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FINAL REPORT

Field Efficacy Studies on *Wasmannia auropunctata* With Ant Baits Registered For Use On Tropical Fruit Crops in Hawaii

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FINAL PROGRESS REPORT

Project Title: Field Efficacy Studies on *Wasmannia auropunctata* with Ant Baits Registered for use on Tropical Fruit Crops in Hawai'i

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Cost of Contract: $85,743

Term of Contract: June 16, 2006 to April 1, 2008

Scope of Service/Research: See Progress Report

Primary Objective: Test ant baits (Esteem and Conserve) registered for use in tropical fruit orchards. The efficacy of these will be compared to that of Amdro, a highly effective bait for *Wasmannia auropunctata* that is not registered for broadcast use in crops.

Field Efficacy Studies on *Wasmannia auropunctata* with Ant Baits Registered for use on Tropical Fruit Crops in Hawai'i

The Little Fire Ant (LFA), *Wasmannia auropunctata*, is a unicolonial tramp ant species native to the American tropics (Ulloa-Chacon and Cherix 1990). It is known for its ability to eliminate terrestrial invertebrates, including other ants, in areas where it has been introduced (Clark et al. 1982). It is also known to establish symbiotic relationships with phytophagous pest insects and has been observed facilitating large populations of these pests in citrus orchards in Florida (Spencer 1941), coffee farms in Puerto Rico (Smith 1937), and ornamental plants in New Caledonia (Fabres and Brown 1978). In addition to the negative economic impacts LFA has had on farming communities, it also has a powerful sting that can leave painful welts on its victims for up to three days (Spencer 1941; Smith 1965), and can cause blindness in mammals (Walsh et al. 2004).

LFA was first reported in Hilo, Hawaii in 1999 in a tropical fruit orchard. It is suspected that it was accidentally introduced to the island in shipments of ornamental nursery plants. It has subsequently spread throughout east Hawaii due in part to the sale of these infested plants. On Hawaii island it has infested approximately 200 acres of cultivated land and an undetermined amount of uncultivated land. It was also introduced to the island of Kauai (ostensibly in contaminated nursery plants from Hilo) where it has continued to spread despite intensive control efforts (P. Conant, personal communication, August 30, 2007). Although LFA can tolerate a variety of habitats, it seems to prefer areas of high temperature and humidity (Lubin 1985). This suggests that every Hawaiian island is at risk of LFA infestation.

Control of LFA on the island of Hawaii is difficult due in part to the lack of knowledge about the efficacy of registered baits. The current registered baits were formulated for use in dry climates and for other ant species (primarily the Red Imported Fire Ant, *Solenopsis invicta*). Due to the wet weather in many parts of the state and the quick breakdown of baits when exposed to the elements, broadcast treatment in Hawaii is problematic during most times of year.

We have recently concluded a small study to determine the most effective baits to use in crops. We tested 3 compounds in this study: hydramethylnon (Amdro), pyriproxifen (Esteem), and spinosad (Conserve and Entrust). All 3 were broadcast on the ground (trials 1 & 2), and spinosad was applied in trees (trial 3).

Results of these studies suggest low mortality rates and quick population rebound of treated areas. These findings are highlighting the fact that current treatment protocols for LFA in Hawaii do not provide a viable means of control. Additional funding is essential for testing new baits as well as new methods of application for current baits.

References

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Objective

Conduct field efficacy trials using various rates of Amdro, Esteem, and Justice/Conserve/Entrust ant baits to control *Wasmannia auropunctata*.

Materials and Methods

Trial 1

Experimental Plan
7 treatments, 3 replications, 2 trials. Treatment plots are 50' x 50'

Treatment (Trials 1 and 2)		Rate
A.	Amdro (hydramethylnon 0.73% a.i.)	1.0 lb/ac
B.	Amdro (hydramethylnon 0.73% a.i.)	2.0 lb/ac
C.	Esteem (pyriproxyfen 0.5% a.i.)	1.5 lb/ac
D.	Esteem (pyriproxyfen 0.5% a.i.)	2.0 lb/ac
E.	Justice/Conserve (spinosad 0.015% a.i.)	2.5 lb/ac
F.	Justice/Conserve (spinosad 0.015% a.i.)	5.0 lb/ac
G.	Control	

