EVALUATION OF SPRAYABLE MATING DISRUPTION FOR PINK BOLLWORM IN NON-BT COTTON

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Abstract

The Pink Bollworm Eradication Program relies on highly effective but labor intensive, early season application of pheromone formulation for mating disruption and occasional late season aerial applications. The eradication program needs a sprayable formulation that lasts at least 30 days to augment use of the much longer lasting Rope formulation. Trials were conducted in cotton fields where the standard Rope was compared to three other formulations and application methods. All formulations tested lasted greater than 30 days early season; only the acrylic GEL formulation was proven to provide at least 30 day protection early, mid and late season.

Introduction

The pink bollworm (PBW), *Pectinophora gossypiella* (Saunders), a native species of India, was introduced to the U.S. in 1917 by infested seeds shipped from Mexico. Despite successful eradication of this initial infestation, the pest persisted along the Mexican border allowing reinfestation and spread to several states in the country (Noble, 1969). Since the early 1960s, the Arizona cotton industry has suffered significant economic loss from PBW due to lowered yields and lint quality and the expense for control. High cost, insecticide resistant pests and environmental problems are associated with insecticides (Henneberry, 1998). In addition, insecticides have limited effect on PBW since they often hatch under the calyx on the cotton boll and immediately enter the boll, thereby avoiding exposure to the chemical (Noble, 1969).

In order to find more effective means of control and to avoid the problems of insecticides, other less invasive procedures have been developed. One such technique is mating disruption using pheromones. This involves applying excess amounts of, or high density of emitting point sources, of a synthetic of the female PBW pheromone to the cotton plants. Observations indicate that the application of synthetic pheromone causes males to visit these point sources instead of visiting the females. In addition, the high doses of pheromone in these point sources may overwhelm the males' senses causing habituation of the peripheral sensory system, or adaptation of the central nervous system, rendering the male PBW unable to locate a female, mate and reproduce. The standard Rope technique used to apply PBW pheromones on cotton fields is very effective and is the current standard in the PBW Eradication Program. It is also labor intensive and application is generally limited to early season, before the canopy has closed. The currently available and more easily applied sprayable pheromone applications, using microencapsulated formulations or fibers, last 7-10 days. A sprayable formula with a longer lifetime, proven weatherability and an ability to be applied by various standard techniques (tractor, airplane) would give the Program added flexibility. In addition the sprayable must be economical, harmless to the crop (not phytotoxic) and easy to handle and clean up. In order to investigate this, GEL supplied by Pacific Biocontrol Corporation, SPLAT PBW™

(Specialized Pheromone & Lure Application Technology for pink bollworm) made by ISCA Technologies applied with conventional equipment both aerially by plane and on the ground by tractor were tested against check fields and the standard PB-ROPE L, also provided by Pacific Biocontrol Corp.

Materials & Methods

The trials were conducted in non-Bt cotton fields in Wellton, Arizona (Yuma County). This area was selected because it was not yet included in the eradication program that covers the rest of the state. The county is expected to be a part of the eradication program in 2008. All fields were irrigated and ranged from 30 – 40 acres. Four replications were used: each with five fields that were treated with either PB-ROPE L, GEL, ground-applied SPLAT PBW (SPLAT G), aerially-applied SPLAT PBW (SPLAT A) or no treatment (check). The Rope was applied by tractor at the standard rate of 200/acre. GEL was applied by a specialized tractor at 10 gram AI/acre, with 250 point sources/acre. SPLAT G was applied by commercial tractor at 20 gram AI/acre in 1kg of formulation, resulting in 1g droplets. SPLAT A was applied by commercial airplane at 10 grams AI/acre in 300 grams of formulation, droplet size 0.5-4.0 mm. When the traps reached the economic threshold (ET) of 1 moth/trap/day, applicators were notified and reapplications took place shortly after, depending on irrigation and applicator schedules. However, due to various difficulties, only the GEL formulation was reapplied as prescribed. Early season data is reported for all treatments; only GEL is compared to the standard Rope and Check treatments season long.

A standard Delta trap was placed at each corner of the field, 30 rows from the edge and 30 paces in. Traps contained a rubber septa pheromone lure (changed biweekly) and were checked for male moths twice a week.
Bolls were collected once a week for six weeks. Bolls (25) in near proximity to each trap were picked and held in boll boxes, later inspected for infestation. The boll count data was inconclusive, with infestations rising over time in each field, regardless of treatment. This might be due to migration of already mated females since mating disruption affects only males and the treated fields were often surrounded by untreated fields with very high PBW populations.

