

A FIVE YEAR REVIEW OF LYGUS EFFICACY AND COTTON YIELD STUDIES

IN CENTRAL ARIZONA

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Abstract

From 1993 to 1997 more than 25 randomized and replicated small plot cotton insecticide studies have been conducted by DuPont at the University of Arizona, Maricopa Agricultural Center. In these studies, more than 28 different insecticides have been evaluated alone and/or in combination for efficacy on Lygus bugs and whitefly. Impact on secondary pests and beneficial insects were monitored, and all experiments were taken to yield. Lygus adults have been considerably more difficult to control than nymphs for all insecticides tested. Vydate®C-LV, Orthene® and Monitor® applied at 0.5-1.0 lbai/ac have clearly demonstrated the most effective knockdown and residual control of Lygus nymphs. The highest labeled rates have provided the longest residual activity on Lygus nymphs and the highest seed cotton yields.

Introduction

With the advent of Bt cotton varieties (a caterpillar-killing protein derived from a strain of *Bacillus thuringiensis* added to the DNA of cotton plants) to control pink bollworm, *Pectinophora gossypiella* (Saunders), and insect growth regulators (IGR's) to manage whiteflies, *Bemisia tabaci* (Gennadius) a.k.a. *Bemisia argentifolii* (Bellows and Perring), Lygus bugs (*Lygus* spp.) have vaulted to the forefront of importance in Arizona cotton production.

Lygus hesperus (Knight) is by far the most abundant (95%) of all Lygus species found in the cotton growing areas of central and western Arizona. Adults are highly motile, and may move into and out of a cotton field depending on the condition of other plants in the area. They often move at the time local vegetation is drying out, alfalfa is cut, or when safflower matures. Their effect on cotton depends on the length of time they stay in this crop and whether or not they reproduce there. Large nymphal populations are much more destructive than occasional adult immigrations. Young nymphs feed on tender vegetative tissues, but in the third and fourth instars the bugs begin to attack small squares. Feeding by Lygus can significantly reduce cotton yields due to the shedding of immature squares and damage to bolls (Mauney and Henneberry 1978, 1984). Generally, insecticide treatments are not recommended until nymphs are present, indicating a reproducing population.

Infestations that develop before or during the main pink bollworm season, have to be very carefully evaluated before any attempt is made to reduce them with insecticides. The presence of healthy populations of predators and parasites is particularly valuable in managing major pest populations. Symptoms of Lygus damage to squares include puncture marks, yellowish spots of excrement, internal and external discoloration. Excessive feeding on fruiting cotton causes "flaring" and "shedding" of injured squares, blossoms, and small bolls. Prolonged feeding causes unusually tall plants and abnormal branching of the main stem. Lygus economic thresholds are considered to be when square damage reaches 25% with associated presence of nymphs. Sweep net samples are recommended to supplement the square count method. Economic threshold is currently considered to be 15-20 Lygus bugs (nymphs and adults) per 100 sweeps.

For the past five years (1993 to 1997), more than 25 randomized and replicated small plot cotton insecticide studies have been conducted by DuPont at the University of Arizona, Maricopa Agricultural Center. In these studies, more than 28 different insecticides (Table 1) have been evaluated alone and/or in combination for efficacy on Lygus bugs and whitefly. The Maricopa area is notorious for having heavy Lygus pressure in cotton July through September. Lygus adults sampled from the Maricopa area have been found to be the least susceptible population to standard insecticides in the state of Arizona (Dennehy and Russell 1996; Russell et.al., 1997). It is believed that the intensive use of pyrethroid and organophosphate insecticides for whitefly and pink bollworm control in cotton has selected for resistance in Lygus.

The objectives of this research was to: 1) compare various rates of Vydate®C-LV insecticide to standard insecticides used in California and Arizona for Lygus control, 2) determine relative knockdown and residual activity on nymphs and adults, 3) evaluate efficacy on other important pests (i.e. whitefly), 4) monitor impact on beneficial insects, 5) observe compatibility and crop tolerance from multiple applications and tank-mix combinations, 6) compare performance in Bt versus non-Bt cotton, 7) collect seed cotton yields, and ultimately, 8) generate data for the federal registration of Vydate®C-LV for Lygus control in California and Arizona. While there is an incredible volume of data available, time does not permit us to discuss all of the above information. This paper will focus on Lygus efficacy and cotton yield data from at least one representative study each year from 1993-1997.

Materials and Methods

1993 Lygus Efficacy Study

Upland cotton, variety DPL 5415 (Test no: WEC-93-010), was dry planted to 40 inch rows and furrow irrigated for the first time on 1 April. Test site was located in Field 107, Borders 15-18 at the University of Arizona, Maricopa

Agricultural Center. Plots were 4 rows wide by 175 feet long. Three replications were used in a randomized complete block design. A single application was made to fruiting cotton on 17 July. A Spirit hiboy sprayer with CO₂ as a propellant was used for all applications. A front mounted spray boom treated four rows at a time utilizing 3 nozzles per row. Hose drops with swivels were used between rows to direct side nozzles toward the upper third of the cotton plant and one nozzle over the top of each row. Nozzles used were Teejet TJ60 11002. Spray volume was 22 gpa and spray pressure was 30 psi. All treatments included an organosilicone surfactant (Kinetic[®]) at the rate of 0.125% v/v.

Insect pest and beneficial insect sampling methods consisted of taking 50 sweeps per plot, using a standard size insect sweep net. Sweep samples were taken from a middle row to count adult and immature stages of each species at 3, 6 and 10 DAT (days after treatment).

1994 Lygus Efficacy and Cotton Yield Studies

Upland cotton, variety DPL 5415 (WEC-94-014/015), was dry planted to 40 inch rows and furrow irrigated for the first time on 21 April. Test site was in Field 107, Borders 11-13 at the University of Arizona, Maricopa Agricultural Center. Plots were 4 rows wide by 40 feet long, with an 8 foot alleyway between the ends of plots, and a skip row between adjacent plots (4x1 planting pattern). Three replications were used in a randomized complete block design. A single application of each insecticide was made to fruiting cotton on 21 July. A Spirit hiboy sprayer with CO₂ as a propellant was used for all applications. Five follow-up applications were made on 29 July, 4, 12, 24 August, and 2 September with the addition of Danitol 2.4E at 0.20 lbai/ac for whitefly suppression. A front mounted spray boom treated four rows at a time utilizing 3 nozzles per row. Hose drops with swivels were used between rows to direct side nozzles toward the upper third of the cotton plant and one nozzle over the top of each row. Nozzles used were Teejet TJ60 11002. Spray volume was 30 gpa and spray pressure was 35 psi. All treatments included an organosilicone surfactant (Kinetic[®]) at the rate of 0.125% v/v.

Insect pest and beneficial insect sampling methods consisted of taking 20 sweeps per plot, using a standard size insect sweep net. Sweep samples were taken from a middle row to count adult and immature stages of each species on 25 July (4 DAT1) and 1 August (3DAT2).

Seed cotton yields were taken using a two row cotton picker modified for small plot cotton picking on 13 October. The two middle rows by 40 feet were picked from each plot and weighed with an electronic scale.

1995 Lygus Efficacy Study

Upland cotton, variety DPL 5415 (WEC-95-004), was dry planted to 40 inch rows and furrow irrigated for the first time on 7 April. Test site was in Field 3, Border 73-74 at

the University of Arizona, Maricopa Agricultural Center. Plots were 4 rows wide by 50 feet long, with a 9 foot alleyway between the ends of plots, and a skip row between adjacent plots (4x1 planting pattern). Four replications were used in a randomized complete block design. A single application of each insecticide was made to fruiting cotton on 20 July. A John Deere 6000 Hi-Cycle[™] sprayer with compressed air as a propellant was used for all applications. A rear mounted spray boom treated four rows at a time utilizing 3 nozzles per row. Hose drops with swivels were used between rows to direct side nozzles toward the upper third of the cotton plant and one nozzle over the top of each row. Nozzles used were Teejet TJ60 11002. Spray volume was 24 gpa and spray pressure was 36 psi. All treatments included an organosilicone surfactant (Kinetic[®]) at the rate of 0.125% v/v.

