2002 BELTWIDE COTTON CONFERENCES, ATLANTA, GA – JANUARY 8-12

BOLL WEEVIL ERADICATION IN THE U.S., 2001

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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 over 5.0 million acres of cotton in Virginia, North Carolina, South Carolina, Georgia, Florida, most of Alabama, Middle 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 10.0 million acres of cotton in Mississippi, Tennessee, Missouri, Arkansas, Louisiana, Oklahoma, Texas, and New Mexico. Further, the program is scheduled to expand in 2002 to include 0.6 million additional acres in northeast Arkansas and the Coastal Bend region of Texas. This will result in approximately 99% of the Cotton Belt being involved in boll weevil eradication, with 30% being weevil-free and the remaining 69% nearing eradication. Nationwide eradication is expected by 2005.

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, 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.

Arkansas. 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, into the Central Zone (212,000 acres) in 2000, and into the Northeast Ridge Zone (135,000 acres) in 2001 (Kiser et al., 2001).

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). 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).

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, 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 2001, 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.

Post-Eradication Zones

- ***Southeast.*** 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.
- ***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 from 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.
- ***Texas.*** In the Southern Rolling Plains (SRP) Zone, traps were placed at one trap per 20 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.
- ***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.
- ***Missouri* (diapause phase, 2001).** Traps were placed at approximately one trap per 20 acres in the first week of July and inspected weekly through harvest. Trapping during the diapause phase enables

program managers to establish a relative baseline of weevil population density and distribution for comparison purposes during the subsequent years of eradication.

- ***Arkansas.*** In the Southwest, Southeast, and Central zones, 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. In the Northeast Ridge Zone (diapause phase, 2001), traps were deployed at one trap per field shortly after planting and inspected weekly for historical data.
- ***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.
- ***Kansas.*** Boll weevil traps were placed at a rate of one trap per field shortly after planting and inspected bi-weekly until harvest.
- ***Oklahoma.*** Traps were placed at one trap per five acres at planting and inspected weekly through harvest.
- ***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 and Lea County zones, traps were placed at a rate of one trap per five acres. In the Roosevelt/Curry Zone (diapause phase, 2001), 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.

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 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 2001 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 (2001)*- in Missouri, weekly aerial applications with malathion ULV began on August 13 through August 31, totaling three applications per field over the program area. Subsequent applications were made only when weevils were present on an area (groups of contiguous fields) by area basis as indicated by trap catches. In the Northeast Ridge Zone of Arkansas, weekly aerial applications of malathion ULV began during the second week of August and continued until harvest or a killing freeze. In the Southern Blacklands of Texas, the weekly aerial application began in the first week of July. In the Southern and Northern High Plains zones, application began in the first week of September and continued until defoliation and harvesting or a killing freeze. In Roosevelt/Curry Zone of New Mexico, weekly aerial application began in the first week of September and continued until defoliation and harvesting or a killing freeze.

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

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, Middle Tennessee, Southern Rolling Plains of Texas, Southern California, and Arizona, as well as the neighboring regions of the Mexicali Valley, Sonoita, and Caborca in Mexico (Figure 8).

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 2001.
- ***North Carolina.*** A seasonal total of 175 weevils were captured in one filed (13.4 acres) located in Lee County. This resulted in a total of 13.4 cotton acres (0.001% of the statewide production) being treated by the program.
- ***South Carolina.*** There were no weevils captured or acres treated in the entire state in 2001.
- ***Georgia.*** A total of 4 weevils were captured in Turner County during the 2001 trapping season. This resulted in a total of 836 cotton acres (0.06%) being treated by the program.
- ***Florida.*** There were no weevils captured or acres treated in the entire state of Florida in 2001.
- ***Alabama.*** A total of 434 weevils were captured in 2001, mostly in the northwestern region, adjacent to Mississippi and Tennessee cotton-growing regions. The program treated a total of 657 cotton acres (0.09%), mostly in the northwestern region.
- ***Middle Tennessee.*** There were no weevils captured or acres treated in 2001.

