# EFFICACY OF VARIOUS INSECTICIDE TREATMENTS TO CONTROL COTTON APHIDS AND PREVENT ECONOMIC LOSS IN OKLAHOMA IN 1995

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## Abstract

Insecticides at different rates and combinations were used to produce different populations of cotton aphids infesting cotton in Oklahoma. The test was delayed until aphid densities neared 100 aphids/leaf. The E.P.A. established this threshold of 100 aphids/leaf to justify use of Furadan 4F to control mid-season cotton aphid infestation throughout the U.S. under the Section 18 Emergency Exemption Label. Efficacy varied greatly between treatments leading to a wide range of aphid densities which persisted up to 14 DAT. Variation in aphid densities and duration of the infestation after spraying allowed the impact of aphids on boll weight and yield to also be measured. High aphid densities had adverse effects on boll weight and yield, but not on lint grade or strength. There was no negative linear, or negative curvilinear relationship between aphid densities and boll weight or yield 1 DBT. However 3 DAT, 7 DAT, and 14 DAT a significantly negative curvilinear relationship with boll weight and a significantly negative linear relationship with yield occurred. Increased aphid levels reduced boll weight and yield. Significant yield loss occurred by waiting to spray until the E.P.A.'s established action threshold was reached. Action thresholds should be lowered to compensate for time needed to initiate treatment. Maintaining Oklahoma's current economic threshold of 50 aphids/leaf should allow ample time for reaction to initiate control keeping aphid levels below 100 aphids/leaf averting significantly yield loss in infested fields.

## Introduction

Widespread cotton aphid populations developed across the Rolling Plains of Texas and Oklahoma in 1995. Many factors are involved in the development of economically important populations. Besides indiscriminate use of insecticides without regard for economic thresholds and development of organophosphate resistance, there are many interactions that affect population trends. Slosser, et.al. 1989, concluded that an interaction between bioclimate and plant nutritional status stimulated initial population increases.

The relationship between late-season aphid populations found in Oklahoma and yield is not well understood. This experiment was conducted to determine the efficacy of insecticides to control cotton aphids. The test was delayed until aphid densities neared 100 aphids per leaf. The E.P.A. established this threshold of 100 aphids/leaf to justify use of Furadan 4F to control mid-season cotton aphid infestation throughout the U.S. under the Section 18 Emergency Exemption Label. Efficacy varied greatly between treatments leading to a wide range of aphid densities which persisted up to 14 DAT, allowing the impact of aphids on boll weight and yield to also be measured.

## Methods and Materials

The dryland field was planted to Paymaster HS 26 on June 9, 1995, and was located southwest of Granite, OK, in Greer County. A rapidly developing population of cotton aphids was noticed on July 31, 1995. For easy reference, plants sampled were flagged. Sampling began on August 16, 1995, the day before initiation of the test (DBT). Aphid numbers were estimated weekly by sampling 15 leaves from three zones located within the canopy. In addition to flagging plants, leaves were also tagged to allow rapid follow up assessments 3, 7 and 14 days after treatment (DAT). The top position leaf sampled was the first fully expanded leaf (located 3 to 4 nodes below the plant terminal). The middle position leaf sampled was located 5 nodes below the top leaf and the bottom position leaf sampled was located 5 positions below the middle leaf. Aphids/leaf is an average of 3 sampling zones. Pre-treatment counts taken on August 16, 1995, revealed aphid numbers ranging between 66 aphids/leaf to 111 aphids/leaf. The check averaged 98 aphids/leaf. Plot size was 4 rows by 100 ft arranged in C.R.B. design with 3 replications. Insecticide treatments were applied by ground rig on August 17, 1995. The $CO_2$ sprayer was calibrated to deliver 10 gallons finish spray/acre using 8002 nozzles at 22 psi. at 4 mph.

In addition to monitoring aphid levels, 20 bolls located at 6 and 10 nodes below the plant terminal were picked and weighed on September 7, 1995. For convenience of discussion boll weight (ounces) is the average weight of both the 6 and 10 position bolls. Cotton yields were determined by hand-harvesting 13.0 ft of row in each plot on October 24, 1995. Cotton samples were ginned at the Oklahoma Research and Extension Center at Altus, OK, and lint qualities were determined by the USDA Cotton Classing Office at Abilene, TX.

Aphid numbers (number/leaf), boll weight (ounces), yield (lbs/acre) and lint qualities were statistically analyzed using the Duncan's Multiple Range Test at the 95% level of probability unless specifically noted. In addition the data was analyzed to determine the coefficient correlation (R) between aphid density, boll weight and yield.