Insect pest and beneficial insect sampling methods consisted of taking 25 sweeps per plot, using a standard size insect sweep net. Sweep samples were taken from a middle row to count adult and immature stages of each species on 24 July (4 DAT) and 28 July (8 DAT).

1996 Lygus Efficacy and Cotton Yield Studies

Upland Bt cotton, variety NuCotn 33^B (WEC-96-004), and upland non-Bt cotton, variety DPL 5415 (WEC-96-005), were dry planted to 40 inch rows and furrow irrigated for the first time on 4 April. Test site was in Field 3, Borders 78-80 at the University of Arizona, Maricopa Agricultural Center. Plots were 4 rows wide by 50 feet long, with a 9 foot alleyway between the ends of plots, and a skip row between adjacent plots (4x1 planting pattern). Four replications were used in a split-plot design. Four applications were made to fruiting cotton on 12, 29 July, 20 August, and 5 September. A John Deere 6000 Hi-Cycle[™] sprayer with compressed air as a propellant was used for all applications. A rear mounted spray boom treated four rows at a time broadcast over-the-top. Nine Teejet TJ60 11002 nozzles were used per spray boom. Spray volume was 22 gpa and spray pressure was 40 psi. All treatments included an organosilicone surfactant (Kinetic[®]) at the rate of 0.125% v/v. The first and second applications included an IGR for whitefly suppression. Knack[®]0.86E was applied alone and as a tank-mix with the other insecticide treatments at 0.05 lbai/ac in the first application only 12 July. Applaud[®]70W was applied alone over the previously treated Knack[®] plots and as a tank-mix partner with the other insecticide treatments at 0.35 lbai/ac in the second application only 29 July. The third and fourth applications did not include an IGR with the insecticide treatments.

Insect pest and beneficial insect sampling methods consisted of taking 20 sweeps per plot, using a standard size insect sweep net. Sweep samples were taken from a middle row to count adult and immature stages of each species. One to three sweep count evaluations were made following each application.

Seed cotton yields were taken using a two row cotton picker modified for small plot cotton picking on 8 November. The two middle rows by 50 feet were picked from each plot and weighed with an electronic scale.

1997 Lygus Efficacy and Cotton Yield Studies

Upland Bt cotton, variety NuCotn 33^B (WEC-97-009), and upland non-Bt cotton, variety DPL 5415 (WEC-97-010/011), were dry planted to 40 inch rows and furrow irrigated for the first time on 7 April. Test sites were in Field 3, Borders 75-76 and 78-80, respectively, at the University of Arizona, Maricopa Agricultural Center. Plots were 4 rows wide by 50 feet long, with a 9 foot alleyway between the ends of plots, and a skip row between adjacent plots (4x1 planting pattern). Four replications were used in a randomized complete block design. Four applications were made to fruiting cotton on 22 July, 4, 18 August, and 2 September. A John Deere 6000 Hi-Cycle™ sprayer with compressed air as a propellant was used for all applications. A rear mounted spray boom treated four rows at a time broadcast over-the-top. Nine Teejet TJ60 11002 nozzles were used per spray boom. Spray volume was 22 gpa and spray pressure was 40 psi. All treatments included an organosilicone surfactant (Kinetic®) at the rate of 0.125% v/v.

A late planted cotton study was also conducted in 1997. Upland Bt cotton, variety NuCotn 33^B (WEC-97-012), was dry planted to 40 inch rows and furrow irrigated for the first time on 15 May. Test site was in Field 2, Border 77 at the University of Arizona, Maricopa Agricultural Center. Plots were 4 rows wide by 50 feet long, with a 9 foot alleyway between the ends of plots, and a skip row between adjacent plots (4x1 planting pattern). Three replications were used in a randomized complete block design. Four applications were made to fruiting cotton on 22 July, 4, 18 August, and 2 September. A John Deere 6000 Hi-Cycle™ sprayer with compressed air as a propellant was used for all applications. A rear mounted spray boom treated four rows at a time broadcast over-the-top. Nine Teejet TJ60 11002 nozzles were used per spray boom. Spray volume was 22 gpa and spray pressure was 40 psi. All treatments included an organosilicone surfactant (Kinetic®) at the rate of 0.125% v/v.

Insect pest and beneficial insect sampling methods consisted of taking 20 sweeps per plot, using a standard size insect sweep net, from a middle row to count adult and immature stages of each species. One to three sweep count evaluations were made following each application.

Seed cotton yields were taken using a two row cotton picker modified for small plot cotton picking on 6 October (early planted cotton) and 29 October (late planted cotton). The two middle rows by 50 feet were picked from each plot and weighed with an electronic scale.

Data Analysis

Analysis of variance was used to determine the effects of various insecticide treatments on Lygus nymphs, adults, and all (nymphs & adults). It was also used for seed cotton yields. Means were separated with the Student-Newman-Keuls test for variable.

Results and Discussion

1993 Lygus Efficacy Study

Lygus pressure was extremely heavy in this experiment (WEC-93-010). At the start of this study, Lygus nymph and adult counts averaged 75 Lygus/100 sweeps. Nymph counts made up 80% of the population. Lygus numbers grew to an average of 213 Lygus/100 sweeps in the untreated check plots on 27 July (10 DAT) with nymphs making up 55% of the population.

All insecticides used in this study significantly reduced Lygus nymph counts compared to the untreated check 3, 6 and 10 DAT (Table 2). On the 6 and 10 DAT evaluations, only the pyrethroid Capture® at 0.08 lbai/ac and the untreated check had significantly higher nymph counts than the other insecticide treatments.

Lygus adult counts were not significantly reduced until the 6 DAT evaluation (Table 3). This could be attributed to the maturing of nymphs to adults as the study progressed. Capture® at 0.08 lbai/ac, Monitor® at 1.0 lbai/ac and Vydate®C-LV at 0.75 and 1.0 lbai/ac provided the best numeric reduction in adult counts (53-74% control), but none of the insecticide treatments were significantly different from each other. The last evaluation, conducted on 27 July (10 DAT), showed that all insecticide treatments, with the exception of Capture®, had significantly lower Lygus adults than the untreated check. Again, this is most likely due to the large number of uncontrolled nymphs in these plots developing into adults.

Vydate®C-LV at 0.5-1.0 lbai/ac and Monitor® at 1.0 lbai/ac performed the best on Lygus nymphs during the 3-10 DAT evaluation period providing an average of 94-97% control (Table 5).

1994 Lygus Efficacy and Cotton Yield Studies

Lygus pressure was very high in this study (WEC-94-014/015). At the start of this test, Lygus nymph and adult counts averaged 45 Lygus/100 sweeps. Nymphs counts made up 60% of the population. Lygus numbers grew to an average of 130 Lygus/100 sweeps in the untreated check plots by 1 August (3 DAT2) with nymphs still making up 57% of the population.

All treatments significantly reduced Lygus nymph counts compared to the untreated check 4 DAT1 (Table 6). Curacron® at 0.75 lbai/ac was not as effective as the other

insecticide treatments however, providing only 39% control of *Lygus* nymphs.

Whitefly pressure was extremely heavy in this study. Beginning on 29 July, subsequent applications included Danitol®2.4E at 0.2 lbai/ac as a tank-mix partner, with all insecticide treatments for whitefly suppression.

Lygus nymph control, following two applications and two evaluation dates, showed Vydate®C-LV at 0.25-1.0 lbai/ac, Lannate®LV at 0.5 lbai/ac, and Orthene® at 0.5-0.9 lbai/ac providing greater than 94% control of *Lygus* nymphs 3-4 DAT (Table 7).

