

Evaluation of QRD as an individual mound treatment for red imported fire ant, *Solenopsis invicta* (Hymenoptera: Formicidae)

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In Texas, there is a growing interest in using naturally derived insecticides for controlling all insects, including red imported fire ants, *Solenopsis invicta* Buren (Hymenoptera: Formicidae). These products are termed “organic” (Drees and Lennon 1998). Currently, a product containing d-limonene which is an extract derived from citrus peel, has been effective at lowering fire ant populations when used as drench on an individual mound treatment (Engler et al 2005).

However in recent years, there have been advances in identifying other novel plant compounds. One such compound is QRD 400, a plant extract derived from *Chenopodium ambrosioides*, which is closely related to common lambsquarter. The plant extracts work via several modes of action to control a broad range of soft bodied insects, including thrips, mites, whiteflies, mealybugs, and fungus gnats. QRD 400 has been shown in trials to be safe for beneficials, and its different mode of action makes it an excellent rotation partner for resistance management. This product shows immediate and residual control of pests through dual modes of action and it is less persistent in the environment than many synthetic chemistries. It is pending US EPA approval, with potential for OMRI/IMO/NOP certification (information provided by AgraQuest, Inc).

For this trial we wanted to evaluate the effectiveness of combinations of Safer® Brand Insecticidal Soap (49.52% potassium salts of fatty acids) and Dawn® Original Scent Ultra Dishwashing Liquid with Erath Earth® Orange Oil (100% orange oil) compared to QRD 400 and the effective organic killing agent d-limonene (78.2% d-limonene in Safer® Brand Fire Ant Killer).

Methods and Materials

This trial was established on March 22, 2007 at 7 Estates Rd, Lucas, TX. Twenty four plots of varying length, each containing five red imported fire ant mounds were established. Each active mound within each plot was marked with a field flag and sprayed with field paint. A mound was considered active using the minimal disturbance method, where an active colony has a dozen or more workers emerge following a mild disturbance. Plot lengths (Table 1) were measured and arrayed from shortest to longest and divided into four replicates (blocks) for each of the six treatments. 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 randomly assigned to plots in order to minimize pre-treatment differences in total plot length.

The treatments placed on each mound included:

1. Untreated Control- 1 gal water
2. Safer® Brand Fire Ant Killer Concentrate, d-limonene (2 fl oz)/gal water
3. Safer® Insecticidal Soap (1.5 fl. oz.) with Erath Earth® Orange Oil (2 fl oz)/gal water

4. Safer® Insecticidal Soap (1.5 fl. oz.) with Erath Earth® Orange Oil (1 fl oz)/gal water
5. Dawn® Soap (1.5 fl oz) with Erath Earth® Orange Oil (1 fl oz)/gal water
6. QRD 400- 1 fl oz/gal water

Evaluations were made at 2, 7, 14 and 30 days post treatment using the minimal disturbance method. Data were analyzed for each pre- and post-treatment observation using Analysis of Variance (ANOVA) with means separated using Duncan's Multiple Range Test at $P \leq 0.05$ (SPSS for Windows, Lead Technologies, Inc. Version 13.0).

Results and Discussion

Upon analysis of the data at two days, Safer® Insecticidal Soap (1.5 fl oz) with orange oil (2 fl oz) had significantly fewer active mounds compared to the other treatments (Table 2); d-limonene had significantly fewer active mounds compared to QRD 400, Dawn® soap with orange oil and the water control; QRD 400 had significantly fewer active mounds than the water control. At 7 days, Safer® Insecticidal Soap (1.5 fl oz) with orange oil (2 fl oz) had significantly fewer active mounds compared to the other treatments; Dawn® soap with orange oil had significantly fewer active mounds than the water control. At 14 days, Safer® Insecticidal Soap (2 fl oz) with orange oil (1 fl oz), QRD 400 and d-limonene had significantly fewer active mounds compared to the other treatments; water control had significantly more active mounds than all other treatments. At 30 days, Safer® Insecticidal Soap (2 fl oz) with orange oil (1 fl oz), QRD 400 and d-limonene had significantly fewer active mounds compared to the other treatments; Dawn® soap with orange oil had significantly fewer active mounds than the water control.

Overall, the Safer® Insecticidal Soap (1.5 fl oz) with orange oil (2 fl oz) had the fewest active fire ant mounds throughout the trial. However when price per mound treatment was analyzed, the Safer® Insecticidal Soap (1.5 fl oz) with orange oil (2 fl oz) was most expensive treatment with a cost of \$2.35 per mound. When comparing the other treatments, d-limonene cost \$1.81 a mound, followed by Safer® Insecticidal Soap (1.5 fl oz) with orange oil (1 fl oz) with a cost of \$1.72 per mound, and Dawn® soap with orange oil with a cost of \$0.82 per mound. The price per mound for the QRD 400 can not be determined at this time.

One limiting factor of this trial could be the plots containing polygene colonies, so one treatment may not have killed all the queens with the colony. Perhaps the treatments should have been applied on a weekly or bimonthly basis to contact all queens within the colony, in order to decrease the colonies. Also, there was six inches of rainfall the following week after treatment. This could have diluted and reduced the amount of chemical remaining in the soil, so the fire ants were less likely to be killed via direct contact. Future trials should be scheduled to evaluate such factors.

Table 1. Treatment block assignments based upon plot length.

Plot Number	Plot Length (ft)	Treatment
23, 5, 3, 9	34, 30, 24, 13	Untreated Control (1 gal water)
29, 17, 16, 7	46, 29, 27, 11	D-Limonene (5 fl oz/gal water)
24, 4, 6, 11	34, 30, 27, 12	Safer Soap/Orange Oil (1.5 fl oz/2 fl oz/gal water)
1, 21, 22, 14	41.5, 30, 22, 20	Safer Soap/Orange Oil (1.5 fl oz/1 fl oz/gal water)
2, 13, 12, 8	32, 32, 22, 21	Dawn Soap/Orange Oil (1.5 fl oz/1 fl oz/gal water)
32, 18, 15, 10	48, 29, 22, 15	QRD 400 (1 fl oz/gal water)

Table 2. Mean number of active red imported fire ant mounds found at 2, 7, 14 and 30 days post treatment in Lucas, TX.

Treatment	2 Days	7 Days	14 days	30 Days
Untreated Control	5.00d	4.75d	4.75d	4.75c
Dawn Soap/Orange Oil	4.00cd	3.25c	3.50bc	3.25b
D-Limonene	2.00b	1.50ab	1.50a	1.25a
QRD 400	3.50c	1.50ab	1.50a	1.25a
Safer Soap/Orange Oil (1.5-1)	3.00bc	2.50bc	2.25ab	2.25ab
Safer Soap/Orange Oil (1.5-2)	0.50a	0.75a	1.25a	1.50a

^aMeans 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).

Literature Cited

Drees, B. M. And L. Lennon. 1998. A review of "organic" and other alternative methods for fire ant control. Fire Ant Plan Fact Sheet FAPFS012. Texas Imported Fire Ant Research & Management Project, Texas A&M University System, College Station, Texas. 8 pp.

Engler, K., B.M. Drees, and M. Barton. 2005. Effects of organic Texas Two Step Method compared to individual mound treatments with spinosad fire ant bait. Red Imported Fire Ant Applied Research and Demonstration Reports 2003-2004. Texas Cooperative Extension, College Station, TX 11-14. <http://fireant.tamu.edu>.

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