Texas Imported Fire Ant Research & Management Project

RED IMPORTED FIRE ANT MANAGEMENT APPLIED RESEARCH AND DEMONSTRATION REPORTS 1997-2001

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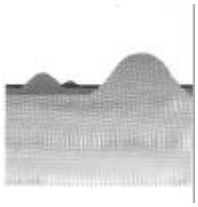

RED IMPORTED FIRE ANT MANAGEMENT APPLIED RESEARCH AND DEMONSTRATION REPORTS 1997-2001

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Foreword

This handbook includes 23 reports of applied research, result and method demonstrations conducted by faculty and staff of the Texas Cooperative Extension (previously the Texas Agricultural Extension Service or TAEX). Minimal editing of submitted reports by Bastiaan M. Drees, Professor and Extension Entomologist and Coordinator of the Texas Fire Ant Research & Management Project, made these reports somewhat uniform. Not all field and laboratory trials reported herein were conducted by personnel or funded directly by the Texas Fire Ant Project. Reports were compiled to depict as a broader representation of red imported fire ant research and Extension activities within the Texas A&M University Systems's Texas Cooperative Extension.

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Control of Imported Fire Ant Colonies by Field Removal

Bastiaan M. Drees, Professor and Extension Entomologist

In "The Texas Two-Step Method: Do-it-yourself Fire Ant Control for Homes and Neighborhoods" (Merchant and Drees, 2000, L-5070, Texas Agricultural Extension Service, Texas A&M University) and some popular magazines (Organic Gardening, April 2001), one non-chemical control option discussed encourages people to remove fire ant colonies by digging them up and then placing them in a bucket containing soapy water to drown the ants. This trial was conducted to determine if this method actually eliminates field colonies from the landscape as a method of imported fire ant control.

Materials and Methods

Four pairs of plots of various sizes were established, November 15, 2000 (150 by 15 ft. or 2,250 sq. ft. pair; 30 by 30 ft. or 900 sq. ft. pair; 39 by 48 ft. or 1,872 sq. ft. pair; and 75 by 75 ft. or 5,625 sq. ft. pair). Each plot contained 6 red imported fire ant mounds. In one of each pair of plots, ant colonies were removed by shoveling them into a 5 gallon plastic bucket until all visible brood and most of the worker ants had been eliminated from the field location. Colonies in the other pair of plots was slightly disturbed to determine ant activity and presence of brood (larval and pupal stages). All ant mound sites were marked for later observation. At 5, 11, 19, 35 and 51 days (Nov. 20, 26, Dec. 4, 20, 2000 and Jan. 5, 2001) after establishing this trial, marked mound sites were monitored for ant mounding activity to determine if colonies had been successfully removed from the field. On Nov. 22, 2000 due to the many active ant mounds in plots where colonies were removed, an effort was made to physically remove even more of the colonies remaining.

Data were analyzed using the Student's *t* test ($P \leq 0.05$) to compare mean numbers of imported fire ant mounds from "dug" versus control plots and "new" mounds appearing within treatment plots for each post-treatment evaluation date and for of these dates combined. Percent "control" was calculated for each evaluation date by dividing the number of ant active mounds from treated ("dug") plot means by active mound numbers in untreated plots, subtraction the total from 1 and multiplying by 100. Similarly, percent change in the number of "new" ant mounds detected in each plot was calculated, and finally the percent change was calculated for the "total" ant mound per plot means.

Results and Discussion

Field Removal: This trial was conducted during a period of cool temperatures, with several night temperatures approaching freezing during previous nights, and the temperature of the day this trial was established was less than 60 degrees F and overcast. Two of the plots were established in morning hours (8:30 to 9:45 a.m.), and two were established in the afternoon (2:30 to 4:00 p.m.). Colonies removed from the field were either taken into the laboratory for further studies or placed into a single pile 150 ft. from any of the plot sites. One colony removed from the

field was drowned in soapy water as described below.

To remove imported fire ant colonies from the field without being stung in the process is a challenge and a concern for anyone trying to follow directions for this "control method." With temperatures below 60 degrees, the cold-blooded ants move much more slowly. To prepare to dig colonies, protective clothing, such as rubber gloves and boots, liberally dusted with baby powder (corn starch or talcum), reduces the probability of being stung by "angry" worker ants. The shovel handle and inner surface of the 5-gallon bucket were also dusted with baby powder using a large ball of cotton to apply the dust. Fire ant workers can not crawl up vertical surfaces dusted with baby powder as long as the powder remains dry and in place.

