# Defoliation of Pima and Upland Cotton at the Safford Agricultural Center, 1996

*L.J. Clark and E.W. Carpenter*

## *Abstract*

*Nine 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 50 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 clay loam variant
Previous crop: Cotton
Planting date: 26 April, 1996 Rate: 25 lbs/ac
Herbicide: 1.5 pts/ac Triflurilin applied pre-plant, Cotton Pro applied at lay-by
Fertilizer: 200 lbs/ac $NH_4SO_4$ sidedressed 30 May, 100 lbs/ac Urea sidedressed 16 July
Irrigation: Watered up plus 7 irrigations (30 ac in + 3.5 in rain) Last date: 30 August
Defoliation date: Applied 4 October (14 gal/ac, 40 psi) Observations: 10/10, 10/21
Cumulative heat units: At defoliation 3479, 1st obs. 3587 ($\Delta$=108), 2nd obs. 3737 ($\Delta$=150)
Harvest: 1st pick: 6 November 2nd pick: 26 November

| Number | Treatment Abbreviation | Treatment |
|---|---|---|
| 1 | GS | Ginstar 180 EC 8.8 oz/ac |
| 2 | GS + NIS | Ginstar 180 EC 8.8 oz/ac + Bond 2pt/100 gal |
| 3 | GS + D-RET | Ginstar 180 EC 8.8 oz/ac + Chemtrol 3 qt/100 gal |
| 4 | GS + PRP | Ginstar 180 EC 8.8 oz/ac + Prep 1 pt/ac |
| 5 | SF | Starfire (21 oz/ac) |
| 6 | CHL + SF | Sodium Chlorate (2 gal/ac) + Starfire (11 oz) |
| 7 | DRP + DEF | Dropp 3.2 oz/ac + DEF 0.75 pt/ac |
| 8 | CHL | Sodium Chlorate (3 gal/ac) |
| 9 | CK | Untreated Check |

Applied at a rate of 14 gallons of water per acre through Teejet flat fan nozzles on 20 inch spacings over 4 rows. Approximately 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 were made by two independent researchers and these values were averaged in Tables 1 and 2. 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 weather conditions were ideal and warmer than normal from the time the defoliants were applied until the second observation was made. A graph of the heat units are found in reference 1. The evening after the last observation the weather changed, frost finished the defoliations and few differences were observed between plots at harvest.

Tables 1 and 2 show the effects of the various treatments at 6 and 17 days after the defoliants were applied. To aid in the evaluation, these numbers were plotted and are found in Figure 1. Leaf drop is, of course, the desired result from defoliation. Leaves that are left green can stain the lint and leaves that are desiccated and frozen on the plant can be crushed in with the lint and increase the trash content and lower the grade. The physical observations of these factors is very subjective and difficult to make. This increases the coefficient of variability (CV) and makes the statistical differentiation between treatments difficult. Starting with the graph on the lower left side, a gentle increase in leaf drop was seen from treatments 1 through 4. The non-ionic surfactant, drift retardant and Prep all made an apparent improvement in the action of the Ginstar at 6 days after treatment. The Chlorate and Starfire appeared to be slightly more effective than any of the Ginstar treatments at the 6 day observation. After 17 days, the Ginstar + Prep had a slight edge over the other treatments and all of the Ginstar treatments were about the same. The concern about Starfire freezing leaves on the plants is evident from the upper left-hand graph. After 6 days most of the leaves in that treatment were desiccated, but still on the plant. Seventeen days after the treatments, most of the leaves dropped, but that treatment still had about twice as many leaves frozen on the plants as did the other treatments. Other interesting effects are seen from the graphs of long staple cotton. Those are left for the reader to savor. Looking at the short staple graphs, those on the right, the chlorate, chlorate plus Starfire and Ginstar plus a non-ionic surfactant were the most effective at causing leaf drop after 6 days. After 17 days, however, all of the Ginstar treatments had above 80% leaf drop and all the other treatments had less than 80%. Again, Starfire was the quickest to knock the green out of the plants but hung on to some of the leaves to the end.

