BWACT PRODUCT IMPROVEMENTS AND QC/QA IMPLEMENTATION IN 1998 FOR EXPANDED UTILIZATION IN COMMERCIAL AND US BOLL WEEVIL ERADICATION PROGRAMS

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Abstract

The use of pheromonal based products, Boll Weevil Traps and BWACTs (Bait Sticks, TMPs or TMBs) is expanding in the USA and Latin America. This paper reports on procedures that have been identified and are being implemented to ensure high quality BWACTs and pheromone dispensers for use in boll weevil eradication and IPM Programs. Field studies reported in the 1998 Beltwide Cotton Conference created an awareness for alternative test methods to determine residual activity and pheromone liberation. The paper reports on work that is underway to develop alternative methods to aid in quality control and quality assurance, and to provide alternative, improved delivery systems. As a company, Plato Industries is dedicated to providing high quality, consistent products to its end users.

Introduction

The use of pheromonal based products in conventional IPM programs for cotton insect control and in area wide boll weevil eradication programs is expanding in the USA and Latin America (Plato and Plato 1998). This expansion has created an increased awareness for consistency of high quality products to be used in "kill stations" and traps, specifically the insecticidal coating on the Boll Weevil Attract and Control Tube (BWACT or "bait stick") and the Grandlure pheromone dispensers. In the USA, the "bait stick" is trade marked as BWACT, whereas in Latin America, as the Tubo Mata Picudo (TMP) and Tubo Mata Bicudo (TMB); boll weevil traps and dispensers of pheromones and insecticides as marketed by their respective generic names.

This paper discusses the activities which Plato Industries Inc. (PII) and certain of its collaborators conducted in 1998 to improve the "quality control" and "quality assurance" aspects of the BWACT insecticidal and pheromonal componenets. As with any new technology, there is a "learning curve" which must be experienced to ensure the correct manufacture and proper utilization of a new product. The BWACT is no exception; it has evolved from a coated, wooden "bait stick" with a "pheromone "cap", both produced by a handmade process, to a "semi-mechanized" produced, biodegradable "kill tube" with a 3 X 3 inch perhomone dispenser that is inserted into the top of the BWACT.

The formula of the "insecticidal coating" consists of specific ingredients that if altered in content or composition, create a serious reduction in insecticide (malathion) liberation for dermal toxicity to boll weevils. The BWACT formula was developed and patented by the USDA Boll Weevil Research Laboratory (BWRL) in Mississippi State, Mississippi in 1991/92; whereas, the BWACT pheromone dispenser was developed under a Cooperative Research and Development Agreement with the BWRL in 1992/93. In 1993/94 PII and the BWRL agreed to and published for interested collaborators a bioassay protocol as the "standard" for use in determining the residual field life of the "kill tube". The Grandlure dispenser liberation rate and residual life of the dispenser have been and are currently determined by a GC analytical method of the BWRL.

The attraction power of grandlure pheromone is reasonably well documented and is an area of lesser concern to interested end users. The aforementioned "standard" for determing residual life or insecticidal activity of the BWACT was established to facilitate efficacy determinations for product registration in Latin American and provide US researchers with a method for "in-house" determinations. The scentific community seemed to have been reasonably satisfied with using the "bioassay approach" of the standard until a report at the 1998 Beltwide Cotton Conference of minimal boll weevil control with BWACTs in the Rio Grande and Brazos Valleys (Spurgeon et. al. 1998). An investigation of the manufacturing dates of the BWACTs used in this test illustrated that the product had nearly expired and the expiration factor helped to explain the "control failure". However, the report did create considerable controversy and this resulted in improved controls for "in field" inventory and the development of a "chemical wash" method to deternime analytically the amount of available malathion on a "tube" surface for boll weevil control. The "chemical wash" test method is being run parallel to bioassays by PII with the intent to establish an alternate, more accurate method than the bioassay to determine residual field life or predicted percent control from weathered BWACTs.

Plato Industries is dedicated to providing high quality products and has communicated to interested collaborators and boll weevil eradication foundations the Quality Control/Quality Assurance (QC/QA) Procedures which are employed in its BWACT and pheromone manufacturing processes. These procedures are described hereinafter.

Discussion

After four years of broad scale use of the BWACT in the USA and in Latin America, PII and its collaborators have identified several aspects about the BWACT system in

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which product improvements would be justifiable. Behavioral studies in 1998 by D. A. Wolfenbarger (Plato et. al. 1999) exhibited 3 to 4 weeks residual control of weevils; whereas, properly conducted bioassays at various locations in the USA and Latin America (Plato and Plato 1998) demonstrated 6 to 8 weeks of residual activity. As of today, there is no good explanation for the difference; studies will be conducted in 1999 to reconcile the differences. Observations by PII and others indicate that it would be better if the liberation of the Grandlure pheromone from the BWACT dispenser were to occur more evenly; currently, studies are underway by PII with different delivery systems designed for a more even liberation. The QC/QA procedures reported herein for raw materials, storage of raw materials, product "in process", finished product, packaging and finished product storage are designed to ensure that PII "end use" BWACTs and pheromone dispensers are of high quality, within label specifications and have a shelf life of 18 months and 48 months, respectively. Evaluations with improved delivery systems are in place, or on the drawing boards; these should contribute to continued expansion of product usage and improved implementation of the technology.

