

Defoliation Research on Pima and Upland Cotton at the Maricopa Agricultural Center in 1993

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Abstract

Field studies were conducted at the Maricopa Agricultural Center to evaluate the effectiveness of selected defoliation treatments on Pima and upland cotton under warm and cool weather conditions. Weather conditions during September tests were warm and dry while in late October tests weather was very cool. Defoliation treatments resulted in a high percentage of leaf desiccation in a test on 10 September. Ginstar and Dropp + Def treatments gave good defoliation of cotton in a 23 September test. In October tests, defoliation treatments were effective on Pima cotton but upland cotton was difficult to defoliate. Ginstar defoliant was generally as effective as the Dropp + Def treatment at the rates tested.

Introduction

Pima cotton has generally been more difficult to defoliate than upland cotton. Defoliation results with Pima have varied between fields, time of year and years. In many cases, two or more applications of defoliant have been required to properly prepare the crop for harvest. What is desired, both for Pima and upland cotton, is a treatment that would consistently defoliate cotton in a single application. Defoliation research on Pima cotton has been conducted in Arizona for several years and progress has been made toward developing an effective treatment. In some instances, under warm weather conditions in September, Dropp defoliant has been effective when used alone (Nelson and Hart, 1991). However, most research has shown that Dropp used with organo-phosphate materials offers the most potential for a single application treatment for Pima cotton (Silvertooth et al, 1992; Silvertooth et al, 1993).

Defoliation research on upland cotton has been conducted by the University of Arizona for many years. There is an ongoing research program at the Maricopa Agricultural Center directed toward developing defoliation strategies for new varieties and evaluating new harvest-aid chemicals and spray adjuvants as they become available.

Currently, there is interest in harvesting cotton earlier in the season than in the past to reduce inputs and insect problems. Cotton for early harvest must be defoliated when air temperatures are high and the plants are still actively growing. It has generally been more difficult to defoliate the crop under these conditions 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, new experimental defoliants and new adjuvants on Pima and upland cotton under both warm and cool weather conditions.

Materials and Methods

Seed of Pima S-7 and DPL5415 cotton was planted at the Maricopa Agricultural Center in moist soil on 9 April 1993. The plantings were furrow irrigated and received a total of 100 lbs. of N/A during the season. The final irrigation was on 16 August for defoliation tests conducted in September and 14 September for test conducted in October. Defoliation tests were conducted on 10 Sept., 8 Oct., 21 Oct. and 28 Oct. The test on 10 Sept. involved only DPL5415 cotton while on all other dates both DPL5415 and Pima tests were conducted. In all of these tests, defoliation treatments were applied with a HiBoy sprayer using a 7 nozzles/row spray boom. Descriptions of the defoliation treatments used in the various tests are shown in Tables 1-9. Plots were 4 rows wide by 38 ft. long. All tests utilized randomized complete block experimental designs with 3 or 4 replications. Plots were rated for percent defoliation by 2-3 individuals 7 and 14 days after application of chemicals.

In the test with DPL5415 on 10 Sept. (Table 1), maximum and minimum temperatures were 105 and 70°F, respectively, on the day defoliant was applied. Average maximum and minimum temperatures for the 7 day period after application were 97 and 68°F, respectively. In the 14 day period after application of defoliant, 309 HU (86/55°F thresholds) were accumulated and no rainfall was recorded.

In tests conducted on 23 Sept. (Tables 2 and 3), maximum and minimum temperatures were 100 and 63°F, respectively, on the day defoliant was applied. Average maximum and minimum temperatures for the 7 day period after application were 100 and 59°F, respectively. In the 14 day period after application of defoliant, 307 HU were accumulated and no rainfall was recorded.

In tests conducted on 8 Oct. (Tables 4 and 5), maximum and minimum temperatures were 91 and 63°F, respectively, on the day defoliant was applied. Average maximum and minimum temperatures for the 7 day period after application were 91 and 60°F, respectively. In the 14 day period after application of defoliant, 227 HU were accumulated and no rainfall was recorded.

In tests conducted on 21 Oct. (Tables 6 and 7), maximum and minimum temperatures were 87 and 45°F, respectively, on the day defoliant was applied. Average maximum and minimum temperatures for the 7 day period after application were 87 and 51°F, respectively. In the 14 day period after application of defoliant, 175 HU were accumulated and no rainfall was recorded.

In tests conducted on 28 Oct. (Tables 8 and 9), maximum and minimum temperatures were 82 and 51°F, respectively, on the day defoliant was applied. Average maximum and minimum temperatures for the 7 day period after application were 80 and 45°F, respectively. In the 14 day period after application of defoliant, 140 HU were accumulated and no rainfall was recorded.

Results and Discussion

Results of defoliation tests in September are shown in Tables 1-3. Defoliation treatments resulted in a high percentage of leaf desiccation in the upland test on 10 September. Apparently, the rates of the defoliant used were too high when applied under the weather conditions that prevailed in mid September. In that test, air temperatures were very high and over 300 HU were accumulated in the 14 day period after application of defoliant. In the 23 September test, the rates of Dropp and Def were reduced and desiccation was much lower. Desiccation appeared to be a problem in the Pima test at the 7 day evaluation, but a high percentage of the leaves were defoliated after 14 days (Table 2). Ginstar and Dropp + Def treatments were generally very effective in defoliating both Pima and upland cotton in a single application in September.

