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PRELIMINARY EXAMINATION OF THE EFFECTS OF LORSBAN APPLICATIONS FOR PINK BOLLWORM CONTROL ON BENEFICIAL AND SECONDARY PEST POPULATIONS

C. Scott Bundy and Brad Lewis
Department of Entomology, Plant Pathology, and Weed Science
New Mexico State University
Las Cruces, NM

Abstract

The effects of Lorsban 4E applications for pink bollworm control were assessed for populations of beneficial arthropods and secondary pests on Acala cotton in New Mexico. Treatments consisted of early-, mid-, late-season, and season-long applications of lorsban applied at 10-day intervals. Populations of beneficials and plant bugs were estimated with a suction sampler, aphids with leaf counts, and pink bollworm with examination of bolls. Aphid populations were very low this season –peaking at an average of slightly over 4 per leaf. Late-season pink bollworm infestations reached as high as 56.3% in the late season treatment. Lorsban applications did not appear to affect the seasonal abundance of the majority of predaceous Heteroptera, lacewings, or plant bugs. Only populations of Geocoris and spiders were significantly less than the control. Lady beetle numbers were significantly lower numbers in the 1AP and 2 AP treatments. This is likely credited to low aphid populations that did not begin to build until just prior to the beginning of the 3AP treatment. Based on one year's research, results indicate that repeated use of Lorsban 4E in southern New Mexico during a light aphid year should not result in an increase of cotton aphids above that of an untreated field. Possible reasons for these results are briefly discussed.

Introduction

The pink bollworm, *Pectinophora gossypiella* (Saunders), is a key pest of cotton in the western United States, particularly Arizona, California, New Mexico, and west Texas. In recent years New Mexico cotton has been greatly impacted by pink bollworm and the boll weevil. New Mexico is presently in a Boll Weevil Eradication Project (BWEP), and the initiation of an eradication project for pink bollworm (PBWEP) is under consideration. In nearby El Paso and the Trans-Pecos Valley of Texas, an active pink bollworm eradication project is currently underway. According to the New Mexico Department of Agriculture (Sherry Sanderson, personal communication), Lorsban 4E (chlorpyrifos) will be the insecticide of choice if a pink bollworm eradication project is initiated in the state.

Pink bollworm, like the boll weevil, has been a difficult pest to control because it is exposed only briefly as an egg and as an adult. The larval stage is passed well protected within squares and bolls. Therefore, chemical control targets adult mating flights. The use of malathion required by the BWEP often results in increased whitefly and cotton aphid populations (Layton et al. 1999). These pests, generally maintained at subeconomic levels, often develop extremely high populations with sustained insecticide use required in BWEP and implicated in a PBWEP (Leonard et al. 1999). These sucking insects become increasingly important as late season pests because of the resulting "sticky" cotton (Henneberry et al. 2000). Sticky cotton is difficult to gin, and in many places not accepted.

Lorsban 4E, a broad spectrum organophosphate insecticide, has longer residual activitiy than malathion. Efficacy of Lorsban 4E on cotton aphids appears to be variable depending upon the host plant and the environment (Godfrey and Fuson 2001). Populations of beneficials can be reduced by lorsban applications. However, seasonal abundance of certain beneficials may not be significantly affected (Braman and Pendley 1993). The goal of this ongoing study is to evaluate the impact that repeated applications of Lorsban 4E, similar to those from an eradication program, may have on beneficial and secondary pest populations in southern New Mexico cotton.

Materials and Methods

Experimental Design

This study was initiated in 2001 at the Leyendecker Plant Sciences Research Center near Las Cruces, New Mexico. A two-acre field planted to Acala 1517-99 cotton was utilized for this study. The cotton was planted on 40-in bed spacings, furrow irrigated, and grown using agronomic practices for the area. Each plot was 10 rows by 35 feet in length (0.02 acres). Four untreated rows and six-foot alleys separated adjacent plots. Treatments consisted of Lorsban 4E applied at 2 pints per acre during four periods of the growing season. Treatment periods were season-long, early season only, mid-season only, and late-season only applications of Lorsban 4E. Except for season-long, all other treatment periods consisted of three sequential Lorsban 4E applications made at approximately 10-day intervals. Nine Lorsban 4E applications were made to the season-long plots (ALL) starting on June 20 and continued through September 20 at 10-day intervals. Early season applications

(1AP) were initiated on June 20 and continued through July 9. Mid-season applications (2AP) were initiated on August 2 and continued through August 18. Late-season applications (3AP) were initiated on August 28 and continued through September 17. Treatments, including an untreated check (UNT), were replicated four times. Sampling was initiated at squaring and continued until plant maturity. Data for seasonal arthropod abundances were analyzed using a split plot in time model using an ANOVA (SAS Institute 1999).

