

PROGRESS OF PINK BOLLWORM ERADICATION IN THE U.S. AND MEXICO, 2005

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Abstract

The bilateral areawide pink bollworm eradication program, which is designed to eliminate the pink bollworm (PBW), *Pectinophora gossypiella* (Saunders), from all cotton-producing areas of the United States and adjacent areas of northern Mexico, completed a successful 2005 season in Phase I. This first phase of the program includes the El Paso/Trans Pecos area of Texas (EPTP), South Central New Mexico (SCNM), and Chihuahua, Mexico.

The 2005 program was highly effective in significantly reducing the overall PBW population in all three regions. The current trapping data indicate that PBW adults were reduced by 99.4 percent in EPTP, 99.7 percent in SCNM, and 99.9 percent in Chihuahua in 2005, when compared with 2000 and 2001, when the program began in each of the three areas.

This report provides a summary of the 2005 PBW eradication program in West Texas, South Central New Mexico, and Chihuahua, Mexico, and previews plans for the 2006 expansion into eastern and central Arizona.

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.

In 2000, the Cotton Council's Pink Bollworm Action Committee recommended launching a "bilateral" PBW eradication program in the United States and northern Mexico. 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 2005; and Phase III in 2007 (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 22,000 acres of cotton in Doña Ana and Luna counties. The Chihuahua region consists of approximately 93,000 acres in Juarez, Ascension, Janos, Ojinaga and the surrounding cotton-growing areas.

In 1999, cotton producers in EPTP 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 approved PBW eradication in May 2002, as they were completing boll weevil eradication. The Chihuahua growers approved the combined program in March 2002. The program began in EPTP in 2001 and in SCNM and Chihuahua in 2002. Program activities in 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, Greenlee, Pinal, Pima and Maricopa counties. In 2004, cotton producers in Arizona approved a statewide referendum for PBW eradication, with plans to begin the program in eastern and central Arizona in 2006. The remainder of the state is slated to begin the program in 2007 as part of Phase III. In addition, producers in the Sonora and Caborca regions of Mexico, which consists of approximately 8,000 acres of cotton, are considering plans to implement the program in 2006.

Phase III

This final program area is comprised of approximately 180,000 acres of cotton in western Arizona, Southern California, and northwest Mexico. This includes Mohave, La Paz, and Yuma counties of Arizona; Riverside and Imperial counties of California; and the Mexicali - San Luis Valley of Mexico. Phase III is to begin in 2007.

This report provides a summary of the 2005 PBW eradication program in West Texas, South Central New Mexico, and Chihuahua, Mexico, and previews plans for the 2006 expansion into eastern and central Arizona.

Materials & 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 gossypure (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., 1999).

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 2005, consisted of cultural control, mating disruption, Bt transgenic cotton, sterile PBW releases, and limited chemical control.

1. 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.

2. Mating Disruption with PBW Sex Pheromone (gossyplure) — aerial, ground, or hand application of PBW pheromone were made only to conventional cotton fields (non-transgenic) 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 pinhead square. Except for reasons beyond the control of program managers, such as efficacy concerns resulting from rope buried during 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 NoMate-PBW® (Scentry Biologicals, Billings, MT) at the six-true-leaf growth stage, which provided the necessary control until the rope was applied.

Unlike the first two to three years of the program, where rope was applied to all non-Bt cotton fields, in 2005, rope was applied only to fields that met a predetermined criteria: fields with high levels of moth catches in the spring; fields with known larval infestation in the 2004 growing-season; or fields located near environmentally sensitive sites where aerial applications were not practical. This has resulted in a total of 9,226 (21.3%) acres in EPTP, 1,900 (8.6%) acres in SCNM, and 24,577 (26%) acres in Chihuahua being treated with rope.

In addition, 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 each time a field met the treatment criteria (treatment threshold). The threshold was calculated based on a predetermined ratio of PBW native and sterile trap captures. Non-Bt fields that maintained 1 (native moth):60 or greater (sterile moth) ratio did not receive pheromone applications. Non-Bt fields that exhibited 1 (native moth): 30-59 (sterile moth) ratio received a single pheromone application. Non-Bt fields that exhibited 1 (native moth): 30 or less (sterile moth) ratio, received a dual pheromone application, which consisted of the insecticide chlorpyrifos, at a rate of 24 fl oz/ac (0.75 lb. [AI]/ac), as an overspray along with the pheromone application. This has resulted in a total of 6,228 (14.3%) acres in EPTP, 3,500 (15.9%) acres in SCNM, and 289.3 (0.3%) acres in Chihuahua being treated with single or dual pheromone application.

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 16,809 acres (34%), in South Central New Mexico it was 10,000 acres (45%), and in Chihuahua it was 48,657 acres (52%). Growers adhered to the Environmental Protection Agency's (EPA) Refuge Requirements, designed as a strategy for insect resistance management (IRM).

