SECOND YEAR BOLL WEEVIL CONTROL RESULTS WITH BWACT™ FROM ALABAMA, ARKANSAS, LOUISIANA, MISSISSIPPI, MISSOURI, TENNESSEE AND TEXAS IN LOW AND HEAVILY INFESTED ZONES

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Abstract

The Boll Weevil Attract and Control Tube (**BWACT**), a novel, biorational, "reduced risk/reduced use" boll weevil control system has been substantially improved during the last three years. Pheromone dispenser modifications, increase in pheromone content, duration of insecticide residual control and refinement of field placement, spacing, timing and criteria to measure control have contributed to good research, extension, crop consultant and cotton producer results. During 1994 and 1995, results Alabama, Arkansas, Louisiana, Mississippi, Missouri, Tennessee, Texas and Latin America illustrated that the use of **BWACT** in IPM cotton insect control programs can generally be expected to provide one or more of the following benefits:

Up to a 95% reduction of an overwintered boll weevil population,
1 to 4 weeks delay in the initiation of early and mid season weevil insecticide sprays,
1 to 9 less weevil insecticide applications during a crop,
20% to 60% reduction in seasonal square damage from boll weevils,
10% to 45% increase in retained fruit in the #1 and #2 fruiting positions,
50 to 175 pounds per acre lint increase,
$50 to $115 per acre operating profit increase from insecticide savings and increased yield, and
Up to a 97% reduction of a diapausing boll weevil population.

Results from the 1994 and 1995 Southeast Boll Weevil Eradication Foundation's Program in Alabama and Mississippi provided evidence that the incorporation of **BWACT**s substantially lowered program costs and contributed to the eradication of the boll weevil in an environmentally acceptable, economical and effective manner.

Introduction

During the 1995 Beltwide Cotton Conference, Plato Industries, Inc. (PII) reported on substantial improvements which had been made in 1993/1994 to the Boll Weevil Attract and Control Tube (**BWACT**, formerly known as the Boll Weevil Bait Stick, **BWBS** , Tubo Mata Picudo, **TMP**, Tubo Mata Bicudo or **TMB**); additionally, PII reported on 1994 field tests by cooperators and on **BWACT** use in various boll weevil eradication zones. This paper reports on a continuation of many of the 1994 field tests, on data collected in 1995 from cooperators in low and heavily infested zones, on new "use tactics/methods" deployed in 1995 and on results from the large scale use of the **BWACT**s in a West Texas boll weevil suppression program and in the Southeast Boll Weevil Eradication Foundation's (SEBWEF) eradication program.

In 1995, PII worked diligently to provide end users with **BWACT**s which had an effective field life of an average of 50 days and to convince crop con-sultants and researchers to use the **BWACT**s at recommended label direc-tions. Where the PII "recommended program" was followed and appropriate criteria were employed to measure performance, the **BWACT**s provided substantial positive benefits. Several researchers and leading crop consultants from Alabama, Arkansas, Louisiana, Mississippi, Missouri, Tennessee and Texas gave a 100% effort to correctly use and evaluate the **BWACT** in 1995. Our company sincerely appreciates these individuals and the progress which they made in demonstrating the value of this technology for use in IPM, suppression and eradication programs for the cotton boll weevil.

Materials and Methods

The **BWACT** Control Tubes used in the tests were all processed in the same manner and had insecticidal coatings which, after 55 days of weathering, provided an average LD80 or higher. Malathion continued to be the insecticidal toxicant of choice; but in 1996, PII plans to register an alternative toxicant for use in the Control Tube coating. The color attractant component of the coating was the same in 1994 and 1995; however, it was observed to deteriorate too much under extended sunlight/UV conditions. The boll weevil is attracted visually to the color and the color component of the Control Tube has been improved for use in 1996. PII and its collaborators will continue to improve the Control Tube to maximize performance.