Arthropod Evaluations

Cotton aphid populations were evaluated by counting the number of aphids on 20 upper and 20 lower canopy leaves that were randomly selected from each plot. Aphid evaluations were initiated prior to first bloom and continued until plant senescence.

Pink bollworm moth populations were monitored throughout the season using delta traps baited with gossyplure (Trécé® pherocon). Traps were placed throughout the farm. Pink bollworm damage was evaluated at the end of the season by cutting 20 bolls randomly collected from each plot on two consecutive weeks. Other arthropod populations, including beneficials, were evaluated by using a suction sampler on one randomly selected row in each plot. Each sample was bagged, returned to the laboratory, and frozen until it could be counted.

Results

Numbers of cotton aphids per leaf for the first year of the study are found in Figure 1. Aphids were not detected until mid August, and no treatment reached an economic level during this study. Populations peaked at 4.2 per leaf in the 1AP treatment. ALL plots averaged 1.7 aphids per leaf at the end of the season –significantly fewer than the untreated check and the 1 AP treatments at 3.2 and 4.2 respectively. Aphid herbivory did not result in the accumulation of honeydew in any of the plots.

No Lorsban 4E insecticide treatment resulted in less than 27% pink bollworm infested green bolls at the end of the season (Figure 2). UNT plots averaged the greatest number of damaged bolls at 38.8%, and the ALL treatments the least at 27.5% for the September 20 evaluations. Seven days later, percent pink bollworm-damaged bolls increased in all plots with the 3AP treatment the highest at 56.3% and 2AP the lowest at 35.0%.

Seasonal Arthropod Densities

Predator populations remained consistent in cotton. Heteropteran bugs were the most numerous predators in this system. *Orius* was seasonally most abundant (42%), followed by nabids (33%), *Geocoris* (13%), followed by *Deraeocoris* (5%), assassin bugs (4%), and berytids (3%) (Figure 3). As a group predaceous Heteroptera were significantly less abundant in the ALL and 1AP treatments of Lorsban than the 2AP and 3AP, but not significantly different from the UNT (Figure 4). Individually, of the predatory bugs only *Geocoris* was found to be significantly less abundant in the ALL than the UNT. This was also true of spiders. Lady beetle populations were significantly lower in the 1AP and 2AP treatments than the other treatments. Lacewings (99% of which were green lacewings) were not significantly different among any treatment. Phytophagous plant bugs were seasonally the most common pest group in cotton. Lygus composed only a small portion of these numbers (12%), and the majority were various phytophagous mirids (88%) including blackmarked and cotton fleahoppers. No significant differences among treatments were observed for these insects.

Conclusions

Although aphids were present in the field, the 2001 growing season was not considered a heavy aphid year in southern New Mexico cotton. Season-long applications of Lorsban 4E did not result in an increase in aphid populations above that of the untreated check. No Lorsban 4E applications appeared to affect the seasonal abundance of the majority of predaceous Heteroptera, lacewings, or phytophagous plant bugs. Only populations of *Geocoris* and spiders were significantly less than the control. The significantly lower numbers of lady beetles in the 1AP and 2 AP treatments is likely credited to low aphid populations that did not begin to build until just prior to the beginning of the 3AP treatment.

Reasons for Lorsban’s failure to affect the populations of the majority of beneficial arthropods examined in this study include tolerance to the insecticide and continued reinfestation from surrounding fields. Lorsban 4E manufacturer’s claims include ‘quick recolonization of beneficials’ following applications. Agriculture in southern New Mexico includes significant alfalfa acreage interspersed among small fields of a wide variety of crops. Alfalfa is a well-known feeder of beneficials that readily move into surrounding fields when hay is cut. Immigration of beneficials (and plant bugs) could affect seasonal abundance of these insects in cotton following Lorsban 4E applications.

Based on one year's research, results indicate that repeated use of Lorsban 4E during a light aphid year should not result in an increase of cotton aphids above that of an untreated field. Findings indicate that Lorsban 4E may still be somewhat efficacious on cotton aphids in southern New Mexico and/or impact on principle beneficials is minimal with respect to aphid herbivory.