BWACT QA/QC

The ingredients of the BWACT coating are alcohol, a binding material, dye, thickener, cottonseed oil and malathion insecticide. With the exception of cottonseed oil, all are according to very clear specifications and are in the original packaging of the respective manufacturer. Crude cottonseed oil is purchased in bulk at oil mills and transported by PII to its Houston Plant.

The BWACTs are "batch" produced, based upon contracts for supply; at the end of each "use season", PII works with its customers to ensure that products "in inventory" are in specification and applicable for the next use season. The "batch" process is operated on a weekly basis and it consists of the following steps:

- Ingredients are weighed and thoroughly mixed for a defined time period.
- The mixture is pumped to a storage tank.
- Mixture is constantly agitated while in storage and pumped as needed to a dipping tank.
- At the end of a week, the mixture is returned to the storage tank.
- At the end of a production run, the mixture is stored in sealed drums until the next run.

The insecticidal coating of the BWACTs is accomplished by submerging a basket holding several hundred tubes into the above mentioned ingredients. The steps to ensure the correct amount of insecticidal "coating" are:

- Tubes are waterproofed and coated.
- Five tubes are selected daily at random for average dry weight.
- During the coating process, tubes are checked for correct weight.
- The entire basket is re-dipped if weights are not correct.

Finished product packaging is a semi-automated process; the packaging materials currently being employed are a plastic wrap that is manipulated to hold a bundle of five tubes. Twelve bundles of five tubes each are placed in a plastic bag that is sealed and placed in a shipping carton containing the respective amount of tube anchors, pheromones, gloves and installation instruction. The shipping cartons are labeled with the lot number and expiration date.

The numbering system that PII uses for each lot is composed of the pallet number, the box number on the pallet and the Julian day and year. BWACTs are packaged within two days from being coated.

The expiration date as placed on each carton is 18 months from the production date; this date nearly always will provide the flexibility for product use during two consecutive crop seasons. However, as an operating rule, PII only supplies recently manufactured BWACTs.

PII maintains an archive of samples from each production batch; typically, one BWACT batch is selected at random. This is combined with four other BWACTs, placed in a bundle, labeled and dated. The samples are held for two years under ambient/warehouse conditions at the PII plant in Houston, Texas.

After BWACTs are packaged in the cartons, 27 cartons are stacked on a custom pallet; the pallet holding the 27 cartons is then wrapped with a plastic stretch film. Subsequently, a corrugated protector is placed around the pallet and wrapped again with stretch film. Each pallet is then labeled with lot numbers of its cartons.

Insecticidal activity of the tube coating is currently confirmed through two different test procedures, the bioassay standard and a chemical wash analysis; both were developed by the USDA Boll Weevil Research Laboratory (BWRL), Mississippi State, MS. During each production batch, tubes are selected at random for the archives and for activity tests. Tubes are sent to the BWRL for the bioassay standard test and to a third party analytical laboratory for the chemical wash analysis.

Pheromone Dispenser QC/QA

The QC/QA for pheromone dispensers as they relate to raw material procurement, storage, product "in process", finished product packaging and finished product storage are described hereinafter.

The Grandlure technical grade as defined by the USDA BWRL is obtained from the only US commercial manufacturer in its original, unopened containers; it is a minimum 95% puity. The other components of the pheromone dispensers, resins, plastisols and foil paper are obtained from the original manufacturers, with standard specifications and in the original packaging.

The resins and plastisols are weighed, mixed and pumped into holding drums; weight per drum is adjusted in accordance with the purity of the Grandlure technical. The Grandlure is added and mixed thoroughly with the plastic components; the holding drums containing the components are sealed and held ready for manufacturing purposes.

The PII pheromone dispensers are made through an extrusion process, calibrated for the correct thickness and cut to the correct size. Thickness is checked periodically and samples are continuously collected during each production run. Dispensers are counted, stacked and packaged for storage under refrigerated conditions.

The samples collected during the manufacturing are for archive and analytical purposes; these are labeled, dated and sealed. Samples, as well as finished product, are maintained at four degrees C; random samples are sent to the USDA BWRL and a third party lab for a GC analysis. The GC protocol is that of the USDA BWRL. Archive samples are maintained for four years.

Finished product is packaged in a metallized polyester bag with a polyethylene inner liner. The bags are heat sealed and labeled with the respective lot number and expiration date as described for the BWACTs. The expiration date is four years from the date of manufacture.

Results

For various different reasons, the comparative results between the BWACT chemical wash and the bioassay standard test were insufficient to draw conclusions in time for the 1999 Beltwide Conference. Data is still being collected from the USDA BWRL and the third party analytical chemical laboratory; the results will be available for distribution after March 1999. Preliminary data indicate that the chemical wash analysis is a more objective test method than the bioassay standard for evaluating the residual field life efficacy of the BWACT. Results from the improved pheromone delivery systems will be available in mid 1999.

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