Evaluation of Crop Management Practices on Soil Infiltration

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INTRODUCTION

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

MATERIALS & METHODS

Infiltration experiments under saturated conditions were performed near Gilmore City and Ames, Iowa on clay loam soils. The sites have 48 field plots with a corn-soybean rotation. Ames has 16 plots consisting of no cover/no-till (Fig. 1) and cover/no-till (Fig. 2) plots. Gilmore City has 32 plots consisting of four cover crop/tillage combinations: no cover/till (Fig. 3), rye cover/no-till (Fig. 4), no cover/no-till (Fig. 5) and rye cover/till (not shown). Ames utilizes a split-plot, RCB design while Gilmore City has a randomized block design.

Field measurements were taken with a Cornell Sprinkle Infiltrometer (Ogden et al., 1997) at a target drip application rate of 0.5 cm/min for 60 minutes (or until steady state conditions were reached). Data were collected from September 2011 through June 2012. Measurements include time to runoff, saturated infiltration rate and runoff rate.

Ames, Iowa - May 2012

Fig 1: No Cover/No-Till

Fig. 2: Cover/No-Till

Gilmore City, Iowa - April 2012

Fig 3: No Cover / Till

Fig. 4: Cover / No-Till

Fig 5: No Cover / No-Till

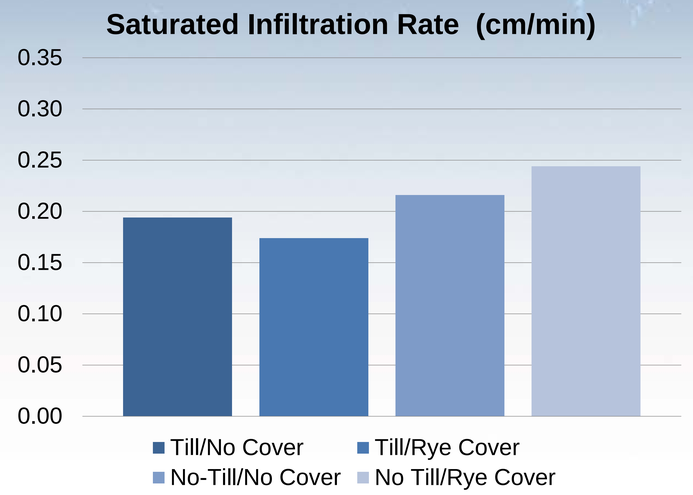

FIGURE 6: INFILTRATION RATES FOR COVER CROP AND TILLAGE PLOTS - GILMORE CITY, IOWA

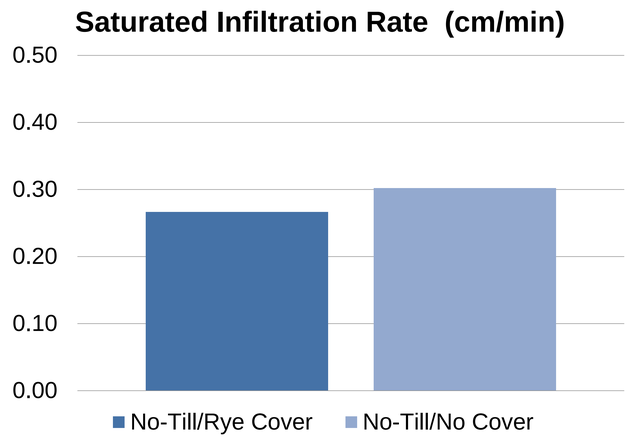

FIGURE 7: INFILTRATION RATES FOR COVER CROP PLOTS – AMES, IOWA

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).

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RESULTS & DISCUSSION

For the Gilmore City site, Figure 6 displays relatively small impacts of cover crops on infiltration rates. In tilled plots, rye cover (0.17 cm/min) had lower average infiltration rates than no cover (0.19 cm/min) plots. Conversely under no-till conditions, rye cover (0.24 cm/min) had higher average infiltration rates than no cover (0.22 cm/min) plots. Both no-till conditions with and without cover (0.24 and 0.22 cm/min) resulted in higher average infiltration rates than tilled conditions with and without cover (0.17 and 0.19 cm/min).

For the Ames site, Figure 7 displays lower average infiltration rates for the rye cover (0.27 cm/min) than no cover (0.30 cm/min) plots under no-till conditions. Overall, the average infiltration rates were slightly higher when comparing no-till/rye cover and no-till/no cover results of Ames (0.27 and 0.30 cm/min) to Gilmore City (0.24 and 0.22 cm/min), respectively.

CONCLUSION

Utilizing cover crops, no-till or a combination of practices has the potential to improve soil structure and increase water infiltration rates. Based on limited data collected to date, treatment effects seem marginal when studying the benefits of cover crops on infiltration rates for this season with average differences between cover conditions of 0.02 and 0.03 cm/min for Gilmore City and Ames, respectively. Minimal establishment of rye cover during Spring 2012 may have reduced the impacts of rye cover, particularly in Gilmore City. There is some indication that infiltration rates were favored by no-till. Data from multiple seasons will be required to draw reliable conclusions regarding impact of these management systems on infiltration at these sites.

REFERENCES

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