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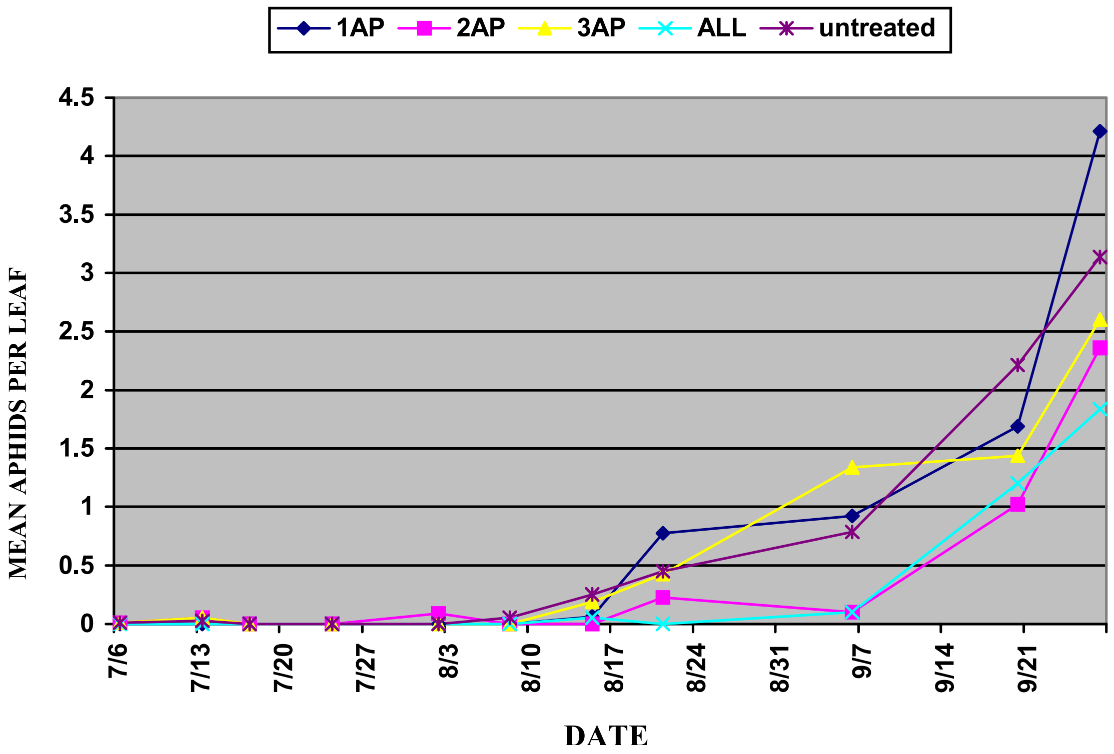

Figure 1. Mean number of aphids per cotton leaf at Leyendecker Farm, 2001.

