. Managing water is one the most important- if not the most important aspect of modern agriculture, especially in environments similar to SD that are historically known for limited annual precipitation. A study was conducted to compare short and long-term animal grazing on soil health and water properties at four locations in SD.

## What was done?

- Three long-term (> 30 years) sites- two near Bristol, and one near Salem, SD and a short-term (3-years) management site at SDSU Southeast Research Farm near Beresford were identified for the study.
- At each site, three management practices- i) corn-soy-small grains-cover crop-grazing, ii) corn-soy,

and iii) pasture under grazing were identified for the study. Pasture was considered a 'check' or a reference point for other two practices.

- Soil samples were taken from each practice at all sites in 2019 and analyzed for soil water properties, such as soil organic matter (SOM), water infiltration rate, soil porosity, and soil water content. All measurements were determined for the top two inches of the soil profile.

## Key Findings

- SOM was consistently higher for practices with diverse crop rotations, cover crops and grazing at all long-term sites. The differences in SOM were not highly contrasting for short-term site (Figure 1)

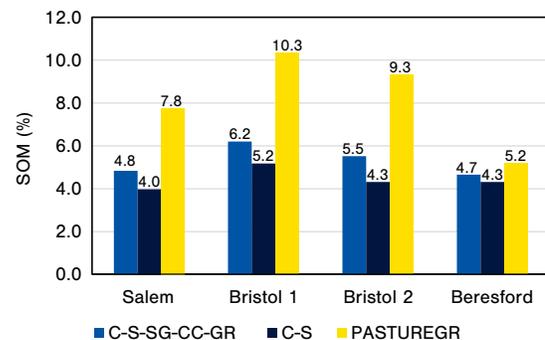


Figure 1. Soil Organic Matter (SOM) at top 2" soil under corn-soybean (C-S), corn-soybean with small grain, cover crops and grazing (C-S-SG-CC-GR), and pasture grazing (PASTUREGR) systems. Salem and Bristol sites are under long-term management system (>30 years) and Beresford is under short term management system (3 years).

- Pores or voids in soil hold both water and air. Voids in top two inches of soil were greater for practices with diverse crop rotations, cover crops and grazing when compared to corn-soy rotation. Additionally, voids and total soil carbon in samples from long-term management systems (i.e. > 30 years) were consistently higher compared to the systems that are just being transitioned to these practices (i.e. 3 years) (Figures 2 and 3)

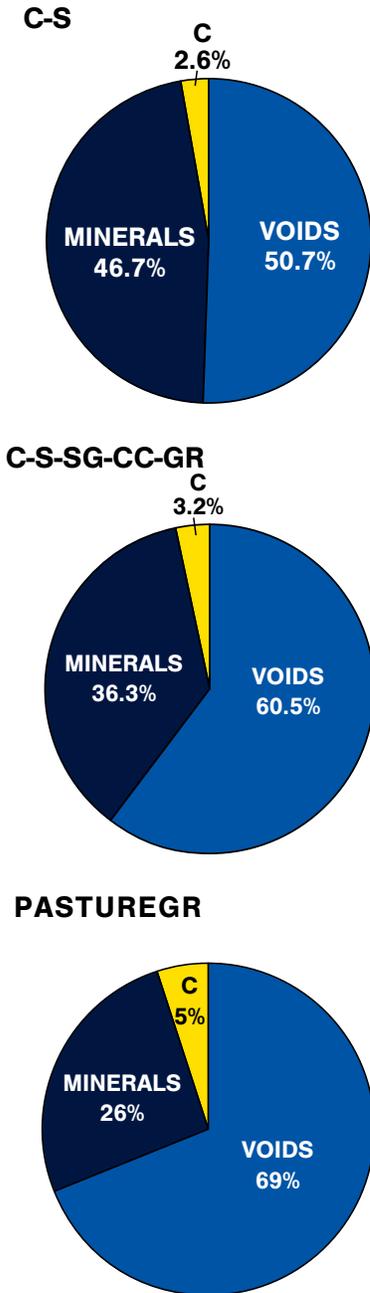


Figure 2. Average percentages of pores (voids), soil carbon, and minerals in top 2" soil under corn-soybean (C-S), corn-soybean with small grain, cover crops and grazing (C-S-SG-CC-GR), and pasture grazing (PASTUREGR) at three long-term management sites (>30 years) in Bristol and Salem, SD.

