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BOLL WEEVIL ERADICATION IN THE U.S., 2002

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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 nearly 6.0 million acres of cotton in Virginia, North Carolina, South Carolina, Georgia, Florida, most of Alabama, Middle Tennessee, West 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 9.1 million acres of cotton in Mississippi, Tennessee, Missouri, Arkansas, Louisiana, Oklahoma, Texas, and New Mexico. Further, pending positive grower referenda, the program is scheduled to expand in 2003 to include additional 0.45 million acres in the Northeast Delta of Arkansas and the Northern Blacklands region of Texas. This will result in over 98% of the Cotton Belt being involved in boll weevil eradication, with 38% having completed eradication and the remaining 60% nearing eradication.

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 cooperative boll weevil eradication program began in southern North Carolina (15,000 acres) and South Carolina (70,000 acres) in 1983, after the successful 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 (USDA, 1991).

The program expanded into Georgia (287,500 acres) in 1987, Florida (107,000 acres) in 1987, southeastern Alabama (61,000 acres) in 1987, and Middle Tennessee (11,000 acres) in 1994 (James R. Brazzel, 1989; Sidney E. Cousins, 1991; Bill Grefenstette, 1996). Boll weevil eradication was completed in North Carolina, South Carolina, Georgia, Florida, and Alabama (excluding the northwestern region) and Middle Tennessee in 1987, 1990, 1992, 1993, 2000, respectively.

The program also began in the Imperial Valley of California (60,000 acres) in 1983, 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 total acres) in 2000 (Figure 1).

Mississippi

After a brief pause, the program restarted in Region IV (70,000 acres) and began in Region III (400,000 acres) in 1997, then expanded into Region II (225,000 acres) in 1998 (Jim Brumley, 1999), and finally into Region I (600,000 acres) in 1999 (Figure 2).

Missouri

The program began in 2001 and included the entire cotton-growing area (405,000 acres) of the state (Figure 3).

Louisiana

The program started in the Red River Zone (66,000 acres) in 1997 (Figure 4), and expanded into the remainder of the state, referred to as the Northeast Zone (545,000) in 1999.

Arkansas
The program started in the Southwest Zone (6,000 acres) in 1997 (Figure 5), in conjunction with the Louisiana Red River program, expanded into the Southeast Zone (300,000 acres) in 1999, the Central Zone (212,000 acres) in 2000, the Northeast Ridge Zone (135,000 acres) in 2001, and into Poinsett County (25,000 acres) in 2002 (Kiser et al., 2002 and in press, NCC, 2003).

Oklahoma
The program began in 1998 and included the entire cotton-growing area (250,000 acres) of the state (Figure 6).

Texas
The program began in the Southern Rolling Plains (220,000 acres) in 1994 (Figure 7). 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). In 2001, the program expanded into the Southern High Plains/Caprock (1,140,000 acres), Northern High Plains (550,000 acres), and Southern Blacklands (100,000 acres) zones (Allen et al., 2001). In 2002, the program expanded again into the Upper Coastal Bend Zone (188,000 acres).

New Mexico
The program started in the South Central New Mexico and Luna County (32,000 acres) zones in 1998 (Figure 8), 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, and the Roosevelt/Curry program began with the diapause phase in 2001 in conjunction with the Northwest Plains Zone of Texas.

This report provides a summary of boll weevil eradication in the U.S. in 2002, and future plans for program expansion.

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 and placement.

Post-eradication Zones:
Southeast. I*n* Virginia, North Carolina, South Carolina, Georgia, Florida, and most of Alabama, traps were placed at approximately one trap per ten acres beginning June 13 and inspected biweekly through November 27. Approximately 1,400 acres of cotton in Lauderdale County of Alabama (near Mississippi and Tennessee active zones) were trapped season-long at one trap per one acre and inspected weekly. Additionally, the program experimented with a trapping scheme of one trap per twenty acres, serviced on three-week intervals, on approximately 200,000 acres in southwest Georgia. The data was promising and will be evaluated regarding changes to future detection protocols.

Southwest. 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 of Mexico) and the southeastern counties at one trap per forty 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.

Kansas, Boll weevil traps were placed at a rate of one trap per field shortly after planting and inspected bi-weekly until harvest or a killing freeze.

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

Active Eradication Zones:

Mississippi. 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, baited and inspected weekly through harvest or a killing freeze.

Tennessee. 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 through harvest or a killing freeze.

Missouri. Traps were placed around the perimeter of all cotton fields, approximately 350 feet apart (averaging one trap per 4 acres), at or shortly after planting (2nd week of April) and inspected weekly (beginning May 6) through harvest or a killing freeze.

