

NUTRIENT MANAGEMENT IN COTTON-SORGHUM ROTATION VS. COTTON-COTTON MONOCULTURE

J.D. Booker, K.F. Bronson, and J.W. Keeling

Texas Agricultural Experiment Station

Lubbock, TX

C.L. Trostle

Texas Cooperative Extension

Lubbock, TX

Abstract

The main crop rotated with cotton on the Southern High Plains is sorghum. Surprisingly, yield data on the cotton-sorghum rotation compared to continuous cotton is sparse. The practice of crop rotation has been long recognized as a benefit to soil from the standpoint of pest, diseases and soil fertility. Although much soil fertility information has been generated in the last 40 years on monocropped sorghum and cotton, very little study has been done on the fertilizer needs of the cotton-sorghum rotation. During the 2000 cropping season, a study comparing cotton after sorghum, sorghum after cotton, and continuous cotton systems was established. Within these systems, fertilizer treatments of 3 rates of nitrogen (N) fertilizer, 2 rates of phosphorus (P) fertilizer and 2 rates of zinc (Zn) were imposed. Only data from the continuous cotton and the cotton after sorghum systems are addressed in this paper.

The objectives of this research were to:

- Validate soil test recommendations for N, P, and Zn within a cotton sorghum rotation;
- Assess rotation effects on cotton yields.

This field research study, located at the Lubbock Research & Extension Center, is a split-plot design with three replicates. Mainplots (24, 40-inch rows by 200 ft) are crop system, i.e., continuous cotton, cotton after sorghum, and sorghum after cotton. Subplots (8, 40-inch rows by 50 ft) are factorial combinations of 3 rates of N fertilizer (zero, 1X, and 2X), 2 rates of P fertilizer (zero and 1X) and 2 rates of Zn fertilizer (zero and 1X). The 1X rates for the three nutrients are equivalent to the soil test based recommendations; the 2X N rate is two times the 1X recommendation. Fertilizer rates were determined by the average soil test value in each crop system, and assumed a 1.5 bale per acre yield goal. Nitrogen, P, and Zn rates were based on Oklahoma State University recommendations. Soil samples were taken from the 0-6, 6-12, 12-24, and 24-36 inch soil depths in the spring of each year. All depths were analyzed for extractable soil nitrate. The 0-6 inch samples were analyzed for other nutrients such as P, K, Zn, Fe, and organic matter. Phosphorus (10-34-0, liquid ammonium phosphate) and Zn (10% EDTA-Zn) were applied pre-plant by knifing-in liquid fertilizers 3 inch deep, on top of the rows. The 1X N rate and half of the 2X rate was knifed-in pre-plant (32-0-0, urea ammonium nitrate) at 3 inches depth, four inches off the row. The second half of the 2X N rate was applied in the same manner at the cotton's first square growth stage.

Paymaster ® Round-up Ready 2326 cotton and "Golden Acres Genetics 1506" sorghum were planted in May of each year. During each season, one pre-plant irrigation of approximately 3.5 inches, and 4-6 alternate furrow irrigations of approximately 2 inches each were applied, depending on evapotranspiration. Cotton samples of approximately 1/1000th of an acre per plot have been manually sampled in October of each year.

This study has run for four calendar years, providing 3 years (2001, 2002, and 2003) of data comparing the cotton after sorghum and the continuous cotton systems. Results from these three years have shown:

- No difference in the average (across fertility treatments) of cotton yields after sorghum compared to continuous cotton;
- Nitrate-N levels were much lower in the soil profile after sorghum, this increases the importance of N management in cotton after sorghum;
- A linear yield response to N fertilizer in the cotton after sorghum system, a yield response to P fertilizer in the continuous cotton system, and no response to Zn fertilizer in either system.