CHANGES IN SOIL MOISTURE WITH CONSERVATION PRACTICES IN COTTON PRODUCTION SYSTEMS

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Abstract

Conservation tillage practices offer producers improved economic and environmental benefits through enhanced yields with reduced inputs. Changes in soil structure and hydrology result from the alteration of tillage practices and cover crops used in conservation management practices. This study was undertaken to quantitate the changes in soil nutrients and water under various conservation production practices, and their resultant impact on cotton fiber quality and yield. We examined the impacts of changes in tillage (subsoiling) and cover crop (winter wheat) on soil moisture and nutrients during the growing season. Final yield and cotton fiber quality were determined for each production system, and used to determine total economic return.

Introduction

Conservation tillage practices have been shown to improve soil quality parameters, and may increase cotton crop yield and quality and improve the return on investment of cotton production. Reductions in tillage and incorporation of cover crops have been shown to improve soil nutrients and water availability, reducing the need for supplemental irrigation. Concerns arise, however, on the clay soils common to alluvial areas such as the Mississippi Delta. The heavier soils hold moisture early in the year, decreasing soil temperature and impeding stand establishment. Cover crops can contribute additional moisture and lower soil temperatures due to decreased insolation at the soil surface. This research was undertaken to examine differences in soil nutrients and water availability following different tillage practices, and with incorporation of winter wheat cover crops into cotton production. We also measured changes in cotton fiber quality and yield for the different management practices. Treatments with winter wheat were found to require more water, rather than less as has been seen in other studies using rye as a cover crop (Balkcom et al., 2006). This may result from the lower biomass produced with winter wheat compared to rye.

Materials and Methods

Cotton (*Gossypium hirsutum* cv. DPL 444BR) was planted in 32 rows x 30 m plots in the spring. Conventional production practices included in-row subsoiling in the fall. Conservation plots were not subsoiled, and were planted with winter wheat cover crop in the fall. Cover crops were terminated with herbicide three weeks prior to planting the cash crop. Standard agricultural practices of fertilizer, insect and weed control were followed. Soil moisture was measured with Watermark soil moisture sensors placed at 15 cm (6”) intervals in the rooting zone to a depth of 0.9 m (36”). Irrigation was supplied with an overhead sprinkler irrigation system, begun when the readily available soil moisture at 30 cm (12”) was depleted (-50 - -70 mbars), and continued at 5 day increments thereafter unless significant rainfall was received. Plots were harvested with a commercial cotton picker equipped with a sampling system for large plot harvests. Seed cotton was ginned on a 10-saw research gin. Standard cotton classing was performed at the USDA-AMS Classing Office in Dumas, AR.

Conclusions

Irrigation significantly improved yield, in both conventional and conservation production systems for one of the three years of the study, though the conservation systems showed the greatest sensitivity to drought. The decrease in yield with conservation production practices is commonly seen, and may result from declines in soil available moisture with cover crop. Irrigation was particularly important in increasing the fiber length in the conservation system. Strength was also sensitive to production practices, but showed only slight improvement with irrigation. Little difference was observed in cotton lint value between the conservation and conventional production systems. Conventional production practices resulted in faster soil drying prior to planting, though no differences in crop establishment were observed. The Watermark soil moisture sensors recorded rapid soil drying in all years of the study. Supplemental irrigation restored soil moisture throughout the soil profile.

References

Balkcom, k.s., Reeves, D.W., Shaw, J.N., Burmester, C.H., and Curtis, L.M. 2006. Cotton Yield and Fiber Quality from Irrigated Tillage Systems in the Tennessee Valley. Agronomy Journal. 98:596-602.

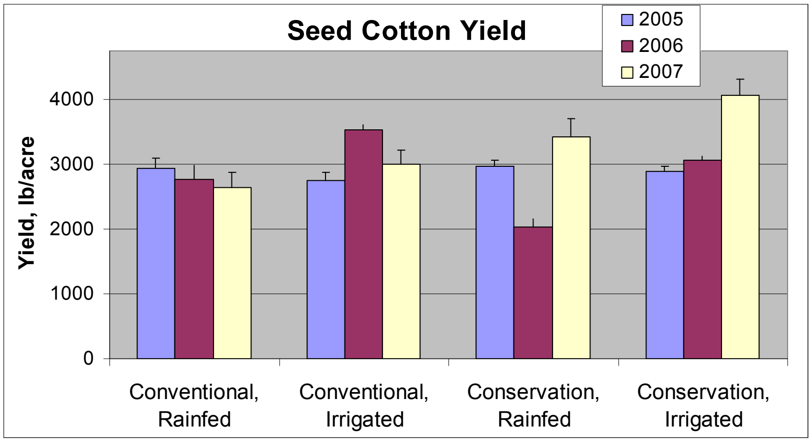
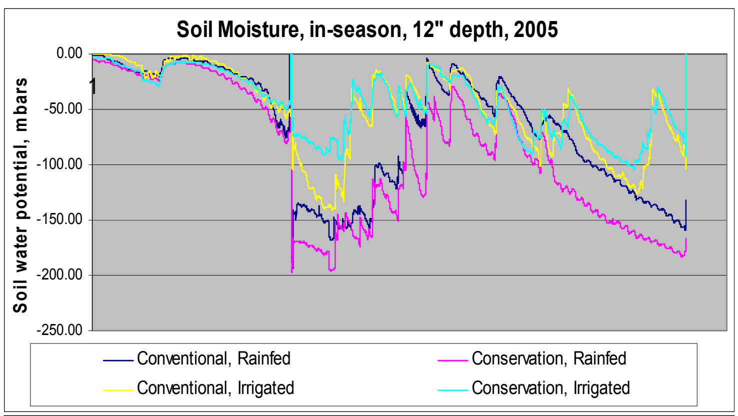


Figure 1. Seed cotton yield with management practices and irrigation.



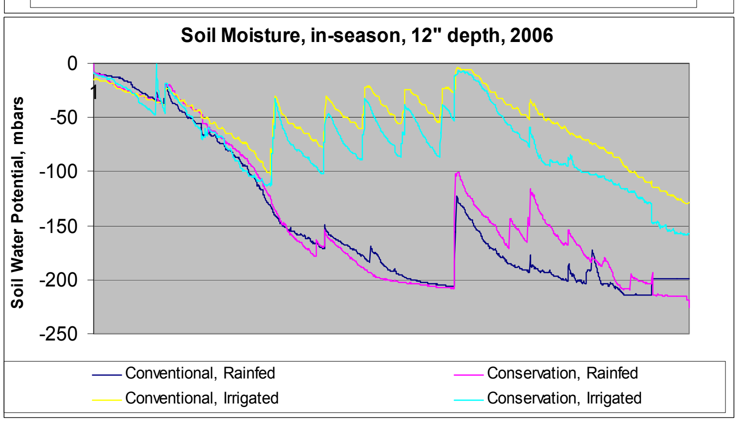


Figure 2. Soil moisture measured with Watermark soil moisture sensors throughout the growing season.