Arkansas. Traps were placed around the perimeter of all cotton fields shortly after planting at approximately 300 feet apart (averaging one trap per 3 acres) and inspected weekly through harvest or a killing freeze.

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 through harvest or a killing freeze.

Oklahoma. Traps were placed at one trap per 5 acres at planting and inspected weekly through harvest or a killing freeze.

Texas. 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.

New Mexico. 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, Lea County, and Roosevelt/Curry zones, traps were placed at a rate of one trap per 5 acres.

Control

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

1. Cultural Control: Time frames for uniform cotton planting and harvesting, as organized by growers, local agricultural extension service, 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 crop residues as soon as possible after harvest 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 of trapping, 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). The 2002 season-long action threshold was a trap catch of 1-2 adult boll weevils per field (40-acres or less) in all active zones.
   b. *Diapause phase (2002)* - in the Upper Coastal Bend of Texas, weekly aerial applications with malathion ULV began on July 15 and continued until cotton fields were defoliated and harvested.

Both formulations of malathion (Fyfanon® ULV and Atrapa™) were used at a rate of 10 fl oz/ac in Mississippi, Tennessee, Missouri and Arkansas, at 16 fl oz/ac in Louisiana, and 12 fl oz/ac in 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 equipment. 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

To date, the boll weevil has been eradicated from nearly 6.0 million acres of cotton in Virginia, North Carolina, South Carolina, Georgia, Florida, most of Alabama, Middle Tennessee, West Texas, Southern California, and Arizona, as well as the neighboring regions of the Mexicali Valley, Sonoita, and Caborca in Mexico (Figure 9).

Post-eradication Zones:

Southeast. 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, Alabama. In Virginia and North Carolina, the state agricultural departments carried out post-eradication activities with support from SEBWEF.

Virginia. There were no weevils detected or acres treated by the program or producers in the entire state in 2002.

North Carolina. A seasonal total of 15 weevils were captured in two fields (total of 38.5 acres) located in Nash County, and 1 weevil in one field (37 acres) in Wake County. This resulted in a total of 38.5 cotton acres (0.004% of the statewide production) being treated by the program.

South Carolina. There were no weevils captured or acres treated in the entire state in 2002.

Georgia. a total of 80 weevils were captured in two fields (total of 131 acres) in Brooks County, and 2 weevils in two fields (total of 60 acres) in Wayne County. This resulted in a total of 170 cotton acres (0.01%) being treated by the program.

Florida. There were no weevils captured or acres treated in the entire state in 2002.

Alabama. A total of 476 weevils were captured in 2002, mostly in the southwestern region, adjacent to Mississippi cotton-growing regions. This resulted in a total of 1,800 cotton acres (0.3%) being treated by the program.

Middle Tennessee. There were no weevils captured or acres treated in 2002.

Southwest. 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, Arizona, and in Mexico by Sanidad Vegetal in cooperation with USDA-APHIS.

Southern California. Trap inspections in the Imperial Valley revealed no boll weevils; there were no treatments in 2002.

Arizona. Season-long trap inspections in 2002 indicated no boll weevils in the state; there were no treatments by the program or producers.

Kansas. With the Kansas cotton producers' support, program activities were cooperatively carried out by the Kansas Department of Agriculture and USDA-APHIS. There were no weevils captured or acres treated in the entire cotton-growing region in 2002.

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

Southern Rolling Plains. A seasonal total of 16 weevils were captured in two fields (total of 60 acres) in Tom Green County. This resulted in a total of 2,050 acres (0.8%) being treated by the program.

Active Eradication Zones:

In 2002, the program was implemented on approximately 9.1 million acres of cotton in Mississippi, Tennessee, Missouri, Arkansas, Louisiana, Oklahoma, Texas, and New Mexico. A slight increase in the boll weevil population was observed in some of the mid-South and Texas zones in 2002 as compared with 2001. The increase was caused by several factors, including: frequent rainfall in the fall of 2001, and again in the spring and summer of 2002 in LA, AR, MS, and TN, prevented timely and effective insecticide applications; the no-fly zone imposed around the Memphis Airport in the fall of 2001, resulting from the 9/11 terrorist attack, prevented aerial applications on all cotton fields within a 35-mile radius; and heavy boll weevil migration from regions outside the eradication program. However, the overall boll weevil populations in all active zones remained significantly lower in 2002 than in 2000.

Mississippi. The 2002 season-long mean number of weevils per trap in Region I was 0.017, in 2001 it was 0.04, and in 2000 it was 0.6; a reduction of 97.2% in 2002 when compared with 2000. In Region II, the 2002 mean was 0.03, in 2001 it was

0.02, and in 2000 it was 0.1; a reduction of 70.0% in 2002 as compared with 2000. In Region III, the 2002 mean was 0.04, in 2001 it was 0.03, and in 2000 it was 0.3; a reduction of 86.7% in 2002 as compared with 2000. In Region IV, the 2002 mean was 0.002, in 2001 it was 0.003, and 2000 it was 0.11; a reduction of 98.2% in 2002 as compared to 2000 (Farrell Boyd, personal communication).

