### BOLL WEEVIL ERADICATION UPDATE – ARKANSAS, 2011 Michael Catanach Danny Kiser Arkansas Boll Weevil Eradication Foundation, Inc. Little Rock, AR

#### <u>Abstract</u>

The Arkansas Boll Weevil Eradication Program (ABWEP) was initiated in 1997 to rid the state of the boll weevil *Anthonomus grandis* Boheman.

The Arkansas program began in the Southwest zone in 1997 with the diapause phase, followed by season-long phases in 1998, 1999, 2000, 2001, and season-long maintenance phases in 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010 and 2011. The seasonal mean number of boll weevils captured per trap per week in 2011 was significantly less than in 1998. The mean in 2011 was 0.0 weevils per trap per week, and in 1998 it was 3.99, a reduction rate of 100%. Insecticide applications in 2011 for boll weevils were reduced by 100.0%, compared to 1998.

The program expanded into the Southeast zone in 1999 with the diapause phase, followed by season-long phases in 2000, 2001, 2002, 2003 and season-long maintenance phases in 2004, 2005, 2006, 2007, 2008, 2009, 2010 and 2011. The seasonal mean number of boll weevils captured per trap per week in 2011 was significantly less than in 2000. The mean in 2011 was 0.0 weevils per trap per week, and in 2000 it was 5.54, a reduction rate of 100.0%. Insecticide applications made by the program in 2011 were less than in 2000 by 100.0%.

The program expanded into the Central zone in 2000 with the diapause phase of the program followed by a season-long phase in 2001, 2002, 2003 and 2004, and season-long maintenance phases in 2005, 2006, 2007, 2008, 2009, 2010 and 2011. The seasonal mean number of boll weevils captured per trap per week in 2011 was significantly less than in 2000. The mean in 2011 was 0.00, and in 2000 it was 15.66, a reduction rate of 100.0% in 2011 when compared with 2000. Insecticide applications made by the program in 2011 were less than in 2000 by 100.0%.

The program expanded into the Northeast Ridge zone in 2001 with the diapause phase, followed by a season-long phase in 2002, 2003, 2004 and 2005, and season-long maintenance phase in 2006, 2007, 2008, 2009, 2010 and 2011. The seasonal mean number of boll weevils captured per trap per week in 2011 was significantly less than in 2001. The mean in 2011 was 0.0, and was 8.70 in 2001, a reduction rate of 100.0%. Insecticide applications made by the program in 2011 were less than in 2002 by 100.0%.

The program expanded in the Northeast Ridge Zone to include Eastern Poinsett in 2002 with the diapause phase, followed by a season-long phase in 2003, 2004, 2005 and 2006, and season-long maintenance phase in 2007, 2008, 2009, 2010 and 2011. The seasonal mean number of boll weevils captured per trap per week in 2011 was reduced when compared to the trapping program in 2001. The mean in 2011 was 0.0, and was 11.79 in 2001, a reduction of 100.0%.

The program expanded into the Northeast Delta Zone in 2003 with the diapause phase, followed by a season-long phase in 2004, 2005, 2006 and 2007, and season-long maintenance phase in 2008, 2009, 2010 and 2011. The seasonal mean number of boll weevils captured per trap per week in 2011 was significantly less than in 2003. The season mean number of boll weevils captured per trap per week in 2011 was 0.0, and was 9.576 in 2003 a reduction of 100.0%. Insecticide applications made by the program in 2011 were less than in 2003 by 100.0%.

The results of the ABWEP, demonstrated to this point, indicate significant progress made toward eradication, especially when proven operational principles are effectively implemented. The use of pheromone baited traps for detection, along with sound cultural, mechanical and chemical control methods simultaneously implemented within a harmonized system is proving successful in eradicating the boll weevil. Quality control of all aspects of program activities continues to be carried out season-long.

### **Introduction**

The plan to eliminate the boll weevil, *Anthonomus grandis* Boheman, a native of Mexico and Central America, from the United States has expanded into all regions of the US cotton belt in 2005. This is certainly true in the state of Arkansas. Expansion of the eradication effort into Eastern Poinsett in 2002 and into Eastern Craighead and Mississippi counties in 2003 brought all cotton acreages located in the State of Arkansas and the entire Southeastern portion of the cotton belt into active eradication. This is critical to the success of the Arkansas eradication effort as well as to adjoining states, which have been effected by migrating boll weevil populations. The history of the boll weevil eradication program in Arkansas was previously described (Kiser, et al. 2001).