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 2001.
- ***Arizona.*** Season-long trap inspections in 2001 indicated no boll weevils in the state and there were no treatments by the program or producers.
- ***Texas.*** Post-eradication program activities are carried out by the Texas Boll Weevil Eradication Foundation headquartered in Abilene, Texas.
- ***Southern Rolling Plains.*** There were no weevils captured or acres treated in 2001.
- ***Kansas.*** With the Kansas cotton producers' support, program activities were cooperatively carried out by KDA and USDA-APHIS. There were no weevils captured or acres treated in the entire cotton-growing region in 2001.

Active Eradication Zones

In 2001, the program was implemented on approximately 10.0 million acres of cotton in Mississippi, Tennessee, Missouri, Arkansas, Louisiana, Oklahoma, Texas, and New Mexico.

- ***Mississippi.*** Boll weevil populations have been reduced significantly in all four eradication regions. The 2001 season-long mean number of weevils per trap in Region I was 0.04, and in 2000 it was 0.6, a reduction of 93.3% in 2001 when compared with 2000. In Region II, the 2001 mean was 0.02, and in 2000 it was 0.1, a reduction of 80.0%. In Region III, the 2001 mean was 0.03 and in 2000 it was 0.3, a reduction of 90.0%. In Region IV, the 2001 mean was 0.003 and 2000 it was 0.11, a reduction of 97.3% in 2001 as compared to 2000 (Farrell Boyd, personal communication).
- ***Tennessee.*** The 2001 season-long mean number of adult weevils per trap in Region I was 0.05 and in 2000 it was 0.9, a reduction of 94.4% in 2001 as compared to 2000 (Ron Seward, personal communication).
- ***Missouri.*** The 2001 overall mean number of adult weevils captured per trap in Region I was 1.04, and in Region II it was 0.23. Trapping information collected during the 2001 diapause phase will be used for comparison during the subsequent years of eradication (Dewey Wayne King, personal communication).

- ***Arkansas.*** In the Southwest Zone, the 2001 season-long weekly mean number of weevils captured per trap was 0.065 and in 2000 it was 0.66, a reduction of 90.2% in 2001 when compared with 2000. In the Southeast Zone, the 2001 mean was 0.328 and in 2000 it was 5.54, a reduction of 94.1% in 2001 when compared with 2000. In the Central zone, the 2001 mean was 0.40 and 2000 it was 16.2, a reduction of 97.5% in 2001 when compared with 2000 (Kiser et al., in press, NCC, 2002).
- ***Louisiana.*** In the Red River Zone, the 2001 monthly mean number of adult weevils trapped per acre was significantly less than 2000. The mean in 2001 was 0.02 and in 2000 it was 0.05, a reduction of 60.0% in 2001 when compared with 2000. In the Northeast Zone, the 2001 mean number of weevils per trap per week was 0.13, and in 2000 it was 0.85, a reduction of 87.7% in 2001 when compared with 2000 (John Andries, personal communication).
- ***Texas.*** The 2001 season-long mean number of adult weevils captured per trap per week in the Rolling Plains Central (RPC), South Texas/Winter Garden (ST/WG), 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 2000. In RPC, the mean in 2001 was 0.0006 and in 2000 it was 0.27, a reduction of 99.8% in 2001 when compared with 2000. The RPC Zone is to be declared eradicated in 2002. In ST/WG, the 2001 mean was 0.158, and in 2000 it was 1.144, a reduction of 86.2% in 2001 when compared with 2000. The 2001 mean in EP/TP was 0.0003, and in 2000 it was 0.009, a reduction of 96.7% in 2001 when compared with 2000. The EP/TP Zone is to be declared eradicated in 2002. The 2001 mean in NWP was 0.017, and in 2000 it was 1.314, a reduction of 98.7% in 2001 when compared with 2000. The 2001 mean in WHP was 0.023, and in 2000 it was 0.718, a reduction of 96.8% in 2001 when compared with 2000. The 2001 mean in PB was 0.01, and in 2000 it was 0.457, a reduction of 97.8% in 2001 when compared to 2000. The 2001 mean in NRP was 0.061, and in 2000 it was 2.6, a reduction of 97.6% in 2001 when compared with 2000 (Allen et al., in press, NCC, 2002).
- ***Oklahoma.*** The 2001 season-long mean number of adult weevils captured per trap per month was significantly less than in 2000. The mean in 2001 was 0.035, and in 2000 it was 1.7, a reduction of 97.9% in 2001 when compared with 2000 (Jerry Coakley, personal communication).
- ***New Mexico.*** The 2001 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 in 2000. The 2001 mean in SCNM was 0.03 and in 2000 it was 0.32, a reduction of 90.6% in 2001 when compared with 2000. The 2001 mean in PV was 2.5 and in 2000 it was 10.0, a reduction of 75.0% in 2001 when compared with 2000 (Aaron Miller and Joe Friesen, personal communication).

