BOLL WEEVIL ERADICATION UPDATE - TEXAS, 1998

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Abstract

The boll weevil eradication program in Texas was initiated in 1994 in an effort to rid the state of the cotton boll weevil, *Anthonomus grandis* Boheman.

The program was first initiated in the Southern Rolling Plains (SRP) on 220,000 acres of cotton in September of 1994 with the diapause phase, followed by a season-long phase of the program in 1995, 1996, 1997 and 1998.

The SRP is the first zone to advance to eradication status in the state of Texas. Boll weevil populations were almost non-existent during the 1998 cotton growing season. The seasonal mean number of boll weevils captured per trap per week in 1998 was significantly less than in 1997, 1996 and 1995. The mean in 1998 was 0.04, in 1997 it was 1.3, in 1996 it was 2.9, and in 1995 it was 10.6. This represents a reduction rate of 99.6% in 1998 as compared to 1995, 96.9% as compared to 1997, and 98.6% as compared to 1996. Insecticide applications in 1998 were reduced by 95.5% as compared to 1995.

In 1996, the program was initiated with the diapause phase in the South Texas/Winter Garden (ST/WG) and in the Rolling Plains Central (RPC) zones on approximately 350,000 and 700,000 acres respectively. In 1997, due to the suspension of field activity during the legal and the legislative process (May - June 1997), program plans in the ST/WG and RPC had to be altered. A second diapause phase was implemented in 1997 instead of the season-long phase. The first season-long phase was implemented in both zones in 1998.

In the ST/WG zone, the seasonal mean number of boll weevils per trap per week in 1998 was significantly less than in 1996. The 1998 mean was 1.4, and in1996 it was 15.3, a reduction rate of 90.9% in 1998 as compared to 1996.

In the RPC zone, the seasonal mean number of boll weevils per trap per week in 1998 was significantly less than in 1996. The 1998 mean was 1.1, and in1996 it was 18.3, a reduction rate of 94.0% in 1998 as compared to 1996.

These results demonstrate that the area-wide eradication approach, utilizing pheromone traps with sound cultural, mechanical and chemical controls, represents an effective strategy in reducing boll weevil populations as planned, subsequently eliminating the most destructive cotton pest in the state. The plan is to sequentially implement the program in all of the cotton growing regions to achieve statewide eradication.

Introduction

The boll weevil, *Anthonomus grandis* Bohman, a native of Mexico and Central America, was first introduced into the United States, near Brownsville, Texas, about 1892 (Hunter and Hinds, 1905). By 1922, the pest had spread into cotton growing areas of the United States from the eastern two-thirds of Texas and Oklahoma to the Atlantic Ocean. Northern and western portions of Texas were colonized by the boll weevil during a subsequent range of expansion that occurred between 1953 and 1966 (Newsom and Brazzel, 1968). In 1903 the Texas Legislature offered a $50,000 cash reward for a practical way to control the boll weevil.

Yield losses attributed to the boll weevil, the cost of insecticide control, environmental considerations, infestation of secondary insect pests and insect resistance have all resulted in an aggressive effort to develop a beltwide strategy for controlling the boll weevil in the United States.

Although most growers judiciously apply control measures to boll weevil infested acreage in almost all such areas, 5 to 20 percent of the infested acreage may receive inadequate or no control treatments (Knipling, 1979). This uncontrolled acreage harbors populations capable of reinfesting neighboring areas. Models developed by Knipling (1979) demonstrate that if only 10 percent of a population remains untreated, that portion of the population can develop normally and redistribute throughout the entire area after only four generations, or in less than one growing season. Also, judicious application of control measures cannot protect against reinfestation from neighboring areas the

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following season; thus, growers who treat their acreage are faced with a continuing need to reapply insecticide to control reinfestations.

The National Cotton Council estimates that the boll weevil has cost United States cotton producers more than $13 billion since entering from Mexico a century ago (National Cotton Council, 1994). It is generally agreed that cotton cannot continue to be profitably grown in areas where the insect persist and that other control strategies are imperative.

