SOIL WATER DEPLETION AND RECHARGE FOLLOWING COVER CROP USE IN TEXAS COTTON PRODUCTION

Joseph A. Burke
Katie L. Lewis
Texas A&M AgriLife Research
Lubbock, TX

Abstract

The Southern High Plains (SHP) region of Texas is one of the largest producers of cotton (*Gossypium hirsutum* L.) in the United States. Limited rainfall and high wind speeds cause the potential evapotranspiration to be two to three times greater than the annual rainfall. Coupled with course-textured soils, the region is prone to severe wind erosion. Conservation management practices, like no-tillage and cover crops, can reduce a soil's susceptibility to wind erosion, but their adoption has been limited on the SHP due to producers' concerns regarding cover crop water use and yield reductions. This study sought to evaluate the impact of cover crops and no-tillage on soil water availability in cotton cropping systems. A field experiment was conducted from November 2018 through November 2020 at the Agricultural Complex for Advanced Research and Extension Systems (Ag-CARES) in Lamesa, TX. Soil water (, , VWC, volumetric water content) was determined using a field calibrated CPN 503 neutron probe (InstroTek Inc. Raleigh, NC) bi-weekly throughout the duration of the experiment. Three continuous cotton cropping systems were evaluated 1) traditional tillage with winter fallow (CVT) established in 1998; 2) no-tillage with rye (*Secale cereal* L.) cover (R-NT) established in 1998; and 3) no-tillage with mixed species cover (M-NT) established in 2014 from half of the existing R-NT plots. The mixed species cover consisted of 50% rye, 33% Austrian winter pea (*Pisum sativum* L.), 10% hairy vetch (*Vicia villosa* Roth), and 7% radish (*Raphanus sativus* L.), by weight. Soil water usage followed four distinct trends: 1) decreased soil water prior to planting cotton from soil evaporation or cover crop water use; 2) increased soil water near planting from precipitation and deficit irrigation; 3) decreased soil water during the growing season as cotton develops vegetatively; and 4) increased soil water as cotton vegetative growth and water demand decreases. Prior to terminating cover crops, soil water was depleted more with the use of cover crops than the conventional fallow period. However, water recharge was greater in the no-tillage cover crop systems following cover crop termination compared to the conventional system. During active cotton growth, soil water was greater following cover crops than the fallow period with the conventional practice. While no-tillage and cover crops maintained greater measurable water during the cotton growing season compared to the conventional tillage system, cover crop termination timing and spring precipitation events will have a significant impact on water availability to the subsequent cotton crop in deficit irrigated systems. Reductions in yield have been observed with these conservation systems and additional research is needed to determine the cause of these reductions. Additionally, water availability following cover crops needs to be evaluated in dryland cotton cropping system where irrigation is not available to reduce the impact of cover crop soil water depletion.