BOLL WEEVIL ERADICATION - NATIONAL STATUS, 2000 Osama El-Lissy and Bill Grefenstette United States Department of Agriculture Animal and Plant Health Inspection Service Riverdale, MD

Abstract

The boll weevil eradication program in the United States began in 1983 to rid the Cotton Belt of the boll weevil, *Anthonomus grandis* Boheman.

To date, the boll weevil has been eradicated from over 5.0 million acres of cotton in Virginia, North Carolina, South Carolina, Georgia, Florida, most of Alabama, Central Tennessee, Southern Rolling Plains of Texas, southern California, and Arizona, as well as from the neighboring regions of the Mexicali Valley, Sonoita, and Caborca in Mexico.

The program is currently operating in an additional 6.8 million acres of cotton in Mississippi, Tennessee, Louisiana, Arkansas, Oklahoma, Texas, and New Mexico. Further, the program is scheduled to expand in 2001 to include 2.4 million additional acres in Missouri, Arkansas, Texas, and New Mexico.

The remarkable environmental, biological, and economic benefits realized in the eradicated regions make boll weevil eradication one of the most important agricultural programs in history.

Introduction

The boll weevil, *Anthonomus grandis* Boheman, a native of Mexico and Central America, was first introduced into the United States, near Brownsville, Texas, about 1892 (Hunter et al., 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 between 1953 and 1966 (Newsom and Brazzel, 1968).

In view of the economic and environmental problems posed by the boll weevil and in recognition of the technical advances developed over almost 100 years, a cooperative boll weevil eradication experiment was initiated in 1971 in southern Mississippi and parts of Louisiana and Alabama (Parencia 1978; Perkins 1980). This experiment used an integrated control approach including chemical treatment, release of sterile male weevils, 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 from the U.S.

Subsequent discussions among federal and state research agencies, extension, regulatory officials, and grower organizations led to a decision by USDA in 1977 to conduct two additional area-wide boll weevil eradication trials in Mississippi, and in North Carolina and Virginia. The success of the 3-year boll weevil eradication trials, initiated in 1978 on 32,500 acres in North Carolina and Virginia, and on 32,000 acres in Mississippi, led to the boll weevil eradication program in the southeastern and southwestern cotton-growing regions of the U.S. (USDA, 1991).

The Southeast Boll Weevil Eradication Program began in southern North Carolina (15,000 acres) and South Carolina (70,000 acres) in 1983, Georgia (287,500 acres) in 1987, Florida (107,000 acres) in 1987, southeastern Alabama (61,000 acres) in 1987, and central Tennessee (11,000 acres) in 1994 (James R. Brazzel, 1989; Sidney E. Cousins, 1991; Bill Grefenstette,

Reprinted from the *Proceedings of the Beltwide Cotton Conference* Volume 2:776-781 (2001) National Cotton Council, Memphis TN 1996). Boll weevil eradication was completed in North Carolina, South Carolina, Georgia, Florida, and Alabama (excluding the northwestern region) and central Tennessee in 1987, 1990, 1992, 1993, 2000, respectively.

The Southwest Boll Weevil Eradication Program began in 1983 in the Imperial Valley of California (60,000 acres), western Arizona in 1985 (70,000 acres), central Arizona in 1988 (420,000 acres), Mexicali Valley of Mexico in 1988 (160,000 acres), and the Sonoita cotton region of Mexico in 1988 (5,000 acres). In 1991, boll weevil eradication was successfully completed in southern California, Arizona, and northwest Mexico.

Environmental, biological and economic benefits realized as a result of the success of the boll weevil eradication program in the southeast and the southwest (Carlson et al., 1989; USDA, 1991; Haney et al., 1996), led to program expansion into the rest of the Cotton Belt.

Tennessee

The program began in Region I (174,000 acres) of west Tennessee in 1998 (Jim Brumley, 1999), and expanded into regions II and III (345,000 acres) in 2000 (Figure 1).

Mississippi

The program restarted in Region IV (70,000 acres) and began in Region III (400,000 acres) in 1997, and expanded into Region II (225,000 acres) in 1998 (Jim Brumley, 1999). The program was also expanded into Region I (600,000 acres) in 1999 (Figure 2).