In view of the economic and environmental problems posed by the boll weevil and in recognition of the technical advances developed over the past 100 years, a cooperative boll weevil eradication experiment was implemented in 1971 in southern Mississippi and parts of Louisiana and Alabama. This experiment used an integrated control approach which included chemical treatment, releases of sterile boll weevil males, mass trapping, and cultural control. Based on this experiment, a special study committee of the National Cotton Council of America concluded that it was technically and operationally feasible to eliminate the boll weevil. The success of a subsequent 3-year boll weevil eradication trial, initiated in 1977 on 32,500 acres in North Carolina and Virginia, led to the initiation of the Southwestern and Southeastern boll weevil eradication programs (USDA, 1991). Except for occasional minimal reappearances of weevils, the boll weevils for all practical purposes, have been eradicated from the cotton growing regions in the states of Virginia, North Carolina, South Carolina, Georgia, Florida, Alabama, California, Arizona, and Northwest Mexico (Cunningham and Grefenstette, 1998).

In 1993, the Texas Boll Weevil Eradication Foundation (TBWEF) was established by the Texas Legislature to oversee the implementation of the boll weevil eradication program in Texas. In March of 1994, the cotton producers and landowners in the Southern Rolling Plains (SRP) passed a referendum with a majority vote of 84% to initiate the first eradication program in the state. The program started in the SRP with the diapause phase in the fall of 1994 on approximately 220,000 acres. In October of 1994, the producers and landowners in the Lower Rio Grande Valley (LRGV) zone passed a referendum with a majority vote of 73% to initiate the eradication program. The program started in the LRGV in the spring of 1995 with the season-long phase on approximately 360,000 acres. In January of 1996, the LRGV growers opted to discontinue the program. In 1996, the program began in the South Texas/Winter Garden (ST/WG) zone on approximately 350,000 acres with the diapause phase after a majority vote of 73% in February of 1995. In 1996, the program also began in the Rolling Plains Central (RPC) zone on approximately 700,000 acres with the diapause phase after a majority vote of 85% in December of 1994. In September of 1996, producers and landowners in the St. Lawrence (St.L) zone also passed a referendum with a majority vote of 75% to start the program with the diapause phase in the fall of 1997.

In May of 1997, the Texas Supreme Court rendered a decision finding the initial boll weevil law, under which the TBWEF operated, unconstitutional in that the nonprofit Foundation had authority similar to governmental agencies. The Texas Legislature during the 75th session addressed the concerns that were outlined by the Supreme Court and a new law was passed and signed by the governor in June of 1997. As an outcome of the new law, the Texas Department of Agriculture (TDA) was granted oversight authority and the TBWEF was charged with carrying out eradication programs in the state. The law also outlined six statutory zones: the Southern Rolling Plains (SRP); the Rolling Plains Central (RPC); the South Texas/Winter Garden (ST/WG); the Northern High Plains (NHP); the Southern High Plains/Caprock (SHP/C) and the St. Lawrence (St. L). Additionally, the Texas legislature elected to remove seven of the 31 counties in the ST/WG zone, including Austin, Brazoria, Colorado, Fort Bend, Jackson, Matagorda and Wharton. Further, the law mandated the holding of referendums in each of the zones to provide growers an opportunity to vote in order to continue the already initiated eradication programs in the SRP, RPC, and ST/WG. On October 20, 1997, the growers in ST/WG voted to continue the eradication program by nearly 70%. On February 2, 1998, the growers in SRP voted to continue the eradication program by nearly 80%; and on March 11, 1998, the RPC growers passed the referendum to continue the program by 86%.

Due to the suspension of field activity during the legal and the legislative process (May - June 1997), program plans in the ST/WG and RPC had to be altered. A second diapause phase had to be implemented in 1997 instead of the scheduled season-long phase. Despite the late start, a season-long phase was implemented in the SRP. The 1998 season marked the implementation of the first season-long phase in both RPC and ST/WG zones.