The Southwest Zone program was initiated with the diapause phase in 1997 with operations under the direction of the Louisiana Boll Weevil Eradication Program. The Arkansas Boll Weevil Eradication Foundation (ABWEF) assumed program operations starting with the third season-long phase of the program in 2000, and continued during the fourth season-long phase in 2001, the first season-long maintenance phase in 2002, the second season-long maintenance phase in 2003, the third season-long maintenance phase in 2004 the fourth season-long maintenance phase in 2005, the fifth season-long maintenance phase in 2006, the sixth season-long maintenance phase in 2007, the seventh season-long maintenance phase in 2008, the eighth season-long maintenance phase in 2009, the ninth season-long maintenance phase in 2010 and the tenth season-long maintenance phase in 2011. Program operations were initiated in the Southeast Zone with the diapause phase in August 1999. The first season-long phase of the program began in the spring of 2000, and was followed by a second season-long phase in 2001, the third seasonlong phase in 2002, the forth season-long phase in 2003, the first season-long maintenance phase in 2004, the second season-long maintenance phase in 2005, the third season-long maintenance phase in 2006, the fourth season-long maintenance phase in 2007, the fifth season-long maintenance phase in 2008, the sixth season-long maintenance phase in 2009, the seventh season-long maintenance phase in 2010 and the eighth season-long maintenance phase in 2011. Program operations were also implemented with the diapause phase in the Central Zone in August 2000, and were followed by the first season-long phase in 2001, the second season-long phase in 2002, the third season-long phase in 2003, the forth season-long phase in 2004, the first season-long season maintenance phase in 2005, the second season-long maintenance phase in 2006, the third season-long maintenance phase in 2007, the fourth seasonlong maintenance phase in 2008, the fifth season-long maintenance phase in 2009, the sixth season-long maintenance phase in 2010 and the seventh season-long maintenance phase in 2011. The Northeast Ridge Zone began the program operations with the diapause phase in 2001. The first season-long phase of the program began in the spring of 2002, the second season-long phase in 2003, third season-long phase in 2004, the fourth season-long phase in 2005, the fifth season-long phase in 2006, the first season-long maintenance phase in 2007, the second season-long maintenance phase in 2008, the third season-long maintenance phase in 2009, the fourth season-long maintenance phase in 2010 and the fifth season-long maintenance phase in 2011. The Arkansas State Plant Board entered into an agreement with the Arkansas Boll Weevil Eradication Foundation to carry out the eradication program in the Northeast Delta Zone as previously reported (Kiser et al, 2005). Program operations were implemented with the diapause phase in the Northeast Delta Zone in August 2003. The first season-long phase of the program began in the spring of 2004, the second season-long phase in 2005, the third season-long phase in 2006, the fourth season-long phase in 2007, the first season-long maintenance phase in 2008, the second season-long maintenance phase in 2009, the third season-long maintenance phase in 2010 and the forth season-long maintenance phase in 2011. With the initiation of the Northeast Delta Zone the entire state of Arkansas is currently under eradication.

### **Methods and Materials**

Five Eradication Zones were established through legislative action, grower referenda and the Arkansas State Plant Board. These zones, including 2011 cotton crop acreage, are as follows (Figure 1):

1.	Southwest	3,905 acres
2.	Southeast	142,027 acres
3.	Central	172,851 acres
4.	Northeast Ridge	111,528 acres
5.	Northeast Delta	201,748 acres

# **Mapping**

In active eradication zones, all cotton fields were located, identified and accurately mapped for successful implementation of eradication programs. Geo-Explorer global positioning system (GPS) hand held units along with post processing deferential correction, using Pathfinder software, were utilized in identifying the exact location of each field (within a sub-meter of accuracy). Maps were created for each field by using geographic data in a geographic-database (MapInfo). Each field is assigned a unique nine-digit number as previously reported (El-Lissy et al, 1996). In addition to the advantages discussed in the previously noted publication, determining the exact location of each field and using the unique identifying numbers makes it possible to ensure high quality of aerial, ground and mistblower applications by overlaying GPS treatment data on field maps. It also allows for detailed spatial analysis of trapping data.