The pheromone dispensers used in the 1995 tests contained 60 mg. of grand-lure pheromone. At the request of the USDA-ARS-Boll Weevil Research Unit (BWRU), the grandlure content was increased in January, 1995 from 40 mg. to 60 mg. Prior release studies by the BWRU have demonstrated an almost linear relationship in the increased number of boll weevils responding to an increase of grandlure amounts. Thus, the grandlure amount was in-creased by 50% and the pheromone dispenser was improved to provide a "release time" from an approximate 35 days in 1994 to approximately 50 days in 1995.

Reprinted from the *Proceedings of the Beltwide Cotton Conference*
Volume 2:1002-1007 (1996)
National Cotton Council, Memphis TN

The product improvements in the **BWACT** system has been implemented with the sole intent of providing increased product activity for use in IPM, suppression and eradication programs. Hopefully, these improvements will contribute to more positive results from researchers and extension workers who have not had positive experiences. The **BWACT** should be viewed as a preventative product and any practical improvement which contributes to a significant boll weevil population reduction should be considered. When an additional 20% to 50% weevil population reduction occurs in a field being infested, substantial benefits can result during the first 6 to 8 weeks of fruit formation.

The field placements of **BWACT** in all of the tests were predominantly the same, i.e. outside of the planted cotton, around the field perimeter:

Ten or more yards outside of the cotton planted rows,
On the "off side" of a turn row,
Between fence posts in the top 3 strands of a fence line,
On the water free, "high side" of a ditch, canal or levee bank,
Always in an area free of grass and weeds with good visibility, air flow and sun light (use of a "burndown" herbicide to keep the **BWACT** area free of grass and weeds was an easy, low cost method),
Out of the way of farm equipment, i.e. in fence lines, between light/telephone poles and their "guy wire" anchors, etc. and
Alongside "in field" trees, ditch banks, well heads, culverts, buildings, any and all "in field" over-wintering sites.

During 1995, field tests by the University of Tennessee corroborated the importance of correct placement and provided data which discourages the placement of the **BWACT** in the top three strands of a fence line, within a tree "drip line" area and/or within a weedy/grassy spot.

The spacing in the 1995 field tests was generally 100 feet; however, and noted in the Arkansas tests by crop consultant Charles Denver, these were conducted with an alternative placement regime of 300 feet **:** 150 feet **:** 75 feet. In most commercial installations, the **BWACT**s were deployed adjacent to over-wintering sites in historical boll weevil problem fields. In fields of less than 10 acres, 200 feet spacing was used and 150 feet was used in 10 to 25 acre fields. Fall diapause installations were predominately at 200 feet spacing.

The timing of commercial installations were not as consistent as PII would have preferred; it varied from 30 days before planting to 30 days after planting. PII estimates that 80% of the **BWACT**s used in 1995 were installed at planting, as it was logistically the easiest way to get the job done. In most all 1995 tests the **BWACT**s were around fields for an average time of 100 days. The amount of time that is required for a **BWACT** Program to reduce a boll weevil population to "sub economical" damaging levels is not clearly known; however, the data reported herein provides evidence that the average 100 days of attraction and control is substantially more effective in reduction of an over-wintered population than 50 days, especially in moderate to high boll weevil population zones.

The performance measurement criteria used in 1995 were:

Weevil counts at 0 to 60 days from a few traps on the **BWACT** perimeter line, compared to traps on the perimeter of the non **BWACT** treated field (according to the USDA-ARS-BWRU, the **BWACT** will bias the trap count downward to 60% of normal),
The % boll weevil punctured squares, punctured squares per 14 feet of row or per acre and % fruit retention in the #1 and #2 fruiting positions at 40 to 90 days after planting,
The dates at which the boll weevil economic damage threshold level occurred and re-occurred after treatment,
The number of boll weevil sprays required to make the crop and,
The ultimate yield per acre.

In general the **BWACT** Program benefits were difficult to measure in 1995; most of the mid-season and late season criteria were masked because of bollworm, budworm and beet army worm outbreaks which required massive insecticide treatments. In commercial IPM programs operated with a strategy of maximum protection and minimum tolerance of insect pest pressure, there were instances when no benefits were observed; but, in most control pro-grams based on "state extension threshold levels", positive benefits were measurable.

