

# Effect of Plant Nitrogen Status on Effectiveness of PIX And Defoliants for Short Season Cotton Production

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## ABSTRACT

*A field study was conducted at the Maricopa Agricultural Center to determine the effect of nitrogen fertility level on the effectiveness of PIX and defoliants for short-season-cotton production. Increasing the nitrogen fertility level from 90 lbs N/A to 240 lbs N/A increased lint yields from 2.23 to 3.14 bales/A, respectively, in a 157-day growing season. PIX treatments did not promote earliness, and resulted in yield reductions. Increasing the application rates of Dropp from 0.1 to 0.2 lbs a.i./A and Def-6 from 0.75 to 1.13 lbs a.i./A resulted in increases in leaf drop. There was a significant linear decrease in the effectiveness of defoliants as the petiole  $\text{NO}_3\text{-N}$  content increased from 850 to 2450 ppm.*

## INTRODUCTION

Recently, there has been interest in Arizona in the use of a short-season-production system for cotton. The short-season system referred to here is a 135- to 150-day season with an approximate 15 August irrigation termination date. This production system has several advantages over a full-season system such as: reduced irrigation and insecticide inputs; it can act as a method of population suppression of pink bollworm and other insects by reducing the overwintering generation and it can result in improved lint quality.

The main disadvantage of the short-season system is that growers face a loss of yield from the elimination of the late-season "top crop." To offset this, the short-season crop should be managed to maximize the production of early bolls. One method of promoting earliness is through the use of growth-regulating chemicals. Growth regulators have potential as a means of manipulating growth to increase the production of early bolls as well as controlling plant growth and reducing production inputs.

Another area of concern for growers in the management of cotton for short-season production is defoliation. For short-season production, the crop must be defoliated in late August or early September when conditions are favorable for vegetative growth, and foliage is often very dense. Limited information is available concerning the management of nitrogen fertility to condition the cotton plant for defoliation, particularly for early termination. The objective of this research was to determine the effect of the nitrogen fertility level on effectiveness of PIX and defoliants for short-season-cotton production. An important aspect of this work was to evaluate the use of petiole nitrate monitoring as a guide to defoliant selection and time of application.

## MATERIALS AND METHODS

Seeds of the cultivar DPL 90 were planted on 7 April 1989 in moist soil at the Maricopa Agricultural Center. The plot area did not receive preplant N fertilizer. A crop of sweet sudan was grown without N fertilizer in the plot area in the summer of 1988 and removed from the field at the end of the season to lower the residual N content of the soil. The N treatments used were: 1) 90 lbs N/A, 2) 150 lbs N/A, and 3) 240 lbs N/A. The N fertilizer was side-dressed on plots on 20 April, 8 June, 21 June, 11 July and 25 July. Soil samples were collected before planting and after harvest to determine the residual N present. The nitrate content of cotton

petioles was monitored throughout the season for N treatment plots. At the time defoliant treatments were applied, petioles and blades were collected from all defoliation plots and analyzed for nitrate-nitrogen content.

Within each of the four N treatment plots, four growth-regulator treatments were established as follows:

- 1 - Check.
- 2 - PIX at 0.02 lbs a.i./A on 16 June (prebloom) and 27 June (early bloom).
- 3 - PIX at 0.04 lbs a.i./A on 27 June (early bloom).
- 4 - PIX at 0.02 lbs a.i./A on 27 June (early bloom) and 11 July.

The cotton plants were approximately 16, 22 and 26 inches in height on 16 June, 27 June and 11 July, respectively. PIX was applied as a foliar spray by a ground rig sprayer. To measure the effect of PIX on earliness, cumulative yield data were collected for growth regulator plots. Open cotton was picked in subplots in each growth regulator plot weekly from 1 August through September. Plant heights were measured in each plot on 4 August and 11 September.

Four defoliation treatments were established as subplots in each growth regulator plot as follows:

- 1 - Dropp at 0.10 lbs a.i./A + crop oil at 0.7 pint/acre.
- 2 - Dropp at 0.20 lbs a.i./A + crop oil at 0.7 pint/acre.
- 3 - Def-6 at 0.75 lbs a.i./A + X-77 at 0.5 pint/acre.
- 4 - Def-6 at 1.13 lbs a.i./A + X-77 at 0.5 pint/acre.