We located an LFA infestation in Kea'au, Hawai'i that encompasses enough square footage to accommodate all treatment plots for trial 1. Plots for Esteem and Justice/Conserve were established in a macadamia orchard, and the Amdro plots were set-up in a dracaena field about 50 m away. Treatment plots of 50 X 50 feet, were marked with chaser flags, and were separated by buffers of at least 50 feet. Each plot contained 5 sample sites that were configured in an 'X' pattern and centered in the plot. Hand-held fertilizer spreaders were used to apply the baits to the plots. All plots were sampled prior to treatment using a 7 dram vial baited with 0.25 grams of peanut butter. The plots were monitored every 2 weeks or as weather permitted. This continued until populations went to zero, or until 4 months passed.

Trial 2

Trial 2 was established inside 10 acres of manicured lawn that was heavily infested with LFA. The plots were set up identical to trial 1, except that treatments were done on a weekly basis.

Trial 3

Experimental Plan
3 treatments, 12 replications, 1 trial, 36 trees

Treatment (Trial 3)		Rate
A.	Entrust mixture (spinosad 0.01% a.i.)	40 g/tree
B.	Conserve (spinosad 0.015 a.i.)	35 g/tree
C.	Control	

Trial 3 was designed to control ants in trees. Because LFA typically nests in trees as well as on the ground, it is important to find a non-broadcast bait that will control them in the trees. A paste would be ideal for this since it can be spread directly on the trees. Unfortunately, there is no paste bait registered for use in Hawaii. Therefore, a bait was created by mixing Entrust (spinosad 80% a.i.) powder with peanut butter to serve as our paste to formulate a concentration of 0.01% a. i. This mixture was spread on the trunks and limbs of the trees at 40 grams per tree. Conserve was applied to the trees in a sleeve tube made of window screen. The tube was filled with 35 grams of Conserve, then wrapped around the trees and secured with a tack. The trial was set up in an infested rambutan orchard. 36 trees were used (12 Entrust, 12 Conserve, and 12 control). Each tree had a base diameter of between 6 and 8 inches and a height of approximately 12 feet.

Results

Trial 1

Conserve and Amdro decreased populations to low levels only after being used several weeks in a row (each treatment is denoted by an arrow on the graphs). These populations always rebounded to much higher levels within 1 month of halting treatments (Figures 1 & 2). Esteem did not decrease populations below control levels (Figure 3).