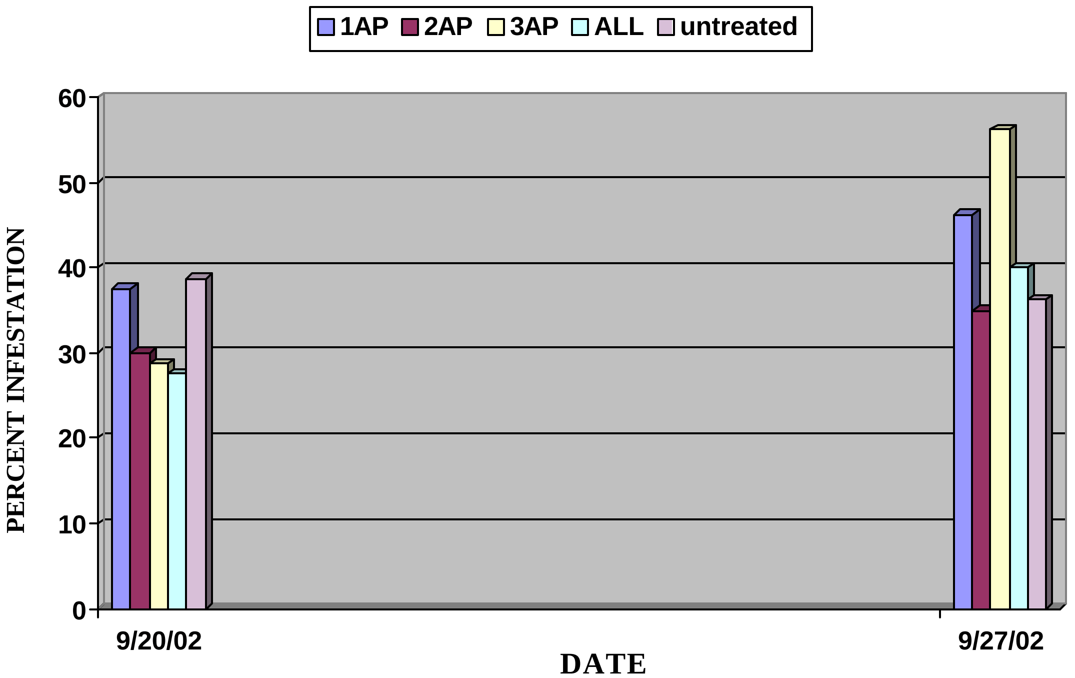

Figure 2. Percentages pink bollworm-infested green bolls collected from cotton plots at Leyendecker Farm, 2001.

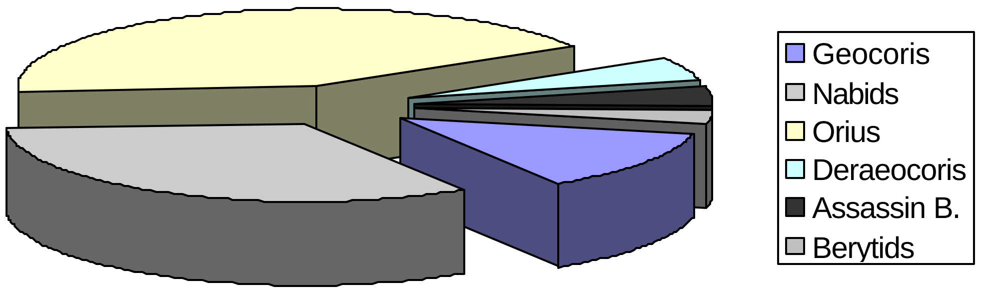

Figure 3. Total numbers of beneficial Heteroptera in New Mexico Cotton at Leyendecker Farm, 2001.

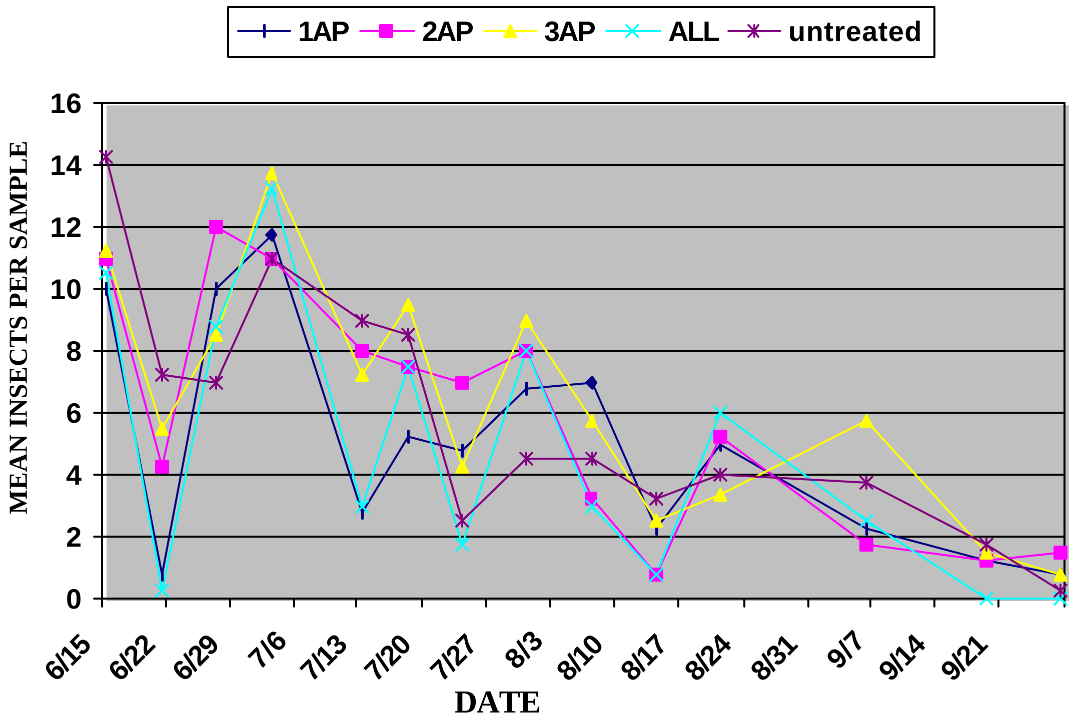

Figure 4. Mean number of predatory Heteroptera per suction sample on cotton at Leyendecker Farm, 2001.