Program Expansion in 2002

In 2002, pending growers' approval through scheduled referendums, the program is expected to expand into an additional 0.6 million acres in Arkansas and Texas.

- ***Arkansas.*** Cotton producers in the Northeast Delta Zone (350,000 acres) have scheduled a referendum in January 2002. If approved, program operation will begin with the diapause phase in 2002.
- ***Texas.*** Cotton producers in the Upper Coastal Bend Zone (270,000 acres) have also scheduled a referendum in January 2002. The plan is to begin program operations with the diapause phase in 2002.

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.

References Cited

Allen, Charles T., Lindy Patton, Larry Smith, and Richard Newman, 2001. Texas Boll Weevil Eradication Update. Proc. Beltwide Cotton Production and Research Conf. National Cotton Council of America. Anaheim, CA, 934-936 pp.

Allen, Charles T., Lindy Patton, Larry Smith, and Richard Newman, 2002 (in press). Status of Boll Weevil Eradication in Texas. Proc. Beltwide Cotton Production and Research Conf. National Cotton Council of America. Atlanta, GA.

Brazzel, J. R., 1989. Boll Weevil Eradication-An Update, 1989. Proc. Beltwide Cotton Production and Research Conf. National Cotton Council of America. Nashville, TN, 218-220 pp.

Brumley, Jim, 1999. Boll Weevil Eradication Program Update- Southeast and Midsouth Zones. Proc. Beltwide Cotton Production and Research Conf. National Cotton Council of America. Orlando, FL, 814-816 pp.

Carlson, Gerald A., Glenn Sappie, and Michael Hammig, 1989. Economic Returns to Boll Weevil Eradication, 1989. USDA-ERS, Agri. Econ. Report No. 621.

El-Lissy, O., Frank Myers, Ray Frisbie, Tom Fuchs, Don Rummel, Rick Smathers, Ed King, Chuck Bare, Frank Carter, Gary Busse, Nolan Niehues, and Jack Hayes, 1996. Boll Weevil Eradication Status in Texas. Proc. Beltwide Cotton Production and Research Conf. National Cotton Council of America. Nashville, TN, 831-839 pp.

El-Lissy, O. and John Moschos, 1999. Development of Computerized Expert System as a Management Tool for Boll Weevil Eradication. Proc. Beltwide Cotton Production and Research Conf. National Cotton Council of America. Orlando, FL, 834-838 pp.

El-Lissy, O., Danny Kiser, Lindy Patton, Ray Frisbie, Tom Fuchs, Don Rummel, Roy Parker, Jeff Slosser, Don Dippel, J.R. Coppedge, Frank Carter, James Boston, and Jack Hayes, 2000. Boll Weevil Eradication Update-Texas, 1999. Proc. Beltwide Cotton Production and Research Conf. National Cotton Council of America. San Antonio, TX, 1076-1083 pp.

Final Environmental Impact Statement, 1991. National Boll Weevil Eradication Program, USDA-APHIS. Volume 1, S-3.

Grefenstette, Bill, 1996. Boll Weevil Eradication: Status and Future Plans, 1996. Proc. Beltwide Cotton Production and Research Conf. National Cotton Council of America. Nashville, TN, 17-20 pp.

Haney, P. B., W. J. Lewis, and W. R. Lambert, 1996. Cotton Production and Boll Weevil in Georgia: History, Cost of Control, and Benefits of Eradication. GA Agri. Experiment Station, Bull. No. 428.

Kiser, Danny, Michael Catanach, Douglas Ladner, Don Johnson, Gus Lorenz, Keith Martin, Don Plunkett, Bill Roberson, Jerry Williams, Cecil Williams, Tina Teague, Phil Tugwell, Bill Yearian, Charles Denver, Moris O'Quinn, Osama El-Lissy, Gene Martin, and David Wildy. 2001. Boll Weevil Eradication Status- Arkansas, 2000. Proc. Beltwide Cotton Production and Research Conf. National Cotton Council of America, Anaheim, CA, 947-952 pp.

