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STATUS OF THE PINK BOLLWORM SUPPRESSION/ERADICATION PROGRAM IN TEXAS

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Abstract

The first year of treatment in the Texas Pink Bollworm Suppression/Eradication program resulted in elimination of economically significant levels of pink bollworm damage from El Paso/Trans Pecos cotton fields, and substantial reductions in pink bollworm populations. Trapping data indicated pink bollworm populations were reduced 74 percent from levels trapped in 1999.

Introduction

Since its first appearance in the U.S., in Robertson County, TX about 1917, the pink bollworm has become a key pest in western areas of the Cotton Belt. The National Cotton Council estimates pink bollworm costs cotton producers in the western U.S. approximately $21.6 million annually in prevention, control and yield losses. In Texas, pink bollworm infestations and losses are seen primarily in cotton fields west of the Pecos river. In the past, producers have had to rely on insecticides to avoid severe yield losses from pink bollworm. This insecticide based system had many associated problems. Accurate scouting was essential to properly time treatments. Occasionally infestations went undetected and severe damage occurred. Some producers were vigilant while neighboring producers were not. The lack of an area-wide approach to the problem allowed infestations to persist and often worsen. Multiple insecticide applications were costly, and the risk and frequency of secondary pest outbreaks increased. The advent of Bt transgenic cotton has allowed producers to stabilize their cost of controlling pink bollworm and this technology has provided excellent control, but the lack of an area-wide approach has allowed pink bollworm populations to persist.

Obviously, elimination of a pest and prevention of re-infestation have long term benefits to the cotton producers in the region. In the El Paso/Trans Pecos area many producers grow American pima cotton. Bt transgenic pima cotton varieties are not currently available to them . Upland growers currently using Bt cotton varieties stand to benefit from elimination of pink bollworm because the risk of severe losses from the pest are eliminated. Eradication would allow upland cotton growers to reevaluate the expense of purchasing Bt varieties. In addition, elimination of the pest removes the threat of resurgence of pink bollworm and its damage should the protection afforded by Bt cotton fail.

In March of 1999, cotton producers in the El Paso/Trans Pecos (EP/TP) zone passed a referendum to conduct a boll weevil and pink bollworm suppression/eradication program to begin in the fall of that year. The program began with initiation of boll weevil eradication and two years of trapping to provide population information prior to the initiation of the pink bollworm program. The treatment phase of the pink bollworm program began on 46,621 acres of cotton in 2001.

The initial objective was to reduce pink bollworm populations and damage across the zone to below levels at which economic damage would occur. This objective was to be reached in 2001. The next objective was to continue to suppress pink bollworm populations and work with cotton producers in adjacent areas of Mexico and New Mexico to eradicate the pest from the region.

Methods and Materials

El-Lissy et al. (1997) provided a detailed description of the boll weevil eradication methods from which the methods used in this program were adapted.

Mapping

The planting of Bt transgenic cotton varieties was encouraged by reducing the assessment on acres planted to these varieties. Immediately after seedling emergence, all cotton fields were mapped using differentially corrected GPS technology (Geo II and III GPS units and Pathfinder Software, Trimble Navigation). The presence or absence of the Bt toxin was determined by randomly selecting seedlings from all cotton fields in the El Paso/Trans Pecos zone and testing them using ELISA test procedures (SDS Inc.). Field maps were constructed using Map Info software. Field maps were color coded to indicate Bt

transgenic cotton, non-Bt cotton, and sensitive site fields (those near houses, schools, etc.). Producer data, field numbers, and other information was electronically associated with each field. Through this process, 2018 fields were mapped.

Trapping

Between seedling emergence and the appearance of pinhead squares, gossyplure (pink bollworm sex pheromone) baited delta traps (Scentry Biologicals) were deployed around all fields at a density of approximately 1 trap per 10 acres. Each trap was bar coded which allowed the trap data to be electronically associated with a physical location on the maps. From deployment to the time fields were harvested and no longer hostable, traps were checked weekly and replaced at least every two weeks. Trap catch information, crop stage and other data were recorded weekly using hand held electronic scanners/data loggers (TimeWand II, Videx).

Control

Several pink bollworm control components were used. Testing for the presence of the Bt toxin revealed that 22,933 of the 46,621 acres of cotton in the zone (49%) was Bt cotton. The Pecos work unit was 76 percent Bt cotton, the Fort Hancock work unit was 48 percent Bt cotton and the El Paso work unit was 32 percent Bt cotton. These acres were treated with other pink bollworm controls only as needed to comply with U.S. E.P.A. Bt cotton refugia requirements.

