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PINK BOLLWORM ERADICATION PROGRESS REPORT

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Abstract

The areawide pink bollworm eradication program, which is designed to rid all cotton-producing areas of the United States and adjacent areas of northern Mexico from the pink bollworm (PBW), completed a successful 2002 in Phase I, which includes the El Paso/Trans Pecos area of Texas (EPTP), South Central New Mexico (SCNM), and Chihuahua, Mexico.

The 2002 trapping data indicate that PBW adults were reduced by over 84% in EPTP, 91% in SCNM, and 95% in Chihuahua in 2002 when compared with 2000 and 2001. Similarly, data from PBW larval survey conducted in randomly selected fields in all three program areas coincided with the low level of the adult populations. The overall mean number of PBW larvae per 100 bolls sampled in EPTP, SCNM, and Chihuahua was 0.81, 0.45, and 0.30, respectively.

The 2002 program was highly effective in reducing the overall PBW population to a below economic level in all three regions; Texas, New Mexico, and Chihuahua. This low-level population maximizes the effectiveness of the sterile moth component, when it becomes available, in further reducing the population and ultimately achieving the goal of eradication.

Introduction

The bilateral areawide pink bollworm eradication program began in 2001-2002 in an effort to rid all cotton-producing areas of the United States and adjacent areas of northern Mexico from the pink bollworm (PBW), *Pectinophora gossypiella* (Saunders).

The PBW has been a major economic pest of cotton in West Texas, southern New Mexico, Arizona, Southern California, and northern Mexico. Conventional insecticides have not provided a long-term solution to the pink bollworm problem (Henneberry 1986). Control costs for PBW in Southern California and Arizona were estimated to exceed $1.2 billion over the past thirty years (Roberson et al. 1998, Antilla et al. 1999). Yield losses caused by PBW ranged from $85-$170 per acre each year (Antilla et al. 1999). Most recently, the National Cotton Council's PBW Technical Advisory Committee estimates that U.S. cotton producers' annual losses to pink bollworm are over $32 million, due to prevention and control costs, and lower yields resulting from crop damage.

The eradication plan includes coordinated efforts by cotton producer communities and federal, state, regional, county, and local entities in the U.S. and Mexico to control and eventually eliminate the PBW from cotton-producing regions of West Texas, New Mexico, Arizona, California, and northern Mexico (El-Lissy et al, 2002). Pending grower approval through scheduled referendums, adequate funding and PBW rearing capacity, the plan is to implement the PBW eradication program in three incremental phases: Phase I in 2001-2002, Phase II in 2004, and Phase III in 2006 (Figure 1).

Phase I

The program area is comprised of the El Paso/Trans Pecos (EPTP) region of West Texas, south-central New Mexico (SCNM), and Chihuahua, Mexico. The EPTP region consists of approximately 55,000 acres of cotton in Brewster, Crane, Crockett, Culberson, El Paso, Hudspeth, Jeff Davis, Loving, Pecos, Presidio, Reeves, Terrell, Ward, Winkler, and Val Verde counties. The SCNM region consists of approximately 26,000 acres of cotton in Doña Ana and Luna counties. The Chihuahua region consists of approximately 80,000 acres in Juarez, Ascension, Janos, Ojinaga and the surrounding cotton-growing areas.

In 1999, cotton producers in EPTP had approved a combined boll weevil (BW) and pink bollworm (PBW) eradication program, with the BW portion being implemented in 1999, and PBW eradication starting in 2001. The SCNM cotton producers had approved PBW eradication in May 2002, as they were completing boll weevil eradication. The Chihuahua growers approved the combined program in March of 2002. The program began in EPTP in 2001 and in SCNM and in Chihuahua in 2002. Program activities in the EPTP were carried out by the Texas Boll Weevil Eradication Foundation, in SCNM by the South Central New Mexico Boll Weevil Control Committee, and in Chihuahua by the Chihuahua Grower Committee and Sanidad Vegetal.