Additionally, upon the request of growers, the SHP/C and NHP statutory zones were divided into five eradication zones, including the Western High Plains (WHP), Permian Basin (PB), Southern High Plains/ Caprock (SHP/C), Northwestern Plains (NWP), and Northern High Plains (NHP).

Materials and Methods

Twelve eradication zones were established by the Texas Legislature during the 75th session, via grower referenda, and by the Texas Department of Agriculture. The designated eradication zones are:

1. Southern Rolling Plains (SRP), (200,000 acres)
2. St. Lawrence (St.L), (150,000 acres)

3. South Texas/Winter Garden (ST/WG), (350,000 acres)
4. Rolling Plains Central (RPC), (750,000 acres)
5. Southern High Plains/Caprock (SHP/C), (1,200,000 acres)
6. Northern High Plains (NHP), (550,000 acres)
7. Western High Plains (WHP), (850,000 acres)
8. Permian Basin (PB), (600,000 acres)
9. Northern Rolling Plains (NRP), (400,000 acres)
10. Northwest Plains (NWP), (550,000 acres)
11. Southern Blacklands (SBL), (200,000 acres)
12. El Paso/Trans Pecos (EP/TP), (60,000 acres)(Figure 1).

Mapping

Mapping is one of the first phases of operation in any eradication zone. The purpose of mapping is to identify the exact location of each cotton field and determine the surrounding environment. The program continues to utilize a numbering system that is designed to identify each cotton field in the state with a unique number (El-Lissy et al., 1996). All cotton fields were mapped using the differentially corrected Global Positioning System (GPS) in the same manner as described previously (El-Lissy et al., 1997).

Detection

(1.) Trapping: Boll weevil traps continue to be utilized as the primary tool of detection. Traps were baited with one-inch square laminated polyvinyl chloride dispensers impregnated with 10 mg of grandlure. Traps were placed at or shortly after planting around all cotton fields at a density of one per five acres and inspected weekly (El-Lissy et al., 1996). The crop phenology of each field was also reported at the same time traps were inspected. The program continued to utilize the Barcode System in the same manner as described previously (El-Lissy et al., 1997).

(2.) Field Survey (scouting): The purpose of the survey was to measure the level of field infestation as it relates to trapping information. Ten randomly selected fields per work unit (15,000 acres) were designated as survey fields, five of which were located near boll weevil overwintering sites. Each of the designated fields was divided into four quadrants and fifty squares were randomly collected from each quadrant weekly. All squares were examined and weevil damage was recorded. Additional fields were inspected for infestation when the trap catch was borderline to the action threshold for treatment. Further, during the week of September 8, 1998, ten randomly selected fields per county in RPC, WHP, PB, NRP, SHP/C, NWP, and NHP were scouted. The purpose of this survey was to measure boll weevil population densities both inside and outside active eradication zones.

Control

The control part of the eradication program consists of cultural, mechanical and chemical control:

(1.) Cultural Control: windows for uniform cotton planting and harvesting, as organized by grower advisory committee in each zone, are key components of cultural control by providing the necessary host-free period. In the SRP and RPC, most growers started to plant on or about May 15. Growers began planting February 15 in the ST/WG. In RPC, due to the severe drought conditions experienced in 1998, growers were offered a rebate to destroy failed cotton fields through September 21 in an effort to reduce insecticide treatments. In zones with mandatory stalk destruction rules and regulations, such as the ST/WG zone in which temperate climates may induce regrowth during the winter months (off-season), TBWEF personnel assisted TDA in maintaining a host-free period. Information was provided to TDA identifying fields that were out of compliance with plow-up regulations before the stalk destruction date. Additionally, the TBWEF continued to offer an early plow-up rebate as an incentive for growers to destroy cotton stalks as soon as possible after harvest.

(2.) Mechanical Control: while the primary function of the trap was to measure the adult boll weevil population densities and identify their locations, another key benefit was removing portions of these populations in the process (El-Lissy, 1998).

