Cotton response to growth regulator Pix

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It controlled rank plant growth but had no significant effect on yield

Mepiquat-chloride (Pix) became available in California during the 1981 production year for control of excessive vegetative growth in cotton. California yield results have varied with environmental conditions. Nationally, results have been erratic in many cotton growing areas where conditions are more variable than in California.

We conducted 23 replicated trials for four years, 1979 through 1982, on research stations and in large-scale test plots with grower cooperators. This report compares cotton response to the growth regulator at the rate of 1 pint per acre and the untreated control under conditions considered normal for the area. We also evaluated response under various cultural inputs (fertility, irrigation, varieties, row spacings), application rates, and timing but will not present those findings here.

Yield and fiber properties

Differences in average lint yield were not significant over the four years (table 1). The growth regulator caused significant yield increases in some tests and decreases in others, resulting in a significant interaction between location (experiment) and treatment. Overall yield differences were small, because

most of the trials (17) were conducted during 1981 or 1982, when environmental conditions favored rapid early boll set with resulting controlled vegetative growth. Environmental conditions in 1979 and 1980 favored more growth and resulted in greater yield differences.

Six trials in 1982 compared rates of Pix. Average lint yields were 1,034, 1,068, and 1,025 pounds per acre for the rates of 0 (untreated control), 0.5, and 1 pint per acre, respectively. Under the ideal fruit-setting periods of 1981 and 1982, apparently the 1-pint application resulted in cutout too early in the growing season.

The growth regulator reduced gin turnout and lint percentages (table 1). The reason is that treated plants have a larger seed weight, which results in a smaller ratio of lint to lint plus seed (lint percent). Even though Pix-treated plants have less trash, the extra seed weight reduces the gin turnout (ratio of lint to lint plus seed plus trash).

Treatments did not affect fiber length, uniformity index, and elongation (capacity to stretch without breaking).

Pix improved fiber strength slightly, but the experiment-by-treatment interaction indicates this response was not consistent. Micronaire values from treated plants were consistently slightly higher, possibly because the growth regulator increased either fiber maturity or fiber coarseness. The explanation probably lies in improved maturity, because an earliness response to Pix has been consistent.

Earlier maturity

Plots were sequentially harvested over a five-week period at eight locations in 1981. Pix plots had significantly higher percentages of final yield in the first week of harvest and lower percentages in the last two harvest periods (table 2).

Plant characteristics

The growth regulator consistently reduced plant height and number of main stem nodes. Plant height was reduced 15 percent (41.4 inches in untreated, 35 inches in treated plots) as compared with only a 4 percent reduction (21.4 to 20.6) in number of nodes. Most of the height reduction was related to shortening of the internodes.

Treatment did not significantly alter the number of fruiting positions produced (averaging 898,000 per acre in Pix plots, 922,000 in controls in five 1982 trials). The 3 percent reduction of fruiting positions due to Pix as compared with the 4 percent reduction in number of nodes indicates that treatment probably did not change the number of fruiting positions initiated on a fruiting branch. In these tests, bolls matured on 32.4 percent of the fruiting positions produced in treated plots as compared with 30.3 percent in control plots.

The growth regulator affected the location of the bolls that matured. In comparison with no treatment, use of Pix increased the number of bolls in the bottom (up through node 8) of the plant (76,000 per acre in treated, 65,000 in untreated plots), tended to increase the number of bolls in the center (nodes 9-12) of the plant (142,000 vs. 129,000: not significant), but decreased the number of bolls at the upper nodes (13 and above) of the plant (70,000 per acre in treated, 91,000 in untreated plots). These results agree with boll count data showing that Pix normally increases the number of bolls present early in the year, but, given a full season, nontreated plants tend to catch up because of earlier cutout in treated plants. The earlier maturity associated with Pix was due solely to earlier cutout, because the time required from bloom to open boll was exactly the same in three trials conducted in 1982.

The growth regulator did not alter the number of bolls present at the first, second, or third position on a fruiting branch, but treated plants had more bolls on vegetative branches (53,000 per acre in Pix plots as opposed to 42,000 in controls). The size of these branches and the number of positions were not larger, just the percentage of positions that matured bolls. The reason is probably the greater light penetration into the lower canopy because of decreased leaf area of treated plants. The same tendency has been noted for reduced irrigations or reduced nitrogen fertilizer, which also controlled the size of the canopy and increased the number of bolls on vegetative branches.

Nutrient concentrations

During the early bloom period, petioles of treated and untreated plants did not differ in nitrate, phosphate, or potassium levels. By first open boll, treated plants had slightly higher nitrate levels with a small trend for the other nutrients to be higher. It is doubtful that these differences resulted from greater nutrient uptake, since treated plants were lower in total dry weight than control plants. In lower-weight plants, equal nutrient uptake would be expressed in higher tissue concentrations.

Conclusions

Pix is an effective growth regulator for controlling rank cotton plant growth. Conditions during most of these tests were not such that growth control was translated into a yield advantage. Fiber quality was either equal to or slightly better than lint from nontreated plants. Earlier maturity for treated plants was associated with more rapid early boll set followed by an earlier cutout of boll setting.

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TABLE 1. Effect of Pix on average cotton yield and fiber properties

Factor	Treatment		L.S.D. 0.05*	Location interaction	% C.V.†
	Pix	Control			
Lint yields (lb/acre)	1,213	1,201	N.S.	Yes	6.3
Gin turnout (%)	31.0	31.4	0.3	No	2.9
Lint percent	36.1	36.6	0.2	No	1.5
2.5% span length (in)	1.12	1.12	N.S.	No	1.7
50% span length (in)	0.50	0.50	N.S.	No	2.7
Uniformity index	47	47	N.S.	Yes	1.9
Strength (g/tex)	24.0	23.6	0.3	Yes	3.1
Elongation (E_1)	8.0	8.0	N.S.	No	4.6
Micronaire	4.18	4.11	0.05	No	4.1

NOTE: Average values based on 23 replicated trials conducted over a 4-year period: 2 in 1979, 4 in 1980; 9 in 1981, and 8 in 1982.
* Least significant difference at 5% levels.
† Coefficient of variability.

TABLE 2. Effect of Pix on average percentage of final yield by week of sequential harvest

Week of harvest	Treatment		L.S.D. 0.05	Location interaction	% C.V.
	Control	Pix			
1	21.1	26.5	2.3	Yes	18.9
2	19.6	20.1	N.S.	No	21.6
3	17.8	17.2	N.S.	No	16.9
4	21.0	21.0	N.S.	No	19.3
5	12.5	9.8	1.7	No	30.1
≥6	8.0	5.5	2.1	No	61.0

NOTE: Averages based on eight replicated trials conducted during 1981.