Tennessee. The 2002 season-long mean number of adult weevils per trap in Region I was 0.2, in 2001 it was 0.11, and in 2000 it was 1.5; a reduction of 86.7% in 2002 as compared with 2000. In Region II, the 2002 mean was 0.05, and in 2001 it was 0.16; a reduction of 68.8% in 2002 as compared with 2001. In Region III, the 2002 mean was 0.18 and in 2001 it was 0.06 (Ron Seward, personal communication).

Missouri. In Region I, the 2002 season-long mean number of adult weevils captured per trap was 0.98 and in 2001 it was 1.04. In Region II, the 2002 mean was 0.33 and in 2001 it was 0.23 (Dewey Wayne King, personal communication).

Arkansas. In the Southwest Zone, the 2002 season-long mean number of weevils captured per trap was 0.002, in 2001 it was 0.065, and in 2000 it was 0.66; a reduction of 99.7% in 2002 when compared with 2000. In the Southeast Zone, the 2002 mean was 0.13, in 2001 it was 0.328, and in 2000 it was 5.54; a reduction of 97.7% in 2002 when compared with 2000. In the Central Zone, the 2002 mean was 0.36, in 2001 it was 0.40 and, in 2000 it was 16.2; a reduction of 97.8% in 2002 when compared with 2000. In the Northeast Ridge zone, the 2002 mean was 1.3 and in 2001 it was 5.4; a reduction of 75.9% in 2002 as when compared with 2001 (Kiser et al., 2002, and in press, NCC, 2003).

Louisiana. In the Red River Zone, the 2002 monthly mean number of weevils trapped per acre was 0.003, in 2001it was 0.02, and in 2000 it was 0.05; a reduction of 94.0% in 2002 when compared with 2000. In the Northeast Zone, the 2002 mean was 0.03, in 2001 it was 0.13, and in 2000 it was 0.85; a reduction of 96.57% in 2002 when compared with 2000 (John Andries, personal communication).

Texas. The 2002 season-long mean number of weevils captured per trap per week in the El Paso/Trans Pecos (EP/TP), Northern High Plains (NHP), Northern Rolling Plains (NRP), Northwest Plains (NWP), Permian Basin (PB), Rolling Plains Central (RPC), South Texas/Winter Garden (ST/WG), Southern Blacklands (SBL), Southern High Plains (SHP), and Western High Plains (WHP) zones was significantly less than previous years. In EP/TP, the 2002 mean was 0.00051, in 2001 it was 0.0003, and in 2000 it was 0.009; a reduction of 94.3% in 2002 as compared with 2000. In NHP, the 2002 mean was 0.005 and in 2001 it was 1.0; a reduction of 99.5% in 2002 as compared to 2001. In NRP, the 2002 mean was 0.002, in 2001 it was 0.59, and in 2000 it was 2.6; a reduction of 96.6% in 2002 as compared with 2000. In NWP, the 2002 mean was 0.001, in 2001 it was 0.016, and in 2000 it was 1.3; a reduction of 99.9% in 2002 as compared with 2000. In PB, the 2002 mean was 0.03, in 2001 it was 0.01, and in 2000 it was 0.45; a reduction of 93.3%. In RPC, the 2002 mean was 0.009, in 2001 it was 0.0006, and in 2000 it was 0.028; a reduction of 66.4% in 2002 as compared with 2000. In ST/WG, the 2002 mean was 0.15, in 2001 it was 0.16, and in 2000 it was 1.1; a reduction of 86.4% in 2002 as compared with 2000. In SBL, the 2002 mean was 1.5 and in 2001 it was 15.5; a reduction of 90.3% in 2002 as compared with 2001. In SHP, the 2002 mean was 0.005 and in 2001 it was 1.3; a reduction of 99.6% in 2002 as compared with 2001. In WHP, the 2002 mean was 0.003, in 2001 it was 0.023, and in 2000 it was 0.7; a reduction of 99.6% in 2002 as compared with 2000 (2002 TX Boll Weevil Eradication Foundation Report and Allen et al., in press, NCC, 2003).

Oklahoma. The 2002 season-long mean number of adult weevils captured per trap per month was significantly less than in 2000. The mean in 2002 was 0.01, in 2001 it was 0.035, and in 2000 it was 1.7; a reduction of 99.4% in 2002 when compared with 2000 (Jerry Coakley, personal communication).