Louisiana

The program started in the Red River zone (66,000 acres) in 1997 (Figure 3), and expanded into the Northeast Zone (545,000) in 1999.

<u>Arkansas</u>

The program started in the Southwest zone (6,000 acres) in 1997 (Figure 4), in conjunction with the Louisiana Red River program, expanded into the Southeast zone (300,000 acres) in 1999, and into the Central zone (212,000 acres) in 2000.

Oklahoma

The program began in 1998 and included the entire cotton-growing area (250,000 acres) of the state (Figure 5).

Texas

The program began in the Southern Rolling Plains (220,000 acres) in 1994 (Figure 6). The program was expanded in 1996 into the Rolling Plains Central (600,000 acres) and South Texas/Winter Garden (650,000) zones. In 1999, the program expanded again into the El Paso/Trans Pecos (50,000 acres), Western High Plains (800,000 acres), Permian Basin (700,000 acres), Northwest Plains (550,000 acres), and Northern Rolling Plains (350,000 acres) zones (El-Lissy et al., 1996 and 2000.)

New Mexico

The program started in the South Central New Mexico and Luna County (32,000 acres) zones in 1998 (Figure 7), and expanded into the Pecos Valley zone (15,000 acres) in 2000. The Lea County (17,000 acres) program began in 1999 as part of the Western High Plains of Texas.

This report provides a brief update of boll weevil eradication in 2000 and future plans for program expansion in the U.S.

Materials and Methods

The operational success of the boll weevil eradication program hinges on three separate, yet interdependent, components including, mapping, detection, and control.

Mapping

Mapping is one of the first phases of operation in any eradication zone. Mapping identifies the exact location of each cotton field and defines the surrounding environment. The methodology of mapping used in boll weevil eradication evolved from hand-drawn cotton fields on topographic county maps in the mid 1980's, to aerial photos in the late 1980's, to the Global Positioning System (GPS) in the early to mid 1990's. Currently, all active eradication zones are using differentially corrected GPS in the same or similar manner as described previously (El-Lissy et al., 1996 and 1999.) Additionally, each field is identified with a unique number to provide for accurate data management.

Detection

All eradication zones use the boll weevil pheromone trap as the primary tool of detection. Unique regional, ecological and environmental differences across the Cotton Belt have resulted in slight variations in trapping density.

Post-Eradication Zones

<u>Southeast</u>. In Virginia, North Carolina, South Carolina, Georgia, Florida, and most of Alabama, traps were placed at approximately one trap per ten acres beginning June 15 and inspected biweekly until the end of November. Cotton fields in northwest Alabama (near Mississippi and Tennessee active zones) were trapped season-long at approximately one trap per one acre and inspected weekly.

<u>Southwest</u>. In southern California (Imperial Valley), traps were strategically placed along major highways and interstates (All American Canal, I-8, and HWY. 98) at a trap every five miles and inspected monthly. In Arizona, boll weevil traps were placed around all cotton fields in southern Arizona (within 50 miles from Mexico) and the southeastern counties at one trap per twenty acres. In central and western Arizona, traps were placed at a density of one trap per 160 acres. All traps in Arizona were deployed at planting and inspected biweekly until defoliation.

<u>*Texas.*</u> In the Southern Rolling Plains (SRP) zone, traps were placed at one trap per ten acres, except around fields located on the western side of the zone, adjacent to the St. Lawrence cotton growing region, traps where maintained at one trap per five acres. All traps in the SRP were inspected weekly.

Active Eradication Zones

<u>Tennessee</u>. In Region I, traps were placed around the perimeter of all cotton fields, approximately 200 feet apart (averaging one trap per 1-2 acres), at or shortly after planting and inspected weekly. In Regions II and III (diapause phase, 2000), traps were placed at one trap per field during the month of July and inspected biweekly. Additionally, a number of randomly selected fields were trapped at one trap per one acre to provide comparative data with future trapping information.

<u>*Mississippi*</u>. Traps were placed at planting, approximately 350 feet apart, around the perimeter of each field (averaging one trap per 2-5 acres) in all regions and inspected weekly through harvest. Traps were baited weekly.

