Commercially Available Broadcast Compounds for the Control of Red Imported Fire Ants

Palestine Airport, Anderson Co., Texas - 2002

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In 2002, a number of companies contracted with Texas Cooperative Extension to test their broadcast red imported fire ant (*Solenopsis invicta* Buren) control products. Most protocols dictated the use of common "standard" products with which to compare theirs. To save labor, valuable research space and to provide additional comparisons, four protocols were combined for this one trial. This report provides a head-to-head comparison of only the commercially available products - 9 out of the total 18 treatments in the trial. Individual reports on the specific protocols, which include experimental products, follow.

Objective: Provide head-to-head comparison of the major brands and/or types of broadcast fire ant control products.

Materials and Methods

The test site was located at the municipal airport of Palestine, in central east Texas. The airport consists of two perpendicular, asphalt runways 4000 and 5000 feet in length arranged at right angles to each other to form a cross. They are connected by several asphalt taxiways. The entire site is mowed at least once per year with strips adjacent to the runways mowed more frequently. Soil at the site is generally sandy. The great majority of red imported fire ant (*Solenopsis invicta* Buren) mounds are located in the somewhat heavier fill soil within 20 feet of the pavement, though few were found in actual contact with the pavement.

Plots were arranged to utilize as many runway lights as possible as plot end markers. Plots along unlighted taxiways were measured and marked with small pieces of rope nailed into the ground. These were also fixed with a GPS unit. Plots were 200 feet long (the distance between lights) with a 10 foot untreated buffer at each end. One long edge of every plot was in contact with pavement. Plots were 60.5 feet wide for a total treatment area of 0.25 acres (180 x 60.5 feet). Sample areas consisted of the strip of land 20 feet wide, adjacent to the pavement along one long edge, and 10 feet inside the treatment area at the ends. Total sample area: 3,200 $ft.^2$ (160 x 20 feet = 0.073 acres).

Mounds were evaluated using the minimal disturbance technique. Mounds were lightly disturbed with a pointed tool handle and ant reaction observed. A mound was considered active if a sufficient number of ants appeared at the surface, compared to the reaction of mounds in untreated areas, given the prevailing weather conditions. Evaluations were completed before 1:00 p.m. during the summer to avoid false negative readings due to the heat.

Pre-counts were conducted on June 4, 2002 and treatments applied on June 11. Bait treatments were applied by hand using Earth-Way® Ev–Spred rotary seeders, while granular products were applied using a Warren's T-7II spreader. Post-treatment counts were taken on June 20 and 27, July 11 and 23, August 12, September 11, October 16 and December 18.

Treatments were assigned based on pre-count active mound numbers using the method outlined in Barr and Best (2002) to help compensate for initial mound count variability. Because of the loss of two plots in this group of treatments to construction and insufficient material to treat two more, the low-density replication of the remaining treatments were omitted to provide a balanced, three replication design. Appropriate data were then analyzed using SAS ANOVA procedures with means separated using Duncan's Multiple Range Test (for more liberal mean separations) and Tukey's Studentized Range (HSD) Test (for consistency with other reports), $P < 0.05$.

Table 1. Broadcast treatments. Palestine, Texas Municipal Airport, 2002

Product name	Active ingredient	Formulation	Application Rate
Amdro®	hydramethylnon	0.73% conv. bait[1]	1.5 lbs./acre
Logic®	fenoxycarb	1.0% conv. bait	1.5 lbs/acre
Extinguish™	s-methoprene	0.5% conv. bait	1.5 lbs/acre
Distance®	pyriproxyfen	0.5% conv. bait	1.5 lbs/acre
Talstar® 2G	bifenthrin	0.2% granular	100 lbs./acre
Amdro + Extinguish	hydramethylnon + s-methoprene	50:50 hopper blend	1.5 lbs./acre total
Top Choice®	fipronil	0.0143% granular	87 lbs./acre
Firestar®	fipronil	0.00015% on Tast-E-Bait carrier	1.5 lbs./acre
untreated	N/A	N/A	N/A

[1] Conventional bait = soy bean oil formulated on defatted corn grit.

