RELATIONSHIP BETWEEN SOIL HEALTH AND NUTRIENT AVAILABILITY IN SEMI-ARID COTTON PRODUCTION

Joseph A. Burke
Texas A&M AgriLife Research and Extension, Lubbock, TX
joseph.burke@ag.tamu.edu (806) 746-6101

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

Jamie L. Foster
Texas A&M AgriLife Research, Corpus Christi, TX

ABSTRACT

The use of conservation management practices, like cover crops and no-tillage, is common in semi-arid cropping systems to reduce wind erosion. However, the use of these practices can also reduce cotton lint yield. The purpose of this study was to determine the impact of nitrogen (N) management in conservation cropping systems to increase cotton lint yield. An experiment was conducted at the Agricultural Complex for Advanced Research and Extension Systems in Lamesa, TX, USA. 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 hairy vetch (*Vicia villosa* Roth, 10%), radish (*Raphanus sativus* L. 7%), winter pea (*Pisum sativum* L., 33%), and rye (50%, by weight). Conventional tillage and no-tillage with rye cover crop treatments were established in 1998 and the mixed species cover was seed in 2014 by splitting the 32 row plots into 16 rows within the rye cover crop plots. The experiment utilized litterbags in 2020 and 2021 to determine cover crop decomposition rates following termination. In 2020, approximately 75% of the cover crop biomass remained 128-d following termination, while approximately 25% of the biomass remained 128-d after termination in 2021. These results indicate that only 31-32 kg N ha^{-1} would be available for cotton growth during the entire 2020 growing season. This limited biomass mineralization could have resulted in N limitations as soil microorganisms immobilized the N to complete their cellular functions. The differences in decomposition rate between 2020 and 2021 are likely the result of significant differences in biomass production between the two years. Following cover crop termination, soil inorganic N levels remained constant 0-8 DAT before increasing at 16 DAT. This increase in inorganic N at 16 DAT follows increases in soil proteins 8 DAT. Following termination, proteins are one of the first products to be released from the biomass, as soil microbes mineralize those proteins, they release soil inorganic N resulting in the increase in soil N observed at 16 DAT. After the peak at 8 DAT, soil protein levels decreased throughout the rest of the cotton growing season. Soil inorganic N levels were similar between 16 and 32 DAT, but significantly increased at 64 DAT. The increase in NO_3-N and inorganic N observed at 64 DAT is likely due to N fertilization shortly after cotton planting. These results indicate that there is likely N immobilization early in the growing season following cover crop termination. These results demonstrate that N management practices that account for potential N

immobilization following cover crops can significantly increase cotton lint yield and decrease the potential yield loss associated with conservation management practices in semi-arid regions.