Louisiana. Traps were placed at planting, approximately 150 feet apart, around the perimeter of each field (averaging one trap per 2 acres) and inspected weekly.

<u>Arkansas</u>. In the Southwest and Southeast zones, traps were placed around the perimeter of all cotton fields shortly after planting at 175-300 feet apart (averaging one trap per 3 acres) and inspected weekly. In the Central Zone (diapause phase, 2000), traps were deployed at one trap per field shortly after planting and inspected weekly for historical data. **Louisiana**. Traps were placed approximately 200 feet apart around the perimeter of each field (averaging one trap per 1-2 acres) at planting and inspected weekly until harvest.

<u>Oklahoma</u>. Traps were placed at one trap per five acres at planting and inspected weekly through harvest.

<u>*Texas.*</u> Traps were placed approximately 500 feet apart around the perimeter of each field (averaging one trap per 5-7 acres) in all eradication zones and inspected weekly until harvest or a killing freeze.

<u>New Mexico</u>. In the South Central and Luna County zones, traps were placed around the perimeter of all cotton fields at planting at a rate of one trap per 2-3 acres and inspected weekly until harvest. In the Pecos Valley zone (diapause phase, 2000), traps were placed during the month of August at one trap per field and inspected weekly until harvest.

Control

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

- Cultural Control: Time frames for uniform cotton planting and harvesting, as organized by growers, extension, and in some cases state regulatory agencies are key components of cultural control in providing the necessary host-free period. In some states such as Arkansas and Texas, growers were offered a rebate to destroy failed or harvested cotton fields as soon as possible in an effort to reduce overwintering populations and insecticide treatments.
- 2. Mechanical Control: Although the primary function of the trap is detection, another key benefit, especially in low weevil populations, is removing portions of the population (Lloyd et al., 1972.)
- 3. Chemical Control:
 - a. Season-long phase a single application of malathion ULV was made, beginning at the pinhead square growth stage, to fields that had reached the treatment criteria (action threshold). With the exception of some zones in Arkansas and Texas, the season-long action threshold was a trap catch of two adult boll weevils per field (40acres or less) in all active zones. In the Central Zone of Arkansas (Kiser et al., in press, NCC-2001) and the Western High Plains (WHP) of Texas (Allen et al., in press, NCC-2001), the action threshold was increased to as many as five weevils per field during the mid-season only.
 - b. Diapause phase in Regions II and III of Tennessee, malathion applications began during the week of July 31 with a single application every five days for the first three applications. Subsequent applications were made weekly until defoliation and harvesting or a killing freeze, which occurred the first week of October. In the Central Zone of Arkansas, weekly aerial applications of malathion began during the week of August 14 until harvest or a killing freeze. In the Pecos Valley zone of New Mexico, weekly applications began in the last week of August and continued until harvest or a killing freeze.

Both formulations of malathion (Fyfanon® ULV and Atrapa[™]) were used at a rate of 10 fl oz/ac in Tennessee, Mississippi and Arkansas (except Southeast zone) and at 12 fl oz/ac in Louisiana, Oklahoma, Texas, and New Mexico. All aircraft were equipped with differentially corrected GPS for documentation and quality control purposes in the same manner as described previously (El-Lissy et al., 1997). Fields 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.

Results and Discussion

Today, the boll weevil has been eradicated from over 5.0 million acres of cotton in Virginia, North Carolina, South Carolina, Georgia, Florida, most of Alabama, Central Tennessee, Southern Rolling Plains of Texas, southern California, and Arizona, as well as the neighboring regions of Mexicali Valley, Sonoita, and Caborca in Mexico (Figure 8).

Post-Eradication Zones

<u>Southeast</u>. All post-eradication program activities in South Carolina, Georgia, Florida, and Alabama were carried out by the Southeastern Boll Weevil Eradication Foundation (SEBWEF), headquartered in Montgomery, AL. In Virginia and North Carolina, post-eradication activities are carried out by the state agricultural departments with support from SEBWEF.

<u>Virginia</u>. There were no weevils detected or acres treated by the program or producers in the entire state in 2000.

North Carolina. There was one weevil captured in Pasquotank County during the week of August 14, 2000. There were no acres treated by the program or producers.

