# DEFOLIATION SCREENING STUDY IN AUSTRALIAN (FIBER MAX 819) COTTON

**A. S. Godoy, M. E. Castro and C. E. A. Garcia**
**Cotton Breeder, Weed Specialist and Cotton Specialist**
**INIFAP-SAGAR**
**Mexico**

## Abstract

This study was designed to evaluate the response of Australian cotton (Fiber Max 819) to chemical defoliation. The field experiment was established on April 13, 1999, at southwest of San Pedro, Coahuila, Mexico. The experimental design was a randomized complete block with four replications. Nineteen treatments of defoliation were evaluated and compared with a control without defoliant application. Defoliant evaluation was based on a scale of 0 to 100 (0 meaning no defoliation). Number of bolls and open bolls, dry weight of abscised leaves, seedcotton (kg/ha), yield components, and fiber quality were measured. Butifos, ethephon with cyclanilide alone or with adjuvant and thidiazuron with adjuvant or ethephon and cyclanilide were the best treatments to defoliate Fiber Max cotton variety. Defoliation treatments produced negative effects on seedcotton.

## Introduction

Cotton is one of the most important crops at the Comarca Lagunera region in Mexico. However, the acreage planted with cotton has decreased during the last years due to the lack of water to irrigate it and the low international price. Most of the information on cotton defoliation deals with the performance of defoliants on Deltapine type varieties (Moreno et al., 1998). However, cotton growers are using varieties that are affected in different ways by the defoliant commercially used (Moreno et al., 1998). On the other hand, there are new products to defoliate cotton plants, but their technology is unknown for our conditions. Also, temperature, humidity, and crop maturity (Crawford and Collins, 1989; McWorther, 1982; Penner, 1989 and Snipes and Willis, 1994) affect defoliant maximum efficiency. Penner (1989) and Snipes and Willis (1994) reported that active ingredients of defoliants could be reduced by the use of adjuvant with high levels of defoliation. The objective of this study was to evaluate the response of Australian cotton (Fiber Max 819) to chemical defoliation.

## Materials and Methods

The field experiment was planted to Fiber Max 819 on April 13, 1999, and was located southwest of San Pedro, Coahuila, Mexico. The distance between rows was 0.80 m and the distance between plants was 0.15 m. The experimental design was a randomized complete block with four replications. Nineteen treatments of defoliation were evaluated and compared with a control without application of defoliant (Table 1). The experimental units were four 0.80 m rows by six m long. Defoliants were applied on August 18, 1999. Treatments were broadcast applied with a Robin RS03 sprayer using Tee Jet nozzles at 0.80m spacing. A total volume of 469 l/ha was applied using 40 psi. Wind speed and air temperature ranged from 0-8 km/h and a temperature of 30˚C. Defoliant evaluation was based on a scale of 0 to 100 (0 meaning no defoliation). Number of bolls and open bolls and number of leaves per $m^2$ remaining on the plants after 8 and 15 days after defoliant application were also collected to evaluate the effect of treatments. Seedcotton yield (kg/ha) was determined by harvesting two center rows of each plot. A 20-boll sample of seedcotton was hand picked prior to harvest and yield components and fiber properties were determined from these samples. Fiber analysis was done at Laguna Experiment Station Cotton Fiber Testing Laboratory and included span length in mm, fiber strength in pounds per square inch, and fiber fineness and micronaire index. The cultural practices used during the crop growing season were those normally recommended for cotton production in the Comarca Lagunera region.

## Results and Discussion

### Percent of Defoliation

Table 2 summarizes results of percent of defoliation of cotton plants with different defoliation treatments evaluated during 1999. The data clearly reflect that thidiazuron at 0.050 kg/ha of ai produced a poor defoliation after 8 days of application with a value of 45 per cent. However, defoliation values increased to 94 and 80 per cent when thidiazuron was applied with adjuvant such as ammonium sulfate or oil concentrate, respectively. Butifos applied alone or with adjuvant had a percent of defoliation higher than 95 at 8 or 15 days after treatment application. Respect to dimethipim, results on Table 2 show that alone or mixed with adjuvant had a poor defoliation, percentages ranged from 11 to 42 at 8 or 15 days after their application.

Results on the percent of defoliation with ethephon with cyclanilide indicated that this treatment could be a good alternative to defoliate the Australian cotton variety. Same efficacy was observed when ethephon with cyclanilide were mixed with thidiazuron at 0.050 kg ai/ha or with butifos at 1.8 kg ai/ha. However, as presented before, butifos do not need any adjuvant to produce an optimum defoliation. Treatments with thidiazuron fluid at 0.125 and 0.187 kg of ai/ha had percent of defoliation values lower than 90 percent after 15 days after application.

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**Dry Weight of Abscised Leaves**

The values of dry weight of abscised leaves, in an area of 1.6 $m^2$, for the defoliation treatments are presented in Table 3. Treatments with the highest values of this variable at 8 days after application of defoliant were butifos at 1.8 kg ai/ha alone or mixed with adjuvant; thidiazuron at 0.050 kg/ha of ai mixed with adjuvant and Ethephon with cyclanilide mixed with thidiazuron or butifos. The lowest values of dry weight of abscised leaves were obtained by the hand defoliated control and by dimethipim alone or mixed with adjuvant.