Phase II
This second program area is comprised of approximately 220,000 cotton acres in southeastern and central Arizona, including Cochise, Graham, Pima and Maricopa counties. Pending grower approval, the plan is to begin Phase II of program operation in 2004.

Phase III
This final program area is comprised of approximately 120,000 acres of cotton in western Arizona and Southern California. This includes Mohave, La Paz, and Yuma counties of Arizona, and Riverside and Imperial counties of California. The plan is to begin Phase III in 2006.

This report provides a summary of the 2002 PBW eradication program in West Texas, south central New Mexico, and Chihuahua, Mexico.

Materials and Methods

Embracing the integrated pest management (IPM) approach, the operational success of the areawide PBW eradication program hinges on three separate, yet interdependent, components including: *mapping, detection*, and *control*.

Mapping
Mapping is the first operational step implemented in the eradication program. All cotton fields were mapped with a differentially corrected Global Positioning System (GPS) (El-Lissy et al. 1996). In addition to identifying the exact location and the surrounding environment of all cotton fields, another important aspect of mapping was to record and verify the different types of cotton planted – transgenic Bt, conventional, and long-staple – in each field. The presence or absence of Bt cotton was verified by testing seedlings in at least four different locations in each field, using the DAS ELISA and ImmunoStrip test system (Agdia, Inc., Elkhart, IN). The program also utilized a numbering system that identifies each cotton field with a unique number.

Detection
Trapping -- delta traps baited with rubber septa impregnated with 4 mg of gossyplure (Scentry Biologicals, Billings, MT), and attached with brass fasteners to a wooden stake were placed around the perimeter of each cotton field. Traps were placed at planting, or shortly thereafter, at a rate of one trap per ten acres and inspected weekly, until defoliation and harvest or a killing freeze (Leggett et al. 1994). Both the traps and the pheromone dispensers were replaced biweekly. The barcode system (TimeWand II, Videx, Corvallis, OR) was used in collecting all trapping information (El-Lissy et al., 1997).

Visual Inspection (scouting) -- beginning at the bloom stage, 20 randomly selected cotton fields (30% Bt and 70% conventional), per work unit (12,000 -15,000 acres), were inspected weekly for rosetted blooms. Weekly larval surveys in bolls were also conducted in the same fields by sampling 25 bolls per quadrant beginning at the boll formation (quarter size) stage and continued through cut-out.

Control
The control part of the eradication program, implemented in 2002, consisted of cultural control, mating disruption, Bt transgenic cotton, and chemical control.

Cultural Control. Uniform cotton planting and harvesting timeframes, defoliation and stalk destruction practices, recommended by the local Agricultural Extension Service, were highly encouraged, as they constitute an important strategy in reducing diapausing PBW populations during the off-season months.

Mating Disruption with PBW Sex Pheromone (gossyplure). Aerial, ground, or hand application of PBW pheromone were made only to conventional cotton fields (non-transgenic), or to Bt transgenic cotton fields imbedded with conventional cotton (95:5 embedded refuge), that met the predetermined treatment threshold.

PB-Rope L® (Pacific Biocontrol Corp., Phoenix, AZ) dispensers were hand-twisted around the main stem of the cotton plant near the bottom, at a density of 200 dispensers (28 gm [AI]) per acre. Generally, rope applications were made at or near the six true leaf growth stage and before the pinhead square. Except for reasons beyond the control of program managers, such as the late passage of the referendum in NM (May 2002), or efficacy concerns resulting from rope buried during the cultivation practices, especially in sandy soils in EPTP, all rope was applied on schedule. Where rope applications were delayed, however, the situation was mitigated by using sprayable formulations such as CheckMate® PBW (Concep, Inc, Bend, OR) or NoMate-PBW® (Scentry Biologicals, Billings, MT) at the six true leaf growth stage, which provided the necessary control until the rope was applied.

