

## **Reduction of fire ant populations, *Solenopsis invicta* Buren (Hymenoptera: Formicidae), with individual mound treatments of Mosquito Barrier®**

Kimberly Schofield, Program Specialist-IPM  
Texas AgriLife Extension

Red imported fire ants, *Solenopsis invicta* Buren, are nuisance insects that interfere with outdoor activities and their sting can cause serious medical problems. The problems they can cause in urban areas make them a desirable pest to control (Drees et al. 2002). There are many products sold to control fire ants, however there is a growing interest in using naturally derived insecticides for controlling and repelling all insects, including red imported fire ants, *Solenopsis invicta* Buren (Hymenoptera: Formicidae). These products are termed “organic” (Drees and Lennon 1998).

There are several organic fire ant control products on the market, but few have been scientifically proven to significantly reduce fire ant populations. Garlic extract is an organic insecticide which is claimed to reduce many pest insects. Mosquito Barrier®, containing garlic extract, is labeled as effective in reducing mosquito, flea and tick populations in yards, parks, athletic fields and golf courses. Mosquito Barrier® is also labeled to reduce populations of larger animals such as armadillos, field mice and geese. Since this product is labeled to control many animal pests, it was tested for its effectiveness in reducing red imported fire ant populations. Client testimonials claim Mosquito Barrier® reduces fire ant populations. The directions for use of Mosquito Barrier® are for a 1 foot diameter mound, use 1 gallon of water mixed with 4 ounces of Mosquito Barrier®; for 2 foot diameter mounds use 2 gallons of water mixed with 8 ounces of Mosquito Barrier®; for 3 foot diameter mounds use 3 gallons of water mixed with 12 ounces of Mosquito Barrier®. All of these mixtures should be stirred well with the water and then applied in the early morning using a watering can or bucket.

In this trial, we evaluated the reduction of fire ant populations with individual mound treatments with Mosquito Barrier® (99.3% garlic, 0.5% citric acid, and 0.2% potassium sorbate) at 4oz, 6oz and 8oz rates compared to water and untreated controls.

### **Materials and Methods**

On September 25, 2008, 20 plots measuring 124 feet in width were established in a 150 acre hay meadow off of FM 455 in Clarksville, TX (Figure 1). Plots were measured beginning at 6:30am with temperatures at 70° F. Flags were inserted into the ground to denote the beginning and end of the plots. Within each plot, 10 active fire ant mounds were flagged for a total of 200 flagged mounds. Red imported fire ant mounds were counted within each plot by disturbing suspected mound sites with a stick to determine activity. Mounds were considered active if many (dozens of) worker ants were observed within 15 seconds.

A total of 20 plots were measured with various lengths. Plot lengths were arrayed from shortest to longest, then divided into 4 blocks containing 4 treatment plots each. This allowed the total length of plots for all the treatment plots to be roughly equal, so colony migration into and out of the plot areas was similar for all treatments. Within

each treatment block, treatments were assigned to plots at random in order to minimize pre-treatment differences in total plot length (Table 1).

The treatments included:

1. Untreated control- received no treatment
2. Water control -1 gal of water
3. 4 oz Mosquito Barrier®/ 1 gal water
4. 6oz Mosquito Barrier®/1 gal water
5. 8oz Mosquito Barrier®/ 1 gal water

Treatments were applied beginning at 7:00 am on September 26, 2008 with temperatures at 70° F. Each of the treatments was thoroughly mixed with 1 gallon of water and a shovel was used to remove the top portion of the mound before application. The treatments were applied using a Dynamic Design Model Number #WC81 watering can (<http://www.planter.com>) (Figure 2).

Evaluation of mound activity was conducted prior to application and at 3 days, 1 week, 2 weeks, 3 weeks, 4 weeks, 6 weeks and 8 weeks. For the evaluation process, red imported fire ant mounds were disturbed using a stick. The mounds were considered active if many (dozens of) worker ants were observed within 15 seconds. Data were analyzed using Analysis of Variance (ANOVA) test with means separated using Duncan's Multiple Range Test at  $P \leq 0.05$  (SPSS for Windows, Lead Technologies, Version 13.0).

