

# Modification of Flowering in Pima Cotton with Ethephon<sup>1</sup>

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## ABSTRACT

In greenhouse experiments 2-chloroethylphosphonic acid (ethephon) was applied to American Pima cotton (*Gossypium barbadense* L.) plants, cultivar 'Pima S-4,' to determine if the first-formed (lowest) floral buds could be easily removed. At altitudes above 762 m (2,500 feet) this cultivar may set fruit too low on the plant for efficient mechanical harvesting when it is grown on soils of less than average productivity. Spray applications of 0.032M Ethephon raised the node level of the first flower about four nodes. The timing of the application did not appear to be unreasonably critical.

**Additional index words:** 2-chloroethylphosphonic acid, *Gossypium* spp.

**F**RUITING branches or sympodia are commonly initiated beginning at about the sixth main stem node of the cotton plant and at successive nodes (3). Flowering occurs progressively on the successive nodes of the sympodium and on the successive sympodia. The exact node level at which the first flower occurs is determined in large part by the environment (4, 5, 6).

American Pima cotton (*Gossypium barbadense* L.), cultivar 'Pima S-4,' may set fruit too low on the plant for efficient mechanical harvesting when it is grown on soils of less than average productivity at altitudes above 762 m (2,500 feet). If the first-formed (lowest) floral buds could be easily removed, fruit set would be forced higher on the plant and mechanical picking would be facilitated.

Numerous physiological responses, including abscission of various parts, have been reported from applications of 2-chloroethylphosphonic acid (ethephon) to plant tissues (1, 2, 5, 7, 8, 9, 10). This research was initiated to determine if ethephon (Ethrel, Amchem 68-240<sup>3</sup>) could cause abscission of floral buds present at the time of application without reducing yield. Results of preliminary greenhouse experiments to test the effectiveness of ethephon and application methods are presented here.

## MATERIALS AND METHODS

Pima S-4 cotton plants were grown in aerated nutrient solutions in the greenhouse, four plants per 32- × 37- × 12-cm

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<sup>3</sup> Ethrel is the trademark name for several formulations of ethephon sold by Amchem Products, Inc., Ambler, Pa. Amchem 68-240 is the formulation used here. Mention of a trademark or proprietary product does not constitute a guarantee or warranty of the product by the U. S. Department of Agriculture, and it does not imply approval to the exclusion of other products that may also be suitable.

pan. An aqueous solution of ethephon was sprayed once on each group of plants at the indicated time. In test 1 the solution was sprayed on the indicated floral buds until dripping. In all other tests entire plants were sprayed at the rate of 61 liters/ha.

## RESULTS AND DISCUSSION

Local application of 0.016 M ethephon to the first three floral buds as soon as all three buds were visible eliminated approximately two buds with no other apparent temporary or permanent damage to the plant (Test 1, Table 1). Higher concentrations irreversibly damaged the apical growing point. Spray applications to the entire plant also caused abscission of the first-formed squares, but a higher concentration was necessary for approximately the same effect (Table 2, Test 2).

When 0.032 M ethephon was sprayed over the entire plant, the first flower, which occurred about 4 weeks later, was about four nodes higher than on untreated plants (Table 2, Test 3). This is approximately two nodes higher than was indicated by observations of square abscission 9 days after treatment (Table 2, Test 2).

The effectiveness of ethephon at different stages of growth was determined in Tests 4 and 5 (Table 3). Applications of 0.032M ethephon in test 4 at two stages of plant growth differing 9 days in age caused a difference of almost five nodes in the level of the first flower. In Test 5, groups of plants treated with 0.032M ethephon either 7, 14, or 21 days after the initial group was treated flowered approximately 3.5 nodes above the node level for untreated plants. These three treatments were not significantly different from each other or from the initial treatment, but they

Table 1. Node number of lowest surviving floral bud of Pima S-4 plants treated with ethephon. First three floral buds locally sprayed when all three were visible. Data are averages of nine plants per treatment.

Test 1	
Conc, M	Node number of lowest surviving floral bud*
0	5.0 c
0.004	5.6 c
0.008	6.7 b
0.016	6.9 b
0.032	7.1 ba (apex dead, one plant)
0.064	7.7 a (apex dead, three plants)
0.128	apex dead, all plants
0.256	apex dead, all plants

\* Means followed by a letter in common are not statistically different at the .05 level of probability (Duncan's new multiple range test).

Table 2. Node number of lowest surviving floral bud and first flower on Pima S-4 cotton plants sprayed with ethephon. Whole plants sprayed when first three floral buds were visible. Data are from two separate tests and are averages of four replications, four plants per replication.

Concentration, M	Test 2		Test 3	
	Node no.* of lowest surviving floral bud	Delay due to treatment, no. of nodes	Node no.* of first flower	Delay due to treatment, no. of nodes
0	4.8		4.2	
0.008	5.5	0.7	5.0	0.8
0.032	7.4	2.6	8.6	4.4

\* Within each test, all means are statistically different at the .05 level of probability (Duncan's new multiple range test).

**Table 3. Node numbers of first flower on Pima S-4 cotton plants sprayed with single applications of ethephon at various times in two tests. Data are averages of three replications, four plants per replication.**

Time of application	Conc., M	Node no. of first flower*	Delay due to treatment, no. of nodes
<b>Test 4</b>			
Largest floral bud 3mm wide	0	11.9 b	
	0.008	11.9 b	0
	0.032	15.6 ab	3.7
9 days after first application	0.008	15.1 ab	3.2
	0.032	20.3 a	8.4
<b>Test 5</b>			
Unfolding of leaf subtending first floral bud	0	8.5 b	
	0.008	7.3 b	0
	0.032	10.3 ab	1.8
7 days after first application	0.008	8.4 b	0
	0.032	12.2 a	3.7
14 days after first application	0.008	8.9 ab	0.1
	0.032	11.9 a	3.4
21 days after first application	0.008	7.2 b	0
	0.032	12.0 a	3.5

\* Within each test, means followed by a common letter are not statistically different at the .05 level of probability (Duncan's new multiple range test).

were different from untreated plants. The initial treatment did not differ significantly from the control.

The first flower occurred at about the 12th node of control plants in Test 4. This abnormally high node level probably resulted from lack of night-temperature control in the greenhouse at the time of the experiment (late June and July). Night temperatures were generally above 30 C after the plants were treated. Mauney (6) has reported similar delays in floral initiation when the night temperature was 30 C. Night temperatures in the greenhouse during Test 5 (Oct.-

Nov.) as well as during Tests 1 to 3 (Dec.-Apr.) were between 20 and 25 C.

These results indicate that ethephon can cause abscission of the first formed floral buds of Pima S-4 cotton. The material can be easily applied as a foliar spray. The timing of the application does not appear to be unreasonably critical. Further tests in the field will be necessary to determine if yield is affected.

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