

## EVALUATION OF “ORGANIC” PRODUCTS AND HOME REMEDIES TO ELIMINATE RED IMPORTED FIRE ANT COLONIES

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Interest in home remedies and “organic” treatments for the red imported fire ant, *Solenopsis invicta* Buren, remains high. A number of home remedies such as soap solutions (Roberts 1987) and instant grits (Garrett, 1993) have been proposed or supported with anecdotal observations. However, few have actually been scientifically evaluated in formal field trials. Some products (Erath Earth Orange Oil, Erath Earth Gathering and Holding co., Hico, TX and Ridants®, CedarCide Industries, Inc., Spring, TX) are not pesticides registered by the Environmental Protection Agency (EPA), but are sold as “elixirs relating to plants and insects” or are promoted to control fire ants while claiming to be exempt from registration. The 25(b) clause of the Fungicide, Insecticide Rodenticide Act (FIFRA) allows products containing certain food grade active ingredients and inert ingredients to be exempt from FIFRA, which requires EPA registration provided they are approved for sale in Texas by the Texas Department of Agriculture (TDA) and have effectiveness proven through scientific evaluations (efficacy trials).

The series of trials reported herein were conducted to generate field data to align product or treatment performance with consumer expectations. Results are not intended to provide a basis for the endorsement or recommendation for use by the Texas Imported Fire Ant Research & Management Project, the Texas Cooperative Extension or the Texas Agricultural Experiment Station at The Texas A&M University System.

### Materials and Methods

Trials were conducted on the Texas A&M University campus on grounds located near the George Bush Presidential Library. This area is regularly mowed and contained predominantly Bermuda turf grass. Plots were established by locating, and marking with field flags, sets of 10 red imported fire ant (henceforth referred to as the fire ant) mounds in areas of roughly equal widths and varying in length depending on fire ant mound density. Plot areas were calculated and arrayed from smallest to largest plot. Blocks of treatments were then established with one block (replication) containing the smallest plots, one block with medium-sized plots and one with the largest plots. This method accommodates fire ant colony movement through the course of the trial. Within each block, treatments were randomly assigned so that each trial’s treatments were replicated three times.

All treatments (**Appendix 1**) were applied from 1 gal jugs through a colander to break the flow into a gentle sprinkle to simulate a garden sprinkler. Additional mounds detected in plots at the time of treatment were marked with different colored flags to eliminate them from further evaluation.

Fire ant mounds were assessed using the minimal disturbance method, whereby mounds were disturbed with a field flag or shovel. When 12 or more fire ants emerged from the disturbed mound in a defensive reaction, the mound was considered to contain a fire ant colony. This

method was used to establish plots and to evaluate treatments periodically following application of treatments. At the later post-treatment evaluations, an effort was made to assess other active fire ant mounds within treatment plots, thereby providing data on “new” or “satellite” mounds which result from colony movement. However, due to the appearance of many “new” mounds in plots and abandonment of untreated controls in both dry and water-drenched check plots, new mounds were recorded either for occurring within a 5 ft. radius of the treated and marked mound or occurring within the plot. The new mounds closer to the treated mounds were considered more likely to represent “satellite” mounds caused by fire ant colony migration or “shattering” of colonies whereby the treated colony split into two or more “new” colonies.

Trial 1. This trial was established on September 26, 2001 ranging in size from 5,320 to 14,570 sq. ft. Treatments were applied Sept. 27 in the afternoon, when the weather was clear and the high temperature reached 82 degrees F. Treatments included:

- 1) Untreated dry check mounds
- 2) Water only - 1 gallon water per mound
- 3) Liquid dishwashing detergent - 2 fl oz (4 Tbsp) Dawn
- 4) Liquid dishwashing detergent plus orange oil - 1 fl oz (2 Tbsp) Dawn plus 1 fl oz (2 Tbsp) Erath Earth Orange Oil
- 5) Citrex™ Fire Ant Killer - below labeled rate application of 3 fl oz/gallon (the new, low rate currently pending labeling is 5 fl oz/gal, pers. com. Craig Gant)

Trial 2. Plots were established on September 26, 2001 with additional treatment plots established on Sept. 28 and Oct. 4

- 1) Untreated dry check mounds (from Trial 1). Treatments included:
- 2) Instant grits (Quaker® Instant Grits Original, The Quaker Oats Company, P. O. Box 049003, Chicago, IL 60604-9003) - 0.5 cup per mound, minimum (three plots treated Sept. 27 (I), 28 (II), and Oct. 1 (III), respectively).