Seed cotton yields were significantly better in all insecticide treatments than the untreated check (Table 8). Yields were essentially a mirror image of what the *Lygus* efficacy data showed. The treatments that provided the best *Lygus* nymph efficacy, responded with the best seed cotton yields. Vydate®C-LV at 0.75 and 1.0 lbai/ac, and Orthene® at 0.9 lbai/ac provided the best overall yields, producing an average of 1905, 1938 and 1873 pounds more seed cotton (657, 669 and 646 lbs estimated lint) than the untreated check, respectively.

1995 *Lygus* Efficacy Study

Lygus pressure was very high in this study (WEC-95-004). *Lygus* nymph and adult counts in the untreated check plots averaged 70 *Lygus*/100 sweeps on 24 July (4 DAT) and 89 *Lygus*/100 sweeps on 28 July (8 DAT). Nymph counts made up 71% and 62% of the population on those dates, respectively.

All treatments significantly reduced *Lygus* nymph counts compared to the untreated check 4 and 8 DAT (Table 9-10). Vydate®C-LV at 0.38-0.75 lbai/ac, Orthene® at 0.9 lbai/ac and Lannate®LV at 0.5 lbai/ac were significantly more effective on *Lygus* nymphs than Lorsban® at 0.75 lbai/ac, Provado® at 0.05 lbai/ac, and Capture® at 0.06 lbai/ac 8 DAT.

Following two evaluation dates (4 and 8 DAT), Vydate®C-LV at 0.38-0.75 lbai/ac provided an average of 93-97% control of *Lygus* nymphs (Table 11). Orthene® at 0.9 lbai/ac averaged 89% control, Lannate®LV (76%) , Provado®(64%), Capture®(53%), and Lorsban®(46%)

1996 *Lygus* Efficacy and Cotton Yield Studies

Lygus pressure was again high in both Bt cotton and non-Bt cotton. *Lygus* nymph and adult counts in the untreated check plots averaged 21 *Lygus*/100 sweeps in the Bt cotton on 15 July (3 DAT1), and 25 *Lygus*/100 sweeps in the non-Bt cotton. Nymph counts made up 65% of the population in the Bt cotton and 75% of the population in the non-Bt cotton on this date. *Lygus* counts averaged 141 and 136 *Lygus*/100 sweeps in the untreated check plots 26 July (14 DAT1) in the Bt and non-Bt cotton, respectively.

In the Bt cotton (WEC-96-004), all treatments significantly reduced *Lygus* nymph counts 7 DAT1, with the exception of Knack® alone (Table 12). By the 26 July sweep count evaluation (14 DAT1), only Vydate®C-LV at 1.0 lbai/ac and Orthene® at 0.9 lbai/ac had significantly less *Lygus* nymphs than the untreated check.

Seasonal mean control of *Lygus* nymphs, following four applications and seven evaluations made 3-10 DAT in Bt cotton, showed Vydate®C-LV at 0.5, 0.75 and 1.0 lbai/ac providing 84%, 88% and 95% control, respectively (Table 14). Orthene® at 0.9 lbai/ac gave 95% control, Thiodan® at 0.75 lbai/ac (54%), and Curacron® at 0.75 lbai/ac (40%).

Bt seed cotton yields were significantly higher than the untreated check in all insecticide treatments, with the exception of Curacron® (Table 16). The treatments that provided the best *Lygus* nymph efficacy, responded with the best Bt seed cotton yields. Vydate®C-LV at 0.75 and 1.0 lbai/ac, and Orthene® at 0.9 lbai/ac provided the best overall yields, producing 947, 1250 and 1171 more seed cotton (313, 413 and 386 lbs estimated lint) than the untreated check, respectively.

In the non-Bt cotton (WEC-96-005), all treatments significantly reduced *Lygus* nymph counts compared to the untreated check at 3 and 7 DAT1 (Table 13). By the 26 July sweep count evaluation (14 DAT1) only Vydate®C-LV at 0.75 and 1.0 lbai/ac, and Orthene® at 0.9 lbai/ac had significantly less *Lygus* nymphs than the untreated check.

Seasonal mean control of *Lygus* nymphs, following four applications and seven evaluations made 3-10 DAT in non-Bt cotton, showed Vydate®C-LV at 0.5, 0.75 and 1.0 lbai/ac providing 92%, 96% and 97% control, respectively (Table 15). Orthene® at 0.9 lbai/ac gave 94% control, Thiodan® at 0.75 lbai/ac (74%), and Curacron® at 0.75 lbai/ac (49%).

Non-Bt seed cotton yields were again significantly higher than the untreated check in all insecticide treatments, with the exception of Curacron® (Table 17). The treatments that provided the best *Lygus* nymph efficacy, responded with the best non-Bt seed cotton yields. Vydate®C-LV at 0.75 and 1.0 lbai/ac, and Orthene® at 0.9 lbai/ac provided the best overall yields, producing 1316, 1592 and 1447 pounds more seed cotton (434, 525 and 478 lbs estimated lint) than the untreated check, respectively.

1997 *Lygus* Efficacy and Cotton Yield Studies

The early to mid 1997 cotton growing season in central Arizona was very favorable for cotton planted in early April. By the time *Lygus* nymph populations began to build to treatable levels at UA MAC most of the cotton crop had already been produced on the plant, particularly with the Bt cotton variety NuCotn 33^B.

Lygus pressure was again high in both Bt and non-Bt cotton studies. *Lygus* nymph and adult counts in the untreated

check plots averaged 40 Lygus/100 sweeps in the Bt cotton study on 24 July (2 DAT1), 61-64 Lygus/100 sweeps in the non-Bt cotton studies. Nymph counts made up 43% of the population in the Bt cotton study and 45-47% of the population in the non-Bt cotton studies on this date. Lygus counts averaged 73 and 111-139 Lygus/100 sweeps in the untreated check plots 29 July (10 DAT1) in the Bt and non-Bt cotton studies, respectively.

In the Bt cotton study (WEC-97-009), seasonal mean counts of Lygus nymphs, following four applications and four evaluations at 2 DAT, showed Vydate®C-LV at 0.75 and 1.0 lbai/ac, Orthene® at 1.0 lbai/ac and Monitor® at 1.0 lbai/ac averaged greater than 90-94% knockdown of Lygus nymphs (Table 18). Lannate®LV at 0.68 lbai/ac averaged 80% knockdown, Supracide® at 1.0 lbai/ac (79%), MSR® at 0.5 lbai/ac (67%), and dimethoate at 0.5 lbai/ac (58%).

Seasonal mean counts of Lygus adults, following four applications and four evaluations 2 DAT, showed Vydate®C-LV at 0.75 and 1.0 lbai/ac, Orthene® at 1.0 lbai/ac and Monitor® at 1.0 lbai/ac averaged 44-53% knockdown of Lygus adults. Dimethoate at 0.5 lbai/ac averaged 40% knockdown, Supracide® at 1.0 lbai/ac (36%), Lannate®LV at 0.68 lbai/ac (31%), and MSR® at 0.5 lbai/ac (19%).

In the non-Bt cotton study (WEC-97-010), Vydate®C-LV + non-pyrethroid insecticide tank-mixes (most at their highest labeled rates), were evaluated for Lygus nymph and adult knockdown activity (Table 19). Seasonal mean counts of Lygus nymphs, following four applications and four evaluations at 2 DAT, showed Vydate®C-LV + Monitor® and Orthene® + Monitor® tank-mixes provided the best knockdown of Lygus nymphs (97-98%). Next best were Vydate®C-LV tank-mixes with dimethoate at 0.5 lbai/ac (96%), Lannate®LV at 0.68 lbai/ac (94%), MSR® at 0.5 lbai/ac (91%), Orthene® at 0.5-1.0 lbai/ac (86-90%), and Supracide® at 0.5 lbai/ac (86%).

