

**Efficacy of Works Well for the Control of Individual Fire Ant Colonies
Lake Conroe Dam, Montgomery County, Texas
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Works Well[®], a mixture of short-chain aliphatic and aromatic hydrocarbons was evaluated by TAEX in 1995. The product provided 60-80% control of individually treated red imported fire ant (*Solenopsis invicta* Buren) mounds over the course of the one month test. The number of active mounds were statistically similar to those of a standard treatment, Orthene[®] (75% acephate), and significantly lower than those in untreated control plots. Contact with Works Well results in immediate ant death, however, with only 2 - 6 oz. applied per mound, control is thought to be achieved through vapor toxicity. Additional laboratory tests were performed on Works Well to help determine it's action against fire ants. Results indicated that ants require exposure times of 15 to 20 minutes at high vapor concentrations to cause mortality.

Results were forwarded by the manufacturer to the Environmental Protection Agency (EPA) as part of the registration process. The EPA responded with three specific experimental protocols to address efficacy concerns: 1) the effect of high ambient temperatures, 2) the effect of sandy versus clay soil type and, 3) the effects of disturbance at time of treatment. The result of negotiations with the manufacturer was a protocol for a single test designed to "address" all three concerns. The test was conducted in relatively hot, dry conditions on a site with sandy soil and mounds were probed before treatment. It must be emphasized that, since all three factors differed from the first test, the treatment conditions and results **can not be directly compared**.

Materials and Methods

The test was located in an area below the earthen dam of Lake Conroe, Montgomery County, Texas. The soil on the test site was a deep, moderately coarse sand or loamy sand. The test site was mowed to a height of 3.5 inches during the last week of May 1997. The test was established on 3 June 1997 in the following manner. Two strips, 40 feet wide and approximately 200 feet long each, were measured and marked using six-foot long pieces of 3/8-inch diameter reinforcing rod at all corners. The strips were surveyed for active mounds and mound activity assessed using the minimal disturbance technique. Beginning at one end of a strip, 10 active mounds were marked with red surveyor's flags. The next 10 mounds were marked with orange flags and so on, alternating colors, until 12 sets of 10 mounds (plots) had been marked. The length of each plot was then measured, arrayed lowest to highest and divided into four blocks of three plots each (replications). Treatments were assigned within blocks so that the total lengths for each treatment were approximately the same.

Treatments included the following:

- 1) Untreated Control,
- 2) Works Well - amount applied according to mound size,
- 3) Spectracide® Dursban®, 6% chlorpyrifos, 2 oz. concentrate in one gallon water per mound.

Treatments were applied 5 June 1997, beginning at approximately 10:30 a.m. The weather was partly cloudy and humid, with a slight breeze. Temperature at the end of the test was approximately 85 degrees F and the soil was dry to slightly moist.

Dr. Warren Hardwick, manufacturer of Works Well, was present for the test and applied all the Works Well treatments personally. Dr. Hardwick located the site of greatest ant activity in each mound and probed to a depth where resistance was met using a pointed metal rod approximately 3/8-inch in diameter. The material was applied directly from a half-gallon metal can with a single-hole squirt cap. He applied the desired amount of Works Well into the hole then sprayed a band of fluid around the perimeter of the mound and on top of the mound. The time of each application was recorded on a stopwatch. After all mounds were treated, the remaining fluid in each can was measured in a graduated cylinder and subtracted from the stated full volume. In this way, the amount applied per mound could be calculated later.

Standard chlorpyrifos drenches were applied during the same time period by Dr. Bastiaan M. Drees using a plastic sprinkler can with a breaker nozzle. Before applications began, the plots were re-surveyed for any moved or missed mounds. These mounds were marked with blue flags and treated with the appropriate chemical after marked-mound treatments.

The first evaluations was conducted on 6 June at 9:00 a.m.. Weather conditions were similar to those of the treatment date. Each marked mound was disturbed with a pointed tool handle until ants rose to the surface in a defensive action (“active”) or failed to appear after 10 - 20 seconds (“inactive”). Dr. Hardwick was present for all evaluations and agreed with the evaluator’s assessment of mound activity at the time. The number of active mounds was recorded for each plot. During the first evaluation, active mounds in Works Well and standard-treated plots were marked with large, yellow flags for later re-treatment. The plots were surveyed and any active unmarked mounds were also marked with large, yellow flags.

The second evaluation was conducted on 9 June 1997 at 8:00 a.m. The weather was overcast, with sprinkling rain, temperature 70-75 degrees. Evaluations were conducted in a similar manner. Active Works Well-treated mounds were re-treated by Dr. Hardwick at this time and the application times recorded. Active, unmarked mounds were also treated. No chlorpyrifos-treated mounds were active, so only unmarked ones were treated.

The one-week post-treatment evaluation was conducted 12 June 1997, beginning at 9:00 a.m. The weather was partly cloudy, temperature 75 - 80 degrees F and the soil was slightly moist. Minimal disturbance evaluations were conducted on all originally flagged mounds and given “active” or “non-active” ratings. The plots were also surveyed for satellite mound formation. Flags were removed from previously marked satellite mounds if they showed no activity.

