

Nutrient management in cotton-cotton and cotton-sorghum rotations (portion of PROFIT proposal # 12-9901)

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## Introduction

The main rotation crop in cotton cropping in 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 the last 40 years on monocropped sorghum and monocropped cotton, very little study has been done on the fertilizer needs of the cotton-sorghum rotation. Starting with the year 2000 cropping season we established a limited irrigation study of cotton-sorghum vs. sorghum-cotton vs continuous cotton. Fertilizer treatments are 3 rates of N fertilizer, 2 rates of P fertilizer and 2 rates of Zn.

This project will benefit producers by providing sorely needed fertilizer recommendations for the cotton-sorghum rotation. Other expected benefits include documentation of yield gains by rotating versus monocropping and soil organic matter build up by rotating with sorghum compared to continuous cotton.

## Methodology

This research project has the following objectives:

1. Quantify N, P, and Zn response and develop fertilizer recommendations in continuous cotton and cotton-sorghum rotation.
2. Quantify yield benefit of rotation versus monocropping.
3. Quantify changes in soil properties such as organic matter with rotation versus monocropping.

This field research study, located at the Lubbock Res. & Extn. Cntr, is in a split-plot design with three replicates. Mainplots ( 8, 40-in. rows by 200 ft) are crop rotation: continuous cotton, cotton-sorghum, and sorghum-cotton. Subplots (8, 40-in. rows by 50 ft) are 3 rates of N fertilizer, 2 rates of P fertilizer and 2 rates of Zn. In the first year of the study we were able to arrange the study so that the continuous cotton plots were in an area that was in cotton last year and the rotation crops were in areas whose “previous” crop was the alternate crop in the rotation. In the spring of 2000, intensive soil samples were taken from the 0-6 and 6-24 in. soil layers for routine nutrient analysis. Table 1 describes the initial soil test results and the rates of fertilizer applied. Phosphorus (0-18-0 as  $H_3PO_4$ ) and Zn (10% EDTA-Zn) were applied pre-plant by knifing-in liquid fertilizers 3 in. deep, on top of the rows. The first rate of Nitrogen (soil-test and yield goal based) and half of second rate (based on two times the first rate) was knifed-in preplant (32-0-0, urea ammonium nitrate) at 3 in. depth , four inches off the row. The second half of the 2<sup>nd</sup> Nitrogen rate was applied in the same manner at first square in cotton and at 5 leaf stage in sorghum. Four alternate furrow irrigations of about 4 in. were applied during the season. Hand harvesting was done on two 20 ft rows of each plots.

## Results and Discussion

The 2000 growing season in Lubbock was wet early and droughty mid to late season. Due to the lack of rains in July and August one more irrigation than was originally planned for this “limited irrigation” study was done.

No response to N, P, or Zn were observed in either cotton or sorghum. This result is not surprising in the first year of a soil fertility study, especially with the “medium” testing soil (Table 1). However, rotation or “previous crop” effects were positive and statistically significant (Table 2). The yield gains from rotation were 136 lb lint/ac and 1144 lb grain/ac. Our original yield goals were surpassed in sorghum, matched in cotton after sorghum and not met in cotton after cotton, respectively.

In year 2001, the second year of the study we hope to see more fertilizer response as nutrient levels in the un-fertilized plots are drawn down. Soil sampling planned for Spring, 2001 will tell us the latest soil test levels. We also expect to continue to see positive rotation effects which constitutes conceptually simple but effective technology the producers can use this year.

Table 1. Soil test results and fertilizer rates applied to cotton-sorghum rotation study, Lubbock, TX, 2000

Crop	Yield goal	Soil Zn (ppm)	Zn fert. Rate (lb/ac)	Soil NO <sub>3</sub> -N (lb/ac)	1st N fert. Rate (lb/ac)	2 <sup>nd</sup> (2x) N fert. Rate (lb/ac)	Soil P (ppm)	P fert. Rate (lb P <sub>2</sub> O <sub>5</sub> /ac)
Cotton	1.5 ba/ac	0.2	2	39	51	102	19.8	45
Sorghum	4000 lb/ac	0.2	4	39	31	62	19.8	40

Table 2. Yields of cotton and sorghum as affected by previous crop

2000 Crop	1999 crop	2000 Crop Yields (lb/ac)	Standard dev.	Number of Plots
Cotton	Cotton	641	48	48
Cotton	Sorghum	777	96	96
Sorghum	Sorghum	5080	562	24
Sorghum	Cotton	6224	533	12