Kiser, Danny, Michael Catanach, Douglas Ladner, Don Johnson, Gus Lorenz, Keith Martin, Don Plunkett, Bill Roberson, Jerry Williams, Cecil Williams, Tina Teague, Phil Tugwell, Bill Yearian, Charles Denver, Moris O'Quinn, Osama El-Lissy, Gene Martin, and David Wildy. 2002 (in press). Boll Weevil Eradication Status-Arkansas, 2001. Proc. Beltwide Cotton Production and Research Conf. National Cotton Council of America, Atlanta, GA.

Lloyd, E.P., M. E. Merkl, F. C. Tingle, W. P. Scott, D. D. Hardee, and T. B. Davich, 1972. Evaluation of male-baited traps for control for boll weevils following a reproduction-diapause program in Monroe County, Mississippi. J. Econ. Entomol. 65:552-555 pp.

Sidney E. Cousins, 1991. Progress in the United States Boll Weevil Eradication Programs. 1991 Proc. Beltwide Cotton Production and Research Conf. National Cotton Council of America. 609-610 pp.

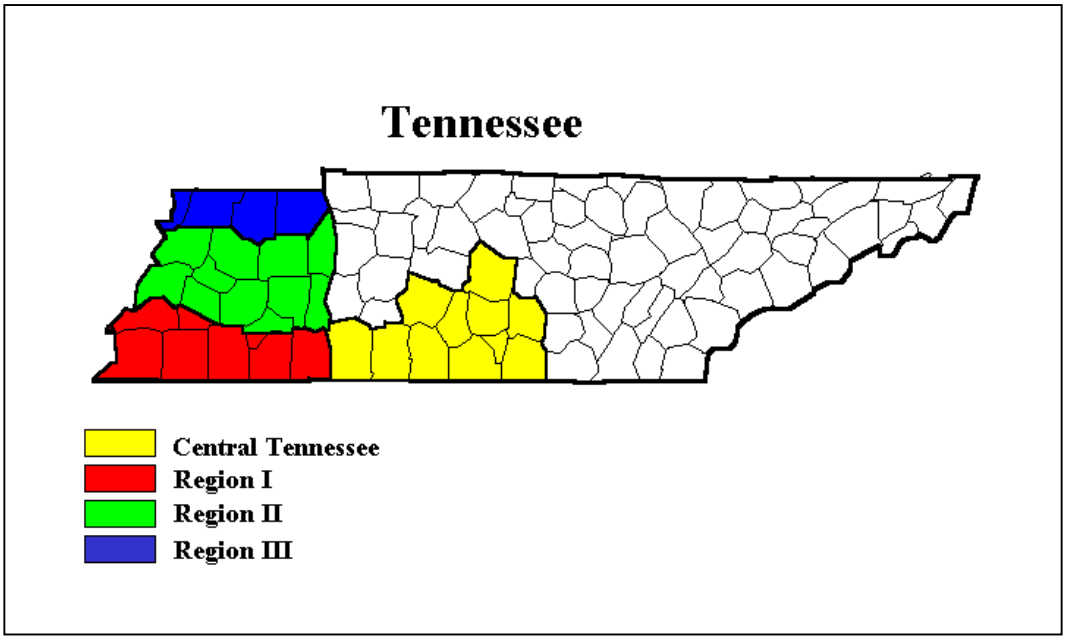

Figure 1. Tennessee Boll Weevil Eradication Zones.

