Defoliation of Pima and Upland Cotton at the Safford Agricultural Center, 1995

L.J. Clark, E.W. Carpenter and P.N. Odom

Abstract

Twelve defoliation treatments were applied to Pima and upland cotton to compare the treatment effects on percent defoliation of the plants, percent first pick values, percent gin trash and any effects they might have on fiber qualities. All of the treatments were beneficial compared to the untreated check, but differences between treatments were small.

Introduction

Defoliation of cotton plants prior to harvest is a practice introduced many years ago to reduce leaf trash in the harvested cotton. At higher elevations defoliation is practiced by a smaller percentage of the growers than other parts of the state because cool temperatures at harvest time reduces the effectiveness of many of the chemicals used as defoliants and frost can effectively defoliate the plants with no cost. This study was initiated in 1991 on Pima cotton, and was expanded to include upland cotton as well. The objective of the study was to see how effective each of the defoliation treatments was under the prevailing weather conditions present this year.

Materials and Methods

The study was implemented using Pima S-6 and DP 90. Treatments were applied to plots 4 rows wide and approximately 35 feet long, in a replicated randomized complete block design. The following crop history indicates the cultural practices employed in the experiment:

Crop history

Soil type: Pima silty clay loam variant
Previous crop: Alfalfa
Planting date: 26 April, 1995 Rate: 25 lbs/ac
Herbicide: Caparol applied at lay-by
Fertilizer: 100 lbs/ac urea side dressed 9 June
Irrigation: Planted into moisture plus 7 irrigations (26 ac in + 4.6 in rain) Last date: 6 September
Defoliation date: Applied 5 October (25 gal/ac, 40 psi) Observations: 10/12, 10/19, 10/20
Cumulative heat units: At defoliation 3303, 1st obs. 3406 (Δ=103), 2nd obs. 3514 (Δ=211), 3rd obs. 3527
Harvest: 1st pick: 27 October 2nd pick: 27 November

One week and two weeks after defoliation each plot was evaluated to determine the amount of leaf drop, the green leaves remaining and the percentage of leaves desiccated and frozen on the plants. Observations on the first week were made by two independent researchers and these values were averaged in Tables 1a and 2a. Observations made for the two week evaluation were made by two different researchers, but one day apart. The plots were harvested twice to determine if the defoliation caused any boll opening. Grab samples were taken from two of the replicates to determine if the defoliants had any effect on trash content in the lint.

Results and Discussion

Weather is a large factor affecting how well defoliants work. The defoliants were applied a week later in 1995 than in 1994 (1) because of delayed crop development caused by the cool spring (see Figure 1 in reference 2). Fortunately. the late fall weather was warmer than normal (3) and the same number of heat units, 211, were received in the 14 days after treatment (DAT) as in the previous year. Unfortunately, however, the wind was much calmer in 1995 leaving many of the desiccated leaves on the plant. Tables 1a and 2a give the defoliation observations for long and short staple cotton. respectively. Defoliation observations are very difficult to make with accuracy which leads to very high coefficients of variability, this in turn weakens the statistical separation of treatments.

Looking first at the defoliation results on long staple cotton in Table 1a we see that the untreated check is distinguishable from the treated plots, but the differences between treatments is a bit complex. Figure 1 shows the percent leaf drop or defoliation from long staple cotton by treatment and by observation date. The ribbon is the 7 day observation where dramatic differences are seen. Ginstar at 8.8 oz per acre plus 1 pint of Prep was the outstanding treatment followed sodium chlorate and the other Ginstar plus Prep treatment. In addition to the leaves that had defoliated, many were desiccated but had not yet fallen from the plants as shown in Figure 2. Ginstar plus non-ionic surfactant (NIS) and the Starfire treatments were the highest in this category. By the 14/15 day observations the defoliation effects had pretty much evened out at around 40%. The low rate of Ginstar appeared to be slightly lower, but higher than the check. The 14 DAT column shows the cumulative effect of desiccation and defoliation. After these observations and before harvest, winds came and caused many of the desiccated leaves to fall. Yields, percent first pick and percent gin trash are shown in Table 1b. It is not anticipated that defoliants would affect yield and no significant differences are seen. Percent first pick could be different if the defoliants had a boll opening action as in the case of Prep. Again no differences were seen even though the check plot had a slightly lower value. As anticipated, the check plot had the highest amount of trash removed at the gin, but its value was not statistically separable from most of the other treatments. HVI analyses are found in Table 1c. A statistical analysis was not done to conserve time in the preparation of the report, even though a standard deviation is reported at the bottom of the column. A value greater than 2 standard deviation units between contrasted pairs of values would roughly correspond to a significant difference at the 95% level of confidence. Using this as the criteria, no significant differences were seen between any of the HVI values.