Results and Discussion

The most serious "road blocks" encountered in 1995 were people/time related for **BWACT** installation and servicing. In 1996, PII and its distributors, Terra International Inc. and the United Agri Products Companies (Central Valley Chemical, Mid Valley Chemical, Tri-State Chemicals and Tri-State Delta Chemicals) will be experimenting with an installation / servicing program in conjunction with consultants and cotton producers which will insure a more timely and correct **BWACT** use.

During 1995, PII and its cooperators designed and implemented several large scale, isolated tests to assist in establishing, measuring and interpretation of performance criteria for **BWACT**. The results reported herein help to answer the aforementioned questions; the results from 1994 and 1995 continue to demonstrate that the **BWACT**'s should not be used as a stand alone product but in conjunction with proven IPM programs containing other products and cultural practices. For example, in a large scale test, one **BWACT** plus one diapause spray was equivalent to four diapause sprays of an area wide boll weevil suppression program in Texas, and in 1994, one

BWACT plus one diapause spray in the Noxubee County, Mississippi eradication program had the same population reduction effect as seven diapause sprays in adjacent counties. However, one **BWACT** by itself was not sufficient to provide equivalent results.

Test work in 1995 varied from as small as 20 acres with an LSU Extension Agent in Morehouse Parish (Oak Ridge), Louisiana to a 21,000 acre study under an EPA "reduced use/reduced risk" grant in Howard County (Big Spring), Texas with the Texas Department of Agriculture, in the Plains Cotton Growers' boll weevil suppressions program.

The 1995 results confirm those of 1994 and lend support to PII's product position statements, that the use of the **BWACT** in IPM cotton insect control programs can generally be expected to provide one or more of the following benefits:

Up to a 95% reduction of an over wintered boll weevil population,
1 to 4 weeks delay in the initiation of early and mid season weevil insecticide sprays,
1 to 9 less weevil insecticide applications during a crop,
20% to 60% reduction in seasoned square damage from boll weevils,
10% to 45% increase in retained fruit in the #1 and #2 fruiting positions,
50 to 175 pounds per acre lint increase,
$50 to $115 per acre operating profit increase from insecticide savings and increased yield, and
Up to a 97% reduction of a diapausing boll weevil population.

Results from the 1994 and 1995 SEBWEF's eradication program provided evidence that the incorporation of **BWACT**s into several zones substantially lowered program costs and contributed to the eradication of the boll weevil in an environmentally acceptable, economical and effective manner.

Alabama

During 1996, members of USDA-APHIS, boards of directors and technical advisory committees from respective state foundations involved in boll weevil eradication will draw upon the Noxubee County, Mississippi results, Howard County, Texas results (comments in the Texas section of this paper) and APHIS use experience in Chambers, Lee and Macon Counties, Alabama to make decisions on using the **BWACT** as an alternative product for deployment in 1996 eradication programs. With that consideration in mind, PII believes it justifiable to comment in this paper on these 3 evaluations.

The 1996 APHIS experience in Chambers, Lee and Macon Counties with the **BWACT** was positive. In Chambers County, **BWACT**s were installed at planting in May and replaced at six week intervals until the fall diapause program terminated. In Lee and Macon counties, **BWACT**s were installed in fields which caught a cumulative of 3 weevils per week before the pin head square stage. The results are reported in Table 1.

It should be noted that in the fields in Alabama where the **BWACT**s were used, no secondary pest problems developed during 1995, as well as during 1994; whereas, outside the **BWACT** treated zones secondary pests were generally a problem.

The SEBWEF has purchased and used an approximate 60,000 **BWACT**s during 1994 and 1995; in both years valuable use experience has been obtained and the SEBWEF program is expected to be substantially expanded in 1996.

Arkansas

Various tests and demonstrations were conducted by the Cooperative Extension Service, University Research workers and crop consultants. Results are from 3 sources, Marvin Wall (retired Area Entomologist), Charles Denver (crop consultant) and Dr. Phil Tugwell (Professor of Entomology, University of Arkansas).

