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PLANT POPULATION STUDY ON DOUBLE ROW AND CONVENTIONAL 30" COTTON IN TULARE COUNTY, CALIFORNIA

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Abstract

Studies were conducted in 2002 and 2003 to compare different plant densities in double row and single row thirty-inch bed cotton near Visalia, California. For 2002, the double row had final plant densities of 22, 36, and 50 thousand plants per acre. The single row had 47, 75, and 83 thousand plants per acre. Higher densities were attempted but there was approximately 40 percent stand loss using the Great Plains planter in 2002. In 2003, the double row had 44, 61, and 72 thousand plants per acre using a "Monosem" planter. The single row had 30, 43, 59, and 80 thousand plants per acre. Light readings showed that double row cotton intercepted more light early in the season and about 5-6 days ahead in terms of light interception. In 2002 there were not significant lint yield differences between double row cotton on 22, 36, or 50 thousand plants per acre or single row thirty inch at 47 thousand plants per acre. Single row densities of 72 or 83 thousand plants per acre significantly reduced yields. In 2003, there were not significant differences between double row 30-inch cotton with densities from 44 to 72 thousand plants per acre and single row 30-inch cotton with densities of 30 to 80 thousand plants per acre. There were no significant differences between mepiquat chloride application treatments in either year.

Introduction

In an attempt to decrease production costs of cotton and perhaps raise yields, a unique variation of ultra narrow row production was initiated in Merced County in 1998. The planting configuration used two seed lines of cotton, seven to ten inches apart, on a 30-inch bed. More than 1000 acres of double row 30 inch cotton were planted in 2001 and 2002 at various locations in the San Joaquin Valley (mostly in the northern San Joaquin Valley) using either a "Great Plains" drill type planter or a "Monosem" brand planter designed to precisely place seeds in two lines as close as 7 inches apart, or variations on the sled planter used in the earlier years of field trials. Sites have been initiated at several other locations in the San Joaquin Valley in recent years also to investigate the potential utility of the double-row planting concepts. Similar studies were being conducted by the University of Arizona with double row systems on 38-inch rows.

Using the double row management approach assumes that with the high density planting: Cotton should more effectively compete with weeds and achieve earlier row closure and shading of beds and furrows than with single-row plantings, resulting in less need for cultivation and perhaps herbicides. Higher plant densities mean that fewer bolls are required per plant to achieve the same yield, as long as average boll size is not significantly affected. It was also assumed the higher rates of mepiquat chlorate would be needed in the double row system.

Previous University of California plant density studies on single row 38 to 40 inch beds have not shown any yield advantage to increasing populations greater than 45,000 plants per acre. Generally top yields were obtained, as long plants were a minimum of one plant per foot of row on a uniform stand. Results of similar studies on 30-inch beds have been more variable but showing a similar trend.

Materials and Methods

Studies were conducted in 2002 and 2003 to compare different plant densities in double row and single row thirty-inch cotton near Visalia, California. Acala cotton variety Phytogen 72 was planted on April 12, 2002 and on April 8 in 2003. The plot size for both years was 50 feet by 1235 feet, replicated four times. The studies were harvested on October 17 and 18 in 2002 and November 17 in 2003. The studies had six plant populations. For 2002, the double row had final plant densities of 22, 36, and 50 thousand plants per acre. The single row had 47, 75, and 83 thousand plants per acre. Higher densities were attempted but there was up to 40 percent stand losses using the Great Plains planter. In 2002, the Great Plains 10 bed double row planter was used. A significant problem was how to maintain adequate moisture for both seed lines when planting two lines closer to the bed edge rather than one line down the center. In 2003, the Monosem 6 bed double row planter was provided by Monsanto. In 2003, the double row had 44, 61, and 72 thousand plants per acre. The grower capped the double row by using a

sweep down the furrow. This greatly improved the final stand compared to the previous year. The single row had 30, 43, 59, and 80 thousand plants per acre.