Defoliant chemicals were applied on 11 September with a Hi-Boy sprayer using 5 nozzles per row traveling at 1.5 mph. The total volume of spray was 25 GPA. Defoliation treatment plots were 4 rows wide by 25 feet long. Plots were rated visually 7 and 14 days after application of chemicals. After the 14-day evaluation, all plots received an application of Dropp + Def-6 to prepare the planting for mechanical harvest. The final irrigation for this planting was 25 August. Experimental design was a split-splitplot with four replications. The cotton from 25 feet of the center 2 rows in each defoliation plot was harvested by machine on 2 October.

## RESULTS AND DISCUSSION

The cotton in this test was grown as a short-season crop, although the 157-day season was somewhat longer than the desired 135 to 150 day season. This growing season, 7 April to 11 September, had 3,652 heat units ( $86^{\circ}/55^{\circ}$  F thresholds) and resulted in the production of over three bales of lint/A in the highest N treatment.

Nitrogen fertility treatments had a significant effect on lint yields. The 240 lbs N/A treatment produced higher lint yields (3.14 bales/A) than the 90 lbs and 150 lbs N/A treatments (2.23 and 2.65 bales/A, respectively). Plants in the lowest N treatment (90 lbs N/A) were deficient in N most of the season and were an average of 12 inches shorter in height than plants in the highest N treatment.

In this test, PIX did not promote earliness, and resulted in reductions in lint yield at the final harvest (Table 1). Nitrogen treatments had no effect on the yield response of cotton to PIX treatments (data not shown). Plant height was reduced by PIX and this effect was observed at all N fertility levels.

Defoliation treatments resulted in leaf drop percentages of 80, 74 and 70 in N treatments No. 1-3, respectively. The high percentage of leaf drop in the lowest N treatment was due, in part, to the effects of N deficiency. Plants in N treatment No. 1 were already 30% to 40% naturally defoliated at the time defoliants were applied compared to 10% to 20% for the higher N treatments. Increasing the application rates of Dropp and Def-6 increased the percent leaf drop (Table 2). Dropp and Def-6 gave similar defoliation results. In general, the defoliation treatments tested were not effective in preparing the planting for harvest, particularly in plots with high N application rates, and a second application of defoliants was necessary.

There was a significant linear ( $P < 0.01$ ,  $R = -0.68$ ) decrease in the effectiveness of defoliants as the petiole nitrate content increased. This relationship was obtained from data from the 2 highest N treatments and included a

range of 850 to 2450 ppm in petiole NO<sub>3</sub>-N and a range of 63% to 78% in defoliation percentages. Data from the lowest N treatment were not included because of the high percentage of natural defoliation that had occurred before defoliation treatments were applied. In 1988 we were unable to find a relationship between petiole nitrate content and defoliation (Nelson et al., 1989), but in that test, petiole nitrate values were generally low, below 1500 ppm. More data are needed to define clearly this relationship.

## REFERENCES

Nelson, J. M., R. E. Briggs and G. Hart. 1989. Effect of plant nitrogen status and growth regulators on earliness, effectiveness of defoliants, and yield of Upland cotton. University of Arizona College of Agriculture Cotton Report Series P-77, pp. 65-68.

Table 1. Effect of PIX treatments on lint yield and height of DPL 90 cotton for short-season production.

Treatment	Lint Yield			Plant Ht. 11 Sep.
	16 Aug.	06 Sep.	Final Harvest	
	(lbs/A)			(inches)
PIX-prebloom + early bloom	1544 a <sup>1</sup>	2613 a	3834 b	39 b
PIX-early bloom	1555 a	2726 a	3781 bc	39 b
PIX-early bloom + 14 days later	1547 a	2746 a	3719 c	38 b
Check	1318 a	2620 a	4069 a	44 a

<sup>1</sup> Means followed by the same letter are not significantly different at the 0.05 probability level according to Student-Newman-Keuls Test.

Table 2. Effect of defoliation treatments on leaf drop of DPL 90 cotton for short-season production.

Treatment	Application Rate	Leaf Drop
	(lbs a.i./A)	(%)
Dropp	0.10	72 b <sup>1</sup>
Dropp	0.20	79 a
Def-6	0.75	72 b
Def-6	1.13	76 a

<sup>1</sup> Means followed by the same letter are not significantly different at the 0.05 probability level according to Student-Newman-Keuls Test.