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STATUS OF THE PINK BOLLWORM SUPPRESSION/ERADICATION PROGRAM IN TEXAS

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Abstract

The Texas Pink Bollworm Suppression/Eradication program has been making treatments to suppress this damaging pest of western cotton for two years in the El Paso/Trans Pecos region. The program has removed pink bollworm as an economic concern for cotton growers in the region. Pink bollworm moth populations have been suppressed by more than 85 percent from 2000 population levels, the year before the program began. Larval boll infestations have been reduced 66 percent in one calendar year.

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 along and 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. Frequent, accurate scouting was essential to properly time treatments. Occasionally infestations went undetected and severe damage occurred. In some cases some producers were vigilant and protected their crop while neighboring producers did 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 there are costs associated with the use of the Bt technology that must be paid each year. Also in systems relying primarily on Bt technology for pink bollworm suppression, producers are limited in their variety selection to only Bt varieties. In addition, the lack of an area-wide approach to population suppression allows pink bollworm populations to persist as a threat to the cotton industry in infested areas.

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 program was improved and continued on the 41, 652 acres in the zone in 2002.

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 reached in 2001, the first year of the program. 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. In 2002 producers in the state of Chihuahua, Mexico, and in the Mesilla Valley of New Mexico initiated programs similar to the Texas program thereby forming a cohesive effort to eliminate pink bollworm 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 (AgDia 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.

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 (minimum of 2 traps per field). 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 technologies were used. Bolgard cotton was planted on 23,084 acres or 50 percent of the cotton acres in the zone in 2001 and 18,700 of the 41,652 acres or 45 percent of the cotton acres in the zone in 2002 (Table 1). The Pecos work unit was 76 percent Bt cotton in 2001 and 83 percent Bt cotton in 2002. The Fort Hancock work unit was 48 percent Bt in 2001 and 40 percent Bt cotton in 2002. The lowest Bt cotton use was in the El Paso work unit which had 32 percent Bt cotton in 2001 but only 22 percent Bt cotton in 2002.

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 5,408 acres or 11 percent of the cotton acreage in 2001 and 9,384 acres or 22 percent of the cotton acreage in 2002. A local labor contractor was used to apply the pheromone rope dispensers each year. 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. In addition, the high dose rope product was applied to "hot spot" areas within the zone. In the Pecos work unit 10 acres were treated with the rope in 2001 and no fields were treated with rope in 2002. In the Fort Hancock work unit 747 acres or 4 percent of the acreage were treated with rope in 2001 and 1,636 acres or 10 percent of the acreage were treated with rope in 2002. In the El Paso work unit 4,651acres or 30 percent were treated with rope in 2001 and 7,420 acres or 53 percent received rope treatment in 2002 (Table 1). The high dose rope dispensers were expected to provide season-long suppression from a single application, but aerially applied pheromone and/or Lorsban insecticide was used late season on these fields if moth catches triggered treatments. Peromone rope was used on the 288 acres of organic cotton located near Van Horn.

The primary sprayable pheromone mating disruption product used was NoMate PBW Fiber (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 aerially applied pheromone mating disruption product during 2001 and 2002. The period of peak fiber use was June through the first week of October. During that time about 5,000 acres were treated with the fiber each week both years. After the pinhead square treatments, the Fiber was 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 male and female moths could find one another and mate. If pheromone traps were capable of attracting males, the assumption was that female moths could also attract males resulting in larval infestations.

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 and during that period about 1,500 acres were treated in the zone each week. As pheromone dispensers depleted on fields and moth catches averaged above 1 moth per trap per night dual applications consisting of Lorsban and Fiber were applied to the fields. The peak period for use of dual treatments was the last week of August though the first week of October. 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 boll weevil/pink bollworm eradication 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, 2001 and 2002 data sets.

In 2001, 25 blooms and later 25 bolls were sampled in each of four quadrants of 16 to 18 randomly selected fields in each of 3 work units each week. The fields chosen for sampling stayed constant. This data is not available in years prior to 2001. Bloom and boll sampling data from first bloom through the third week of October are provided.

Results

Control

The ropes worked well in providing season-long pink bollworm trap suppression. Trap catches from rope treated areas tended to be lower when higher percentages of fields in an area were treated with this technology. The ropes have been used on a higher percentage of the acres in the El Paso work unit in both 2001 and 2002 in which strong program progress was seen in pink bollworm population reduction in both 2001 and 2002 (Tables 1,2 and 3).

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.

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 then be prevented from mating through mating disruption. 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.