The following Cooperative Extension Service test was conducted on John Sims' 225 acre farm at Selma, Drew County; **BWACT**s were installed for the second year on the same 50 acres and compared to the same adjacent, non **BWACT** treated area of 60 acres about ¼ mile away. The 50 and 60 acre fields were very similar, along a "tree lined ridge" and always has heavy weevils. Results from 1994 are reported in last year's Beltwide proceedings. **BWACT**s were installed on May 10 and replaced on or about July 10. Seventeen boll weevil traps were installed on April 14 with pheromone replacements each 2 weeks until July 3, about 4 weeks after pinhead square formation. The trap counts from 4/24 to 7/3, threshold dates on which sprays "triggered" and yield data are reported in Table 2.

According to John Sims, the **BWACT** treated field (which historically is his worst weevil field) gave an excellent yield of 1036 lbs./acre; it was sprayed once at pinhead on 6/19 and border sprayed on 7/3. No other weevil sprays were required until August 10; whereas the Conventional 60 acres were sprayed on 6/13 for the first pinhead and repeatedly sprayed throughout the crop for weevils. A comparison of yield shows an approximate 300 lbs. of lint or $225 per acre profit increase in the **BWACT** treatment; when yields of 1994 are compared, the yield increase was 205 lbs. more per acre.

Charles Denver, crop consultant (Dermott, Chicot County) conducted a second year series of "spacing" and "timing" evaluations using punctured squares and yield as the performance criteria on three 38 to 45 acre fields adjacent to heavily, weevil infested areas on the Bayou Bartholomew. The comparisons are in Table 3.

Agronomically the fields were all similar, separated by ¼ mile and all in heavily infested boll weevil areas. The **BWACT** fields received 2 automatic pinhead sprays on 6/7 and 6/13 and seven late season sprays; the conventional

fields received 2 pin heads on 6/7 and 6/13 and 8 late season sprays. All late season sprays started around July 10 and terminated in early September. In general the **BWACT** fields had fewer weevils early, less weevils to fight and an average of 80% less damage. The **BWACT** fields never exceeded the spray threshold of one punctured square per foot of row; whereas, the check fields averaged above threshold for the 12.5 weeks of data collection. Yield data collected on the **BWACT** fields exhibited an 80 lb. ($60.00) to 110 lb. ($82.50) per acre increase. This data suggests that the use of **BWACT**s to reduce boll weevils during mid and late season provides positive results.

Dr. Phil Tugwell conducted laboratory bioassay tests to ascertain the residual control of the **BWACT**; he used **BWACT**s from 1994 and 1995 production which were obtained from the market place. The bioassay technique used by Dr. Tugwell was developed by Dr. Eric Villavaso (USDA-ARS-BWRU). Three replications of 10 weevils / **BWACT** were exposed for 30 seconds each and held in petri dishes for 24 hours. A summary of the results are in Graph 10.

The boll weevil test animals were generally from "wild" populations collected in traps; these residual control results corroborate USDA-ARS-BWRU bioassays in 1994 and 1995.

Louisiana

One of the more comprehensive 2nd year field evaluations in 1995 was conducted by Dr. Steve Micinski and other LSU personnel in concert with Mike Sanders (cotton producer) and Steve Schultz (crop consultant) in Northwest, Louisiana. The details of this study are presented in another paper during this session.

In Northeast Louisiana, 2 demonstrations were conducted by L.S.U. personnel in heavily, boll weevil infested fields. The first demonstration was conducted in South Morehouse Parish by Terry Erwin, Extension Agent on Harper Armstrong Farms in about 40 acres.

BWACTs were placed on May 1, 1995, 2 weeks before the cotton was planted. A 2nd installation of **BWACT**s was made about June 24 at "match head" and a 3rd installation on July 24, at mid-bloom. The wooded areas next to this cotton field were ideal over-wintering sites for boll weevils. Two pheromone baited traps were used to detect the presence of weevils. These traps were placed on opposite perimeters of the field, not in the **BWACT** line and not within 100 yards of a **BWACT**. A summary of the trap counts and insecticide application is in Table 4.

