Bifenthrin Individual Mound Treatment and Broadcast Treatment Comparison Test
Coulter Field, Brazos Co., Texas - 1998

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There are three general methods of controlling red imported fire ants (*Solenopsis invicta* Buren) on large areas: individual mound treatments, broadcast baits and surface-applied contact insecticides. Each method has its advantages and disadvantages. Individual mound treatments (IMT's) provide fast control, but mounds must be located and treated individually, which can be expensive and time consuming in large areas with high mound densities. It is also very difficult, if not impossible, to locate every colony, particularly those without visible mounds. Broadcast baits are, supposedly, picked up by every colony in an area, though results usually show 80-95% control, and are rather inexpensive compared to the other methods. However, baits work very slowly, taking anywhere from 2 weeks to over 6 months to reach full suppression, depending on product used, season of application and weather conditions. Surface-applied contact insecticides provide fast suppression of virtually all ant foraging activity in an area for some weeks, depending on product, but eliminate colonies only with repeated applications. They are more expensive per acre than broadcast baits, but much less labor intensive than IMT's in most instances.

The purpose of this test was to compare individual mound treatments and broadcast (surface) applications of a granular, a flowable liquid and an experimental liquid formulation of bifenthrin, a synthetic pyrethroid, to each other and a standard treatment (chlorpyrifos). A broadcast Amdro® (hydramethylnon) treatment was included so that the bifenthrin formulations could be compared to a fast-acting broadcast bait for speed and duration of ant suppression. Also added to the test was a broadcast application of hydramethylnon formulated on "lightweight aggregate", a rock-like granule that has a farther spreader "throw" than the defatted corn cob grit used for most conventional fire ant baits.

Materials and Methods

The test was located at Coulter Field, a municipal airport serving Bryan/College Station, Brazos Co., Texas. The site was gently sloping with shallow, sandy loam soils over a claypan. The test area was covered by native grasses and forbs which had been mowed, but never grazed, for many years. Vegetation ranged from lush to sparse over the course of the test and the site.

Plots consisted of 100 x 100 foot squares (0.23 ac). The sampling area for all plots was a central circle, 40 feet in radius (0.115 ac.). This circle also served as the treatment area for all IMT's. Because of the difficulty in broadcasting or spraying products accurately in a circle, all broadcast and surface treatments were applied over the entire plot.

Evaluations were conducted in two ways. The first were simple active mound counts using the minimal disturbance technique. The second was to determine ant foraging presence through the use of bait stations. Some difficulty was encountered with this second technique. The original protocol called for the use of glass scintillation vials containing bits of bait. This technique produced a very inconsistent all-or-nothing response by the ants, even when vials were within a

few feet of each other in the same plot. The method used for most of the test was to place three 1.5-inch diameter plastic weigh boats about three feet apart in a line in the center of the plot. Two pieces of Tender Vittles® cat food were placed in each boat. Boats were placed in all test plots in sequential order, which took approximately 30 minutes. After waiting another 30 minutes and using the same order as for placement, the estimated number of ants in each boat was recorded for later analysis and the boats picked up.

A total of 53 plots were evaluated for mound numbers on 27 April 1998. Those plots with very low or very high numbers were not used. Plots were arrayed by mound number from lowest to highest, then divided into four equal groups (replications) of 11 plots each. Treatments were assigned within replications so that the total number of mounds for each treatment (total of all four replications) was as equal as possible. Treatments included:

Product	Application	Rate
1. Talstar® Flowable (7.9% bifenthrin)	Surface spray	26.06 ml/1000 ft^2
2. Talstar® Flowable (7.9% bifenthrin)	IMT drench	1 tsp/gal. water/md
3. SPG97-001 (experimental bifenthrin)	Surface spray	86.9 ml/1000 ft^2
4. SPG97-001 (experimental bifenthrin)	IMT drench	2 tsp/gal. water/md
5. Talstar granular (0.2% bifenthrin)	Broadcast	2.30 lb/1000 ft^2
6. Talstar® granular (0.2% bifenthrin)	IMT + 1 gal water	1/4 cup/md
7. Dursban® 4E (chlorpyrifos)	Surface spray	217 ml/28 gal water/ac.
8. Dursban® 4E (chlorpyrifos)	IMT drench	1 oz./gal water/md
9. Amdro® (0.73% hydramethylnon)	Broadcast	1.5 lb/ac
10. Agg. granule + 0.73% hydramethylnon)	Broadcast	1.5 lb/ac
11. untreated control	untreated	--

Treatments were applied 28-30 April 1998. IMT treatments were applied using appropriate measuring devices and two-gallon plastic watering cans. All mounds within the central 40-foot radius circle were treated. Granular and bait products were applied with a Cyclone® 1C1 hand spreader. Due to heavy rain late in the afternoon of 27 April, the ground was too soft to use a full size tractor with a boom sprayer for broadcast toxicant application. Instead, a 14 gallon, 12V, 6-foot boom sprayer was towed behind a John Deere STX 38 lawn tractor.

Evaluations were conducted as follows: 6 May (foraging), 8 May (mound), 15 May (mound and foraging), 29 May (mound) and 1 June (foraging).

