

Defoliation of Pima and Upland Cotton at the Safford Agricultural Center, 2000

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Abstract

Nine defoliation treatments based on defoliating agents that are in use in the area plus two additives (compounds A, B) 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. One of the additives enhanced the early defoliation effectiveness of chlorate, the other additive enhanced the effectiveness of Ginstar throughout the defoliation process. More studies will be needed before recommendations can be made.

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 defoliants and frost can effectively defoliate the plants with no cost. This study took a little different approach than previous studies in that two materials that have been proven effective were used either at full strength or half strength and two different materials were 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 crop history indicates the cultural practices employed in the experiment:

Crop history

Soil type: Pima clay loam variant

Previous crop: Cotton

Planting date: 12 April, 2000 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 8 irrigations (46 ac in + 3.3 in rain) Last date: 22 Aug

Defoliation date: Applied: 19 Sep Observations: 29 September and 5 October

Cumulative heat units: At defoliation 2979, at 1st obs. 3142 ($\hat{I}_1=163$), at 2nd obs. 3248 ($\hat{I}_2=269$)

Harvest: 1st pick: 29 November 2nd pick: none

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 plants.

Number	Treatment abbreviation	Treatment
1	GS8.8oz	Ginstar 180 EC 8.8 oz/ac
2	GS4.4oz +Syl	Ginstar 180 EC 4.4 oz/ac + 0.25% Sylgard 309
3	GS4.4oz +Syl+2A	Ginstar 180 EC 4.4 oz/ac + 0.25% Sylgard 309 + 2% Compound A
4	GS4.4oz +Syl +4A	Ginstar 180 EC 4.4 oz/ac + 0.25% Sylgard 309 + 4% Compound A
5	GS4.4oz + Syl +4B	Ginstar 180 EC 4.4 oz/ac + 0.25% Sylgard 309 + 4% Compound B
6	CHL3g + Syl	Sodium Chlorate (3 gal/ac) + 0.25% Sylgard 309
7	CHL3g + Syl +4A	Sodium Chlorate (3 gal/ac) + 0.25% Sylgard 309 + 4% Compound A
8	CHL3g + Syl + 4B	Sodium Chlorate (3 gal/ac) + 0.25% Sylgard 309 + 4% Compound B
9	CK	Untreated Check

Results and Discussion

Table 1 shows the defoliation effects and yields on Upland cotton. On the first observation date, 10 days after treatment (10 DAT), Ginstar at the high (normal) rate produced the largest percentage leaf drop. Cutting the Ginstar rate in half and adding Sylgard caused a small (statistically insignificant) decrease in leaf drop. Adding materials 'A' and 'B' made little difference. Three gallons of chlorate per acre with Sylgard produced significantly less leaf drop than most of the Ginstar treatments. With the addition of 4% 'A' or 'B', leaf drop increased to about the same percentages as the Ginstar treatments. After 16 days (16 DAT) the high rate of Ginstar still produced the largest percentage leaf drop, the half rate of Ginstar performed almost as well, followed by Chlorate + Sylgard, and Ginstar with 4% of either 'A' or 'B'. The additives that had enhanced the performance of chlorate early seemed to slow down its activity in the long run. Yield differences are shown in the last column. The lowest yield is seen with the Ginstar treatments alone. It is possible that Ginstar shut the plants down prematurely, but this is not thought to be the case. If this were the case, it would seem that the additives ameliorated the effect. The highest yields were seen when 4% of material 'A' was added to the defoliant. It is not known if material 'A' has any yield enhancing properties.