According to Terry Erwin, "the 40 acres never needed a boll weevil application on its own until 8/7/95" (83 days after planting). In August, the number of weevil punctured squares steadily increased to the 30% - 40% level; this was attributed to crop cut-out with fewer squares for weevils to choose from. In summary, the **BWACT**s appeared to have greatly reduced the amount of insecticide applications for weevil control in this field. The crop was made on 3 weevil sprays in July and August; adjacent fields required an average of 6 sprays for boll weevil control during the same period. In 1994, this 40 acre field required 10 weevil sprays. The cotton producer had an approximate $50 / acre cost savings compared to last year and an approximate $20 / acre savings this year, compared to adjacent farms.

In Franklin Parish, Carol L. Pinnel-Alison, Dr. Roger Leonard and Dr. Ralph D. Bagwell of the LSU System conducted a second year demonstration on a 42 acre cotton field divided into 2 treatments. One treatment (15 acres) was managed with conventional boll weevil control products and the other (27 acres) was treated with **BWACT**s. The 1st installation of **BWACT**s was 1 day after planting. Twenty six **BWACT**s were placed along the perimeter of the field next to over-wintering sites. A 2nd installation of **BWACT**s was on June 20, 1995 at pinhead squaring. Ten pheromone baited boll weevil traps were placed through the center of the conventional treatment and 10 diagonally through the **BWACT** treatment on May 16, 1995. The traps were checked for 6 weeks beginning May 22 through June 26, 1995. Five hundred squares were collected from each treatment on July 14 to determine the boll weevil damage. This field received a **BWACT** diapause treatment on September 28, 1994. A summary of the results is presented in Table 5.

According to the LSU cooperators, "the data obtained suggest that the **BWACT** tubes may have reduced the boll weevil damaged squares. The cost of boll weevil control was higher using the **BWACT** tubes". The total cost for boll weevil control in the Conventional plot was $11.04/acre including application costs; 3 sets of **BWACT** tubes cost $18.78/acre. From the trap counts it appears that during the 6 week period, the weevil population was quite large; however, the **BWACT** program reduced the boll weevil population 64% more than the conventional approach. Both programs kept the weevil damage below 2% punctured squares as of 7/14/95. No data is available for the balance of the crop year.

Mississippi

Many interested people have been awaiting the USDA-ARS and APHIS analysis on the 1994 Noxubee County test in eradication zone 4; this test utilized the **BWACT** and 1 malathion spray as compared to 7 - 8 sprays in adjacent counties under the SEBWEF's program. The Noxubee analysis is scheduled for presentation by the USDA/ARS/BWRU at this conference.

In Mississippi Delta (eradication zone 1), the zone is considered to be an area largely free of boll weevils; however, with the recent years of mild winters, weevils

have been increasing in the "heart land" of the Delta. In 1995 a test was conducted at the MSU Delta Research and Experiment Station, Stoneville, Mississippi by Dr. F. A. Harris. The cotton on the Station was divided into 2 large blocks; the south block, approximately 280 acres, was treated with **BWACT** at 1 tube / acre. The north block, approximately 145 acres, was not treated with the **BWACT**; otherwise, both blocks were over-sprayed as thresholds indicated.

The **BWACT**s were placed in the south block on 5/8, 7/26, 9/6 and 10/16 around perimeter at 1 tube / 64 feet. Pheromone traps at a rate of 1 per 10 acres were placed around perimeter at 1 trap / 640 feet; the pattern was 9 **BWACT** tubes and 1 pheromone trap. In the non **BWACT** treatment, pheromone traps were placed along West field margins (along Deer Creek) and on North end at 1 trap / 16 acres. Pheromone traps were serviced at approximately 2 week intervals when new lures were placed in traps and captured weevils removed and counted. Boll weevil punctured squares (50 squares per site) were counted on 3 dates (7/7, 7/26 and 8/8) at 8 sites in the **BWACT** treatment and 4 sites in the non **BWACT** treatment.

Data on trap catches and punctured squares are in Table 6. The trap data illustrates an average of 550% more boll weevils in the non **BWACT** treatment than in the **BWACT** treatment through early August. The data shows an increase in percent boll weevil damaged squares in the non **BWACT** treatment to a level almost 3 times as high as the **BWACT** treatment. According to Dr. Harris, data from an unreplicated test require caution in making conclusions. It appears that the **BWACT** suppressed field populations of boll weevil and reduced square damage. The areas will be trapped for spring emergence in 1996 and the **BWACT** and trapping pattern will be repeated.