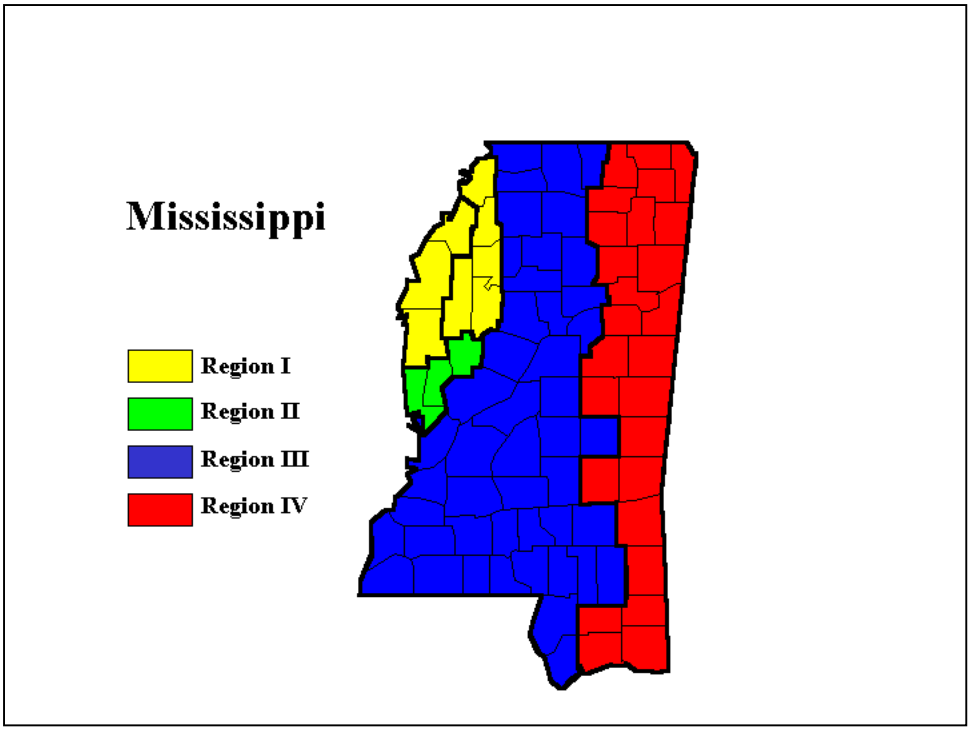

Figure 2. Mississippi Boll Weevil Eradication Zones.

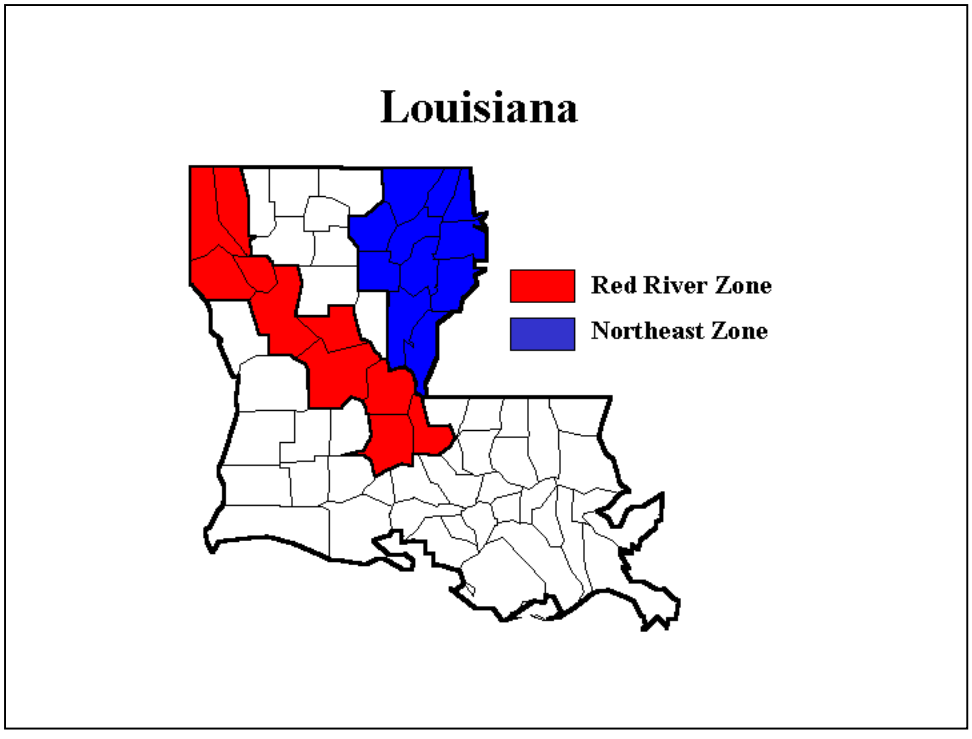

Figure 3. Louisiana Boll Weevil Eradication Zones.

