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STATUS OF "BAIT STICK" USE IN BOLL WEEVIL SUPPRESSION AND ERADICATION PROGRAMS IN LATIN AMERICA

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Abstract

The use of the "Bait Stick" technology in boll weevil control, prevention, suppression and eradication continues to make good progress and play an important role in 1.4 million acres of area-wide programs in Argentina, Brazil, Colombia and Paraguay.

The "Bait Stick" (known as the BWACT in the USA, the Tubo Mata Bicudo or TMB in Brazil and the Tubo Mata Picudo or TMP in Spanish speaking Latin America) has been successfully used by Paraguay for 5 years (in crop 2001/2002, about 500,000 ac.) and by Colombia for 2 years (in 2001/2002, about 100,000 ac.) in their National Cotton Reactivation Programs. In state programs of Alagoas, Ceará, Goias, Paraiba, Pernambuco and Rio Grande do Norte in Brazil (currently about 300,000 ac.), the TMB is being deployed as a strategic component to reactivate family farm cotton production. In IPM programs of Brazil, the TMB has been adopted as an effective, economical and environmentally friendly product in the states of Bahia, Mato Grosso, Mato Grosso Sur, Minas Gerias, Parana and Sao Paulo in about 375,000 acres. For 7 years, the country of Argentina (in about 500,000 ac.) has successfully used pheromone traps and TMPs as part of their program to detect, eradicate and prevent the establishment of boll weevils in their major cotton zones. Currently, there is a strong desire on the part of the Argentines to collaborate on similar programs with Brazil in the States of Parana and Sao Paulo (about 150,000 ac.) and with Paraguay in its departments (same as states) of Neembucu, Misiones and Itapua (about 100,000 ac.). The Argentines (SENASA) wants to move the "line of defense" against the boll weevil further away from their cotton growing zones.

The "Bait Stick" or TMB/TMP results from the national and state (area-wide) programs in Argentina, Brazil, Colombia and Paraguay have been very promising. Where used correctly, boll weevil populations have been greatly reduced, seed cotton yields have been increased an average of 350 lbs. per acre and insecticide usage for boll weevil control has been reduced from an average of 7 per crop to less than 1. As a result, the incidence of mammalian poisoning, outbreaks of secondary pests and damage to beneficial insect populations has been drastically reduced. When used according to recommendations, the TMB/TMP programs have eliminated the economic damage from boll weevils at an approximate per acre cost of $8.80 per crop cycle and resulted in an average "cost to benefit" ratio of "$1 to $12".

Results from the aforementioned programs are presented in Figure 1. Index terms: *Anthonomus grandis*, boll weevil eradication, BWACT, Grandlure.

Introduction

During 1990, the USDA-ARS's Boll Weevil Research Lab introduced the "Bait Stick" to the cotton industry (Smith et al., 1991) as an alternative, new approach to the control of cotton boll weevils, an approach that was "preventive" and could result in the reduction of damaging weevil populations and the use of insecticides.

The "Bait Stick" Technology was licensed to Plato Industries Inc. in January 1992; at the same time frame, product development efforts were initiated under a Cooperative Research and Development Agreement with the Boll Weevil Research Lab. Through collaborative work, Experimental Use Periments were obtained and in December 1993, the US EPA granted the "Bait Stick" the first "low risk-low use" insecticide registration in the USA. A key factor in the EPA's decision for granting the registration was the potential use for this technology in the US Boll Weevil Eradication Programs (BWEPs). The "Bait Stick" was introduced commercially in the USA as the Boll Weevil Attract & Control Tube or BWACT, in Brazil as the Tubo Mata Bicudo or TMB and in Spanish speaking Latin America as the Tubo Mata Picudo or TMP. A comprehensive history of the commercial development of the technology, with an extensive bibliography, was presented in the 2001 NCC's Beltwide Cotton Conference (Plato et al., 2001).