The **BWACT**s reduced the overwintered weevil population by about 85% and had an average of 35% less damage. The 15.5% damage level on 8/8 may be considered threshold and this could result in 2 - 3 sprays to minimize late season damage. The North and South blocks were sprayed an equal amount, approximately 8 applications for all pests. No data is available at this time on fruit retention and yield.

Missouri

The University of Missouri Delta Center Experiment Station was not able to collect meaningful results due to multi insect pest spraying and weather inhibiting the timely placement of **BWACT**s in the test plots. However, **BWACT**s were commercially used on about 25 cotton production sites; as a general rule, the **BWACT**s eliminated the necessity for pin head sprays.

Tennessee

There were several second-year **BWACT** programs conducted by large growers and the University of Tennessee. The UT results are to be presented by Dr. Philip Roberts in a separate paper at this conference.

No definitive data were collected from the production operations of Jimmy Hargett, Harris Hughes nor Tom Hughes, all second year users on large acreage. In the case of Jimmy Hargett, approximately 3,000 acres were under the **BWACT** program; about 1,000 acres were under a second year of **BWACT**s, i.e. 1994 had 3 installations and 1995 had 2. In 1995, trap counts were nil, no pin heads sprays were required and only border sprays were made for weevils. No weevils or punctured squares were observed until the end of August, at which time weevils proceeded to take the top crop. Adjacent fields to the Hargett farms, not under a **BWACT** program, were treated 1 to 3 times at pin head. Jimmy Hargett believes that the **BWACT** program is a better approach than conventional practices and intends to stay with the program in 1996.

Texas

Texas, as well as Oklahoma, remains behind the Mid South States in use of the **BWACT** and demonstration of positive results. In 1995, 3 official evaluations were conducted by the Texas A&M University (TAMU) and Texas Department of Agriculture (TDA).

In North Central Texas, Mr. Bill Langston, TAMU at Dallas, conducted a second-year test with the **BWACT**s; the results were reported in the "poster" sessions at the 1995 and this Beltwide Conference. In his 1995 test, the **BWACT** program demonstrated an over-wintered weevil population reduction from a high level to a low level, which resulted in the elimination of 3 insecticide applications necessary to make the 1995 crop.

On the Gulf Coast, a test was conducted by Dr. Roy Parker, TAMU at Corpus Christi on pheromone release rates of the Hercon and Plato dispensers; the results corroborated USDA/ARS/BWRU results on the **BWACT** dispensers' effective life of 50 days. In the same study, trap data illustrated that under his test design, the **BWACT** pheromone interfered with the "in field" trap catches and the punctured squares from the **BWACT** treatment were not statistically different from the check at $P = 0.05$. Dr. Parker is reporting this work separately.

It is generally believed by most **BWACT** advocates that official tests in Texas have not been conducted on a large enough area to fully assess the **BWACT** performance. Therefore, in the fall of 1994, the TDA orchestrated an approximate 21,000 acre field test in Howard County (near Big Spring), Texas; participants in the test protocol were TDA, TAMU, USDA-ARS, EPA, PII and Plains Cotton Growers (PCG) personnel. Implementation of the field

work was by TDA, TAMU and a PII; aerial applications were by PCG. The official report on this test has not been completed; it is being prepared by TDA for the participants and other interested parties. PII's reasons for closely collaborating in this test were:

To evaluate **BWACT**, an EPA registered "reduced risk/use" point source device, for population reduction and control of migrating and diapausing boll weevils in West Texas,
To illustrate the effectiveness and "user value" of the BWACT for deployment by the PCG in their High Plains Boll Weevil Diapause Control Program,
To assess the **BWACT** potential for use in area wide boll weevil suppression, control and eradication programs in Texas and Oklahoma,
To obtain collaboration of governmental groups and cotton producer associa-tions in deploying the **BWACT** in the boll weevil control, suppression, maintenance, eradication and barrier programs, and
To assist the EPA and the TDA to substantiate and quantify the amount of reduced insecticide potential obtainable from **BWACT** usage in the Texas and Oklahoma boll weevil eradication programs.