Looking at Table 3, there was no difference in percent first pick for either long or short staple cotton as was expected because of the hard frosts after the defoliation and before harvest. The highest yields on both long and short staple occurred with the treatment including Prep. Even though the differences were not significantly higher than most of the other treatments, this is intriguing. There is a possibility that Prep opened some bolls that didn't open in the other treatments. In looking at the percent gin trash, no conclusions can be drawn. The check plots, with the most foliage left after the last observation, should have had the most gin trash, but didn't. The Ginstar treatments that had the highest percent leaf drop, should have had the least gin trash, but in several cases didn't.

HVI values are given in Tables 4 and 5. There appears to be a correlation between percent gin trash from Table 3 to Grade for long staple and Leaf Grade for short staple. It is, however, difficult to relate fiber differences to defoliation treatments. The only differences expected for length, uniformity, strength, elongation and micronaire would be if the plants were defoliated pre-maturely and the fiber were damaged. It is not felt that this is the case for this test. If Prep did hasten the maturity of some bolls, there is no evidence of that in this data.

One other objective of this experiment was to see if a drift retardant would have a deleterious effect on the efficacy of Ginstar. The results of this experiment showed no statistically significant differences between the defoliation effects of Ginstar alone vs Ginstar with Chemtrol drift retardant.

## References

1. Clark, L.J., E.W. Carpenter, G.L. Hart and J.M. Nelson. 1997. 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.*

**Table 1. Defoliation observations on long staple cotton (Pima S-6) on the Safford Agricultural Center, 1996.**

| Treatment | 6 DAT | | | 17 DAT | | |
|---|---|---|---|---|---|---|
| | % Lf Drp | % Green | % Desic | % Lf Drp | % Green | % Desic |
| Ginstar 8.8 oz | 26.3 a[1] | 13.8 cd | 60.0 ab | 81.9 ab | 8.1 cd | 10.0 bc |
| Ginstar 8.8 oz + NIS | 30.0 a | 22.5 c | 47.5 bc | 83.8 a | 2.5 d | 13.8 b |
| Ginstar 8.8 oz + drift retd | 33.8 a | 11.3 cd | 55.0 abc | 83.8 a | 2.5 d | 13.8 b |
| Ginstar 8.8 oz + Prep 1 pt | 38.8 a | 5.6 d | 55.6 abc | 84.4 a | 2.5 d | 13.1 bc |
| Starfire (21 oz) | 30.6 a | 3.1 d | 66.3 a | 75.0 abc | 4.4 d | 20.6 a |
| Chlorate (2 gal)+Starfire (11oz) | 40.6 a | 16.3 cd | 43.0 c | 72.5 bc | 18.1 b | 9.4 c |
| Dropp 3.2 oz + DEF 3/4 pt | 26.9 a | 45.6 b | 28.1 d | 75.0 abc | 13.8 bc | 11.3 bc |
| Sodium Chlorate (3 gal) | 31.3 a | 15.0 cd | 54.4 abc | 70.0 c | 20.0 b | 10.0 bc |
| Check | 11.9 b | 77.5 a | 10.6 e | 26.9 d | 68.8 a | 4.4 d |
| Average | 30 | 23.4 | 46.7 | 72.6 | 15.6 | 11.8 |
| LSD(05) | 13.6 | 11.7 | 13.3 | 8.8 | 8.6 | 3.7 |
| CV(%) | 31.1 | 34.3 | 19.4 | 8.3 | 37.3 | 21.4 |