For the short staple trial, affects of the defoliation treatments are seen in Table 2a. Similar to the long staple trial, the untreated check plots stood out from the other treatments, but the other treatments were not separable statistically. Figures 3 and 4 graphically show the percent leaf drop and leaves frozen on the plants. A much higher percent defoliation took place the first week on short staple compared to long staple. During the second week after the treatments few leaves dropped and the activity of the defoliants mainly desiccated leaves but left them on the plants. The high rate of Ginstar had the most effect on defoliation plus desiccation and this effect was statistically greater than that of the sodium chlorate treatment and the check. Lint yield, percent first pick and percent gin trash are shown in the second half of Table 1b. No differences were seen in the yield nor percent first pick even though the yields of Ginstar plus 1 pint of Prep, Ginstar plus non-ionic surfactant and the Starfire treatments seemed a bit low. The check plot had the highest percent of trash removed at the gin but it was followed closely by the Ginstar plus Def combination. There was a correlation between percent gin trash and the percent desiccation plus defoliation ($p=0.025$, $r=-0.375$). HVI values are found in Table 2b. Using the standard deviation values as described in the previous paragraph a few statistical differences were found. Ginstar plus 1/6th pint of Prep had lower values of length and uniformity , the 8.8 oz rate of Ginstar had longer fiber length and the Dropp plus Def had a slightly lower elongation. The analysis that produced the trash grade was considered unreliable by the laboratory so not much will be said about that values except that the check seemed to have a lower value than the other treatments.

All in all, the defoliation treatments were better than the untreated check but differences between treatments, including the area standard, sodium chlorate, were small.

References

1. Clark, L.J., E.W. Carpenter and P.N. Odom. 1995. Defoliation of Pima and Upland cotton at the Safford Agricultural Center, 1994. Cotton, A College of Agriculture Report, The University of Arizona, Tucson, AZ. Series P-99, pp. 46-51.

2. Clark, L.J., E.W. Carpenter, G.L. Hart and J.M. Nelson. 1996. Short staple regional cotton variety trial, Safford Agricultural Center, 1995. Cotton, A College of Agriculture Report, The University of Arizona, Tucson, AZ. *In this publication.*

3. Brown, P.W. 1991. Normal values of heat accumulation for southern Arizona. Extension Report 190041. The University of Arizona, Tucson.

Table 1a. Defoliation observations on long staple cotton (Pima S-6) on the Safford Agricultural Center, 1995.

Treatment	7 DAT			14 DAT	15 DAT		
	% Defol	% Green	% Desic	% Desic+ Defol	% Defol	% Green	% Desic
Check	5.0 d	81.7 a	13.3 d	13.3 b	20.0 b	56.7 a	23.3 c
Ginstar 8.8 oz	31.7 a-c	51.7 b-d	16.7 cd	63.3 b	33.3 a	33.3 b	33.3abc
Ginstar 10 oz	18.3 b-d	63.3 a-c	18.3 cd	65.0 a	40.0 a	23.3 b	36.7 abc
Ginstar 12.8 oz	26.7 a-d	38.3 c-e	35 bc	76.7 a	40.0 a	23.3 b	36.7 abc
Ginstar 8.8 oz + DEF.75pt	11.7 c-d	70.0 ab	18.3 cd	65.0 a	40.0 a	33.3 b	26.7 bc
Ginstar 8.8 oz +Prep 1pt	46.7 a	36.7 c-e	16.7 cd	80.0 a	40.0 a	30.0 b	30.0 abc
Ginstar 8.8 oz + NIS	18.3 b-d	18.3 e	63.3 a	76.7 a	43.3 a	13.3 b	43.3 a
Ginstar 8.8 oz + COC	20.0 b-d	63.3 a-c	16.7 cd	63.3 a	43.3 a	31.7 b	25.0 bc
Ginstar 8.8 oz + Prep .16pt	36.7 ab	36.7 c-e	26.7 cd	65.0 a	43.3 a	23.3 b	33.3 abc
Defol 3.2 oz + DEF 0.75pt	33.3 a-c	36.7 c-e	30.0 cd	66.7 a	43.3 a	23.3 b	33.3 abc
Starfire 1 pt/ac	26.7 a-d	28.3 de	45.0 b	50.0 a	40.0 a	20.0 b	40.0 ab
Sodium Chlorate (3g)	42.7 ab	33.3 c-e	25.0 cd	50.0 a	40.0 a	33.3 b	26.7 bc
Average	26.39	46.5	27.1	61.3	38.9	28.8	32.4
LSD(05)	15.1	18.8	12.4	19.7	11.8	14.3	9.3
CV(%)	33.8	23.9	26.7	19	17.9	29.3	17