The **BWACT** test zone was in a 15 square mile rectangular area inside the PCG's Program area, isolated from no-spray zones by about 20 miles on the west, 15 to 20 miles on the South and East and more than 50 miles to the North. It was compared to an adjacent "L" shaped zone on the West and South, a conventional treated area in 23 square miles and to an untreated 4556 acre area laying 20 miles to the west. TDA, TAMU and PII were to collect the data and TDA was to present the data in a form suitable for use by the EPA, TDA, PCG, Texas Boll Weevil Eradication Foundation, USDA-ARS, USDA-APHIS and the TAMU system.

On 8/9/95, an extensive square collection program was conducted by TDA, TAMU and PII personnel in each field; this was at about 75 days from planting, at mid to peak bloom. One hundred squares were collected from each field in each zone and damage was determined by TAMU.

As previously mentioned, the **BWACT** "efficacy" and "user value" will be evaluated and reported by TDA. However, during the protocol establishment, TAMU personnel asserted that in their opinion, a comparison of 1995 damaged square data would be the prime criteria for determining efficacy and "user value". The damaged square counts on 8/9/95 were summarized by TAMU and are recorded in Table 7.

In general the punctured square and cost data associated with the above treatments corroborate other large scale tests; this data illustrates that the **BWACT** + 1 malathion application is equivalent to 3 or 4 malathion applica-tions. In PII's opinion, it is not appropriate to expect an alternative technolo-gy, especially an environmentally friendly technology like the **BWACT**, to sterilize the fields. It should be clear that the **BWACT** is an alternative to certain chemical sprays and it should be incorporated to reduce applications in existing programs, not to completely replace all chemical sprays.

In terms of suppression and eradication programs, it is known that killing the last few weevils with an insecticide applied by air is extremely difficult; low numbers of weevils can be killed by an attract and control device much easier than with chemical insecticides. In this test, the **BWACT**/malathion approach provided a $4.86/acre or 50% cost savings; such a savings can translate to millions of dollars in an area wide program.

Conclusion

The 1994/1995 product improvements of the **BWACT** system have positioned it as a practical method for broadscale use in IPM cotton insect control programs, as well as federal and state boll weevil suppression and eradication programs. The 1994 and 1995 results from the improved **BWACT** product have clearly demonstrated that it provides important biological and economical benefits to cotton producers in the Mid South and Texas states. Consultant and cotton producer "use trends" signify that the **BWACT** has the potential to become an important input for maximizing yields and profitability in the Mid South states, as well as Texas, Oklahoma and Latin America. Results from several 1994 and 1995 large scale tests in Alabama, Mississippi and Texas should provide USDA-ARS, USDA-APHIS and various cotton producer and state boll weevil eradication organizations with sufficient biological, economical and environmental evidence to broadly use this new technology in all current and up coming campaigns.

Table 1: Aphis BWACT Program in Central Alabama - 1995

County	Number of Fields	Acres	Fields Requiring Treatment before Diapause
Chambers Co.	31	474	1 (14 ac.)
Lee/Macon Co.	49	2390	0 (0 ac.)

Table 2: S.E. Arkansas 1994 Diapuase / 1995
Over-wintered Boll Weevil Evaluations - Trap Counts, Damage Threshold Dates and Yield Data

Trmt.	Avg./ Trap/ wk	Avg Punc. Sqs/14 ft.	Approximate Threshold date on	95 Yield in lbs. of lint	94 Yield in lbs. of lint	93 Yield in lbs. of lint
BWACT 50 ac.	29.1	17.9 (6/26-7/24)	Aug. 10	1036	1130	820
CONV. 60 ac.	93.1	20.3 (6/26-7/24)	July 4	736	925	

Table 3: S.E. Arkansas BWACT Comparison of Spacing and Installation Timing Effects on Square Damage and Yield -1995