Results of the early October tests are shown in Tables 4 and 5. Excellent defoliation was obtained in the Pima test using either Ginstar or Dropp + Def, but none of the treatments were effective in a single application in the upland test. Several factors made the upland cotton difficult to defoliate in October. First, the 14 September termination irrigation resulted in upland cotton with a very dense, green canopy at the time of defoliation. Second, whitefly populations increased late in the season, particularly on upland cotton, and many leaves had a

coating of honeydew when defoliants were applied.

Results of the late October tests are shown in Tables 6, 7, and 8. Ginstar and Dropp + Def treatments gave good defoliation of Pima cotton when applied on 21 and 28 October. In the 21 October test, the two highest rates of Ginstar resulted in acceptable defoliation of upland cotton, but on 28 October no treatment was effective. Temperatures were very cool during the late October tests and only 140 HU were accumulated in the 14 day period after the 28 October application of defoliants. In addition, the upland cotton used in the late October tests had a very dense canopy in which very little natural leaf drop had occurred. Under cooler temperatures Ginstar was as effective as Dropp + Def.

References

- Nelson, J.M. and G. Hart. 1991. Defoliation research 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, S.W. Stedman, P.W. Brown and D.R. Howell. 1992. Defoliation of Pima Cotton, 1991. Cotton, A College of Agriculture Report. University of Arizona, Series P-91:289-301.
- Silvertooth, J.C., S.H. Husman, P.W. Brown and J. Burnett. 1993. Cotton defoliation evaluations, 1992. Cotton, A College of Agriculture Report. University of Arizona, Series P-94:44-55.

Table 1. Defoliation test using DP5415 cotton on 10 September 1993.

Treatments ¹	Rate (lbs. a.i./A)	Defoliation (%)		Desiccation
		7 days	14 days	14 days
01 Ginstar SN597 ²	0.075	58ab ⁵	67a	15bc
02 Ginstar SN597	0.10	60ab	68a	25abc
03 Ginstar SN597	0.15	46b	38b	47a
04 Dropp + Def ³	0.15 + 0.75	68a	58ab	32ab
05 Dropp + Def ⁴	0.15 + 0.75	54ab	58ab	32ab
06 Check	-----	13c	14c	0c

¹ Treatments were applied at a rate of 20 GPA.

² Ginstar SN597 is an experimental Nor-Am formulation.

³ Treatment 04 was applied with 1 pt./A Agri-Dex.

⁴ Treatment 05 was applied with 1 pt./A Dyne-Amic.

⁵ Means in columns followed by the same letter are not significantly different at the 0.05 probability level.

Table 2. Defoliation test using Pima S-7 cotton on 23 September 1993.

Treatments ¹	Rate (lbs. a.i./A)	Defoliation (%)	Desiccation (%)	Defoliation (%) ⁶
		7 days	7 days	14 days
01 Ginstar SN597 ²	0.075	22a ⁵	55ab	80a
02 Ginstar SN597	0.10	27a	55ab	84a
03 Ginstar SN597	0.15	23a	57a	86a
04 Dropp + Def ³	0.10 + 0.56	25a	52ab	87a
05 Dropp + Def ⁴	0.10 + 0.56	25a	50b	83a
06 Check	----	23a	0c	31b

¹ Treatments were applied at a rate of 20 GPA.

² Ginstar SN597 is an experimental Nor-Am formulation.

³ Treatment 04 was applied with 1 pt./A Agri-Dex.

⁴ Treatment 05 was applied with 1/2 pt./A Dyne-Amic.

⁵ Means in columns followed by the same letter are not significantly different at the 0.05 probability level.

⁶ Desiccation occurred in treatments 01-05 but was less than 10%.

Table 3. Defoliation test using DP5415 cotton on 23 September 1993.

Treatments ¹	Rate (lbs. a.i./A)	Defoliation (%)	
		7 days	14 days
01 Ginstar SN597 ²	0.075	41a ⁵	65b
02 Ginstar SN597	0.10	43a	89a
03 Ginstar SN597	0.15	43a	85a
04 Dropp + Def ³	0.10 + 0.56	46a	82a
05 Dropp + Def ⁴	0.10 + 0.56	37a	62b
07 Check	----	17b	20c

¹ Treatments were applied at a rate of 20 GPA.

² Ginstar SN597 is an experimental Nor-Am formulation.

³ Treatment 05 was applied with 1/2 pt./A Dyne-Amic.

⁵ Means in columns followed by the same letter are not significantly different at the 0.05 probability level.

Table 4. Defoliation test using Pima S-7 cotton on 8 October 1993.