Table 2a. Defoliation observations on short staple cotton (DP 90) on the Safford Agricultural Center, 1995.

Treatment	7 DAT			14 DAT	15 DAT		
	% Defol	% Green	% Desic	% Defol + Desic	% Defol	% Green	% Desic
Check	6.7 b	85.0 a	8.3 a	16.7 c	10.0 b	70.0 a	20.0 a
Ginstar 8.8 oz	41.7 a	45.0 b	13.3 a	78.3 ab	43.3 a	28.3 b	28.3 a
Ginstar 10 oz	63.3 a	20.0 b	16.7 a	81.7 ab	43.3 a	16.7 b	40.0 a
Ginstar 12.8 oz	51.7 a	31.7 b	16.7 a	91.7 a	50.0 a	13.3 b	36.7 a
Ginstar 8.8 oz + DEF .75pt	36.7 a	53.3 b	10.0 a	75.0 ab	46.7 a	23.3 b	30.0 a
Ginstar 8.8 oz + Prep 1 qt	53.3 a	31.7 b	15.0 a	80.0 ab	50.0 a	20.0 b	30.0 a
Ginstar 8.8 oz + NIS	51.7 a	21.7 b	26.7 a	78.3 ab	43.3 a	18.3 b	38.3 a
Ginstar 8.8 oz + COC	43.3 a	46.7 b	10.0 a	63.3 ab	36.7 a	43.3 b	20.0 a
Ginstar 8.8 oz + Prep .16pt	56.7 a	26.7 b	16.7 a	80.0 ab	60.0 a	10.0 b	30.0 a
Defol 3.2 oz + DEF 0.75pt	45.0 a	40.0 b	15.0 a	71.7 ab	50.0 a	18.3 b	31.7 a
Starfire 1 pt/ac	43.3 a	31.7 b	25.0 a	68.3 ab	40.0 a	18.0 b	42.0 a
Sodium Chlorate (3g)	43.3 a	40.0 b	16.7 a	56.7 b	36.7 a	33.3 b	30.0 a
Average	44.7	39.4	15.8	70.1	42.5	26.1	31.4
LSD(05)	15.7	21.9	12	18.8	19.9	22.1	20.1
CV(%)	20.7	32.8	44.9	15.8	27.7	50.1	37.8

Table 1b. Yield and percent lint turnout for a defoliation study on long and short staple cotton on the Safford Agricultural Center, 1994.

