

# Defoliation of Pima and Upland Cotton at the Safford Agricultural Center, 2001

L.J. Clark, R.D. Coleman, E.W. Carpenter and E.R. Norton

## Abstract

*Nine defoliation treatments based on standard and reduced rates of Ginstar and Chlorate plus two additives (compounds F and S) were applied to Pima and Upland cotton to compare the treatment effects on percent leaf drop and yields. All of the treatments were beneficial to leaf drop compared to the untreated check with the Ginstar treatments generally performing better than the Chlorate. Both of the additives enhanced the early defoliation effectiveness for the reduced rates of Chlorate and Ginstar over all other treatments, including the full rates of the Chlorate and Ginstar. Generally, this same enhanced effectiveness was seen of the additives plus reduced rates over the full rates of Chlorate and Ginstar throughout the defoliation process. This is the second year of the study.*

## Introduction

Defoliation of cotton plants prior to harvest is a practice introduced many years ago to reduce leaf trash and green stain 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 defoliant and frost can effectively defoliate the plants with no chemicals. This study took a little different approach than previous studies in that two defoliation materials that have proven effective were used either at full strength or reduced strength (half strength for Chlorate and one third strength for Ginstar). The reduced strength treatments had additional additives added to them, as a tank mix, to see if defoliation performance could be enhanced.

## Materials and Methods

The study was implemented using HTO and DP 655BR as representatives of the Pima and Upland cotton varieties grown in the area. Treatments were applied to plots 4 rows wide and approximately 50 feet long, in a replicated randomized complete block design. The following table indicates the cultural practices employed in the experiment:

### Crop history

Soil type: Pima clay loam variant

Previous crop: Cotton

Planting date: 19 April, 2001 Rate: 25 lbs/ac Varieties: HTO Pima, DP 655BR

Herbicide: 1.5 pts/ac Treflan applied pre-plant, Prometryne applied at lay-by

Fertilizer: 100 lbs/ac Urea side dressed 5/23 and 6/28

Irrigation: Watered up plus 7 irrigations (40 ac in + 2.8 ac out) East date: 21 Aug (Uplnd), 29 Aug (Pma)

Defoliation date: Applied: Observations: 27 Sep, 2 Oct and 6 Oct (4, 8 and 12 DAT)

Cumulative heat units: At defoliation 3309, at 1<sup>st</sup> obs. (I<sub>1</sub>=50), at 2<sup>nd</sup> obs. (I<sub>2</sub>=86), at 3<sup>rd</sup> obs. (I<sub>3</sub>=69)

Harvest: 1st pick: 22 October

The treatments listed below were applied at a rate of 20 gallons of water per acre through Teejet flat fan nozzles on 20 inch spacings over 4 rows. Ten days and 16 days after defoliation treatments were applied each plot was evaluated to determine the amount of leaf drop from the

| Number | Treatment abbreviation | Treatment  |
|--------|------------------------|--|
| 1      | GS8.8oz                | Ginstar 180 EC 8.8 oz/ac   |
| 2      | GS2.9oz +Syl           | Ginstar 180 EC 2.9 oz/ac + 0.25% Sylgard 309                     |
| 3      | GS2.9oz +Syl+4%F       | Ginstar 180 EC 2.9 oz/ac + 0.25% Sylgard 309 + 4% Compound F     |
| 4      | GS2.9oz +Syl +4%S      | Ginstar 180 EC 2.9 oz/ac + 0.25% Sylgard 309 + 4% Compound S     |
| 5      | CHL3g + Syl            | Sodium Chlorate (3 gal/ac) + 0.25% Sylgard 309                   |
| 6      | CHL1.5g + Syl          | Sodium Chlorate (1.5 gal/ac) + 0.25% Sylgard 309                 |
| 7      | CHL1.5g + Syl +4%F     | Sodium Chlorate (1.5 gal/ac) + 0.25% Sylgard 309 + 4% Compound F |
| 8      | CHL1.5g + Syl + 4%S    | Sodium Chlorate (1.5 gal/ac) + 0.25% Sylgard 309 + 4% Compound S |
| 9      | CK                     | Untreated Check +0.25% Sylgard 309                               |