Several pheromone mating disruption products were used. High dose, hand applied gossyplure dispensers (PB-ROPE L, Pacific Biocontrol Corporation) were used at an application rate of approximately 200 dispensers per acre on 5,399 acres of cotton in the zone. Local labor contractors were used to apply the pheromone rope dispensers. Fields were selected for treatment with rope based on whether or not they could be treated by air. Fields surrounded by houses, near schools, near environmentally sensitive sites and organic cotton fields were treated with the ropes. The high dose rope dispensers were expected to provide season-long suppression from a single application. PB-ROPE L was applied to 5,399 acres of cotton.

Sprayable pheromone mating disruption products used were NoMate PBW Fiber and NoMate PBW MEC (Scentry Biologicals Inc.) The fiber was applied in a thick adhesive (BioTac, Scentry Biologicals Inc.) at a rate of 15 grams of fiber per acre. Zeta-cypermethrin (Fury, FMC Corp.) was added to the mixture such that it was applied at a rate of 0.000586 lbs ai/acre (1/2 fl. oz/acre) to provide suppression of adult male moths attempting to mate with the fibers. NoMate PBW Fiber was the most heavily used pheromone mating disruption product. From early June through mid October fiber was applied to between 5,000 and 10,000 acres per week. A total of 142,841 acres were treated. Sprayable pheromone treatments were initiated at pinhead square stage. After the pinhead square treatments, sprayable pheromone products were reapplied when traps around a field caught pink bollworm moths. Positive trap catches around a field indicated the presence of pink bollworm moths and low enough concentration of pheromone in the field that males could respond to pheromone traps. If pheromone traps were capable of attracting males, the assumption was that female moths could also attract males resulting in infestations.

NoMate PBW MEC, a micro-encapsulated formulation which can be applied using a conventional hydraulic boom, was used at a rate of 12 grams per acre. NoMate PBW MEC was used on a limited basis by air and was used in combination with Lorsban in mistblower applications. This product was used on 11,456 acres.

Fields in which moths were caught at above 1 moth per trap per night received applications of Lorsban 4E applied at a rate of 24 fluid oz. per acre. It was used most heavily in August and September.

Organic cotton fields were treated with the pheromone rope and, in some cases with Tracer applied at a rate of 2 fluid oz. per acre. Only 475 acres were treated with Tracer.

All aerial treatments were triggered by moth trap catches.

Monitoring

Two methods of monitoring pink bollworm populations were used. Trapping information has been collected since the fall of 1999 when the program was begun in the EP/TP zone. The 1999 and 2000 trap catch information provides a baseline to which populations in later years can be compared. In this data set, information from the Fort Hancock and El Paso work units were combined in 1999 but separated in the 2000 and 2001 data sets.

In 2001, 25 blooms and later 25 bolls were sampled in each of four quadrants of 20 randomly selected fields in each of 3 work units each week. The 60 fields chosen for sampling stayed constant during the year. Although this data is not available in years prior to 2001, the 2001 data provides information about the infestation level in each area. Boll sampling data from the last week of August through the third week of October will be provided.

Results

Control

The ropes worked well in providing season-long pink bollworm trap suppression except in areas where grower cultivation practices moved soil onto the bases of the plants covering the ropes with soil. Some of these fields required treatment by other means to prevent pink bollworm populations increases and damage.

Sprayable pheromones were effective in suppressing moth trap catches. The NoMate PBW Fiber mating disruption/male attract and kill approach was effective in suppressing pink bollworm moth trap catches for about 14 days after an application. NoMate PBW MEC was effective, but did not provide control for as long as the fiber applications.

Insecticides were used on a limited basis when trap captures increased. The objective of insecticide use was to reduce numbers of mated female moths. Insecticides provided short term elimination of the threat of larval boll infestation. They also renewed effectiveness of the mating disruption treatments since mated moths were eliminated and emerging unmated moths could be prevented from mating. Lorsban provided excellent short term reductions in trap catches. It was helpful in suppressing pink bollworm populations in more heavily infested areas primarily late in the season. Tracer was used for adult moth suppression on organic cotton. Trap data indicated that it provided a limited amount of suppression of pink bollworm, but it was the only insecticide available for use on organic cotton.

Trap Data

The results of the pink bollworm trapping data are given in Table 1. The data show numbers of traps inspected and moth trap catches by work unit from 1999 to 2000. Relatively large numbers of traps were inspected in each work unit each year. Numbers of inspections are somewhat lower in 1999 since this was the first year of trapping and traps were not deployed until the fall of the year.

After the initiation of the treatment phase of the program in 2001, moth trap captures declined from numbers seen in 1999 and 2000. Captures in 2001 were 62 percent lower than those in 2000 and 74 percent lower than in 1999.