PBW Sterile Moths — sterile PBW moths produced at the PBW rearing facility in Phoenix, AZ, were shipped daily to El Paso, Texas. Shipments were distributed to the three program areas: EPTP, SCNM, and Juarez for field releases. PBW sterile releases were made twice a week over each district beginning at the four-leaf cotton growth stage (May 10) through the end of September. PBW sterile releases were made over the entire cotton-growing area; however, it was primarily targeted to non-Bt cotton acreages. This has resulted in the release of over 1.1 billion sterile moths in EPTP, 393 million in SCNM, and 64.5 million in Juarez, MX, or an average of approximately 260 sterile moths per non-Bt cotton acre per day.

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 five percent or higher.

Results and Discussion

The area-wide pink bollworm eradication program has been highly successful in reducing 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 (EPTP) zone in 2005 as compared with 2004, 2003, 2002, 2001, and 2000. The 2005 season-long weekly mean number of PBW moths per trap was 0.1, in 2004 it was 0.96, in 2003 it was 1.8, in 2002 it was 2.6, in 2001 it was 5.2, and in 2000 it was 17.8; a reduction of 89.6%, 94.4%, 96.2%, 98.1%, and 99.4% in 2005 when compared with 2004, 2003, 2002, 2001, and 2000, respectively (Texas Boll Weevil Eradication Foundation, Abilene, TX) (Figure 2).

New Mexico — the 2005 season-long weekly mean number of PBW moths per trap was 0.06, in 2004 it was 0.37, in 2003 it was 3.27, in 2002 it was 1.6, and in 2001 it was 17.9; a reduction of 83.8%, 98.2%, 96.3%, and 99.7% in 2005 when compared with 2004, 2003, 2002, and 2001, respectively (South Central New Mexico PBW Eradication Committee, Las Cruces, NM) (Figure 3).

Chihuahua, Mexico — the 2005 season-long mean number of PBW moths per trap was 0.025, in 2004 it was 0.017, in 2003 it was 0.048, in 2002 it was 0.8 and in 2001 it was 16.8; a reduction of 47.9%, 96.9%, 99.9% in 2005 when compared with 2003, 2002, and 2001, respectively (Sanidad Vegetal, Chihuahua, MX) (Figure 4).

Based on the above, the area-wide PBW eradication program has been highly effective in reducing the overall population to a sub-economic level in all three regions: West Texas, New Mexico, and Chihuahua. The effectiveness of the sterile moth component is maximized in this low-level population, 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 industry leadership and vision, necessary for the success of the program. The daily operation of the program depends on 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.

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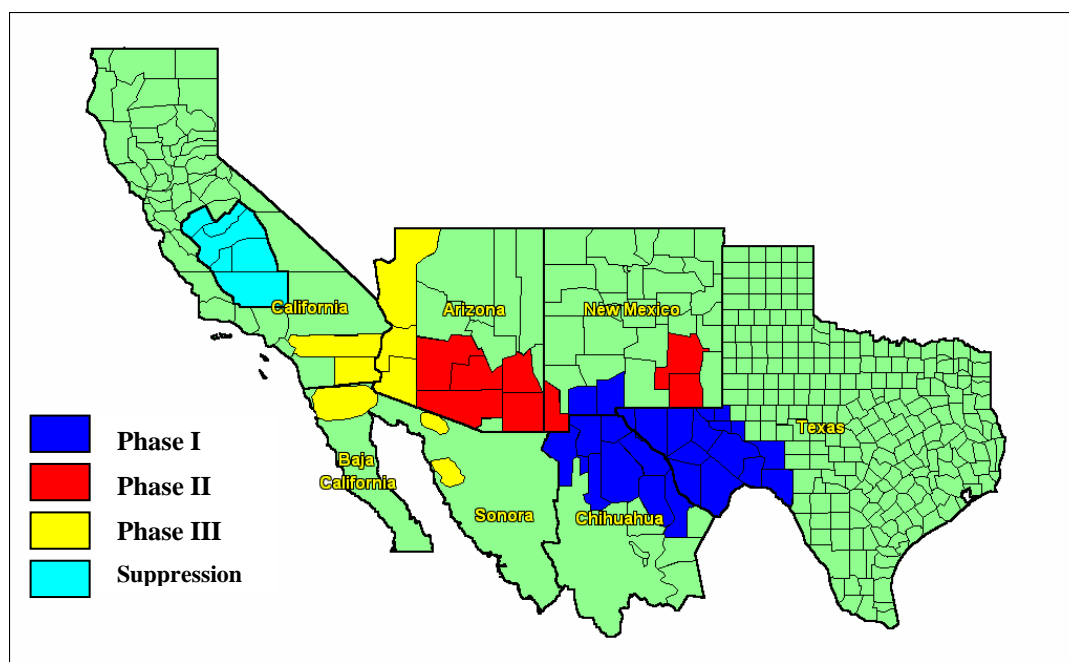


Figure 1. Incremental Phases of the Proposed Pink Bollworm Eradication Program.