Seasonal mean counts of Lygus adults, following four applications and four evaluations 2 DAT, showed Vydate®C-LV tank-mixes with Lannate®LV gave the best knockdown of Lygus adults (69%). Vydate®C-LV + Monitor®, Vydate®C-LV + Orthene®, and Orthene® + Monitor® tank-mixes averaged 57% knockdown. Vydate®C-LV tank-mixes with Orthene® at 0.5 lbai/ac (53%) and dimethoate at 0.5 lbai/ac (53%) were the next best. Vydate®C-LV tank-mixes with Supracide® at 0.5 lbai/ac (44%), and MSR® at 0.5 lbai/ac (34%) provided the least effective knockdown of adults 2 DAT.

In the other non-Bt cotton study (WEC-97-011), Vydate®C-LV + pyrethroid insecticide tank-mixes (most at their highest labeled rates), were evaluated for Lygus nymph and adult knockdown activity (Table 20). Seasonal mean counts of Lygus nymphs, following four applications and four evaluations at 2 DAT, showed Vydate®C-LV tank-mixed

with most of the pyrethroids averaged 90-97% knockdown of Lygus nymphs.

Seasonal mean counts of Lygus adults following four applications and four evaluations 2 DAT, showed Vydate®C-LV + Mustang® (85%) and Vydate®C-LV + Baythroid® (82%) gave the best knockdown of Lygus adults. Vydate®C-LV tank-mixes with Karate® (76%), Asana®XL (74%), Decis® (56%), Capture® (54%), and Danitol® (48%) were next best. Orthene® + Capture® averaged 56% knockdown of adults 2 DAT.

Seed cotton yields from the three Lygus efficacy studies discussed above clearly showed that the Bt cotton (WEC-97-009), with products used alone, had its crop already made before the first Lygus treatment was applied on 22 July. While there are numeric increases in yield versus the untreated check, none of the treatments yielded significantly higher seed cotton (Table 21).

Seed cotton yields from the non-pyrethroid tank-mix study (WEC-97-010) on non-Bt cotton, showed that all insecticide treatments had significantly higher seed cotton yields than the untreated check (Table 22). There was no significant differences in seed cotton yields among insecticide treatments, with the exception of Vydate®C-LV + MSR® having significantly less yield than the highest yielding treatment.

Seed cotton yields from the pyrethroid tank-mix study (WEC-97-011) on non-Bt cotton, showed all insecticide treatments had significantly higher seed cotton yields than the untreated check (Table 23). There was no significant difference in seed cotton yields among insecticide treatments.

The late planted Bt cotton study (WEC-97-012), located in the field immediately between the earlier planted studies, was used to evaluate whitefly primarily. However, we did take insect sweep counts 5-7 days following each application. Because of the late planting, this Bt cotton was very lush in growth, and had significantly less fruiting sites when the first whitefly/Lygus applications went on 22 July. Lygus nymph and adults counts in the untreated check plots averaged 25 Lygus/100 sweeps on 28 July (6 DAT1). Nymph counts made up only 27% of the population at this time. Lygus counts in the untreated check plots averaged 52 Lygus/100 sweeps (48% nymphs) on 12 August (7 DAT2), 48 Lygus/100 sweeps (63% nymphs) on 25 August (7 DAT3), and 53 Lygus/100 sweeps (69% nymphs) on 3 September (5 DAT4).

What is interesting about the data from this study, is that we had an opportunity to compare a single Lygus insecticide (Vydate®C-LV at 0.75 lbai/ac) to several tank-mix treatments (Vydate®C-LV + Curacron®, Vydate®C-LV + Orthene®, and Danitol® + Orthene®).

Seasonal mean counts of *Lygus* nymphs, following four applications and four evaluations taken 5-7 DAT, showed Vydate®C-LV applied alone at 0.75 lbai/ac giving an average of 93% control (Table 24). Vydate®C-LV + Orthene® averaged 95% control, and Danitol® + Orthene® averaged 92% control of *Lygus* nymphs. Vydate®C-LV + Curacron® was the least effective treatment with only 73% control on *Lygus* nymphs.

Seasonal mean counts of *Lygus* adults, following four applications and four evaluations taken 5-7 DAT in late planted Bt cotton, showed no significant difference in adult control from the untreated check.

Seed cotton yields from this late planted Bt cotton study was very interesting. All insecticide treatments had significantly higher seed cotton yields than the untreated check (Table 25). Vydate®C-LV alone (198% of check), Vydate®C-LV + Orthene® (252% of check), and Danitol® + Orthene® (232% of check) all had seed cotton yields significantly better than Vydate®C-LV + Curacron® (182% of check). This seed cotton yield data corresponds with the *Lygus* nymph efficacy data. It also indicates, that while the tank-mixture of Vydate®C-LV + Curacron® has been effective in suppressing whitefly populations, Curacron® could be causing some antagonism (reduced activity) in *Lygus* control, that could potentially effect cotton yields under heavy *Lygus* pressure.

Conclusions

Vydate®C-LV, Orthene® and Monitor® applied at 0.5-1.0 lbai/ac have clearly demonstrated the most effective knockdown and residual control of *Lygus* nymphs. The highest labeled rates (1.0 lbai/ac) have provided the longest residual activity on *Lygus* nymphs and the highest seed cotton yields. Tank-mix combinations with pyrethroids have resulted in slightly better adult knockdown, but this activity on adults has been short-lived. Tank-mix combinations of Vydate®C-LV with non-pyrethroid insecticides such as Orthene® and Monitor® have provided numerical increases in *Lygus* control, but not necessarily significant differences versus any of these products used alone at their highest labeled rates. Seed cotton yields taken from each test from 1993-1997 have reflected *Lygus* efficacy results with corresponding yields.

On 20 March 1997 DuPont was granted a Federal registration for *Lygus hesperus* control with Vydate®C-LV insecticide. California accepted the registration on 21 July 1997.

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Table 1. Insecticides evaluated for *Lygus* and whitefly efficacy 1993-1997 by chemical class, trade name, and common name.

<u>Organophosphate</u>	<u>Carbamate</u>	<u>Pyrethroid</u>	<u>Misc.</u>
Bolstar® (sulprofos)	Lannate® (methomyl)	Asana® (esfenvalerate)	Applaud® (buprofezin)
Curacron® (profenofos)	Larvin® (thiodicarb)	Baythroid® (cyfluthrin)	Knack® (pyriproxyfen)
Cygon® (dimethoate)	Vydate® (oxamyl)	Capture® (bifenthrin)	Ovasyn® (amitraz)
Lorsban®/Lock-on® (chlorpyrifos)		Danitol® (fenpropathrin)	Pirate® (chlofenapyr)
Monitor® (methamidophos)		Decis® (deltamethrin)	Plenum® (pymetrozine)
MSR® (oxydemeton-methyl)		Karate® (lambda cyhalothrin)	Provado® (imidacloprid)
Orthene® (acephate)		Mustang® (zeta-cypermethrin)	Steward™ (indoxacarb)
PennCap-M® (methyl-parathion)			Thiodan® (endosulfan)
Supracide® (methidathion)			Tracer® (spinosad)

Table 2. Mean number of Lygus nymphs per 100 sweeps at 3, 6 and 10 Days After Treatment (Maricopa, AZ 1993).

Non-Bt Cot		# Lygus nymphs/100 sweeps		
WEC-93-010	Rate	20 Jul	23 Jul	27 Jul
Treatments ^a	lbai/ac	3 DAT	6 DAT	10 DAT
Vydate C-LV	0.50	5.3 b	7.3 c	2.0 c
Vydate C-LV	0.75	2.0 b	7.3 c	2.0 c
Vydate C-LV	1.00	6.0 b	0.0 c	1.3 c
Thiodan 3E	1.00	11.3 b	11.3 c	20.7 c
Dimethoate 4E	0.50	4.0 b	4.7 c	12.7 c
Supracide 2E	1.00	11.3 b	15.3 c	9.3 c
Monitor 4L	1.00	3.3 b	4.0 c	0.7 c
Capture 2E	0.08	28.7 b	55.3 b	60.0 b
Untreated	-----	60.0 a	93.3 a	96.0 a

Means within a column followed by the same letter are not significantly different.