Results and Discussion

Over the course of the test, weather conditions were particularly favorable for fire ant mound building with regular rains and temperatures exceeding 100°F on only a few days. Additionally, the area was mowed on at least two occasions. The result was mounds that were easily detectable, even during the summer months. These conditions combined to make this a "textbook" example of how the various products are expected to perform in the field and provided a welcome change from years of intense summer heat and drought.

The fastest acting products Amdro, Talstar, and the hopper blend of Amdro + Extinguish yielded significantly ($P < 0.05$) fewer active mounds versus untreated by one week post-treatment **(Table 2)**. TopChoice and Firestar dropped to significantly lower levels by 2 weeks (or week one using Duncan's test). The 4 week evaluation was somewhat anomalous since the area was in the process of being mowed. Some plots had tall standing grass while others had a thick layer of clippings and other had the clippings blown off, all making for highly variable mound spotting conditions. Results for this date should be taken with these conditions in mind.

By the 6 week evaluation, plots treated with the fast-acting products had begun to show some re-infestation. Though still numerically much lower than untreated plots, they failed to separate out statistically. On the other hand, the insect growth regulator (IGR, Logic, Extinguish, Distance) and TopChoice-treated plots dropped to significantly ($P < 0.05$) lower levels by six weeks and two months post-treatment.

By 3 months post-treatment, Logic and Extinguish, the two slowest-acting products, had achieved 100% control. TopChoice and Distance maintained fewer than one active mound per plot, while the other plots, particularly Amdro and Talstar had undergone substantial re-infestation. TopChoice was the only product maintaining significant ($P < 0.05$) control at 6 months post-treatment (using Tukey's separations), though others still maintained a very good degree of mound suppression. At 12 months, Logic, Extinguish, and the Amdro:Extinguish hopper blend maintained significantly ($P < 0.05$) lower active mound numbers than the untreated control, strong support of the longer duration of control of IGR baits and the advantage of the hopper blend. TopChoice treatments, not surprisingly, showed the lowest number of mounds in the entire test.

During the mid 1990's, tests indicated that fast-acting products gave shorter duration control while IGR products gave slow, but longer duration control (Drees and Barr, 1997) (Dybas, 1998). Subsequent tests during the late 90's through 2001 did not support the longer duration control of IGR's (see Effectiveness of Different Ratios and Formulations of Broadcast Hydramethylnon + s-Methoprene for the Control of Fire Ant Colonies, p.25). It was suspected at the time that the severe heat and drought of those latter summers were a contributing factor. The hypothesis is that the IGRs maintain mound suppression in two ways. One is that surviving worker ants maintain an effective dose of the IGR in their crops and feed it to invading queens which are affected. This idea is supported by some laboratory work (unpublished). The other mechanism is that the remaining ants defend, or at least occupy, their territory against invasion by other colonies and/or newly mated queens.

Table 2. Results of red imported fire ant mound evaluations: 3,200 ft^2 plots, 3 replications. Palestine, TX, treated 6/11/02.

	Mean number of active mounds									
Treat.	Pre	1 wk	2 wk	4 wk	6 wk	2 mo	3 mo	4 mo	6 mo	12 mo
untreated	19.3 a/a	20.0 a/a	17.3 a/a	13.0 a/a	18.7 a/a	14.7 a/a	12.7 a/a	19.3 a/a	19.3 a/a	20.0 a/a
Amdro	16.3 a/a	5.0 c/d	0.7 d/b	4.0 ab/a	5.7 bc/ab	3.7 bc/ab	7.0 ab/a	10.0 ab/a	9.0 ab/ab	12.0 ab/ab
Logic	17.3 a/a	12.3 bc/abc	11.0 ab/ab	6.3 ab/a	6.7 bc/ab	1.7 c/b	0.0 b/a	2.3 b/a	2.7 b/ab	3.7 bc/b
Exting.	17.7 a/a	18.0 ab/ab	9.0 bc/ab	4.3 ab/a	2.0 bc/b	1.0 c/b	0.0 b/a	2.0 b/a	2.3 b/ab	5.33 bc/b
Distance	18.0 a/a	10.0 cd/abc	6.7 bcd/ab	1.3 b/a	3.7 bc/ab	0.7 c/b	0.3 b/a	3.3 b/a	4.0 b/ab	8.0 bc/ab
Talstar	19.3 a/a	4.3 d/c	2.00 cd/b	0.3 b/a	3.3 bc/ab	3.7 bc/ab	6.7 ab/a	11.3 ab/a	8.3 ab/ab	6.3 bc/ab
Amd:Ext	17.3 a/a	4.7 d/c	1.7 d/b	2.3 ab/a	6.7 bc/ab	5.7 bc/ab	2.7 b/a	6.3 b/a	8.0 ab/ab	5.7 bc/b
Topcho	19.3 a/a	8.0 dc/bc	2.0 cd/b	1.0 b/a	0.0 c/b	0.0 c/b	0.7 b/a	1.0 b/a	0.7 b/b	1.7 c/b
Firestar	16.7 a/a	8.0 dc/bc	4.0 cd/b	8.7 ab/a	11.0 ab/ab	10.3 ab/ab	2.7 b/a	6.3 b/a	10.0 ab/ab	8.3 ab/bc
F	0.29*	8.19	6.10	1.44	2.70	3.12	2.23	1.99	2.04	2.96
P	0.9606	0.0001	0.0008	0.2498	0.0370	0.0208	0.0742	0.1057	0.0987	0.0258
R^2	0.7868	0.8365	0.7922	0.4732	0.6282	0.6612	0.5817	0.5546	0.5601	0.6493
MSE	14.176	14.537	13.856	34.523	29.662	18.94	20.398	41.778	40.787	23.861