The results of the defoliants on Pima cotton is shown in Table 2. The *Gossypium barbadense* (Pima) specie of cotton reacts very differently from the *G. hirsutum* (Upland) specie to chemical treatments to terminate growth (1) and those differences are evident in this study. The Chlorate treatment with 4% 'B' had the highest percentage leaf drop on the first observation date, followed by the high rate of Ginstar, the half rate of Ginstar + 4% 'A' and the other two treatments with Ginstar and 'B' and 'A'. There were no statistically significant differences between the treatments, except the check, but the additives seemed to enhance the early defoliation activity of the Chlorate and Ginstar. By the second observation date, the defoliation effects had evened out quite a bit and the half rate of Ginstar plus 4% 'A' had the highest percent leaf drop followed closely by the high rate of Ginstar. The highest yields were seen in the treatments with Chlorate and the half rate of Ginstar. This did not follow the logic used on Upland cotton, that the additives ameliorated the adverse physiological effects of the defoliants. Perhaps this is another example of the differences between the species.

The object of the study was to find a more effective and less costly alternative to the traditionally used defoliants. A couple of the treatments show some possibility. Material 'B' showed an early enhancement of defoliation on both Pima and Upland and material 'A' showed an enhancing effect with Ginstar with a more lasting effect. These materials should be studied more to verify the effects seen this year and an economic analysis must be done to see if the cost of the additives is greater or less than the cost of the traditional defoliants.

Summary

1. The best overall defoliation treatments for Pima and Upland cotton were Ginstar +/- compounds A or B; of these, two treatments, Ginstar (4.4 oz/acre) + compound A at 4% and Ginstar (8.8 oz/acre), were the most effective. The yields were approximately the same as the average yield for all treatments.

2. A comparison of treatment effects at Day 10 and 16 revealed that the rate of defoliation was accelerated by compound addition to:

- a) Chlorate, both Pima and Upland
- b) Ginstar, only Pima

References

Kittock, D.L., H.F. Arle, J.R. Mauney and L.A. Bariola. 1973. Effect of several chemical treatments on cotton fruiting. In Proceedings of the Beltwide Cotton Production Research Conference, Phoenix, AZ. p. 33.

Table 1. Defoliation effects and yield values for defoliation studies on Upland cotton, Safford Agricultural Center, 2000.

Treatments	29 September (10 DAT)	5 October (16 DAT)	Seedcotton Yield (lbs/ac)
	% Leaf Drop	% Leaf Drop	
GS 8.8oz	93.3 a	95.5 a	3386.0 b
GS 4.4 +Syl	87.5 a	94.8 ab	3159.3 b
GS 4.4+Syl+2A	81.3 ab	89.8 ab	3559.0 ab
GS 4.4+Syl+4A	87.3 a	92.3 ab	3847.4 a
GS 4.4+Syl+4B	88.8 a	92.0 ab	3724.4 ab
Chl 3g+Syl	63.3 b	93.5 ab	3498.9 ab
Chl 3g+Syl+4A	76.3 ab	88.5 b	3592.5 ab
Chl 3g+Syl+4B	80.8 ab	89.5 ab	3476.3 ab
Check	7.5 c	12.5 c	3522.7 ab
Average	74	83.1	3529.6
LSD(05)	20.1	6.0	548.6
CV(%)	18.6	4.97	10.7

Table 2. Defoliation effects and yield values for defoliation studies on Pima cotton, Safford Agricultural Center, 2000.

Treatments	29 September (10 DAT)	5 October (16 DAT)	Seedcotton Yield (lbs/ac)
	% Leaf Drop	% Leaf Drop	
GS 8.8oz	94.5 a	97.3 a	1575.0 ab
GS 4.4 +Syl	73.3 a	94.5 ab	1690.4 a
GS 4.4+Syl+2A	90.6 a	92.8 ab	1599.2 ab
GS 4.4+Syl+4A	93.8 a	97.5 a	1587.5 ab
GS 4.4+Syl+4B	91.0 a	93.5 ab	1543.6 ab
Chl 3g+Syl	71.5 a	88.0 b	1701.7 a
Chl 3g+Syl+4A	69.5 a	91.3 ab	1506.5 ab
Chl 3g+Syl+4B	95.8 a	91.0 ab	1377.4 b
Check	19.5 b	17.0 c	1619.4 ab
Average	77.5	84.8	1577.8
LSD(05)	30.6	6.5	267.7
CV(%)	27	5.2	11.6