NITROGEN AND TILLAGE COMPARISONS OF CONVENTIONAL AND ULTRA-NARROW ROW COTTON

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Abstract. This research was conducted in 1997 and 1998 on a Dothan sandy loam (fine, loamy siliceous, thermic Plinthic Kandiudults) located at the North Florida Res. and Educ. Center (NFREC), Quincy, FL. The objective was to compare 36" row-spaced cotton planted with a strip-till planter to ultra-narrow row cotton (UNR) with 7" row width planted with a Great Plains no-till drill (both planted in minimum and conventional tillage). Three N rates (0, 60, 120 lb N acre^{-1}) were applied in 1997and four (0, 60, 120, and 180 lb a.i. N acre^{-1}) were applied in 1998. Increased N rates generally increased number of bolls plant^{-1} for both row treatments with higher increase of boll number in conventional row width as compared to UNR. Significantly higher yields of cotton were obtained for UNR as compared to conventional rows in both years with the highest yield on UNR at 120 lb N acre^{-1} in 1997 and with no N in 1998 due to hard lock.

INTRODUCTION

Cotton production increased rapidly in Florida, from about 12,000 acres in 1985 to 98,000 acres in 1996 with the production of 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 natural formation of tillage pans has been recognized as a limiting 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, MS, on 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 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, tillage had no significant effects on cotton yield components. Above-normal rainfall and strip-till with no-traffic treatment gave the highest seed cotton yield of 2445 lb acre^{-1} 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 objectives of this research were to compare minimum and conventional tillage for cotton planted in 36" and 7" 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, FL in 1997 and 1998. The experimental design was a randomized complete block design, with four replications. Plot size was 40 ft x 12 ft for conventional planted cotton and 40 ft x 20 ft for UNR cotton in both years. Paymaster 1220 Roundup Ready/BG cotton was planted in UNR following wheat with the Great Plains No-till drill at 2 seeds ft^{-1} of row (7 inch row spacing) and with a Brown Row-till implement and KMC planters at 3-4 seeds ft^{-1} of row (36 inch row spacing). Cotton was sidedressed with 60 and 120 lb N acre^{-1} (treatments with the rate of 180 lb N acre^{-1} got only 120 lb N acre^{-1}) using Gandy Fertilizer spreader on UNR cotton and FP Fertilizer spreader on 36 inch rows. An additional rate of 60 lb N acre^{-1} was applied on the treatment with 180 lb N acre^{-1} two weeks later. Cotton was broadcast sprayed with Roundup @ 1 pt acre^{-1} + Induce @ pt 25 gal^{-1} H_2O at the 4th node stage and then directed sprayed on an as need basis. Insects were scouted and pest controlled using standard pest management practices. Pix plant growth regulator was applied at 12 oz. per acre two times two weeks apart. Cotton was defoliated with Prep @ 2 pt. acre^{-1} + Harvade @ .5 pt. acre^{-1} and Roundup @.5 pt. acre^{-1}. Cotton was picked from the UNR section of the

experiment with a stripper harvester and the 36 inch wide cotton rows were picked with a International 782 spindle picker. The lint cotton yield, from the sections picked with a spindle picker, were calculated as 38% of the seed cotton yield and stripper harvested was calculated as 31% of seed cotton yield.

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 1997, plant population averaged three times more for UNR cotton as compared to conventional row widths (Table 1). Significantly taller plants occurred on the conventional rows as compared to UNR (3.76 and 2.53 ft, respectively) and heights increased with higher N rates (3.00, 3.08, and 3.35 ft. at 0, 60, and 120 lb N acre^{-1}) (Table 2). 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} (10.2, 13.9, and 14.2 boll plant^{-1}) as compared to UNR (3.9, 4.7, and 5.8 boll plant^{-1}) (Table 3). In 1997, lint yields were significantly higher on UNR than conventionally planted cotton (1076 and 786 lb acre^{-1}, respectively) (Table 4) and were also higher at the application of 120 lb N acre^{-1} as compared to 0 and 60 lb N acre^{-1} (1041, 876, and 875 lb acre^{-1}, respectively). There was no significant influence of tillage on the yield in either year. In 1998, plants were taller from 7" row spacing as compared to 36" row spacing (3.64 and 3.33 ft, respectively) (Table 5). Plants were also taller at higher N rates of 120 and 180 lb acre^{-1} (3.64 and 3.73 ft, respectively) than N rates of 60 or 0 lb acre^{-1} (3.44 and 3.12 ft, respectively). In 1998, height to node ratio was higher for the UNR cotton as compared to the conventional row width cotton (Table 6). There was a tendency for taller plants with higher N rates. Lint yields were low from both row widths due to hard lock problems. There was over twice as many bolls per plant in 36" row width as compared to UNR (Table 7). Total hard lock bolls for the study was 84% (Table 8) averaged over the entire study, resulting in low yields. However, yield of UNR cotton averaged almost three times more lint than 36" row width (Table 9). Nitrogen rate decreased yield in each case on both row widths due to late rains which activated the N late causing late growth and green bolls and more hard lock problems. UNR cotton planted either no-till or conventional shows much potential for more yield than conventional row width cotton but much work needs to be done to answer fertility, defoliation, marketing and ginning questions.