Treatment	Long Staple			Short Staple		
	Lint Yield	Percent 1st Pk	% Gin Trash	Lint Yield	Percent 1st Pk	% Gin Trash
Check	514.6 a	59.1 a	11.3 a	1061.7 a	85.7 a	10.3 a
Ginstar 8.8 oz	514.7 a	65.6 a	7.0 b	1039.1 a	86.8 a	6.5 abc
Ginstar 10 oz	562.9 a	62.9 a	9.8 a	1060.8 a	88.0 a	7.2 abc
Ginstar 12.8oz	571.9 a	72.4 a	10.0 a	1204.1 a	93.2 a	6.3 abc
Ginstar 8.8 oz +DEF.75pt	652.3 a	60.9 a	9.3 a	1134.9 a	91.0 a	10.25 a
Ginstar 8.8 oz + Prep 1pt	555.5 a	67.0 a	9.3 a	907.0 a	87.5 a	3.9 c
Ginstar 8.8 oz + NIS	477.2 a	76.7 a	10.7 a	934.2 a	89.8 a	5.6 bc
Ginstar 8.8 oz + COC	469.0 a	60.1 a	9.2 a	1116.2 a	85.6 a	6.8 abc
Ginstar 8.8 oz + Prep.16pt	493.0 a	67.1 a	10.3 a	1035.0 a	88.6 a	9.3 ab
Defol 3.2 oz + DEF .75pt	559.9 a	63.7 a	10.5 a	1092.0 a	87.6 a	5.4 bc
Starfire 1 pt/ac	484.3 a	70.1 a	10.1 a	893.3 a	86.2 a	9.4 ab
Sodium Chlorate (3g)	558.7 a	68.8 a	9.5 a	1092.4 a	86.8 a	7.7 abc
Average	534.5	66.2	9.7	1047.6	88.1	7.37
LSD(05)	230.1	12.2	2.1	294.5	9.1	2.45
CV(%)	25.4	10.9	12.8	16.6	6.1	19.6

Table 1c. HVI values for a defoliation study on long staple cotton on the Safford Agricultural Center, 1995.

Treatment	Length	Uniformity	Strength	Elongation	Micronaire	Grade
Check	1.33	85.4	37.5	11.0	3.9	3
Ginstar 8.8 oz	1.32	86.2	35.3	10.5	3.7	2.5
Ginstar 10 oz	1.32	86.8	35.9	11.0	3.9	3
Ginstar 12.8oz	1.33	86.0	37.2	10.5	3.9	3
Ginstar 8.8 oz +DEF.75pt	1.32	85.2	37.7	11.0	3.8	3
Ginstar 8.8 oz + Prep 1pt	1.33	85.3	38.7	10.5	3.7	2.5
Ginstar 8.8 oz + NIS	1.32	85.0	35.0	10.5	3.5	3
Ginstar 8.8 oz + COC	1.33	85.6	35.8	10.0	3.7	3
Ginstar 8.8 oz + Prep.16pt	1.34	85.7	38.5	11.0	3.6	3
Defol 3.2 oz + DEF .75pt	1.33	86.0	38.4	11.0	3.8	3
Starfire 1 pt/ac	1.34	86.3	37.1	10.5	3.7	3
Sodium Chlorate (3g)	1.33	85.4	35.5	10.5	3.8	3
Average	1.33	85.7	36.93	10.77	3.75	2.9
Std Dev	0.01	0.538	1.33	0.335	0.12	0.19

Table 2b. HVI values for a defoliation study on short staple cotton on the Safford Agricultural Center, 1995.

Treatment	Length (inches)	Uniformity	Strength g/tex	Elongation	Micronaire	Color Grade	Trash Grade
Check	1.12	81.6	31.1	9.9	4.4	21/31	3
Ginstar 8.8 oz	1.13	82.8	30.4	9.9	4.2	31	1
Ginstar 10 oz	1.10	82.0	32.2	10.0	4.4	31	2
Ginstar 12.8oz	1.10	81.7	30.1	10.0	4.7	21/31	1
Ginstar 8.8 oz +DEF.75pt	1.10	81.8	31.4	9.9	4.5	21/31	2
Ginstar 8.8 oz + Prep 1pt	1.10	82.6	29.9	9.9	4.4	31	1
Ginstar 8.8 oz + NIS	1.10	81.0	29.9	9.9	4.4	21/31	2
Ginstar 8.8 oz + COC	1.13	81.8	29.9	9.9	4.3	31	1
Ginstar 8.8 oz + Prep.16pt	1.07	79.9	29.0	9.9	4.4	31	2
Defol 3.2 oz + DEF .75pt	1.09	82.1	31.4	9.8	4.7	31	1
Starfire 1 pt/ac	1.10	80.4	28.8	9.9	4.0	21	1
Sodium Chlorate (3g)	1.08	81.7	31.2	9.9	4.7	31	2
Average	1.10	81.6	30.4	9.9	4.4	--	1.6
Std Dev	0.02	0.8	1.03	0.05	0.21	--	0.67