In EPTP, the rope was used only in the earliest planted cotton fields, in fields with high levels of moth catches, as well as in fields located near environmentally sensitive sites where aerial applications were not practical. This has resulted in a total of 9,385 (23%) acres being treated with rope. In SCNM, all conventional fields were treated with rope, after receiving at least one application of CheckMate® PBW. This has resulted in a total of 10,690 (63%) acres being treated with rope. In Chihuahua, MX, all conventional cotton fields, 26,784 (58%) acres were treated with rope.

In EPTP, a single application of NoMate-PBW®, at a rate of 15 gm/ac (1.05 gm [AI]/ac of gossyplure), mixed with polybutene sticker (Bio-Tac, Scentry Biologicals, Inc.) at a rate of 5.3 oz/ac and the insecticide zeta-cypermethrin (Fury, FMC Corp.) at a rate of 0.5 fl oz/ac (0.00058 lb. [AI]/ac), was made by air beginning at the pinhead square stage, each time a field met the treatment criteria (treatment threshold). The threshold was a trap capture averaging more than zero and less than one moth per trap per night. The insecticide chlorpyrifos, at a rate of 24 fl oz/ac (0.75 lb. [AI]/ac), was added to the pheromone application as an over-spray (doubleton application), only when the average trap capture equaled or exceeded one moth per trap per night.

Bt Transgenic Cotton. Planting of the Bt transgenic cotton varieties was highly encouraged as they provide an exceptional level of control for PBW. In EPTP, the total number of acres planted with Bt cotton varieties was 18,161 acres (44%), in South Central New Mexico it was 6,368 acres (37%), and in Chihuahua it was 26,784 acres (58%). Growers adhered to the Environmental Protection Agency's (EPA) Refuge Requirements, designed as a strategy for insect resistance management (IRM).

Chemical Control. Aerial or ground applications of the insecticide chlorpyrifos at a rate of 24 fl oz/ac (0.75 lb. [AI]/ac), were made only to prevent economic loss in fields that exhibited larval infestations of 5 percent or higher.

Results and Discussion

The first year of the area-wide pink bollworm eradication program has been successful in meeting its objectives in suppressing the overall PBW population in El Paso/Trans Pecos of Texas, South Central New Mexico, and Chihuahua, Mexico.

Texas

The overall PBW population has been reduced significantly in the El Paso/Trans Pecos in 2002 as compared with 2001 and 2000. The 2002 season-long weekly mean number of PBW moths per trap was 2.5, in 2001 it was 5.2, and in 2000 it was 17.8; a reduction of 84.3% in 2002 when compared with 2000. Additionally, the 2002 overall weekly mean number of PBW larvae per 100 bolls sampled, in 50 randomly selected fields, was 0.81 and in 2001 it was 4.53; a reduction at 82% in 2002 compared with 2001(Texas Boll Weevil Eradication Foundation, Abilene, TX), (Allen et al., in press, NCC, 2003) (Figure 2).

New Mexico

The 2002 season-long mean number of PBW moths per trap was 1.6 and in 2001 it was 17.9; a reduction of 91.1% in 2002 as compared with 2001(South Central New Mexico PBW Eradication Committee, Las Cruses, NM) (Figure 3). The 2002 overall weekly mean number of PBW larvae per 100 bolls sampled, in 43 randomly selected fields was 0.45.

Chihuahua, Mexico

The 2002 season-long mean number of PBW moths per trap was 0.8 and in 2001 it was 16.8; a reduction of 95.2% in 2002 when compared with 2001 (Sanidad Vegetal, Chihuahua, MX) (Figure 4). The 2002 overall weekly mean number of PBW larvae per 100 bolls sampled, in 121 randomly selected fields was 0.3.

Based on the above, the first year of Phase I of the PBW eradication program has been highly effective in reducing the overall population to a below economic level in all three regions: West Texas, New Mexico, and Chihuahua. This low-level population maximizes the effectiveness of the sterile moth component, when it becomes available, in further reducing the PBW population and ultimately achieving the goal of eradication.