After identifying active ant mounds, they were removed by digging them from the soil and placing the ant-containing soil into the 5-gallon bucket. In the case of small to medium sized ant mounds (4-6 inches in diameter), only ½ to 3/4 of the bucket was filled with soil. In the case of large mounds (12 to 18 inches in diameter), ant-containing soil filled the bucket or required two buckets-full to remove the field colony. Because temperatures had been cool, ants and brood were found to be deep in the soil, with "pockets" of brood being found 6 to 9 inches below soil level. During warmer, sunny periods, brood and ants would be expected to be closer to the mound surface and colonies easier to remove. However, they would be moving much faster, increasing the probability of being stung. Data from the 5 day "post-treatment" evaluation indicated most sites from which ant colonies were dug still had ant colony activity. Therefore, a second attempt was made to remove ant-containing dirt from the site. The diameters and depths of holes dug to remove ants were measured on the day the trial was terminated, January 5, 2000, and averaged 17.2 inches wide by 6.4 inches deep (per plot: 13.3 inches wide by 5.2 inches deep; 17.5 by 7.6; 20.8 by 6.7; 17.2 by 6.2), with a range from 10 to 24 inches wide and 4 to 10 inches deep.

"Drowning ants": To "drown" ant colonies, 2.5 gallons of water were added to a second 5-gallon bucket and 6 fl. oz. Dawn liquid dishwashing (2 fl. oz. per gallon detergent was added and stirred. The soapy water was then added to the ant-and-soil-containing bucket. This technique eliminated sloshing or splashing of water and allowed the proper amount of soapy water to be added to whatever volume of ant-containing-soil was in the bucket. Ant activity was eliminated within a matter of minutes using this technique, as expected.

Control of Field Colonies by Digging and Removal: Five days (Nov. 20, 3:15 p.m.) from removal of ant colonies, plots were inspected (**Table 1**). Rain and cool nights, near freezing, had occurred during this period. However, high temperatures in the afternoon were in the low 60's. In most sites, ants and brood were seen nesting on the upper, sun-lit, edge of the hole. In only a few sites where mounds had been removed ants were not present. Presence of queen ants was not determined. Plots in sandier soil with larger colonies had more active mounds. In heavy black clay plots with smaller (>6 inch diameter) mounds, less ant activity was noted. Evidently, a single attempt at field removal of colonies on a cool day was not very successful.

Throughout the 51 day monitoring period, percent "control" of ant mounds dug out of field plots ranged between 8.6 and 43.4 percent (**Table 1**), although the sites from which colonies were removed did appear to have far fewer ants than were associated with untreated ant colony sites. No significant differences were found between treatments ("dug" versus untreated) for any date except on the 5 day post-treatment date (3.50 ± 1.73 "dug" versus 5.50 ± 0.58 "untreated check"; $t = -2/1909$; $P = 0.0355$; d. f. = 6). For the analysis of data for all post-treatment sampling

dates, were was a statistically significant 27.9 percent reduction of ant mound numbers per plot between "dug" (3.75 $\pm$ 1.80) versus "untreated check" (5.20 $\pm$ 0.6959) (t = -3/3667; P = 0.0009; d. f. = 38). Although not significantly different, there were generally, more "new" ant mounds observed in plots from which colonies were removed throughout this period (ranging from 13.3 to 46.5 percent more "new" ant colonies), suggesting that ants remaining after their colonies were disturbed by digging most likely moved to a new, nearby site to construct a new, "satellite" ant mound. As a result, the actual "control" of imported fire ant colonies per unit area ("total" of treated or dug plus "new" ant colonies) ranged from 14.1 percent reduction to a 12.8 percent increase in colony numbers over the monitoring period.

These results do not support a management suggestion for physical removal of imported fire ant colonies from the field by shoveling them into a bucket as a non-chemical control method, whether one drowns the ants after collection or not. Different results could be obtained if this trial were to be repeated at a different time of the year, under different environmental conditions or in sites with different soil types or ant forms (the ants in these sites were assumed to be the polygyne or multiple queen form of the red imported fire ant).

Despite care taken to avoid being stung by the ants, this researcher experienced some stings in carrying out this trial. Therefore, this method of "control" should be discouraged by anyone with a sensitivity to insect stings and venom.

Table 1. Elimination of red imported fire ant from field plots by shoveling ant mounds into a 5-gallon plastic bucket, Brazos Co., Texas, on Nov. 15, 2000.