1. Values followed by the same letter, within columns, are not significantly different at the 95% level of confidence.

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

| Treatment | 6 DAT | | | 17 DAT | | |
|---|---|---|---|---|---|---|
| | % Lf Drp | % Green | % Desic | % Lf Drp | % Green | % Desic |
| Ginstar 8.8 oz | 26.9 c[1] | 26.3 bc | 46.9 b | 88.8 a | 1.3 e | 10.0 bc |
| Ginstar 8.8 oz + NIS | 36.3 abc | 19.4 cd | 43.1 b | 89.4 a | 2.5 de | 8.1 cd |
| Ginstar 8.8 oz + drift retd | 33.1 abc | 35.0 b | 31.9 b | 83.1 a | 4.4 de | 12.5 b |
| Ginstar 8.8 oz + Prep 1 pt | 31.3 abc | 33.8 b | 35.0 b | 82.5 a | 4.4 de | 13.1 ab |
| Starfire (21 oz) | 27.5 bc | 8.1 d | 64.4 a | 74.4 b | 8.8 cd | 16.9 a |
| Chlorate (2 gal)+Starfire (11oz) | 37.5 ab | 23.1 bc | 38.1 b | 73.1 b | 17.5 b | 9.4 bc |
| Dropp 3.2 oz + DEF 3/4 pt | 31.0 abc | 28.8 bc | 40.2 b | 74.1 b | 13.3 bc | 12.5 b |
| Sodium Chlorate (3 gal) | 38.8 a | 15.6 cd | 41.9 b | 75.6 b | 13.8 bc | 10.6 bc |
| Check | 12.5 d | 78.1 a | 9.4 c | 16.3 c | 79.4 a | 4.4 d |
| Average | 30.5 | 29.8 | 39 | 73 | 16.1 | 10.8 |
| LSD(05) | 9.4 | 12.8 | 15.8 | 6.5 | 6.2 | 3.8 |
| CV(%) | 21.1 | 29.3 | 27.7 | 6.1 | 26.4 | 23.8 |

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**Table 3. Yield and percent lint turnout for a defoliation study on long and short staple cotton on the Safford Agricultural Center, 1996.**

| Treatment | Long Staple | | | Short Staple | | |
|---|---|---|---|---|---|---|
| | Lint Yield | Percent 1st Pk | % Gin Trash | Lint Yield | Percent 1st Pk | % Gin Trash |
| Ginstar 8.8 oz | 867 ab[1] | 95.0 a | 9.8 c | 1435 a | 96.7 a | 8.8 ab |
| Ginstar 8.8 oz + NIS | 943 ab | 93.7 a | 12.4 ab | 1479 a | 96.0 a | 8.3 ab |
| Ginstar 8.8 oz + drift retd | 971 ab | 94.2 a | 9.7 c | 1453 a | 96.6 a | 8.7 ab |
| Ginstar 8.8 oz + Prep 1 pt | 1014 a | 94.3 a | 9.6 c | 1620 a | 95.8 a | 9.4 ab |
| Starfire (21 oz) | 962 ab | 95.4 a | 10.1 bc | 1419 a | 96.5 a | 6.8 b |
| Chlorate (2 gal)+Starfire | 825 b | 93.9 a | 12.8 a | 1417 a | 96.9 a | 9.2 ab |
| Dropp 3.2 oz + DEF 3/4 | 975 ab | 95.5 a | 11.5 abc | 1509 a | 96.3 a | 10.1 a |
| Sodium Chlorate (3 gal) | 969 ab | 93.9 a | 12.8 a | 1565 a | 96.1 a | 8.7 ab |
| Check | 900 ab | 93.8 a | 11.8 abc | 1498 a | 97.1 a | 9.3 ab |
| Average | 936.3 | 94.4 | 11.1 | 1488.4 | 96.4 | 8.8 |
| LSD(05) | 162.4 | 1.96 | 2.2 | 217.5 | 1.5 | 2.8 |
| CV(%) | 11.9 | 1.4 | 13.5 | 10 | 1.1 | 22 |