Acknowledgments

The pink bollworm eradication program exemplifies the cooperative federal-state-industry effort in the U.S. and Mexico in ridding the cotton industry in both countries of one of its most devastating pests. The National Cotton Council's Pink Bollworm Action Committee provides the industry's leadership and vision necessary for success of the program. The daily operation of the program is entirely due to the tireless efforts of grower organizations like the Texas Boll Weevil Eradication Foundation, the South Central New Mexico Boll Weevil Control Committee, and the Chihuahua Grower Committee. The PBW Technical Advisory Committee, working with the Extension Service and Sanidad Vegetal, provides the technical and operational support for the program. The New Mexico Department of Agriculture, the Texas Department of Agriculture, Sanidad Vegetal and the USDA continue to play instrumental roles in the success of pink bollworm eradication in the U.S. and northern Mexico.

References

Allen, C. T., Edward Herrera, Lindy Patton, and Larry Smith. 2003 (in press). Status of Pink Bollworm Eradication Program in Texas. Proc. Beltwide Cotton Production and Research Conf. National Cotton Council of America. Nashville, TN.

Antilla, L., M. Whitlow, R. T. Staten, O. El-Lissy, and F. Myers. 1996. An integrated approach to areawide pink bollworm management in Arizona. Proc. Beltwide Cotton Production and Research Conf., National Cotton Council of America, 1083-1085 pp.

Antilla, L., M. Whitlow, J. White, C. Youngker, T. J. Dennehy, and R. T. Staten. 1999. Alternative infield refuge strategies for control of pink bollworm in Bt transgenic cotton. Proc. Beltwide Cotton Production and Research Conf., National Cotton Council of America, 1241-1242 pp.

El-Lissy, O., Frank Myers, Ray Frisbie, Tom Fuchs, Don Rummel, Rick Smathers, Ed King, Chuck Bare, Frank Carter, Gary Busse, Nolan Niehues, and Jack Hayes, 1996. Boll Weevil Eradication Status in Texas. Proc. Beltwide Cotton Production and Research Conf. National Cotton Council of America. Nashville, TN, 831-839 pp.

El-Lissy, O., R. T. Staten, and Bill Grefenstette, 2002. Pink Bollworm Eradication Plan in the U.S., Proc. Beltwide Cotton Production and Research Conf. National Cotton Council of America. Atlanta, GA.

Henneberry, T. J., T. J. Bariola, L. A. and D. L. Kittock. 1980. Integrating methods for control of the pink bollworm and other cotton insects in the southwestern United States. USDA, Tech. Bull. No. 1610. 45 pp.

Henneberry, T. J. 1986. Pink bollworm management in cotton in the southwestern United States. U.S. Dep. Agric. Agric. Res. Serv. ARS-51.

Leggett, J. E., Osama El-Lissy, and Larry Antilla. 1994. Pink bollworm moth catches with perimeter and in-field gossyplure baited traps. Southwestern Entomologist. Vol. 19, No. 2:147-155 pp.

National Cotton Council of America. 2001. Pink Bollworm Eradication: A Window of Opportunity, 1-6 pp.

Roberson, R., L. Antilla, T. J. Dennehy, R. T. Staten. 1998. Pink bollworm areawide suppression-eradication action plan. National Cotton Council of America, Pink Bollworm Action Committee report.

