CONVENTIONAL VS. ULTRA-NARROW ROW (UNR) COTTON IN DIFFERENT TILLAGE SYSTEMS

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ABSTRACT

This research was conducted in 1996 and 1997 on a Dothan sandy loam (fine, loamy siliceous, thermic Plinthic Kandiudults) located at the North Florida Research and Education Center (NFREC), Quincy, Florida. The objective was to compare 36-in. row-spaced cotton planted with a Ro-till planter vs ultra-narrow row cotton (UNR) with 7-in. row width planted with the Great Plains no-till drill (both planted in minimum and conventional tillage). Four nitrogen treatments (0, 60, 120 and 180 lb N/acre) were applied in 1996 and three N rates (0, 60, 120 lb N/acre) in 1997. Higher cotton emergence was obtained on conventional row width in strip till than UNR. Increased N rates generally increased number of bolls/plant for both row treatments with higher increase of boll number in conventional row width when compared to UNR. Significantly higher yields of cotton were obtained for UNR when compared to conventional rows with the highest lint cotton yield on UNR at 120 lb N/acre.

INTRODUCTION

Cotton production has increased rapidly in Florida, from 49,000 acres in 1991 to 98,000 acres in 1996 with the production of 73,000 bales (1 bale = 480 lb) in 1991 to 130,000 bales in 1996. According to Touchton and Reeves (1988), conservation tillage systems have a beneficial effect on cotton production in the sandy coastal plain soils of the southeastern states, but the formation of tillage pans due to soil compaction has also been recognized as a possible limitation in these soils. Torbert and Reeves (1991) showed that, in years of below-normal rainfall during the growing season, strip tillage (no-till plus in-row subsoiling) was found to maintain the highest seed cotton yield. Fertilizer-N application had no effect on cotton yields in an extremely dry growing season, suggesting that the beneficial effect of N fertilizer may be limited under such conditions.

Studies conducted near Stoneville, Mississippi, on the UNR cotton showed no effect of row spacing on seed cotton yields (Heitholt et al., 1993). The results suggest that some agronomic traits of cotton might be expected to be similar regardless of row spacing; therefore, management practices, such as recommendations for the rate and timing of defoliation chemicals, do not necessarily need modification in narrow row systems.

According to the study conducted by Torbert and Reeves (1994) increasing N application increased cotton biomass and decreased lint percentage. In a dry year, 1990, non-traffic decreased seed cotton yield from 1500 to 1360 kg/ha (1335 to 1210 lb/acre, respectively) while tillage had no significant effects on cotton yield components. Above-normal rainfall and the strip-till with non-traffic treatment gave the highest seed cotton yield of 2749 kg/ha (2445 lb/acre) and the greatest fertilizer N uptake efficiency (35%). Results indicate that the detrimental effects of traffic on N uptake efficiency may be reduced with conservation tillage systems and that higher fertilizer N application rates may not be needed for conservation tillage practices such as strip-till in Coastal Plain soils.

The objective of this research was to compare minimum and conventional tillage for cotton planted in 36-in. and 7-in. row spacings with different N rates on cotton.

MATERIALS AND METHODS

These studies were conducted on a Dothan sandy loam (fine, loamy siliceous, thermic Plinthic Kandiudults) located on the NFREC, Quincy, Florida, in 1996 and 1997. The experimental design was a randomized complete block with four replications. Plot size was 40 by 12 ft for conventionally planted cotton and 40 by 20 ft for UNR cotton in 1996 and 20 by 6 ft for all plots in 1997.

Experiment Conducted in 1996

Paymaster 1244 Roundup Ready/Bt (RR/Bt) cotton was planted in UNR following wheat in no-till with the Great Plains no-till drill at 2 seeds/ft of row (7-in. row spacing) and with a Brown Row-till implement and KMC planters at 3 to 4 seeds/ft of row (36-in. row spacing) 12 July 1996. On 9 August cotton was side-dressed with 60 and 120 lb N/acre (treatments with the rate of 180 lb N/acre got only 120 lb N/acre) using a Gandy Fertilizer spreader on UNR cotton and an FP Fertilizer spreader on 36-in. rows. An additional rate of 60 lb N/acre was applied on the treatment with 180 lb N/acre 4 September. Cotton was broadcast sprayed with Roundup at 1 pt/acre + Induce at 1 pt/25 gal H_2O 20 August. On 16 September cotton was broadcast sprayed with Dipel ES at 1 pt/acre + Lannate at 1 pt/acre to control the fall armyworms on cotton. Cotton was defoliated with Prep at 2 pt/acre + Harvade at 0.5 pt/acre + Roundup at 0.5 pt/acre + crop oil at 1 pt/acre 30

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October and with Prep 1.5 pt/acre + Harvade at 0.5 pt/acre + crop oil at 1 pt/acre 13 November.

