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# ALTERNATIVE RED IMPORTED FIRE ANT CONTROL METHOD AND RESULT DEMONSTRATION

When it comes to killing fire ants, American ingenuity is alive and well - particularly in Texas. Currently there are several new methods on the market for the control of red imported fire ant (Solenopsis invicta Buren). These products are unique in several ways. First, several of them do not use insecticides but rather employ electricity or water to kill ants. Second, several of the new devices are intended for the equipment leasing and service markets rather than for homeowner use. Thus, although they may be initially expensive, their cost over time for killing fire ants in mounds may make these products competitive.

Historically, the first non-chemical fire ant control product was the McCoy Ant Stomper (advertized in the Progressive Farmer, 1978). This device was a windmill. As wind activated the windmill, the windmill turned a crank than operated a vibrating plate (stomper). When placed on top of a fire ant mound, the agitation of the mound by the stomper was thought to be unfavorable for the ants in the mound, causing them to migrate to a new location. This devise was based on a concept similar to that behind periodic disturbance of mounds with a shovel or other implement (i.e. lawn mower adjusted to a low setting) to force mounds to move to other, less disturbed areas. Although the McCoy Ant Stomper is no longer available, the distinction between any action which makes mounds move as opposed to actually killing a colony is still a difficult one to make. Careful experimental design and treatment or mapping of all mounds in an area is required to prove that a product is actually eliminating mounds.

Another device marketed recently was called the "Exterminator" (J&L Marketing). This device used a cartridge containing two explosive and burning elements placed on the end of an exterminating rod. The rod was inserted into the hill, creating a blast in the queens chamber that destroyed the entire colony. No data concerning the efficacy of safety of this device has been published.

The Texas Agricultural Extension Service has primarily conducted result demonstrations with insecticide products registered by the Environmental Protection Agency and the Texas Department of Agriculture. A report entitled, "Red imported fire ant control result demonstrations, 1979-1986" includes 43 reports documenting the effectiveness of numerous products containing one or more of 20 different active ingredients. This report also includes results of field trials using the straw itch or Pymotes mites currently on the market billed as "fire mites" and advertized as a biological method of fire ant control. These mites have not been found to be effective in eliminating fire ant mounds.

Biological control agents and devices currently on the market for the treatment of red imported fire ant mounds are not required to be registered by the EPA as long as there is no chemical insecticide involved. Therefore, efficacy data for these devices has not been generated by public agencies such as universities or the Extension Service. This result demonstration is designed to test the performance of several of the new (non-chemical) mechanical control devices and one method of applying a vaporized form of an insecticide (resmethrin).

Results of demonstration efforts are used to formulate management recommendations. These are published by TAEX, in a publication entitled, "Fire ants and their control" (B-1536), which can be obtained through the Department of Agricultural Communications at Texas A&M University or by visiting your county agent. This publication lists over 66 products currently registered for control of red imported fire ants and their nests. Products and other methods of control vary greatly in cost, environmental impact, labor involved in application, mode and speed of action and effectiveness. Because there are so many alternatives, there is a great deal of misunderstanding on the part of the general public as to product performance. The educational programs conducted by the Texas Agricultural Extension Service are designed to document product performance, enabling the user to have realistic expectations from investments made for fire ant suppression efforts.

## MATERIALS AND METHODS

Four techniques for eliminating ant activity in mounds were evaluated in this result demonstration:

1. The Yaard-Vark™, donated for experimentation by J. R. McCracken of Bryan, Texas, son of the inventor, uses 10 watts of electricity to electrocute ants attempting to crawl up the device past a wire coil similar to a miniature "bug zapper". The literature with the product claims that the ants' behavior is altered so that the ants "attack one another" and "fight each other to the death". This claim has not been scientifically proven. Although the instructions state that the device should be left in the mound three hours or more until ant activity ceases, Mr. McCracken suggested leaving the device in each mound for 15 to 20 minutes, probing it into several locations within the mound during that period. This treatment is used to "traumatize" the ants producing inactive colonies within 1-2 days (Pers. comm.).