Trmt.	Acs	Pltg. Date	Spacing	Installed Dates	Avg. Punc./ 14' 6/19-7/31	Avg. Punc/14' 8/1-9/8	Total Avg. Wkly Punc./14'	Yield per Ac. lbs. of lint
BWACT #4c	40	5/30	1/300'	5/1 & 8/1				
			1/150'	6/1				
			1/75'	7/1	0.7	6.5	3.4	980
#2	45	5/7	1/300'	5/1				
			1/150'	6/1	0.6	7.7	3.7	950
Check	38	5/4	--	--	7.9	28.0	16.3	870

Table 4: Northeast Louisiana Trap Catches and Insecticidal Schedule from BWACT Field - 1995

Date	Treatment	Weevils/Trap/Week
5/01	1st BWACT	
5/15	Planting date	31.5
5/22		52.5
5/29		60
6/05		12
6/12		4
6/19		9
6/24	2nd BWACT	-
6/26	Vydate & Provado for plant bugs	5
7/03		2
7/10		1
7/11	Ammo applic. to control bugs	-
7/17		0
7/24	3rd BWACT application	0
7/31		4
8/07	Scout-X-Tra + Methyl	-
8/23	Scout-X-Tra + Methyl	-
8/29	Curacon + Methyl	-

Table 5: North East Louisiana Trap Counts, Percent Population Reduction, Number of Punctured Squares and % Damaged Squares

DATE	TREATMENT	
	BWACT	CONVENTIONAL
5/22/1995	93	671
5/29/1995	130	190
6/05/1995	458	345
6/13/1995	82	115
6/20/1995	64 (Provado applic.)	52 (Provado applic.)
6/26/1995	11	4(Vydate applic.)
TOTAL	838	1377
Mean /week	139.7	229.5
Mean / trap	83.8	137.7
Mean / trap / week	14	23
% reduction over Conv.	64%	-
7/8/95	-	Vydate applic.
No. damaged squares - 7/14	7	3
% damaged squares - 7/14	1.4	0.6

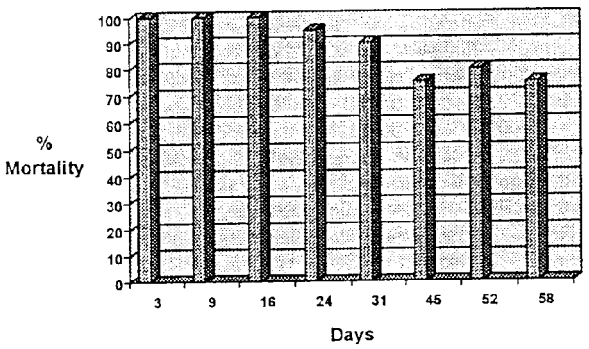
Table 6: MSU Delta Station Boll Weevil Trap Catches and % Damaged Squares - 1995

Date	BWACT Traps	Non BWACT Traps	BWACT Squares	Non BWACT Squares
5/8	14.3	14.3	--	
5/22	10.4	152.1	--	
6/5	4.5	37.7	--	
6/19	3.3	12.9	--	
7/6	1.2	6.3	--	
7/7	--	--	5.5	1
7/17				
7/20	1.3	3.8	--	--
7/26	--	--	1.8	3.5
8/4	1.9	2.4	--	--
8/8	--	--	5.8	15.5
8/17	8.2	4.6	--	--
8/31	62.1	32.3	--	--
Avg./Wk 5/8-7/20	5.8	37.9	4.4	6.7

*Mean boll weevils / trap each 2 weeks

Table 7: Boll Weevil Punctured Square Data and Per Acre Program Cost from BWACT Test in Howard County, Texas - 1995.

Treatment	# Field	# Acres	Avg. % Punctures	Cost/Acre
BWACT + 1 Mal	15	4,029	2.5	$4.74
4 Malathion	36	8,871	1.4	$9.60
BWACT	10	3,520	6.7	$2.34
Check	27	4,556	9.5	$0.00



GRAPH 1: AVERAGE BIOASSAY RESULTS FROM THREE LOTS "WEATHERED" - 6/9 to 8/3