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## Results and Conclusions

Prior to treatment aphid populations exceeded 66 aphids/leaf in all plots on 8/16/1995 (Table 1). Aphid populations remained high in the check ≥ 98 aphids/leaf 1 DBT, 3 DAT, and 7 DAT. Aphid numbers surpassed 100 aphids/leaf in 4 treatments 3 DAT and in 6 treatments 7DAT. Aphid numbers declined rapidly in all plots. Aphid numbers remained above 50 aphids/leaf in seven treatments 14 DAT. Beneficial insects reduced aphid levels in the check to 24 aphids/leaf 14 DAT.

Precent control ranged from - 16% for Endosulfan 1.0lb. AI/acre to 99% for Furadan .125lb. AI/acre, 3 DAT (Table 2). Percent control increased or remained constant for 11 of the 18 treatments 7 DAT. Only five of the 17 insecticide treatments provided greater than 80% control for all three sampling dates.

Boll weight varied among treatments (Table 3). Greatest boll weight (.58 ounces/boll) occurred in Furadan .25lb AI/acre (significantly greater boll weight occurred in eight of the nine treatments with low aphid-densities than the Check other treatments with higher aphid numbers). Boll weight in these eight treatments were significantly different from the remaining 9 treatments including the Check.

Lint yields are also shown in Table 3. The lower-density aphid plots had produced greater yields than higher-density aphid plots. Bidrin .25lb. AI/acre + Provado .02 AI/acre produced 223 lbs. lint/acre which was significantly different than Endosulfan .5lb. AI/acre 123 lbs. lint/acre and Lorsban .50lb. AI/acre 122 lbs. lint/acre. Aphid numbers have no significant impact on lint quality.

No negative linear relationship existed 1 DBT between aphid numbers and boll weight or yield (Figure 1 and Figure 5). However a significant negative linear relationship occurred between aphid densities and boll weight and yield 3 DAT, 7 DAT and 14 DAT. A slightly better fit ($R^2$) occurred when the boll weight data was compared to aphid densities in a curvilinear relationship (Figure 2, 3 and 4). Boll weight decreased as aphid numbers increased at all three dates until aphids exceeded 80 to 100 aphids/leaf when boll weights improved slightly.

Increase in aphid numbers resulted in a similar yield reduction trend at all three dates. Little difference in yields occurred if aphid numbers remained light (below 20 aphids/leaf). Noticeable yield loss occurred when aphid numbers exceeded 50 aphids/leaf 3 DAT, 7 DAT, or 14 DAT (Figure 5,6, and 8).

To prevent economic loss from occurring, resistant cotton aphid infestations must be sprayed before density levels reach 100 aphids/leaf. Significant injury occurred within 3 days after populations reached and exceeded 100 aphids/leaf. Action thresholds justifying control should be lowered to compensate for time needed to initiate treatment. *Maintaining Oklahoma's current economic threshold of 50 aphids/leaf should allow ample time for reaction to initiate control keeping aphid levels below 100 aphids/leaf averting significantly yield loss in infested cotton fields.*

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## Literature Cited

Slosser, J.E., W.E. Pinchak and D.R. Rummel. 1989. A review of known and potential factors affecting the population dynamics of the cotton aphid. Southwestern Entomol. 14(3): 302-312.

Table 1. Aphid population trends, Kruska Farm, Oklahoma, 1995

| Treatment | Rate Lbs AI/Acre | Aphids/Leaf 1 DBT[1] | 3 DAT | 7 DAT | 14 DAT |
|---|---|---|---|---|---|
| Furadan | 0.25 | 88a | 1e | 1d | 0c |
| Ovasyn/ Provado | 0.125 0.02 | 93a | 15de | 6cd | 2c |
| Bidrin | 0.5 | 66a | 12de | 2cd | 1c |
| Lorsban/ Provado | 0.5 0.02 | 104a | 25de | 13cd | 6c |
| Bidrin/ Ovasyn | 0.25 0.125 | 89a | 20de | 1cd | 1c |
| Bidrin/ Curacron | 0.25 0.25 | 91a | 19de | 3cd | 4c |
| Bidrin/ Provado | 0.25 0.02 | 95a | 14de | 8cd | 1c |
| Provado | 0.04 | 105a | 57bcd | 5cd | 4c |
| Provado | 0.02 | 71a | 18de | 9cd | 5c |
| Check | | 98a | 119a | 111b | 24bc |
| Dibrom | 1.0 | 89a | 1de | 30cd | 64abc |
| Lorsban | 0.5 | 84a | 117ab | 151ab | 86ab |
| Ovasyn | 0.125 | 84a | 104ab | 144ab | 65abc |
| Lannate | 0.25 | 96a | 44cde | 32cd | 52abc |
| Endosulfan | 0.5 | 79a | 101ab | 134ab | 77ab |
| Endosulfan | 1.0 | 112a | 122a | 170a | 57abc |
| Curacron | 0.5 | 82.a | 81abc | 157a | 94a |
| Dimethoate | 0.25 | 81a | 56bcd | 50c | 32abc |

[1] DBT = Days before treatment and DAT = Days after treatment.
[2] Silwet 8oz/Acre added to all treatments.