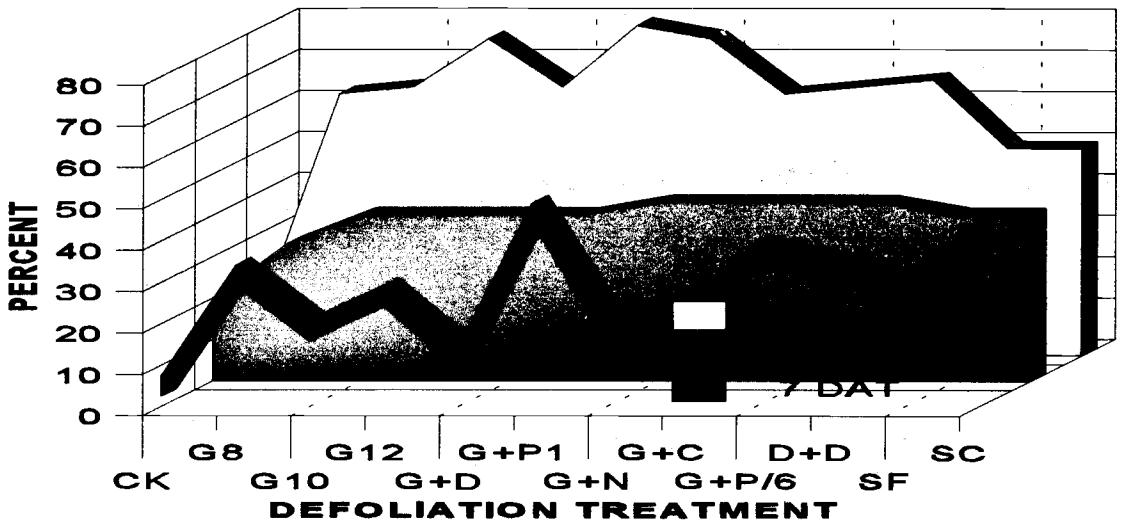

Figure 1. Percent leaf drop on long staple cotton, Safford Agricultural Center, 1995.

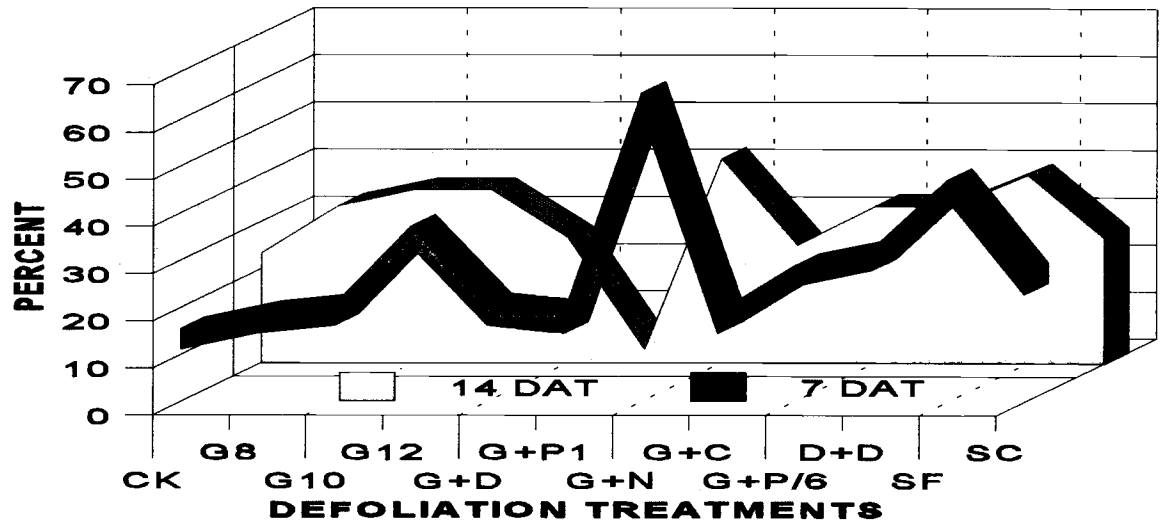

Figure 2. Percent of leaves frozen on long staple cotton, Safford Agricultural Center, 1995.

