Irrigation Efficiencies, Nitrogen Applications, and Lint Yields of Upland Cotton Grown at The Maricopa Agricultural Center, 1991

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Abstract

The computer program AZSched, with weather data obtained from AzMet, was used to schedule irrigation for a yield trial of Upland Cotton (DPL 90) at the Maricopa Agricultural Center in 1991. Cotton lint yields were compared between plots from four treatments involving the combination of two irrigation efficiencies (70% and 90%) and two nitrogen fertilizer applications (broadcast and sidedress). The amount of nitrogen fertilizer applied to the broadcast plots was 145# N/A. One hundred thirty pounds N/A was applied to the sidedressed plots. A potassium bromide tracer was applied to select areas in each plot at the time of initial fertilization. Soil samples from each plot were taken to a depth of 10' for analysis of bromide and nitrate to determine the depth of water movement through the soil profile. Irrigation amounts averaged 42.8" for 70% efficiency and 36.7" for 90% efficiency. No significant difference in lint yield was noticed between the two nitrogen fertilizer applications, but significant differences existed between the two irrigation efficiencies.

Introduction

Water is a limited resource in the desert Southwest. As cities grow, more water will be necessary to met the need of the increasing population. With increasing demands put on a limited water supply, conservation from both the agricultural and urban communities will be necessary.

One method of conserving agricultural water is to increase irrigation efficiency. Enough water should be applied to a field to meet the consumptive use of the crop and leach salts out of the root zone. An irrigation efficiency of 100% would supply only enough water for the consumptive use of the crop. Lower irrigation efficiencies would provide the additional water needed for leaching salts.

The concern of leaching is contamination of ground water supplies. Fertilizer salts, such as nitrates, move down the soil profile with the flow of water. Nitrates not utilized by the crop move past the root zone and may enter the ground water supply.

This yield trial compares lint yield of DPL90 grown under two irrigation efficiencies and two nitrogen applications. Water and nitrate movement down the soil profile will be monitored at the end of the growing season.

Materials and Methods

A randomized complete block design of four treatments and three replications was used to compare lint yields of DPL90. The four treatments were:

1. 90% irrigation efficiency and broadcast application of nitrogen fertilizer.
2. 90% irrigation efficiency and sidedress application of nitrogen fertilizer.
3. 70% irrigation efficiency and broadcast application of nitrogen fertilizer.
4. 70% irrigation efficiency and sidedress application of nitrogen fertilizer.

Each plot was 390' long and eight (40") beds wide. Urea fertilizer was broadcast and incorporated into the respective plots on March 14th at the rate of 90#N/A. At this time, Potassium bromide (KBr), was applied to select areas in the broadcast plots. All plots were irrigated on April 2nd. DPL90 was planted in 40" beds in moisture at about 15 lbs/A. Nitrogen fertilizer was sidedressed to the respective plots on May 9th at the rate of 75# N/A. Also, at this time, KBr was applied to select areas in the sidedress plots. Further nitrogen applications were sidedressed to all plots on June 18th and July 16th at the rates of 35# N/S and 20# N/A, respectively.

Ten irrigations were scheduled during the growing season starting on May 15th and ending on August 26th. Irrigation amounts were based on the AZSched computer program. Water was measured and applied by the use of an in-line meter and gated pipes.

Defoliant was applied to the crop on September 25th and the crop was harvested on October 23rd. The four middle beds of each plot was harvested for yield to eliminate any border effects the outside rows have on yield. Subsamples of seed cotton was taken from each plot to calculate lint yield.

After harvest, soil samples were taken to a depth of 10' in each of the areas where KBr was applied. These samples will be analyzed to determine the depth of bromide and nitrate movement in the soil profile.

Results and Discussion

Results and data of the yield trial are presented in Tables and Figure 1. The primary source of variation in the amount of water applied to the irrigation efficiency plots was the result of the pre-irrigation variability. Enough water had to be applied in each plot (from 6" in plot 12 to 10" in plot 6), to sub the water across the furrows. Once the soil had been pre-irrigated, and after the first and second post emergent irrigations, there was little variation in the amount of water applied to the 70% and 90% efficiency plots (Fig.1). To reduce this preplant irrigation variation in the future, the volume of water will be increased to quickly wet the soil in each plot.

There were no differences in yield due to nitrogen fertilizer application as shown in Table 2. There were significant differences, however minimal they may be, in the cost of fertilizer when compared to lint yield. Irrigation efficiency significantly affected lint yield. The additional water provided to the cotton crop grown at 70% irrigation efficiency significantly increased the lint yield of DPL90 by up to 200#/A. The average lint yield of the 70% efficiency plots was 1367#/A compared to an average yield of 1169#/A lint yield of the 90% efficiency plots.

