# EVALUATION OF AN ALIPHATIC PETROLEUM HYDROCARBON, WORKS WELL, AS AN INDIVIDUAL RED IMPORTED FIRE ANT MOUND TREATMENT

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Works Well, a product consisting largely of short-chain, aliphatic petroleum hydrocarbons (APH), was evaluated as a potential liquid fumigant treatment for individual mounds of the red imported fire ant, *Solenopsis invicta* Buren. Historically, 1,1,1 trichloroethane, sold as MC-96, was available as a quick kill liquid fumigant product. However, this pesticide was discontinued due to the ozone depletion properties of the active ingredient. Few products remain that can provide a quick knockdown of ant activity in treated colonies.

## Materials and Methods

The trial was initiated, 6 February 1995 behind the earthen dam of Somerville Lake, Burleson County, Texas. The area is controlled by the U.S. Army Corps of Engineers and access is limited to authorized personnel. The soil is well drained sandy clay with covering vegetation of native bunch grasses and, at the time of treatment, patches of clover. The area was mowed the previous fall, but there was little regrowth of grasses at test initiation. Three treatments were evaluated: 1) Untreated control; 2) Works Well (APH) at a rate of 4 fl. oz. per mound (2 oz. in a punched hole, 2 oz. sprinkled on mound; 4 oz. or 114 ml., total); and 3) Orthene® Fire Ant Killer (75% acephate) at a rate of 2 tsp. per mound, was applied on top of each mound.

A strip, 30 feet wide and indeterminate length was marked with surveyor's flags. Beginning at one end of the strip, the ground was surveyed and all active fire ant mounds marked with a surveyor's flag until 10 were marked. This process was repeated using alternating colors of flags until 12 sets of 10 mounds were marked. Each set of 10 mounds was considered a plot. Numbered flags (1-12) were placed at the plot edges and the lengths of the plots recorded. The plot lengths were ordered from longest to shortest and grouped into 4 sets of 3 plots each. Treatments were randomly assigned to specific plots within sets by drawing slips of paper from a container.

Works Well was measured into a graduated cylinder. Using a piece of aluminum tubing provided by the manufacturer, a hole was punched into the center of each mound until firm resistance was met. Approximately half the Works Well was poured down the hole, with the remainder sprinkled across the mound surface. This procedure was used on 3 of the 4 plots. No hole was punched in the 10 mounds of the remaining plot as the procedure was rather awkward and appeared unnecessary given the rapid absorption of the product into the soil.

Evaluations were conducted before and periodically after treatment (0, 48 hrs., 8, 15, 28, and 32 days; 6, 8, 14, 21 Feb., 6, 10 April, respectively) using the minimal disturbance technique.

Mounds were lightly struck with a sharpened tool handle and if 15-20 ants came to the surface in a defensive reaction within 30 seconds, a mound was considered active. The plots were mowed immediately after the one month evaluation to aid in the spotting of satellite mounds. Five days were allowed between mowing and the final evaluation to allow for mound rebuilding. Since mound building can be considered a sign of a "healthy", active mound, the marked mounds were evaluated for this characteristic as well as ant activity when the plots were surveyed for satellite mounds. Results were analyzed using PC SAS analysis of variance (ANOVA) procedure and means were separated using Tukey's Studentized Range Test ($P \leq 0.05$). Since Works Well is still in the developmental stages of product development and E.P.A. registration, notes and observations were made regarding aspects of product use.

**Results and Discussion**

The four plots containing the 40 mounds treated with Works Well occupied an area of 4185 sq. ft. (0.096 acre) or an average of 417 mounds/acre (Range: 264 - 691 mounds/acre). The total amount of material applied was 160 oz., the equivalent of 13.0 gallons/acre. (Range: 8.25 - 21.6 gallons/acre). The 4 plots containing the 40 Orthene-treated mounds occupied an area of 4,020 sq. ft. (0.092 acre) or an average of 435 mounds per acre (Range: 309 - 807 mounds/acre). The total amount of material applied was 0.313 lbs., the equivalent of 3.40 lbs./acre (Range: 2.41 - 6.30 lbs./acre).

