CALIFORNIA PINK BOLLWORM CONTROL PROGRAM 2011/2012 UPDATE

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Abstract

The California Department of Food and Agriculture (CDFA) participates in the United States Department of Agriculture's Area-Wide Pink Bollworm (PBW) Eradication Program. The CDFA PBW program follows the protocols created by USDA to prevent the establishment and spread of PBW. CDFA uses survey trapping, pheromone application for mating disruption, sterile PBW moth releases, crop cultural control, and in Southern California the use of one hundred percent transgenic *Bacillus thuringiensis* (*Bt*) cotton. These techniques have proven to be very successful in California; in 2011 a total of two non-sterile PBW moths were trapped in California (one in the San Joaquin Valley and one in Imperial Valley). In 2012, California entered into year one of a four year eradication confirmation phase. CDFA has halted sterile PBW moth releases in the San Joaquin Valley and reduced the area treated with sterile moths in Southern California as it attempts to confirm eradication. CDFA continues extensive survey trapping in all cotton growing areas, the use of one hundred percent *Bt* cotton planting in Southern California, ongoing cotton plow down requirements in all areas and pheromone treatments in susceptible areas, such as okra acreage in Southern California. To date, no native/wild type moths were trapped in California in 2012.

Introduction

The pink bollworm, *Pectinophora gossypiella* Saunders, is one of the most important cotton pests in the United States (US). This serious economic pest is the subject of various area-wide control programs conducted by federal, state, local and commercial organizations throughout areas of the US Cotton Belt.

The California Department of Food and Agriculture (CDFA) Pink Bollworm (PBW) Program prevents the establishment and spread of this devastating pest and follows the basic guidelines and protocols established under the United States Department of Agriculture (USDA) Area-wide PBW Eradication Program. The technology used to eradicate the pink bollworm has five primary components: 1) extensive survey, consisting of mapping and trapping cotton acreage; 2) transgenic *Bacillus thuringiensis (Bt)* cotton; 3) sterile PBW moth releases; 4) pheromone application for mating disruption; and, 5) crop cultural control requirements. Program technologies are applied on an area-wide basis within each growing area.

Southern California cotton growing regions were added to the USDA PBW Area-wide Eradication Program in 2007 (Figure 1).

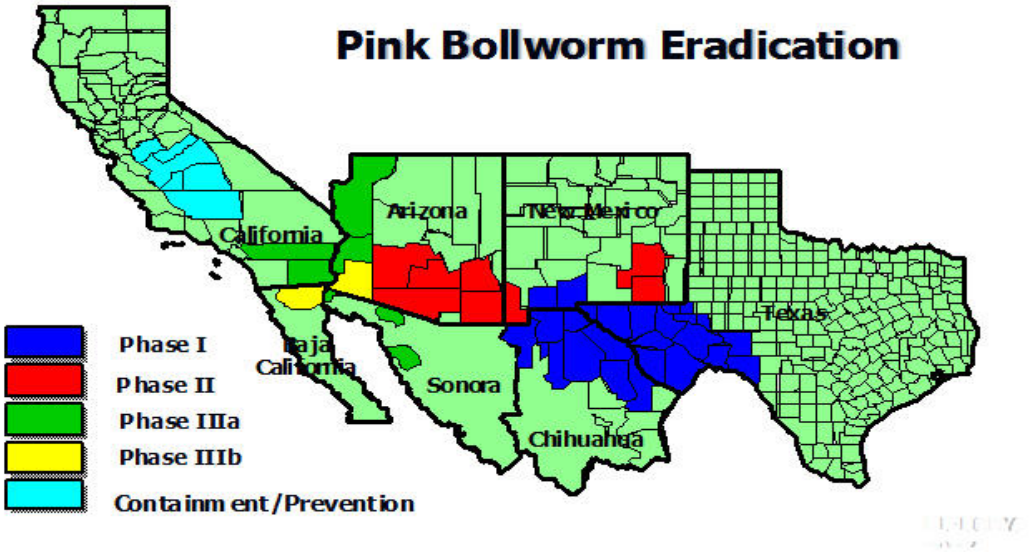


Figure 1. Pink Bollworm Area-wide Eradication Map

The program activities of detection and control are coordinated with the USDA and other cooperating state agencies. The CDFA PBW Program uses a risk-based management approach for program detection and control objectives within the San Joaquin Valley containment /prevention area.