# **Detection**

Trapping: Boll weevil pheromone traps (Plato Industries, Inc., Houston, Texas) (Plato et al, 2001) were placed around the perimeter of all fields located in season-long active phase zones shortly after planting at a space of approximately 300 feet (Boyd et al, 2000). During 2011 all Arkansas Boll Weevil Eradication Program (ABWEP) Zones where 2010 fall weevil trap captures had averaged at or above .01 boll weevils per trap per week spacing was 300 feet, between .01 and .002 boll weevils captured per trap in fall of 2010 the spacing was 900 feet, where 2010 fall weevil captures averaged .001 or less boll weevils per trap, the spacing was 1800 feet and where in 2010 and 2009 no weevils were captured the spacing was 7200 feet. Fields adjacent to other states were trapped at approximately 300 feet. In 2011 all ABWEP Zone traps were baited with combo lure, 25 mg of grandlure and 60 mg eugenol impregnated onto polyvinyl chloride one-inch square laminated dispenser (Plato Industries, Inc., Houston, Texas) and were inspected either weekly in areas where spaced at 300 or 900 feet or every three weeks where traps were spaced at 1800 or 7200 feet. Grandlure dispensers were replaced tri-weekly, leaving the dispenser from the previous cycle in addition to the new dispenser. Therefore, each dispenser was left in the trap for a total of six weeks. On the same schedule as listed for grandlure replacement one-inch by half-inch laminated polyvinyl chloride dispensers impregnated with 0.6 gm of dichlorvos (DDVP) (Plato Industries, Inc., Houston, Texas), were placed in each trap to kill weevils as they entered traps.

### **Control**

The control component of the ABWEP is comprised of cultural, mechanical and chemical control:

- 1. Cultural Control: timely cotton planting, defoliation, harvesting and crop destruction, as recommended by Arkansas Agricultural Extension Service, are essential in providing a necessary boll weevil host-free period. Another important cultural practice is maintaining well-drained, accessible turn-rows, which allow for timely inspections of boll weevil traps and mistblower treatments.
- 2. Mechanical Control: while detection remains the principal function of the boll weevil trap, a certain percentage of the boll weevil population is also removed in the process. As boll weevil populations are reduced in the field, the percentage of the boll weevils that are removed by traps increases (Lloyd et al, 1972). Traps become especially important as a control mechanism in the final phase of eradication.
- 3. Chemical Control: Malathion ultra-low-volume (ULV) was applied by air and ground equipment. Airplanes and helicopters were equipped with differentially corrected GPS data recording systems and spray systems calibrated for ULV applications following USDA-APHIS-PPQ guidelines. High-clearance ground sprayers and trucks were equipped with Big John Mistblower units. All ground spray systems were equipped and calibrated to apply ULV Malathion (16.0 fl oz/ac, 1.23 lb [AI]/ac).
  - a. Season-long phase:
    - Southwest Zone: In 2011, ABWEP personnel implemented the tenth season-long maintenance phase of the program. Beginning at pinhead square, fields reaching treatment criteria (action threshold), received three automatic applications of Fyfanon® ULV (12.0 fl oz/ac, 0.92 lb [AI]/ac). Season-long treatments were based on an action threshold of one weevil trapped per field or if a boll weevil infestation was evident. When fields triggered according to the above criteria all surrounding fields were also treated.
    - 2) Southeast Zone: in the spring of 2011 ABWEP personnel began the eighth season-long maintenance phase of the program. Beginning at pinhead square, fields reaching treatment criteria (action threshold), received three automatic applications of Fyfanon® ULV at (10.0 fl

oz/ac, 0.77 lb [AI]/ac). Season-long treatments were based on an action threshold of one weevil trapped per field or if a boll weevil infestation was evident. When fields triggered according to the above criteria all surrounding fields were also treated.

- 3) Central Zone: in the spring of 2011 ABWEP personnel began the seventh season-long maintenance phase of the program. Beginning at pinhead square, fields reaching treatment criteria (action threshold), received three automatic applications of Fyfanon® ULV at (10.0 fl oz/ac, 0.77 lb [AI]/ac). Season-long treatments were based on an action threshold of one weevil trapped per field or if a boll weevil infestation was evident. When fields triggered according to the above criteria adjacent fields were also treated.
- 4) Northeast Ridge Zone: in the spring of 2011 ABWEP personnel began the sixth season-long maintenance phase of the program. Beginning at pinhead square, fields reaching treatment criteria (action threshold), received three automatic applications of Fyfanon® ULV at (10.0 fl oz/ac, 0.77 lb [AI]/ac). Season-long treatments were based on an action threshold of one weevil trapped per field or if a boll weevil infestation was evident. When fields triggered according to the above criteria adjacent fields were also treated.
- 5) Northeast Ridge Zone (Eastern Poinsett): in the spring of 2011 ABWEP personnel began the fifth season-long maintenance phase of the program. Beginning at pinhead square, fields reaching treatment criteria (action threshold), received three automatic applications of Fyfanon® ULV at (10.0 fl oz/ac, 0.77 lb [AI]/ac). Season-long treatments were based on an action threshold of one weevil trapped per field or if a boll weevil infestation was evident. When fields triggered according to the above criteria adjacent fields were also treated.
- 6) Northeast Delta Zone: in the spring of 2011 ABWEP personnel began the fourth season-long maintenance phase of the program. Beginning at pinhead square, fields reaching treatment criteria (action threshold), received three automatic applications of Fyfanon® ULV at (10.0 fl oz/ac, 0.77 lb [AI]/ac). Season-long treatments were based on an action threshold of one weevil trapped per field or if a boll weevil infestation was evident. This threshold was adjusted in some areas depending upon weevil captures thru the season. When fields triggered according to the above criteria adjacent fields were also treated.