Results

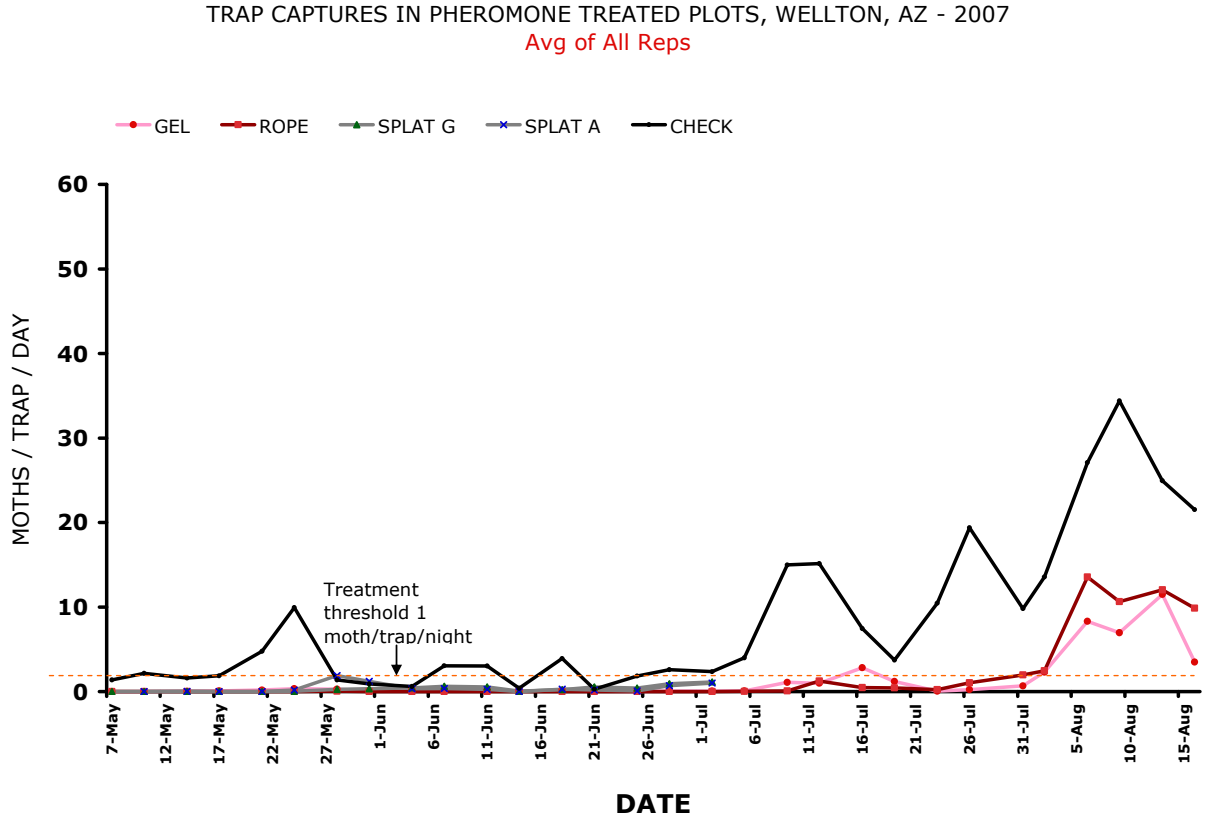

Figure 1: The average number of pink bollworm catches in each treatment (n=4).

Early season results are encouraging for all treatments, although average trap catches were low in many fields, including two of the check fields. By mid-season the catches in all check fields broke the threshold and remained above it for the duration of the season. The variations among replicates are indications of differences among the fields available for each replicate. Even so, the aerial formulation, SPLAT A, performed well, especially since aerial application distributes the pheromone formulation onto the entire surface of the field and only a small proportion lands on early-season, 6 leaf cotton. Droplets landing on the soil will be covered by tilling or washed away by irrigation. Thus application technique has an effect on efficacy, longevity and logistics. Aerial application is desirable for an areawide eradication program because it allows rapid application of the formulation to large areas, season long, but does not allow for targeting small plants. Ground applications, in contrast, can accurately aim the delivery of the pheromone formulation onto the small plants, but are impossible to apply when a field is wet or once the cotton canopy closes.