Table 1. Influence of Row Width and N Rate on Plant Population of Cotton at NFREC, Quincy, Fl in 1997.

Row Width	Nitrogen rate (lb acre^{-1})			Avg
	0	60	120	
in.	---------- thousands acre^{-1} ----------			
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

CONCLUSIONS

18. Number of bolls per plant generally increased with higher N rates and were higher on plants from conventional rows than UNR.
19. Higher yields of cotton were obtained at higher N rates in 1997 and were opposite due to drought and hard lock bolls in 1998.
20. Significantly higher yields were obtained on UNR as compared to conventional row widths in both years.

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Table 2. Influence of Row Width and N Rate on Plant Height of Cotton at NFREC, Quincy, FL in 1997.

Row width	Nitrogen rate (lb acre^{-1})			Avg.
	0	60	120	
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 3. Influence of Row Width and N Rate on Number Bolls on Cotton at NFREC, Quincy, FL in 1997.

Row width	Nitrogen rate (lb acre^{-1})			Avg.
	0	60	120	
in.	---------- bolls plant^{-1} ----------			
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	8.8

$LSD_{(0.05)}$ for row width 1.02 $LSD_{(0.05)}$ for nitrogen rate 1.25
$LSD_{(0.05)}$ for row width x nitrogen rate ns

Table 4. Influence of Row Width, Tillage, and N Rate on Lint Yields of UNR Vs. Conventionally Planted Cotton at NFREC, Quincy, FL in 1997.

N rate	Row spacing - 7 inch			Row spacing - 36 inch			Avg.
	No-till	Conv.	Avg. (N rate)	Strip-till	Conv.	Avg. (N rate)	
lb acre^{-1}	lb lint acre^{-1}			lb lint acre^{-1}			
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.

Table 5. Influence of Row Width and N Rate on Plant Height of Cotton at NFREC, Quincy, FL in 1998.

Row width	Nitrogen rate (lb acre^{-1})				
	0	60	120	180	Avg
in.	---------- ft ----------				
36	2.91	3.27	3.57	3.56	3.33
7	3.33	3.61	3.72	3.90	3.64
Avg.	3.12	3.44	3.64	3.73	3.49

$LSD_{(0.05)}$ for row width = 0.097; $LSD_{(0.05)}$ for nitrogen rate = 0.138; $LSD_{(0.05)}$ for row width x nitrogen rate = NS

Table 6. Influence of Row Width and N Rate on Height to Node Ratio (Hnr) for Cotton at NFREC, Quincy, FL in 1998.

N rate	Row width (inch)		
	7	36	Avg.
lb acre^{-1}		ratio	
0	2.34	2.22	2.28
60	2.40	2.28	2.34
120	2.56	2.33	2.45
180	2.70	2.35	2.53
Avg.	2.50	2.29	2.40

$LSD_{(0.05)}$ for row width = 0.074; $LSD_{(0.05)}$ for N rate = NS; $LSD_{(0.05)}$ for row width x N rate = NS.

Table 7. Influence of Row Width and N Rate on Boll Number per Plant at NFREC, Quincy, FL in 1998.

N rate	Row width (inch)		
	7	36	Avg.
lb acre^{-1}	---------- bolls plant^{-1} ----------		
0	7.7	17.3	12.5
60	9.1	19.6	14.4
120	8.2	18.0	13.1
180	6.7	20.0	13.4
Avg.	7.9	18.7	13.4

$LSD_{(0.05)}$ for row width = 1.60; $LSD_{(0.05)}$ for N rate = NS; $LSD_{(0.05)}$ for row width x N rate = NS.

Table 8. Influence of Row Width and N Rate on Percent Hard Lock Bolls on Cotton at NFREC, Quincy, FL in 1998.

N rate	Row width (inch)		
	7	36	Avg.
lb acre^{-1}	----------%----------		
0	77.7	85.9	81.8
60	85.9	81.3	83.6
120	82.7	86.9	84.8
180	84.7	91.1	87.9
Avg.	82.7	86.3	83.9

$LSD_{(0.05)}$ for row width = NS; $LSD_{(0.05)}$ for N rate = NS; $LSD_{(0.05)}$ for row width x N rate = NS.

Table 9. Influence of Row Width and N Rate on Lint Cotton Yield at NFREC, Quincy, FL in 1998.

N rate	Row width (inch)		
	7	36	Avg.
lb acre^{-1}	-------- lb acre^{-1} --------		
0	714	224	469
60	577	228	403
120	548	200	374
180	522	156	339
Avg.	590	202	396

$LSD_{(0.05)}$ for row width = 29.8; $LSD_{(0.05)}$ for N rate = 42.1; $LSD_{(0.05)}$ for row width x N rate = 59.6.