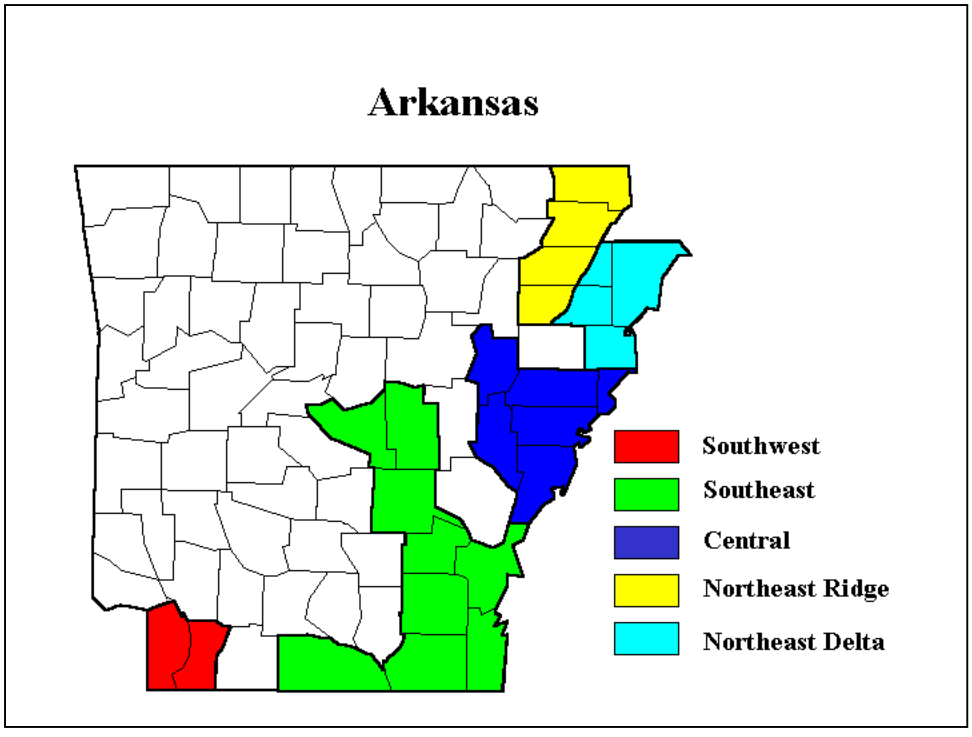

Figure 4. Arkansas Boll Weevil Eradication Zones.

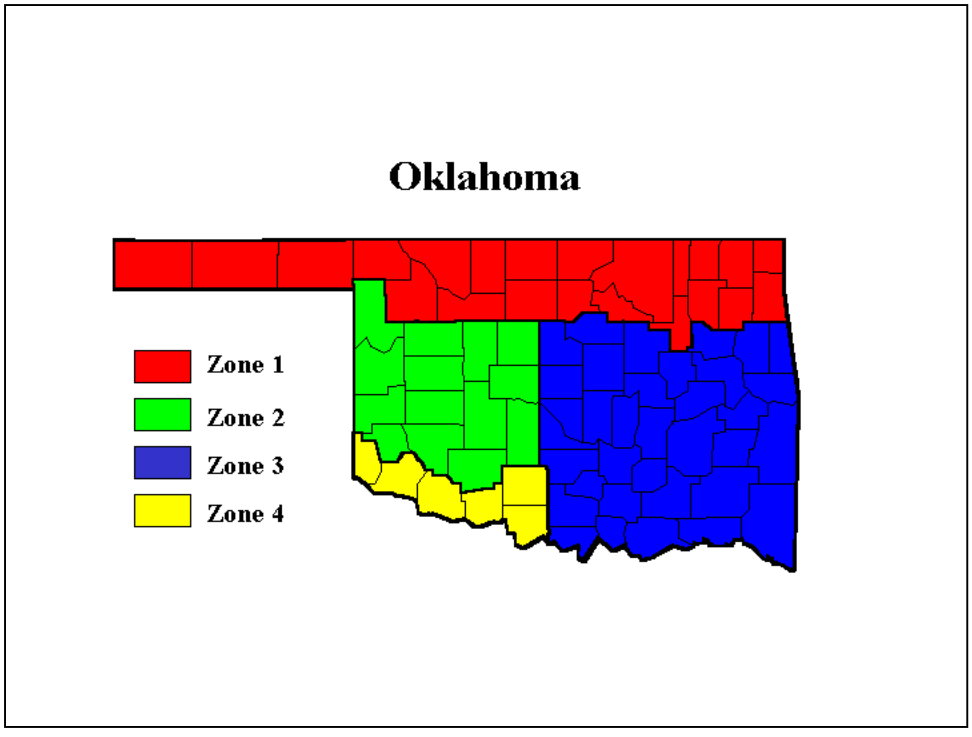

Figure 5. Oklahoma Boll Weevil Eradication Zones.

