INFLUENCE OF CROP ROTATIONS, TILLAGE AND NITROGEN FERTILITY ON COTTON YIELDS

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Introduction

Use of crop rotations can be instrumental in increasing plant nutrient utilization efficiency, improve weed control and increase crop yields. Cotton grower interest in use of conservation tillage has increased in the South. Such factors as conservation of soil and available water and product output economics have influenced this change. Past research evaluating crop rotations which included legumes and utilize biological nitrogen fixation under various conservation tillage systems in the South and Southwest is limited.

The objectives of our research included the development of crop rotation/tillage systems and nitrogen (N) fertility levels for profitable production of major crops of feed grain and cotton; and to investigate the contribution of a legume in rotation to the N fertilizer requirements of cotton.

Materials and Methods

This experiment was conducted at the Texas A&M University Agricultural Research & Extension Center Farm at Corpus Christi for years (1990-1997). Grain sorghum (*Sorghum bicolor*, (L.) Moench, variety DK 37) and cotton (*Gossypium hirsutum*, variety CAB-CS) and soybean *(Glycine max*, variety NK 452) were grown on a Victoria clay soil (*Udic Pellusterts*) during the 1990-1995 seasons. Seeding rates were 85,000, 80,000 and 96,000 seed/A for grain sorghum, cotton, and soybean, respectively. Corn (*Zea mays*) was substituted for grain sorghum for the last two years (1996, 1997). The experiment was conducted in a randomized block design and replicated four times. Crop rotation systems were compared as main plots. These included cotton-corn, corn-cotton, soybean-cotton and continuous corn. Cotton was grown in alternate years with corn and soybean. Reduced or minimum tillage (total 5 tillage operations) was compared with conventional tillage (10 tillage operations) in a split-plot design. There were three different fertilizer N rates used in each cropping and tillage system. The three N levels were no fertilization, 30 and 60 lb/A (recommended soil test rate). Phosphorus was applied at 20 lb P_20_5/A. All fertilizer was preplant banded in a 4x4 inch placement. Fertilizer rates were evaluated in a split-split plot design. Glypohsate and paraquat were used between tillage operations to control fall and winter weeds in the minimum till plots.

Results and Discussion

Yields for he first year (1990) were drastically reduced due to severe drought and are not discussed. In 1991, no significant differences in lint yield among rotation systems were measured regardless of N rate and tillage system. Cotton responded to the high N rate (60 lb/A) following sorghum when grown under conventional tillage. In the soybean-cotton rotation, response was obtained to only the medium N rate (30 lb/A). Under reduced tillage, no response to N rates was measured in the soybean-cotton system while a linear relationship between lint yields and N rate was apparent in the sorghum-cotton rotation.

The scheduled sequence of crop rotations for the third year did not provide an evaluation of rotation effects on cotton. However, data showed that cotton grown under minimum tillage was as productive as cotton grown with conventional tillage. Data for the following year showed the strong contribution from soybean compared to sorghum grown in alternate years with cotton in an unfertilized system which was reflected in 75% and 92% yield increases for conventional and minimum tillage systems, respectively. As N rate was increased to 30 lb/A, 12% and 31% increases in lint yields were measured for the same tillage systems. Higher N rates in the conventional system reduced benefits from the soybean, but in the minimum till system, the legume contribution still caused a 17% boost in lint yields over sorghum.

Yield data for the third rotation cycle of soybean-cotton (sixth year, 1995) showed a 23 percent (121 lb) increase due to soybean for the conventional system and a 25 percent (138 lb) yield benefit when soybean and cotton were grown with minimum tillage. In the fourth cycle of the rotation (1997) soybean again boosted lint yields over the corn-cotton rotation by 23 percent (76 lb) in the conventional system but only 3 percent (9 lb) with minimum tillage. Due to delayed planting and a summer drought, yields in 1997 approached only 55 percent of those in 1995 and apparently resulted in some suppression in treatment response.

Summary

The soybean-cotton rotation resulted in substantial stand reduction in one half of the seasons compared to feed grain-cotton rotation. The reduced stand may have had an effect on yield response. Tillage treatment had no effect on stand establishment. The lint yield advantage from soybean in rotation with cotton compared to either grain sorghum or corn fluctuated widely with season and precipitation. The rotation effect was consistently largest at the 0 and 30 lb N/A rates with yield advantages peaking at 277 lb lint/A with no N fertilizer and 173 lb lint/A at 30 lb N/A. All yield benefits to cotton from soybean in rotation as

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compared to corn were nullified by N fertilizer rates of 60 lb/A. The rotation influence on average yields was similar for MT and CT. The longevity of the rotation did not appear to influence the actual yield benefits to cotton.

Rotation benefits from cotton to grain sorghum and corn yields were largest at low N rates. Slightly higher rotation effects were measured with the MT system.

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