The USDA pays the costs of sterile production/release activities within California's Area-wide PBW Eradication Program. All other program costs of the CDFA PBW Program are industry funded by an assessment fee of $2.00 per bale.

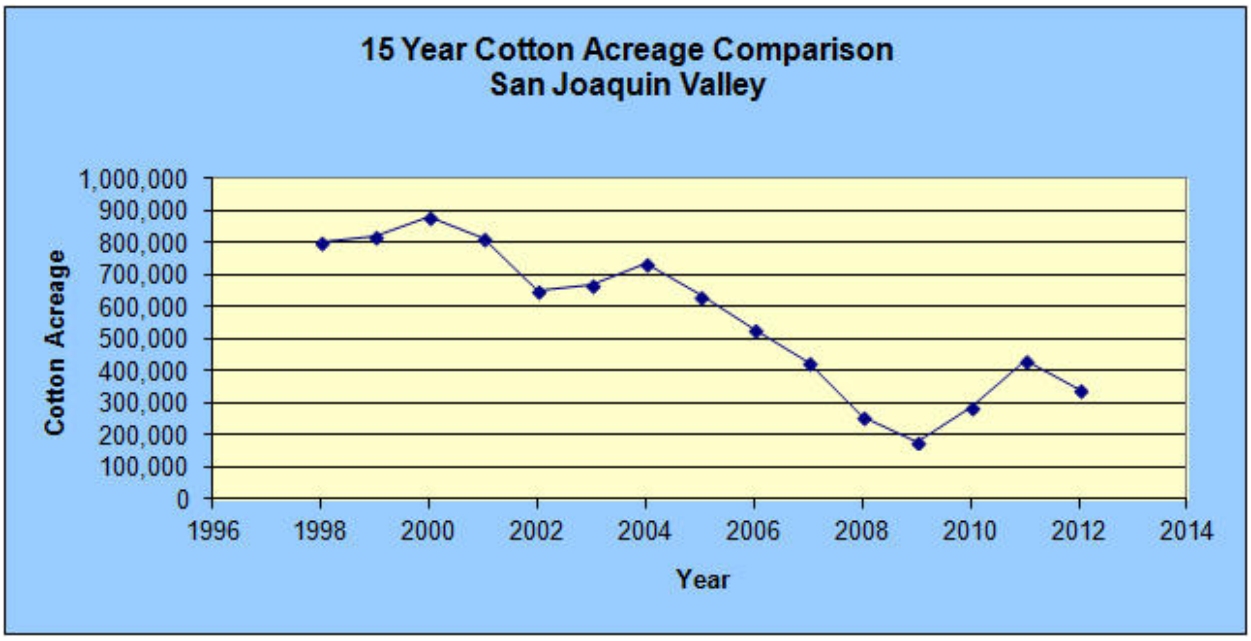
Methods

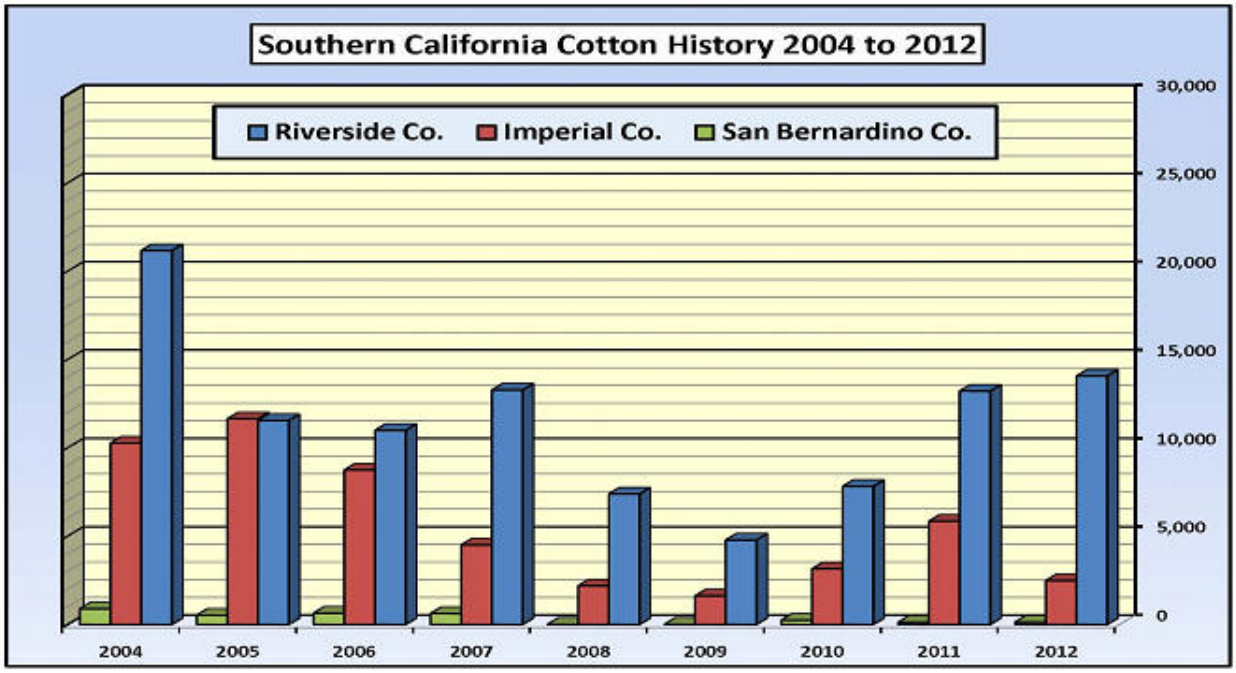
Survey

The extensive survey component of the PBW eradication program includes field mapping of all cotton grown within California and lure baited trapping.

Mapping

Crews use handheld GPS (Global Positioning System) Units to validate cotton field locations. The GPS data points are digitized into MapInfo® software and the resulting maps are used by program personnel in trapping, boll survey, sterile release, and plowdown compliance monitoring. In 2011, PBW Program personnel mapped 431,500 acres of cotton in the San Joaquin Valley, 19,200 acres in Imperial Valley and 3,895 acres in the Sacramento Valley for a grand total of 454,595 acres statewide. The total 2012 California cotton acreage was 366,409 acres, which was down approximately 21 percent from the 2011 mapped acreage (Figures 2, 3). The San Joaquin Valley had a total of 345,000 mapped acres, with 18,015 acres in the Imperial Valley and 3,394 acres in the Sacramento Valley. Pima cotton plantings in the San Joaquin Valley for 2011 and 2012 averaged 63 percent of the total cotton acreage. All cotton planted in the Imperial Valley in 2011 and 2012 was *Bt* cotton.





Figures 2 & 3. Cotton Acreage Comparisons

Trapping

Trapping in the Imperial Valley is conducted in compliance with the USDA Area-wide PBW Eradication Program. The San Joaquin Valley uses different trapping ratios: 1) 1 trap per 60 acres, 2) 1 trap per 80 acres, and 3) 1 trap per 100 acres (Figure 4). The trap ratios are based on historic native PBW captures, climate history, and PBW development history.

