

Effect of Plant Nitrogen Status on Effectiveness of Defoliant for Short Season Cotton Production

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Abstract

A field study was conducted at the Maricopa Agricultural Center to determine the influence of nitrogen fertility level on the effectiveness of defoliant for short-season cotton production. Increasing the nitrogen fertility level from 30 to 130 lbs N/A decreased lint yields from 3.2 to 2.6 bales/A. High residual soil N favored the use of a low N fertility rate. Defoliation treatments were most effective at the 30 lbs. N/A fertility level. Increasing the application rate of Dropp from 0.2 to 0.4 lbs. a.i./A increased the percent defoliation. There was a significant linear decrease in the effectiveness of defoliant as the petiole NO₃-N content increased from 300 to 7000 ppm.

Introduction

Recently, there has been interest 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 production 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; it can act as a method of whitefly control through avoidance; and it can result in improved lint quality. The lower yield potential of a short-season system may be offset by savings from reduced usage of insecticides, water and fertilizer.

An area of concern for growers in the management of cotton for short-season production is preparing the crop for harvest. The short-season crop must be defoliated in early to mid September when conditions are favorable for vegetative growth and the 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.

Research at the Maricopa Agricultural Center in 1989 indicated that there was a significant linear decrease in the effectiveness of defoliant as the petiole NO₃-N content increased (Nelson et al, 1990). The objective of this work was to gather additional information on the effect of nitrogen fertility level on effectiveness of defoliant for short-season cotton production. An important aspect of this work was to again evaluate the use of petiole nitrate monitoring as a guide to defoliant selection and time of application.

Materials and Methods

Seeds of DPL-90 were planted on 10 April, 1990 in moist soil at the Maricopa Agricultural Center. The plot area did not receive preplant N fertilizer. Nitrogen treatments used were: 1) 30 lbs. N/A, 2) 70 lbs. N/A and 3) 130 lbs. N/A. The nitrogen fertilizer was applied in water on 30 May and was side-dressed on plots on 13 June and 13 July. Soil samples were collected before planting and after harvest to determine the residual N present. The nitrate content of the petioles was monitored throughout the season for the 3 nitrogen treatments.

At the time defoliant treatments were applied, petioles were collected from all defoliation treatment plots and analyzed for nitrate-nitrogen content.

Two defoliation treatments were established as subplots in each nitrogen treatment plot as follows: 1- Dropp at 0.2 lbs. a.i./A + Crop oil at 1 pt/A and 2-Dropp at 0.4 lbs a.i./A + Crop oil at 1 pt/A. Each defoliation treatment was replicated 3 times in each nitrogen treatment. Defoliation treatments were applied on 21 September with a Hi-Boy sprayer using 7 nozzles per row and a total spray volume of 29 GPA. Defoliation treatment plots were 4 rows wide by 30 feet long. Plots were rated visually 7 and 14 days after chemicals were applied. The final irrigation for this cotton was 27 August. Experimental design was a split plot with 4 replications of the main plots (nitrogen treatments). The cotton from 30 feet of the center 2 rows in each defoliation plot was harvested by machine on 15 October.

Results and Discussion

The cotton in this test was grown as a short-season crop, although the 164-day season was longer than the desired 135-150 day season. This growing season, 10 April to 21 September, had 3,774 heat units ($86^{\circ}/55^{\circ}\text{F}$ thresholds) and resulted in the production of over three bales of lint/A in the highest yielding nitrogen treatment.

Nitrogen fertility had a significant effect on lint yields. The 30 lbs. N/A treatment produced a higher lint yield (3.2 bales/A) than the 70 and 130 lbs N/A treatments (2.8 and 2.6 bales/A, respectively) Residual soil N was high in this test and the application of 30 lbs. of N/A was adequate for high cotton yields. The two higher N fertility levels resulted in excessive vegetative growth.

The effect of the defoliation treatments on leaf drop of cotton grown at different N fertility levels is shown in Table 1. Defoliation treatments were most effective at the 30 lbs N/A fertility level. A second application of defoliants was necessary to adequately prepare the cotton grown at the two higher N rates for harvest. Increasing the application rate of Dropp from 0.2 to 0.4 lbs a.i./A improved the percent defoliation.

There was a significant ($R = -0.71$, $P < 0.01$) decrease in the effectiveness of Dropp (0.4 lbs. a.i./A) as the petiole $\text{NO}_3\text{-N}$ content increased. This relationship was determined by comparing the percent leaf drop and petiole $\text{NO}_3\text{-N}$ content for each plot sprayed with the high rate of Dropp. A wide range of defoliation and $\text{NO}_3\text{-N}$ values were obtained as shown below:

Defoliation (%)	Average Petiole $\text{NO}_3\text{-N}$ (ppm)
70-74	5,340
75-79	3,850
80-84	1,840
85-89	1,160
90-94	560

These data indicate that there were differences in defoliation percentages at the lower petiole $\text{NO}_3\text{-N}$ levels (below 2,000 ppm). For example, plots with 560 ppm had higher defoliation percentages than plots with 1,840 ppm. In 1989, a similar relationship was obtained over a range of 850 to 2,450 ppm (Nelson, et al, 1990).

The results of this test demonstrate the importance of nitrogen fertility management in preparing upland cotton for September termination. The highest defoliation percentages were obtained when petiole $\text{NO}_3\text{-N}$ content was below 1,000 ppm.

References

Nelson, J.M., R. E. Briggs and G. Hart. 1990. Effect of plant nitrogen status on effectiveness of Pix and defoliants for short-season cotton production. Cotton: A College of Agriculture Report. University of Arizona, Series P-81, pp. 39-42.

Table 1. Effect of nitrogen fertility and defoliation treatments on leaf drop of DPL-90 cotton for short-season production.

Defoliation Treatment ¹	Nitrogen Applied			AVE.
	30 lbs N/A	70 lbs. N/A	130 lbs N/A	
	-----% Defoliation ² -----			
Dropp at 0.2 lbs a.i./A	81	70	65	72
Dropp at 0.4 lbs a.i./A	88	79	75	79
LSD(0.05)				2

¹Defoliation treatments were applied on 17 September.

²Defoliation ratings were 14 days after treatments were applied.