2. The Anster™, developed and promoted by John C. Connolly of the Antser, Inc., is a mechanical devise using a two-cycle engine to rotate prongs or blades arranged to churn the soil of the mound, physically disrupting ants. Water is added during the agitation process, and the resulting slurry encases remaining ants in water-saturated mound medium. This device is being developed for the service sector (Private pest control operators) and/or the lease/rental market.

3. Ant Fire, Inc. has developed a device, called the Earthfire® Injection System, that vaporizes the insecticide, resmethrin (Earthfire®), to fumigate fire ant mounds. Resmethrin is a rapid knockdown product with no little or residual activity. It has a relatively low order of toxicity to mammals. This device is being developed for the service sector (Private pest control operators) and/or the lease/rental market.

4. The hot water method is probably the oldest tactic used to eliminate fire ant mounds. Recent reports in the scientific literature (Tschinkel and Howard, 1980) reported that 3 gal of hot water (90$^{o}$ C) produced about 60% control of treated mounds. In this trial, mounds were treated using a water heating device rented from Hotsy of Houston to treat mounds with 2-3 gal of very hot (+170$^{o}$ F) water.

Prior to treatment, a random sample of 30 mounds in the testing area were measured, with height and width recorded. Mounds were numerous (probably of the multiple queen or polygynous type). Mounds were 10.03 ($\pm$ 3.91 SD) inches in diameter and 2.43 ($\pm$ 0.98) tall (N = 30). Soil at the pasture site selected was sandy.

During treatments, the time required for each of the devices/methods to treat each mound was recorded for a sample of mounds treated. Results of these treatments for the Earth Fire and Antser devices was subjected to a Student's t test to determine differences in required to treat each mound.

Each device was used to treat a minimum of 30 marked and staked red imported fire ant mounds, May 27, 1987. An additional set of 30 mounds were marked but left untreated as a control group. Mounds were inspected 7 and 21 days after treatment and rated for ant activity as either active or inactive. Mounds were considered active if worker ants displayed defensive behavior when the marked mounds were minimally disturbed. The presence of a few worker ants was not considered to indicate the presence of an active colony, and thus although noted, these mounds were analyzed as inactive mounds. Conditions in the area of treated mounds were also evaluated for phytotoxicity to vegetation and physical disturbance. During evaluation periods, the existence of "new" mounds within 3 ft of the treated mound were assumed to be satellite mounds resulting from surviving ants in the treated mound selecting a new mound site. Certainly, the possibility exists that some of these "satellite" mounds migrated close to treated mounds from other locations.

Rainfall, monitored during the treatment and evaluation period, was heavy (Table 1), flooding portions of areas containing treated mounds. These areas were abandoned and evaluations continued in areas where flooding did not occur.

For analysis, mound evaluations for each of the treatment and control groups were divided into five consecutive sets of five mounds each (Note: Although a minimum of 30 mounds were treated with each method or device, flooding conditions due to heavy rains prohibited all originally-treated mounds from being evaluated). Percent active mounds and percent of mounds with satellite mounds within a three-foot radius were calculated for each set. The resulting percent values were subjected to an analysis of variance using the Least Significant Difference test at the $P \leq 0.05$ level for each post-treatment evaluation date. Unfortunately, the 7-day post-treatment data for Earthfire was misplaced, and the analysis was performed with existing data.

## RESULTS AND DISCUSSION

The Yaard-vark required 30 minutes to treat each mound. Five devices were operating simultaneously using a portable generator, and thus treatment of 30 mounds required 3 hours (15 hours if only one device had been available). The Earthfire injection system required significantly less time to treat each mound than did the Antser, requiring 33.36 ($\pm$ 9.42) vs 44.55 ($\pm$ 4.16) seconds per mound (N = 22 and 11, respectively, D.F. = 31, t = -3.776; P = .0004). Hot water treatments were not timed since the water source was located remotely from the treatment site and individual five gallon buckets of hot water needed to be delivered via pickup truck. Producing large quantities of hot water is an obstacle for the practice large-scale use of this method.

All treatments produced an almost immediate effect of ants in mounds except the Yaard-vark. This device did produce a ring of dead ants at the base of the device while it was inserted into the mound. However, the number of mounds rendered inactive using this tool was not significantly different from those in the untreated sets of mounds throughout the observation period (Table 1).

