

# Evaluation of Various Materials for Harvest Preparation and Defoliation in Southeastern Arizona

E.R. Norton and H. Borrego

## Abstract

*A single defoliation experiment was conducted during the 2004 growing season in an effort to evaluate the effectiveness of commercially available harvest preparation materials in the higher elevation areas of southeastern Arizona. Many growers will not employ a defoliation regime but will let the crop naturally senesce with the cooler temperatures and frost. This evaluation compared a standard treatment of Ginstar with some additional tank mix ethephon based products from DuPont and BASF. These treatments were compared to the common Na chlorate treatment employed by many growers in this region of the state. Treatments included a base rate of 8 oz/acre Ginstar with three different rates of both CottonQuick and Prep. Treatments were applied on 15 October in a randomized complete block design with four replications. Data collected included observations of percent defoliation, percent regrowth control, and percent open boll on two separate dates after treatment (27 October and 4 November). Yield data was also collected at the end of the season by harvesting the center two rows of each plot. Sub samples were collected for fiber quality analysis. Results showed significant differences among treatments with respect to defoliation parameters measured. Treatments including Ginstar and higher rates of both CottonQuick and Prep performed well. The treatment consisting of Na chlorate alone was also effective. The Ginstar + CottonQuick treatment did appear to have a slight advantage in final percent open boll counts. No significant differences among treatments were detected with respect to yield and fiber quality. However, lint yield for the control treatment was lower than the other defoliation treatments. This would indicate that some type of defoliation regime does provide benefit in terms of increased yield.*

## Introduction

Proper defoliation is oftentimes a difficult task to accomplish in an economical and efficient fashion. Many factors influence the effectiveness of any defoliation treatment such as weather, vigor of the crop, and water status of the crop. Mitigating factors can result in the need for more than one application of a chemical defoliant.

Chemical defoliation is an attempt to enhance a natural physiological process that occurs in the plant as it matures. As the cotton plant matures and begins to desiccate, an abscission layer begins to form at the base of the petiole where the leaf is attached to the stem. The formation of this abscission layer is driven by hormonal relationships within the plant (Cathey, 1986). As this layer forms the weight of the leaf will break the abscission layer and shear off the plant.

Chemical treatments are designed to enhance this process in preparing the crop for a clean, efficient harvest. Proper timing of defoliant applications is critical to achieving an effective defoliation. The crop must be physiologically active in order for this abscission layer to be formed. If the crop is stressed, a proper abscission layer will not be formed and a chemical defoliant may cause the leaves to 'freeze' on the

plant and result in an increased level of trash in the lint. A crop that is growing very vigorously may require several applications of chemical defoliants to 'slow the crop down' in order for defoliation to effectively occur.

The objective of this study was to evaluate the effect of several harvest preparation materials and some additional additives in an attempt to refine recommendations on defoliation materials.

## **Materials and Methods**

Plots were arranged in a randomized complete block design with nine treatments and four replications. Plots consisted of four, 36-inch rows in width and extending 40 feet in length. Plots were planted to the cultivar Deltapine DP555BR on 20 April 2004. Plots were managed in an optimum fashion with respect to fertilization, irrigation, and pest control throughout the entire season. The final irrigation was applied on 13 September 2004.

Treatments were imposed on 15 October 2004 as outlined in Table 1. A John Deere Hi-Cycle (JD6000) that has been customized with a small plot CO<sub>2</sub> sprayer was used to apply the treatments. Defoliants were applied at a carrier rate of 19 gallons per acre and a pressure of 35 psi. Heat unit accumulations on the day of treatment and at 12 and 20 days after treatment (DAT) are shown in Table 2. Evaluations of treatment effects were made on two separate days after treatment (27 October and 4 November). Evaluations included estimations of percent leaf drop, percent regrowth control, and percent open boll. Lint yield estimates were made by harvesting the center two rows of each plot and weighing the resultant seedcotton. Sub-samples were collected for fiber quality determination and sent to the USDA Phoenix Classing Office.

All data was subjected to analysis of variance in an effort to separate out statistical differences for all dependant variables including lint yield, fiber quality parameters, percent leaf drop, percent regrowth control and percent open boll. All statistical analysis was conducted in accordance with procedures outlined by the SAS Institute (2002) and Gomez and Gomez (1985).

