

Defoliation Research on Pima and Upland Cotton at The Maricopa Agricultural Center in 1991

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Abstract

A field study was conducted at the Maricopa Agricultural Center to evaluate the effectiveness of selected defoliant treatments on Pima and Upland cotton under warm and cool weather conditions. In September tests, no defoliant treatment was effective in a single application. Upland cotton that was injured by frost in late October was difficult to defoliate in November tests. Pima cotton exhibited less frost injury than Upland and all defoliant treatments resulted in good defoliation in November

Introduction

Many cotton producers in central Arizona have experienced difficulty in defoliating Pima cotton. Needed is a defoliation strategy for Pima cotton that gives consistently good results. Defoliation research on Pima cotton has been conducted in Arizona for several years and some progress has been made toward the development of an effective treatment. Research has shown that Dropp defoliant used with various combinations of Def and Accelerate offers the most potential for a single application treatment (Silvertooth et al., 1991.) Tests at the Maricopa Agricultural Center indicate that Dropp used alone can be an effective defoliant for Pima in September when air temperatures are near 100°F and minimum temperatures are 67°F (Nelson and Hart, 1991).

Defoliation research on upland cotton has been conducted by the University of Arizona for many years. There is an ongoing research program to develop defoliation strategies for new varieties and to evaluate new harvest aid chemicals and spray adjuvants as they become available. Currently, there is interest in harvesting cotton earlier than in the past to reduce inputs and insect problems. This means that cotton must be defoliated when air temperatures are high and plants are still growing rapidly. Under these conditions it has generally been more difficult to defoliate cotton than later in the season when temperatures have moderated, growth has slowed and leaves are becoming senescent.

The objective of this research was to determine the effectiveness of presently available defoliants and new experimental defoliants on Pima and upland cotton under both warm and cool weather conditions.

Materials and Methods

Pima S-6 and DPL 90 cotton was planted at the Maricopa Agricultural Center in moist soil on 9 April 1991. The plantings were furrow irrigated and received a total of 68 lbs. of N/A during the season. The final irrigation was on 10 September. Two tests were established in these plantings: one in which defoliants were applied to Pima and upland cotton on 24 September, and one in which defoliants were applied on 4 November. In another test, located in a DPL 90 planting adjacent to the two tests previously described, defoliants were applied on 7 November. In all of these tests, defoliant treatments were applied with a HiBoy sprayer using 7 nozzles/row.

Descriptions of the defoliant treatments used in the various tests are shown in Tables 1-5. Plots were 4 rows wide and 30 feet long. These tests utilized randomized complete block designs with 4 replications. Plots were rated for percent defoliation by 2-3 individuals 7 and 14 days after application of chemicals.

In the tests on 24 September, maximum and minimum air temperatures were 99 and 62°F, respectively, on the day defoliants were applied. Average maximum and minimum temperatures for the 7 day period after application were 98 and 63°F, respectively. In the 14 day period after application, 302 HU were accumulated. No rainfall was recorded during this period and the minimum humidity averaged 16%. Petiole NO₃-N averaged 2,500 ppm when defoliants were applied.

In the tests on 4 November, maximum and minimum air temperature were 76 and 39°F, respectively, on the day defoliants were applied. Average maximum and minimum temperatures for the 7 day period after application were 80 and 47°F, respectively. These tests were affected somewhat by a frost that occurred on 29 October, prior to application of defoliants. Upper canopy leaves were injured but not killed and very little natural defoliation resulted. In the 14 day period after application of defoliants, 118 HU were accumulated. Rainfall totaling 0.08 inches was recorded during the 14 day evaluation period. Petiole NO₃-N levels were 1000 ppm or lower when defoliants were applied.

In the test on 7 November, maximum and minimum air temperatures on the day defoliants were applied were 84 and 47°F, respectively. Average maximum and minimum temperatures for the 7 day period after application were 79 and 52°F, respectively. In the 14 day period after application, 92 HU were accumulated. Rainfall totaling 0.08 inches was recorded during the 14 day evaluation period.

Results and Discussion

Results of the 24 September Pima and DPL 90 defoliation tests are shown in Tables 1 and 2, respectively. These tests were characterized by very warm temperatures, low minimum humidity and dense foliage at the time treatments were applied. Very little natural defoliation was occurring in these plantings in late September. No defoliant treatment tested was effective on either Pima or DPL 90 as a single application. The defoliants appeared to be more effective on Pima than DPL 90 cotton.