Trial 3. Plots were established October 3 and 4, 2001 and treatments were applied from 10:00 a.m. to 1:00 p.m. on Oct. 4. Temperature was 86 degrees F and weather was clear. Treatments included:

1. Water, only - 1 gallon water per mound
2. Ridants® - 1 gallon Ready-To-Use drench per mound
3. CedarCide Pet, Horse & Livestock Concentrate - 1 Tbsp plus 1 tsp per gallon per mound.

In addition, five fire ant mounds were treated with TFA Super-Kill™ Fire Ant Eliminator using a sample and directions provided by the manufacturer. This treatment was not considered part of Trial 3 although mounds were drenched Oct. 4, 2001.

Data from all Trials were analyzed using analysis of variance (ANOVA) and means were separated using the Duncan’s Multiple Range Test at the 5 percent level of probability (Microstat, Ecosoft Inc., Indianapolis, IN).

## **Results**

No significant rainfall occurred until after October 5, with weather being mild (daytime high temperatures in the mid-80 and nights in the 60 degree F range) and dry. Soil moisture was fairly dry. Thereafter, rains saturated soils and brought fire ants to the surface and dramatically increasing the number of fire ant mounds in plots. In additions, many colonies in dry and water-drench control (check) plots relocated. As a result, we began recording fire ant mounds within a 5 ft radius circle of the originally treated mound.

Trial 1. Three days after treatment, all mound drench treatments, including a water-only treatment, significantly reduced numbers of active fire ant mounds relative to untreated (dry) control/check mound plot means (**Table 1**). The soap and water only treatments provided similar results as did the Citrex™ and citrus oil plus soap treatments, although the latter provided significantly better control. From 8 to 29 days after treatment, Citrex, soap and citrus oil plus soap treatments provided significant reductions of treated and marked fire ant mounds relative to both water-only and dry untreated plot means. Furthermore, when accounting for colony movement within a 5 ft radius of the treated mound site, the Citrex and citrus oil and soap treatments provided significant reductions of mound numbers. Due to the appearance of numerous “new” mounds within plots, no treatment provided significant reductions of fire ant mounds within plots 15 and 29 days following treatment.

Trial 2. Quaker® Instant Grits Original, applied at 0.5 cup per fire ant mound resulted in no significant reductions relative to untreated control (dry check) plot mean mound numbers over the 29 day duration of this trial (**Table 2**).

Trial 3. Although the number of treated and marked fire ant mounds drenched with CedarCide Pet, Horse & Livestock Concentrate were numerically reduced 1 day after treatment, the reduction was not significant (**Table 3**). Fire ant mounds treated with Ridants® were still active although the number of fire ants appeared to be dramatically reduced. Three days after treatment, the cedar oil containing products had significantly reduced active fire ant mound numbers relative to water only mound drench untreated control (check) plot means. Thereafter, new fire ant mounds appearing in plots eliminated significant differences between treatment plot fire ant mound numbers through the 29 day duration of this trial.

Interestingly, on the 15<sup>th</sup> day after treatment (October 19), the treated and marked mound site plot means for the two cedar oil products were significantly lower than untreated check plot means. However, then the number of fire ant mounds within a 5 ft radius of the marked site was analyzed, more fire ant mounds were found in cedar oil drenched plots, with significantly more in plots treated with CedarCide Pet, Horse & Livestock Concentrate. These data imply that cedar oil products are, in fact, acting primarily as insect repellent products - not contact insecticides. Treated fire ant colonies not only relocated to nearby sites, but they also split into several fire ant colonies (a phenomenon also called shattering). This site is suspected of harboring the multiple queen (polygynous) form of the fire ant which are capable of colony splitting because each mound contains more than one reproductively active queen ant.

## **Discussion**

September and October are the rainiest months of the year in College Station, Texas (**Figure 1**). At this time fire ant colonies that have been dwelling deeper in the soil and not

producing visible mounds begin to work towards the surface seeking warmer soil or escaping saturated soils from recent rains. Freshly-built mounds are evidently not stable in their location and fire ant colonies frequently move, evidently in search of better nesting sites or escaping any type of irregularity, i.e., disturbance, disease, predators, etc. Their mounds are not well constructed with “honey-comb” galleries characteristically built by ant species inclined to stay in one location for longer periods of time. However, these more transient fire ant colonies build mounds of freshly dug earth piled on top of turf grass. Thus, the strategy of locating and treating visible mounds misses the colonies dwelling underneath the soil surface, and treated colonies readily abandon mounds and produce new ones in the near vicinity.