Means in the same column with the same letter are not significantly different. Means separated by Duncan's multiple range test/Tukey's studentized range (HSD) test, $P < 0.05$. df = 16.

* F and *P* values are for treatment effects only. Replication $P = 0.0001$ due to stratification of mound densities.

Therefore, in order to maintain control, some worker ants must remain alive, but the hot, droughty summers served to eliminate them and the re-invasion resistance they provided. The summer of 2002, however, did not have such severe conditions. Using Extinguish and Logic as examples, note how they both show a slow, continuous drop in active mound numbers from the first evaluation. They then maintain the lowest counts of any of the baits through the end of the test with control of about 87% versus untreated. Amdro, Firestar and even the fast-acting contact insecticide Talstar, reach maximum suppression in a few weeks, then rebound to only 50-60% control by six months.

Distance showed its "fast IGR" characteristics with mound suppression that was numerically and sometimes statistically greater than Logic and Extinguish through the six week evaluation. Pyriproxyfen reportedly causes some mortality of later stage larvae and/or pupae, while the other IGRs do not affect them. Thus, colonies treated with the other IGRs take a few weeks to rear out all present brood while pyriproxyfen cuts off most brood development at any stage.

This was the first trial conducted by this author using the commercial formulation of Firestar. Though it did not perform badly, showing significant ($P < 0.05$) control versus untreated plots through much of the six-month period, it never reached the level of less than one mound per plot as did all the other treatments, except the hopper blend, at some point. Top Choice, also a fipronil product, showed its characteristic relatively slow activity and very long residual. At six months, it maintained fewer than one mound per plot on average.

One of the few disappointments in the test was that the Amdro:Extinguish hopper blend did not provide substantially longer control than Extinguish alone, though speed of control was comparable to that of Amdro alone. A possible explanation is that the three plots were, by chance, all in areas that had particularly heavy re-invasion pressure compared to other sections of the runways and taxiways. Nevertheless, the hopper blend still had somewhat fewer mounds than Amdro alone at the three and four month evaluations. This may, in fact, actually be the longer duration control manifesting itself at this site in these particular conditions.

A final item of note is that, at their respective points of maximum suppression, there are virtually no differences between any of the treatments. **Table** 3 illustrates this point. The importance of this finding is fundamental to understanding broadcast fire ant control, particularly with the bait products. Simply put, they all work and they all work well. They just work at different speeds and for different lengths of time. Users and manufacturers of broadcast products must understand this concept to fully appreciate what excellent fire ant control these products can deliver.

Table 3. Level and period of maximum mound suppression (see **Table 2** for complete data).

Product	Mean number mounds	Point of max. suppression, post-treatment
Amdro	0.7	2 weeks
Logic	0.0	3 months
Extinguish	0.0	3 months
Distance	0.3	3 months
Talstar 2G	0.3	4 weeks
Amdro + Extinguish	1.7	2 weeks
Top Choice	0.0	6 weeks - 2 months
Firestar	2.7	3 months

Literature Cited

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