## **Results**

The 2004 growing season was cooler than normal so the crop was carried further into the fall in an effort to mature the crop. Defoliation applications were made slightly later than normal due to the extended season. Weather conditions surrounding the application and for the following three weeks were significantly cooler than normal as indicated by heat unit accumulations described in Table 2. However, the crop was near 60% open boll when defoliation applications were made on 15 October 2004.

Significant differences were observed among the treatments with respect to all defoliation parameters measured. Significant differences in percent defoliation were observed with the Na chlorate and the Ginstar treatment with the higher rates of both CottonQuick and Prep providing the best defoliation (Figure 1). Differences among treatments with respect to percent regrowth control were also similar with the Na chlorate treatment and the Ginstar + CottonQuick providing the best control of regrowth (Figure 2). Percent open boll showed very little differences among treatments. All treatments were near 90% open boll by the second observation date except for the control. The Ginstar treatment in combination with the CottonQuick had slightly higher percent open boll counts than the other treatments (Figure 3).

Even though significant differences were observed among treatments with respect to the defoliation parameters measured no significant differences were observed in either final lint yield or fiber quality parameters (Table 3 and Figure 4). The control plots produced the lowest yield in the experiment which

indicates the need for defoliation. Some growers in the upper Gila River valley will not employ a defoliation program and just let the plant naturally senesce with the cooler temperatures and frost. However, our research has indicated that some type of defoliation regime will consistently result in higher lint yields and typically higher fiber quality even though fiber quality differences were not observed in this particular study.

### **Literature Cited**

Cathey, G. W. 1986. "Physiology of defoliation in cotton production." *In J. R. Mauney and J. M. Stewart (ed.), Cotton Physiology. No. 1, Cotton Foundation, Memphis, TN. p. 143-153.*

Gomez, K.A. and A.A. Gomez. 1984. *Statistical Procedures for Agricultural Research*, Inc. Ed. John Wiley and Sons, Inc. p. 307.

SAS Institute. 2002. *SAS/STAT: Procedures*. Release 9.0 ed. SAS Inst., Cary, NC.

Table 1. List of products and rates applied for each treatment in the defoliation trial, Safford Agricultural Center, 2004.

Treatment Number	Product	Rate
1	Ginstar + CottonQuick	8 oz + 16 oz
2	Ginstar + CottonQuick	8 oz + 24 oz
3	Ginstar + CottonQuick	8 oz + 32 oz
4	Ginstar + Prep	8 oz + 8 oz
5	Ginstar + Prep	8 oz + 12 oz
6	Ginstar + Prep	8 oz + 16 oz
7	Na Chlorate + Aim	3 gal + 2 oz
8	Na Chlorate	3 gal
9	Control	

Table 2. Heat unit accumulation data for the defoliation trial, Safford Agricultural Center, 2004.

	Heat Unit Accumulations (86 <sup>o</sup> /55 <sup>o</sup> F) – Since Planting	
	Observed	Normal
Day of Treatment (15 October)	3433	3562
12 DAT (27 October)	113	129
20 DAT (4 November)	147	191

Table 3. Fiber quality results for each of the nine treatments in the defoliation trial, Safford Agricultural Center, 2004.

Treatment	Micronaire	Fiber Length (100ths)	Staple Length (32nds)	Fiber Strength (g/tex)	Uniformity Index	Leaf Grade
1	4.0	112.5	36.0	30.2	80.0	3.5
2	4.0	109.5	35.0	28.9	79.0	2.5
3	4.1	108.5	34.5	28.7	80.5	3.0
4	4.0	112.0	36.0	29.2	81.0	3.0
5	4.1	109.5	35.0	27.7	81.0	3.0
6	4.1	110.5	35.5	28.8	80.5	2.5
7	4.0	109.0	35.0	27.7	80.5	2.5
8	3.7	112.0	36.0	28.6	80.0	3.0
9	4.1	109.0	35.0	28.9	80.0	2.5
§LSD	NS	NS	NS	NS	NS	NS
†CV	7.4	1.9	2.3	3.7	0.87	22.7
‡OSL	0.9270	0.4923	0.5000	0.4176	0.2440	0.7531

\*Means followed by the same letter are not statistically different according to a Fisher's LSD means separation test.