^aall treatments tank-mixed with Kinetic surfactant at 0.125% v/v and applied on 17 July 1993.

Table 3. Mean number of Lygus adults per 100 sweeps at 3, 6 and 10 DAT (Maricopa, AZ, 1993).

Non-Bt Cot		# Lygus adults/100 sweeps		
WEC-93-010	Rate	20 Jul	23 Jul	27 Jul
Treatments ^a	lbai/ac	3 DAT	6 DAT	10 DAT
Vydate C-LV	0.50	8.7 ab	28.7 b	32.0 bc
Vydate C-LV	0.75	10.7 ab	23.3 b	36.0 bc
Vydate C-LV	1.00	7.3 ab	24.0 b	32.0 bc
Thiodan 3E	1.00	12.7 ab	32.7 b	48.7 bc
Dimethoate 4E	0.50	8.0 ab	34.0 b	39.3 bc
Supracide 2E	1.00	20.0 a	33.3 b	29.3 bc
Monitor 4L	1.00	8.7 ab	23.3 b	20.7 c
Capture 2E	0.08	5.3 ab	16.0 b	77.3 b
Untreated	-----	14.0 ab	60.7 a	117.3 a

Means within a column followed by the same letter are not significantly different.

^aall treatments tank-mixed with Kinetic surfactant at 0.125% v/v and applied on 17 July 1993.

Table 4. Mean number of Lygus nymphs and adults per 100 sweeps at 3, 6 and 10 DAT (Maricopa, AZ 1993).

Non-Bt Cot		# Lygus nymphs & adults/100 sweeps		
WEC-93-010	Rate	20 Jul	23 Jul	27 Jul
Treatments ^a	lbai/ac	3 DAT	6 DAT	10 DAT
Vydate C-LV	0.50	14.0 b	36.0 c	34.0 c
Vydate C-LV	0.75	12.7 b	30.7 c	38.0 c
Vydate C-LV	1.00	13.3 b	24.0 c	33.0 c
Thiodan 3E	1.00	24.0 b	44.0 bc	69.3 c
Dimethoate 4E	0.50	12.0 b	38.7 c	52.0 c
Supracide 2E	1.00	31.3 b	48.7 bc	38.7 c
Monitor 4L	1.00	12.0 b	27.3 c	21.3 c
Capture 2E	0.08	34.0 b	71.3 b	137.3 b
Untreated	-----	74.0 a	154.0 a	213.3 a

Means within a column followed by the same letter are not significantly different.

^aall treatments tank-mixed with Kinetic surfactant at 0.125% v/v and applied on 17 July 1993.

Table 5. Mean number of Lygus per 100 sweeps following a single application and three evaluations made 3, 6 and 10 DAT (Maricopa, AZ 1993).

Non-Bt Cot		# Lygus/100 sweeps 3-10 DAT		
WEC-93-010	Rate	Nymphs	Adults	All
Treatments ^a	lbai/ac	(% Cntrl)	(% Cntrl)	(% Cntrl)
Vydate C-LV	0.50	4.9	23.1	28.0
		(94.1)	(63.9)	(81.0)
Vydate C-LV	0.75	3.8	23.3	27.1
		(95.5)	(63.5)	(81.6)
Vydate C-LV	1.00	2.4	21.1	23.5
		(97.1)	(67.0)	(84.0)
Thiodan 3E	1.00	14.4	31.4	45.8
		(82.6)	(51.0)	(68.9)
Dimethoate 4E	0.50	7.1	27.1	34.2
		(91.4)	(57.7)	(76.7)
Supracide 2E	1.00	12.0	27.5	39.6
		(85.6)	(57.0)	(73.1)
Monitor 4L	1.00	2.7	17.6	20.2
		(96.8)	(72.6)	(86.3)
Capture 2E	0.08	48.0	32.9	80.9
		(42.2)	(48.7)	(45.0)
Untreated	-----	83.1	64.0	147.1

^aall treatments tank-mixed with Kinetic surfactant at 0.125% v/v and applied on 17 July 1993.

Table 6. Mean number of Lygus per 100 sweeps following a single application and evaluated at 4 DAT (Maricopa, AZ 1994).

Non-Bt Cot		# Lygus/100 sweeps 4 DAT		
WEC-94-014	Rate	25 Jul	25 Jul	25 Jul
Treatments ^a	lbai/ac	Nymphs	Adults	All
Vydate C-LV	0.25	6.5 c	6.5 a	13.0 bc
Vydate C-LV	0.50	3.5 c	8.5 a	12.0 bc
Vydate C-LV	0.75	0.0 c	0.0 a	0.0 c
Vydate C-LV	1.00	0.0 c	8.5 a	8.5 bc
Lannate LV	0.25	6.5 c	10.0 a	16.5 bc
Lannate LV	0.50	5.0 c	8.5 a	13.5 bc
Curacron 8E	0.75	23.5 b	13.5 a	37.0 ab
Orthene 90S	0.50	6.5 c	5.0 a	11.5 bc
Orthene 90S	0.90	3.5 c	5.0 a	8.5 bc
Untreated	-----	38.5 a	10.0 a	48.5 a

Means within a column followed by the same letter are not significantly different.

^aall treatments tank-mixed with Kinetic surfactant at 0.125% v/v and applied on 21 July 1994.

Table 7. Mean number of Lygus per 100 sweeps following two applications and two evaluation dates 4 DAT1 and 3 DAT2 (Maricopa, AZ 1994).

Non-Bt Cot WEC-94-015 Treatments ^a	Rate lbai/ac	# Lygus/100 sweeps 3-4 DAT		
		Nymphs (% Cntrl)	Adults (% Cntrl)	All (% Cntrl)
Vydate C-LV	0.25	3.3 (94.2)	11.5 (65.4)	14.8 (83.5)
Vydate C-LV	0.50	3.5 (93.8)	9.3 (72.2)	12.8 (85.7)
Vydate C-LV	0.75	0.0 (100.0)	2.5 (92.5)	2.5 (97.2)
Vydate C-LV	1.00	0.0 (100.0)	7.5 (77.4)	7.5 (91.6)
Lannate LV	0.25	8.3 (85.3)	8.3 (75.2)	16.5 (81.5)
Lannate LV	0.50	3.3 (94.2)	6.0 (82.0)	9.3 (89.6)
Curacron 8E	0.75	18.5 (67.0)	12.5 (62.4)	31.0 (65.3)
Orthene 90S	0.50	3.3 (94.2)	4.3 (87.2)	7.5 (91.6)
Orthene 90S	0.90	1.8 (96.9)	3.3 (90.2)	5.0 (94.4)
Untreated	-----	56.0	33.3	89.3

Means within a column followed by the same letter are not significantly different.

^aall treatments tank-mixed with Kinetic surfactant at 0.125% v/v and applied on 21 July 1994. Danitol 2.4E pyrethroid insecticide was tank-mixed with all treatments for whitefly suppression at 0.20 lbai/ac the next five applications on 29 July, 4, 12, 24 August, and 2 September 1994.

Table 8. Non-Bt cotton yields following six applications for Lygus and whitefly control (Maricopa, AZ 1994)

Non-Bt Cot WEC-94-015 Treatments ^a	Rate lbai/a	13 October lb/ac Seed Cotton	% of Untreat d Check	Est. ^b ba/ac Lint
Vydate C-LV	0.25	3870 abc	158.3	2.67
Vydate C-LV	0.50	4072 abc	166.6	2.81
Vydate C-LV	0.75	4349 a	177.9	3.00
Vydate C-LV	1.00	4382 a	179.3	3.02
Lannate LV	0.25	3772 bc	154.3	2.60
Lannate LV	0.50	3876 abc	158.6	2.67
Curacron 8E	0.75	3652 c	149.4	2.52
Orthene 90S	0.50	4098 abc	167.7	2.83
Orthene 90S	0.90	4317 a	176.6	2.98
Untreated	----	2444 d	100.0	1.69

Means within a column followed by the same letter are not significantly different.