South Carolina. There was one weevil captured in Aiken County during the week of October 2, 2000. There were no acres treated by the program or the producers.

<u>Georgia</u>. A total of 16 weevils were captured during the 2000 trapping season (Figure 11). Six weevils were captured in Polk County, two in Dooly, three in Coffee, and one weevil in each of Crisp, Early, Macon, Sumter, and Wilcox counties. This resulted in a total of 1,787 cumulative acres being treated by the program.

Florida. A total of 14 weevils were captured in Santa Rosa County and 1,121 acres were treated.

<u>Alabama</u>. A total of 1,529 weevils were captured in 2000, 1452 (95%) of which were captured in the northwestern region, adjacent to Mississippi and Tennessee cotton-growing regions. The program treated a cumulative total of 73,565 acres, mostly in the northwestern region.

<u>Central Tennessee</u>. A total of 711 weevils were captured in Rutherford, Lawrence, and Giles counties and 2,837 acres were treated.

<u>Southwest</u>. Post-eradication program activities in Southern California were carried out by the Imperial County Commissioner of Agriculture in El Centro, in Arizona by the Arizona Cotton Research and Protection Council in Phoenix, AZ, and in Mexico by Sanidad Vegetal in cooperation with USDA-APHIS.

<u>Southern California</u>. Trap inspections in Imperial Valley revealed no boll weevils; there were no treatments in 2000.

<u>Arizona</u>. Season-long trap inspections in 2000 indicated no boll weevils in the state and there were no treatments by the program or producers.

 \underline{Texas} . Post-eradication program activities are carried out by the Texas Boll Weevil Eradication Foundation headquartered in Abilene, TX.

<u>Southern Rolling Plains</u>. A total of 49 weevils were captured in 2000, predominately on the west side of the zone and 4,010 acres were treated.

Active Eradication Zones

In 2000, the program was implemented on approximately 6.8 million acres of cotton in Tennessee, Mississippi, Louisiana, Arkansas, Oklahoma, Texas, and New Mexico.

<u>Tennessee</u>. Despite challenges and restrictions posed by the nearby urban areas in Regions II and III, the diapause phase of the program was successfully implemented in 2000. In the Somerville Unit (Region I), the mean number of adult weevils trapped per week per acre in the fall of 2000 was significantly less than in 1999. The 2000 mean was 0.59, and in 1999 it was 1.9, a reduction of 68.9% in 2000 when compared to 1999. Program managers credit the start-up of the program in Regions II and III for the reduction of weevil migration into Region I.

<u>Mississippi</u>. Boll weevil populations have been significantly reduced in all four eradication regions. The 2000 overall weekly mean number of weevils trapped per acre in the Aberdeen Work Unit (Region IV) was 1.1, while in 1998 it was 7.1, a reduction rate of 84.5% in 2000 when compared with 1998. The 2000 mean in the Kosciusko Unit (Region III) was 1.6, and in 1998 it was 14.3, a reduction rate of 88.5% in 2000 when compared with 1998. In the Rolling Fork Unit (Region II), the 2000 mean was 0.7, and in 1999 it was 2.1, a reduction rate of 67.6% in 2000 when compared with 1999.

<u>Arkansas</u>. In the Southwest zone, the 2000 weekly mean number of weevils captured per trap was significantly less than 1998. The 2000 mean was 0.76, and in 1998 it was 3.96, a reduction rate of 80.8% in 2000 when compared with 1998. A boll weevil damage survey conducted by program personnel indicates a significant reduction in the level of square/boll damage in the Southeast and Central zones when compared with neighboring regions outside eradication (Kiser et al., in press, NCC, 2001).

Louisiana. In the Red River zone, the 2000 monthly mean number of adult weevils trapped per acre was significantly less than 1998 and 1999. The mean in 2000 was 0.049, in 1999 it was 0.45, and in 1998 it was 1.67, a reduction rate of 97.1% in 2000 when compared with 1998.