§Least Significant Difference

†Coefficient of Variation

‡Observed Significance Level

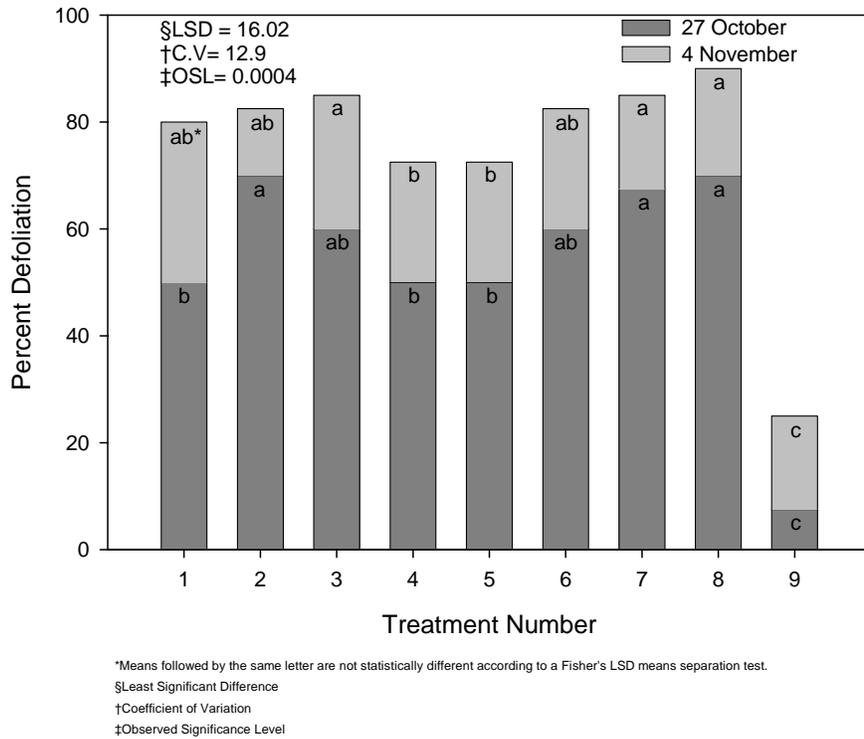


Figure 1. Percent leaf drop for each treatment and each observation date in the Upland cotton defoliation trial, Safford Agricultural Center, 2004.

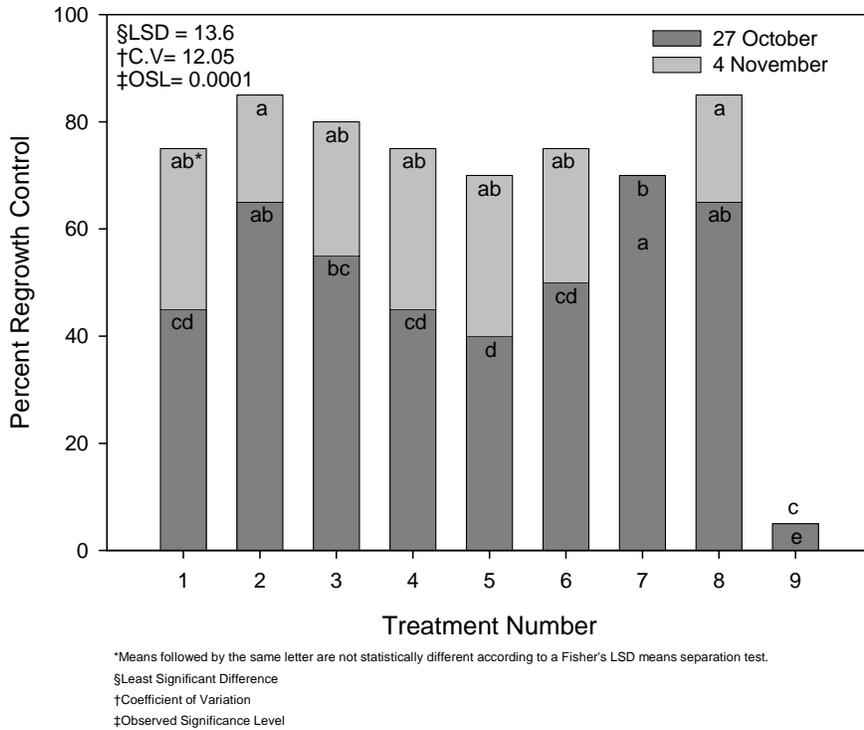


Figure 2. Percent control of regrowth for each treatment and each observation date in the Upland cotton defoliation trial, Safford Agricultural Center, 2004.