Cotton stand and boll number were obtained by counting plants and bolls on two 10-ft-long rows in conventionally planted cotton and a 60 ft^2 area on UNR cotton. Plant population was calculated per acre. Yield was not taken due to the late planting and early frost.

Experiment Conducted in 1997

Before cotton was planted, wheat was mowed from the entire study. The conventional section of the experiment was disc-harrowed and s-tine harrowed. Fertilizer 5-10-15 at 500 lb/acre was broadcast applied on the entire study 6 June. The same day, Paymaster RR/Bt 1244 cotton was planted in the UNR section with a Great Plains no-till drill at 2 seeds/ft of 7-in.-wide rows and the 36-in.-wide row cotton was planted with a Ro-till implement and KMC planters at 3 to 4 seeds/ft of row. On 19 June 19 and 3 July, cotton was broadcast sprayed with Roundup Ultra at 1.5 and 1 pt/acre, respectively.

Karate at 4 oz/acre + Agridex at 1 qt/acre was applied 19 August and 3 September to control the insects. On 4 August, cotton was broadcast sprayed with Pix at 8 oz/acre + Agridex at 2 pt/acre. A second application of Pix at 12 oz/acre + Agridex at 2 pt/acre was made 27 August. Two N rates at 60 and 120 lb N/acre were applied on UNR cotton with a Gandy fertilizer spreader and on conventional rows with an FP fertilizer applicator 8 August.

Cotton was irrigated with 0.5 in. H_2O/acre 11 June, 28 August, 23 September and 8 October. The entire study was defoliated with Prep at 1.5 pt/acre + Dropp at 1/6 lb/acre + Harvade at 8 oz/acre + Dash at 1 pt/acre + Finish at 1.5 pt/acre 21 October. On 10 November cotton was picked from the UNR section of the experiment with a stripper harvester, and the next day the 36-in.-wide cotton rows were picked with an International 782 spindle picker. The lint cotton yield from the sections picked with a spindle picker and stripper harvester was calculated as 38% and 31% of the seed cotton yield, respectively.

Data were analyzed using SAS (1989) by analysis of variance, and means were separated using Fisher's Least Significant Difference Test at the 5% probability level.

RESULTS AND DISCUSSION

In 1996, cotton emergence (Tables 1 and 2) was significantly higher in the conventional row width in strip-till than in UNR in no-till (60.9 and 46.7, respectively). However, there was no significant difference among N rates. In 1997, emergence was not different for either row width or N rates. Plant population was higher on UNR cotton as compared to conventional row width in 1996 and 1997 (65000 and 30900, 95700 and 31200, respectively) because of the higher planting rate on the UNR than 36-in.-wide rows (Table 3 and 4).

Plant height was not significantly different for any analyzed treatment in 1996. In 1997, significantly taller plants occurred on the conventional rows as compared to UNR (3.76 and 2.53, respectively), and heights increased with higher N rates (3.00, 3.08 and 3.35 at 0, 60 and 120 lb N/acre) (Table 5).

Higher rates of N generally increased number of bolls for both row widths with higher boll number per plant in conventional row width at 0, 60 and 120 lb N/acre (1.8, 3.3 and 6.5 bolls/ plant in 1996 and 10.2, 13.9 and 14.2 bolls/plant in 1997, respectively) as compared to UNR (0.8, 1.1 and 1.6 boll/plant in 1996 and 3.9, 4.7 and 5.8 bolls/plant in 1997, respectively) (Table 6 and 7). However, the rate of 180 lb N/acre significantly decreased number of bolls when compared to 120 lb N/acre on conventional row spacing (from 6.5 to 4.4 boll/ plant) in 1996.

In 1997, lint yields were significantly higher on UNR than on conventionally planted cotton (1076 and 786 lb/acre, respectively) (Table 8) and were also higher at the application of 120 lb N/acre as compared to 0 and 60 lb N/acre (1041, 876 and 875 lb/acre, respectively) in 1997. There was no significant influence of tillage systems and previous crops on the yield.

CONCLUSIONS

Plant population was higher on UNR as compared to conventional row widths. Number of bolls per plant generally increased with higher N rates and was higher on conventional rows than on UNR. Higher yields of cotton were obtained at higher N rates and were higher on UNR as compared to conventional rows.

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Table 1. Emergence of cotton at NFREC, Quincy, Florida, in 1996.