Spring moth trap catches peaked in mid to late June in 2000 and in late May and early June in 2001. The magnitude of peak trap catches trap catches in the spring were similar for 2000 and 2001, 16.53 and 15.57, respectively. Fall moth trap catches peaked in mid October 1999, late September 2000 and mid September in 2001. Peak fall moth trap catches were higher in 1999 and 2000 than in 2001, 30.08 and 27.07 versus 10.50. The 2001 reduction in the fall peak moth trap catch peak was 61 percent and 73 percent when compared to 2000 and 1999, respectively.

Boll Sampling Data

Boll sampling data are provided in Table 2. The data shows much lower infestation levels in the Pecos work unit than in the Fort Hancock or El Paso work units. Only 8 pink bollworm infested bolls were found in the Pecos Work Unit while 935 and 829 larvae were found in bolls sampled from Fort Hancock and El Paso, respectively. Only 0.05 percent of the bolls sampled in the Pecos work unit had live larvae in them, while 6.19 and 7.40 percent of the bolls in the Fort Hancock and El Paso work units were infested with live larvae, respectively. Overall, 4.53 percent of the bolls sampled in the EP/TP zone were infested with live pink bollworm larvae.

Peak boll infestation occurred in late September and early October in 2001.

Conclusions

The treatment phase of the pink bollworm program in the EP/TP zone was initiated in the spring of 2001 and conducted successfully the remainder of the season. An aggressive monitoring an treatment protocol was followed. In most cases applications were made in a timely manner in accordance with the established protocol. Grower treatments for pink bollworm control were practically eliminated.

Moth trap catches in 2001 were strongly reduced from levels seen in previous years. Peak moth captures in both the spring and the fall tended to shift a few weeks earlier than had been seen in previous years. Reductions in both seasonal average pink bollworm moth catches and peak moth catches were seen. Season-long reductions in trap catches ranged from 62 percent to 74 percent.

Extensive boll sampling indicated that larval infestations and boll damage were maintained at low levels. Although data for comparison to previous years were not available, no reports of yield loss due to pink bollworm were reported in the zone in 2001.

Much of the technology used in the Texas pink bollworm program was developed in a similar, successful program which was conducted in Parker Valley, Arizona from 1990-95 (Antilla et al. 1996). Results of the Texas program compare favorably with results obtained in the Parker Valley program. The Arizona program was similar in its use of trap triggers, pheromone mating disruption technology, and insecticide applications in areas where higher pink bollworm infestations were identified. It differed by not having Bt transgenic technology available and by utilizing area-wide treatments in the spring and reliance on grower treatments in the fall. Seasonal average trap catches in the Texas program were lower than those in the first year of the Arizona program. They were similar, although slightly higher, than fall trap catches in the Arizona program at the end of the second year. Boll damage levels in the first year of the Texas program were 46 percent lower than boll damage levels seen in the first year of the Arizona program.

The effect of Bt cotton on program progress in the Texas program is notable. The Pecos work unit had the highest percentage of Bt cotton by far the lowest percentage of bolls infested by pink bollworm larvae.

In 2002, program plans are to use the methods used in 2001 to bring about further pink bollworm population reduction in West Texas, and to encourage program initiation in adjacent areas of Chihuahua state in Mexico and the Mesilla Valley of New Mexico. Sterile moth releases are planned to begin in 2003. Effective population suppression prior to the release of sterile moths is expected to allow the released sterile insects to numerically overwhelm the remaining pest population. This will make possible the rapid elimination of the pest from the EP/TP zone.

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Table 1. Pink bollworm moth trapping data from the El Paso/Trans Pecos zone from 1999 to 2001[1].

Traps Inspected					
Year	**Pecos Work Unit**	**Combined Ft. Hancock/El Paso**	**Ft. Hancock Work Unit**	**El Paso Work Unit**	**EP/TP Zone**
1999	11,386	4,998	-	-	16,384
2000	23,617	-	55,182	36,508	102,736
2001	22,672	-	42,611	64,231	142,085
Moths/Trap/Week					
Year	**Pecos Work Unit**	**Combined Ft. Hancock/El Paso**	**Ft. Hancock Work Unit**	**El Paso Work Unit**	**EP/TP Zone**
1999	14.10	32.58	-	-	19.74
2000	9.57	-	11.76	18.17	13.53
2001	5.99	-	5.60	4.53	5.18

[1]1999 data from fall only, 2000 and 2001 data season-long.

Table 2. Pink bollworm boll infestation data, 2001.

Work Unit	Bolls Sampled	Larvae Found	Percent Infestation
Pecos	13,750	8	0.05
Ft. Hancock	15,100	935	6.19
El Paso	11,200	829	7.40
EP/TP Zone	40,050	1,813	4.53