The technology created a lot of interest in Latin America, as it offered a new approach for solving a serious economic barrier to profitable cotton production, the boll weevil. In Nicaragua (1993) and Argentina (1994), national programs using the TMPs were implemented against the boll weevil. The Argentines developed a program to prevent the boll weevil from establishing in its main production areas (about 1,875,000 ac.). This program consisted of strategically placed boll weevil

traps for monitoring migrating weevils, TMPs for killing weevils before they reached cotton producing fields and applications of insecticides and TMPs to eliminate outbreaks detected in producing cotton fields. The Nicaraguan program was based on installations of TMPs at planting (1/mz.) and at stalk destruction (1/mz.) on 100% of the acreage; during 1993-1995, the program was very successful in eliminating large populations of weevils (McKibben et al., 1994) and reducing insecticide applications to prevent weevil damage from an average of 18 to less than 2 per crop cycle (Daxl et al.,1995). These programs lead to expanded TMB/TMP use in other countries.

Discussion and Program Results

Many cotton specialists question why the '"Bait Stick" Technology is more widely used in Latin American programs than in the USA BWEPs. The answers may be found in boll weevil behavioural, environmental and operational differences between the USA and Latin America; between the two, there are substantial differences in boll weevil habitats, weevil activity between crops, alternate hosts, farming operations, climates, availability of farm labor, availability of aerial and ground application equipment, flexibility in program operations and availability of financial resources.

According to studies conducted by Gutierrez (personal communication, 2000), "pheromone based technologies for boll weevil suppression would appear to be extremely promising for large areas of South America. At current prices, it would appear to be less expensive and it would reduce if not eliminate the negative human and environmental health effects, and hence be more sustainable" than conventional insecticide programs. In his studies, he forecasted that 30% of a boll weevil population (within 200 yards of a TMB/TMP) are attracted and removed from the environment each day. Thus, with an effective, "killing life" of 6 to 7 weeks, each TMB/TMP has the potential to eliminate an "existing 30,000 per acre weevil population" during 4 weeks and still have activity for another 3 weeks, to "take-out" migrating weevils that move into a TMB/TMP zone. This appears to be one of the keys for the success of the Latin American programs involving TMB/TMP installations at planting and at stalk destruction.

The recommended use of the BWACT/TMB/TMP in IPM and in area wide control, suppression, eradication and prevention programs, based on several years of field experience and results from Argentina, Bolivia, Brazil, Colombia, Nicaragua, Paraguay and the USA, are outlined in the following; each country program has certain variations, but PIL's general use recommendations are:

- During the end of a crop cycle, at the beginning of weevil dispersal (when weekly trap counts jump to 4+ per trap), BWACTs are installed at one per 200 feet on all sides of the field perimeters to attract and kill emerging/migrating weevils that occur between sprays; they should be replaced, if necessary, each 45 to 50 days. This program should continue through stalk destruction, with BWACTs remaining around the field until 3 weeks after stalk destruction to attract and kill any weevils emerging from the residual squares and bolls of the crop.
- After stalk destruction on large farms, with "well defined" weevil refugios, a few traps should be installed adjacent to the refugios and if weevil captures occur, a barrier line of BWACTs (one per 200 feet) should be installed along side of, or around, any adjacent refugios capturing weevils. The barrier program should continue so long as there are captures in the traps.
- After stalk destruction on the small, family farm fields (normally 2 to 5 ac.), 1 to 2 traps should be installed on "down wind" field borders and if weevil captures occur, a barrier line of BWACTs (one per 200 feet) should be installed along side of, or around, any fields capturing weevils. The barrier program should continue with replacements each 45 days, so long as there are captures in the traps.
- At planting of the next crop, BWACTs should be installed (on the "up-wind sides" and adjacent refugee sides) as soon as fields are planted (one per 200 feet and 30 days later, one in between the first installations, at the 100 feet positions), around all fields that were treated at the end of the last crop and/or around all fields that were in cotton, treated but are rotated out of cotton for this crop cycle.
- In the planted fields, three weeks before the "pin-head square" stage, an adequate number of traps should be installed to determine if 1, 2, 3 or if any, "pin-head" sprays would be required. Subsequent to this, no further weevil insecticide applications (unless punctured square data "trigger" an application) or BWACT installations should be made until weevil dispersal occurs at the end of the crop.