	Nitrogen rate (lb N/acre)				
Row width	0	60	120	180	Avg.
in.	---------- % emergence ----------				
36	63.9	58.6	57.5	63.6	60.9
7	47.1	46.5	46.2	47.0	46.7
Avg.	55.5	52.5	51.9	55.3	53.8
$LSD_{(0.05)}$ for row width			6.69		
$LSD_{(0.05)}$ for nitrogen rate			NS		
$LSD_{(0.05)}$ for row width x nitrogen rate			NS		

Table 2 Emergence of cotton at NFREC, Quincy, Florida, in 1997.

	Nitrogen rate (lb N/acre)			
Row width	0	60	120	Avg
in.	---------- % emergence ----------			
36	57.1	66.7	60.3	61.4
7	67.1	74.1	64.8	68.7
Avg.	62.1	70.4	62.6	65.0
$LSD_{(0.05)}$ for row width			NS	
$LSD_{(0.05)}$ for nitrogen rate			NS	
$LSD_{(0.05)}$ for row width x nitrogen rate			NS	

Table 3. Plant population of cotton at NFREC, Quincy, Florida, in 1996.

	Nitrogen rate (lb N/acre)				
Row width	0	60	120	180	Avg.
in.	----------thousands/acre----------				
36	32.5	29.8	29.2	32.3	30.9
7	65.7	64.8	64.4	65.5	65.1
Avg.	49.1	47.3	46.8	48.9	48.0
$LSD_{(0.05)}$ for row width			7.75		
$LSD_{(0.05)}$ for nitrogen rate			NS		
$LSD_{(0.05)}$ for row width x nitrogen rate			NS		

Table 4. Plant population of cotton at NFREC, Quincy, Florida, in 1997.

	Nitrogen rate (lb N/acre)			
Row width	0	60	120	Avg
in.	----------thousands/acre----------			
36	29.0	33.9	30.7	31.2
7	93.6	103.3	90.3	95.7
Avg.	61.3	68.6	60.5	63.5
$LSD_{(0.05)}$ for row width			14.6	
$LSD_{(0.05)}$ for nitrogen rate			NS	
$LSD_{(0.05)}$ for row width x nitrogen rate			NS	

Table 5. Plant height of cotton at NFREC, Quincy, Florida, in 1997 (No significant differences in 1996).

	Nitrogen rate (lb N/acre)			
Row width	0	60	120	Avg
in.	---------- ft ----------			
36	3.53	3.77	3.97	3.76
7	2.47	2.40	2.73	2.53
Avg.	3.00	3.08	3.35	3.14
$LSD_{(0.05)}$ for row width			0.197	
$LSD_{(0.05)}$ for nitrogen rate			0.241	
$LSD_{(0.05)}$ for row width x nitrogen rate			NS	

Table 6. Number bolls on cotton at NFREC, Quincy, Florida, in 1996.

	Nitrogen rate (lb N/acre)				
Row width	0	60	120	180	Avg
in.	---------- bolls/plant----------				
36	1.8	3.3	6.5	4.4	4.0
7	0.8	1.1	1.6	1.3	1.2
Avg.	1.3	2.2	4.0	2.8	2.6
$LSD_{(0.05)}$ for row width			0.70		
$LSD_{(0.05)}$ for nitrogen rate			0.99		
$LSD_{(0.05)}$ for row width x nitrogen rate			1.40		

Table 7. Number bolls on cotton at NFREC, Quincy, Florida, in 1997.

	Nitrogen rate (lb N/acre)			
Row width	0	60	120	Avg
in.	----------bolls/plant----------			
36	10.2	13.9	14.2	12.8
7	3.9	4.7	5.8	4.8
Avg.	7.0	9.3	10.0	
$LSD_{(0.05)}$ for row width			1.02	
$LSD_{(0.05)}$ for nitrogen rate			1.25	
$LSD_{(0.05)}$ for row width x nitrogen rate			ns	

Table 8. The lint yields (lb) of UNR vs. conventionally planted cotton at NFREC, Quincy, Florida, in 1997.

	Row spacing - 7 in.			Row spacing - 36 in.			
N rate	No-till	Conv.	Avg.	Strip-till	Conv.	Avg.	Avg
lb/acre			N rate			N rate	
0	827	1176	1001	826	677	751	876
60	983	1046	1014	772	698	735	875
120	1196	1227	1212	788	953	871	1041
Avg.	1002	1150	1076	795	776	786	931

$LSD_{(0.05)}$ for row spacing	97.7	$LSD_{(0.05)}$ for tillage	ns
$LSD_{(0.05)}$ for N	119.6	$LSD_{(0.05)}$ for row spacing x tillage	ns
$LSD_{(0.05)}$ for row spacing x N	ns	$LSD_{(0.05)}$ for tillage x N	ns
$LSD_{(0.05)}$ for row spacing x tillage x N	293.3		