**Number of Bolls and Open Bolls per Plant**

Table 4 presents the values of number of bolls and open bolls per plant of cotton treated with different defoliation treatments. Analysis of variance did not detect significant differences among means obtained with the evaluated products to defoliate the cotton variety Fiber Max 819. This result means that any of the treatments had similar effects in accelerate the time of seedcotton harvest.

**Seedcotton Yield and Yield Components**

Seedcotton yield was significantly affected by the defoliation treatments evaluated in this study (Table 5). Results indicated that when defoliant application was made on Fiber Max cotton variety it did not have enough mature bolls required to obtain the final seedcotton production. Respect to yield components, the analysis of variance detected also highly significant differences among the means of defoliation treatments. However, main negative effects on yield components were produced by pink bollworm that reduced boll size and seed index.

**Fiber Characteristics**

Highly significant differences were detected among treatments for all fiber characteristics (Table 6). However, these differences are not important to explain the effects of defoliant in fiber quality.

## Conclusions

Butifos at 1.8 kg ai/ha, ethephon with Cyclanilide alone or with adjuvant and thidiazuron with adjuvant or ethephon and cyclanilide had the highest percentages of defoliation.

Defoliation treatments produced negative effects on seedcotton production.

Dimethipim did not work as expected to defoliate Fiber Max cotton variety.

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Table 1. Description of defoliation treatments.

| Treatments | Doses kg ai/ha |
|---|---|
| 1. Thidiazuron | 0.050 |
| 2. Thidiazuron + Nonionic surfactant | 0.050 + 0.25 % |
| 3. Thidiazuron + Ammonium Sulfate | 0.050 + 8 kg |
| 4. Thidiazuron + Oil concentrate | 0.050 + 2 l |
| 5. Butifos | 1.8 |
| 6. Butifos + Nonionic surfactant | 1.8 + 0.25% |
| 7. Butifos + Ammonium Sulfate | 1.8 + 8 |
| 8. Butifos + Oil concentrate | 1.8 + 2 l |
| 9. Dimethipim | 0.360 |
| 10. Dimethipim + Nonionic Surfactant | 0.360 + 0.25% |
| 11. Dimethipim + Ammonium Sulfate | 0.360 + 8 |
| 12. Dimethipim + Oil concentrate | 0.360 + 2 l |
| 13. Ethephon + Cyclanilide | 0.072 + 0.009 |
| 14. Thidiazuron + Ethephon + Cyclanilide | 0.050 + 0.072 + 0.009 |
| 15. Butifos + Ethephon + Cyclanilide | 1.8 + 0.072 + 0.009 |
| 16. Dimethipim + Ethephon + Cyclanilide | 0.360 + 0.072 + 0.009 |
| 17. Thidiazuron fluid | 0.125 |
| 18. Thidiazuron fluid | 0.187 |
| 19. Check (hand defoliated) | |
| 20. Check (without defoliant) | |

Table 2. Effect of defoliation treatments on percent of defoliation of Fiber Max 819 cotton variety, 1999.

| | Days after application | |
|---|---|---|
| **Treatment No.** | **8** | **15** |
| 1 | 48 | 86 |
| 2 | 69 | 91 |
| 3 | 94 | 97 |
| 4 | 80 | 96 |
| 5 | 96 | 95 |
| 6 | 95 | 97 |
| 7 | 96 | 97 |
| 8 | 96 | 98 |
| 9 | 14 | 38 |
| 10 | 11 | 43 |
| 11 | 15 | 36 |
| 12 | 14 | 43 |
| 13 | 92 | 86 |
| 14 | 94 | 95 |
| 15 | 97 | 98 |
| 16 | 79 | 74 |
| 17 | 80 | 89 |
| 18 | 80 | 87 |
| 19 | 100 | 100 |
| 20 | 0 | 0 |
| L.S.D. | 16 | 16 |

Table 3. Effect of defoliation treatments on dry weight (g) of abscised leaves of Fiber Max cotton variety, 1999.

| **Treatment No.** | **Days after application** | |
|---|---|---|
| | 8 | 15 |
| 1 | 186 | 56 |
| 2 | 220 | 53 |
| 3 | 239 | 63 |
| 4 | 249 | 66 |
| 5 | 318 | 49 |
| 6 | 298 | 52 |
| 7 | 282 | 54 |
| 8 | 305 | 48 |
| 9 | 105 | 57 |
| 10 | 123 | 51 |
| 11 | 132 | 67 |
| 12 | 138 | 79 |
| 13 | 249 | 54 |
| 14 | 278 | 64 |
| 15 | 324 | 42 |
| 16 | 278 | 55 |
| 17 | 213 | 42 |
| 18 | 278 | 42 |
| 19 | 184 | 0 |
| 20 | 0 | 109 |
| L.S.D. | 0.094 | 0.030 |

Table 4. Effect of defoliation treatments on the number of bolls and open bolls per plant of Fiber Max 819 cotton variety, 1999.

