MARANA: 1975, Pounds Seed Cotton Harvested, Lost in the Field, Total and Picking Efficiency after Two Pickings with a Single-row Spindle Machine

Treatment	Pounds S/C per acre Picked	Lost	Total Yield	Harvesting eff., Percent
2 rows, 6" apart 24#/acre	2,243	401	2,644 a	84.62 ab
2 rows, 8" apart 24#/acre	2,307	493	2,800 a	82.17 b
2 rows, 10" apart 24#/acre	1,735	646	2,381 a	72.78 c
Single row 24#/acre	2,316	324	2,640 a	86.55 a
2 rows, 12" apart 12#/acre	1,901	739	2,640 a	71.96 c

At Safford the eight- and 10-inch spacings gave significantly higher total yields, but the higher picking efficiency of the single-row planting more than offset the gain from wider spacing. At Marana, there was no difference in yield by spacing. At both locations there were serious losses from trying to harvest the double-row cotton with a spindle machine--losses too great to ignore.

WATER AND FERTILIZER MANAGEMENT OF SHORT-SEASON, HIGH-DENSITY COTTON

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INTRODUCTION

Water management of short-season, high-density cotton was studied for three seasons (1972, 1973 and 1974). Various irrigation schedules and nitrogen fertilizer application rates were examined. Data on amounts of water applied, yield, boll and fiber properties, soil nitrate levels and cotton petiole nitrate levels were collected.

The three-year study was conducted at The University of Arizona Experimental Farm at Marana. The research was funded by a grant from the Cooperative States Research Service (CSRS).

PROCEDURE

During each of the three years two separate experiments were conducted. One dealt mainly with establishing irrigation management criteria and the other was mainly used to determine fertilizer management criteria. The irrigation experiment will be discussed here in some detail while the fertilizer experiment will only be briefly mentioned.

The 1972 and 1973 experiments were discussed in the 1974 and 1975 Cotton Report, respectively. Some data from 1974 will be presented here. This report will present a summary of the three years of the irrigation experiment.

For the 1974 season, four water treatments were investigated:

1. W1 -- moderate stress (allows 55% available soil moisture depletion before irrigation) and early termination.
2. W2 -- moderate stress and late irrigation termination.
3. W3 -- dry (allows 70% available soil moisture depletion before irrigation) and early irrigation termination.
4. W4 -- dry and late irrigation termination.

For 1974, DPL-16 cotton was studied at a population of 60,000 plants per acre. The nitrogen fertilizer rates were zero pounds of N per acre and 100 pounds of N per acre. The plots that received

fertilizer applications in 1972 received 100 pounds of N in 1974. The plots that did not get fertilizer in 1972 did not get fertilizer in 1974. The fertilizer form used was ammonium nitrate.

In 1973, the plots were split by applying and not applying nitrogen fertilizer to the two subplots. In 1974, the effect of the differential soil nitrate levels, caused by the 1973 fertilizer application, was examined.

RESULTS

On March 29, 1974, a preplant irrigation was applied. The field was planted on April 4, 1974. Two post-plant irrigations were applied to the field before the field was divided into individual irrigation plots. Following are amounts of irrigation water supplied to the four irrigation treatments after June 1, 1974: W1 - 15.7 inches, W2 - 18.2 inches, W3 - 9.0 inches, and W-4 - 14.0 inches. Table 1, below, presents mean yields for each treatment.

Table 1. Yields of 1974 Stripper-harvested Cotton (Pounds/Acre) for Four Irrigation Treatments and Four Fertility Treatments.

Irrigation Treatment	1974 Fertilizer	1973 Fertilizer
	pounds/acre	
W1 -- 3744	0 lbs. N - 2923	0 lbs. N - 3394
W2 -- 3718	100 lbs. N - 4003	100 lbs. N - 3533
W3 -- 2962		
W4 -- 3429		

Yields were significantly affected by irrigation treatments. Irrigation treatment W1 (Moderate stress, 55 percent depletion, early irrigation termination) had the highest yield, 3744 pounds per acre. Next was W2 (Moderate stress, late irrigation termination) with 3718 pounds per acre. Yield in W2 plots was not significantly different from W1 or W4 (dry, 70 percent depletion - late irrigation termination), which resulted in the third highest yield. The plots which received irrigation treatment W4 had an average yield of 3429 pounds per acre, which was significantly different from the average yield of W1 plots. The lowest yield came from plots treated with irrigation treatment W3 (dry - early termination), 2962 pounds per acre.

Irrigation treatments W1 and W4 have higher yields per unit of water applied than W2 and W3, if estimates are made of total amount of water applied to each treatment. This indicates that moderate stress irrigation with early irrigation termination (W1) can have a yield per unit of water applied similar to a dry treatment with late irrigation termination (W4).

Yield of stripper-harvested seed cotton was significantly different due to the 1974 nitrogen fertilizer treatments. Yields were 4003 pounds per acre for the 100-pound application of N versus 2923 pounds per acre for the no application of N.

There were no statistically significant interactions of water and nitrogen. However, a study of the data shows that regardless of the irrigation treatment, yields tended to increase with application of the nitrogen fertilizer.

