Evaluation of Crop Management Practices Impact on Soil Infiltration

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INTRODUCTION

Water infiltration rate is an important indicator of soil structure and stability. Favorable management practices may increase infiltration rates and reduce surface runoff and loss of nutrients and soil. Our objective is to determine a relationship of cover crop and tillage practices on infiltration rates in corn based cropping systems.

MATERIALS & METHODS

Infiltration experiments under saturated conditions were performed near Ames (ISUAG) (Figs 1-2) and Gilmore City (Figs 3-5), Iowa on clay loam soils. ISUAG has 16 plots consisting of no cover/no-till and cover/no-till. Gilmore City has 32 plots consisting of four tillage/cover crop combinations: till/no cover (CP-SP), no-till/rye cover (NT-rye), no-till/no cover (NT-SP) and till/rye cover (CP-rye). ISUAG utilizes a split-plot, randomized block design while Gilmore City has a randomized block design.

Field measurements were taken with a Cornell Sprinkle Infiltrometer (Ogden et al., 1997) at a simulated drip application rate of 0.5 cm/min for 60 minutes (or until steady state conditions were reached). Measurements include time to runoff, saturated infiltration rate, and runoff rate. Data presented were collected during the 2012 growing season.

ISUAG 2012

Fig 1: No Cover/No-Till

Fig. 2: Cover/No-Till

Gilmore City 2012

Fig 3: No Cover / Till

Fig. 4: Cover / No-Till

Fig 5: No Cover / No-Till

Fig. 6: 2012 Gilmore City Infiltration Results

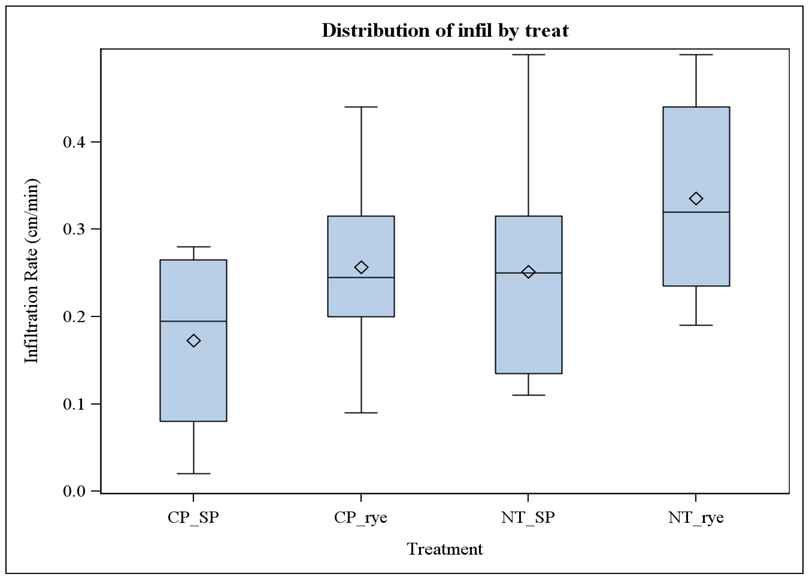


Table 1: Estimated Mean Difference Between Treatments

Parameter	Estimate (cm/min)	Infil. Rate Increase*	Pr > |t|
1. Impact of No-Till without Rye Cover (CP-SP vs NT-SP)	0.0805	46.9%	0.179
2. Impact of No-Till with Rye Cover (CP-Rye vs NT-Rye)	0.0795	31.1%	0.184
3. Impact of Rye Cover with Tillage (CP-SP vs CP-Rye)	0.0838	48.8%	0.163
4. Impact of Rye Cover with No-Till (NT-SP vs NT-Rye)	0.0837	32.8%	0.163

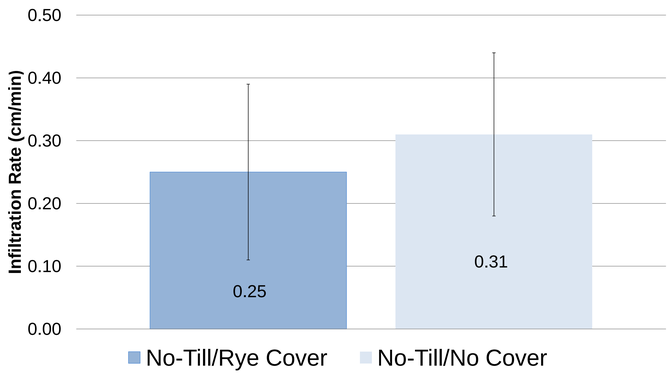
*Increase in parameters 1 and 2 are a result of no-till practices and 3 and 4 are a result of cover crops impacts.

Table 2: Treatment Effect Model Results

Source	F Value	Pr > F
Overall Treatment Effect	2.62	0.0729

Note: The field infiltration capacity was determined from the measured steady state infiltration rate after adjustment for three dimensional flow at the bottom of the ring. An adjustment factor of 0.80 was utilized based on a clay loam soil and a 7 cm ring depth (Reynolds and Elrick 1990).

Fig. 7: 2012 ISUAG Infiltration Results



RESULTS & DISCUSSION

At the Gilmore City site, Figure 6 displays box plot results of the treatment effects on saturated infiltration rates. The till/no cover plots had the lowest average infiltration rates while the no-till/rye cover plots had the highest average infiltration rates. All three treatment options involving rye cover and/or no-till had higher infiltration rates than the till/no cover plots. The overall treatment effect model had a p-value of 0.0729 suggesting treatment effects were not significant at the 0.05 probability level. At the ISUAG site, Figure 7 displays lower average infiltration rates for the rye cover than the no cover plots indicating no benefit to rye cover in 2012.

CONCLUSION

Utilizing cover crops, no-till or a combination of practices has the potential to improve soil structure and increase infiltration rates based on literature. Different results were obtained from separate sites in Iowa where Gilmore City saw potentially encouraging results while ISUAG did not. Data from multiple seasons will be required to draw reliable conclusions regarding the impact of these management systems on infiltration. Further, multiple year results will also help answer whether infiltration rates increase over time from long-term implementation of no-till and cover crop techniques.

REFERENCES

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