

EVALUATION OF INDIVIDUAL RED IMPORTED FIRE ANT MOUND TREATMENTS USING ORGANIC SOLUTIONS™ FORMULATIONS OF PYRETHRINS PLUS DIATOMACEOUS EARTH

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This trial was conducted to evaluate the effectiveness of two pyrethrins, piperonyl butoxide plus diatomaceous earth formulations (PermaGuard™, marketed as Organic Solutions™ Fire Ant Killer) as individual mound or surface treatments to suppress red imported fire ant, *Solenopsis invicta* Buren (Hymenoptera: Formicidae), mound activity as compared to commonly used individual mound treatments (acephate, chlorpyrifos).

Materials and Methods

Six treatments were evaluated to reduce the number of red imported fire ant mounds in treated areas. Treatments included:

- 1) PermaGuard™, D-20 (0.2 % pyrethrins, 1% piperonyl butoxide plus diatomaceous earth)
- 4 tbsp./gal./mound
NOTE: Quanta Lab (9330 Corporate Dr. #703, Selma, TX 78154-1257; 210/651-5799; FAX: 210/651-9271) analysis of this material documented 0.1% pyrethrins plus 0.9% piperonyl butoxide (Report #950S1004, 26 April 1995).
- 2) PermaGuard™ D-21 (0.1 % pyrethrins, 1% piperonyl butoxide plus diatomaceous earth)
- 4 tbsp./gal./mound
NOTE: Quanta Lab analysis of this material documented 0.1% pyrethrins plus 0.6% piperonyl butoxide (Report #950S1003, 26 April 1995).
- 3) Ortho-Klor® Soil Insect and Termite Killer (12.8% chlorpyrifos) - 2 tbsp./gal./mound
- 4) Orthene® Systemic Insect Control (9.4% acephate liquid) - 2 tbsp./gal./mound
- 5) Untreated control - 1 gal. water per mound
- 6) Permaguard D-20 applied with a Ortho® Dial'n Spray Hose-End Sprayer driven by a Shurflo® Diaphragm Pump powered by a 12 volt battery that delivers 40 psi. calibrated to deliver 2 lbs. Permaguard® in 50 gal. water per acre after spraying each mound within the treated area using an inward spiral spray pattern until the mound structure collapsed.

Four sets of replicated plots of equal width and variable length, containing ten (10) red imported fire ant mounds were established for each treatment (40 mounds treated per treatment). Treatment blocks were assigned by arraying plot length from longest to shortest and treatments were randomly assigned within each block. Each mound was marked with a plot flag and received one of the six treatments. Periodically (3, 7, 14 and 31 days; on 6, 10, 17 Feb. and 6 March,

respectively) following treatment, treated mounds and plots were inspected for ant activity using the minimal disturbance method. Results were analyzed using Analysis Of Variance (ANOVA) and means separated using Tukey's Studentized Range Test ($P \leq 0.05$).

Results and Discussion

The area chosen to conduct this trial had a high number (580.8 mounds) of red imported fire ant mounds per acre, suspected to be an infestation of the polygynous form of the fire ant. The average plot size was 750 sq. ft. On the day of treatment, the temperature ranged from 64.5 to 68.2 degrees F and relative humidity from 50 to 43 percent. Individual mound drenches of flagged mounds required about 2.4 man minutes per mound (\$0.17 per mound at minimum wage of \$4.25 per hour). Per mound cost for treatments was \$0.48/mound for Orthene® Systemic Insect Control and \$0.55/mound for Ortho-Klor® Soil Insect & Termite Killer.

Ten ounces of Permaguard® were mixed per gallon of water and used to fill the sprayer. The Ortho® Dial'n Spray Hose-End Sprayer, set at 8 oz rate, emitted 1.62 gal water/minute and sprayed out 13.5 fl oz dissolved insecticide per minute. Permaguard™ was dispensed at 0.0176 oz per minute. The amount of spray used on the hose-end treated plots is listed below:

<u>Plot no./length</u>	<u>Spray time/plot</u>	<u>Spray time/10 mounds</u>	<u>Total amount</u>
6 15 ft	19 sec. (4.3 fl. oz.)	80 sec. (18 fl. oz)	= 1.74 oz.
7 46 ft	59 sec. (13.3)	69 sec. (15.5)	= 2.25 oz.
23 24 ft	31 sec. (7.0)	56 sec. (12.6)	= 1.53 oz.
24 18.5 ft	24 sec. (5.4)	85 sec. (5.4)	= 1.91 oz.

Permaguard® D-20

Four tablespoons of Permaguard™ D-20 weighs 22.2 grams or 0.78 oz. Plots receiving individual mound drenches for 10 mounds received 7.8 oz. product.

The Permaguard® formulations performed differently, with D-20 (0.2% pyrethrins, 1% piperonyl butoxide plus diatomaceous earth) providing significantly better elimination of ant activity than D-21 (0.1% pyrethrins) 3 days following application (**Table 1**). Permaguard™ D-20, applied as an individual mound treatment eliminated ant activity in treated mounds more quickly than did Orthene® Systemic Insect Control (9.4% acephate), and performed statistically similar to Ortho-Klor® Soil Insect and Termite Killer (12.8% chlorpyrifos) throughout the trial. From 1 to 4 weeks following application, all individual mound treatments significantly reduced ant activity in treated mounds relative to ant activity in untreated control (water drench only) mounds and performed statistically the same, providing 75 to 100 percent suppression of ant activity in treated mounds.