## Results and Discussion

Table 1 shows the leaf status after defoliation on Upland cotton over 3 dates of observations. These observations took place at 3, 8 and 12 days after treatment (DAT). Looking at the percent of leaves dropped on the first observation date, one sees that fewer leaves were dropped with the low rate (LR) than at the high rate (HR) with both Ginstar and Chlorate. By adding either of the two additives, however, the leaf drop percentages increased (with one exception) to equal or greater than that of the HR. [The exception, the low rate of Chlorate with 4% S added, doesn't seem to follow the trend shown in the Ginstar treatments on Upland cotton, the trends shown in the Pima part of the study, nor the trends seen in the 2000 study (1). This treatment seems suspect and is probably due to an erroneous application.] This trend continues through the other 2 observation dates and the additive "F" produces the greatest leaf drop with the low rates of both defoliant. The column on percent frozen indicates that none of the treatments causes leaves to freeze on the plants to be harvested along with the seed cotton. For economic considerations, then, one must know the cost of additive "F" to compare with the cost reduction in the two defoliant with which it was applied.

Table 3 show similar data for the Pima part of the study. Results are quite similar, except that the additive "S" seems to be the stronger choice.

Figures 1 and 2 show the comparison between similar treatments for the two years of the study. It is observed that the defoliation in 2000 was more complete than in 2001. This is in part because the last observation in 2000 was 16 days after treatment, whereas the last observation in 2001 was only 12 days after treatment. Another difference is the low rate (LR) of Ginstar in 2000 was half the amount of the high rate (HR) and in 2001 the LR was one third the amount of the HR. The same conclusion can be drawn from both studies, the additives compensate for the rate reduction of the primary defoliant. So, the question as to what formulation to use depends on the cost of the additives and proper registration of these materials for use on cotton at harvest time.

If defoliation treatments are applied at the proper stage of development of the plant there should be no decrease in yield. In Table 2 the Check plot on Upland cotton had a yield statistically greater than the half rate plots treated with both additive F and S. This makes one wonder if the materials were added before physical maturity of the plants. Lint turnouts varied, but no trends could be seen that would tie these differences to treatments. The last two columns in Table 1 were percent loss of weight from the lint caused by the ginning and cleaning processes. It was assumed that the samples from untreated plots would have more leaf trash and thus have greater losses as the seed cotton was processed. This did not turn out to be the case. There was a strong positive correlation between the two sources of loss, but not correlation between these losses and lint yield and not correlation between these losses and percent leaf drop.

Looking at Table 4 containing data on Pima cotton similar to those discussed for Upland cotton on Table 1, one sees yield differences but no correlation to what was seen with Upland cotton. The highest yield was seen with the full rate of Chlorate and the lowest yield with the half rate of Chlorate and additive S. The untreated check was in the middle of the range. No differences were seen in percent lint turnout and no significant correlations between ginning or cleaning losses with yield or with percent leaf drop.

Sub samples were not sent to the classing office to see if grades were affected by treatment, since no differences had been seen in previous studies.

## References

1. Clark, L.J. and E.W. Carpenter. 2001. Defoliation of Pima and Upland cotton at the Safford Agricultural Center, 2000. Cotton, A College of Agriculture and Life Sciences Report, The University of Arizona, Tucson, AZ. Series P-125, pp. 34-37.