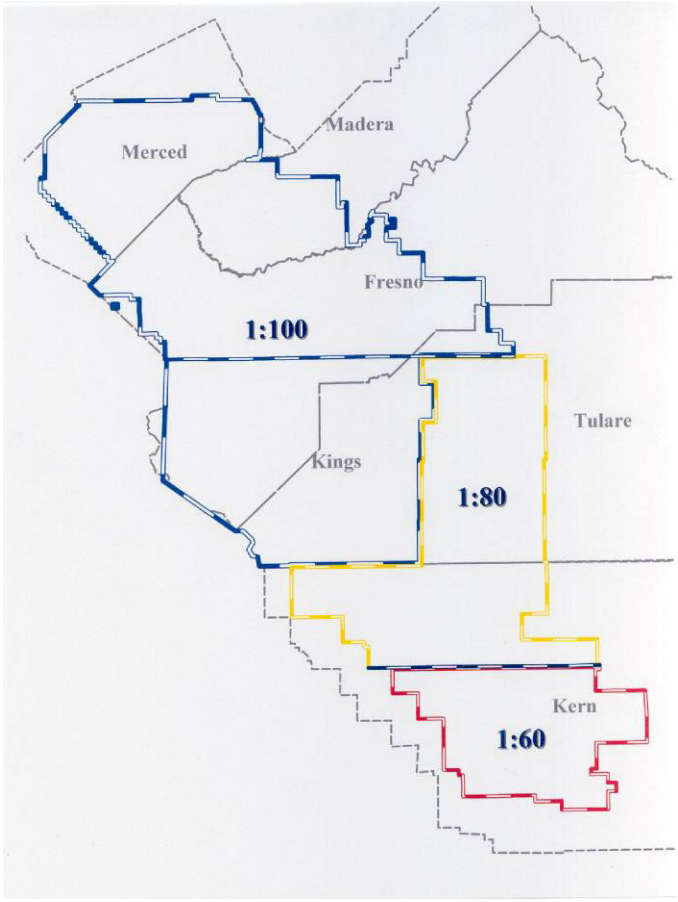


Figure 4. San Joaquin Valley Bio-potential Zones

The starting dates for each bio-potential zone are staggered to align with the PBW heat unit model. General detection trapping is scheduled based on the heat unit model in the southern San Joaquin Valley with traps being removed after defoliation. The total number of traps deployed during the peak of the season was 5,469 traps in 2011 and 4,313 traps in 2012. The Program used a 2 mg Consep® lure in the pheromone baited traps. Traps were inspected bi-weekly in the San Joaquin Valley and lures were changed at four 4 week intervals.

Southern California trapping is performed at 1 trap per 10 acres for non-*Bt* cotton and 1 trap per 60 acres in *Bt* cotton. Staff placed a total of 456 traps in 2011 and 419 traps in 2012 in the Southern California counties of Imperial, Riverside and San Bernardino. All traps were serviced weekly.

Sterile Insect Release

In 2011, the average daily release rate for the San Joaquin Valley was 1 million sterile moths per day, per release site when sterile release began in May. The sterile release plan is mapped to insure adequate coverage (Figure 5). The release rate was consistent at approximately 6 million per week until releases concluded October 1, 2011. Approximately 134 million sterile pink bollworm moths were released in the San Joaquin Valley.

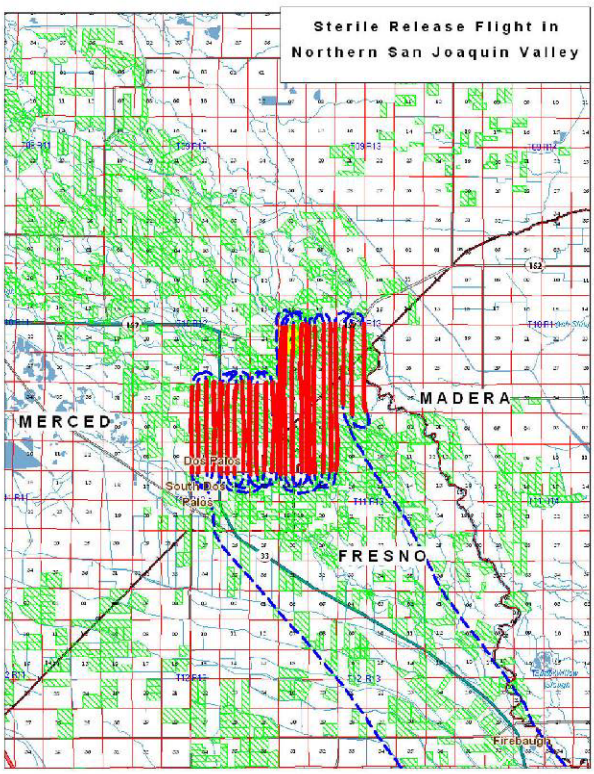


Figure 5. Aerial Sterile Insect Release Plan

Mass aerial dispersal of sterile PBW moths was performed on cotton plantings in Imperial, Riverside and San Bernardino counties. Approximately 76.9 million sterile moths were released during the cotton-growing season in southern California as a component of the PBW Area-wide Eradication Program.

In 2012, mass aerial dispersal of sterile PBW moths was performed only in the Bard/Winterhaven area of Southern California due to the close proximity to Yuma, Arizona (Phase IIIB) and over okra plantings in Imperial Valley. Approximately 5.3 million sterile moths were released during the cotton-growing season.

Dispersal of sterile moths was ceased in all other cotton-growing areas of California in an effort to substantiate eradication confirmation.

Pheromone Application

Pheromone application is another control method available for PBW Program use that has been proven to be a very successful method of the mating disruption technique. This technique induces mating confusion and disruption, interfering with reproduction during this period.