	Fire ant mounds per field plot/6 ant mounds (replicated 4 times) Days following colony removal					
	Pre-Nov. 15	5 days Nov. 20	11 days Nov. 26	19 days Dec. 4	35 days Dec. 20	51 days Jan.5, 2001
Field removal	6	5.3	3.5	3.0	3.8	3.3
"New" mounds -	0	1.3	4.3	5.3	7.5	4.8
Total	6	6.6	7.8	8.3	11.3	8.1
Untreated	6	5.8	5.3	5.3	5.0	4.5
"New" mounds -	0	1.3	2.3	4.5	5.3	3.8
Total	6	7.1	7.3	9.8	10.3	8.3
Percent "Control"						
Treated mounds	-	8.6%	34.0%	43.4%	24.0%	26.7%
"New mounds"	-	0.0	-46.5	-15.1	-13.3	-20.8
Total	-	14.1	-12.8	10.2	-8.8	12.0

*Re-dug colonies, Nov. 22

Laboratory Assay of Effect of Instant Grits and Malt-O-Meal for Imported Fire Ant Control

Bastiaan M. Drees, Professor and Extension Entomologist

Use of instant grits or similar products has been a home remedy for attempted red imported fire ant control throughout the Southeastern United States. The practice has become fairly common and those using the technique have reported good results so frequently that the practice has become recommended by certain organic gardeners and practitioners (H. Garret. 1993. Texas Organic Gardening Book. Gulf Publishing Company. Houston, Texas. (p. 140) 245 pp.). This laboratory study was undertaken to develop some scientific data regarding the effects of instant grits and Malt-O-Meal in fire ant colonies.

Filtering capacity of ants. "Solids are inevitably consumed by worker ants during grooming as well as foraging, but are excluded from the ants' liquid diet before food is ingested. The unique filtering capability is facilitated by two structures that have evolved to become integral parts of the ants' alimentary tract. The buccal tube (BT) is a narrow passageway, lined with setae (hairs), leading from the oral cavity to the pharynx. Particles that are too large to pass through the BT are retained within a ventral infolding of the oral cavity, the infrabuccal pocket (IBP). If particles of a specific size are fed to an ant and the number of particles recovered from its IBP is divided by the total number of particles recovered from both the IBP and the crop, the resulting ratio provides an estimate of the ant's filtering effectiveness at that particle size. Matrix-bound, micro-encapsulated, or microbial control agents whose delayed mode of action requires ingestion would be unlikely candidates as potential formicides for ant species who could, due to particle size, exclude them from their diet." The red imported fire ant workers are extremely effective at excluding 82 percent of 0.2µm diameter microspheres from a sugar water solution. At diameters of 0.5 and 0.75µm, workers filtered 98 and >99 percent of microshpheres, respectively. No microspheres with a diameter of 1.0 or 1.8µm were recovered from the crop of any worker (From: John M. Petti. 1997. "A comparison of food filtering efficiency in workers of the red imported fire ant, Pharoah ant, and Florida carpenter ant", pp. 97-98, *in* Proceedings of the 1997 Imported Fire Ant Research Conference", Gainesville, FL).

Materials and Methods

This trial was initiated on November 15, 2000, when twelve red imported fire ant colonies were dug from field locations into 5-gallon plastic buckets. The inner surfaces of the buckets and shovel handle had been liberally dusted with baby powder to prevent ants from climbing up the vertical surfaces to escape. Colonies were placed in the laboratory and maintained at room temperature throughout the duration of this trial. After colonies in buckets had been given a day to establish in he bucket, four colonies each were given either instant grits, Malt-O-Meal or nothing (untreated control). Colonies were monitored 1, 2, 5, 7, 11, 19 days (Nov. 16, 17, 20, 22, 26, Dec. 4) following treatment to determine if colonies were active and surviving.

Results and Discussion

By using this laboratory assay method, results are replicated (4 times), and were conducted at room temperature to overcome cooler outdoor conditions at that time of year which would have reduced ant foraging on the "bait" treatment particles. In addition, ant colonies could not migrate or move away from the treatment site, which is a problem in field trials when determining if a colony perished or merely re-located. Field studies, however, during warmer climactic conditions should be conducted to confirm these laboratory observations.

Examination of colonies at the five-day inspection confirmed that the two replicates of colonies dug in an area of heavy black clay soil were all very weak and small. They were each provided a tube of water. Each colony was given two seafood-flavored seafood pellets (Tender Vitals®). Ants from colonies dug in sandier soil continued to actively move soil, building up "mounds" housed in buckets.

On Nov. 26, ants in one bucket treated with grits, collected from black clay soil, appeared to have declining activity. All colonies dug from that substrate (2 replicates) showed less activity than ants collected from sandier soil. At the end of the trial, ant colonies in buckets were returned to the field and soil was examined for presence of ants and developing stages (larvae and pupae). All twelve colonies were found to be alive and were producing at least some brood. However, food particles were found throughout the soil profile, indicating that, indeed, the foraging worker ants retrieved the particles and brought them into the nest. Because no colony was eliminated by either treatment, no statistical analysis was conducted on these data.

Results of this no-choice, laboratory study do not support use of instant grits or Malt-O-Meal as an effective treatment for eliminating colonies of the red imported fire ant.

Table 1. Red imported fire ant colony survival after receiving 1 cup Malt-O-Meal, instant grits or no treatment (1 = live colony).

