2004 BELTWIDE COTTON CONFERENCES, SAN ANTONIO, TX – JANUARY 5-9

POTENTIAL FOR NEW PHEROMONE MATING-DISRUPTION FORMULATIONS FOR PINK BOLLWORM

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Abstract

Four experimental formulations of synthetic gossyplure were tested in the fields in Southern California, Central Arizona and West Texas. Results indicate that these formulations suppress trap capture, an indicator of mating activity, of sterile and native pink bollworm for as long as 47 days. Longevity of the pheromone varied widely among the tests based on location, time of year, and rate of application. Results were promising enough that further testing of these formulations is planned for early season tests in 2004.

Introduction

Synthetic gossyplure in controlled release formulations can be used to effectively and economically manage populations of the pink bollworm (PBW) , *Pectinophora gossypiella*, (Saunders), in cotton (Staten et al. 1989). The most widely used commercial formulation in the US today requires hand application (PB-ROPE L). This formulation is effective and economical but the need for hand application is a disadvantage due to the limited availability of manual labor. Sprayable gossyplure formulations are commercially available but these materials also have critical limitations, including the need for specialized or modified application equipment, or short field longevity requiring frequent reapplication (Staten et al. 1987, Gaston et al. 1977, Brooks et al. 1979, Doane and Brooks 1981). There is a need for an effective , economical gossyplure formulation that can be applied easily and quickly with standard, unmodified application equipment. The purpose of these tests was to evaluate several experimental formulations of encapsulated gossyplure for effectiveness in trap suppression and longevity (persistence) in the field.

Materials and Methods

All PBC and 3M materials were diluted with water, no stickers necessary. Suterra Checkmate XL was mixed with the sticker Cohere at the recommended rate of 1 pt/100 gallons. Containers were rinsed several times with dilution water to insure efficient, complete transfer of each formulation to the spray tank. Test methods are summarized in Table 1.

Sterile insect technology (SIT) was used as needed to aid in the detection of pheromone breakdown. Moths were released the day of shipment according to protocol outlined by USDA-APHIS in Phoenix, AZ. Each plot was trapped with 3 - 5 delta traps. A standard septum lure was used and replaced every 14 days or as needed. Traps were monitored regularly (at least weekly), as warranted. Data was recorded and reported. A treatment was considered ineffective or "broken" when an average of 1 moth/trap/night was caught.

Bt cotton fields were used to ensure no crop damage in case of product failure. Fields of 40 to 80 acres were used and were located at least ½ mile from closest non Bt cotton tied with pheromone [PB Rope® L). Treatment plots were either ½ or 1 acre, spaced evenly in each field with at least 200 rows (38" centers) in each field, each field was considered one replication.

For the two Suterra Checkmate XL tests (Imperial Valley, CA and El Paso, TX) the treatments were: 1) an industry recommended rate, 2) a rate below the recommended rate, 3) a rate above the recommended rate and 4) an untreated check. In the Imperial Valley, pheromone was applied on May 19-23, at 3 rates (6, 9 and 12 g AI/acre) plus a control, on plots in four cotton fields (replications), each with 4 standard PBW Delta traps with standard lures. In El Paso, Texas, 3 cotton fields (replications) were treated on June 18, each with 5 standard PBW Delta traps with standard lures. The product was applied at the rate of ½ gallon/acre, at the stated rates, mixed with water, with modified Herbi backpack sprayers.

For the Buckeye, AZ, there were 3 replications, each replication an 80 acre field, 4 treatment plots of one half acre each, per rep. Four standard delta traps were placed in each plot, rubber septa changed every 2 weeks, traps checked 1 - 3 times/week, traps replaced as needed. Each plot was treated (except check) with 2.5 liters/acre of material. All plots in a replicate were treated on the same day. Surface winds had to be <= 6 mph in order to treat. A 5-row, hand-carried spray boom was used. Data (native adult counts per trap per day) were recorded. Pretreatment native moth counts were judged sufficient and SIT was not required.

Results and Discussion

The general linear procedure and Tukey's Studentized Range (HSD) Test, SAS Corporation®, was used to test for significance of differences in longevity of each treatment. The results for the Imperial Valley test (F value for treatment 47.43, P <0.0001) indicate that the 12 gram treatment of Suterra Checkmate XL lasted significantly longer than the 9 or 6 gram, which could not be separated statistically, and that all treatments significantly outlasted the untreated control plots (Table 2). Figure 1 shows PBW trap counts over the course of the test in one of the replicates.

The results for the El Paso test (F value for treatment 10.87, P <0.0001) are similar to Imperial Valley except the rates for the Suterra Checkmate XL do not separate as distinctly. At El Paso, the rankings are the same but the 12 gram and 9 gram could not be separated, nor did the 6 gram separate from the control (Table 3). The El Paso test had fewer replications and more missing data due to lack of entry to fields. These factors may account for the discrepancies. In any case, together the tests indicate good PBW trap suppression and longevity of the formulation, especially at the 12 gram AI/acre rate.