New Mexico. The 2002 season-long mean number of adult weevils captured per trap per week in South Central New Mexico (SCNM) and Pecos Valley (PV) was significantly less than previous years. The 2002 mean in SCNM was 0.002, in 2001 it was 0.03, and in 2000 it was 0.32; a reduction of 99.4% in 2002 when compared with 2000. The 2002 mean in PV was 0.96, in 2001 it was 2.5, and in 2000 it was 10.0; a reduction of 90.4% in 2002 when compared with 2000 (Aaron Miller and Joe Friesen, personal communication).

Program Expansion in 2003:

In 2003, pending growers' approval through scheduled referendums, the program is expected to expand into an additional 0.45 million acres in Arkansas and Texas.

Arkansas. Cotton producers in the Northeast Delta Zone (350,000 acres) have scheduled a referendum in December 2002. If approved, program operation will begin with the diapause phase in 2003.

Texas. Cotton producers in the Northern Blacklands Zone (100,000 acres) have also scheduled a referendum in December 2002. The plan is to begin program operations with the diapause phase in 2003.

Acknowledgments

The nationwide boll weevil eradication program exemplifies an unsurpassed cooperative federal-state-industry effort in ridding the U.S. cotton industry of its most devastating pest. The operational success of the program is entirely 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, Oklahoma Boll Weevil Eradication Organization, South Central New Mexico Boll Weevil Control Committee, Pecos Valley Boll Weevil Control Committee, Arizona Cotton Research and Protection Council, Imperial County Commissioner of Agriculture, and Kansas Department 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 in the U.S.

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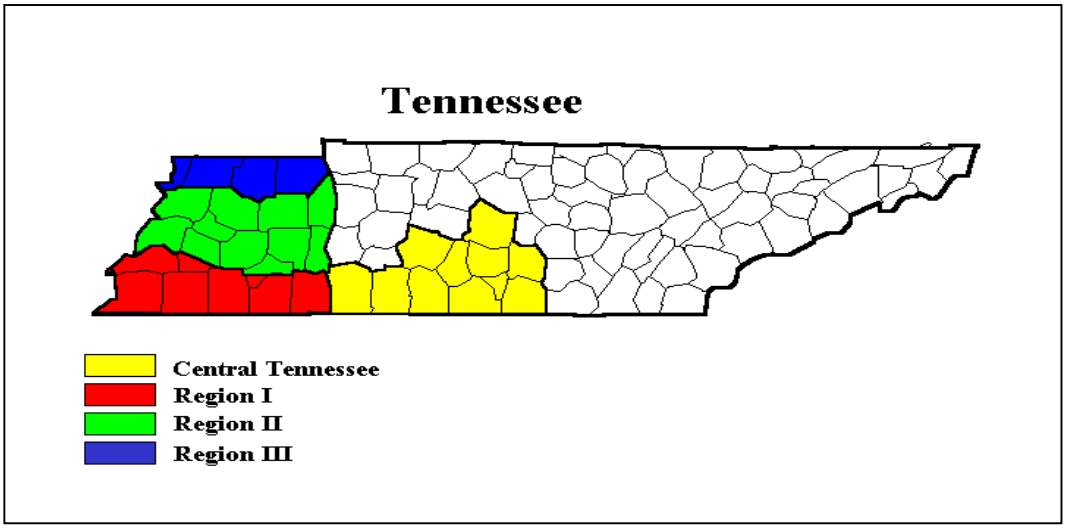

Figure 1. Tennessee Boll Weevil Eradication Zones.