Results

Table 1. Mean number of foraging workers or active mounds for four replications

Product	Pre-count	1 week[1] foraging	10 day mound	2 week mound	2 week[2] foraging	4 week mound	4 week[2] foraging
Talstar® Flow - Brd	13.75 a	0.50 ab	9.75 abcd	8.00 abc	9.00 b	4.50 ab	41.25 b
Talstar® Flow - IMT	13.75 a	0.75 ab	2.75 d	1.50 c	19.00 b	1.25 b	75.00 ab
SPG97-001 - Brd	14.00 a	0.50 ab	8.75 abcd	11.25 abc	75.00 ab	8.00 ab	58.25 ab
SPG97-001 - IMT	13.75 a	1.00 a	2.5 d	2.00 c	26.25 b	0.75 b	67.50 ab
Talstar® gran - Brd	13.75 a	0.00 b	12.00 abc	8.50 abc	5.25 b	5.50 ab	23.50 b
Talstar gran - IMT	13.75 a	1.00 a	3.25 d	2.50 bc	26.75 b	1.00 b	92.50 ab
Dursban® - Brd	13.75 a	0.50 ab	7.50 cd	4.25 bc	31.25 ab	5.00 ab	46.75 b
Dursban® - IMT	13.75 a	1.00 a	3.75 cd	3.25 bc	19.25 b	0.75 b	47.00 b
Amdro® - Brd	13.75 a	0.50 ab	7.75 bcd	6.75 abc	12.50 b	2.25 b	19.25 b
Agg. granule - Brd	13.75 a	1.00 a	16.25 ab	12.25 ab	73.25 ab	10.00 a	85.00 ab
untreated	13.75 a	1.00 a	16.50 a	14.75 a	102.5 a	11.75 a	132.50 a
F	19.77	2.80	7.22	4.35	4.24	6.05	4.22
probability	0.0001	0.0097	0.0001	0.0004	0.0005	0.0001	0.0005
R^2	0.8954	0.5484	0.7579	0.6532	0.6476	0.7237	0.6465
Min. sig. diff.	3.2184	0.9129	8.5659	9.8066	71.454	7.492	75.269

df = 30, critical value of Studentized range = 4.917

[1] Due erratic results, vials were given a "+" or "-" rating based on ant presence in the vials. Ratings were converted and analyzed as 1.00 and 0.00 respectively.

[2] Mean of three weigh boats per plot and four plots per treatment. Bait was removed entirely from some weigh boats, so no ants were present by the time of evaluation. These stations were given an arbitrary number of 50 ants.

Results analyzed using PC SAS analysis of variance procedures ($P < 0.05$). Means separated using Tukey's studentized range test.

Discussion

Results from the test were somewhat disappointing, due largely to no rain and high temperatures beginning immediately after test initiation and lasting through mid-September. Bifenthrin applications suppressed surface foraging to varying degrees at two weeks post-treatment. The Talstar Flowable spray and Talstar granular broadcast provided the best suppression, to 5-10% that of the untreated plots, but no treatment kept 100% of the ants from all 12 bait stations used for each treatment. By week four, foraging ant numbers were on the rise, though the numerical trends seen at two weeks continued. A number of treatments had significantly ($P<0.05$) fewer foraging ants that the untreated control, but there was no clear trend as to which products consistently gave better suppression.

Mound activity elimination showed similar results. Plots treated with IMT's showed rapid reductions in active mound numbers. Control levels of about 80% versus untreated plots were seen in two weeks, increasing to over 90% in four weeks. Based on field observations, it is believed that the active mounds found in these plots were simply not seen and treated, rather than there being any type of product failure, so the actual control rate for *treated* mounds probably approached 100% for all IMT treatments. All IMT treatments showed significantly ($P<0.05$) fewer active mounds than untreated control plots at both two and four weeks post-treatment. There were only slight numerical differences between IMT treatments.

Surface contact insecticide applications showed greater numerical reductions of active mounds than any of the IMT's, though this is not borne out statistically. Active mound number reductions in broadcast toxicant-treated versus untreated plots ranged from 25% - 50% at two and four weeks. Though there were few, or overlapping, statistical separations between products, the numbered compound fared worse than either Talstar granular or flowable, which had the highest active mound control of the broadcast toxicants.

Amdro showed a 50% reduction in active mounds in two weeks, with about an 80% reduction in a month. Though it never reached the mound elimination levels of the toxicant IMT's, it exceeded those of the broadcast-applied toxicants by four weeks post-treatment. Significant statistical differences were few or overlapping with no clear trend. The lightweight aggregate formulation of hydramethylnon resulted in little reduction in active mounds or foraging ant numbers. The product was very oily and difficult to apply.

Extreme weather conditions played a major role in the conduct of this test. There was a light shower two weeks after test initiation (mid-May) which was the last precipitation received at the test site until mid-September. Temperatures were very high with a record-breaking string of 100EF+ days in June, July and August (total of 51 with 42 consecutive). Consequently, ant mound building activity ceased by mid-June, making it impossible to visually locate colonies. Furthermore, foraging levels increased from Week 2 to Week 4 despite the heat and drought, indicating that the toxicant compounds had "broken" and were allowing ants to move on the ground surface. The result of these factors is that there was no attempt to evaluate the test until rains were received and temperatures cooled in the fall. By that time, City of Bryan mowing crews had destroyed the plot markers, making accurate relocation impossible, so the test was discontinued.

In conclusion, it appears that toxicant IMT's eliminate more mounds from an area than broadcast toxicants and do it much more quickly than Amdro, the fastest acting broadcast bait available, under the conditions of this particular test. There were few differences in effectiveness between IMT products. Labor requirements, on the other hand, were quite different between IMT's and either broadcast baits or toxicants. It took three workers approximately eight hours to locate and treat all 16 IMT plots. It took one worker less than three hours to treat all 12 spray-applied toxicant plots using a very small, slow spray rig. It took less than five minutes per plot to treat with the broadcast baits.

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