SOIL FERTILITY MANAGEMENT UNDER TWO CONSERVATION TILLAGE SYSTEMS

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Abstract

Conservation tillage can conserve moisture, reduce erosion, prevent non-point pollution and in some instances enhance crop yields. It can also lower production costs because conservation tillage requires less trips over the field with mechanical equipment. Cotton producers have been reluctant to accept minimum till or no-till practices. Currently, about seven percent of the cotton produced in the U.S. is managed under some form of reduced tillage and about one percent is grown using No-Till techniques. Therefore, approximately one million acres of cotton in the U.S. was grown in 1997 using some form of reduced tillage system. Probably, the most important factor in a successful no-till or minimum till system of cotton production is weed control. The increasing availability of herbicide resistant cotton varieties should improve the ability of more producers to manage cotton profitable under a reduced or no-till system. Another factor in cost savings besides fewer trips over the field involves less capital replacement and less interest expense on machinery.

Previous studies have shown tillage methods and nitrogen application rates can have a direct effect on cotton lint yields. The purpose of this study was to evaluate four tillage practices combined with three fertilizer regimes in a rainfed production system. A field study was conducted from 1988 to 1997 at the Texas A&M Agricultural Research and Extension Center Farm at Corpus Christi, on a Victoria clay soil. Twelve treatments were arranged in a randomized complete block design with four replications. The four tillage systems were evaluated as main plots as follows: CT-Conventional, MT-Minimum Till, MTC-Minimum Till+in-row Chisel, and NT-No-Till. Fertilizer was banded four inches to the side and four inches below the seed zone. The three nitrogen rates evaluated as split plots were 0, 40, and 60 lbs N/A. Phosphorus was applied to all treatments at a rate of 40 lbs P_20_5/A. The cotton cultivar G&P 3774 was used in 1988 through 1995. In 1996 and 1997, G&P 74+ was planted.

Cotton grown without fertilizer with both minimum tillage systems produced yields equal to those measured with conventional tillage and significantly higher than the NT cotton. The respective yields were as follows:MT-570, MT+Ch-558, CT-593 lbs lint/A. The NT produced significantly less with 482 lbs lint/A. With two-thirds of the soil test recommended fertilizer rate (40 lb N), all conservation tillage treatments produced yields equaling or exceeding CT yields. No-Till yields were 94% of CT yields while MT and MT+Ch produced relative yields of 104 and 100% respectively. At this N rate per acre lint yields were 641 for the MT, 616 for MT+Ch, and 575 for the NT. At the full soil test recommended fertilizer rate (60 N), yields with MT and MT+Ch exceeded CT yields by 42 and 51 lb/A, respectively. The yields for each tillage treatment are as follows: MT+CH=663, MT=654, CT=612, and NT= 591 lbs lint/A.

Linear regression of N rates on lint yields indicate significant positive relationships for all conservation tillage systems. Regression coefficients which indicate lint increases per lb applied N/A were as follows: NT=1.76, MT+Ch=1.51, and MT=1.43 with corresponding R squared values of 0.89, 0.78, and 0.96. The production function for CT tillage produced a nonsignificant linear relationship. The lack of N response indicates increased N availability through oxidation of soil organic matter with the excessive tillage associated with the CT system.

Response to conservation tillage varied with rainfall. With above average rainfall, lint yields from MT were statistically equal to yields under CT and NT. The MT system with In-Row Chisel produced significantly lower yields. Under extreme droughty conditions, lint yields ranged from 35-45 percent of those with above average rainfall for all tillage systems. Yields with NT were substantially lower compared to MT and CT.

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