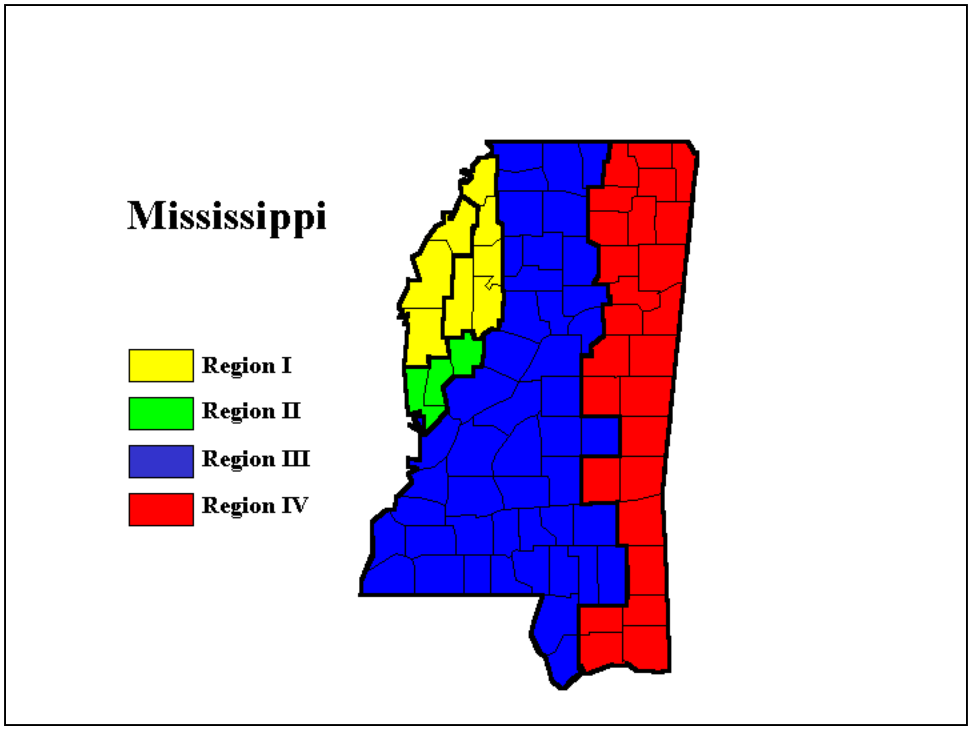

Figure 2. Mississippi Boll Weevil Eradication Zones.

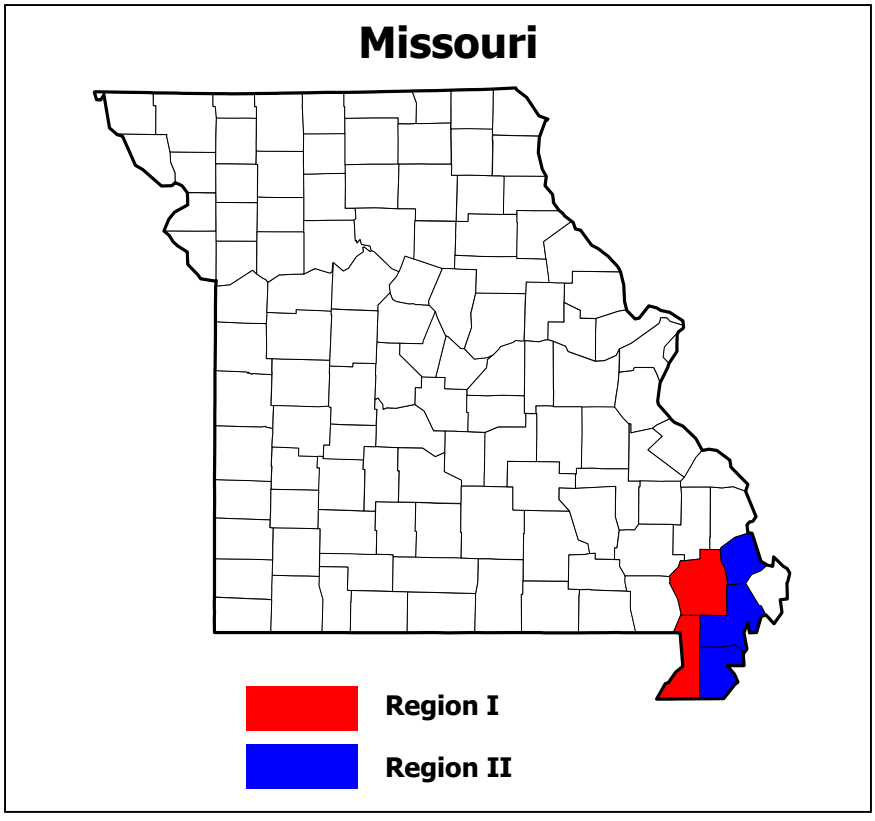

Figure 3. Missouri Boll Weevil Eradication Program.

