NITROGEN AND WATER RESPONSE OF CONVENTIONAL TILL AND CONSERVATION-TILL COTTON IN THE TEXAS HIGH PLAINS

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Abstract

Three million acres of cotton (*Gossypium hirsutum* L.), half which are irrigated, are grown in the Southern High Plains of Texas. This region is characterized by low, erratic rainfall and high winds. The new management techniques of low energy precision application (LEPA) irrigation and conservation-till cotton in terminated wheat residue has been shown to improve water use-efficiency as well as reduce wind erosion. Little N fertilizer response work, however, has been done in these systems. In a three-year study in Lubbock Texas, we looked at the interaction of tillage, irrigation level, and N fertilizer rate on cotton in an Acuff loam.

Cotton lint yields showed a strong positive response to irrigation level. The response to water was quadratic in 1996 and 1997 and linear in the drought year of 1998. Nitrogen fertilizer response was not observed in 1996. In 1997 and in 1998 cotton lint yields responded to N at the 50 and 75% estimated evapotranspiration (ET) replacement irrigation levels, but not at the 0 or 25% ET levels. Tillage effects, tillage by N effects, and tillage by water effects on lint yield were not significant. However, at the highest irrigation level, N fertilizer response of cotton was stronger in the conservation-till cotton-wheat residue system than in the conventional cotton. The N fertilizer response curves at the 75% ET replacement indicated that more N was need in the presence of wheat residue, probably due to early N immobilization.

Evaluation of the chlorophyll meter as an indicator of N status and need of in-season N was done at the 75% ET replacement irrigation level. Chlorophyll meter readings were positively correlated with N fertilizer rate but were not affected by tillage. We used a "sufficiency index" defined as the readings of each plot divided by the readings of the highest N rate. A critical N sufficiency index of 0.95 was shown in 10 out of 12 cases/treatments during the 3-year study to successfully predict the statistical similarity or difference between the yields of the case/treatment and the yields of the highest fertilized plots. In future work this approach needs to be further tested with actual in-season top-dressings or fertigations based on a critical 0.95 sufficiency index. The lack of response of cotton to N fertilizer in the 0% ET irrigation treatments probably means that uses of the chlorophyll meter are limited in dryland cotton systems.

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