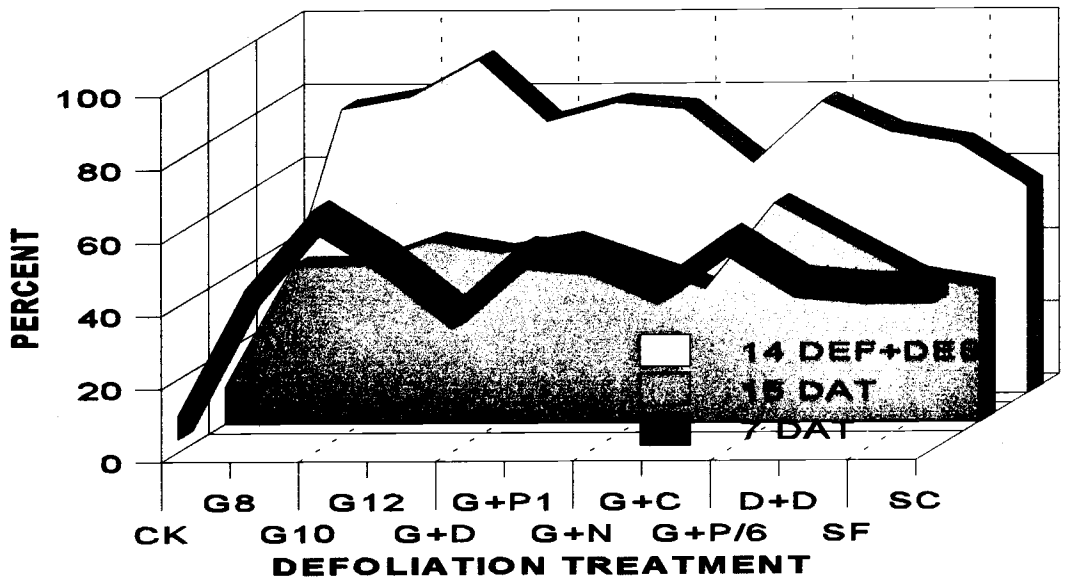

Figure 3. Percent leaf drop from short staple cotton, Safford Agricultural Center, 1995.

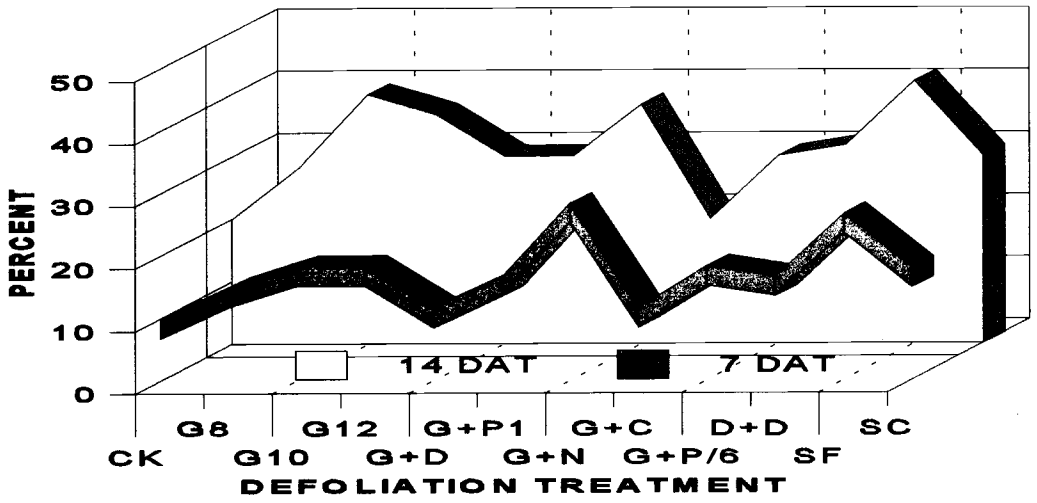

Figure 4. Percent of leaves frozen on short staple cotton, Safford Agricultural Center, 1995.