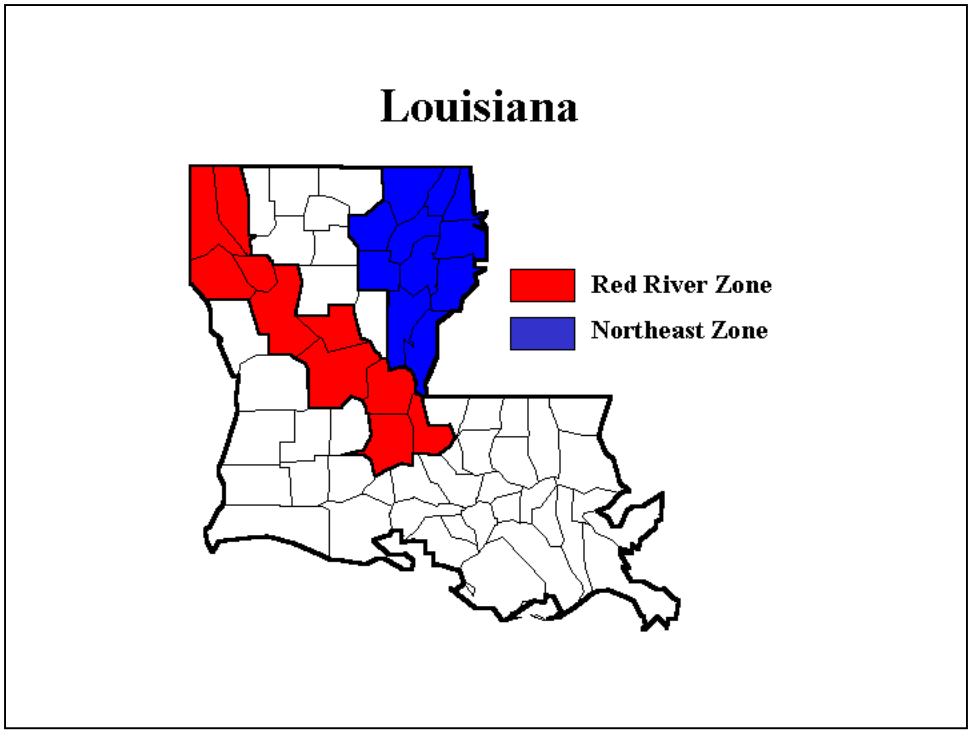

Figure 4. Louisiana Boll Weevil Eradication Zones.

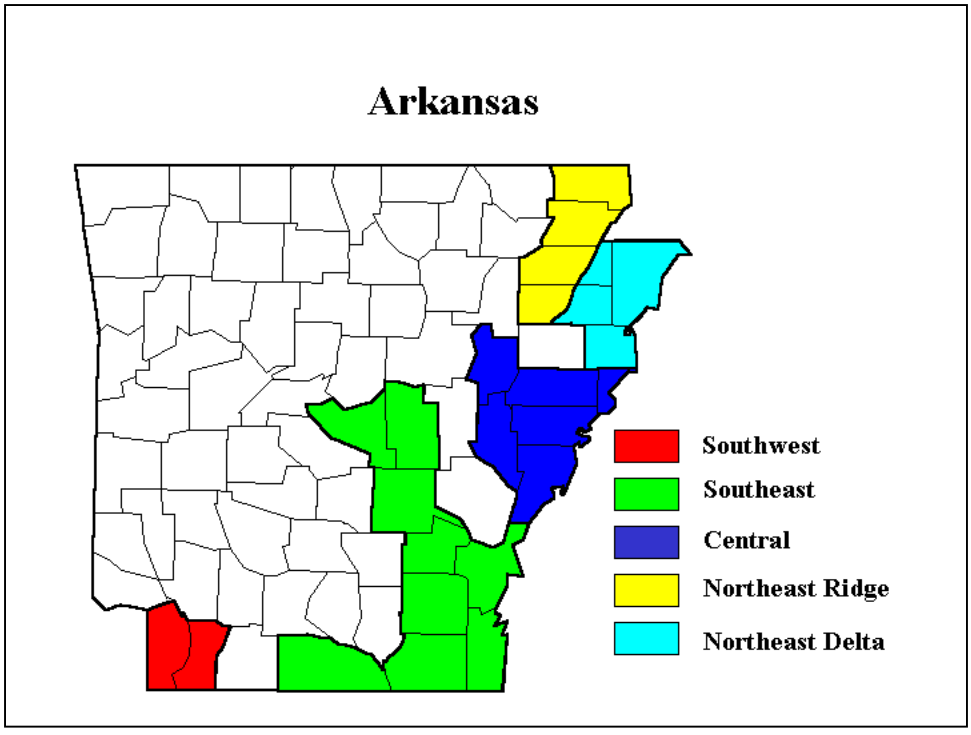

Figure 5. Arkansas Boll Weevil Eradication Zones.