In 2002, the trial received two applications of mepiquat chloride at 9 nodes and 13 nodes. Treatments were split with half of the treatment receiving the standard rate as determined by plant based measurements and the other half receiving a higher rate. In 2003, the trial received one application of mepiquat chloride at 9 nodes. By adding mepiquat chloride the 20 row plots were split into 10 row plots. In 2002, the first 10 rows of the 20 row plot received 0 oz.of mepiquat chloride at 9 nodes and the last 10 rows received 3 oz at 9 nodes. Then at 13 nodes the first 10 rows received 6 oz of mepiquat chloride and the last 10 rows received 10 oz of mepiquat chloride. In 2003, the different plant population treatments were split with the first 10 rows received 3 oz of mepiquat chloride and the last 10 rows received 6 oz of mepiquat chloride.

Photo synthetically active radiation (PAR) was measured between 11 A.M. and 1 P.M. One reading above the canopy and 4 readings beneath the canopy (ground level) were taken by placing the ceptometer vertical to the crop row. Percent light interception was calculated as the difference between PAR above and below the canopy: PAR = [(Above-below)/above] X 100.

Results and Discussions

In 2002, the grower had planting difficulties with the Great Plains planter; often one row in double row plantings came up very well, and the other row spotty. Weed control was not a major problem in field due to past work. The double row treatments were much slower to cultivate. Black nightshade was treated with prythiobac sodium and annual morningglory was treated with prometryn. The grower wished he had used a glyphosate tolerant variety which would have made weed control easier.

Plant populations achieved in 2002 was not consistently as high as those in other dbl-30 plantings, such as achieved by in Merced County studies. In 2003, the plant population was more consistent with other plantings. Capping on double row was done in 2003 and not in 2002. In 2003, double row plants started out slower than the single row plants. Harvest difficulties in 2002 slowed pickers speed (shallow furrows, rows closed and harder to see, guess rows), but in 2003 there were no harvest difficulties partly because a GPS system was used in all tillage and planting operations..

Double row cotton intercepted more light early in the season (Fig. 1). Treatment differences (double vs. single row was evident till July 10. On July 15 and later there were no treatment differences). Double rows were about 5-6 days ahead in terms of light interception. Differences were more evident in 2002 than in 2003 (Fig. 2). Few weeds were observed at end of the season so we could not tell what effect light interception had on the weeds. However, the comparison tests done to date with conventional varieties and a more traditional weed management program have shown similar potential for favorable yield responses and some cost savings, so herbicide-resistant transgenic cotton may be a good choice, but does not appear to be a requirement, for this system.

The final plant mapping data showed that there were not significant differences between double row versus single row or between plant densities, (Table 1,2). In 2002 there were not significant yield differences between double row cotton on 22, 36, or 50 thousand plants per acre or single row thirty inch at 47 thousand plants per acre. Single row densities of 75 or 83 thousand plants per acre significantly reduced yields (Fig.3). There were no significant differences between mepiquat chloride treatments. In 2003, there were not significant differences between double row 30-inch cotton with densities from 44 to 72 thousand plants per acre and single row 30-inch cotton with densities of 30 to 80 thousand plants per acre. There were no significant differences between mepiquat chloride treatments (Fig.4).

Table 1. Effect of varying plant density on final plant mapping.