#### **Results and Discussion**

Trap captures from zone trapping programs and field observations indicate reductions in boll weevil populations in all active zones.

#### Southwest Zone

The Southwest Zone is exhibiting no boll weevil population from trapping data for 2011, and economic damage caused by boll weevils was not noticed in any fields during the 2011 season.

The 2011 season-long mean number of adult weevils captured per trap per week was zero, a total reduction when compared to captures from the 1998 season. The mean number for 2011 was 0.000, in 2010 it was 0.0000, in 2009 it was 0.0000, in 2007 it was 0.0000, in 2006 it was 0.0000, in 2005 it was 0.0004, in 2004 it was 0.0000, in 2003 it was 0.00013, in 2002 it was 0.00196, in 2001 it was 0.065, in 2000 it was 0.666, in 1999 it was 0.68, and in 1998 it was 3.96, a reduction rate of 100% in 2011 as compared to 1998 (Figure 2). The increase in weevils per trap from 2004 to 2005 is due to a single weevil capture in 2005 that is suspected to have come into the area on farm machinery. Accurate comparisons of trap captures between the 1997 diapause phase and 2011 season are unavailable due to very limited trapping information for the 1997 season.

The season-long average number of program applications in 2011 was 0.00, in 2010 it was 0.00, in 2009 it was 0.00, in 2008 it was 0.00, in 2007 it was 0.00, in 2006 it was 0.00, in 2005 it was 0.00, in 2004 it was 0.00, in 2003 it was 0.00, in 2002 it was 3.07, in 2001 it was 12.52, in 2000 it was 4.57 applications per acre, in 1999 it was 12.03, and in 1998 it was 16.73, a reduction of 100% in 2011 compared to 1998 (Figure 3). Information regarding the applications per acre in 1997 was unavailable. The increase in number of applications from 2000 to 2001 is attributed to methods of treatments applied during the 2000 season. For more detailed analysis of treatments during past seasons see Kiser, et al, 2001and 2002.

### Southeast Zone

In the Southeast Zone, boll weevil trap captures were reduced following the fall diapause phase of the program in 1999, and the season-long phases in 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010 and 2011. The 2011 season-long overall mean number of adult boll weevils captured per trap per week was significantly less than 2000. The mean number for 2011 was 0.0000, and in 2000 it was 5.54, a reduction of 100.0% in 2011 as compared to 2000 (Figure 5). The weevils per trap per week number went up from 2004 to 2005 and 2006 due to trapping density being reduced by 80% in 90% of the zone where no weevil populations were detected. Over 99% of the weevils captured in the Southeast Zone during 2008 were captured within a two mile radius of an area near Montrose, Arkansas. Accurate comparisons of trap captures between the 1999 diapause phase and 2011 season are unavailable due to very limited trapping information for the 1999 season. Historically, fall boll weevils per trap per week in certain counties (Donald R. Johnson, personal communication).

The overall mean number of treatments during the diapause phase of 1999 was 5.43 applications per acre. The season-long average number of program applications in 2011 was 0.00, in 2010 it was 0.00, in 2009 it was 0.00, in 2008 it was .24, in 2007 it was .39, in 2006 it was .24, in 2005 it was 0.35, in 2004 it was 1.27, in 2003 it was 4.18, in 2002 it was 7.19, in 2001 it was 9.30 and in 2000 it was 12.11, a reduction of 100.0 % in 2011 compared to 2000 (Figure 6).

# Central Zone

In the Central Zone, boll weevil trap captures have been reduced following the fall diapause phase of the program in 2000, and the season-long phases in 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010 and 2011. The 2011 season-long overall mean number of adult boll weevils captured per trap per week was significantly less than in the 2000 season. The mean number for 2011 was 0.0000, in 2010 it was 0.00032, in 2009 it was 0.0000, in 2008 it was 0.0000, in 2007 it was 0.0211, in 2006 it was .00214, in 2005 it was 0.029, in 2004 it was 0.014, in 2003 was .028, in 2002 it was 0.32, in 2001 it was 0.41, and in 2000 it was 15.66, a reduction of 100.0% in 2011 as compared to 2000 (Figure 7).

