NITROGEN FERTILIZATION OF ULTRA-NARROW-ROW COTTON[1]

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RESEARCH PROBLEM

Recent developments in cotton (*Gossypium hirsutum* L.) production technology in the Mississippi Delta include drill planting cotton. Ultra-narrow-row (UNR) cotton is a low-input production system designed to maximize economic returns. However, research that provides information on production parameters in UNR cotton is scant. Optimal nitrogen (N) fertilization rates in UNR cotton are unknown. The objectives of these studies were to determine how UNR cotton responds to N fertilization.

BACKGROUND INFORMATION

Technology development for UNR cotton production has increased recently. It has long been known that plants grown in very narrow rows intercept and utilize sunlight more efficiently. Potential benefits of UNR cotton production include: reduced production costs, utilization of poorer soils, decreased soil erosion, and utilization o

- f the same equipment for cotton, soybeans, and cereal crops. Potential drawbacks of UNR cotton include: increased weed pressure in low-stand areas; different equipment requirements from conventionally row-spaced cotton (precision drill planter, finger stripper harvester); and lint quality may decline. Varietal differences, fertility requirements, effect of planting date, and other parameters for optimal growth and yield of UNR cotton are unknown.

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RESEARCH DESCRIPTION

A pilot study to evaluate UNR response to N fertilization was conducted in 1997. Fertilizer treatments of 100 lb urea-N/acre, 100 lb Meister-N/acre, 50 lb urea-N/acre, and 0 lb N/acre were strip-applied with a fertilizer buggy just prior to squaring.

The test was expanded in 1998 to include N-rates of 0, 25, 50, 75, 100, and 125 lb urea-N/acre. The test design was randomized complete block with 8 replications. Nitrogen fertilizer treatments were applied as the crop reached the true two-leaf stage. The test was further expanded in 1999 to include a second study site at the Northeast Research and Extension Center (NEREC) near Keiser, Arkansas, with identical treatments.

Measurements taken on the UNR cotton included cotton lint yield, plant height, plant population, boll load, and boll weight. All data were analyzed using the Statistical Analysis System (SAS). Differences among treatments were identified using least significant differences (LSD) calculated at the α=0.05 level of probability.

RESULTS

In the 1997 pilot study, UNR cotton fertilized with either 50 or 100 lb N/acre, regardless of N source, did not differ in lint yield (Table 1). Boll loads and boll weights were not significantly different for the UNR cotton that received N fertilizer. Cotton receiving no N fertilizer produced significantly lower yield, boll load, and boll weight than cotton that received N fertilizer.

The results of the first year (1998) of the expanded study correlated well with the pilot study. The N fertilization rate necessary to produce maximal yield, boll load, and boll weight was 50 lb N/acre (Table 2). Although trends of higher numerical lint yields were observed with the greater N rates, the differences were generally not significantly different from the 50-lb N/acre treatment. Plant height increased with increasing N fertilization up to 100 lb N/acre.

Results from 1999 at SEBES indicated that severe drought conditions masked the impact of N fertilization of cotton (Table 4). Nitrogen fertilization of conventionally row-spaced cotton has been shown to be ineffective under severe water deficit (McConnell et al., 1998). The N treatments were not found to significantly affect any of the measured parameters.

Results from the NEREC were similar to the first year at SEBES. Maximal yields were achieved with only 25 lb N/acre. Plant height significantly increased in treatments up to 75 lb N/acre. No significant differences among N rates were observed in either the plant populations or boll loads at the NEREC.

PRACTICAL APPLICATION

The preliminary responses of UNR cotton to N fertilization treatments indicates that the N required for maximal yield will be less than for cotton grown in convention-

ally spaced rows. Yields were not found to increase with N rates above 50 lb N/acre. Additionally, the 50-lb N/acre treatment usually maximized both the boll load and boll weight at SEBES. The parameters measured in these studies indicated that the N fertilization management of UNR cotton may be substantially different from conventionally grown cotton.

LITERATURE CITED

McConnell J.S., W.H. Baker, and R.C. Kirst, Jr. 1998. Yield and petiole nitrate concentrations of cotton treated with soil-applied and foliar-applied nitrogen. J. Cotton Sci. 2:143-152.

ACKNOWLEDGMENTS

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Table 1. Seedcotton yield, plant height, plant population, boll load, and boll weight of cotton grown in ultra-narrow rows with 0, 50, and 100 lb urea-N/acre and with 100 lb N (Meister)/acre at the Southeast Branch Experiment Station near Rohwer, AR, in 1997.

N Rate	Seedcotton yield	Plant height	Plant population	Boll load	Boll weight
(lb N/acre)	(lb/acre)	(inches)	(plants/acre)	(boll/acre)	(g/boll)
100(M)[z]	2,938	24.9	115,360	393,675	3.36
100	,3008	31.3	140,368	392,869	3.44
50	3333	29.9	108,099	416,263	3.58
0	1529	20.4	118,587	242,820	2.87
$LSD_{(0.05)}$	1099	6.1	NS[y]	119,875	0.38

[z] Meister N.

[y] NS = not significant (P=0.05).

Table 2. Lint yield, plant height, plant population, boll load, and boll weight of cotton grown in ultra-narrow rows with 0, 25, 50, 75, 100, and 125 lb urea-N/acre at the Southeast Branch Experiment Station near Rohwer, AR, from 1998 to 2000.

N Rate	Seedcotton yield	Plant height	Plant population	Boll load	Boll weight
(lb N/acre)	(lb/acre)	(inches)	(plants/acre)	(boll/acre)	(g/boll)
1998					
125	1060	27.5	153,074	349,710	3.31
100	1033	30.5	168,199	327,928	3.39
75	1034	26.3	160,334	341,844	3.30
50	899	24.4	175,460	321,273	3.12
25	745	20.4	177,275	278,921	2.93
0	468	19.9	171,225	191,796	2.84
$LSD_{(0.05)}$	153	4.2	NS	48,066	0.28
1999					
125	700	10.6	130,687	264,400	2.70
100	638	11.4	139,763	253,077	2.55
75	598	12.8	157,914	223,863	2.76
50	548	12.1	148,233	230,950	2.45
25	547	11.4	140,368	233,863	2.41
0	474	12.2	150,048	191,796	2.49
$LSD_{(0.05)}$	NS	NS	NS	NS	NS
2000					
125	648	25.5	107,091	271,055	2.67
100	527	23.7	104,671	232,333	2.46
75	482	22.8	113,326	218,417	2.41
50	384	18.9	98,621	182,115	2.34
25	335	18.8	114,784	183,239	1.98
0	310	17.6	117,982	147,628	2.22
$LSD_{(0.05)}$	110	2.9	NS	40,124	2.94

Table 3. Lint yield, plant height, plant population, and boll load of cotton grown in ultra-narrow rows with 0, 25, 50, 75, 100, and 125 lb urea-N/acre at the Northeast Research and Extension Center near Keiser, AR, in 1999.

N Rate	Lint yield	Plant height	Plant population	Boll load
(lb N/acre)	(lb/acre)	(inches)	(plants/acre)	(boll/acre)
125	989	20.7	212488	341,499
100	1004	20.4	261816	333,910
75	958	23.7	239049	314,938
50	965	20.4	292171	417,387
25	883	17.5	250432	394,621
0	608	16.7	250432	318,732
$LSD_{(0.05)}$	267	2.7	NS	NS