Two factors caused a highly significant difference in plant height. The plots treated with 100 pounds of N per acre in 1974 had plants that were 34 inches tall. The plots that were not treated with nitrogen fertilizer were significantly shorter, 22 inches. Harvesting of the shorter plants became a problem. It was difficult to strip the bottom bolls off the short plants because they were very close to the ground.

The irrigation treatment was the other factor that caused significant difference in plant height. The moderate stress irrigation treatments, W1 and W2, resulted in the taller plants, 30 and 31 inches, respectively. The dry treatments, W3 and W4, caused plant heights of 25 and 27 inches, respectively. There was no significant difference between W1 and W2, and there was no significant difference between W3 and W4.

The 1973 application of nitrogen fertilizer to subplots did not influence boll and fiber properties in 1974. Table 2 shows a summary of the analyses of variance that were performed on the boll and fiber data.

Table 2. Summary of 1974 Analysis of Variance on Boll and Fiber Properties.

Property	1974 Fertilizer		Irrigation Treatment				
	0#N	100#N	W1	W2		W3	W4
Boll Size (Grams/Boll)	5.0	5.4**	5.3a	5.3a		5.0b	5.2a
Lint Percent	30.0**	38.0	38.6ab	38.2b		38.4ab	38.9a
Lint Index	6.8*	6.6	6.8a	6.7a		6.4b	6.8a
Seed Index	10.6	10.8*	10.8a	10.8a		10.4b	10.7a
Seed/Boll	28.9	31.1*	-	-	N.S.	-	-
UMH (Length)	1.14	1.16**	1.15b	1.16a		1.14b	1.14b
Strength	2.96	3.08**	-	-	N.S.	-	-
Micronaire (Fineness)	5.06**	4.82	4.93b	4.96b		4.74c	5.13a

*Significant at 0.05 level.
**Significant at 0.01 level.
N.S. - Not significant.
Values followed by different letters are significantly different at 0.05 level by Student-Newman-Keuls' test.

Boll size (grams per boll) was influenced by the 1974 fertilizer treatments and irrigation treatments in essentially the same way as yield. Boll size was significantly greater, 5.4 grams, for the 100 pounds of N per acre treatment than the zero pounds of N treatment, which averaged 5.0 grams.

Boll size was greater on the moderate stress and dry (with late irrigation termination) treatments than on the dry with early irrigation termination treatment.

Study of the data indicates that the high nitrogen treatment caused increased production of seeds. Low nitrogen appeared to increase lint production. High nitrogen also caused production of significantly longer, stronger and finer lint.

The difference in yield and boll size, due to irrigation treatments, were reflected by similar differences in lint percent, lint index, and seed index. Irrigation treatment W3 consistently had the smallest lint percent, lint index and seed index. Irrigation treatment W1 generally had the highest lint percent, lint index and seed index.

Strength was not significantly influenced by the irrigation treatments. The longest lint resulted from irrigation treatment W2. The lint length was not significantly different among the other irrigation treatments. Irrigation treatment W4 had the finest lint and W3 had the coarsest lint. There was no significant difference on lint fineness between W1 and W2.

SUMMARY AND CONCLUSION

Both in 1973 and 1974 yields were greatest on plots having high soil moisture levels. On these plots, available soil moisture depletion was not to exceed 50 and 55 percent of available soil moisture. Two irrigation treatments in 1973 required that the cotton be stressed or not stressed during various stages of growth. Stressing or not stressing was accomplished by irrigating when a certain available soil moisture depletion level was reached. The data indicate that if available soil moisture depletion before irrigation was changed, it reduced yield. Higher yields were obtained by not changing the criteria of when to irrigate during the season, even for the dry treatment. A possible reason for the yield reduction may have been that when stressed early the cotton plant was small and could not support a large number of bolls. If the plant was stressed later in the season, it probably could not support a large number of flowers or bolls; hence, a reduced yield.

Date of irrigation termination can affect yield, if irrigations are terminated too early, as in the 1974 irrigation treatment, W3. Too early irrigation termination decreased boll size and lint index, which resulted in a reduction of yield. Late irrigation termination also reduced yield for the short-season, high-density cotton production system. The result was that there were more unopened bolls on the cotton plant than if the irrigations had been terminated earlier.

It appears that available soil moisture depletion should not be allowed to increase beyond 50-55 percent before irrigation for the short-season, high-density cotton production system. Also, growers should be careful not to change criteria of when to irrigate during the season. It was observed, during the three years of experiments, that with high plant population the moisture stress changes quickly. Irrigation management decisions must be made and implemented as soon as possible.

These experiments were designed to establish a relationship between water management and fertilizer management. Some interesting points were observed. One was that cotton petiole nitrate nitrogen levels for conventionally grown cotton appear to apply also to high-density cotton. If the cotton is grown for a short-season, then the cotton petiole nitrate level should be lower toward the end of the season than for conventionally grown cotton. Application of 100 pounds of N per acre seemed to adequately meet the crop's needs for the season.