BENEFITS AND CONSEQUENCES OF NO-TILLAGE AND COVER CROP USE IN TEXAS SEMI-ARID COTTON PRODUCTION

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Abstract

Cotton producers on the Texas High Plains have not readily adopted conservation practices such as no-tillage and cover crops due to concerns regarding water availability and its subsequent impact on the proceeding cotton (*Gossypium hirsutum* L.) crop. Cover crops have the potential to immobilize soil nutrients in semi-arid regions where decomposition and mineralization can be slowed by limited water availability. A study was initiated in Lamesa, TX at the Agricultural Complex for Advanced Research and Extension Systems to determine the impact of no-tillage and cover crops on water availability and nutrient cycling. Treatments included: 1) conventional tillage, winter fallow; 2) no-tillage, rye (*Secale cereal* L.) cover crop; and 3) no-tillage, mixed species cover crop. Mixed cover crop species included 10% hairy vetch (*Vicia villosa* Roth), 7% radish (*Raphanus sativus* L.), 33% winter pea (*Pisum sativum* L.), and 50% rye, by weight. Soil water was determined using via neutron attenuation. Litterbags were installed at field-scale into the plots following cover crop termination on 27 March 2020 and collected periodically at 4, 8, 16, 32, 64, and 128 days after termination (DAT) during the growing season to determine biomass decomposition. Soil samples were also collected along with the litterbags to determine inorganic N fractions (nitrate and ammonium) and soil protein concentrations. Results indicate that while soil water was significantly reduced prior to cover crop termination, soil water with no-tillage and a cover crop was greater during active cotton growth compared to the conventional tillage system. Approximately 75% of the terminated cover crop biomass was persistent in the field 128 days after termination. Persistent biomass can result in N immobilization as microbes utilize inorganic N fractions for cellular growth and maintenance. Soil N followed similar trends to biomass decomposition indicating that N may not immediately be available to the cotton crop following a cover crop in this semi-arid ecoregion. Soil protein and inorganic N concentrations peaked 8 and 16 DAT, respectively, before steadily decreasing for the rest of the study period. The subsequent increase in inorganic N following increases in soil proteins was likely the result of rapidly decomposable materials in the biomass being mineralized and nitrified by soil microbes. Results suggest that inorganic N might be limited in semi-arid cotton cropping systems following cover crop termination. Further research is necessary to better understand the relationship between cover crop biomass mineralization and N cycling in these systems. These results suggest N immobilization may serve as a viable culprit to the yield reductions observed following cover crops in Texas High Plains cotton production.