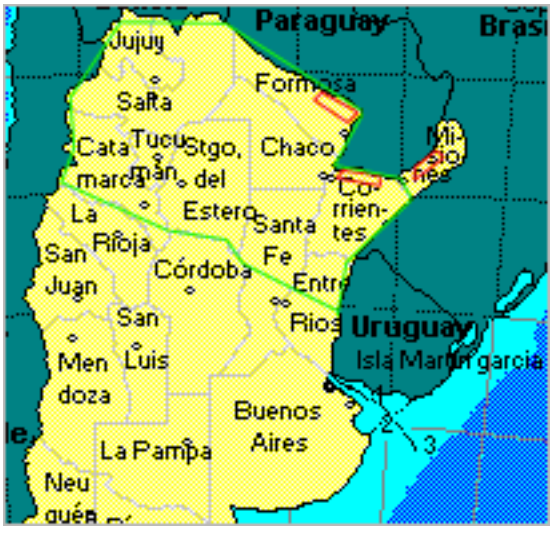
These general recommendations are applicable for a BWEP, an area-wide "Suppression Program" or for an IPM program. In the Colombian and Paraguayan Programs (when used according to recommendations), the TMPs have been instrumental in reducing boll weevil populations to very low levels and this has permitted the crop to be produced without economic damage from weevils. This was accomplished by installations of TMPs in all fields of infested zones at planting, at stalk destruction and in some situations, installations alongside of "well defined" refugios.

Argentina

Cotton production, the textile industry and the country in general have experienced severe climatic and economic problems during the last three years; cotton plantings have decreased from 2,500,000 acres to less than 500,000 and this has made it very difficult for the responsible federal and provincial agricultural authorities to maintain the country free of boll weevils.

The SENASA Boll Weevil Prevention and Eradication Program is based upon strategically placed boll weevil traps for monitoring migrating weevils, TMPs for killing weevils before they reach cotton producing fields and applications of insecticides and TMPs to eliminate outbreaks detected in producing cotton fields. The success of the National Program is measured by weevil captures from about 20,000 boll weevil traps that are placed in the 12 cotton producing provinces and by the elimination of infestations that periodically occur in about 200 acres of cotton in the province of Formosa, adjacent to Paraguay. With the exception of one boll weevil captured in December 1998 in the northwest province of Salta, adjacent to Bolivia, all captures have been in the northeast provinces of Formosa, Corrientes and Misiones.

While migrations have been successfully halted with traps and TMPs and infestations eliminated with insecticide applications and TMP installations for 7 years, SENASA is working to move the "line of defense" against the weevils farther north of its 12 cotton producing provinces into the bordering departments (states) of Paraguay (Neembucu, Misiones and Itapua, about 100,000 ac.) and Brazil (Parana and Sao Paulo, about 150,000 ac.).



The apparent intent is to broaden an existing bi-national agreement (between Argentina and Paraguay) into a tri-national agreement that includes Brazil and to implement the SENASA "boll weevil" prevention and eradication program in the aforementioned zones.

Brazil

Even with the depressed conditions of the cotton industry, in the 2001/2002 crop of Brazil, there are six programs to reactivate cotton in the states of Alagoas, Ceará, Goias, Paraíba, Pernambuco and Rio Grande Do Norte; the programs in each state are similar. However, the Ceará program is the most advanced, clearly defined and appropriately financed; their goal is to eliminate economic damage from weevils and to increase cotton production from 100,000 acres in 2001 to 500,000 in 2005. Cotton production in most of this part of Brazil is typically small grower, 2 to 5 acres per farm, low tech and low inputs. The boll weevil has been widely established in these areas of Brazil for about 15 years; it was the main reason for cotton acreage in the Northeast to decrease from 7.5 million acres of mostly "perennial" cotton to less than 125,000 acres in 1999.