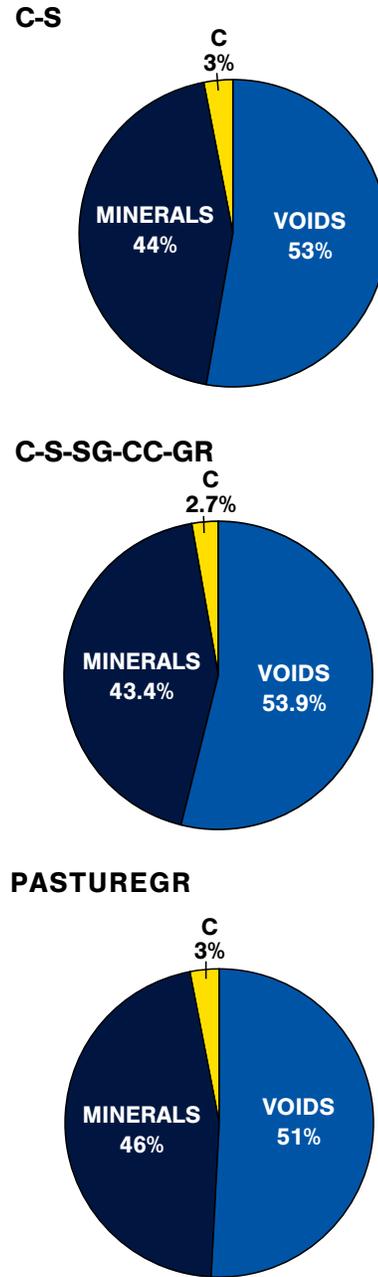


Figure 3. Average percentages of pores (voids), soil carbon, and minerals in top 2" soil under corn-soybean (C-S), corn-soybean with small grain, cover crops and grazing (C-S-SG-CC-GR), and pasture grazing (PASTUREGR) at a short-term management site (3-years) near Beresford, SD.

- Diverse crop rotation along with cover crops and grazing highly enhanced soil water infiltration at all sites (both short and long-term management) when compared with the corn-soybean rotation (Figure 4).

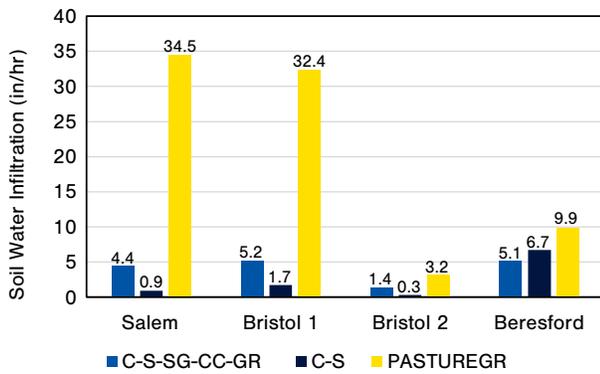


Figure 4. Soil water infiltration rate (in/hr) for corn-soybean rotation (C-S), corn-soybean with small grain, cover crops and grazing (C-S-SG-CC-GR) and pasture grazing (PASTUREGR). Salem and Bristol sites are under long-term management system (>30 years) and Beresford is under short-term management system (3 years).

### Major Conclusion

- Livestock grazing did not harm soil properties when used in combination with other soil health practices such as diverse rotations, cover crops and no-till.
- At all long-term sites, diverse crop rotations, cover crops and livestock grazing showed highly improved SOM, water infiltration rate, and soil porosity.
- Measured differences between management practices were not obviously distinguishable for the short-term soil health practice and grazing site at the Southeast Research Farm.
- These findings suggest that improving overall soil health will require adoption of diversifying crop rotations, incorporating cover crops, and livestock integration in the system more than three years.

### Suggested Reading:

Dhaliwal, J.K., and S. Kumar. 2020. Hydro-physical Soil Properties as Influenced by Short and Long-Term Integrated Crop-Livestock Agroecosystems. Soil Sci. Soc. of Am. J.



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