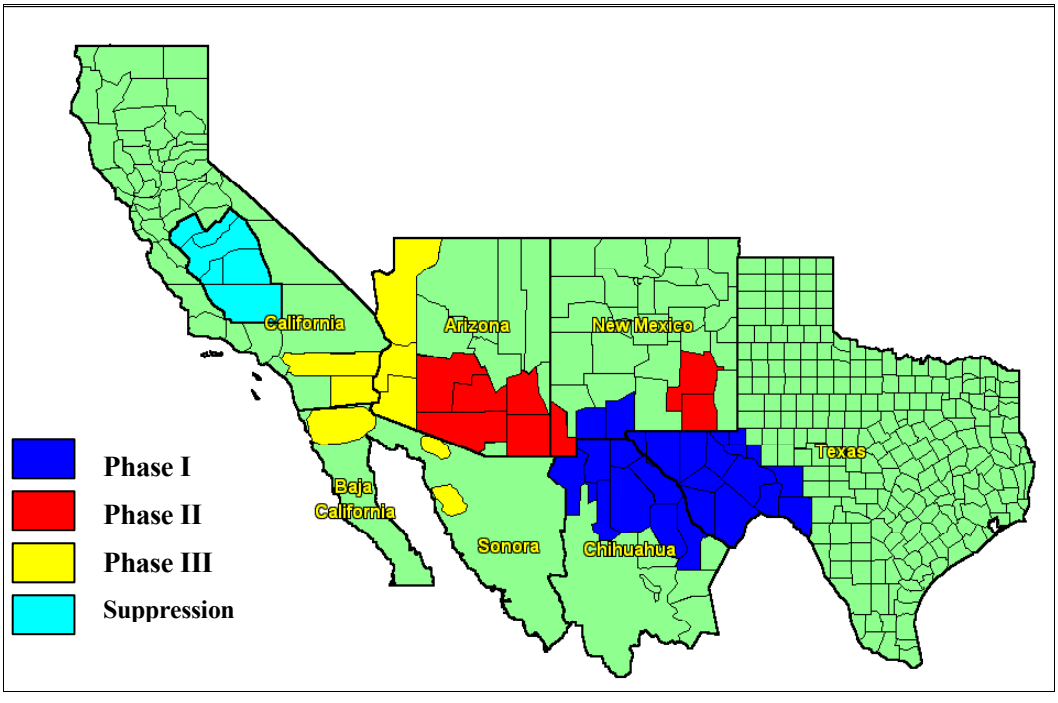

Figure 1. Incremental Phases of the Proposed Pink Bollworm Eradication Program.

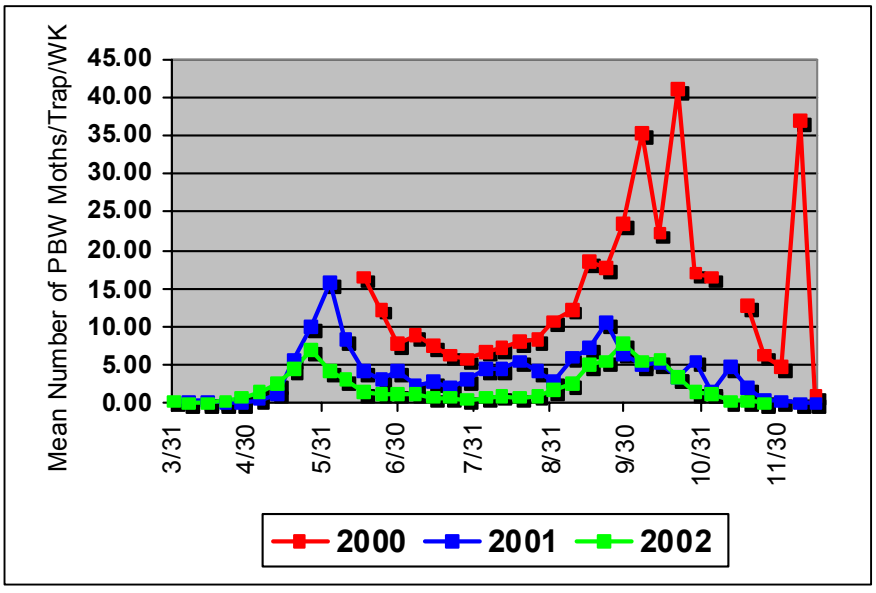

Figure 2. Weekly PBW Trapping, El Paso/Trans Pecos, Texas, 2000, 2001, 2002.