(3.) Chemical Control: a single Fyfanon® ULV (12.0 fl oz/ac, 0.92 lb [AI]/ac) application was made to fields that had reached the treatment criteria (action threshold). The action threshold was a trap catch of two adult boll weevils per 40-acre field, or if weevil colonization were evident. In SRP, the action threshold remained the same throughout the growing season. In RPC the action threshold was increased to five and in ST/WG to seven adult boll weevils per 40-acre field during the mid-season period (bloom to early open boll phenology), then reduced back to two weevils beginning at the early open boll (few open bolls) stage until all hostable plants and food materials were eliminated either by defoliation and harvesting or a killing freeze. Additionally, growers had the option of using alternate insecticides in lieu of program treatments of Fyfanon® ULV during early and mid-season.

Aerial applications were made by airplanes equipped with a spray system designed and calibrated to deliver ultra-low volume. Each aircraft was equipped with a differentially corrected guidance system. This Global Positioning System (GPS) technology is similar to the one used in mapping, and was utilized for documentation and quality control purposes in the same manner as described previously (El-Lissy et al., 1997).

Fields that were located within close proximity to some of the designated environmentally sensitive sites or near permanent obstacles were treated with high-clearance ground sprayers. Mist blowers mounted on pickup trucks were also used to provide accurate placement of insecticide on corners and edges of fields and under power lines or

other obstacles where airplanes had less accessibility (El-Lissy et al., 1996).

Results and Discussion

Southern Rolling Plains Zone

The SRP is the first zone to near eradication status in the state of Texas. Boll weevil populations in SRP were almost non-existent during the 1998 cotton growing season. Preliminary analyses indicate that the 1998 weekly mean number of weevils per trap was significantly less than the previous four years (Figure 2).

The 1998 season-long mean number of adult weevils captured per trap per week was significantly less than 1997, 1996 and 1995. The mean in 1998 was 0.04, 1997 was 1.4, in 1996 was 2.8, and in 1995 was 10.6, a reduction rate of 99.6% in 1998 as compared to 1995, 98.6% as compared to 1996 and 97.1% as compared to 1997 (Figure 3).

The season-long cumulative number of acres treated in 1998 was 198,133 acres, averaging 1.1 applications per acre; in 1997 it was 1,302,847 acres, averaging 7.0 applications per acre; in 1996 it was 785,546 acres, averaging 4.3 applications per acre; and in 1995, it was 2,095,696 acres, averaging 10.9 applications per acre, a reduction rate of 90% in 1998 as compared to 1995.

Rolling Plains Central Zone

In the RPC, preliminary analyses indicate that the 1998 weekly mean number of weevils per trap was significantly less than 1997 and 1996 (Figure 4).

The overall mean number of weevils captured per trap per week during the spring emergence (May 10 - July 22) in both 1997 and 1998 was significantly less than in 1996. The 1998 mean was 1.2, 1997 mean was 7.1 and in 1996 it was 32.6, a reduction rate of 96.3% and 78.2% in 1998 as compared to 1996 and 1997, respectively (Figure 5). The overall mean number of weevils per trap per week during the fall (September 8 - December 8) in 1997 was not significantly different as compared to 1996, however, the 1998 mean was significantly less than 1996 and 1997. The 1998 mean was 0.8, 1997 was 18.19 and 1996 was 22.8, a reduction rate of 96.5% and 95.6% as compared to 1996 and 1997, respectively (Figure 6). This signifies the importance of implementing sound season-long control following the diapause phase of the program. Further, this demonstrates that a diapause phase alone would provide a reduction in populations the following spring, but in the absence of season-long activity, weevil populations would likely rebound to the original level.

The 1998 season-long cumulative number of acres treated was 1,021,945 acres, averaging 4.1 applications; 1997 season-long cumulative number of acres treated in the diapause phase was 4,315,861 acres, averaging 7.0 applications per acre; and in 1996, it was 3,018,434 acres, averaging 6.0 applications.