^aall treatments tank-mixed with Kinetic surfactant at 0.125% v/v and applied on 21 July 1994. Danitol 2.4E pyrethroid insecticide was tank-mixed with all treatments for whitefly suppression at 0.20 lbai/ac the next five applications on 29 July, 4, 12, 24 August, and 2 September 1994.

^bEstimated bales/acre lint assumes 34.5% turn-out and 500 lbs lint/bale.

Table 9. Mean number of Lygus per 100 sweeps following a single application and evaluated at 4 DAT (Maricopa, AZ 1995).

Non-Bt Cot WEC-95-004 Treatments ^a	Rate lbai/ac	# Lygus/100 sweeps 4 DAT		
		24 Jul Nymphs	24 Jul Adults	24 Jul All
Vydate C-LV	0.38	3.0 c	16.0 ab	19.0 bc
Vydate C-LV	0.50	1.0 c	14.0 ab	15.0 bc
Vydate C-LV	0.75	1.0 c	3.0 b	4.0 c
Lannate LV	0.50	15.0 bc	15.0 ab	30.0 bc
Lorsban 4E	0.75	25.0 b	12.0 ab	37.0 b
Orthene 90S	0.90	6.0 bc	9.0 ab	15.0 bc
Provado 1.6F	0.05	15.0 bc	23.0 a	38.0 b
Capture 2E	0.06	25.0 b	15.0 ab	40.0 b
Untreated	-----	50.0 a	20.0 ab	70.0 a

Means within a column followed by the same letter are not significantly different.

^aall treatments tank-mixed with Kinetic surfactant at 0.125% v/v and applied on 20 July 1995.

Table 10. Mean number of Lygus per 100 sweeps following a single application and evaluated at 8 DAT (Maricopa, AZ 1995).

Non-Bt Cot WEC-95-004 Treatments ^a	Rate lbai/ac	# Lygus/100 sweeps 8 DAT		
		28 Jul Nymphs	28 Jul Adults	28 Jul All
Vydate C-LV	0.38	4.0 c	22.0 a	26.0 c
Vydate C-LV	0.50	2.0 c	19.0 a	21.0 c
Vydate C-LV	0.75	3.0 c	18.0 a	21.0 c
Lannate LV	0.50	10.0 c	13.0 a	23.0 c
Lorsban 4E	0.75	32.0 b	33.0 a	65.0 ab
Orthene 90S	0.90	6.0 c	18.0 a	24.0 c
Provado 1.6F	0.05	23.0 b	30.0 a	53.0 bc
Capture 2E	0.06	24.0 b	24.0 a	48.0 bc
Untreated	-----	55.0 a	34.0 a	89.0 a

Means within a column followed by the same letter are not significantly different.

^aall treatments tank-mixed with Kinetic surfactant at 0.125% v/v and applied on 20 July 1995.

Table 11. Mean number of Lygus per 100 sweeps following a single application and two evaluations made 4 and 8 DAT (Maricopa, AZ 1995).

Non-Bt Cot WEC-95-004 Treatments ^a	Rate lbai/ac	# Lygus/100 sweeps 4-8 DAT		
		4 DAT (% Cntrl)	8 DAT (% Cntrl)	8 DAT (% Cntrl)
Vydate C-LV	0.38	3.5 (93.3)	19.0 (29.6)	22.5 (71.7)
Vydate C-LV	0.50	1.5 (97.1)	16.5 (38.9)	18.0 (77.4)
Vydate C-LV	0.75	2.0 (96.2)	10.5 (61.1)	12.5 (84.3)
Lannate LV	0.50	12.5 (76.2)	14.0 (48.2)	26.5 (66.7)
Lorsban 4E	0.75	28.5 (45.7)	22.5 (16.7)	51.0 (35.9)
Orthene 90S	0.90	6.0 (88.6)	13.5 (50.0)	19.5 (75.5)
Provado 1.6F	0.05	19.0 (63.8)	26.5 (1.9)	45.5 (42.8)
Capture 2E	0.06	24.5 (53.3)	19.5 (27.8)	44.0 (44.7)
Untreated	-----	52.0	27.0	79.5

^aall treatments tank-mixed with Kinetic surfactant at 0.125% v/v and applied on 20 July 1995.

Table 12. Mean number of Lygus nymphs per 100 sweeps following a single application and evaluated 3, 7 and 14 DAT1 (Maricopa, AZ 1996).

Bt Cotton		# Lygus nymphs/100 sweeps		
WEC-96-004 Treatments ^a	Rate lbai/ac	15 Jul 3 DAT1	19 Jul 7 DAT1	26 Jul 14 DAT1
Vydate C-LV	0.50	6.3 a	3.8 c	42.5 ab
Vydate C-LV	0.75	1.3 a	6.3 c	45.0 ab
Vydate C-LV	1.00	1.3 a	2.5 c	20.0 b
Orthene 90S	0.90	3.8 a	0.0 c	17.5 b
Curacron 8E	0.75	7.5 a	16.3 bc	81.3 ab
Thiodan 3E	0.75	5.0 a	22.5 bc	60.0 ab
Knack 0.86E	0.05	8.8 a	33.8 ab	88.8 a
Untreated	----	13.8 a	43.8 a	85.0 a

Means within a column followed by the same letter are not significantly different.

^aall treatments tank-mixed with Kinetic surfactant at 0.125% v/v and Knack 0.86E at 0.05 lbai/ac (whitefly suppression) and applied on 12 July 1996.

Table 13. Mean number of Lygus nymphs per 100 sweeps following a single application and evaluated 3, 7 and 14 DAT1 (Maricopa, AZ 1996).

Non-Bt Cot		# Lygus nymphs/100 sweeps		
WEC-96-005 Treatments ^a	Rate lbai/ac	15 Jul 3 DAT1	19 Jul 7 DAT1	26 Jul 14 DAT1
Vydate C-LV	0.50	0.0 b	0.0 c	38.8 bc
Vydate C-LV	0.75	0.0 b	0.0 c	15.0 c
Vydate C-LV	1.00	0.0 b	0.0 c	11.3 c
Orthene 90S	0.90	0.0 b	1.8 c	8.8 c
Curacron 8E	0.75	6.3 b	16.3 bc	110.0 a
Thiodan 3E	0.75	1.3 b	11.3 bc	80.0 ab
Knack 0.86E	0.05	7.5 b	28.8 b	70.0 ab
Untreated	----	18.8 a	48.8 a	76.3 ab

Means within a column followed by the same letter are not significantly different.

^aall treatments tank-mixed with Kinetic surfactant at 0.125% v/v and Knack 0.86E at 0.05 lbai/ac (whitefly suppression) and applied on 12 July 1996.

Table 14. Seasonal mean number of Lygus per 100 sweeps following four applications and seven evaluations made 3-10 DAT in Bt cotton (Maricopa, AZ 1996).

Bt Cotton		SM # Lygus/100 sweeps 3-10 DAT		
WEC-96-004 Treatments ^a	Rate lbai/ac	Nymphs (% Cntrl)	Adults (% Cntrl)	All (% Cntrl)
Vydate C-LV	0.50	4.3 (84.3)	16.1 (21.7)	20.4 (57.5)
Vydate C-LV	0.75	3.2 (88.2)	13.0 (36.5)	16.3 (66.0)
Vydate C-LV	1.00	1.4 (94.8)	10.9 (47.0)	12.3 (74.3)
Orthene 90S	0.90	1.4 (94.8)	9.8 (52.2)	11.3 (76.5)
Curacron 8E	0.75	16.4 (39.9)	17.5 (14.8)	33.9 (29.1)
Thiodan 3E	0.75	12.5 (54.3)	17.1 (16.5)	29.6 (38.1)
Untreated	----	27.3	20.5	47.9

^aall treatments tank-mixed with Kinetic surfactant at 0.125% v/v every application. On 12 July, all treatments were tank-mixed with Knack 0.86E at 0.05 lbai/ac for whitefly suppression. On 29 July, all treatments were tank-mixed with Applaud 70W at 0.35 lbai/ac for extended whitefly suppression. Applications on 20 August and 5 September were applied alone.

