LONG-TERM IMPACTS OF CONSERVATION MANAGEMENT PRACTICES ON AGGREGATION, SOIL MOISTURE, AND COTTON YIELD

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Abstract

Cotton production is a key component of the Texas High Plains economy, but depletion of the Ogallala Aquifer might make producers more reliant on conservation management practices such as conservation tillage, crop rotation, and cover crops (Baumhardt et al., 2008). Questions regarding cover crop water usage is a major concern of agricultural producers in this region (Johnson et al., 2013). Johnson et al. (2013) found the integration of crop rotations and beef cattle rotations results in a 24% reduction in water applied. Schomberg et al. (2006) concluded rye cover can increase cotton (*Gossypium hirsutum* L.) lint yield in a short-term conservation management study in the Southeastern U.S. There is limited information regarding cover crop water-use in long-term conservation management systems of cotton, especially on the Texas High Plains.

The objective of this research was to determine the effects of no-tillage and cover crop use on soil aggregation, stored soil moisture, and cotton yield within a semi-arid cropping system. Research was conducted at the Agricultural Complex for Advanced Research and Extension Systems in Lamesa, TX. The soil at the research location is classified as an Amarillo series (fine-loamy, mixed, superactive, thermic Aridic Paleustalfs). The experimental design was a randomized complete block with three replications of treatments which included conventional tillage (fallow during winter, CT), no-tillage with a rye (*Secale cereal* L.) cover (NTR), and no-tillage with mixed species cover (NTM). No-tillage with a rye cover crop were implemented in the conservation management plots in 1998. In 2014, the NTR plots were split to include a mixed species cover including rye, hairy vetch (*Vicia villosa* Roth), winter pea (*Pinsum sativum* L.), and radish (*Raphanus sativus* L.). Soil samples were collected in April 2017 to determine soil aggregate stability using a dry-sieving method and reported as mean weight diameter (MWD). Stored soil moisture was determined using neutron attenuation. Cotton was planted in May and harvested in November of each year.

Preliminary results indicate the use of no-tillage with cover crops does not increase soil aggregation after 19 years compared to CT. Stored soil moisture is initially reduced by cover crop water use in the NTR and NTM treatments, but following timely rainfall or supplemental irrigation stored soil moisture was significantly greater with the NTR and NTM treatments compared to CT. Increased stored soil moisture was recorded in the NTR and NTM treatments during the cotton growing season compared to CT. Cotton lint yield was greater in CT compared to NTR in 2016 and 2017, but differences between CT and NTM treatments did not exist although CT generally produced greater yields. Cover crop water use did not appear to have an effect on lint yield. Cover crops might reduce yield through immobilization of nitrogen and by serving as a host for plant pathogens like root-knot nematode (Austin et al., 2017; Timper at al., 2006). Future research will attempt to identify yield limiting factors and quantify their impact in soil health management systems.

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