The percent squares and young bolls damaged by weevils during the week of September 8, 1997 was significantly less in the RPC as compared to NRP, NHP, NWP, WHP, PB, SHP/C, and St.L. The percent damaged squares and young bolls in RPC was 0.2, NRP was 30.9, NHP was 38.6, NWP was 9.8, WHP was 64.6, PB was 51.2, SHP/C was 58.7, and St.L was 2.1 (Figure 7). Historically, the level of boll weevil infestation has been higher in RPC as compared to the High Plains cotton growing region (Dr. Tom Fuchs, personal communication).

South Texas / Winter Garden Zone

In the ST/WG, preliminary analyses indicate that the 1998 weekly mean number of weevils per trap was significantly less than 1997 and 1996 (Figure 8).

The overall mean number of weevils captured per trap per week during the spring emergence (February 16 - May 19) in both 1997 and 1998 was significantly less than in 1996. The 1998 mean was 0.5, 1997 mean was 2.1 and in 1996 it was 17.1, a reduction rate of 97.1% and 87.7% in 1998 as compared to 1996 and 1997, respectively (Figure 9). The overall mean number of weevils per trap per week during the fall (July 28 - November 17) of 1997 was not significantly different as compared to 1996, however, the 1998 mean was significantly less than 1996 and 1997. The 1998 mean was 3.8, 1997 was 20.6 and 1996 was 21.7, a reduction rate of 82.5% and 81.6% as compared to 1996 and 1997, respectively (Figure 10). This confirms the importance of implementing sound season-long control following the diapause phase of the program. Again, this demonstrates that a diapause phase alone would provide a reduction in populations the following spring, but in the absence of season-long activity, weevil populations would likely increase again to the original level.

The 1998 season-long cumulative number of acres treated was 1,765,189 acres, averaging 5.8 applications per acre; the 1997 cumulative number of acres treated for the diapause phase was 1,353,028 acres, averaging 4.5 applications; and in 1996, it was 1,772,915 acres, averaging 5.9 applications.

Conclusion

Based on the above, we conclude that the outcome of the area-wide boll weevil eradication program has been successful. In SRP, boll weevil populations were almost non-existent during the 1998 cotton growing season. In RPC, boll weevil populations have been reduced by approximately 94% and in ST/WG by 91%. Moreover, according to the scouting survey conducted during the week of September 8, 1998, it is clearly evident that the eradication program has reduced the level of the weevil populations in the eradication zones while the infestations

seem to be climbing in neighboring cotton growing regions outside the eradication zones.

Acknowledgments

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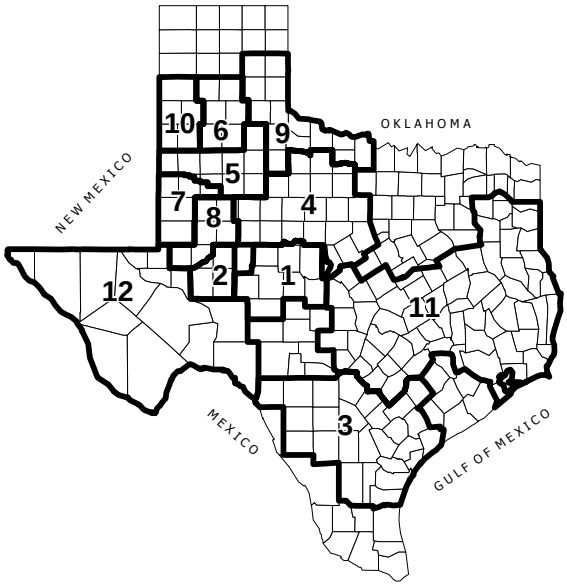