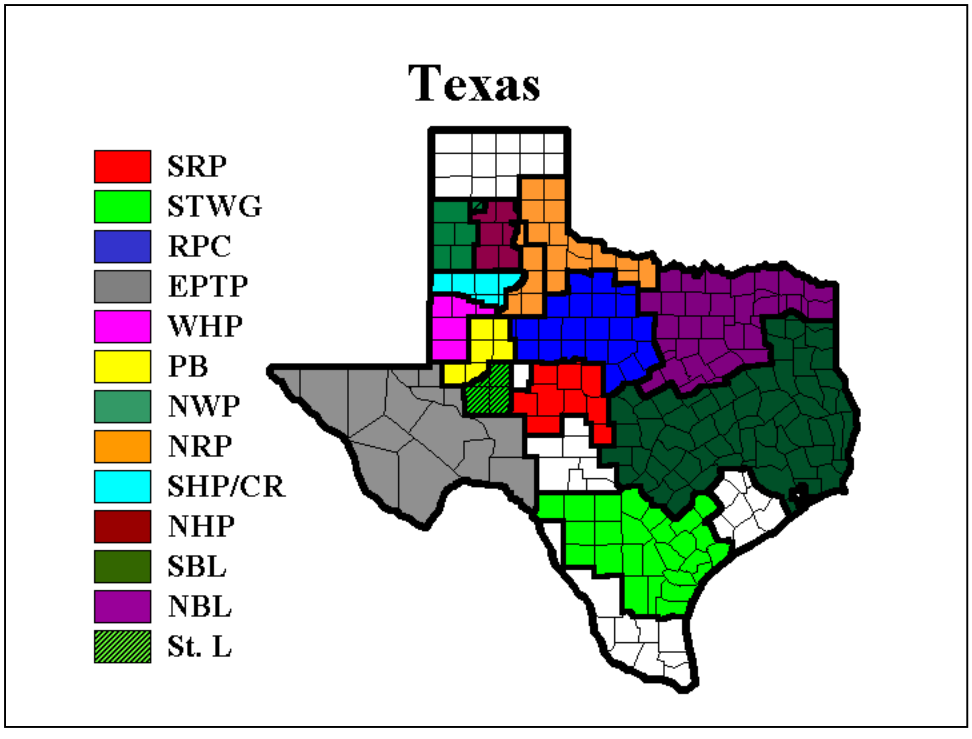

Figure 6. Texas Boll Weevil Eradication Zones.