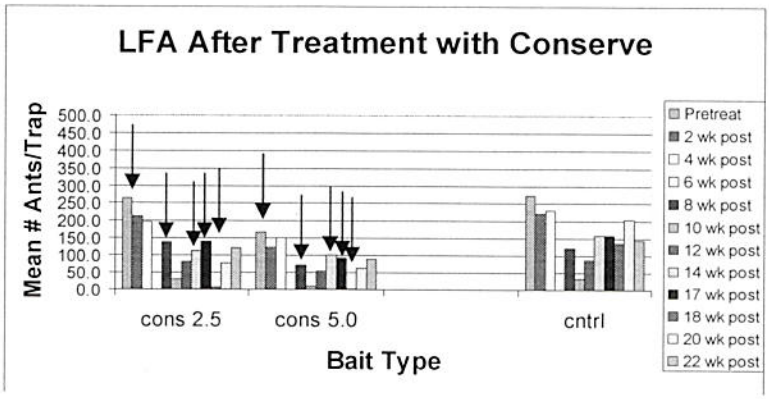

Figure 1

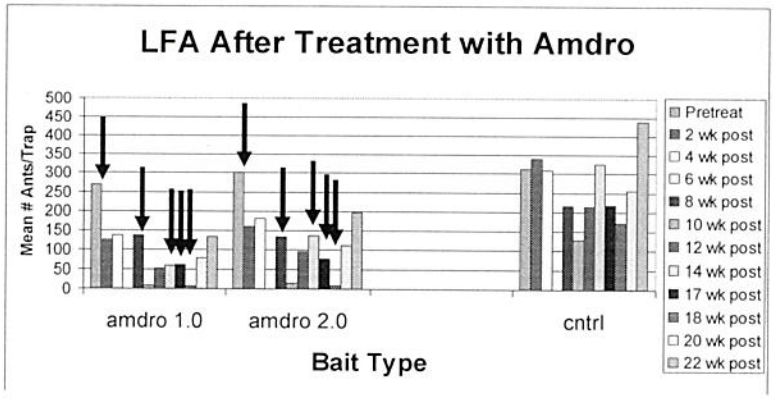

Figure 2

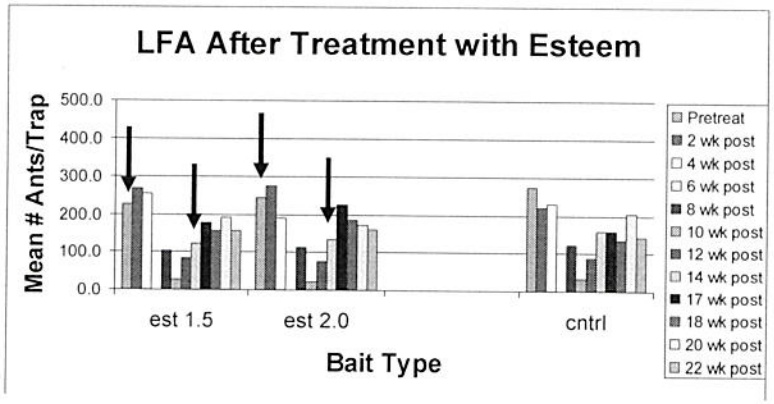

Figure 3

Trial 2

During the first 5 weeks, Conserve and Amdro were broadcast once every week except the period of 2 weeks post start. Conserve decreased the populations very little. Amdro decreased the populations more than Conserve, but as in trial 1, neither bait could bring the populations to zero. LFA populations rebounded to original or higher levels within 5 weeks of discontinuing treatment (Figures 4 & 5). Esteem was broadcast once in each of the first 2 weeks, and showed a steep but short-lived decline in populations at 8 weeks post start. These populations returned to pre-treatment levels within 1 month of reaching their lowest point (Figure 6).