Figure 1: Boll weevil eradication zones in Texas, 1998

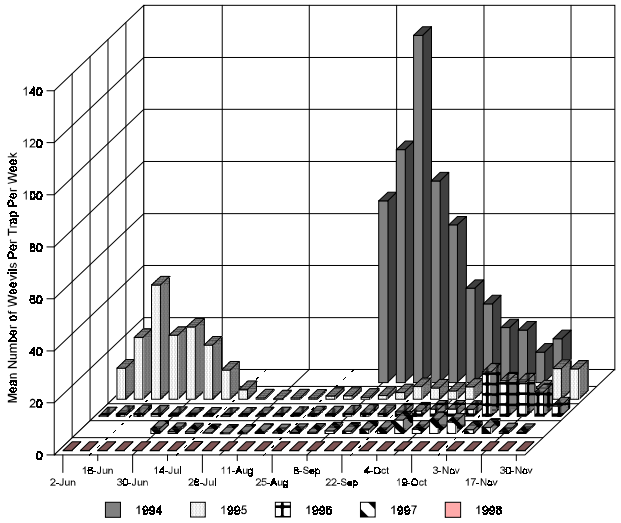

Figure 2. Mean number of adult boll weevils captured per trap per week by year, Southern Rolling Plains Zone of Texas.

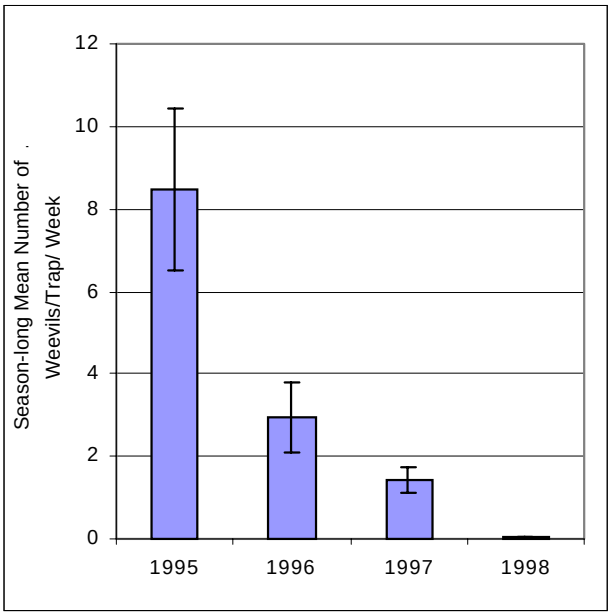

Figure 3. Season-long mean number of adult boll weevils captured per trap per week by year and standard error in the Southern Rolling Plains Zone of Texas.

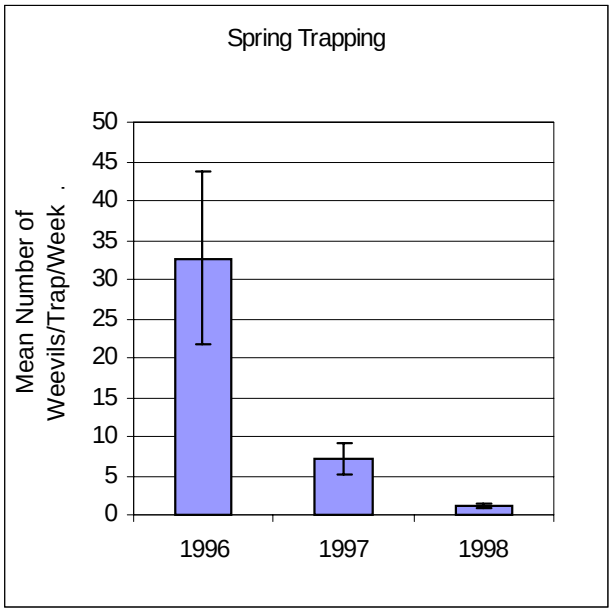

Figure 5. Overall mean number of adult weevils captured per trap per week by year and standard error during the spring of 1996, 1997, and 1998, Rolling Plains Central Zone of Texas.