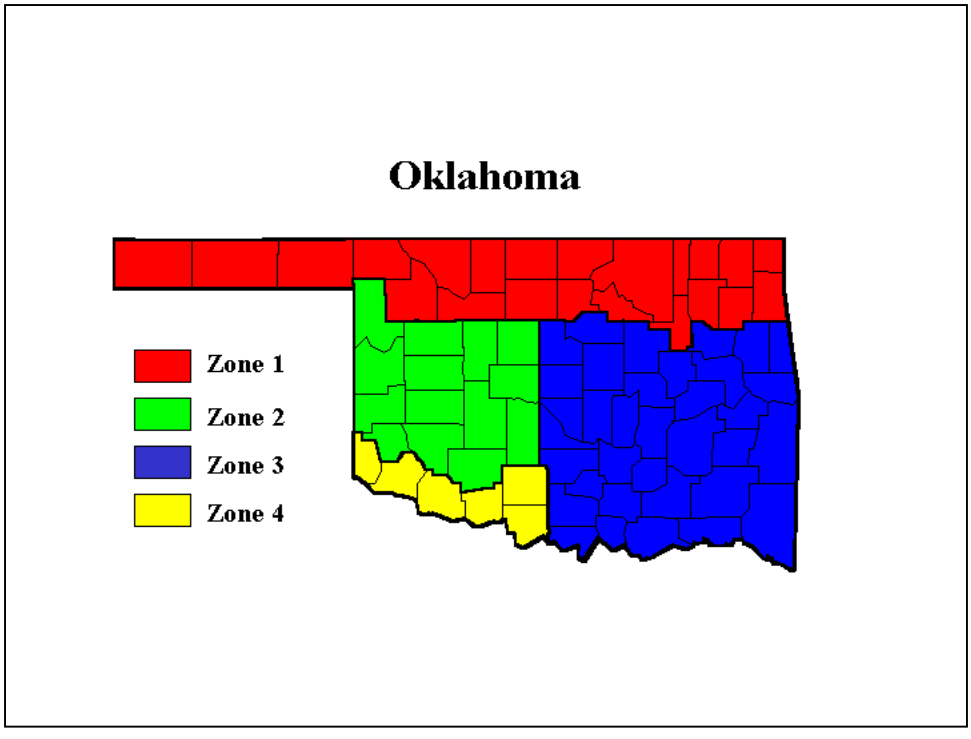

Figure 6. Oklahoma Boll Weevil Eradication Zones.

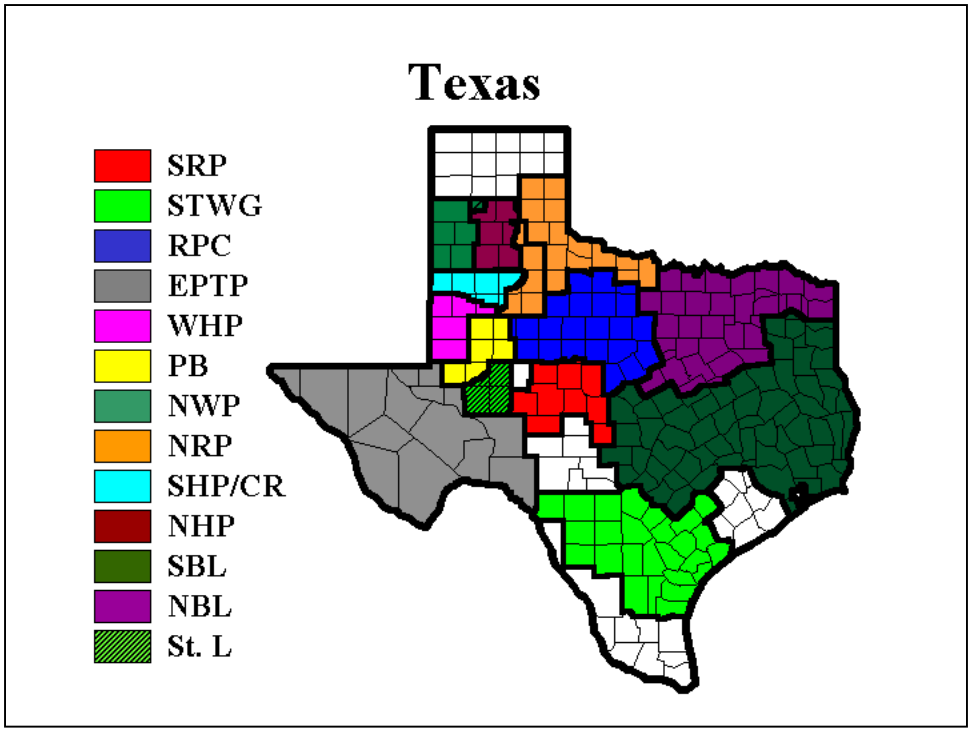

Figure 7. Texas Boll Weevil Eradication Zones.