Bt cotton strongly reduced pink bollworm moth catches and larval infestations in 2001. This is evident from the Pecos work unit data in 2001. Somewhat higher population levels were seen in the Pecos work unit in 2002. Most of this difference is explained by strong migration of pink bollworm moths late season from cotton outside the program to the east, and random selection of a higher percentage of non-Bt cotton fields for boll sampling in 2002. Larval sampling in Bt cotton fields very rarely resulted in discovery of surviving larvae.

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 2002. Relatively large numbers of traps were inspected in each work unit each year. Captures of pink bollworm moths have declined each year since initiation of treatments in 2001. While all work units saw reductions in moths trapped, the largest reductions were seen in the Pecos work unit in 2001 and the El Paso work unit where the long duration pheromone rope was heavily used in both 2001 and 2002.

Overall, moth trap catches declined 62 percent from 2000 to 2001 and 81.5 percent from 2000 to 2002.

Boll Sampling Data

Boll sampling data are provided in Table 2. Boll infestation data are not available for the years prior to the start of the program. Infestations of from 20 to 50 percent of late set bolls were common where multiple insecticide applications were not used to prevent them, however. In 2001 boll sampling from randomly selected fields indicated that an average of 4.53 percent of bolls sampled through the boll maturation period were infested. In 2002 sampling in a similar manner showed only 1.54 percent of bolls were infested with larvae over the same period of time. This represents a 66 percent reduction in the percentage of bolls with larval infestations in one year.

Conclusions

The treatment phase of the pink bollworm program in the EP/TP zone was initiated in the spring of 2001 and conducted successfullyin2001 and 2002. An aggressive monitoring and treatment protocol was followed. Every effort was made to see that all applications made in a timely manner in accordance with the established protocol. Grower treatments for pink bollworm control were practically eliminated in 2001 and none were made in 2002.

Moth trap catches have been strongly reduced each year of the program. Long duration pheromone rope is a very effective product for pink bollworm population reduction. It is especially effective when used on higher percentages of fields in an area.

Extensive boll sampling indicated that larval infestations and boll damage were maintained at low levels in 2001 and were reduced further by program activities in 2002.

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 well with results obtained in the Parker Valley program. The Arizona program was similar in its use of an area-wide approach including trap triggers, pheromone mating disruption technology, and insecticide applications 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. Boll damage levels in the Texas program have been somewhat lower than those seen in Arizona during the first two years of the program.

With native pink bollworm moth populations reduced to low levels, the program expects to move into the next phase of operations soon. Release of sterile pink bollworm moths should begin over the suppressed area as soon as funding needs are met and laboratory facilities can produce the necessary moths. When this phase of the program is operational, pink bollworm can be completely eliminated and re-infestation can be prevented.

In 2002 neighboring cotton producing areas in Chihuahua, Mexico and in the Mesilla Valley of New Mexico have begun similar pink bollworm eradication programs. This cohesive, multi-national and multi-state effort is working toward elimination of the pink bollworm as a pest of cotton in the region.

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Table 1. Acres and percentage use of various pink bollworm control technologies by work unit during 2001 and 2002.

	2001			2002		
Work Unit	**Bt**	**Rope**	**Fiber**	**Bt**	**Rope**	**Fiber**
Pecos	8,644 (76%)	10 (1%)	2,720 (23%)	8,878 (83%)	0 (0%)	1,767 (17%)
Ft. Hancock	9,483 (48%)	747 (4%)	9,526 (48%)	6,822 (40%)	1,636 (10%)	8,596 (50%)
El Paso	4,957 (32%)	4,651 (30%)	5,883 (38%)	3,000 (22%)	7,420 (53%)	3,532 (25%)
Zone	23,084 (50%)	5,408 (11%)	18,079 (39%)	18,700 (45%)	9,056 (22%)	13,895 (33%)

Table 2. Pink bollworm moth trapping data from the El Paso/Trans Pecos zone from 1999 to 2002[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
2002	18,175		46,805	44,456	109,436
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
2002	4.25		2.77	1.48	2.50

[1]1999 data from fall only; 2000, 2001 and 2002 data represent season-long trapping.

Table 3. Pink bollworm boll infestation data from individual work units and for all cotton sampled in the zone.

	2001		2002	
Work Unit/Zone	**Bolls Sampled**	**Percent Infestation**	**Bolls Sampled**	**Percent Infestation**
Pecos	13,750	0.05	12,300	0.42
Ft. Hancock	15,100	6.19	20,700	3.33
El Paso	11,200	7.40	20,500	0.52
EP/TP Zone	40,050	4.53	53,500	1.54