In 2012 pheromone applications were performed in Merced and Imperial Counties. In Merced pheromone applications were conducted at the site where the only non-sterile PBW was captured in the fall of 2011. The application was timed to coincide with the first peak emergence of overwintering PBW. The 2011 find field and six adjacent fields within the 1/8 mile buffer were treated. A total of 18,000 pheromone stations were hand applied on 90 acres at a rate of 200 stations per acre. In Imperial Valley, 105 acres of pima cotton (non-*Bt*) in the Bard/Winterhaven area was treated with pheromone at a rate of 200 stations per acre.

Cotton Plowdown Regulations

A reduced tillage permit was issued by CDFA to the PBW regulated districts in the San Joaquin Valley and a minimum tillage permit was issued to regulated districts in Imperial and Riverside counties. These permits had

several key requirements including grower notification to the local County Agricultural Commissioner, post harvest cotton plant shredding and tillage sufficient to prevent plant regrowth, regulatory inspection of cotton fields; and for the San Joaquin Valley only, substantial prohibited or restricted areas based on PBW native finds.

Results

In the San Joaquin Valley, the lab examined 3,159 traps containing suspect moths submitted by trappers. A total of 55,099 sterile moths and 1 non-sterile moth were identified. The non-sterile moth was captured in Merced County on a 10 acre plot during the week ending September 6, 2011 (Table 1).

For Southern California, the lab examined 5617 traps and identified 118,902 sterile moths and 1 native. The native moth was captured in a trap in Imperial County along the Salton Sea trap line in the week ending May 7, 2011 (Table 2). The program anticipated a historical spike in native captures from mid-August into September due to migration from the adjoining area of northern Mexico; however no additional moths were captured.

Table 1. Summary of 2011 Pink Bollworm Trapping

SAN JOAQUIN VALLEY 2011					
COUNTY	**MAPPED ACREAGE**	**TRAPS**	**STERILE MOTHS RELEASED**	**STERILE MOTHS RECOVERED**	**NON-STERILE MOTHS RECOVERED**
KERN	67,295	1,070	43,978,290	31,221	0
KINGS	132,880	1,393	0	5	0
TULARE	29,600	448	0	1	0
FRESNO	140,645	1,526	30,041,384	8,043	0
MERCED	55,605	949	59,994,973	18,574	1
MADERA	5,475	83	0	8	0
SAN JOAQUIN	0	0	0	0	0
TOTALS	**431,500**	**5,469**	**134,014,647**	**57,852**	**1**
IMPERIAL VALLEY 2011					
COUNTY	**MAPPED ACREAGE**	**TRAPS**	**STERILE MOTHS RELEASED**	**STERILE MOTHS RECOVERED**	**NON-STERILE MOTHS RECOVERED**
IMPERIAL	5,845	76	24,914,940	60,256	0
RIVERSIDE	13,210	331	51,521,310	58,646	0
SAN BERNARDINO	120	0	75,600	0	0
DESERT	0	49	0	95	1
TOTALS	**19,175**	**456**	**76,511,850**	**118,997**	**1**
SACRAMENTO VALLEY 2011					
COUNTY	**MAPPED ACREAGE**	**TRAPS**	**STERILE MOTHS RELEASED**	**STERILE MOTHS RECOVERED**	**NON-STERILE MOTHS RECOVERED**
BUTTE	0	0	0	0	0
COLUSA	915	10	0	0	0
GLENN	2,240	28	0	0	0
SUTTER	740	7	0	0	0
TEHAMA	0	0	0	0	0
YOLO	0	0	0	0	0
TOTALS	**3,895**	**45**	**0**	**0**	**0**

In 2012, the laboratory examined 3 traps from the San Joaquin Valley and identified 3 lookalike moths and 0 non-sterile moths. Staff submitted 1,318 traps from the Imperial Valley and the laboratory identified 56,020 sterile moths and 0 non-sterile moths.