Use of fire ant mound numbers as an indicator of fire ant populations has been brought into question, in part, because of the experience gained by conducting these three Trials. Perhaps it is better to think of fire ant mounds as bubbles in boiling water or as glass balls in a Galileo liquid thermometer which rise to the surface under specific conditions. However, as *relative* indicators of ant fire ant population levels between treatments at a given point in time, ant fire ant mound numbers can still be an appropriate measure.

Trial 1. Plant oils, as those contained in citrus peels (d-limonene), pine (turpentine) and cedar are known to contain ingredients toxic to some insects. Soaps contain surfactants that can cause direct insect mortality by suffocating or drowning pests and can also act as emulsifiers to allow oils to be mixed into water. Soaps also cut through the wax-covered insect exoskeleton allowing active ingredients in oils to penetrate and act to kill cells (cytotoxicants). This effect can be seen in the results of Trial 1 where the 2 fl oz rate of liquid dishwashing detergent eliminated fewer active ant mounds than did the treatment containing half that amount of detergent (1 fl oz) plus 1 fl. oz. orange oil.

Plant oil and soap drench treatments must directly contact the target pests in order to eliminate them. In these trials, one gallon of solution was used to treat each fire ant mound, regardless of its size. Larger fire ant mounds were less likely to have all fire ants eliminated by any of the liquid drench treatments, although the number of worker fire ants emerging from minimally disturbed mounds were far fewer in number following treatments than in water drenched or untreated (dry check) mounds. Thus, the evaluation of active or non-active mounds is a fairly stringent measure of product performance requiring virtually all fire ant activity in treated mounds to be eliminated before it was determined to be inactive.

Trial 2. Use of instant grits has been reported to eliminate fire ant colonies by users for a long time, and some people are adamant about their observations. However, the results from use of *any* fire ant mound treatment are extremely difficult to assess without conducting a replicated, statistically analyzable trial. The results of these trials have pointed to some of these difficulties. In Trial 1, even application of one gallon of tap water drenched on fire ant mounds resulted in some numerical reduction of mounds at treated sites compared to the dry untreated control (check) plot fire ant mound means (**Table 1**). This field trial provides further documentation that this home remedy is ineffective as a fire ant treatment.

Trial 3. Ridants, applied as directed, appears to repel fire ant colonies from treated sites within three days of application. However, colonies do not appear to be eliminated. When a higher concentrated cedar oil product (CedarCide Pet, Horse & Livestock Concentrate - not currently promoted for fire ant control) was used, treated fire ant mounds split as well as relocated,

resulting in more fire ant mounds near the one treated initially. Use of this product for managing fire ants should be carefully thought through. As a repellent, this product may be useful for rendering certain locations, such as potting media, temporarily fire ant free. However, resulting fire ant colony relocation and splitting following treatment makes use of these treatments unlikely for use to reduce fire ant populations.

As with any field trial to assess the effectiveness (efficacy) of fire ant control products, confidence in the results presented here can be improved by conducting additional replicated trials at different locations and times of the year.

### **Literature cited**

Garrett, H. 1993. *Texas Organic Gardening Book*. Gulf Publishing Company. Houston, Texas. (p. 140) 245 pp.).

Roberts, T. 1987. Soap solutions vs. the fire ant. *The IPM Practitioner* IX(6-7), p. 17.

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## Appendix 1. Treatment product information

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**New Fast Acting Formula Ultra Dawn Original Scent** (1.48 l (1.56 qt) or 50 fl oz. container for \$3.58). Dawn contains biodegradable anionic and nonionic surfactants and no phosphate. (Proctor & Gamble, Cincinnati, OH 45202; 800/725-3295)

**Erath Earth Orange Oil** (\$13.95/1 qt (0.95 l.; 1 to 2 oz. per gal. for foliar spray or 6 to 8 oz. per gal soil drench application rates). Cold press orange peel extract is one of the best oils for use in the preparation of organic elixirs relating to plants and insects. (Erath Earth Gathering and Holding co., Rt. 2, Box 11, Hico, TX 76457)