There is a consensus among the leading cotton specialists that the only practical, economical and environmentally acceptable solution for the boll weevil problem is the area-wide destruction of cotton stalks and installations of TMBs (1 per ha.) at the end of the crop cycle and TMB installations (1 per ha.) at planting. Most all programs met with delays in 2001 due to dry weather but they are scheduled to re-start in 2002 on about 70,000 family farms.

EMBRAPA's National Cotton Research Center (CNPA) is continuing its replicated field tests with the TMB in the state of Paraíba; the tests are designed to answer the questions on "how to best use the TMB in the Northeast of Brazil?" The tests are well designed and should provide good statistical information in support to the various state programs. Results of these tests will be reported at the next National Brazilian Cotton Congress in August 2002.

Colombia

In May 2000, Colombia launched, as part of its National Cotton Reactivation Program, a National Plan for the Control of the Cotton Boll Weevil. Colombia continues to have many internal security problems and this deters advancement of the cotton program. Additionally, as with most other countries, there is a significant segment of the plant protection industry opposed to changing boll weevil control methodologies.

The Program is mandatory by law for anyone growing cotton and tied to crop financing. The objective is to increase cotton production from about 100,000 acres to 500,000 during the next 3 to 4 crop cycles. The Reactivation Program contemplates that the National Plan will solve the boll weevil problem by implementing a program of boll weevil traps for monitoring, 2 TMPs per hectare (at stalk destruction and at planting), 100% stalk destruction and concentrated crop plantings in each production zone. However, it appears that until Colombia sorts out its internal problems, progress will be painfully slow.

Paraguay

In 1997, a 5-year National Plan to Reactivate Cotton was launched; it was based on a "pilot project" that had been conducted in a production zone of about 100,000 acres for 2 years. The National Plan was designed to eliminate economic damage from the boll weevil (by using TMPs at planting and at stalk destruction), improve soils through crop rotation and fertilizers, improve seed quality, control insecticide quality, provide crop financing, provide technical services and expand R&D activities for crop production. This program is strategically important to Paraguay, as cotton is their number one "cash" crop for about 120,000 small, family farms, each averaging 2 to 5 acres of cotton. The "scheme of cotton production" employs and involves about 1.5 million people, a third of the country's population.

The National Program has been audited by USA, Brazilian and Colombian delegations with a focus on the boll weevil aspects; their reports (Internal Reports to MAG, Paraguay, 2000) were positive and supportive for program continuation.

The performance of the TMPs has been measured primarily through a "trapping" program of up to 1200 traps in the major production zones; this type of trap and other data as illustrated are similar to the approach used by the US BWEPs to measure program success. The zones and boll weevil captures are illustrated in the following:

In Figure 2, key data from 3 years of TMP installations are presented as a comparison of trap captures to a 3-year average, prior to TMP installations and a comparison of the average number of insecticide applications required to produce each crop during the last 5 years.

It should be mentioned that the National Program for Boll Weevil Control was not implemented at stalk destruction in May/June 2000 and this resulted in larger weevil captures in June-October 2000 and an increased use of weevil insecticides in the 2000/2001 crop. The data clearly illustrate the need for 100% compliance and for TMP installations at planting and at stalk destruction. Otherwise, within 2 to 3 crop cycles:

- The boll weevil will be causing severe economic damage.
- Beneficial insect populations will be decimated by 6 to 8 applications of toxic insecticides (for weevils), applied through knapsack sprayers by "campesino" producers who have only very little knowledge about the correct use of such products.
- Yields will be dropping.
- Cotton will be unprofitable (for various reasons, including increased costs due to the weevil).
- The planted area will probably be reduced, from a 2000/2001 crop of 750,000 acres to less than 250,000.
- The lack of cotton production will create more serious social problems, as have occurred in other countries of Central and South America.