The results for the Buckeye test (F value for treatments 33.21, P <.0001) indicate that PBC2, 3M Exp and PBC1 were similar in longevity and effectiveness to each other and were significantly different from the untreated control plots (Table 4). This test ran very late in the season, had a heavy rainfall immediately following application and did not require SIT due to a substantial native PBW population. Unfortunately, the native PBW population was not uniform and added variability to the analysis. Nonetheless, these formulations are promising and indicate good, persistent PBW trap suppression. Figure 2 shows native PBW trap counts over the course of the test.

Conclusions

The authors are very encouraged by the final results of the test and are forming plans to test a selection of the most promising materials in 2004 in order to find and "calibrate" new, persistent sprayable pheromones for use in wide-area applications. Results indicate a possible breakthrough in sprayable pheromone longevity and a departure from previous formulations. The 2003 tests provided insights for improved methods for subsequent tests. Trap suppression is a one good index of mating disruption, further measures of mating disruption are planned, including placement and subsequent dissection of virgin female PBW placed in the field overnight, and larval data. Plans also include larger scale, whole-field tests.

Acknowledgements

Our sincerest gratitude to Art Heiden, Kenneth Rogers, Kevin Rogers, Larry Antilla and the ACRPC, Nick Colletto, Jose Luis Encalada, Henry Stewart, Manny Saballos, Ray Pierce, TAMU Extension Service, Pacific BioControl, 3M Canada, and Suterra Corporation.

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Table 1. Summary of Test Methods.

Location	SIT	Material 1	Material 2	Material 3	Check	Application Date
Imperial, CA	Yes	Suterra at 6 g	Suterra at 9 g	Suterra at 12 g	Yes	May 20-23, 2003
El Paso, TX	Yes	Suterra at 6 g	Suterra at 9 g	Suterra at 12 g	Yes	June 19, 2003
Buckeye, AZ	No	PBC1 at 10 g	PBC2 at 10 g	3M at 10 g	Yes	July 28-29, 2003

Table 2. Mean nights to threshold for 3 rates of Suterra Checkmate XL in the Imperial Valley, CA, 2003.

Treatment in grams AI /acre	N	Mean Nights to Threshold
12	16	47.063[a]
9	16	35.875[b]
6	16	32.813[b]
Check	16	2.375[c]

[a] Means are significantly different if not followed by the same letter (Tukey's Studentized Range (HSD) test).

Table 3. Mean nights to threshold for 3 rates of Suterra Checkmate XL in El Paso, TX, 2003.

Treatment in grams AI /acre	N	Mean Nights to Threshold
12	12	21.83[a]
9	12	18.83[ab]
6	12	9.25[bc]
Check	12	3.00[c]

[a] Means are significantly different if not followed by the same letter (Tukey's Studentized Range (HSD) test).

Table 4. Mean nights to threshold for two formulation of PBC and 3m Exp, Buckeye, AZ, 2003.

Treatment, at 10 grams AI /acre	N	Mean Nights to Threshold
PBC2	12	26.92[a]
3M Exp	12	25.97[a]
PBC1	12	23.75[a]
Check	12	7.00[b]

[a] Means are significantly different if not followed by the same letter (Tukey's Studentized Range (HSD) test).