Table 15. Seasonal mean number of Lygus per 100 sweeps following four applications and seven evaluations made 3-10 DAT in non-Bt cotton (Maricopa, AZ 1996).

Non-Bt Cot		SM # Lygus/100 sweeps 3-10 DAT		
WEC-96-005 Treatments ^a	Rate lbai/ac	Nymphs (% Cntrl)	Adults (% Cntrl)	All (% Cntrl)
Vydate C-LV	0.50	2.7 (91.5)	12.9 (48.9)	15.5 (72.6)
Vydate C-LV	0.75	1.4 (95.5)	11.1 (56.0)	12.5 (78.0)
Vydate C-LV	1.00	1.1 (96.6)	10.5 (58.2)	11.6 (79.6)
Orthene 90S	0.90	2.0 (93.6)	11.1 (56.0)	13.0 (77.0)
Curacron 8E	0.75	16.1 (49.2)	22.0 (12.8)	38.0 (33.0)
Thiodan 3E	0.75	8.4 (73.5)	16.6 (34.0)	25.0 (56.0)
Untreated	----	31.6	25.2	56.8

^aall treatments tank-mixed with Kinetic surfactant at 0.125% v/v every application. On 12 July, all treatments were tank-mixed with Knack 0.86E at 0.05 lbai/ac for whitefly suppression. On 29 July, all treatments were tank-mixed with Applaud 70W at 0.35 lbai/ac for extended whitefly suppression. Applications on 20 August and 5 September were applied alone.

Table 16. Bt cotton yields following four applications for Lygus and whitefly control (Maricopa, AZ 1996).

Bt Cotton		8 November	% of	Est. ^b
WEC-96-004 Treatments ^a	Rate lbai/ac	lb/ac	Untreated	ba/ac
		Seed Cotton	Check	Lint
Vydate C-LV	0.50	3237 b	130.2	2.14
Vydate C-LV	0.75	3434 ab	138.1	2.27
Vydate C-LV	1.00	3737 a	150.3	2.47
Orthene 90S	0.90	3658 a	147.1	2.41
Curacron 8E	0.75	2553 d	102.7	1.68
Thiodan 3E	0.75	2974 c	119.6	1.96
Untreated	----	2487 d	100.0	1.64

Means within a column followed by the same letter are not significantly different.

^aall treatments tank-mixed with Kinetic surfactant at 0.125% v/v every application. On 12 July, all treatments were tank-mixed with Knack 0.86E at 0.05 lbai/ac for whitefly suppression. On 29 July, all treatments were tank-mixed with Applaud 70W at 0.35 lbai/ac for extended whitefly suppression. Applications on 20 August and 5 September were applied alone.

^bEstimated bales/acre lint assumes 33% turn-out and 500 lbs lint/bale.

Table 17. Non-Bt cotton yields following four applications for Lygus and whitefly control (Maricopa, AZ 1996).

Non-Bt Cot		8 November	% of	Est. ^b
WEC-96-005 Treatments ^a	Rate lbai/ac	lb/ac	Untreated	ba/ac
		Seed Cotton	Check	Lint
Vydate C-LV	0.50	3079 b	161.4	2.03
Vydate C-LV	0.75	3224 ab	169.0	2.13
Vydate C-LV	1.00	3500 a	183.4	2.31
Orthene 90S	0.90	3355 ab	175.8	2.21
Curacron 8E	0.75	2171 d	113.8	1.43
Thiodan 3E	0.75	2553 c	133.8	1.68
Untreated	----	1908 d	100.0	1.26

Means within a column followed by the same letter are not significantly different.

^aall treatments tank-mixed with Kinetic surfactant at 0.125% v/v every application. On 12 July, all treatments were tank-mixed with Knack 0.86E at 0.05 lbai/ac for whitefly suppression. On 29 July, all treatments were tank-mixed with Applaud 70W at 0.35 lbai/ac for extended whitefly suppression. Applications on 20 August and 5 September were applied alone.

^bEstimated bales/acre lint assumes 33% turn-out and 500 lbs lint/bale.

Table 18. Seasonal mean number of Lygus per 100 sweeps following four applications and four evaluations made 2 DAT in Bt cotton (Maricopa, AZ 1997).

Bt Cotton		SM # Lygus/100 sweeps 2 DAT		
WEC-97-009 Treatments ^a	Rate lbai/ac	Nymphs (% Cntrl)	Adults (% Cntrl)	All (% Cntrl)
Vydate C-LV	0.75	1.6 (94.4)	6.9 (52.8)	8.4 (80.3)
Vydate C-LV	1.00	2.8 (90.0)	7.8 (46.4)	10.6 (75.2)
Lannate LV	0.68	5.6 (80.0)	10.0 (31.3)	15.6 (63.5)
MSR 2E	0.50	9.4 (66.6)	11.9 (18.5)	21.3 (50.4)
Dimethoate 4E	0.50	11.9 (57.7)	8.8 (39.9)	20.6 (51.8)
Supracide 2E	1.00	5.9 (78.8)	9.4 (35.6)	15.3 (64.2)
Orthene 90S	1.00	2.2 (92.2)	8.1 (44.2)	10.3 (75.9)
Monitor 4L	1.00	2.5 (91.1)	7.8 (46.4)	10.3 (75.9)
Untreated	----	28.1	14.6	42.8

^aall treatments tank-mixed with Kinetic surfactant at 0.125% v/v and applied on 22 July, 4, 18 August, and 2 September 1997.

Table 19. Seasonal mean number of Lygus per 100 sweeps following four applications and four evaluations made 2 DAT in non-Bt cotton (Maricopa, AZ 1997).

Non-Bt Cot		SM # Lygus/100 sweeps 2 DAT		
WEC-97-010 Treatments ^a	Rate lbai/ac	Nymphs (% Cntrl)	Adults (% Cntrl)	All (% Cntrl)
Vydate C-LV +	1.00 +	1.9 (94.6)	5.9 (68.9)	7.8 (85.4)
Lannate LV	0.68			
Vydate C-LV +	1.00 +	3.1 (90.9)	12.5 (34.4)	15.6 (70.8)
MSR 2E	0.50			
Vydate C-LV +	1.00 +	1.6 (95.5)	9.1 (52.5)	10.6 (80.1)
Dimethoate 4E	0.50			
Vydate C-LV +	1.00 +	5.0 (85.5)	10.6 (44.3)	15.6 (70.8)
Supracide 2E	0.50			
Vydate C-LV +	1.00 +	3.4 (90.0)	9.1 (52.5)	12.5 (76.6)
Orthene 90S	0.50			
Vydate C-LV +	1.00 +	4.7 (86.4)	8.1 (57.4)	12.8 (76.0)
Orthene 90S	1.00			
Vydate C-LV +	1.00 +	0.9 (97.3)	8.1 (57.4)	9.1 (83.0)
Monitor 4L	1.00			
Orthene 90S +	1.00 +	0.6 (98.2)	8.1 (57.4)	8.8 (83.6)
Monitor 4L	1.00			
Untreated	----	34.4	19.1	53.4

^aall treatments tank-mixed with Kinetic surfactant at 0.125% v/v and applied on 22 July, 4, 18 August, and 2 September 1997.

Table 20. Seasonal mean number of Lygus per 100 sweeps following four applications and four evaluations made 2 DAT in non-Bt cotton (Maricopa, AZ 1997).