	Date	
Treatment	Nov. 15 (0 days)	Nov. 16, 17, 20, 22, 26, Dec. 4 (1, 2, 5, 7,11,19 days)
Malt-O-Meal	1,1,1,1	1,1,1,1
Instant grits	1,1,1,1	1,1,1,1
Untreated	1,1,1,1	1,1,1,1

Comparison of Organic Products Against Individual Red Imported Fire Ant Mounds

John Brannen, Global Organic Resources
Cooperator
Nathan L. Riggs, Extension Agent - IPM Bexar County

Summary: Four products produced by the Global Organic Resources Company were compared with Ortho® Ant Stop Orthene® Fire Ant Killer and Gardenville's Orange Oil Fire Ant Killer against individual Red Imported Fire Ant mounds in a non-replicated test. All gave excellent control of mounds within 48 hrs after treatment. At one and three weeks after treatment, all treatments had reduced the number of active treated mounds by 100 percent. The costs per mound ranged from ~$0.19 for Orthene® dust to ~$2.40 for Gardenville's Fire Ant product.

Problem and Objective

Red imported fire ants, *Solenopsis invicta* Buren, cause an estimated $16 million per year in various costs in Bexar County. There are many methods and products available to the average homeowner for managing fire ant problems in the landscape. However, there is a growing demand from homeowners for more "organic" strategies to allow them to battle fire ants in their lawns and gardens. This demonstration was designed to compare some new organic-type fire ant products against those available at the present time (Orthene® dust, Gardenville Orange Oil Fire Ant Killer, Organic Solutions Multipurpose Fire Ant Killer).

Materials and Methods

Groups of 10 red imported fire ant mounds were flagged and assigned to one of 7 treatments (**Table 1**) including an untreated control group. The test site was located in west Bexar County at the Brannen homestead. Mounds were treated on July 19 in the late afternoon with a temperature of 90ºF and dry conditions. Mounds were located in black soil with a caliche base. All mounds were active prior to treatment. Mounds treated with Orthene® dust received 2 teaspoons of material without water, the Gardenville group received 6 oz of product per gallon of water, the 4 Organic Resources products were prepared at 4 TB of product per gallon of water, and the untreated mounds received 1 gallon of fresh water each.

Mound evaluations were made at 24 and 48 hours, and 1 and 4 weeks after treatment. In addition to mound evaluations, mounds were inspected for evidence of new, "satellite" mound formation within 12-18" of the original treated mound. Gardenville and untreated mounds received one gallon of water or solution from a watering can. Mounds treated with Organic Resources products were treated with 1 gallon of solution pumped from either a gasoline or battery powered sprayer attached to a tank on a small trailer. Treatments were not replicated.

Results and Discussion

Results for all evaluations are given in **Table 2**. All of the materials tested gave 100 percent control of fire ant mounds within 1 week of treatment. "Satellite" mounds were seen forming at 24 and 48 hours post treatment (PT) in all groups except untreated and Orthene® dust. One "satellite" mound in the Gardenville group remained active throughout the duration of the demonstration. The remaining "satellite" mounds appeared to be inactive after the 1 week evaluation. During treatment of the Diatect Results group, the application pump malfunctioned consequently reducing the amount of material applied to one large fire ant mound.

These results present a relatively inexpensive and effective means for the average homeowner to manage fire ant problems in their lawns and gardens. These results provide efficacy data for additional weapons in the vast arsenal available to homeowners to battle fire ants.

Acknowledgments

We would like to thank the Brannen family for providing the products, test site, and sponsorship for this demonstration, and Dr. Charles Barr, Extension Program Specialist for his assistance in beginning this experiment.

Table 1. Test materials, treatment doses, and allocations

Treatment	Ingredients	Dose Level	LD_{50}
Untreated	**Water**	**1 gallon**	**NA**
Gardenville Fire Ant Killer (**Note:** this product is not an EPA registered insecticide)	30% orange oil, 70% manure compost tea	6oz/gallon	>5000 mg/kg
Orthene® dust (50 WP)	acephate + inert ingredients	2 teaspoons	980 mg/kg
Organic Solutions Fire Ant Killer	0.1% pyrethrins + 1% piperonyl butoxide (PBO)+ 85% diatomaceous earth (DE) + inert ingredients	4TB/gallon	>5000 mg/kg
Organic Resources Multipurpose Fire Ant Killer I	0.2% pyrethrins + 1% PBO + 85% DE + surfactant + inert ingredients	4TB/gallon	>5000 mg/kg
Organic Resources Multipurpose Fire Ant Killer II	0.2% allethrin + 1% PBO + 85% DE + surfactant + inert ingredients	4TB/gallon	>5000 mg/kg
Diatect Results	0.2% pyrethrins + 85% DE + inert ingredients	4TB/gallon	>5000 mg/kg