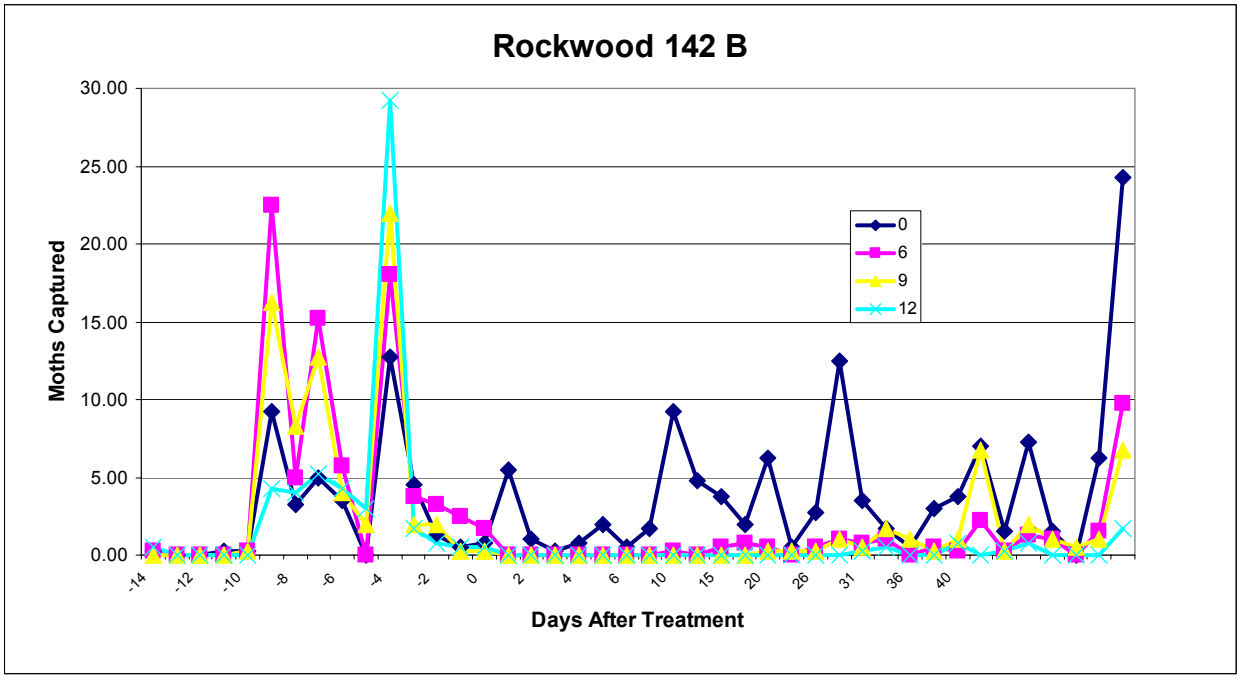

Figure 1. Mean trap catches by treatment, Rockwood field, Imperial Valley, CA, 2003.

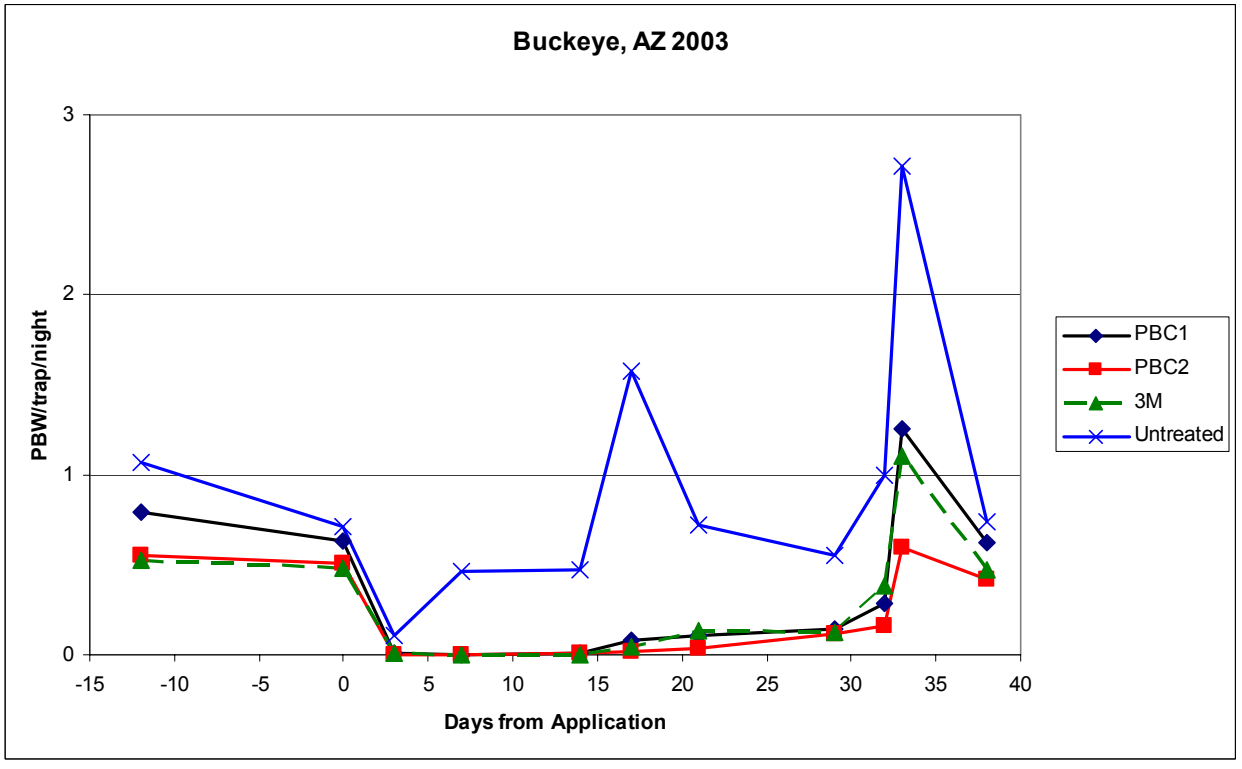

Figure 2. Mean trap catches by treatment, Buckeye, AZ, 2003.