Works Well provided a significant reduction ($P \leq 0.05$) in active mound numbers versus untreated control plots throughout the trial (**Table 1**). Works Well provided significantly quicker elimination of ant activity in treated mounds than did Orthene® Fire Ant Killer within 48 hours of application, but performed similarly 8 days and 1 month after treatment. Curiously, Works Well-treated mounds had significantly more ant activity than did Orthene treated mounds 15 days after treatment. It should be noted that Works Well-treated mounds determined to be "active" were observed to have sustained substantial levels of ant mortality. Large numbers of worker ants were placed in "bone piles" by surviving members of the colony. However, a sufficient number of ants remained so that the level of activity met the "active" criteria.

Numbers of new mounds occurring within treatment plots, referred to as "satellite" mounds, were not significantly different between treatments, although Works Well treated plots harbored numerically fewer (**Table 2**). Both Works Well and Orthene had significantly fewer total active ant mounds (treated + satellite) per plot than the untreated control. Ant activity, as judged by mound building, was significantly suppressed by both Works Well and Orthene versus the untreated mounds. Orthene treated plots, however, had numerically less ant activity, having no mound building on any treated mound.

Treatment times differed for the two products evaluated. Orthene® Fire Ant Killer was applied to 40 previously marked fire ant mounds in 9 minutes, or 13.5 seconds per mound. Conversely, 23 minutes were required to treat 30 mounds with Works Well, or 46 seconds per mound. Most of this time was spent squeezing the chemical out of the plastic bottle provided. It was also inconvenient and time consuming trying to manage three objects (chemical container, graduated

cylinder, and rod) while applying Works Well to mounds in these field plots. The petroleum distillate seemed to penetrate the mound structure quite easily with virtually no soil disturbance. Therefore, the decision was made not to punch the hole in the top of each treated mound in the fourth replicate plot (Plot 12), which was treated by slowly pouring approximately half the volume (2 fl. oz.) on one spot on top of the mound and sprinkling the rest across the mound surface as before. This procedure required 6 minutes to treat 10 mounds, or 36 seconds per mound. A savings of 10 seconds per mound. Again, the bulk of this time was spent squeezing the chemical out of the containers.

Two containers were provided by the Works Well developer. The half-gallon plastic bottle was easy to hold and ejected 3 streams of fluid, making it much faster to fill the measuring container (10-15 seconds per fill). The plastic was flexible which allowed better "pumping". However, this container was unstable in the field when placed on irregular vegetation. This was unhandy when using the rod method of application, but was not a factor when holding only two objects. Also, the 3-stream spout would make it difficult to concentrate the chemical on the mound center if not using a measuring container, but makes for faster coverage of a mound's surface. The half-gallon metal container was easy to hold and was very stable when placed on the ground. However, it's single-stream spout and relatively rigid construction made it prohibitively time-consuming to squeeze out the required amount of material (25-35 seconds per fill). Consequently, the plastic bottle was used for all treatments. It must also be noted that a half-gallon container will only treat 17 mounds at the rate used.

A few extra seconds of treatment time may seem irrelevant, but when multiplied by the number of mounds treated it can become substantial. For instance, at the minimum wage of $4.25 per hour, Orthene costs $1.59 per 100 mounds in labor. Works Well, using the "punch method" costs, $5.43 per 100, but only $4.24 per 100 using the "pour method". By comparison though, one-gallon mound drenches cost about $17.00 per 100, not including the time and logistics involved in getting 100 gallons of water to the treatment site. All these times are based on treating mounds that have been previously located and flagged. In contrast, Orthene® Fire Ant Killer, applied as a dust, is extremely easy to use and requires only a teaspoon and protective gloves to apply. The time involved in accurately measuring out the material is inconsequential. Orthene is also very inexpensive. Using the purchase price for material used in this test and a rate of 2 tsp. per mound, it costs about $0.30 per mound ($0.28 + $0.016). This product can also be applied at a rate of 1 tsp. per mound for smaller mounds. Orthene® dust products are some of the least expensive, easiest to use, and most efficacious currently available individual mound treatments, although broadcast bait products are even less expensive on a per acre basis in areas with many ant mounds and eliminate ant activity more slowly. Therefore, in order for Works Well to be cost competitive with Orthene® dust products, it would need to be priced at about $0.26 per mound in material cost using the $0.04/mound in labor (pour method). At a treatment rate of 4 fl. oz. per mound, the cost would be $8.32 per gallon.