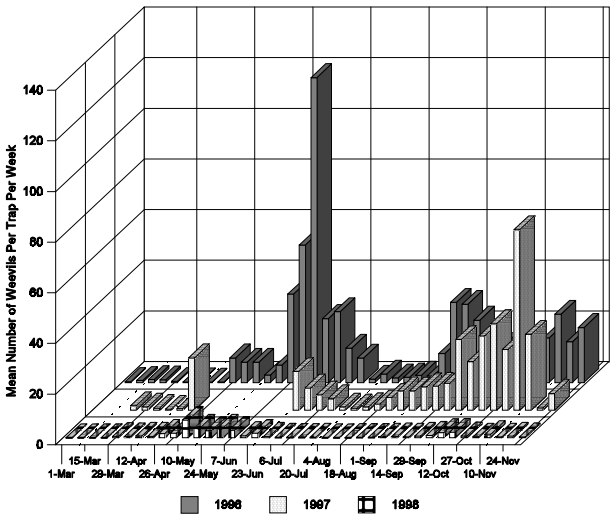

Figure 4. Mean number of adult boll weevils captured per trap per week by year, Rolling Plains Central Zone of Texas. (The absence of trapping information from May 5 to June 22, 1997 was due to the suspension of program activity during the legal and legislative process).

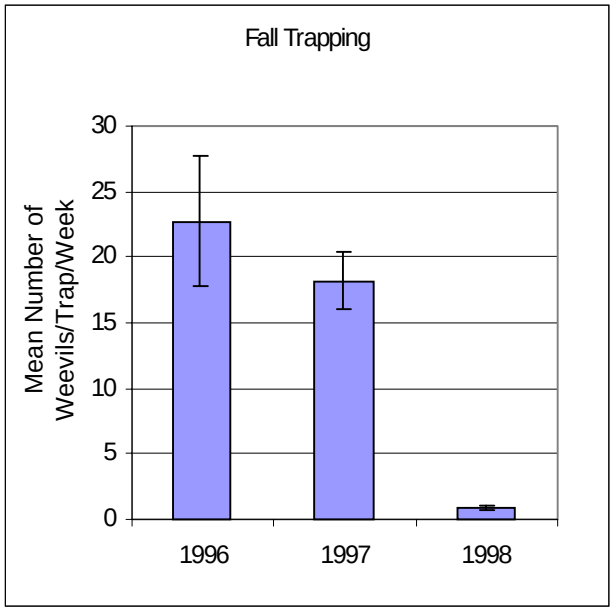

Figure 6. Overall mean number of adult weevils captured per trap per week by year and standard error during the fall of 1996, 1997, and 1998, Rolling Plains Central Zone of Texas.

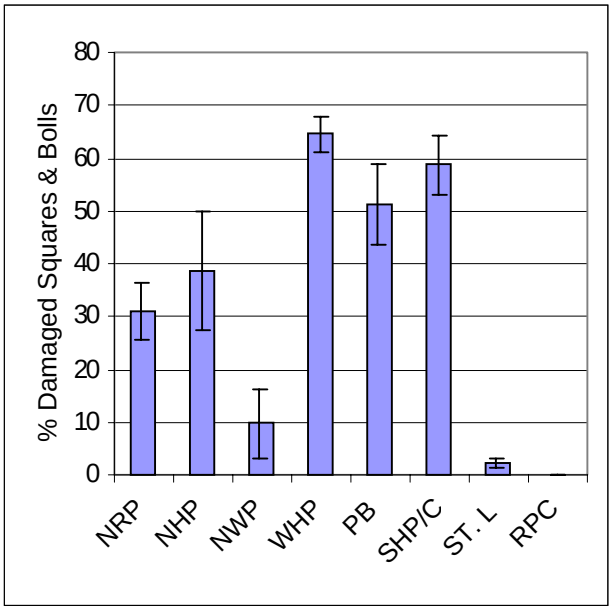

Figure 7. Percent boll weevil damaged squares and bolls and standard error in the NRP, NHP, NWP, WHP, PB, SHP/C, ST.L, and RPC Eradication Zone, Texas, 1998.