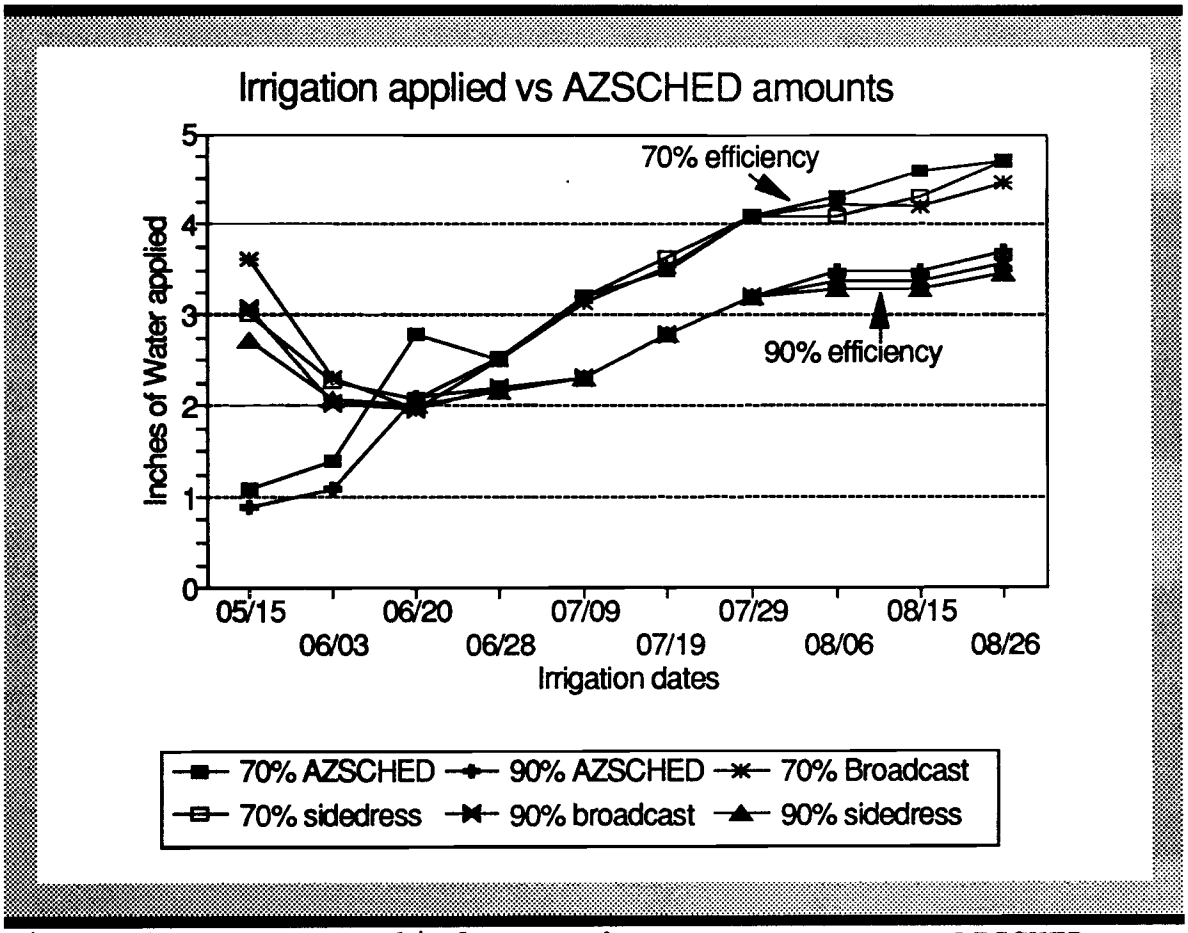

Figure 1. Water applied on each treatments vs. AZSCHED recommended amounts.

Table 1. Yield, Water and Fertilizer Data for Each Plot

Treatment	Plot	Preplant Irrigation Cost (inches)	In-Season Irrigation (inches)	Rain	Total Applied Water	AZMET Estimated Consumptive Use	Fertilizer (#N/A)	Seedcotton (#/A)	Lint (#/A)
70% Broadcast	2	8.6	33.9	.9	43.4	36.8	145	3766	1412
70% Broadcast	7	8.9	34.3	.9	44.1	36.8	145	3599	1346
70% Broadcast	11	7.6	33.9	.9	42.4	36.8	145	3515	1314
70% Sidedress	4	8.9	33.9	.9	43.7	36.8	130	3933	1482
70% Sidedress	5	8.1	33.9	.9	42.9	36.8	130	3850	1432
70% Sidedress	12	6.0	33.9	.9	40.8	36.8	130	3348	1225
90% Broadcast	1	6.7	26.9	.9	34.5	28.8	145	3013	1117
90% Broadcast	6	10.0	28.0	.9	38.9	28.8	145	3264	1227
90% Broadcast	9	7.5	28.7	.9	37.1	28.8	145	3180	1182
90% Sidedress	3	8.3	27.4	.9	36.6	28.8	130	3264	1201
90% Sidedress	8	9.1	27.7	.9	37.7	28.8	130	3013	1126
90% Sidedress	10	7.9	26.9	.9	35.7	28.8	130	3096	1164

Table 2. Sumarized Results of Yield, Water and Fertilizer Data for Each Treatment.

Efficiency/Application	Avg. Total Water (inches)	Lint Yield (#/A)	Total Irrigation Costs ($/#lint)	Fertilizer Costs ($/#lint)
70% Broadcast	43.3	1357a	.143a	.021b
70% Sidedress	42.4	1379a	.138a	.019a
90% Broadcast	36.8	1175b	.140a	.025c
90% Sidedress	36.6	1163b	.141a	.022b

*Values followed by the same letter are not significantly different at the 1% probability level using Duncans Multiple Range Test.
*Costs are based on $55/A-ft. water and $.20/# of N.