| | **8 Days after application** | | **15 Days after application** | |
|---|---|---|---|---|
| **Treatment No.** | **Bolls** | **Open bolls** | **Bolls** | **Open bolls** |
| 1 | 9.0 | 2.3 | 4.0 | 5.8 |
| 2 | 11.3 | 3.0 | 5.8 | 6.8 |
| 3 | 11.8 | 2.8 | 5.3 | 6.8 |
| 4 | 12.0 | 2.3 | 5.8 | 5.0 |
| 5 | 12.8 | 1.8 | 6.8 | 5.8 |
| 6 | 9.5 | 4.0 | 3.5 | 7.5 |
| 7 | 12.0 | 2.8 | 6.0 | 6.7 |
| 8 | 11.5 | 2.8 | 5.5 | 6.8 |
| 9 | 10.8 | 2.0 | 6.3 | 4.0 |
| 10 | 13.5 | 2.8 | 7.3 | 5.8 |
| 11 | 11.3 | 2.0 | 7.0 | 5.0 |
| 12 | 12.5 | 3.0 | 6.5 | 7.0 |
| 13 | 9.8 | 3.0 | 4.5 | 6.3 |
| 14 | 11.3 | 2.3 | 5.5 | 7.3 |
| 15 | 7.8 | 3.8 | 3.8 | 7.5 |
| 16 | 9.5 | 2.8 | 5.0 | 6.3 |
| 17 | 12.8 | 1.8 | 6.8 | 6.0 |
| 18 | 12.3 | 1.5 | 7.5 | 4.5 |
| 19 | 12.3 | 2.3 | 6.0 | 4.8 |
| 20 | 10.0 | 3.3 | 5.3 | 6.0 |
| L.S.D. | 3.98 | 2.21 | 3.40 | 3.42 |

Table 5. Effect of defoliation treatments on seedcotton and yield components of Fiber Max cotton variety, 1999.

| **Treatment No.** | **Seedcotton (kg/ha)** | **Boll size (g)** | **Lint percent** | **Seed index (g)** |
|---|---|---|---|---|
| 1 | 2,328 | 4.2 | 40.0 | 7.6 |
| 2 | 2,229 | 3.9 | 40.5 | 7.6 |
| 3 | 2,042 | 4.0 | 41.1 | 7.4 |
| 4 | 2,392 | 3.9 | 40.2 | 7.3 |
| 5 | 2,469 | 3.8 | 40.1 | 7.5 |
| 6 | 2,122 | 4.0 | 39.1 | 7.8 |
| 7 | 2,739 | 3.7 | 40.1 | 6.7 |
| 8 | 1,960 | 3.8 | 40.5 | 7.0 |
| 9 | 2,646 | 4.6 | 40.7 | 7.6 |
| 10 | 2,443 | 4.2 | 40.6 | 7.8 |
| 11 | 3,139 | 4.2 | 40.9 | 7.8 |
| 12 | 2,611 | 4.3 | 41.3 | 7.9 |
| 13 | 1,879 | 3.9 | 39.6 | 7.8 |
| 14 | 2,323 | 3.5 | 40.3 | 6.8 |
| 15 | 2,891 | 3.7 | 42.5 | 7.0 |
| 16 | 2,521 | 4.0 | 39.1 | 7.7 |
| 17 | 2,648 | 4.2 | 40.3 | 7.5 |
| 18 | 2,623 | 4.1 | 39.4 | 7.6 |
| 19 | 3,214 | 4.1 | 41.4 | 8.0 |
| 20 | 3,287 | 4.2 | 40.2 | 7.7 |
| L.S.D. | 756 | 0.35 | 1.19 | 0.64 |

Table 6. Effect of defoliation treatments on fiber characteristics of Fiber Max cotton variety, 1999.

| Treatment No. | Length (mm) | Strength[1] | Micronaire[2] |
|---|---|---|---|
| 1 | 27.7 | 83.3 | 3.2 |
| 2 | 27.4 | 84.8 | 3.2 |
| 3 | 27.4 | 78.8 | 3.1 |
| 4 | 27.2 | 80.3 | 3.0 |
| 5 | 27.7 | 80.0 | 3.1 |
| 6 | 27.7 | 83.0 | 3.2 |
| 7 | 27.2 | 78.8 | 2.9 |
| 8 | 27.7 | 79.8 | 3.1 |
| 9 | 27.9 | 81.3 | 3.3 |
| 10 | 28.2 | 81.3 | 3.3 |
| 11 | 27.9 | 87.8 | 3.3 |
| 12 | 27.4 | 80.8 | 3.4 |
| 13 | 27.9 | 80.3 | 2.9 |
| 14 | 27.4 | 84.8 | 2.9 |
| 15 | 27.2 | 81.8 | 2.9 |
| 16 | 27.2 | 81.8 | 2.9 |
| 17 | 27.4 | 87.3 | 3.1 |
| 18 | 27.7 | 85.3 | 3.1 |
| 19 | 27.9 | 85.8 | 3.5 |
| 20 | 27.7 | 82.3 | 3.2 |
| L.S.D. | 1.1 | 2.5 | 0.25 |

[1] Thousands of pounds per square inch.

[2] Micronaire units.