1. Values followed by the same letter, within columns, are not significantly different at the 95% level of confidence.

**Table 4. HVI values for a defoliation study on long staple cotton on the Safford Agricultural Center, 1996.**

| Treatment | Length | Uniformity | Strength | Elongation | Micronaire | Grade |
|---|---|---|---|---|---|---|
| Ginstar 8.8 oz | 1.36 a[1] | 90.6 ab | 41.5 bc | 11.0 b | 3.9 ab | 1 |
| Ginstar 8.8 oz + NIS | 1.35 ab | 89.5 b | 40.1 bc | 11.0 b | 4.0 ab | 3 |
| Ginstar 8.8 oz + drift retd | 1.34 b | 87.6 c | 41.5 bc | 11.0 b | 3.8 b | 3 |
| Ginstar 8.8 oz + Prep 1 pt | 1.34 b | 89.5 b | 38.7 c | 11.0 b | 3.9 ab | 3 |
| Starfire (21 oz) | 1.37 a | 90.2 ab | 42.8 b | 11.5 ab | 4.0 ab | 1 |
| Chlorate (2 gal)+Starfire | 1.35 ab | 90.6 ab | 39.9 bc | 11.5 ab | 3.9 ab | 2 |
| Dropp 3.2 oz + DEF 3/4 | 1.36 ab | 90.0 ab | 40.2 bc | 11.0 b | 4.0 ab | 2 |
| Sodium Chlorate (3 gal) | 1.36 ab | 91.0 a | 42.3 b | 12.0 a | 3.9 ab | 3 |
| Check | 1.35 ab | 90.0 ab | 45.6 a | 12.0 a | 4.2 a | 2/3 |
| Average | 1.35 | 89.9 | 41.4 | 11.3 | 3.94 | 2.3 |
| LSD(05) | 0.03 | 1.3 | 2.74 | 0.7 | 0.34 | -- |
| CV(%) | 0.9 | 0.6 | 2.9 | 2.8 | 3.7 | -- |

1. Values followed by the same letter, within columns, are not significantly different at the 95% level of confidence.

**Table 5. HVI values for a defoliation study on short staple cotton on the Safford Agricultural Center, 1996.**

| Treatment | Length (inches) | Uniformity | Strength g/tex | Elongation | Micronaire | Color Grade | Leaf Grade |
|---|---|---|---|---|---|---|---|
| Ginstar 8.8 oz | 1.04 b[1] | 79.7 a | 30.0 a | 9.9 a | 4.5 ab | 31 | ½ |
| Ginstar 8.8 oz + NIS | 1.07 ab | 80.4 a | 30.4 a | 9.9 a | 4.3 bc | 31/41 | 2/3 |
| Ginstar 8.8 oz + drift retd | 1.04 b | 79.5 a | 29.3 a | 9.7 ab | 4.7 a | 31 | ½ |
| Ginstar 8.8 oz + Prep 1 pt | 1.07 ab | 80.2 a | 29.9 a | 9.7 ab | 4.3 bc | 31/41 | 2 |
| Starfire (21 oz) | 1.07 ab | 80.2 a | 29.6 a | 9.8 ab | 4.4 abc | 31 | ½ |
| Chlorate (2 gal)+Starfire | 1.07 ab | 80.7 a | 29.5 a | 9.7 ab | 4.4 abc | 31/41 | ½ |
| Dropp 3.2 oz + DEF 3/4 | 1.06 b | 79.5 a | 28.6 a | 9.7 ab | 4.6 a | 31/41 | 3/2 |
| Sodium Chlorate (3 gal) | 1.11 a | 81.3 a | 29.2 a | 9.5 b | 4.1 c | 31/41 | 2/1 |
| Check | 1.08 ab | 90.7 a | 29.1 a | 9.8 a | 4.4 abc | 31/41 | ½ |
| Average | 1.07 | 80.2 | 29.5 | 9.8 | 4.4 | -- | -- |
| LSD(05) | 0.04 | 1.6 | 2.0 | 0.3 | 0.3 | -- | -- |
| CV(%) | 2.50 | 1.3 | 4.7 | 1.7 | 4.9 | -- | -- |