Non-Bt Cot		SM # Lygus/100 sweeps 2 DAT		
WEC-97-011 Treatments ^a	Rate lbai/ac	Nymphs (% Cntrl)	Adults (% Cntrl)	All (% Cntrl)
Vydate C-LV +	1.00 +	3.1 (92.9)	4.4 (74.1)	7.5 (87.7)
Asana XL	0.05			
Vydate C-LV +	1.00 +	1.6 (96.5)	3.1 (81.5)	4.7 (92.3)
Baythroid 2E	0.05			
Vydate C-LV +	1.00 +	4.4 (90.1)	8.8 (48.2)	13.1 (78.5)
Danitol 2.4E	0.20			
Vydate C-LV +	1.00 +	5.0 (88.7)	7.5 (55.6)	12.5 (79.5)
Decis 1.5E	0.03			
Vydate C-LV +	1.00 +	1.9 (95.7)	4.1 (75.9)	5.9 (90.3)
Karate 1E	0.04			
Vydate C-LV +	1.00 +	2.2 (95.0)	2.5 (85.2)	4.7 (92.3)
Mustang 1.5E	0.05			
Vydate C-LV +	1.00 +	3.4 (92.2)	7.8 (53.7)	11.3 (81.5)
Capture 2E	0.08			
Orthene 90S +	1.00 +	1.6 (96.5)	7.5 (55.6)	9.1 (85.1)
Capture 2E	0.08			
Untreated	----	44.1	16.9	60.9

^aall treatments tank-mixed with Kinetic surfactant at 0.125% v/v and applied on 22 July, 4, 18 August, and 2 September 1997.

Table 21. Bt cotton yields following four applications for Lygus control (Maricopa, AZ 1997).

Bt Cotton	Rate lbai/ac	6 October lb/ac	% of Untreated	Est. ^b lb/ac
WEC-97-009 Treatments ^a		Seed Cotton	Check	Lint
Vydate C-LV	0.75	4075 a	110.6	2.69
Vydate C-LV	1.00	4095 a	111.2	2.70
Lannate LV	0.68	3915 a	106.3	2.58
MSR 2E	0.50	3896 a	105.8	2.57
Dimethoate 2E	0.50	3533 a	95.9	2.33
Supracide 2E	1.00	4066 a	110.4	2.68
Orthene 90S	1.00	4043 a	109.7	2.67
Monitor 4L	1.00	4199 a	114.0	2.77
Untreated	----	3684 a	100.0	2.43

Means within a column followed by the same letter are not significantly different.

^aall treatments tank-mixed with Kinetic surfactant at 0.125% v/v and applied on 22 July, 4, 18 August, and 2 September 1997..

^bEstimated bales/acre lint assumes 33% turn-out and 500 lbs lint/bale.

Table 22. Non-Bt cotton yields following four applications for Lygus control (Maricopa, AZ 1997).

Non-Bt Cot WEC-97-010 Treatments^a	Rate lbai/ac	6 October lb/ac Seed Cotton	% of Untreated Check	Est.^b ba/ac Lint
Vydate C-LV +	1.00 +	3364 ab	119.6	2.22
Lannate LV	0.68			
Vydate C-LV +	1.00 +	3164 b	112.5	2.09
MSR 2E	0.50			
Vydate C-LV +	1.00 +	3393 ab	120.7	2.24
Dimethoate 4E	0.50			
Vydate C-LV +	1.00 +	3566 a	126.8	2.35
Supracide 2E	0.50			
Vydate C-LV +	1.00 +	3279 ab	116.6	2.16
Orthene 90S	0.50			
Vydate C-LV +	1.00 +	3393 ab	120.7	2.24
Orthene 90S	1.00			
Vydate C-LV +	1.00 +	3504 ab	124.6	2.31
Monitor 4L	1.00			
Orthene 90S +	1.00 +	3386 ab	120.4	2.23
Monitor 4L	1.00			
Untreated	----	2812 c	100.0	1.86

Means within a column followed by the same letter are not significantly different.

^aall treatments tank-mixed with Kinetic surfactant at 0.125% v/v and applied on 22 July, 4, 18 August, and 2 September 1997.

^bEstimated bales/acre lint assumes 33% turn-out and 500 lbs lint/bale

Table 23. Non-Bt cotton yields following four applications for Lygus control (Maricopa, AZ 1997).

Non-Bt Cot WEC-97-011 Treatments^a	Rate lbai/ac	6 October lb/ac Seed Cotton	% of Untreated d Check	Est.^b ba/ac Lint
Vydate C-LV +	1.00 +	3605 a	130.3	2.38
Asana XL	0.05			
Vydate C-LV +	1.00 +	3648 a	131.9	2.41
Baythroid 2E	0.05			
Vydate C-LV +	1.00 +	3426 a	123.9	2.26
Danitol 2.4E	0.20			
Vydate C-LV +	1.00 +	3703 a	133.9	2.44
Decis 1.5E	0.03			
Vydate C-LV +	1.00 +	3599 a	130.1	2.38
Karate 1E	0.04			
Vydate C-LV +	1.00 +	3412 a	123.4	2.25
Mustang 1.5E	0.05			
Vydate C-LV +	1.00 +	3494 a	126.3	2.31
Capture 2E	0.08			
Orthene 90S +	1.00 +	3736 a	135.1	2.47
Capture 2E	0.08			
Untreated	----	2766 b	100.0	1.83

Means within a column followed by the same letter are not significantly different.

^aall treatments tank-mixed with Kinetic surfactant at 0.125% v/v and applied on 22 July, 4, 18 August, and 2 September 1997.

^bEstimated bales/acre lint assumes 33% turn-out and 500 lbs lint/bale.

Table 24. Seasonal mean number of Lygus per 100 sweeps following four applications and four evaluations made 5-7 DAT in late planted Bt cotton (Maricopa, AZ 1997).

Bt Cotton WEC-97-012 Treatments^a	Rate lbai/ac	SM # Lygus/100 sweeps 5-7 DAT		
		Nymphs (% Cntrl)	Adults (% Cntrl)	All (% Cntrl)
Vydate C-LV	0.75	1.7 (93.2)	22.1 (0.0)	23.8 (46.7)
Vydate C-LV +	0.75 +	6.7 (72.9)	17.9 (10.4)	24.6 (44.9)
Curacron 8E	0.75			
Vydate C-LV +	0.75 +	1.3 (94.9)	18.8 (6.3)	20.0 (55.1)
Orthene 90S	0.75			
Danitol 2.4E +	0.20 +	2.1 (91.5)	16.7 (16.7)	18.8 (57.9)
Orthene 90S	0.75			
Untreated	----	24.6	20.0	44.6

^aall treatments tank-mixed with Kinetic surfactant at 0.125% v/v and applied on 22 July, 5, 18, 29 August 1997.

Table 25. Late planted (15 May) Bt cotton yields following four applications for Lygus and whitefly control (Maricopa, AZ 1997).

Bt Cotton WEC-97-012 Treatments^a	Rate lbai/ac	29 October lb/ac Seed Cotton	% of Untreated Check	Est.^b ba/ac Lint
Vydate C-LV	0.75	1850 abc	197.6	1.22
Vydate C-LV +	0.75 +	1702 bc	181.8	1.12
Curacron 8E	0.75			
Vydate C-LV +	0.75 +	2355 a	251.6	1.55
Orthene 90S	0.75			
Danitol 2.4E +	0.20 +	2173 ab	232.2	1.43
Orthene 90S	0.75			
Untreated	----	936 d	100.0	0.62

Means within a column followed by the same letter are not significantly different.

^aall treatments tank-mixed with Kinetic surfactant at 0.125% v/v and applied on 22 July, 5, 18, 29 August 1997.

^bEstimated bales/acre lint assumes 33% turn-out and 500 lbs lint/bale.