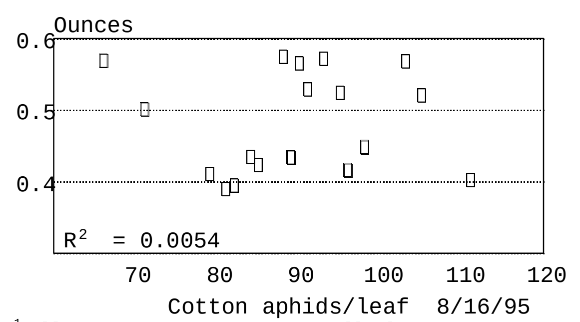
Table 2. Efficacy of insecticide treatments to control cotton aphids, Kruska Farm, Oklahoma, 1995.

| Treatment | Rate Lbs AI/Acre | Percent Control 3 DAT | Percent Control 7 DAT | Percent Control 14 DAT |
|---|---|---|---|---|
| Furadan | 0.25 | 99a | 99a | 100a |
| Ovasyn/<br>Provado | 0.125<br>0.02 | 87a | 95a | 86a |
| Bidrin | 0.5 | 90a | 96a | 79a |
| Lorsban/<br>Provado | 0.5<br>0.02 | 73ab | 80abc | -75a |
| Bidrin/<br>Ovasyn | 0.25<br>0.125 | 84a | 98a | 97a |
| Bidrin/<br>Curacron | 0.25<br>0.25 | 83a | 97a | 79a |
| Bidrin/<br>Provado | 0.25<br>0.02 | 86a | 93a | 92a |
| Provado | 0.04 | 61ab | 94a | 61a |
| Provado | 0.02 | 81a | 86a | 86a |
| Check | | | | |
| Dibrom | 1.0 | 72ab | 71abc | -212a |
| Lorsban | 0.5 | -8d | -72cde | -1114a |
| Ovasyn | 0.125 | 0cd | -126e | -1969a |
| Lannate | 0.25 | 60ab | 63abc | -186a |
| Endosulfan | 0.5 | 6cd | -69bcde | -1902a |
| Endosulfan | 1.0 | -16d | -149e | -1769a |
| Curacron | 0.5 | 23bcd | -94de | -1526a |
| Dimethoate | 0.25 | 51abc | 36abcd | -360a |

Table 3. Impact of varying aphid populations on boll weight and lint production, Kruska Farm, Oklahoma, 1995

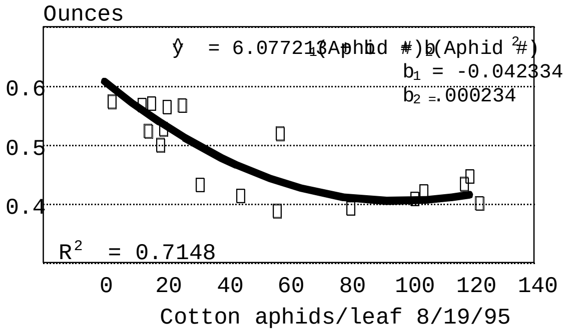
| Treatment | Rate Lbs AI/Acre | Boll Weight (ozs) | Yield Lbs/ Acre | Lint Grade |
|---|---|---|---|---|
| Furadan | 0.25 | .582a | 196ab | 41 |
| Ovasyn/<br>Provado | 0.125<br>0.02 | .579a | 207ab | 41 |
| Bidrin | 0.5 | .576a | 173ab | 41 |
| Lorsban/<br>Provado | 0.5<br>0.02 | .576a | 201ab | 41 |
| Bidrin/<br>Ovasyn | 0.25<br>0.125 | .573a | 212ab | 41 |
| Bidrin/<br>Curacron | 0.25<br>0.25 | .536a | 196ab | 41 |
| Bidrin/<br>Provado | 0.25<br>0.02 | .531a | 223a | 41 |
| Provado | 0.04 | .528a | 153ab | 41 |
| Provado | 0.02 | .509ab | 210ab | 41 |
| Check | | .455bc | 157ab | 41 |
| Dibrom | 1.0 | .441bc | 186ab | 41 |
| Lorsban | 0.5 | .441bc | 122d | 41 |
| Ovasyn | 0.125 | .431c | 145ab | 41 |
| Lannate | 0.25 | .423c | 154ab | 41 |
| Endosulfan | 0.5 | .417c | 123d | 41 |
| Endosulfan | 1.0 | .410c | 137ab | 41 |
| Curacron | 0.5 | .401c | 132ab | 41 |
| Dimethoate | 0.25 | .397c | 176ab | 41 |