2002 Final Plant Mapping											
			# Veg.			% Bolls			% Ret.	95% Zone	% Ret.
Density		#FB	Nodes	Height	HNR	Pos. 1	Pos. 2	Pos. 3	BT 5	(FP 1)	95% Zone
22,000 Double Row	A	18	7	54	2.1	44	31	16	65	20	69
	B	17	7	52	2.2	50	32	9	61	19	60
35,000 Double Row	A	17	7	49	2.1	57	29	7	64	18	64
	B	16	7	47	2.1	62	28	4	69	19	59
50,000 Double Row	A	17	7	50	2.0	55	36	6	65	19	59
	B	18	7	46	1.8	51	32	10	56	19	55
47,000 Single Row	A	17	7	47	2.0	66	28	4	69	19	55
	B	16	7	44	1.9	54	30	10	75	18	71
75,000 Single Row	A	16	7	46	2.0	67	26	4	59	17	57
	B	16	7	44	2.0	61	29	5	59	19	52
83,000 Single Row	A	15	8	48	2.1	40	18	1	48	19	51
	B	17	4	47	2.3	43	21	3	66	15	57

A = Mepiquat Chloride 6 oz at 13 nodes

B = Mepiquat Chloride 3 oz at 9 nodes and 10 oz at 13 nodes

Table 2. Effect of varying plant density on final plant mapping.

2003 Final Plant Mapping											
			# Veg.			% Bolls			% Ret.	95% Zone	% Ret.
Density		#FB	Nodes	Height	HNR	Pos. 1	Pos. 2	Pos. 3	BT 5	(FP 1)	95% Zone
44,000 Double Row	A	21	6	54	1.96	54	27	15	51	24	40
	B	21	7	55	1.99	40	23	23	59	24	44
61,000 Double Row	A	20	6	55	2.10	49	30	18	29	23	29
	B	22	6	57	2.05	41	35	17	35	25	33
72,000 Double Row	A	19	6	54	2.10	62	26	8	41	23	37
	B	21	6	56	2.09	54	27	12	40	24	38
30,000 Single Row	A	21	6	57	2.07	55	29	13	37	24	39
43,000 Single Row	A	21	6	58	2.10	40	24	24	43	24	44
	B	22	6	56	1.98	42	24	21	37	24	37
59,000 Single Row	A	22	6	62	2.18	43	22	28	53	24	37
	B	21	6	61	2.27	62	23	11	56	23	41
80,000 Single Row	B	21	6	57	2.07	55	29	13	37	24	39

A = Mepiquat Chloride 3 oz at 9 nodes
B = Mepiquat Chloride 6 oz at 9 nodes

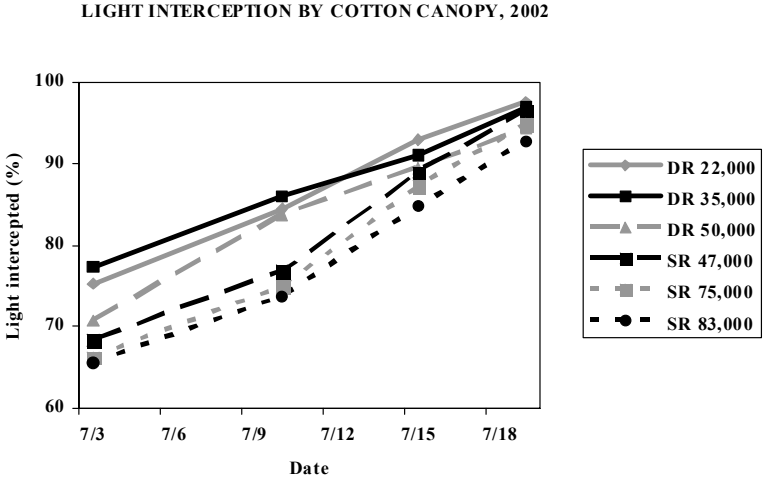

Figure 1. Effect of light intercept varying in plant densities in double (DR) and single (SR) rows.