## Results

Results of active mound evaluations are shown in Table 2. At the three days and 1 week evaluations, the 8oz treatment of Mosquito Barrier® had significantly fewer active fire ant mounds compared to the other treatments and controls. At the two week evaluation, the 6oz and 8oz treatment of Mosquito Barrier® had significantly fewer active fire ant mounds compared to the 4oz treatment and controls; the 4oz treatment of Mosquito Barrier® had significantly fewer active fire ant mounds compared to the controls. At the 3 and 4 week evaluations, the 4oz, 6oz and 8oz treatments of Mosquito Barrier® had significantly fewer active fire ant mounds compared to the controls. At the 6 week evaluation, there were no significant differences found between the Mosquito Barrier® treatments and controls. At the 8 week evaluation, the 4oz, 6oz and 8oz treatments of Mosquito Barrier® had significantly fewer active fire ant mounds compared to the controls.

## Discussion

In conclusion, all of the Mosquito Barrier® treatments reduced the fire ant population compared to the controls. The 8oz rate of Mosquito Barrier® decreased the fire ant population significantly compared to the other treatments at 3 days and 1 week post treatment. The 6oz and 8oz rates of Mosquito Barrier® decreased the number of active mounds compared to the other treatments at two weeks post treatment. The 4oz, 6oz, and 8oz rates of Mosquito Barrier® decreased the number of active fire ant mounds compared to the controls beginning at 3 weeks post treatment. At the 8 week observation, all of the rates of the Mosquito Barrier® product had significantly fewer

active fire ant mounds compared to the control plots. Future studies should be conducted to compare efficacy of other known organic insecticides, such as d-limonene (Engler et al 2005) compared to the 6oz and 8oz rates of the Mosquito Barrier® product.

The average daytime temperature throughout the study was 80°F with a total of 12 inches of rain.

**Table 1.** Treatment block assignments based upon plot length.

<b>Treatment</b>	<b>Plot Number</b>	<b>Plot Length (ft)</b>
<b>4 oz</b>	8, 10, 13, 14	89, 38, 22, 12
<b>6 oz</b>	1, 12, 17, 20	34, 29, 38, 62
<b>8 oz</b>	7, 11, 15, 19	50, 37, 26, 43
<b>Water control</b>	2, 4, 5, 18	39, 26, 21, 75
<b>Dry control</b>	3, 6, 9, 16	29, 39, 67, 24

**Table 2.** Number of active red imported fire ant mounds in the individual mound trial at each observation post treatment in Clarksville, TX. Ten mounds were initially in each plot prior to treatment.

<b>Treatment</b>	<b>3 Days</b>	<b>1 Week</b>	<b>2 Weeks</b>	<b>3 Weeks</b>	<b>4 Weeks</b>	<b>6 Weeks</b>	<b>8 Weeks</b>
<b>4 oz</b>	9.00bc	8.25c	7.50b	7.25b	7.00a	7.00ab	6.25a
<b>6oz</b>	8.25b	6.25b	5.25a	6.25ab	6.25a	6.25a	5.75a
<b>8oz</b>	6.25a	4.50a	4.25a	5.25a	6.00a	5.75a	5.25a
<b>Water Control</b>	9.75c	9.75d	9.25c	9.25c	9.25b	8.25b	8.25b
<b>Untreated Control</b>	10.00c	10.00d	9.25c	9.25c	9.25b	8.25b	8.25b

<sup>a</sup>Means followed by the same letter within the same column were not significantly different using Analysis of Variance (ANOVA) and means separated using Duncan's Multiple Range Test at  $p \leq 0.05$  (SPSS, Windows 11.5).

**Figure 1.** Testing site for individual fire ant mound trial on the 150 acre hay meadow off of FM 455 in Clarksville, TX, where the flags represent active mounds.



**Figure 2.** Treating an individual fire ant mound with Mosquito Barrier® within the 150 acre hay meadow off of FM 455 in Clarksville, TX.



## Literature Cited

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**Appendix 1.** Plot plan of all treatments within the individual mound trial in the 150 acre hay meadow in Clarksville, TX.

6 oz
Water Control
Dry Control
Water Control
Water Control
Dry Control
8oz
4 oz
Dry Control
4 oz
8 oz
6 oz
4 oz
4 oz
8 oz
Dry Control
6 oz
Water Control
8 oz
6 oz