SHORT TERM IMPACTS OF CONSERVATION PRACTICES AND NITROGEN MANAGEMENT IN COTTON PRODUCTION ON THE SOUTHERN HIGH PLAINS

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Abstract

Conservation practices of reduced tillage, cover crop use, and crop rotation have been used in cotton (*Gossypium hirsutum* L.) production on the Texas High Plains since the events of the dust bowl. Reducing soil erosion by about 40% is one of the major benefits to the implementation of these practices over the last century. But with rising costs and modern technology, there is some resistance to implementing such practices on traditionally conventional tillage systems. This study aimed to examine the short-term impacts of implementing conservation practices such as reduced tillage and wheat cover crop use, combined with nitrogen management, on land previously using conventional tillage practices. In addition, the environmental effects (greenhouse gas emissions) of this new system were examined. The focus of this study was to identify whether converting to conservation practices would decrease cotton lint yield in the first few years, and if altering nitrogen (N) fertilizer application strategies within these systems would mitigate the flux of greenhouse gases [carbon dioxide (CO_2) and nitrous oxide (N_2O)] from the soil. This comes from traditional thinking on the High Plains, as well as studies conducted in other areas concerning the mitigation benefits of such conservation systems.

This study was conducted at the Texas A&M AgriLife Research station in Lubbock, Texas over a two-year period (2016 and 2017). The study was designed as a split plot, with tillage as the main plot, and N fertilizer application timing as the split plot. Three tillage regimes were implemented, including: no-till with winter wheat cover (NTW), no-till winter fallow (NT), and conventional tillage winter fallow (CT). Five N application fertilizer timings were evaluated: control (no added N), 100% pre-plant (PP), 100% side-dressed (SD), 40% pre-plant and 60% side-dressed (SPLIT), and 100% pre-plant with a nitrogen stabilizer (urease inhibitor) product from BASF (Limus). Nitrogen fertilizer was applied as urea ammonium nitrate (UAN-32) at 168 kg/ha via knife injection. Cotton (DP 1321 B2RF) was planted in late May 2016, and early June 2017. Soil measurements were determined pre-season for the 2016 season before N fertilizer was applied and indicated low levels of residual nitrate-N in the top 15 cm of the soil. In addition, the soil had a fairly neutral pH of 7.4 and due to the cover crop, had even lower residual nitrate-N in the NTW plots. Pre-season soil samples for the 2017 season were also collected and were similar in pattern to the 2016 samples, with the exception of increased residual nitrate-N, pH decrease with added N compared to the control, and greater nitrate-N in the winter fallow treatments in which UAN was applied in a single application. Greenhouse gas measurements were taken in real time using a Gasmet DX4040 FTIR analyzer. Measurements were collected monthly and 1, 3, and 7 days post fertilizer application. Cumulative values indicated an increase in N_2O and CO_2 emissions in the NTW plots. In addition, there were no significant mitigation effects for the NTW and NT treatments compared to the more common CT x PP N application practices on the high plains.

Lint yield was determined for both years of the study. The CT treatment resulted in greater lint yields in 2016, potentially due to residual N deeper in the soil profile being translocated to higher in the profile by the tillage action, increase direct root interception with N and plant uptake. In 2017, the NTW plots resulted in greater yields, especially when combined with the N STB treatment. This was potentially due to environmental conditions early in the year from which the NTW treatment would have provided some early protection to cotton seedlings. Fiber quality data was also collected for the 2017 season and trended higher for the NTW plots compared to the CT and NT treatments, with no discernable pattern among N treatments, except for the SD application, which had the greatest values for all measured parameters. Microniare was low for every combination of treatment and tillage, which may have been due to late-planting, late winter rains, and an early freeze. The NTW treatment resulted in better micronaire than the CT and NT treatments possibly due to those early season benefits enhancing early maturation.

In conclusion, converting to a NTW system can have some benefits within the first few years of implementation, depending on the environmental conditions. However, the greenhouse gas mitigation benefits of such a system have

not been determined in the short, two-year period of this research, and no recommendation can be made at this time. Although all the factors being evaluated must be considered when deciding to implement conservation practices.