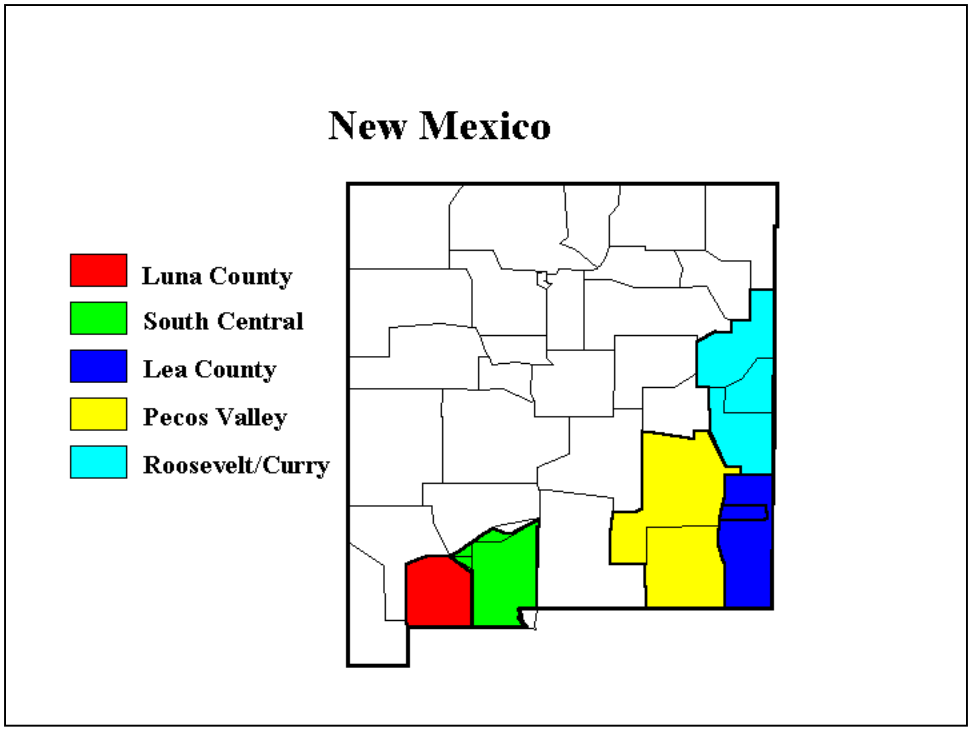

Figure 8. New Mexico Boll Weevil Eradication Zones.

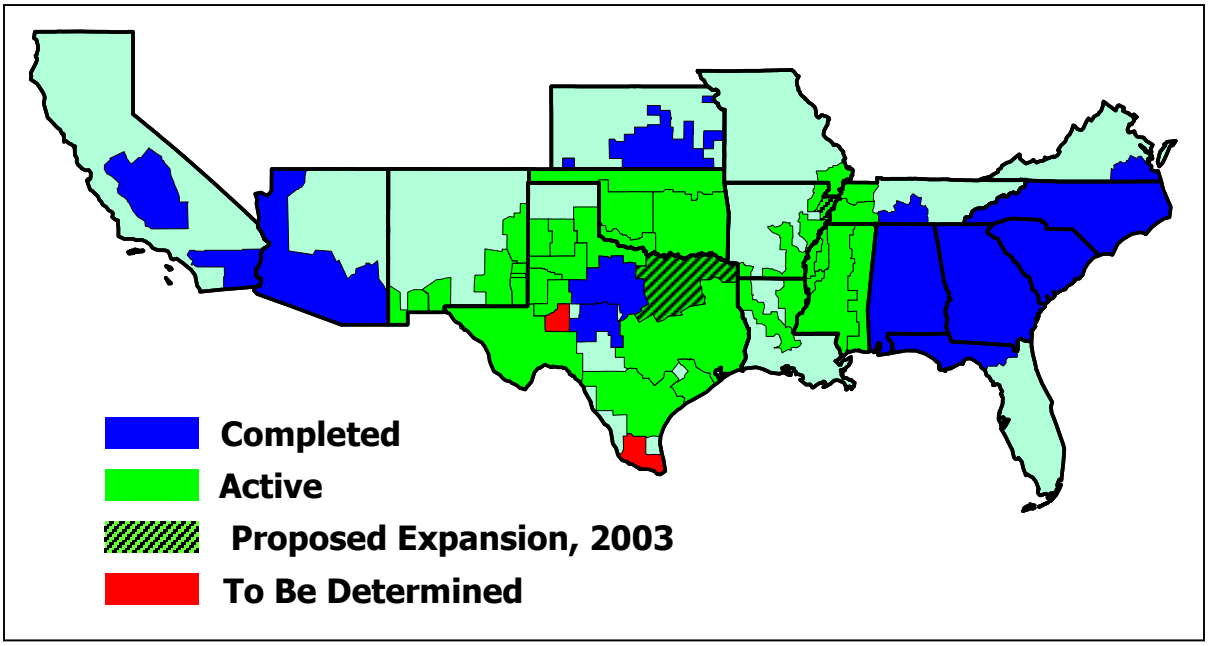

Figure 9. Boll Weevil Eradication Program in the U.S., 2002.