**Table 1. Leaf status after defoliation treatments on Upland cotton, Safford Agricultural Center, 2001.**

| Treatment           | % Dropped         |        |        | % Frozen |        |      | % Green  |         |        |
|---------------------|-------------------|--------|--------|----------|--------|------|----------|---------|--------|
|                     | 9/27 <sub>1</sub> | 10/2   | 10/6   | 9/27     | 10/2   | 10/6 | 9/27     | 10/2    | 10/6   |
| Ginstar 180C 8.8 oz | 13.8 b            | 73.8a  | 87.5 a | 2.5 d    | 0 c    | 0    | 83.8 a   | 26.3 d  | 12.5 c |
| GS 2.9oz +Slgrd     | 11.3bc            | 80.0a  | 85.8 a | 2.5 d    | 1.25bc | 0    | 86.3 a   | 18.8 de | 14.3 c |
| GS 2.9oz+Slg+4%F    | 22.5 a            | 85.0a  | 91.3 a | 25.0 bc  | 3.75ab | 0    | 52.5 d   | 11.3 e  | 8.75 c |
| GS 2.9oz+Syl+4%S    | 15.0 b            | 75.0a  | 87.5 a | 21.3 bc  | 1.25bc | 0    | 63.8 bcd | 23.8 de | 12.5 c |
| Chlorate 3Gal+Syl   | 15.0 b            | 72.5a  | 77.5 a | 28.6 b   | 5.00a  | 0    | 56.3 cd  | 22.5 de | 22.5c  |
| Chl 1.5Gal+Syl      | 12.5bc            | 43.8 b | 58.8 b | 18.8 c   | 5.00a  | 0    | 71.3 b   | 51.3 c  | 41.3 b |
| Chl 1.5Gal+Syl+4%F  | 15.0 b            | 80.0 a | 85.0 a | 37.5 a   | 0 c    | 0    | 52.5 d   | 20.0 de | 15.0 c |
| Chl 1.5Gal+Syl+4%S  | 13.8 b            | 23.8 c | 22.5 c | 21.3 bc  | 5.00a  | 0    | 65.0 bc  | 71.3 b  | 77.5 a |
| Check+Sylgard       | 7.50 c            | 6.25 d | 8.75 c | 0 d      | 0 c    | 0    | 92.5 a   | 92.5 a  | 91.3 a |
| Average             | 14.0              | 60.0   | 67.2   | 17.5     | 2.36   | 0    | 69.3     | 37.5    | 32.8   |
| LSD(05)             | 5.9               | 13.0   | 14.3   | 8.7      | 3.42   | -    | 11.7     | 13.8    | 14.3   |
| CV(%)               | 28.9              | 14.9   | 14.6   | 34.2     | 99.3   | -    | 11.6     | 24.9    | 29.9   |

1. Values followed by the same letter are not significantly different at the 95% level of confidence using standard statistical methods.

**Table 2. Yield, percent lint turnout and trash loss from ginning and cleaning samples, Upland cotton, Safford Agricultural Center, 2001.**

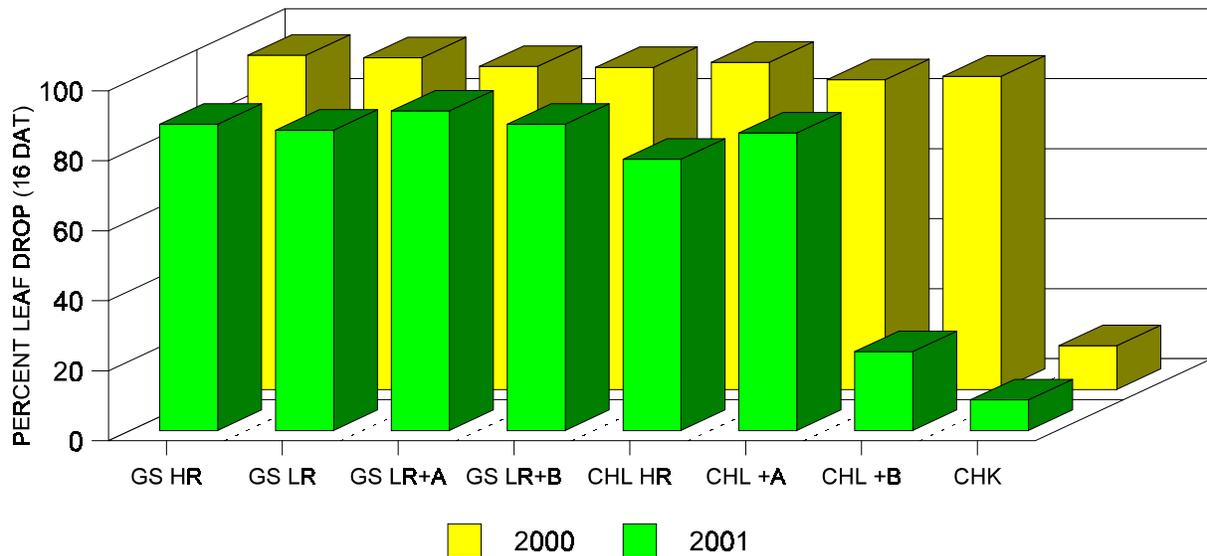
| Treatment           | Lint Yield | % Lint Turnout | % Loss from ginning | % Loss from cleaner |
|---------------------|------------|----------------|---------------------|---------------------|
| Ginstar 180C 8.8 oz | 1175.7 abc | 36.8 d         | 9.90 a              | 8.40 a              |
| GS 2.9oz +Slgrd     | 1222.6 ab  | 38.6 a         | 7.05 d              | 5.45 d              |
| GS 2.9oz+Slg+4%F    | 1199.9 ab  | 38.0 abc       | 8.25 bcd            | 6.90 bcd            |
| GS 2.9oz+Syl+4%S    | 1200.2 ab  | 37.2 bcd       | 8.00 bcd            | 5.65 cd             |
| Chlorate 3Gal+Syl   | 1182.3 abc | 37.6 a-d       | 8.45 bc             | 7.45 ab             |
| Chl 1.5Gal+Syl      | 1202.3 ab  | 37.0 cd        | 8.90 abc            | 7.55 ab             |
| Chl 1.5Gal+Syl+4%F  | 1007.5 c   | 38.1 ab        | 7.70 cd             | 6.50 bcd            |
| Chl 1.5Gal+Syl+4%S  | 1105.6 bc  | 37.0 cd        | 8.50 bc             | 6.95 abc            |
| Check+Sylgard       | 1303.4 a   | 37.9 abc       | 9.10 ab             | 6.60 bcd            |
| Average             | 1177.7     | 37.6           | 8.43                | 6.83                |
| LSD(05)             | 189.2      | 1.02           | 1.35                | 1.49                |
| CV(%)               | 11.0       | 1.85           | 11.0                | 15.0                |