Results of the 4 November Pima and DPL 90 defoliation tests are shown in Tables 3 and 4, respectively. The weather was cool and humidity was generally high. Pima cotton was nearly 50% naturally defoliated when treatments were applied. All defoliant treatments resulted in over 75% defoliation of Pima in 14 days. There were no differences among chemical treatments in effectiveness of defoliation. None of the treatments tested were successful in preparing DPL 90 cotton for harvest in a single application. The frost injury that occurred on 29 October was apparently much more severe on DPL 90 than Pima cotton. Leaves exhibiting frost damage were difficult to defoliate chemically and did not fall from the plant until after a hard freeze in late November.

Results of the 7 November defoliation test with DPL 90 are shown in Table 5. As in the 4 November test, the cotton was damaged by frost. No treatment tested was effective in defoliating the cotton in a single application. The combination treatment, Dropp + Def + Accelerate, was superior to Dropp + the lowest rate of Accelerate.

References

- Nelson, J.M. and G. Hart. 1991. Defoliation research on Pima cotton at the Maricopa Agricultural Center in 1990. Cotton, A College of Agriculture Report. University of Arizona, Series P-87:33-35.
- Silvertooth, J.C., S.H. Husman, G.W. Thacker, D.R. Howell and S.S. Winans. 1991. Defoliation of Pima cotton. Cotton, A College of Agriculture Report. University of Arizona, Series P-87:18-32.

Table 1. Defoliation Test on Pima S-6 Cotton - Maricopa Agricultural Center, September 24, 1991.

Treatments ¹	Rate (lbs a.i./A)	% Defoliation	
		7 days	14 days
01 Dropp ²	0.15	30 ab ⁷	44 abc
02 Dropp + Def	0.15 + 0.75	51 a	63 ab
03 Dropp + Sylgard 309 ³	0.15	32 ab	41 abc
04 Dropp + Sylgard 309 ⁴	0.15	33 ab	39 bc
05 Dropp + Def + Sylgard 309 ³	0.15 + 0.75	48 a	59 ab
06 Dropp + Def + Sylgard 309 ⁴	0.15 + 0.75	46 a	56 ab
07 Dropp + Def + Na ₂ CO ₃ ⁵	0.15 + 0.75 + 0.1725	45 a	56 ab
08 SN597 NA 243 ⁶	0.10	57 a	67 ab
09 SN597 NA 296-1	0.10	54 a	68 ab
10 SN597 NA 297-1	0.10	56 a	70 a
11 SN597 NA 298-1	0.10	40 ab	49 ab
12 Check	--	18 b	23 c

¹Treatments were applied at a rate of 29 GPA.

²Treatments 01,02 and 07 were applied with 1 pt/A Agri-dex.

³Sylgard 309 applied at 0.5% V/V.

⁴Sylgard 309 applied at 1.0% V/V.

⁵Na₂CO₃ (Sodium Carbonate)

⁶SN597 treatments are experimental Nor-Am formulations.

⁷ Means followed by the same letter are not significantly different at the 0.05 probability level.

Table 2. Defoliation Test on DPL 90 Cotton - Maricopa Agricultural Center, September 24, 1991.

Treatments ¹	Rate (lbs a.i./A)	% Defoliation	
		7 days	14 days
01 Dropp ²	0.15	19 ab ⁷	28 ab
02 Dropp + Def	0.15 + 0.75	52 a	58 a
03 Dropp + Sylgard 309 ³	0.15	30 ab	38 ab
04 Dropp + Sylgard 309 ⁴	0.15	30 ab	33 ab
05 Dropp + Def + Sylgard 309 ³	0.15 + 0.75	45 ab	51 ab
06 Dropp + Def + Sylgard 309 ⁴	0.15 + 0.75	50 a	57 a
07 Dropp + Def + Na ₂ CO ₃ ⁵	0.15 + 0.75 + 0.1725	41 ab	49 ab
08 SN597 NA 243 ⁶	0.10	35 ab	42 ab
09 SN597 NA 296-1	0.10	45 ab	55 a
10 SN597 NA 297-1	0.10	30 ab	38 ab
11 SN597 NA 298-1	0.10	32 ab	40 ab
12 Check	--	11 b	19 b

¹Treatments were applied at a rate of 29 GPA.