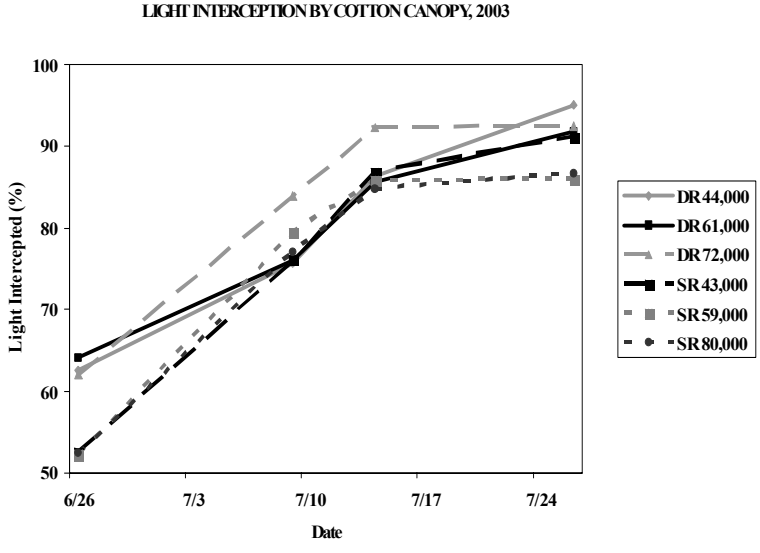

Figure 2. Effect of light intercept varying in plant densities in double (DR) and single (SR) rows

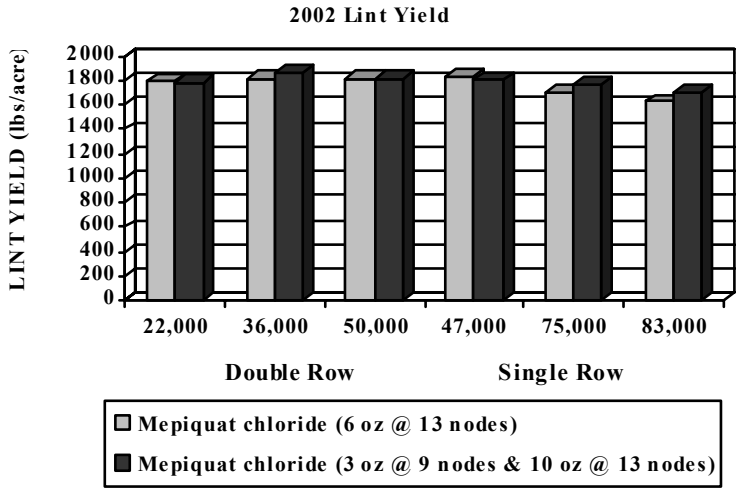

Figure 3. Effect of varying plant densities in double (DBL) and single (SGL) rows.

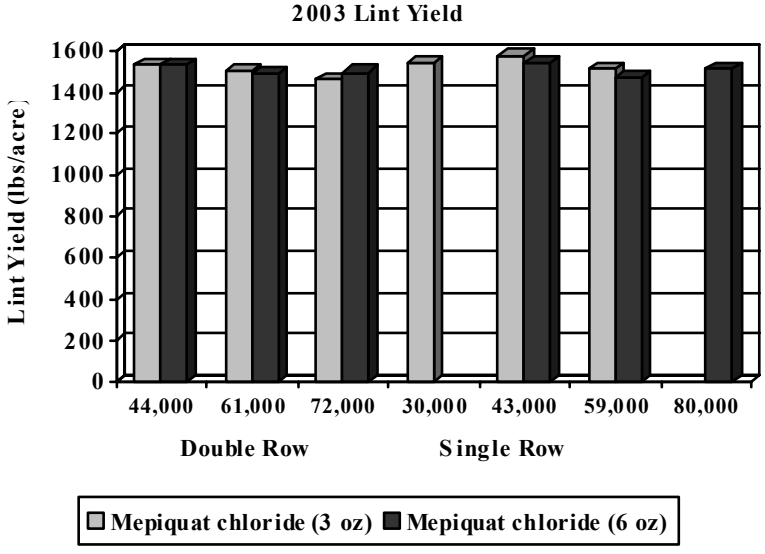

Figure 4. Effect of varying plant densities in double (DBL) and single (SGL) rows.