Figure 1. Effect of cotton aphids 1 D boll weight[1], Kruska farm, Oklahoma 1995



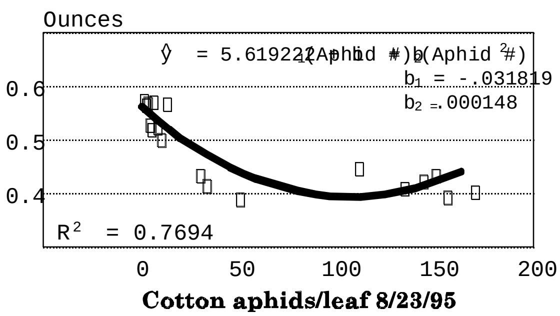

[1]Boll wt. = Average weight of bolls located 6 and 10 positions below plant terminal sampled 9/7/95.

Figure 2. Effect of cotton aphids 3 D
boll weight[1], Kruska farm, Oklahoma 19



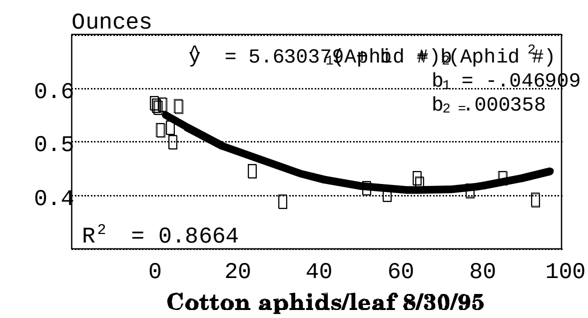

[1]Boll wt. = Average weight of bolls located 6 and 10 positions below plant terminal sampled 9/7/95.

Figure 3. Effect of cotton aphids 7 D
boll weight[1], Kruska farm, Oklahoma 19



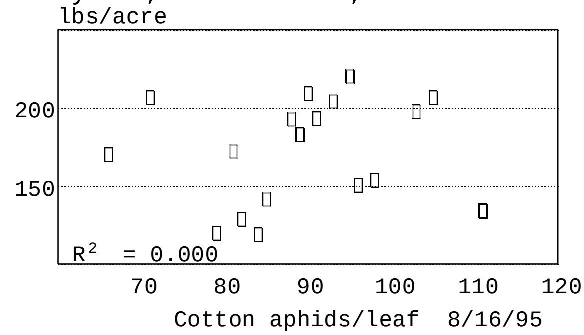

[1]Boll wt. = Average weight of bolls located 6 and 10 positions below plant terminal sampled 9/7/95.

Figure 4. Effect of cotton aphids 14 D
boll weight[1], Kruska farm, Oklahoma 19



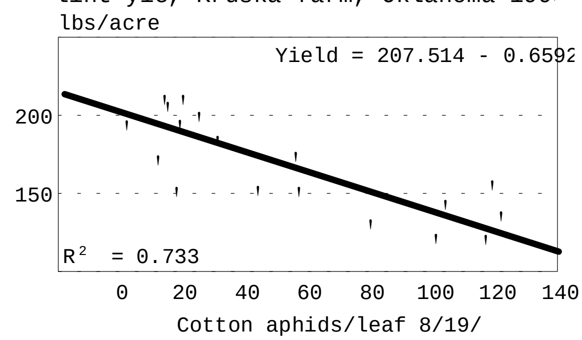

[1]Boll wt. = Average weight of bolls located 6 and 10 positions below plant terminal sampled 9/7/95.

Figure 5. Effect of cotton aphids 1 D
lint yield[1], Kruska farm, Oklahoma 1995.



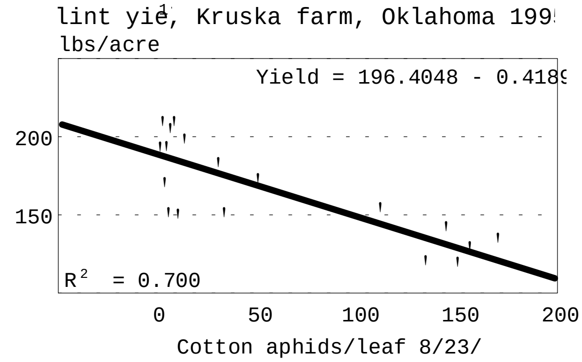

[1]Yield = Lint pounds per acre.

Figure 6. Effect of cotton aphids 3 D
lint yield[1], Kruska farm, Oklahoma 199




[1]Yield = Lint pounds per ac

Figure 7. Effect of cotton aphids 7 D
lint yield[1], Kruska farm, Oklahoma 199




[1]Yield = Lint pounds per ac