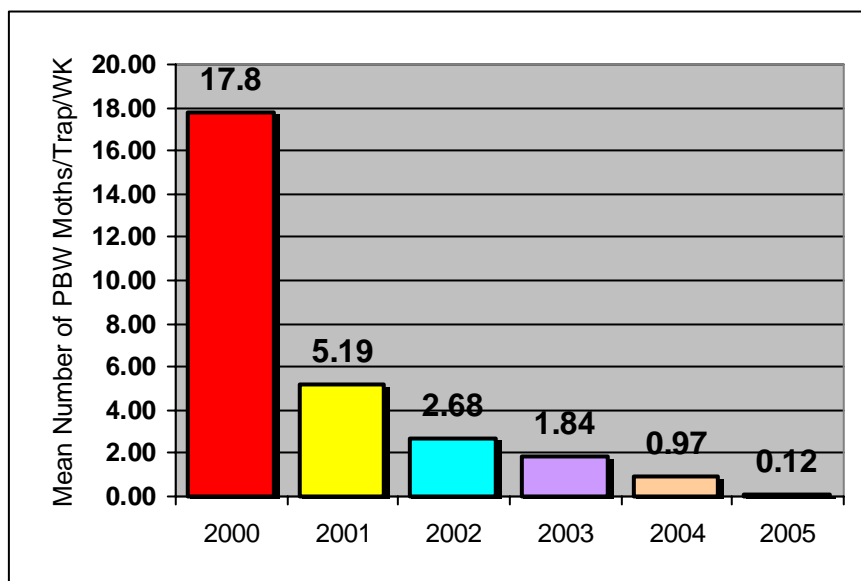


Figure 2. Weekly PBW Trapping, El Paso/Trans Pecos, Texas, 2000, 2001, 2002, 2003, 2004, and 2005.

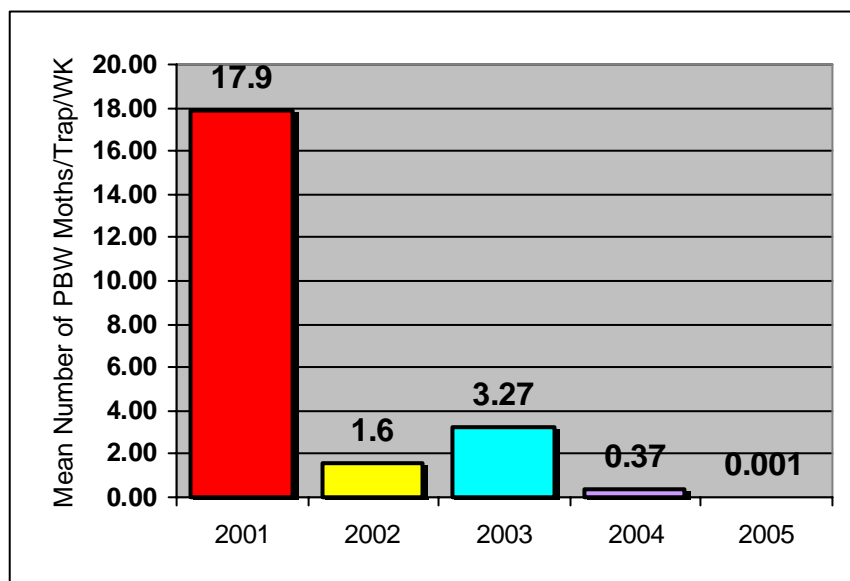


Figure 3. Weekly PBW Trapping, South Central New Mexico, 2001, 2002, 2003, 2004, and 2005.

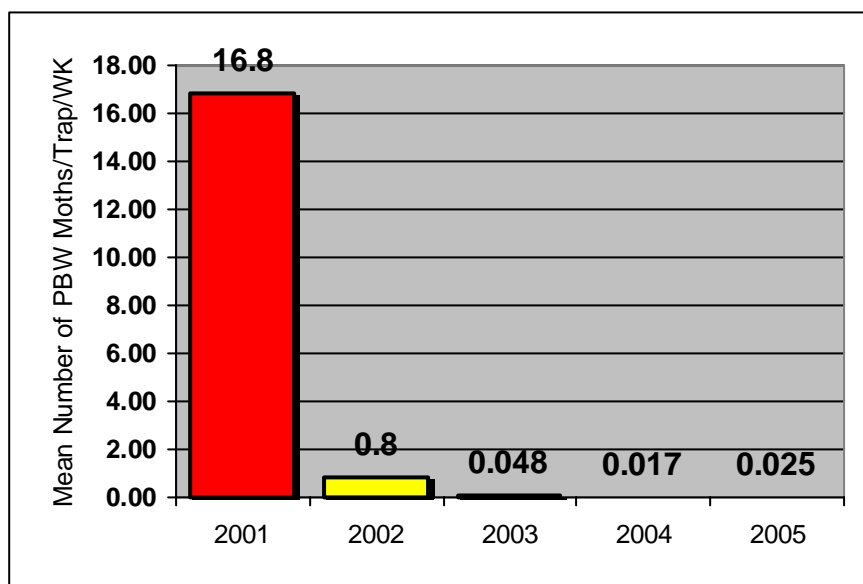


Figure 4. Weekly PBW Trapping, Chihuahua, Mexico, 2001, 2002, 2003, 2004, and 2005.