The surface application of Permaguard™ D-20 significantly reduced the number of ant mounds 1 to 4 weeks following treatment relative to the untreated control (water drench only) plots by 50

to 53 percent. Apparently, the "spiral pattern spray" to individual mounds failed to deliver sufficient product to eliminate ant activity in treated mounds to the extent that 1 gallon individual mound treatments achieved. However, less material was applied to the plots using the surface treatment (1.9 oz. versus 7.8 oz for individual mound treated plots). (Note: The individual mound treatment rate of PermaGuard™ would have resulted in the application of 28.3 lbs. per acre for 581 ant mound infestation in this study area. Obviously, in areas with fewer mounds per acre would require less material.)

None of the treatments applied appeared to greatly aggravate colony movement (**Table 2**), although more "new" colonies appeared in the plots treated with the surface application of PermaGuard™ D-20. However, new mounds appeared in the plots during the course of this 4 week long trial. By the fourth week, only the Ortho-Klor® Soil Insecticide and Termite Killer (chlorpyrifos 12.8%) treated plots contained significantly fewer mounds than did the untreated control plots, having 65 percent fewer mounds. The other treatments performed statistically similar to Ortho-Klor® Soil Insecticide and Termite Killer, achieving percent reductions of active fire ant mounds ranging from 58 to 13 percent.

This trial was conducted in February, and was characterized by mild and wet climate conditions. Field plots were mowed 1 and 27 Feb. Conceivably, colony migration into mowed plots from high grass adjacent areas may have increased because of the mowings or because of natural ant behavior during this period of the year. Further testing with these treatments will provide additional confidence in the results generated from this trial.

Table 1. Mean number active ant mounds following application of individual red imported fire mound treatments, Brazos Co., Texas, 1995.

<u>Treatment</u>	Mean no. active mounds/10^a			
	<u>3 days</u>	<u>1 week</u>	<u>2 week</u>	<u>4 weeks</u>
untreated control				
1 gal. water/mound	10.00 a..	10.00 a..	8.75 a..	9.25 a..
Permaguard™ D-21 (0.1% pyrethrins, 1% PBO)				
4 tbsp./gal./mound	6.00 .b..	2.50 .bc	1.25 ..c	2.00 .bc
Permaguard™ D-20 (0.2% pyrethrins, 1% PBO)				
4 tbsp./gal./mound	1.50 ..cd	0.25 ..c	0.25 ..c	1.00 ..c
Permaguard™ D-20 surface treatment ^b				
2 lbs./50 gal./acre	9.75 a..	4.75 .b.	4.75 .b.	5.00 .b.
Orthene® Systemic Insect Control (9.4% acephate EC)				
2 tbsp./gal./mound	4.00 .bc .	1.00 ..c	1.00 ..c	1.25 ..c
Ortho-Klor® Soil Insect and Termite Killer (12.8% chlorpyrifos)				
2 tbsp./gal./mound	0.00 ...d	0.00 ..c	0.00 ..c	0.00 ..c
<i>F</i>	22.32	30.40	17.80	13.12
<i>P</i>	0.0001	0.0001	0.0001	0.0001
MSE	1.952	1.200	1.7111	2.333
Min. Sig. diff.	3.2104	2.5166	3.0052	3.5093
d.f. = 15; Critical value = 4.595				

^a Means followed by the same letter are not significantly different using analysis of variance (ANOVA) and the Tukey's Studentized Range Test ($P \leq 0.05$).

^b Permaguard™ D-20 applied with a Ortho® Dial'n Spray Hose-End Sprayer driven by a Shurflo® Diaphragm Pump powered by a 12 volt battery that delivers 40 psi. to spray plot surface after spraying each mound within the treated area using an inward spiral spray pattern until the mound structure collapsed.

Table 2. Mean number of new mounds appearing per plot and total number of active ant mounds per plot following treatment of individual red imported fire ant mounds, Brazos Co., Texas, 1995.

<u>Treatment</u>	Mean no. active mounds/plot^a		No. "satellite" mounds/plot^a	
	<u>2 weeks</u>	<u>4 weeks</u>	<u>2 weeks</u>	<u>4 weeks</u>
untreated control	10.25 a..	11.50 a.	1.50 a	2.25 a
Permaguard™ D-21	2.75 .bc	7.25 ab	1.50 a	5.25 a
Permaguard™ D-20	1.00 ..c	4.25 ab	1.25 a	3.25 a
Permaguard™ D-20 surface treatment	7.50 ab.	8.75 ab	2.75 a	3.75 a
Orthene® Systemic Insect Control	2.25 .bc	5.00 ab	1.25 a	3.75 a
Ortho-Klor® Soil Insect and Termite Killer	0.50 ..c	3.50 .b	0.50 a	3.50 a
<i>F</i>	6.35	5.23	0.69	2.14
<i>P</i>	0.0011	0.0029	0.6934	0.0972
MSE	6.275	6.964	2.919	11.986
Min. Sig. diff.	5.755	6.0626	3.9254	7.9537
d.f. = 15; Critical value = 4.595				

^a Means followed by the same letter are not significantly different using analysis of variance (ANOVA) and the Tukey's Studentized Range Test ($P \leq 0.05$).