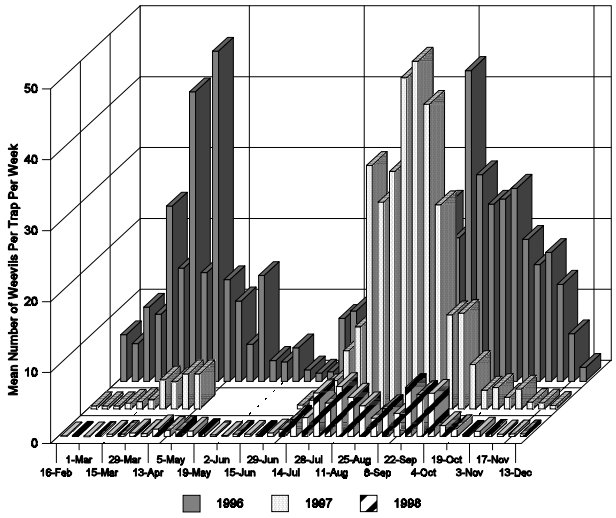

Figure 8. Mean number of adult boll weevils captured per trap per week, during 1996 and 1997, South Texas / Winter Garden, Texas. (The absence of trapping information from May 5 to June 22, 1997 was due to the suspension of program activity during the legal and legislative process).

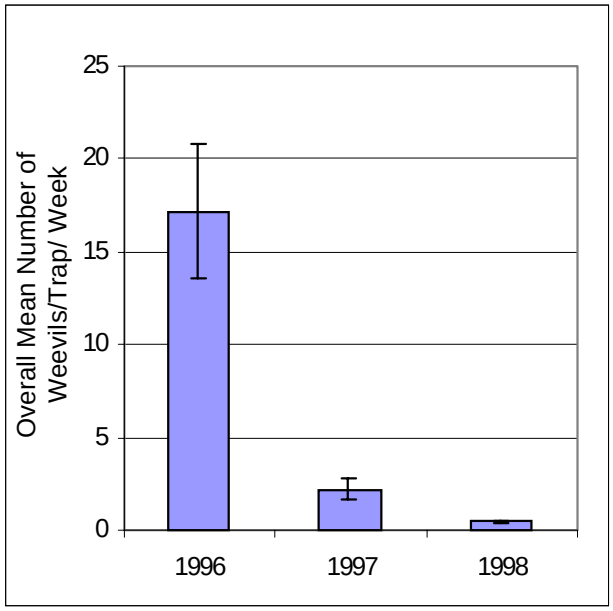

Figure 9. Overall mean number of adult weevils captured per trap per week and standard error during the spring of 1996, 1997, and 1998, South Texas/Winter Garden zone, Texas.

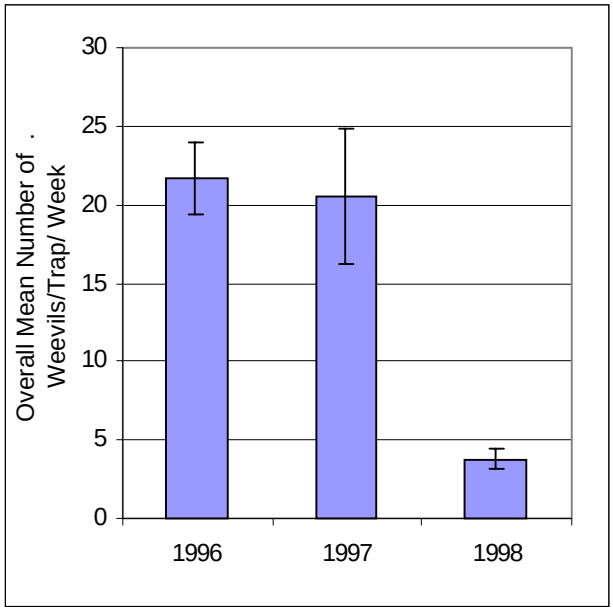

Figure 10. Overall mean number of adult weevils captured per trap per week and standard error during the fall of 1996, 1997, and 1998, South Texas/Winter Garden zone, Texas.