It would seem that with the success of the Paraguayan Program and other programs as described in the foregoing, there would be a greater consensus on the use of the "Attract and Control " technologies in IPM and area wide programs. But "real world" being "real world", the elimination of 6 applications of insecticides in 750,000 acres represents a loss of about $30,000,000 in insecticide sales and there are a lot of commercial interests to stop the use of the TMPs, regain the insecticide sales in Paraguay and stop the other Latin American programs from deploying the TMBs/TMPs.

Conclusion

Since its beginning in Nicaragua in 1993, the use of the "Bait Stick" technology in boll weevil control, prevention, suppression and eradication has continued to make good progress and play an important role in 1.4 million acres of area-wide programs in Argentina, Brazil, Colombia and Paraguay. The development and use history of the TMB/TMP in IPM and area wide programs clearly illustrates that the product and its related technology of "attraction and control" provide an alternative

to conventional spray programs (wash day, weekly or bi-weekly) and Integrated Pesticide Management programs. The TMB/TMP has been demonstrated during several years, in a multitude of tests, to be an ideal "tool" (product) for integration into true IPM (Integrated Pest Management) programs.

In Latin America, the availability of labor for TMB/TMP installations, the year round boll weevil activity and the 42 + days of weevil "attraction and control" by the TMBs/TMPs makes the technology very suitable for use in IPM and area-wide programs. Whereas, BWACT use in USA programs has been limited for many different reasons, but primarily due to labor for installations and the "operational design" of programs (with limited labor).

Historical and current data illustrate that to have successful cotton reactivation program in a weevil infested region, the weevil has to be "taken out" of the production scheme. In Latin America, forced concentrated plantings and TMB/TMP installations at planting and during a "complete" stalk destruction have been the most economical, effective and environmentally friendly tactics to employ for "taking the weevil" out of the production scheme. Where used according to recommendations, the TMB/TMP programs have eliminated the economic damage from boll weevils at an approximate per acre cost of $8.80 per crop cycle and resulted in an average cost benefit ratio of 1:12.

In boll weevil infested regions and countries where the technology is not used, it is primarily due to political, competitive and/or operational factors, not technical and economical.

Literature Cited

Smith, J.W., E.J. Villavaso, G.H. McKibben and W.L. McGovern. 1991. Results of Boll Weevil Bait Stick Tests in Tennessee. Proc 38th Annual Louisiana Insect Control Conference.

Plato, T.A., J.C. Plato, J.S. Plato and S.E. Plato. 2001. Results of the BWACT in Boll Weevil Control, Prevention, Suppression and Eradication Programs in the Americas. Proc. Beltwide Proc. Res. Conference, National Cotton Council, Memphis, TN.

Gutierrez, A.P. 2000. Center for Ecosystems Analysis, Kensington, CA. Personal communication to Plato Industries Inc. Regarding Analysis of the Use Of Grandlure as an Alternative to Pesticide Use in Cotton Production in Brazil.

McKibben, G.H., R.G. Daxl, and J.W. Smith. 1994. Boll Weevil Bait Stick Use in Nicaragua In 1993. Proc. Beltwide Prod. Res. Conference. National Cotton Council, Memphis, TN.

Daxl, R., et. al., 1995. Performance of the Boll Weevil Attract and Control Tube (BWACT) in a 3 year area wide Nicaraguan Boll Weevil Control Program. Proc. Beltwide Prod. Res. Conference, National Cotton Council, Memphis, TN.

