GREENHOUSE GAS EMISSIONS AND NITROGEN DYNAMICS IN TEXAS HIGH PLAINS COTTON

Christopher J. Cobos
Katie L. Lewis
Mark McDonald
Joseph A. Burke
Texas Tech University and Texas A&M AgriLife Research
Lubbock, TX
Paul B. DeLaune
Texas A&M AgriLife Research
Vernon, TX

Abstract

Wind erosion on the Texas High Plains (THP) has remained a consistent issue with cotton (*Gossypium hirsutum* L.) producers across the region for decades. Implementation of conservation management practices, such as cover cropping and reduced or no tillage, has helped decrease soil wind erosion potential while simultaneously increasing soil health. Monitoring greenhouse gas emissions from the soil, such as carbon dioxide and nitrous oxide, when implementing these practices can help inform future agricultural production decisions for both agronomic and environmental sustainability as we further understand the dynamics between soil and plant respiration and denitrification. The objective of this study was to quantify the changes in cotton lint yield, fiber quality, and cotton seed nitrogen levels and to assess changes in soil chemical characteristics, greenhouse gas emissions, and soil microbial abundance with cover crops and altered nitrogen fertilizer application timings in different tillage systems. The study took place in Lubbock, TX from 2016-2019 and was arranged as a split plot design with the main plots consisting of tillage systems: (1) no-tillage with a winter wheat cover crop (NTW), (2) no-tillage with a winter fallow (NT), and a (3) conventional tillage winter fallow system (CT). The sub plots consisted of nitrogen treatments: (1) 100% pre-plant (PP) application, (2) 100% side-dressed (SD), (3) 40% pre-plant with at 60% side-dressed (SPLIT), (4) 100% pre-plant with a nitrogen stabilizer (STB), and (5) no-nitrogen-added control. Throughout the study, cotton lint yield was improved in the NTW systems compared to CT. Soil greenhouse gas emissions were collected and analyzed using a DX-4040 Gasmet Gas Analyzer which simultaneously determined carbon dioxide, nitrous oxide, methane, ammonia, and carbon monoxide. Carbon dioxide emissions in the soil were affected by the tillage system with greater carbon dioxide-carbon in the NTW cotton compared to the control, and the nitrous oxide emissions were affected by the timing of the nitrogen fertilizer applications. In conclusion, implementation of a NTW system in irrigated cotton cropping systems in the THP can potentially be beneficial for cotton production as well as the overall soil health in the system.