**Table 3 Leaf status after defoliation treatments on Pima cotton, Safford Agricultural Center, 2001.**

| Treatment           | % Dropped |         |         | % Frozen |        |        | % Green |          |         |
|---------------------|-----------|---------|---------|----------|--------|--------|---------|----------|---------|
|                     | 9/27      | 10/2    | 10/6    | 9/27     | 10/2   | 10/6   | 9/27    | 10/2     | 10/6    |
| Ginstar 180C 8.8 oz | 6.25 b    | 80.0 a  | 90.0 a  | 13.8 cd  | 7.50 a | 2.00 b | 80.0 ab | 12.5 d   | 9.50 ef |
| GS 2.9oz +Slgrd     | 5.00 b    | 46.3 b  | 81.3 b  | 10.0 de  | 6.25 a | 1.25 b | 85.0 ab | 45.0 abc | 17.5 de |
| GS 2.9oz+Slg+4%F    | 12.5 b    | 76.3 a  | 91.3 a  | 25.0 ab  | 5.00 a | 0 b    | 62.5 c  | 18.8 cd  | 7.50 f  |
| GS 2.9oz+Syl+4%S    | 10.0 b    | 81.3 a  | 92.5 a  | 21.3 abc | 5.00 a | 2.50 b | 68.8 bc | 13.8 d   | 5.00 f  |
| Chlorate 3Gal+Syl   | 15.0 ab   | 41.3 b  | 72.5 c  | 30.0 ab  | 10.0 a | 1.25 b | 55.0 cd | 50.0 ab  | 26.3 c  |
| Chl 1.5Gal+Syl      | 11.3 b    | 27.5 bc | 48.8 d  | 20.0 bcd | 10.0 a | 1.25 b | 68.8 bc | 62.5 ab  | 50.0 b  |
| Chl 1.5Gal+Syl+4%F  | 16.3 ab   | 43.8 b  | 77.5 bc | 27.5 ab  | 6.25 a | 1.25 b | 56.3 cd | 50.0 ab  | 21.3 cd |
| Chl 1.5Gal+Syl+4%S  | 27.5 a    | 46.3 b  | 80.0 bc | 31.3 a   | 16.3 a | 7.50 a | 41.3 d  | 37.5 bcd | 12.5 ef |
| Check+Sylgard       | 5.00 b    | 11.3 c  | 12.5 e  | 2.5 e    | 21.3 a | 0 b    | 92.5 a  | 67.5 a   | 87.5 a  |
| Average             | 12.1      | 50.4    | 71.8    | 20.1     | 9.72   | 1.89   | 67.8    | 39.7     | 26.3    |
| LSD(05)             | 13.2      | 20.1    | 8.51    | 10.7     | 21.2   | 4.43   | 16.6    | 28.4     | 8.56    |
| CV(%)               | 74.9      | 27.3    | 8.12    | 36.5     | 149.6  | 160.7  | 16.8    | 49.4     | 22.3    |