The final, two-week evaluation was conducted on 19 June 1997. Dr. Drees evaluated the marked mounds using the Lofgren and Williams (1982) method of mound activity rating. The plots were also surveyed for satellite mound formation. Conditions at the time of evaluation (beginning 9:00 a.m.) were partly cloudy, 80 - 85 degrees F, with high humidity and calm winds. The soil was moist. Dr. Hardwick was present for all evaluations.

Results

Mean no. active mounds*

Treatment	1-day			4-day		
	Marked	Sat	Tot	Marked	Sat	Tot
Control	10.00 a	1.00 a	11.00 a	9.50 a	0.75 a	10.25 a
Works Well	8.25 b	2.50 a	10.75 a	4.75 b	2.25 a	7.00 a
chlorpyrifos	0.25 c	0.75 a	1.00 b	0.00 c	1.25 a	1.25 b
F-value	104.24	1.08	17.97	32.56	0.72	5.96
Prob.	0.0001	0.4552	0.0015	0.0003	0.6328	0.0253
Min. Sig. Diff.	1.4004	3.3336	3.7403	2.3153	2.8944	5.3019
Crit value	4.339	4.339	4.339	4.339	4.339	4.339
df	6	6	6	6	6	6

Mean no. active mounds

Treatment	7-day			14-day		
	Marked	Sat	Tot	Marked	Sat	Tot
Control	8.25 a	1.75 a	10.00 a	7.75 a	1.75 a	9.50 a
Works Well	2.25 b	1.00 a	3.25 a	0.00 b	1.00 a	1.00 b
chlorpyrifos	0.00 c	1.50 a	1.50 b	0.00 b	1.25 a	1.25 b
F-value	30.69	2.12	15.95	61.29	1.45	24.18
Prob.	0.0003	0.1932	0.0021	0.0001	0.3296	0.0007
Min. Sig. Diff.	2.1392	2.3153	3.2543	1.5761	1.9472	2.7299
Crit value	4.339	4.339	4.339	4.339	4.339	4.339
df	6	6	6	6	6	6

Means in the same column followed by different letters are significantly different ($P < 0.05$) using PC SAS analysis of variance procedures and Tukey's studentized range test for mean separations.

* Marked = 10/plot; Sat = "new" mounds occurring in plot; Tot = marked + sat.

Mound Activity Rating Results

As requested by both the manufacturer and the EPA, the final evaluation of Works Well also included a mound activity rating as defined by Lofgren and Williams (1982).

<u>Treatment</u>	<u>Mean Rating</u>
Control	10.65 a
Works Well	0.00 b
Standard	0.00 b
F-value	25.83
Prob.	0.0001
Min. Sig. Diff.	2.5964
Crit. Value	3.358
df	114

Works Well Application Volume

The application volume for the initial application of Works Well was 80.63 ml \pm 26.80 ml (2.84 oz. \pm 0.94 oz.) per mound. The marked mound density of Works Well plots was 335 mounds per acre. If “blue flagged” mounds are included, the density rises to 469 mounds per acre. Therefore, the application rate per acre was 7.433 gallons/acre \pm 2.46 gal.. If all mounds had been treated with the calculated rate, the total volume per acre would rise to 8.794 gal./ac. \pm 3.444 gal..

Re-treatments on the 19 still-active mounds were made with considerably more volume: 153.16 ml/md \pm 41.06 ml (5.39 oz. \pm 1.45 oz.). Had this rate been used for the initial treatment of marked mounds the per acre rate would have been 14.11 gal./ac. \pm 3.79 gal.. For all mounds, the rate would have risen to nearly 20 gallons per acre.

Discussion

Application of Works Well to individual mounds resulted in significant ($P < 0.05$) elimination of ant activity as compared to those mounds receiving no treatment at all evaluation dates. However, Works Well treated mounds were significantly more active than those receiving a standard chlorpyrifos drench treatment at one, four and seven days post-treatment. In one EPA report to the manufacturer, a requirement for 90% control was mentioned. The following table lists “Percent Control” for each post-treatment evaluation date in this test.

<u>Treatment</u>	Percent Control (% inactive mounds of 40 treated)			
	<u>1 day</u>	<u>4 days*</u>	<u>7 days</u>	<u>14 days</u>
Control	0.0	5.0	17.5	22.5
Works Well	22.5	52.5	77.5	100.0
Standard	97.5	100.0	100.0	100.0

* all active mounds retreated

When both treated and “satellite” mounds within plots were combined, Works Well plots did not differ significantly from untreated control plots. Field notes indicate that an unusually high number of satellite, or new, mounds appeared in one of the high-density Works Well plots immediately after the initial treatment. Mound activity ratings at day 14 showed complete control of all treated mounds by both Works Well and the standard.

Compared to those from the first test, these results were somewhat disappointing. It is suspected that the combination of higher temperatures and/or sandy, porous soil was responsible for the lack of rapid control. Lab tests from the previous test indicate that fire ants must be either directly contacted or exposed to high concentrations of Works Well vapor for at least 15 minutes for mortality to occur. Given the low flash point (135EF) and high volatility of Works Well, it is suspected that the material either volatilized too quickly, did not reach effective vapor concentrations within the mound, or a combination of both, to cause complete elimination of ant activity. Further testing would be necessary to determine which of these factors was the cause.