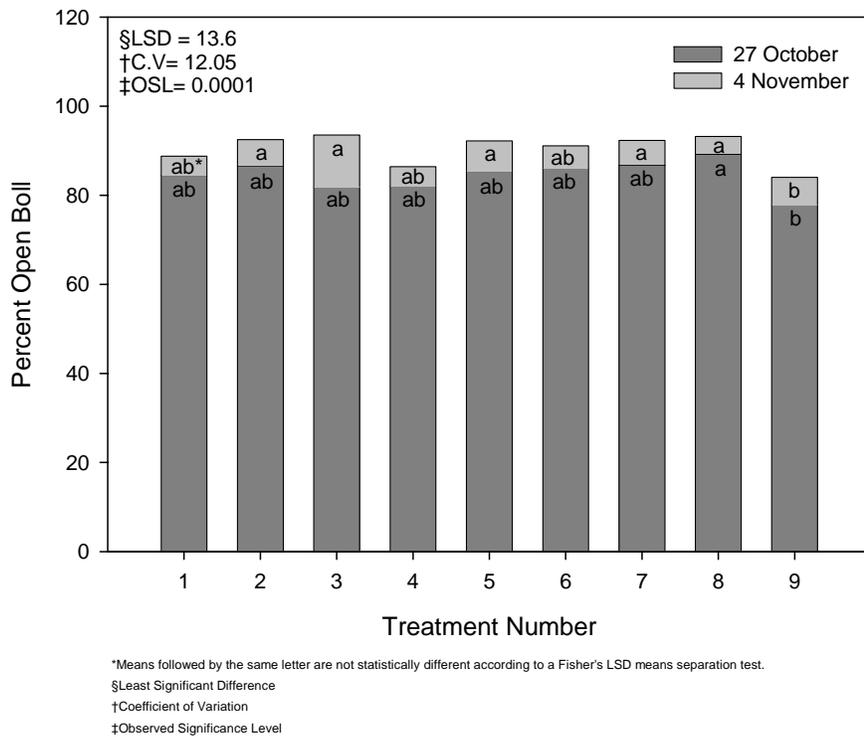


Figure 3. Percent open boll for each treatment and each observation date in the Upland cotton defoliation trial, Safford Agricultural Center, 2004.

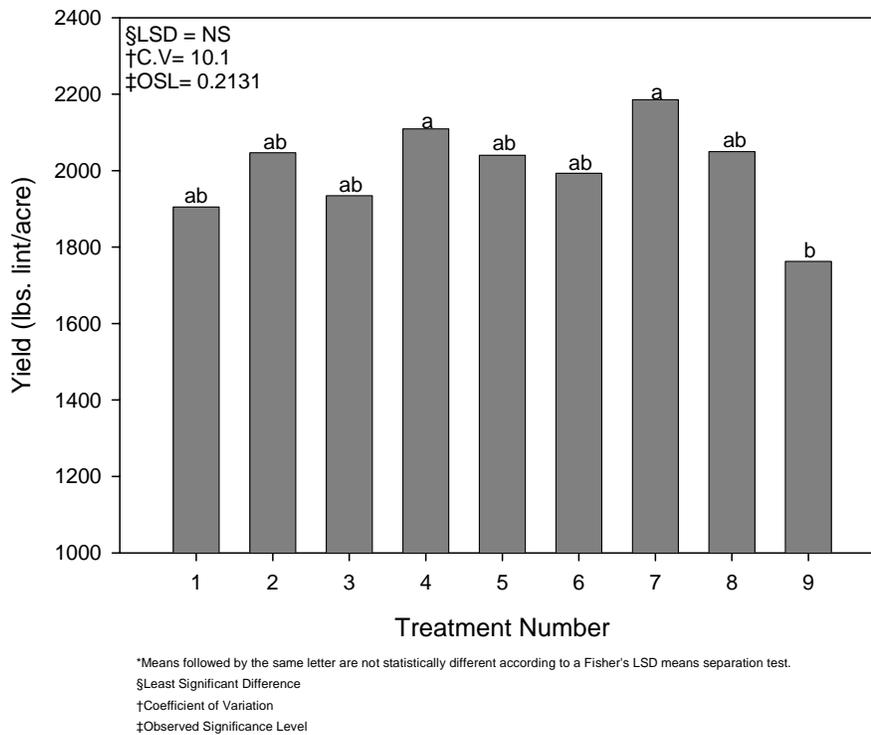


Figure 4. Lint yield estimates for each treatment in the Upland cotton defoliation trial, Safford, Agricultural Center, 2004.