Table 2. Summary of 2012 Pink Bollworm Trapping

SAN JOAQUIN VALLEY 2012					
COUNTY	**MAPPED ACREAGE**	**TRAPS**	**STERILE MOTHS RELEASED**	**STERILE MOTHS RECOVERED**	**NON-STERILE MOTHS RECOVERED**
KERN	55,940	852	0	0	0
KINGS	112,785	1,165	0	0	0
TULARE	20,440	316	0	0	0
FRESNO	102,715	1,107	0	0	0
MERCED	52,125	848	0	0	0
MADERA	995	25	0	0	0
SAN JOAQUIN	0	0	0	0	0
TOTALS	**345,000**	**4,313**	**0**	**0**	**0**
IMPERIAL VALLEY 2012					
COUNTY	**MAPPED ACREAGE**	**TRAPS**	**STERILE MOTHS RELEASED**	**STERILE MOTHS RECOVERED**	**NON-STERILE MOTHS RECOVERED**
IMPERIAL	2,480	21	5,267,350	54,037	0
RIVERSIDE	14,065	349	0	1,030	0
SAN BERNARDINO	0	0	0	0	0
DESERT	0	49	0	399	0
TOTALS	**16,545**	**419**	**5,267,350**	**55,466**	**0**
SACRAMENTO VALLEY 2012					
COUNTY	**MAPPED ACREAGE**	**TRAPS**	**STERILE MOTHS RELEASED**	**STERILE MOTHS RECOVERED**	**NON-STERILE MOTHS RECOVERED**
BUTTE	0	0	0	0	0
COLUSA	557	6	0	0	0
GLENN	1,808	24	0	0	0
SUTTER	954	10	0	0	0
TEHAMA	0	0	0	0	0
YOLO	75	1	0	0	0
TOTALS	**3,394**	**41**	**0**	**0**	**0**

Conclusion

The number of non-sterile captures has been reduced 100 percent from 2010 to 2012, with 6 non-steriles captured in 2010 and 1 non-sterile captured in 2011 no non-sterile moths captured in 2012 (Figure 6).

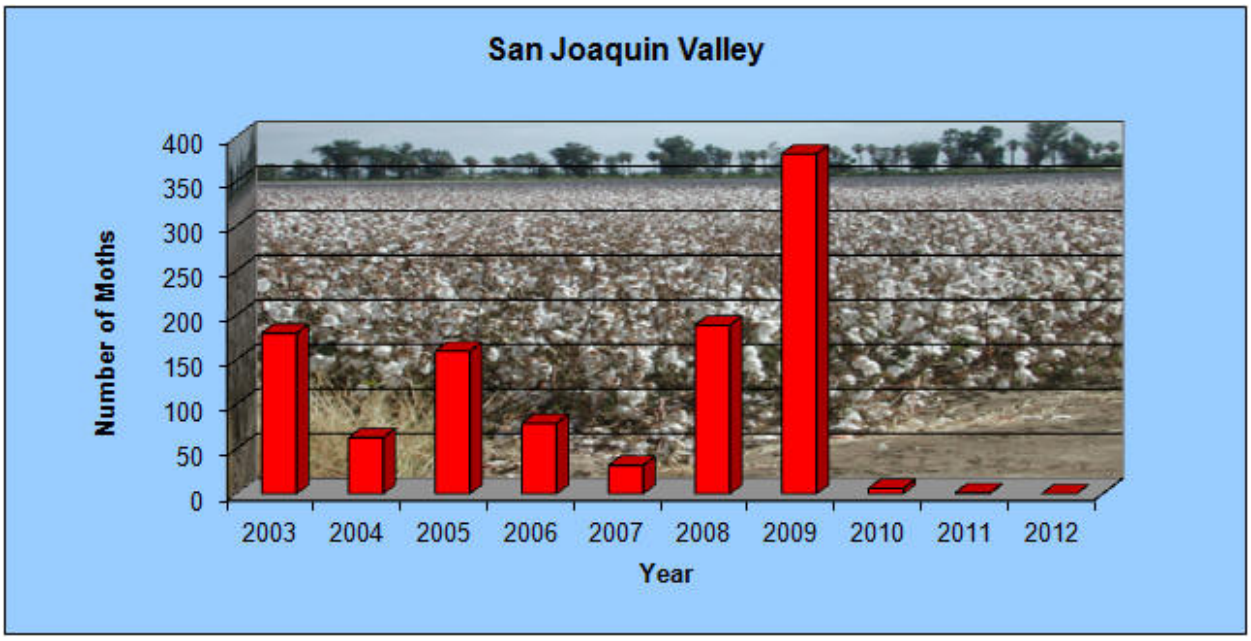


Figure 6. Reduction in San Joaquin Valley Non-sterile Captures.

There has been a 100 percent reduction in the number of non-sterile captures from 2010 to 2012, with 135 natives captured in 2010 and 1 non-sterile captured in 2011 no non-sterile moths captured in 2012 resulting in a 100 percent reduction in non-sterile captures (Figure 7).