Texas. The 2000 season-long mean number of adult weevils captured per trap per week in the Rolling Plains Central (RPC) and South Texas/Winter Garden (ST/WG) zones was significantly less than in previous years. In RPC, the mean in 2000 was 0.03 and in 1997 it was 15.0, a reduction rate of 99.8% in 2000 when compared with 1997. In ST/WG, the 2000 mean was 0.8, and in 1997 it was 11.4, a reduction rate of 93.0% in 2000 when compared with 1997. The overall (fall) mean number of weevils captured per trap per week in the El Paso/Trans Pecos (EP/TP), Northwest Plains (NWP), Western High Plains (WHP), Permian Basin (PB), and Northern Rolling Plains (NRP) zones was significantly less than in 1999. The 2000 mean in EP/TP was 0.01, and in 1999 it was 0.3, a reduction rate of 96.7% in 2000 when compared with 1999. The 2000 mean in NWP was 2.1, and in 1999 it was 5.0, a reduction rate of 48% in 2000 when compared with 1999. The 2000 mean in WHP was 0.8, and in 1999 it was 15.9, a reduction rate of 95% in 2000 when compared with 1999. The 2000 mean in PB was 0.4, and in 1999 it was 10.6, a reduction rate of 96.2% in 2000 when compared to 1999. The 2000 mean in NRP was 2.4, and in 1999 it was 18.8, a reduction rate of 87.2% in 2000 when compared with 1999.

<u>*Oklahoma*</u>. The 2000 season-long mean number of adult weevils captured per trap per month was significantly less than in 1998. The mean in 2000 was 1.1, and in 1998 it was 7.1, a reduction rate of 85.0% in 2000 when compared with 1998.

<u>New Mexico</u>. The 2000 overall mean number of adult weevils captured per trap per week was significantly less than in 1998. The mean in 2000 was 0.12, and in 1998 it was 2.6, a reduction of 95.4% in 2000 when compared with the same time frame in 1998.

Program Expansion in 2001

In 2001, the program is scheduled to expand into an additional 2.4 million acres in Missouri, Arkansas, Texas, and New Mexico.

<u>*Missouri*</u>. In November 2000, cotton producers in Missouri approved a statewide referendum to initiate boll weevil eradication on the 350,000 acres of cotton in the state. The plan is to begin program operations with the diapause phase in 2001. The program will be administered by the SEBWEF.

<u>Arkansas</u>. In September 2000, cotton producers in the Northeast Ridge zone (122,000 acres) approved a referendum to begin program operation with the diapause phase in 2001.

<u>*Texas.*</u> Cotton producers in the Southern Blacklands (120,000 acres), Northern High Plains (600,000 acres), and the Southern High Plains/Caprock (1,200,000 acres) zones approved referendums in February, September, and November 2000, respectively. The plan is to begin program operations with the diapause phase in 2001.

<u>New Mexico</u>. In December 2000, cotton producers in Roosevelt and Curry counties (35,000 acres) approved a referendum to begin program operations with the diapause phase in 2001. The plan is for TBWEF to administer the program in conjunction with the NWP zone.

Acknowledgments

The Belt-wide boll weevil eradication program exemplifies cooperative federal-state-industry effort at its best. The operational success of the program is due to the tireless efforts of grower organizations, including the Southeastern Boll Weevil Eradication Foundation, Mississippi Boll Weevil Management Corporation, Arkansas Boll Weevil Eradication Foundation, Louisiana Department of Agriculture and Forestry, Texas Boll Weevil Eradication Foundation, South Central New Mexico Boll Weevil Control Committee, Pecos Valley Boll Weevil Control Committee, Arizona Cotton Research and Protection Council, and the Imperial County Commissioner of Agriculture. The leadership of the National Cotton Council and technical and operational support of the Extension Service, state agricultural departments and USDA continues to play an instrumental role in the success of boll weevil eradication.

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Figure 1. Tennessee Boll Weevil Eradication Zones.



Figure 2. Mississippi Boll Weevil Eradication Zones.



Figure 3. Louisiana Boll Weevil Eradication Zones.



Figure 4. Arkansas Boll Weevil Eradication Zones.

Oklahoma



Figure 5. Oklahoma Boll Weevil Eradication Zones.



Figure 6. Texas Boll Weevil Eradication Zones.

New Mexico



Figure 7. New Mexico Boll Weevil Eradication Zones.



Figure 8. Boll Weevil Eradication Program in the U.S., 2000.