The catches in the Rope fields, as expected, stayed below threshold until late season. As seen in Figure 1, the series of GEL treatments (2 or 3 per field) maintained trap catches below the treatment threshold except in one case where a treatment could not be made as planned because the field was under irrigation. Nonetheless, the GEL nearly matched the performance of the Rope and satisfied/exceeded the main objective of this research.

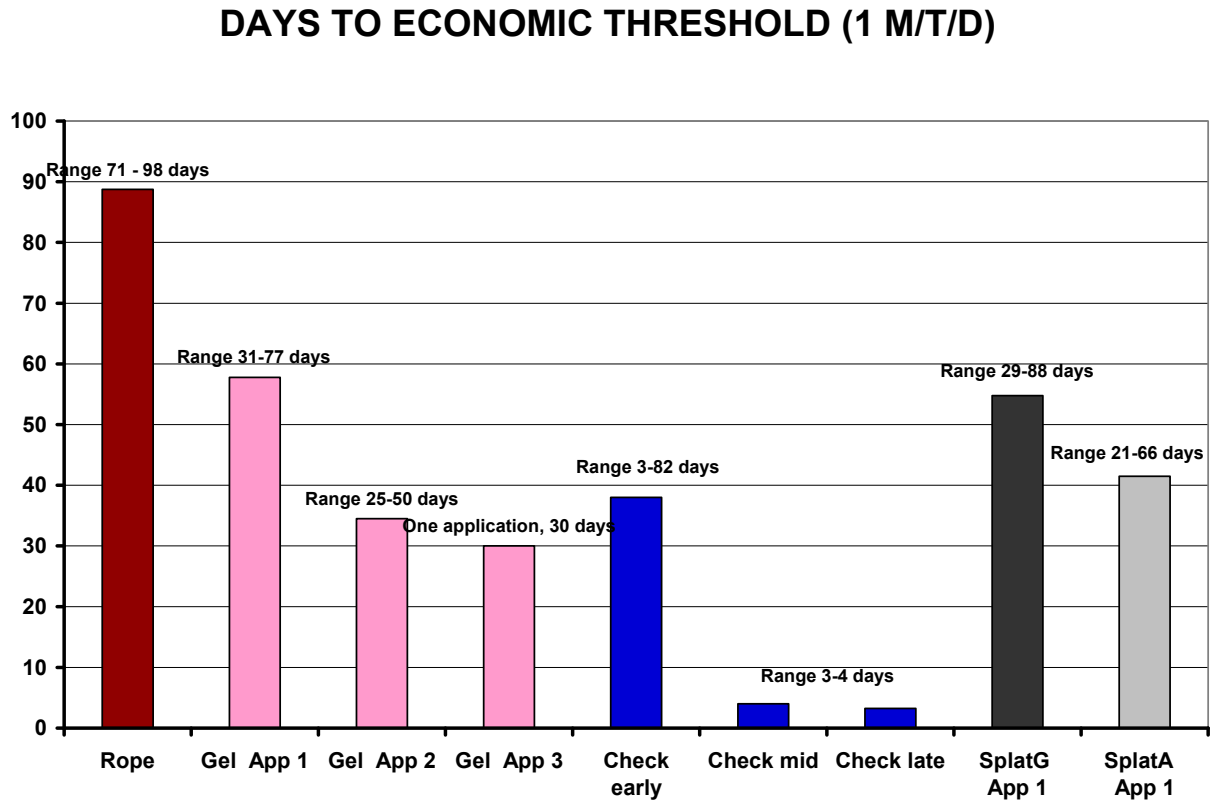

Figure 2: The number of days from application until trap catches reached treatment threshold (1 moth/trap/night).

Figure 2 further illustrates longevity of each treatment. The "days to treatment" threshold for check indicates that 2 of the check fields caught very few PBW for half of the season – a very disappointing development. However, all check fields became generally infested by mid-season; the range of 3-4 days to reach threshold then was an artifact due to checking the traps only twice per week. Most check traps would have been above threshold after a single night, had we been there to count the traps that often.

Discussion

As mentioned in the results, trap catches were kept low in all treatments for the first half of the season. The Splat formulation can be applied by air or ground. The SPLAT A performed well early season; no data is available on it for the remainder of the season. In contrast, the GEL maintained trap catches below threshold throughout the season. GEL also showed excellent storage stability, even at field temperatures in excess of 110°F.

Research indicates that sprayable PBW mating formulations are available that can meet/exceed PBW Eradication Program needs.

References

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Pacific Biocontrol PB-ROPE L: http://www.pacificbiocontrol.com/Labels%20&%20MSDS_files/PB-L-1PP%282004%29.pdf