Do Switchgrass Barriers Improve Water Infiltration Compared to Row Crops?

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Introduction

- Switchgrass (*Panicum virgatum* L.), a warm-season perennial grass, can be used as a barrier to reduce water erosion (Fig. 1)
- Switchgrass barriers can be an alternative to terraces
- They pond runoff and reduce sediment loss (Blanco-Canqui et al. 2004)
- Limited research information is available on the impact of switchgrass barriers on water infiltration
- Capturing precipitation is important in croplands, particularly in water-limited regions

Objectives

- To determine if switchgrass barriers increase water infiltration compared to row crops
- Compare water infiltration measured with the Cornell infiltrometer and the single ring infiltrometer

Fig. 1. Soybean and grass barriers at a study site near Lincoln, NE

Material and Methods

- We studied an experiment established at the Rogers Memorial Farm (RMF) in 1998 about 16 km east of Lincoln, NE (Fig. 2)
- The soil is a silty clay loam with 4% slope
- Five 1.4 m wide-switchgrass barriers were established in parallel rows (38-m intervals) in soybean-sorghum-corn rotation (Fig. 3)
- The design was split plot with no-till and conventional till as main plots and row crop and switchgrass as sub-plots
- We measured water infiltration in soybean phase in summer 2017
- Single ring infiltrometer and Cornell infiltrometer were used
- Total porosity was calculated from the bulk density data measured using core method (0-7.6 cm depth)

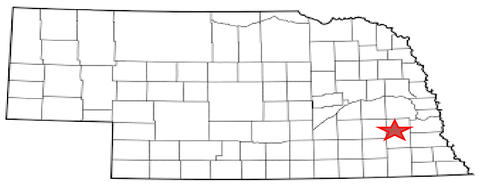

Fig. 2. Map showing the study site near Lincoln, NE

Fig. 3. Satellite image of grass barriers at RMF

Results and Discussion

Fig. 4. Single ring infiltrometer method

Fig. 5. Cornell infiltrometer method

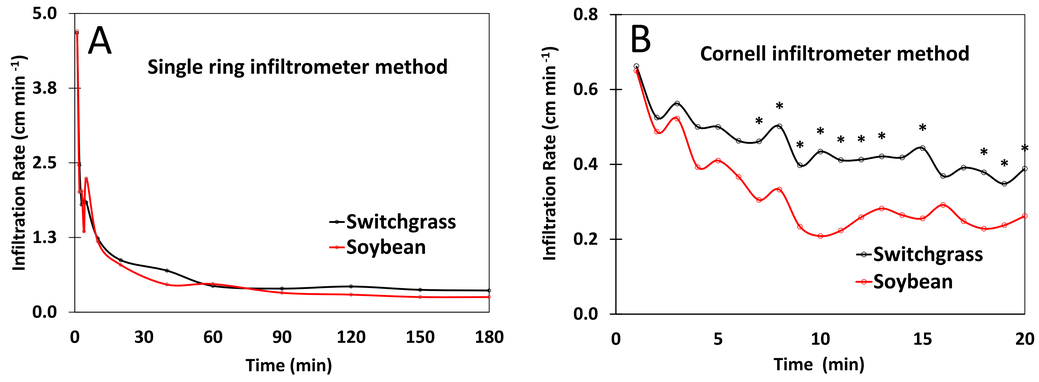

Fig. 6. Infiltration rate using single ring (A) and Cornell (B) infiltrometer method within switchgrass and soybean in no-till and conventional till plots. * indicates significant differences between treatments at $p < 0.05$

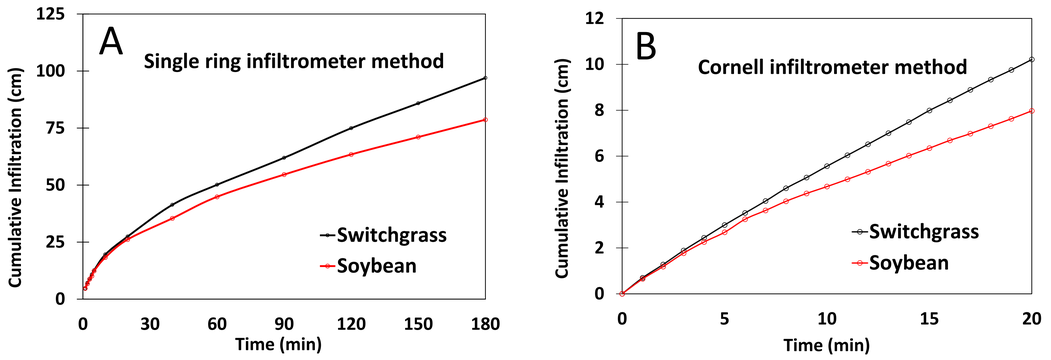

Fig. 7. Cumulative infiltration using single ring (A) and Cornell (B) infiltrometer method within switchgrass and soybean in no-till and conventional till plots. *indicates significant differences between treatments at $p < 0.05$

Fig. 8. Failing switchgrass barrier due to concentrated flow, leading to ephemeral gully erosion

Fig. 9. Sediment in runoff collected with the Cornell infiltrometer

- Grass barriers increased infiltration rate with the Cornell method but not with single ring method (Fig. 6A-B)
- Grass barriers and tillage did not affect cumulative water infiltration (Fig. 7A-B)
- No-till plots had higher total porosity than conventionally tilled plots in the top 7.6 cm soil depth
- Grass barriers yielded less sediment in runoff compared to row crop (Fig. 9)
- The reduced sediment loss under barriers suggests reduced losses of nutrients associated with sediment and runoff (Blanco-Canqui et al., 2004)
- Grass barriers commonly have greater root biomass amount than row crops, which may increase macroporosity and pore continuity, leading to increased infiltration rates (Rachman et al. 2004)

Conclusion

- Grass barriers increased infiltration rate relative to row crop using the Cornell infiltrometer method
- Grass barriers had no effect on infiltration when using ring infiltrometer
- Results suggest that grass barriers could reduce runoff compared with row crops

Acknowledgements

Project funded by the USDA NIFA FY16 Agriculture and Food Research Initiative: Education and Literacy Initiative– Undergraduate Experiential Learning Fellowships Program. Thanks also to Manbir Rakkar [2] and others who helped me collect data

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