The "percent control" attained by Works Well ranged from 60 to 78 percent and most of the colonies considered active were markedly reduced in ant numbers. Complete coverage of the mound surface was necessary for complete elimination of ant activity. Four ounces was excessive for a mound 6 inches in diameter and not sufficient for mounds exceeding 10 inches in diameter.

Apparently, fumigant properties alone are not sufficient to eliminate ant activity in treated mounds. We suspect that product performance will vary under different environmental conditions and soil types. In this trial, weather conditions were ideal for control at the time of treatment. The weather was warm, but not hot, and sunny and the soil was moist. Conditions such as these bring the majority of a colony's ants to just under the surface of the mound along with the queen and brood. Heat causes ants, particularly the queen and brood, to avoid the mound surface, reducing the likelihood of exposure to liquid Works Well. The stated boiling point of Works Well is 95EF. Air temperature in Texas often reaches that level and soil temperatures reach well over 100 degrees for much of the day during the summer. A significant portion of the material would very likely "flash" upon contact with the mound surface and the remainder could evaporate very quickly.

One of Works Well's strengths, as stated, is its potentially low cost. The increased material volume per mound that would be needed under these circumstances would rapidly increase the cost to the consumer. Repeat applications may overcome the problem of incomplete elimination of ant activity in treated mounds, but it would also increase the cost. The top complaints about fire ant control products are their high cost and that they "just move the mounds over". Works Well could suffer the same fate if frequent repeat applications should be required. Finally, even though Works Well is highly volatile (or at least the majority of its components are), it is a petroleum distillate. Products of this type frequently raise environmental safety questions, and concerns over soil and groundwater pollution will need to be addressed by the developer.

**Table 1.** Red imported fire ant mound activity reduction following individual mound treatments (6 February 1995) using Works Well (aliphatic petroleum hydrocarbon, 4 oz./mound) and Orthene® Fire Ant Killer (acephate 75%SP, 2 tsp./mound), Burleson Co., Texas.

| | **Mean no. active mounds/10*** | | | |
|---|---|---|---|---|
| Treatment | 48 hours | 8 days | 15 days | 1 month |
| Untreated control | 10.00 a. | 10.00 a. | 10.00 a.. | 10.00 a. |
| Works Well | 2.25 .b | 3.00 b. | 4.00 .b. | 2.50 .b |
| Orthene® Fire Ant Killer | 8.75 a. | 2.50 b. | 0.25 ..c | 0.00 .b |
| *F* | 28.38 | 9.44 | 24.91 | 30.60 |
| P. | 0.0004 | 0.0082 | 0.0006 | 0.0003 |
| MSE | 1.0278 | 3.0000 | 1.5833 | 1.4444 |
| Min. sig. dif. | 2.1996 | 3.758 | 2.7301 | 2.6076 |
| Critical value | 4.339 | 4.339 | 4.339 | 4.339 |
| d.f. | 6 | 6 | 6 | 6 |

* Means followed by different letters are significantly different using the PC SAS ANOVA procedure and Tukey's Studentized Range Test ($P \leq 0.05$).

**Table 2.** Red imported fire ant mounds in plots 32 days following individual mound treatments (6 February 1995) to ten mounds per plot using Works Well (aliphatic petroleum hydrocarbon, 4 oz./mound) and Orthene® Fire Ant Killer (acephate 75%SP, 2 tsp./mound), Burleson Co., Texas.

| | **Total active ant mounds/4 replicated plots*** | | | |
|---|---|---|---|---|
| Treatment | No. active treated mounds | "Satellite" mounds | Total no. mounds | No. with active "mound building" |
| Untreated | 40 a.. | 27 a | 67 a. | 34 a.. |
| Works Well | 18 .b. | 16 a | 34 .b | 6 .b. |
| Orthene® | 1 ..c | 22 a | 23 .b | 0 .b |
| *F* | 42.64 | 1.60 | 6.86 | 39.00 |
| *P* | 0.0001 | 0.2893 | 0.0181 | 0.0002 |
| MSE | 0.9167 | 14.4722 | 10.6389 | 0.8889 |
| MSD | 2.0773 | 8.254 | 7.0769 | 2.0456 |
| Crit val. | 4.339 | 4.339 | 4.339 | 4.339 |
| d.f. | 6 | 6 | 6 | 6 |

* Totals (active ant mound numbers from 4 replicated plots) followed by different letters are significantly different ($P \leq 0.05$) and means separated using PC SAS Tukey's Studentized Range Test.