The increase in boll weevil captures in 2010 as compared to 2009 was the result of capturing 5 boll weevils in 3 traps. Upon a thorough inspection of the boll weevils captured it seems apparent that the boll weevils were placed in the traps by a third party, the details of this event were previously discussed in (Catanach, et al. 2010). There were no further boll weevil captures so no insecticide applications were required.

The overall mean number of treatments during the diapause phase of 2000 was 6.55 applications per acre. The season-long mean number of treatments in 2011 was 0.0, in 2010 it was 0.0, in 2009 it was 0.0, in 2008 it was 0.0, in 2007 it was .21, in 2006 it was .29, in 2005 it was 1.00, in 2004 it was 1.27, in 2003 it was 8.77, in 2002 it was 10.88 and in 2001 it was 12.80 applications per acre (Figure 8). Treatments were reduced by 100.0% when applications made in 2011 were compared with 2001.

# Northeast Ridge Zone

In the Northeast Ridge Zone, boll weevil trap captures have been reduced following the fall diapause phase of the program in 2001, and the season-long phases in 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010 and 2011. The 2011 season-long overall mean number of adult boll weevils captured per trap per week was significantly less than in the 2001 season. The mean number for 2011 it was 0.0000 and in 2001 it was 8.70, a reduction of 100.0% in 2011 as compared to 2001 (Figure 9).

Trapping information for the Eastern Poinsett portion of the Northeast Ridge was kept separate due to the different phases of the program in each area. In Eastern Poinsett (added to the Northeast Ridge Zone in 2002) the 2011 season-long overall mean number of adult boll weevils captured per trap per week was significantly less than in the 2002 season. The mean number for 2011 was 0.0000 and in 2002 it was 6.127, a reduction of 100.0% in 2011 as compared to 2002 (Figure 10).

The season-long mean number of applications in the Northeast Ridge Zone in 2011 was 0.0000, in 2010 it was 0.0000, in 2008 it was 0.0000, in 2007 it was 0.23, in 2006 it was 2.69, in 2005 it was 5.76, in 2004 it was 6.78, in 2003 it was 8.77, in 2002 it was 11.48 and in 2001 it was 10.42 applications per acre (Figure 11). Treatments were reduced by 100.0% when applications made in 2011 were compared with 2002.

### Northeast Delta Zone

In the Northeast Delta Zone, boll weevil trap captures have been reduced following the fall diapause phase of the program in 2003, and the season-long phase in 2004, 2005, 2006, 2007, 2008, 2009, 2010 and 2011. The 2011 season-long overall mean number of adult boll weevils captured per trap per week was significantly less than in the 2003 season. The mean number for 2011 was 0.0000 and in 2003 it was 9.58, a reduction of 100.0% in 2011 as compared to 2003 (Figure 12).

The season-long mean number of applications in 2011 was 0.00, in 2010 it was 0.00, in 2009 it was 0.00, in 2008 it was 0.00, in 2007 it was 0.84, in 2006 it was 4.00, in 2005 it was 5.49, in 2004 it was 7.41 and in 2003 it was 9.03 applications per acre (Figure 13). Treatments were reduced by 100.0% when applications made in 2011 were compared with 2003.

# **Conclusions**

Based upon the above results, we conclude the ABWEP continues to significantly reduce weevil populations as evidenced by reduced trap captures and boll weevil damage in full season programs as compared with diapause programs.

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Figure 1. Boll weevil eradication zones in Arkansas, 2011.



Figure 2. Mean number of adult boll weevils captured per trap per week by year, Southwest Zone.







Figure 4. Boll Weevil Damage Survey. Overall percent boll weevil damage squares/bolls in the Southeast, Central, Northeast Ridge and Northeast Delta zones, Arkansas, during their first season-long phase of the program.







Figure 6. Season-long mean number of insecticide applications per acre in the Southeast Zone of Arkansas.



Figure 7. Mean number of adult boll weevils captured per trap per week by year, Central Zone.



Figure 8. Season-long mean number of insecticide applications per acre in the Central Zone of Arkansas.



Figure 9. Mean number of adult boll weevils captured per trap per week by year, Northeast Ridge Zone without trap counts from Eastern Poinsett County.



Figure 10. Mean number of adult boll weevils captured per trap per week by year, Eastern Poinsett County, Northeast Ridge Zone.



Figure 11. Season-long mean number of insecticide applications per acre in the Northeast Ridge Zone of Arkansas.



Figure 12. Mean number of adult boll weevils captured per trap per week by year, Northeast Delta Zone.



Figure 13. Season-long mean number of insecticide applications per acre in the Northeast Delta Zone of Arkansas.