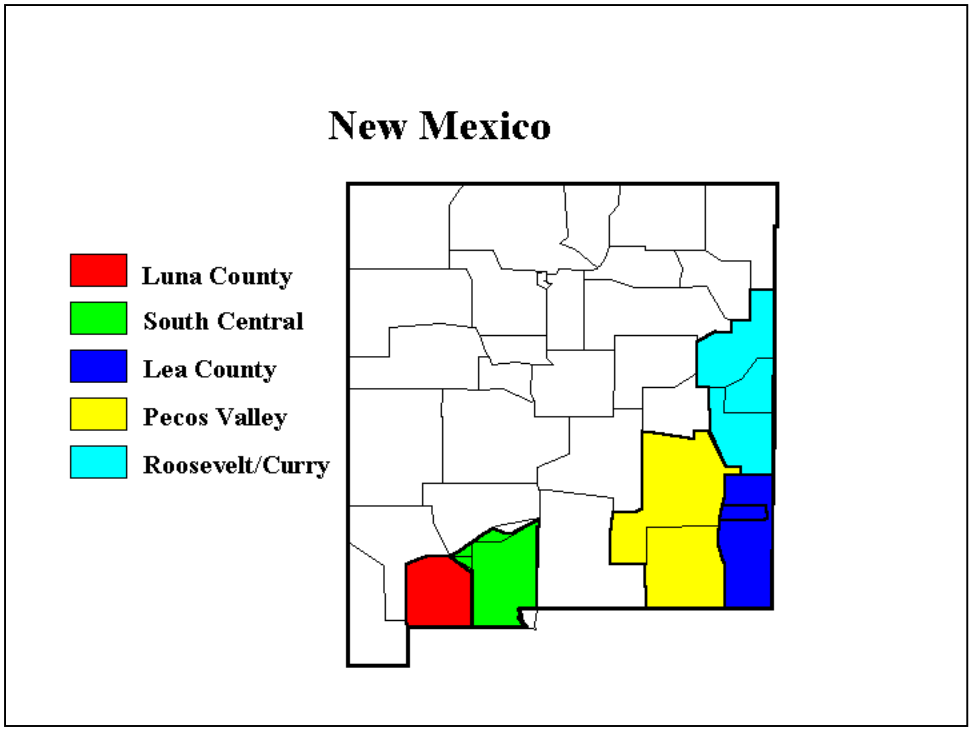

Figure 7. New Mexico Boll Weevil Eradication Zones.

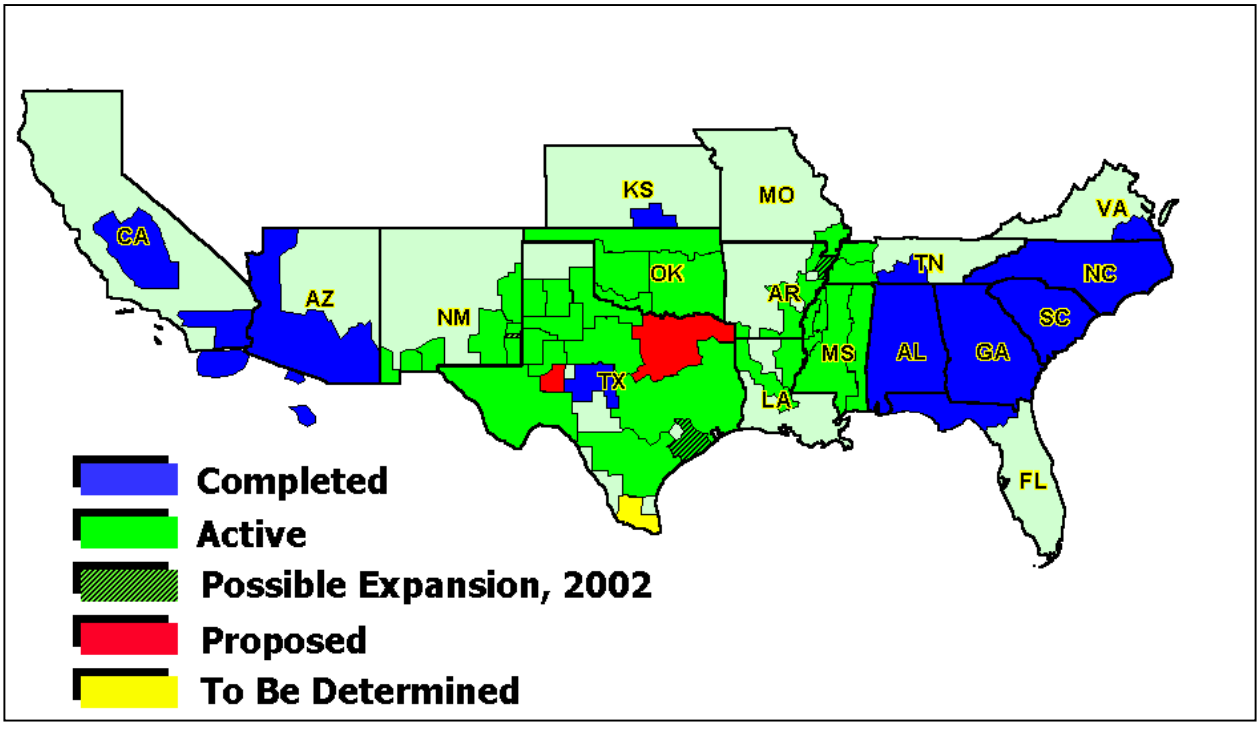

Figure 8. Boll Weevil Eradication Program in the U.S., 2001.