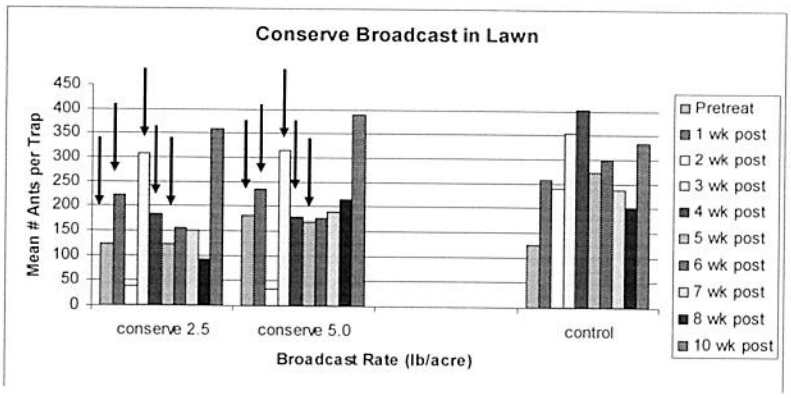

Figure 4

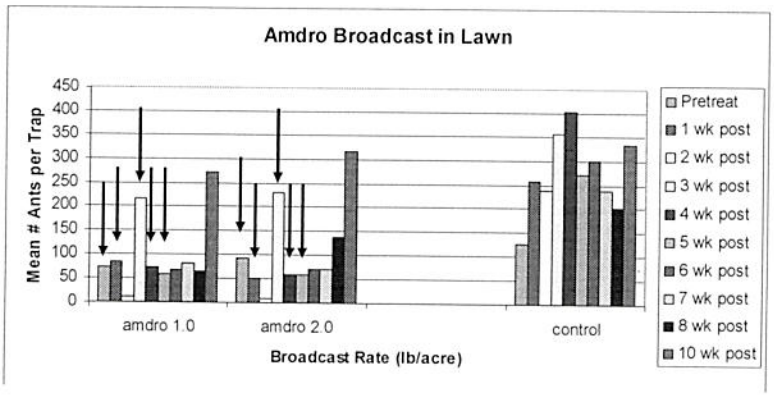

Figure 5

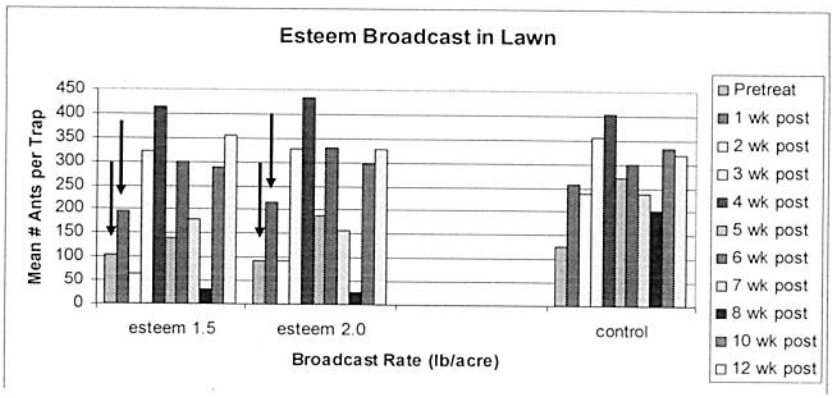

Figure 6

Trial 3

Entrust and Conserve showed some control of LFA in trees (Figure 7), but the populations rebounded within 3 weeks when treatment was discontinued.

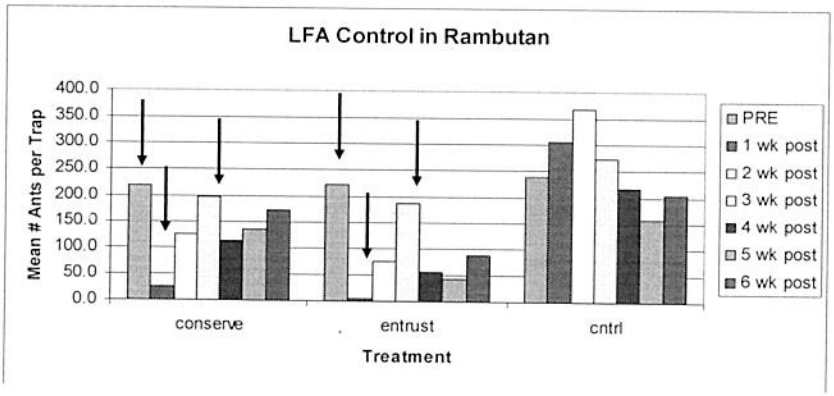

Figure 7

Discussion

Trial 1

Initially we had very limited success with Amdro and Conserve. This was most likely due to not applying the baits frequently enough. At the 14 week mark, the baits were applied weekly for 3 weeks (Figures 1 & 2). At this point, we saw large reductions in the populations.

It should be noted that at the 10 week mark, all populations were low (probably due to a period of dry, hot weather). Esteem did not give any control. Due to these observations, trial 2 was set up with more frequent treatments.

Trial 2

Amdro (and to a lesser extent, Conserve) achieved some control with weekly applications (Figures 4 & 5). As in trial 1, LFA populations rebounded within 5 weeks of discontinuing treatment. Esteem was applied during the first 2 weeks of the trial, and at the 8 week mark produced some control. Within 2 weeks of this low level, the populations had rebounded to pre treatment levels.

Trial 3

Entrust and Conserve gave good control after 1 application. The populations began to rebound at the 2 week mark, probably due to heavy rains that fell immediately after the previous week's application. The third treatment at the 3 week mark decreased the populations on the Entrust trees, but they were rebounding quickly within 3 weeks when treatment was discontinued.

These findings are a big step to understanding the efficacy of LFA baits registered for use in Hawaii. However, it is apparent that current treatment protocols for LFA in Hawaii do not provide a viable means of control. Other baits or bait presentation methods must be explored for specific uses in Hawaii's tropical conditions. The heavy rainfall and thick vegetation where LFA resides makes it a difficult challenge for maximizing the effectiveness of these baits which do not tolerate water or moisture very well. In arboreal situations, it presents a totally new and uncharted area of ant control technologies. Ant control in the last 60 years has concentrated basically on ground applications. There are no baits or technologies as yet developed to combat ant pests in trees anywhere in the world. We are just at the start of a long journey to find a way to control LFA under Hawaii's conditions and complying with the strict environmental rules and regulations.