The Antser produced 12 inch diameter circle of water-saturated mud, having obliterated all vegetation. Shortly following treatment, ants could be seen within the slurry attempting to rebuild the mound. The Earthfire Injection System eliminated all activity in treated mounds within several minutes of application. The use of this system is accompanied with a distinctive odor of the vaporized insecticide formulation. This odor was somewhat persistent, being detected in some of the treated mounds 21 days after application. At both post- treatment evaluation periods, grass around some treated mounds was yellow, indicating some phytotoxic reaction to the treatment. Hot water eliminated ant activity wherever ground was thoroughly soaked. This treatment also killed vegetation that was drenched. After 21 days, treated mounds could easily be spotted because they were surrounded by dead grass.

On the 7 and 21 day post-treatment evaluation dates, the percent of active mounds in sets treated with the Antser and hot water were found to be significantly lower than those of the untreated and Yaard-vark treated mounds, having achieved 80 to 96 percent control of ants colonies in treated mounds. However, the number of satellite mounds occurring in association with these treatments was significantly greater than those associated with the untreated mound sets, except for the hot water treated mounds at the 21 post-treatment evaluation date, ranging from 40 to 68 percent. Thus, "percent control" in the area treated with these methods may be less than that expressed by the percent elimination of ant activity in individually treated mounds when the presence of satellite mounds is taken into consideration.

Satellite mounds are commonly formed by surviving worker ants and may persist for several weeks until the worker ants perish. However, if the queen(s) and brood survive initial treatment as well, satellite mounds can persist and form new permanent mounds. Although brood was detected in some of the satellite mounds, their long-term survival was not monitored.

The Earthfire Injection System treatments resulted in a statistically significant reduction of 84 percent in mound activity relative to the untreated mound sets, but similar to reductions resulting from treatments with hot water or the Antser. Sixteen percent of the Earthfire treated mounds

where found to be associated with satellite mounds 21 days after treatment but this value was not significantly different from that of the untreated mounds. Results of this treatment are statistically similar to those produced by the application of hot water.

In summary, these results should be considered to be preliminary. These methods or devices need to be tested under various conditions, including different soil types (clay) and environmental conditions (different times of the year) before their actual performance can be adequately documented. Excessive rainfall during the observation period may have confounded these results, causing an increase in the normal rate of colony migration and satellite mound formation.

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Tschinkel, W.R. and D.F. Howard. 1980. A simple, non-toxic home remedy against fire ants. Georgia Entomol. Soc. 15(1):102-105.

**Table 1. Rainfall in Harris County, Texas, from May 17 through June 17, 1987.**

| Date | Inches | Date | Inches |
|---|---|---|---|
| May 17 | 1.02 | June 9 | 0.87 |
| 20 | 0.05 | 10 | 3.35 |
| 24 | 0.41 | 11 | trace |
| 30 | 2.40 | 12 | 1.75 |
| June 3 | 0.22 | 13 | 1.95 |
| 4 | 0.25 | 14 | trace |
| 5 | 0.10 | 17 | 1.00 |

**Table 2. Percent active red imported fire ant mounds and percent treated mounds with satellite (newly established) mounds within a 3 ft radius, 7 and 21 days after application of alternate fire ant control devices or methods, Harris County, Texas, May 27,1987.**

| | --% active mounds-- | | % mounds with satellites | |
|---|---|---|---|---|
| Treatment | 7 days | 21 days | 7 days | 21 days |
| Untreated | 96.00a | 60.00a | 0.00c | 20.00b |
| Yaard-vark™ | 96.00a | 72.00a | 20.00bc | 8.00b |
| Hot water | 20.00b | 20.00b | 40.00ab | 32.00ab |
| Antser™ | 8.00b | 4.00b | 68.00a | 46.00a |
| Earthfire® (resmethrin) Injection System | --- | 16.00b | --- | 16.00b |

[1/] Means in columns followed by different letters in columns indicate significant difference according to the Least Significant Difference test at $P \leq 0.05$.