EFFECT OF VARIOUS COVER CROP SPECIES ON WATER INFILTRATION AND BULK DENSITY

Savana S. Davis
Darrin M. Dodds
Lucas X. Franca
Bradley R. Wilson
Jacob P. McNeal
Bradley J. Norris
John J. Williams
Mississippi State University
Starkville, MS

Abstract

Cover crops are defined as any living cover grown between the harvest of one cash crop and planting of a subsequent cash crop in which the land would otherwise be fallow. Cover crops are typically associated with conservation tillage or no-till production systems but can be utilized in conventional tillage systems as well. Improvements in water infiltration have been observed due to cover crop utilization. Water infiltration rate is the function of how quickly water can move down into the soil profile. Cover crops can be especially beneficial in soils that are prone to crusting in that they break up the soil surface and reduce runoff. The objective of this research was to evaluate the effect of cover crop species on water infiltration and bulk density in a conventional tillage system under irrigated and dryland conditions. This experiment was conducted in Starkville, MS (2017-2018) and Tribbett, MS (2017). Plots in each location were 3.9 m wide and 12 m long. Cover crop species seeded in this study included crimson clover (*Trifolium incarnatum*; 11 kg ha^{-1}), oat (*Avena sativa*; 56 kg ha^{-1}), cereal rye (*Secale cereale*; 56 kg ha^{-1}), and a blend of rye + crimson clover (45 + 6 kg ha^{-1}). Cover crops species were seeded in late November due to drought conditions experienced across the state in 2016 and delayed cotton harvest in 2017. Phytogen 444 WRF was seeded at 110,000 seeds ha^{-1}. A split application totaling 134 kg N ha^{-1} was applied just after planting and at pinhead square in all siteyears. Watermark soil moisture sensors were placed at depths of 15, 30, 60, and 90 cm in one replication of each treatment and when sensors averaged -75 kPa, irrigation was triggered. All cover crop treatments were grown under both irrigated and rainfed conditions. Water infiltration readings were taken in-season using single-ring infiltrometers. Rings were placed in traffic furrows, non-traffic furrows, and on top of the beds in three replications in each location. Once installed, rings were filled with water and measurements were taken periodically to determine the infiltration rate. Bulk density measurements were also taken at this time from traffic furrows, non-traffic furrows and on top of the planting beds. Data collected throughout the season were analyzed in SAS v9.4 using the PROC Mixed procedure. Data were subjected to analysis of variance (ANOVA) and means were separated using Fisher's Protected LSD at $\alpha = 0.05$.

Cover crop species did not affect cotton growth and yield. Irrigation slightly delayed cotton maturity. However, differences in maturity did not affect management of the crop. Cotton lint yields were greater under irrigated conditions. Differences were observed in water infiltration and bulk density due to reading location within the experimental unit. Infiltration rate was higher on top of the planting bed than in either the traffic or non-traffic furrow. Within the traffic furrow, an interaction between cover crop species and irrigation was observed with respect to water infiltration rate. In rainfed environments, oats used as a cover crop resulted in increased water infiltration compared to clover, the blend of rye + clover, and the winter fallow. However in irrigated environments, no differences in water infiltration were observed due to cover crop species. Bulk density was lowest when measurements were collected from on top of the planting bed, followed by the non-traffic furrow, and the traffic furrow. Differences in bulk density were also observed due to cover crop species. Bulk density was lower following a crimson clover or cereal rye cover crop than a winter fallow. It is important to note; however, that all bulk density measurements were below 1.40 g cm^{-3}, which is considered ideal for plant growth. No improvements to cotton growth and yield were observed suggesting that the use of cover crops did not increase net returns. However, cover crops can be a viable option if improvements to soil quality are desired in conventional tillage systems.