Treatments ¹	Rate (lbs. a.i./A)	Defoliation (%)	
		7 days	14 days
01 Ginstar SN597 ²	0.10	53ab ⁶	82a
02 Ginstar SN597	0.15	53ab	82a
03 Ginstar SN597	0.188	48ab	78a
04 Dropp + Def ³	0.10 + 0.75	55a	80a
05 Dropp + Def ⁴	0.10 + 0.75	43bc	77ab
06 XP3-559B ^{3,5}	1.875	36c	42c
07 TD-2335 ^{3,5}	0.75	35c	39c
08 TD-2335 + Ammonium Sulfate ³	0.75 + 10.0	46ab	65b

¹ Treatments were applied at a rate of 20 GPA.

² Ginstar SN597 is an experimental Nor-Am formulation.

³ Treatments 04, 06, 07 and 08 were applied with 1 pt./A Agri-Dex.

⁴ Treatment 05 was applied with 1/2 pt./A Dyne-Amic.

⁵ XP3-559B and TD-2335 are experimental Elf Atochem North America formulations.

⁶ Means in columns followed by the same letter are not significantly different at the 0.05 probability level.

Table 5. Defoliation test using DP5415 cotton on 8 October 1993.

Treatments ¹	Rate (lbs. a.i./A)	Defoliation (%)	
		7 days	14 days
01 Ginstar SN597 ²	0.10	25abc ⁶	61a
02 Ginstar SN597	0.15	29a	68a
03 Dropp + Def ³	0.10 + 0.75	29a	60a
04 Dropp + Def ⁴	0.10 + 0.75	28ab	52ab
05 XP3-559B ^{3,5}	1.875	20cd	27b
06 TD-2335 ^{3,5}	0.75	18d	29b
07 TD-2335 + Ammonium Sulfate ³	0.75 + 10.0	22bcd	34b

¹ Treatments were applied at a rate of 20 GPA.

² Ginstar SN597 is an experimental Nor-Am formulation.

³ Treatments 04, 06, 07 and 08 were applied with 1 pt./A Agri-Dex.

⁴ Treatment 05 was applied with 1/2 pt./A Dyne-Amic.

⁵ XP3-559B and TD-2335 are experimental Elf Atochem North America formulations.

⁶ Means in columns followed by the same letter are not significantly different at the 0.05 probability level.

Table 6. Defoliation test using Pima S-7 cotton on 21 October 1993.

Treatments ¹	Rate (lbs. a.i./A)	Defoliation (%)	
		8 days	15 days
01 Ginstar SN597 ²	0.10	82ab ⁵	89ab
02 Ginstar SN597	0.15	87a	90a
03 Ginstar SN597	0.188	85a	89ab
04 Dropp + Def ³	0.10 + 0.75	76ab	85ab
05 TD-2335 + Ammonium Sulfate ^{3,4}	0.75 + 10.0	81ab	79b
06 Check	-----	40c	48c

¹ Treatments were applied at a rate of 20 GPA.

² Ginstar SN597 is an experimental Nor-Am formulation.

³ Treatments 04 and 05 were applied with 1 pt./A Agri-Dex.

⁴ TD-2335 is an experimental Elf Atochem North America formulation.

⁵ Means in columns followed by the same letter are not significantly different at the 0.05 probability level.

Table 7. Defoliation test using DP5415 cotton on 21 October 1993.

Treatments ¹	Rate (lbs. a.i./A)	Defoliation (%)	
		8 days	15 days
01 Ginstar SN597 ²	0.10	43a ⁵	60ab
02 Ginstar SN597	0.15	47a	72a
03 Ginstar SN597	0.188	46a	71a
04 Dropp + Def ³	0.10 + 0.75	46a	58ab
05 TD-2335 + Ammonium Sulfate ^{3,4}	0.75 + 10.0	43a	48b
06 Check	-----	16b	29c

¹ Treatments were applied at a rate of 20 GPA.

² Ginstar SN597 is an experimental Nor-Am formulation.

³ Treatments 04 and 05 were applied with 1 pt./A Agri-Dex.

⁴ TD-2335 is an experimental Elf Atochem North America formulation.

⁵ Means in columns followed by the same letter are not significantly different at the 0.05 probability level.

Table 8. Defoliation tests using Pima S-7 and DP5415 cotton on 28 October 1993.

Treatments ¹	Rate (lbs. a.i./A)	Defoliation (%)			
		Pima S-7		DP5415	
		8 days	15 days	8 days	15days
01 Ginstar SN597 ²	0.15	45a ⁵	73a	15a	50ab
02 Ginstar SN597	0.188	41a	74a	15a	54a
03 Dropp + Def ³	0.10 + 0.75	43a	72a	15a	43b
04 XP3-559B ^{3,4}	1.875	46a	63b	16a	30c

¹ Treatments were applied at a rate of 20 GPA.

² Ginstar SN597 is an experimental Nor-Am formulation.

³ Treatments 03 and 04 were applied with 1 pt./A Agri-Dex.

⁴ TD-2335 is an experimental Elf Atochem North America formulation.

⁵ Means in columns followed by the same letter are not significantly different at the 0.05 probability level.