**Citrex™ Fire Ant Killer** (d-limonene (7.2 lbs./gal.) 78.2%; 32 fl. oz.; 8 fl. oz./gal/mound application rate). Do not disturb mound prior to applying mixture. Mix with water according to the dilution chart. Apply the mixture in the early morning before ants become active. Apply the mixture in a circular motion starting at the base of the mound and continuing to the top of the mound. Make sure fire ant mound is completely saturated. Mix only enough to use at one time. Do not store mixture overnight; avoid contact with eyes or clothing. (WARNING, EPA Reg. No. 72244-1-72440).(EnviroSafe Labs, LLC, 210 North Loop 336 East, Conroe, TX 77301; [www.envirosafelabs.com](http://www.envirosafelabs.com))

**Ridants®** (0.004 cedar oil; retail price: \$4.99/gal ready-to-use; 1 gal. (3.787 l)/mound application rate). Carefully wipe the ant mound with a long handled shovel or rake, exposing the ant eggs. This is best done in the heat of the day. Drench the mound and surrounding area with CedarCide Ridants. For greater coverage dilute 1 gallon of Ridants with 4 gallons of water (optional). To insure results, drench exposed tunnels 12 to 24 hours later. To prevent reinfestation of ants or other insects apply CedarCide Pesticide Granules in desired areas. For economical treatment of multi-acre infestations, soak 1 part CedarCide granules with 3 parts water for a 48 hour period, use the unpurified solution in the same manner described above. **This product is classified as a minimal risk pesticide by the Environmental Protection Agency of the U.S.A. ruling 40CFR 152.25 not intended for tick control.** Promotional literature statements - “Put an end to fire ants without danger to humans or animals. Apply this liquid direct or dilute it for larger mounds. Ants digest the special formula while salivating the soaked soil, a process used to repair their destroyed mound. As the worker ants become ill, reinforcements are called upon until all the ants are dead. CedarCide granules in your yard will repel ants and eliminate infestations. For large colonies of ants, we suggest brewing a batch of your own liquid from granules. Directions on bag. (Dave L. Glassel, Founder and CEO, CedarCide Industries, Inc., P. O. Box 549 Spring, TX 7783; 800/842-1464, [www.cedarcide.com](http://www.cedarcide.com))

**CedarCide Chemical Free Pure Cedar Oil Pet, Horse & Livestock Concentrate** (50% cedar oil; 1 qt container). Mix ½ pint for 25 gallons of water; dilute solutions 400 to 1 for gardening use; safe to use directly on fruit and vegetables; repels numerous insects including ants; CAUTION - avoid contact with eyes; do not take internally; wash hands with soap and water after use; keep out of reach of children. CedarCide 66/33 concentrations are approved as a minimum risk pesticide by the EPA 40CFR 152.B.)(Dave L. Glassel, Founder and CEO, CedarCide Industries, Inc., P. O. Box 549 Spring, TX 7783; 800/842-1464, [www.cedarcide.com](http://www.cedarcide.com))

**TFA Super-Kill™ Fire Ant Eliminator** (pine oil 89%; 32 fl. Oz; 5 ounces (5/8/ cup) per gallon per mound application rate) Shake well before using; pour mixture onto the ant mound starting at the perimeter and continuing in a circular motion to center of the mound; do not disturb the mound before treatment; apply product gently to avoid disturbing the ants; use one gallon of mixture per ant mound; confine mixture to the area of the ant mound in applications to lawns; product may cause browning of, or kill, grass around edges of ant mounds; for best results, use during cooler parts of the day, early to mid-morning, and not during prolonged hot and dry conditions. Precautionary statements - corrosive, causes eye damage; harmful if swallowed; causes skin irritation; do not get in eyes, on skin or clothing; wear goggles or face shield and rubber gloves when handling; wash thoroughly with soap and water after handling; do not store near heat or open flame.(TFA Products, Inc., Houston, TX 77079, DANGER, EPA Reg. No. 70072-1)

**Table 1.** Red imported fire ant mound numbers per 10 mound plot and per plot following September 27, 2001 application of an “organic” product and selected home remedy ant mound drench treatments, Brazos Co., TX.