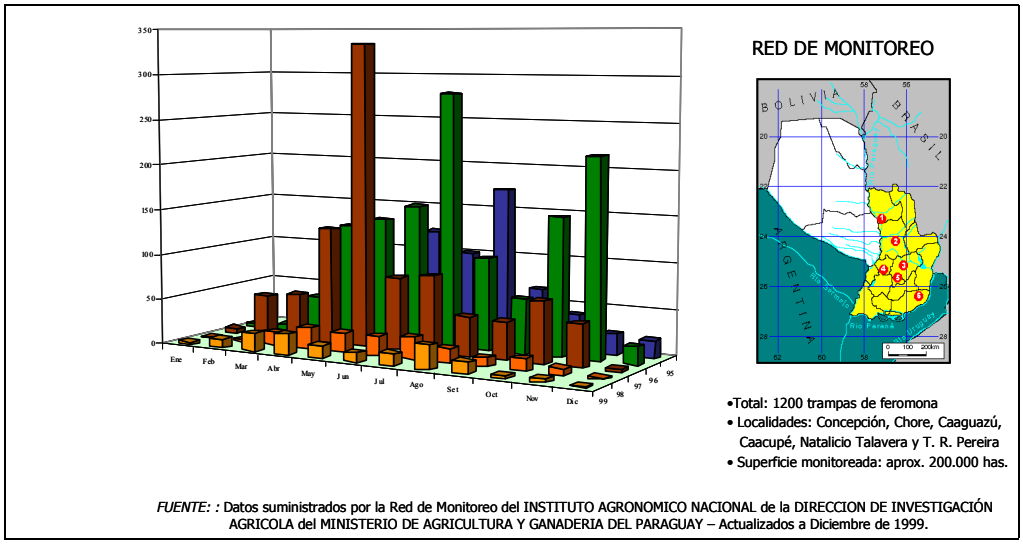
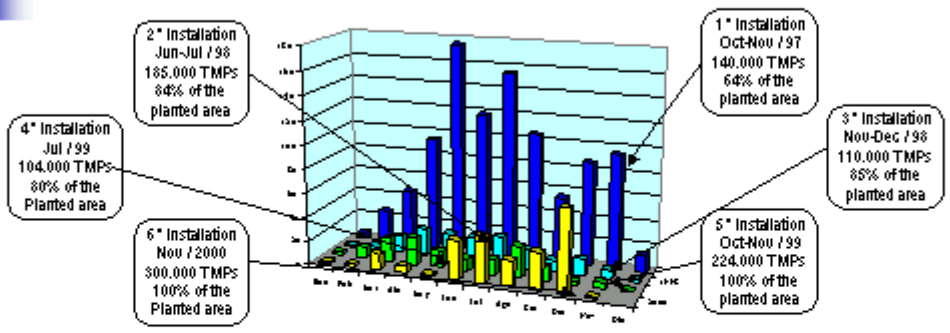


Figure 1.

Key Data from 3 ½ Years of TMP Use in the National Cotton Program of Paraguay for the Prevention of Economic Boll Weevil Damage



Monthly Average Trap Captures	Ene	Feb	Mar	Abr	May	Jun	Jul	Ago	Set	Oct	Nov	Dic
2000	1,48	2,6	13,3	5,9	2,2	33,1	39,6	21,7	30,9	69,6	1,2	
1999	2,8	9,7	19,6	22,5	14,4	10,5	12,9	28,6	12,6	2,8	4,2	1,1
1998	1,6	2,9	14,4	20,3	21,3	21	34	16,4	9,9	13,5	6,9	1,6
Prom. 1998/99/00	4,5	22,05	46,95	94,11	123,98	118,1	154,53	115,68	55,21	86,21	95,21	14,08

Number of Insecticide Applications for Boll Weevil Control					
Before the Use of the TMP		**After the Use of the TMP**			
1995/96 Crop: 6 Applications	1996/97 Crop: 8 Applications	1997/98 Crop: 3 Applications	1998/99 Crop: 0,8 Applications	1999/00 Crop: 0,1 Applications	2000/01 Crop: 1-2 Applications

Source: Data provided by the Instituto Agronómico Nacional, Dirección de Estadística y Censos and Dirección de Extensión Agraria of the Ministerio de Agricultura y Ganadería of Paraguay – December 2000.

Figure 2.