1. Values followed by the same letter, within columns, are not significantly different at the 95% level of confidence.

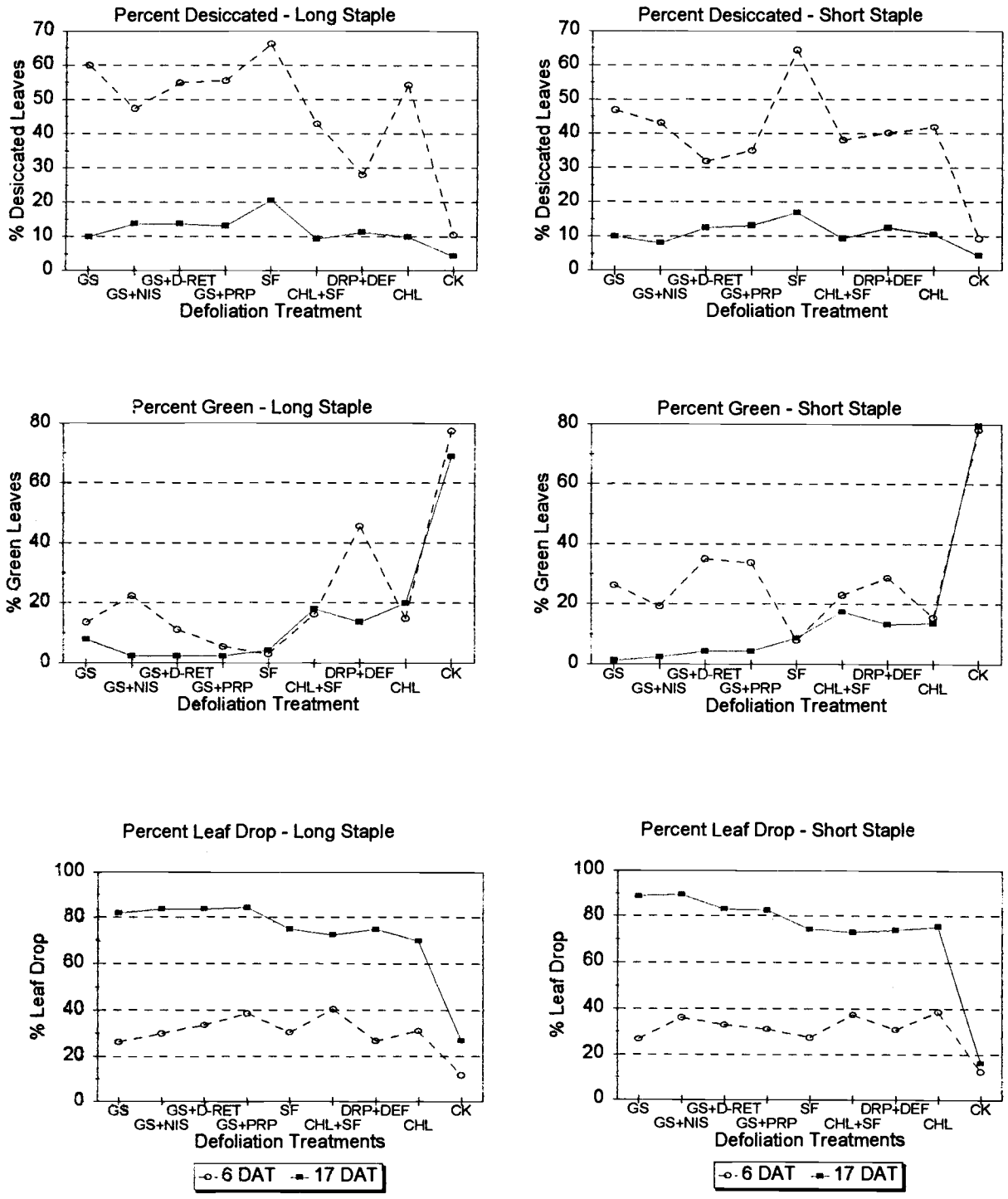


**Figure 1. Percent leaf drop, green leaves and desiccated leaves by defoliant treatment on both long and short staple cotton from a study performed on the Safford Agricultural Center, 1996.**