Overall, there was a significant decline in non-sterile moths trapped in California compared to the Pre-Area-wide PBW Eradication Program 2007 capture levels. The CDFA PBW program has been extremely successful and will continue to actively monitor for incipient PBW infestations.

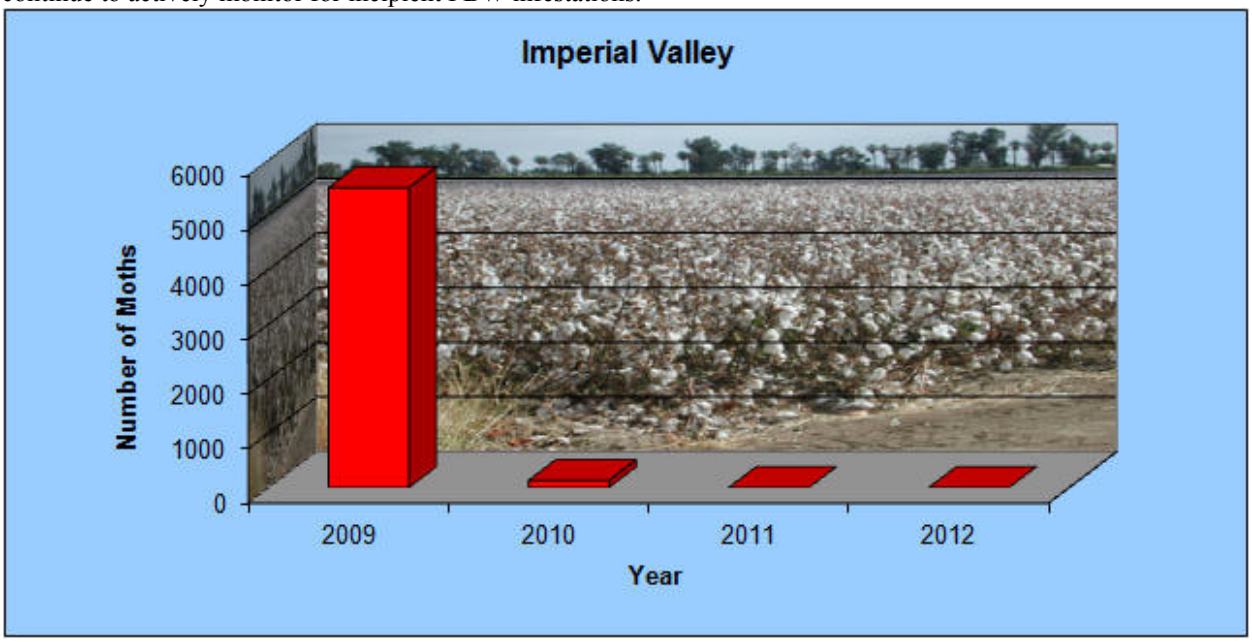


Figure 7. Reduction in Imperial Valley Non-sterile Captures.

Acknowledgements

We wish to thank the California cotton growers, the California Cotton Growers and Ginners Association, and the California Cotton Pest Control Board for supporting the PBW Program throughout its 45 year history. Through their foresight, the development and implementation of Sterile Insect Treatment for PBW has proven to be an effective tool in the control and eradication of PBW infestations.

Payment of assessments by California cotton growers provided the funding for the purchase and construction of the current Pink Bollworm Sterile Insect Rearing Facility in Phoenix, Arizona. This facility was built in 1993 with the intention of having the ability to produce enough sterile insects to allow area-wide PBW control to the major cotton producing states.

We thank the USDA-APHIS for their technical support and facilitation of an aerial sterile release program for Southern California.

Our appreciation goes to Mr. Eion Davis and his many USDA workers for directing and managing the production and shipment of sterile PBW moths at the Phoenix Rearing facility.

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We also wish to thank the Susan O'Toole and her USDA colleagues for their successful efforts in obtaining an EPA Section 18 Crisis Exemption to allow the use of 100% *Bt* cotton plantings in southern California.

We wish to thank Dr. Bob Staten for his work on the Pink Bollworm Area-wide Eradication Program in the US and Mexico.

Lastly, a special thanks to all the CDFA Pink Bollworm Program employees who have steadfastly contributed to the overall success of the California Program through years of dedicated service.