²Treatments 01,02 and 07 were applied with 1 pt/A Agri-dex.

³Sylgard 309 applied at 0.5% V/V.

⁴Sylgard 309 applied at 1.0% V/V.

⁵Na₂CO₃ (Sodium Carbonate)

⁶SN597 treatments are experimental Nor-Am formulations.

⁷ Means followed by the same letter are not significantly different at the 0.05 probability level.

Table 3. Defoliation Test on Upland Cotton - Maricopa Agricultural Center, November 4, 1991.

Treatments ¹	Rate (lbs a.i./A)	% Defoliation	
		7 days	14 days
01 SN 597 NA 243 ²	0.10	65 a ⁴	77 a
02 SN 597 NA 243	0.15	66 a	81 a
03 SN 597 NA 296-1	0.10	67 a	81 a
04 SN 597 NA 296-1	0.15	68 a	82 a
05 SN 597 NA 297-1	0.10	66 a	81 a
06 SN 597 NA 297-1	0.15	67 a	84 a
07 SN 597 NA 298-1	0.10	66 a	81 a
08 SN 597 NA 298-1	0.15	69 a	82 a
09 Dropp+Def+Accelerate ³	0.15 + 0.75 + 0.033	67 a	80 a
10 Dropp+Accelerate	0.15 + 0.033	65 a	77 a
11 Dropp+Accelerate	0.15 + 0.065	68 a	77 a
12 Check	--	55 b	55 b

¹Treatments were applied at a rate of 22 GPA.

²Treatments 01-08 are experimental Nor-Am formulations.

³Treatments 09-11 were applied with 1 pt/A Agri-dex.

⁴Means followed by the same letter are not significantly different at the 0.05 probability level.

Table 4. Defoliation Test on Upland Cotton - Maricopa Agricultural Center, November 4, 1991.

Treatments ¹	Rate (lbs a.i./A)	% Defoliation	
		7 days	14 days
01 SN 597 NA 243 ²	0.10	38 ab ⁴	62 a
02 SN 597 NA 243	0.15	39 ab	58 a
03 SN 597 NA 296-1	0.10	35 ab	51 ab
04 SN 597 NA 296-1	0.15	38 ab	58 a
05 SN 597 NA 297-1	0.10	36 ab	52 ab
06 SN 597 NA 297-1	0.15	38 ab	59 a
07 SN 597 NA 298-1	0.10	35 ab	56 a
08 SN 597 NA 298-1	0.15	38 ab	54 a
09 Dropp+Def+Accelerate ³	0.15 + 0.75 + 0.033	43 a	58 a
10 Dropp+Accelerate	0.15 + 0.033	37 ab	51 ab
11 Dropp+Accelerate	0.15 + 0.065	37 ab	50 ab
12 Check	--	29 b	38 b

¹Treatments were applied at a rate of 22 GPA.

²Treatments 01-08 are experimental Nor-Am formulations.

³Treatments 09-11 were applied with 1 pt/A Agri-dex.

⁴Means followed by the same letter are not significantly different at the 0.05 probability level.

Table 5. Defoliation Test on Upland Cotton - Maricopa Agricultural Center, November 7, 1991.

Treatments ¹	Rate (lbs a.i./A)	% Defoliation	
		7 days	14 days
01 Dropp+Accelerate ²	0.15 + 0.033	41 a ⁴	46 b
02 Dropp+Accelerate	0.15 + 0.050	43 a	51 ab
03 Dropp+Accelerate	0.15 + 0.065	42 a	58 ab
04 Dropp+Def+Accelerate	0.15 + 0.75 + 0.033	45 a	69 a
05 Dropp + Def	0.15 + 0.75	43 a	57 ab
06 SN 597 NA 243 ³	0.15	43 a	63 ab

¹Treatments were applied at a rate of 22 GPA.

²Treatments 01-05 were applied with 1 pt/A Agri-dex.

³Treatment 06 is an experimental Nor-Am formulation.

⁴Means followed by the same letter are not significantly different at the 0.05 probability level.