**Table 4. Yield, percent lint turnout and trash loss from ginning and cleaning samples, Pima cotton, Safford Agricultural Center, 2001.**

| Treatment           | Lint Yield | % Lint Turnout | % Loss from ginning | % Loss from cleaner |
|---------------------|------------|----------------|---------------------|---------------------|
| Ginstar 180C 8.8 oz | 890.9 ab   | 38.6 a         | 9.20 ab             | 6.11 bc             |
| GS 2.9oz +Slgrd     | 877.5 ab   | 38.9 a         | 7.35 d              | 7.09 bc             |
| GS 2.9oz+Slg+4%F    | 717.1 cd   | 38.7 a         | 8.35 bcd            | 7.57 ab             |
| GS 2.9oz+Syl+4%S    | 891.5 ab   | 38.4 a         | 7.95 cd             | 5.21 cc             |
| Chlorate 3Gal+Syl   | 957.9 a    | 38.4 a         | 8.05 cd             | 5.42 bc             |
| Chl 1.5Gal+Syl      | 704.8 cd   | 38.8 a         | 9.60 a              | 6.73 bc             |
| Chl 1.5Gal+Syl+4%F  | 791.8 bcd  | 38.6 a         | 9.50 a              | 6.77 bc             |
| Chl 1.5Gal+Syl+4%S  | 665.3 d    | 38.9 a         | 8.85 abc            | 9.50 a              |
| Check+Sylgard       | 826.8 abc  | 39.2 a         | 8.25 bcd            | 5.49 bc             |
| Average             | 813.7      | 38.7           | 8.57                | 6.66                |
| LSD(05)             | 147.6      | 1.07           | 1.06                | 2.23                |
| CV(%)               | 12.4       | 1.89           | 8.48                | 23.0                |



**Figure 1. Percent leaf drop ca. 2 weeks after treatment for Upland cotton defoliation study on the Safford Agricultural Center, 2000 and 2001.**

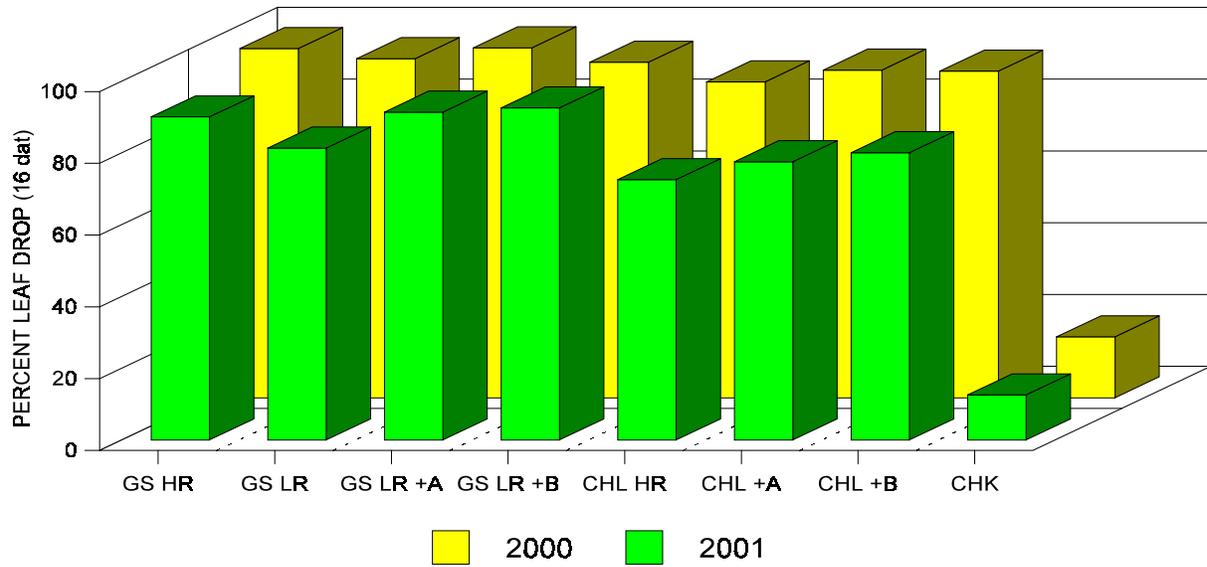


Figure 2. Percent leaf drop ca. 2 weeks after treatment for Pima cotton defoliation study on the Safford Agricultural Center, 2000 and 2001.