Treatment (Sept. 27)	Area (sq. ft.)	No. active fire ant mounds/10 per plot <sup>a</sup>						
		Sept. 30 3 day	Oct. 5 8 days	Oct. 12 <sup>b</sup> 15 days	Nov. 2 <sup>b</sup> 29 days			
Check (1 gal. water)	8,304.0	7.7b	8.7a	4.0a	6.3	6.7a	7.3ab	12.0
Citrex	8,565.0	2.0c	3.3b	1.3b	5.0	1.7b	3.0c	10.3
Soap	9,437.3	6.3b	5.0b	1.0b	18.3	2.7b	4.0bc	12.7
Citrus Oil plus Soap	8,557.3	1.0c	5.0b	1.3b	5.0	1.3b	2.3c	7.3
Dry Ck	15,082	9.7a	10.0a	5.3a	31.7	7.0a	8.3a	
				22.0	8.0	15.3		
Mean Square		41.33	35.27	11.40		22.77	21.50	
F ratio		70.86	15.91	7.125		18.71		
7.049								
Probability		0.0000	0.0007	0.0095		NS	0.0004	
						NS	0.0098	
SSD 5%		1.553	3.028	2.572		NS	2.243	
						4.101	3.551	
						26.174	8.821	

d. f. = 4; n = 3

<sup>a</sup> Means in columns followed by the same letter are not significantly different using ANOVA and separated using the Duncan’s Multiple Range Test at the 5% level; NS = not significant (Microstat).

<sup>b</sup> Number of active mounds out of 10 marked and treated; indented - including the number of active mounds within 5 ft radius of treated mound considered to be “satellite” mounds; and, double indented - total number of active mounds per plot.

**Table 2.** Red imported fire ant mound numbers per 10 mound plot and per plot following September 28 through October 1, 2001 application of 0.5 cup instant grits to three of six plots, Brazos Co., TX.

Treatment		No. active fire ant mounds/10 per plot <sup>a</sup>		
		Oct. 5 8 days	Oct. 12 <sup>b</sup> 15 days	Nov. 2 <sup>b</sup> 29 days
Dry Ck	10.0	5.3	7.0 8.0 22.0	8.3 15.3
Grits	9.33	5.3	7.3 22.3	9.0 9.0 15.0

Probability	NS	NS	NS	NS
SSD 5%	1.061	4.861	4.624 16.672	1.837 4.242 2.807

d. f. = 1; n = 3

<sup>a</sup> Means in columns followed by the same letter are not significantly different using ANOVA and separated using the Duncan's Multiple Range Test at the 5% level; NS = not significant (Microstat).

<sup>b</sup> Number of active mounds out of 10 marked and treated; indented - including the number of active mounds within 5 ft radius of treated mound considered to be "satellite" mounds; and, double indented - total number of active mounds per plot.

**Table 3.** Red imported fire ant mound numbers per 10 mound plot and per plot following October 4, 2001 application of cedar oil-containing liquid drench products, Brazos Co., TX.

Treatment (Oct. 4)	Area (sq. ft.)	No. active fire ant mounds/10 per plot <sup>a</sup>											
		Oct. 5 1 day	Oct. 7 3 days	Oct. 12 <sup>b</sup> 8 days	Oct. 19 <sup>b</sup> 15 days	Nov. 2 <sup>b</sup> 29 days							
Check	4,843.3	7.0	4.3a	2.0	4.3a	6.0a	7.0	8.7b	10.3	19.7	22.0	23.7	
Ridants	3,623.3	6.7	0.7b	0.7	5.7	2.3b	10.3b	8.7	21.3	16.0	25.0	3.0ab	
Conc	4,260.0	2.7	0.3b	0.3	10.7	0.7b	15.0a	16.0	27.3	37.7	35.7		
Mean Square	–	–	14.78	--	10.11	11.44	32.3						
F ratio	–	–	11.57	--	13.00	5.71	5.71						
Probability	NS	NS	0.0217	NS	0.0178	0.0726	0.0674	NS	NS	NS	NS	NS	
SSD 5%			7.59	2.61	2.11	2.04	3.36	6.79	5.50	10.12	24.33	22.81	29.77

d. f. = 2; n = 3

<sup>a</sup> Means in columns followed by the same letter are not significantly different using ANOVA and separated using the Duncan's Multiple Range Test at the 5% level; NS = not significant (Microstat).

<sup>b</sup> Number of active mounds out of 10 marked and treated; indented - including the number of active mounds within 5 ft radius of treated mound considered to be "satellite" mounds; and, double indented - total number of active mounds per plot.

**Figure 1.** Daily mean maximum and minimum temperatures and daily mean precipitation, College Station, TX