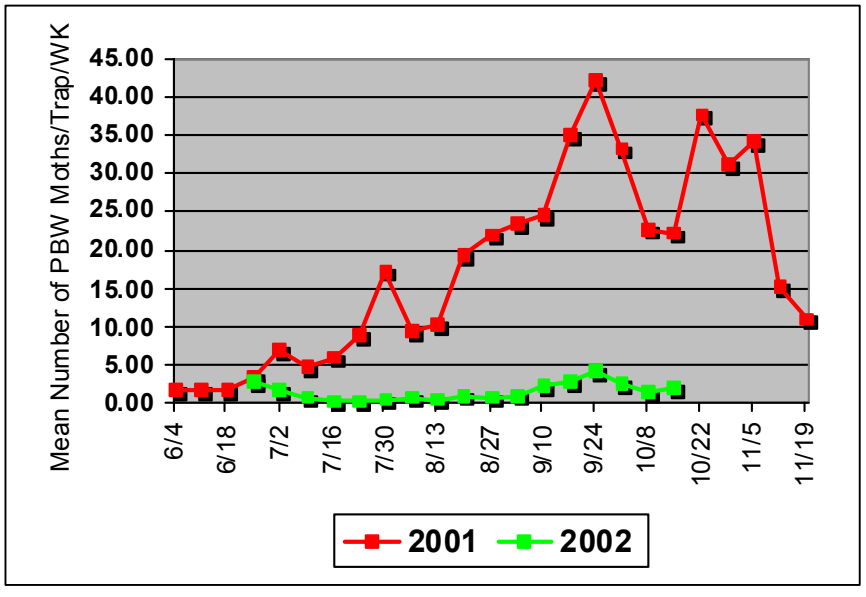

Figure 3. Weekly PBW Trapping, South Central New Mexico, 2001 and 2002.

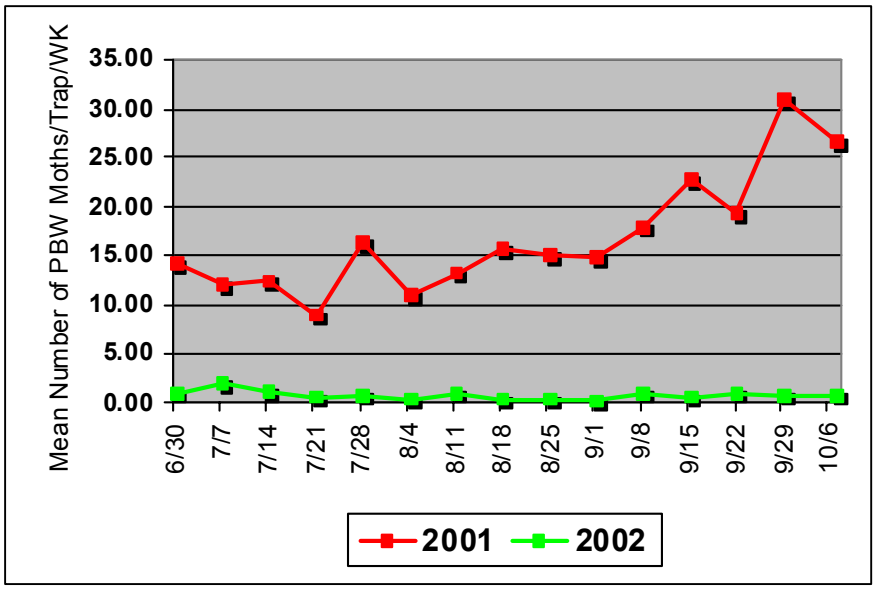

Figure 4. Weekly PBW Trapping, Chihuahua, Mexico, 2001 and 2002.