044-AGR

Cover crops influence seasonal soil temperature and moisture dynamics in conservation tillage-based corn production systems

Abstract:

Cover crops (CCs) are recognized for their potential to improve soil health and enhance crop productivity. However, their impact on soil moisture dynamics remains a critical consideration for their adoption. This study evaluated the effects of different CC treatments on soil temperature, and moisture dynamics in a corn cropping system at the Tennessee State University Agricultural Research and Education Center (TSU-AREC) farm. A split-plot randomized complete block design was employed, with CCs as the main plot factor and nitrogen (N) fertilizer management as the subplot factor. The CC treatments consisted of cereal rye monoculture, crimson clover monoculture, rye-clover mixture, and no-CC weedy fallow control. Subplots were managed with two N fertilizer rates: zero and a standard rate of 202 kg N ha^{-1}. HOBO multi-depth soil moisture sensors recorded volumetric soil moisture at three depths (0–15 cm, 15–30 cm, and 30–45 cm) to assess soil water dynamics. Results showed that rye and rye-clover mixture significantly increased soil water storage ($P < 0.1$) compared to the no-CC control, while crimson clover had no significant effect. Cumulative infiltration was also significantly higher under rye and rye-clover mixture ($P < 0.05$). No significant differences were observed in cumulative evapotranspiration among treatments. Additionally, the rye-clover mixture significantly reduced soil temperature ($P<0.05$) relative to the no-CC control. These findings highlight the dual benefits of rye and rye-clover mixture in enhancing soil water storage and infiltration while moderating soil temperature. These findings provide valuable insights for selecting a cover crop that can optimize soil moisture management and mitigate soil temperature extremes, which might improve corn production in agricultural systems.

Keywords: Cover crops, soil moisture dynamics, soil water storage, HOBO sensors, moisture retention, nitrogen application, climate-smart agriculture.