EVALUATION OF CURRENTLY REGISTERED AND EXPERIMENTAL BROADCAST-APPLIED BAIT-FORMULATED INSECTICIDES FOR SUPPRESSION OF THE RED IMPORTED FIRE ANT

Bastiaan M. Drees, Professor and Extension Entomologist and
Charles L. Barr, Extension Associate

This test is the most comprehensive side-by-side comparison of broadcast baits yet conducted by our Applied Fire Ant Research Program. Results will be used to help determine which baits are most appropriate for use in a given situation based on speed of mound activity elimination, total active mound reduction and duration of suppression. In order to compare the speed and effectiveness of the available, or potentially available, fire ant baits, products from several companies were combined into a single large-scale field test. Additionally, an experimental compound from American Cyanamid (AC 303,630, a pyrrole insecticide/miticide) was tested for effectiveness at four different formulation rates, plus a blank.

Materials and Methods

Plots were established, 29 and 30 August 1996, in an approximately 40 acre field in the western part of Brazos County, Texas. Pre-treatment fire ant mound number were obtained, 2 and 3 September, by counting all active ant mounds within a 0.25 acre circle in the center of each 0.5 acre square plot. A mound was considered active if a sufficient number of ants rose to the surface within 15 seconds of light disturbance given the weather conditions at the time (the minimum disturbance method). Pre-count data were arrayed from lowest to highest then grouped into four blocks of 10 plots each. Treatments were assigned within groups so that the total number of mounds for each treatment was as equal as possible across all blocks.

The terrain of the experimental site was extremely rough due to the great number of large, grass-covered fire ant mounds. The roughness made it impossible to drive any type of vehicle fast enough or at a steady enough speed to accurately apply baits with the precision needed for this test. Hand application with a "belly-bumper" seeder was also impractical due to size of the test and need for even, complete coverage. Consequently, a gasoline-powered Solo® backpack mist sprayer was modified to apply fire ant baits. Modifications were very simple and the treatments appeared to go out easily and quite evenly with a minimum of skips. All products were applied at a rate of 1.5 pounds per acre. Treatments were applied late in the day to avoid the possibilities of photodegradation, loss of material due to heat melting the carrier, and afternoon thundershowers.

The following treatments were applied:

10 September, 4:30-7:00 p.m.
1. Amdro®/Siege® (hydramethylnon)
2. Logic®/Award® (fenoxycarb)
3. V71639 (pyriproxyfen)
4. Affirm®/Ascend® (abamectin)
5. AC 303,630 blank
Untreated Control

12 September, 4:00-7:00 p.m.
6. AC 303,630 .001% (a pyrrole)
7. AC 303,630 .0025%
8. AC 303,630 .005%
9. AC 303,630 .0075%

Post-treatment counts were conducted 18 - 19 September, 30 September - 1 October, and 11 October. A rating scale was used to help determine mound activity reduction. Upon disturbance mounds were rated as follows: 3 = over 1,000 ants; 2 = 100 - 1,000 ants; 1 = less than 100 ants. Thereafter (21 March 1997), plots other than those treated with AC 303,630 were monitored for number of active mounds, but mounds were not individually rated for activity.

Evaluators attempted to compensate for differences in temperature and time of day when assigning ratings. Statistical analyses were conducted using PC SAS Analysis of Variance (ANOVA) and means were separated using Tukey's studentized range test ($P \leq 0.05$). Both number of mounds and total rating [Ó(number of mounds X rating)] for each plot were analyzed.

Results and Discussion

Application of hydramethylnon (Amdro® Insecticide Bait/Siege®) bait resulted in 75 percent active mound reduction in one week, with an 84 percent reduction in one month (**Table 1**). This speed of activity for hydramethylnon bait is unprecedented in our experience. It is likely that climate conditions played a major part in such a rapid reduction. This area of Texas had been under severe drought conditions for several months resulting in an almost complete lack of fire ant mound building activity and, it was observed, significant decreases in colony size. The area then received over 10 inches of rainfall in August alone, accompanied by below normal high temperatures. These favorable conditions resulted in vigorous mound building activity, a flush of brood production, and a likely increase in foraging activity. Therefore, small, weakened colonies probably picked up a large proportion of all the baits. Since hydramethylnon is know to be toxic to both queens and workers, there was a sufficient amount picked up to kill a proportionally greater number of workers in these smaller colonies than would normally occur in large colonies. The result was a very rapid elimination of ant mound activity in hydramethylnon bait treated plots.

The remaining registered, commercially-available treatments appeared to be progressing as expected, given the characteristics of their active ingredients. Abamectin (Affirm™/Ascend®) bait produced no statistically significant reduction of mound activity at one week, though it did have a numerical reduction. By two weeks post-treatment, it was statistically lower than the untreated check and by four weeks, abamectin bait had reduced mound numbers by over 60 percent relative to pre-count levels. Fenoxycarb (Logic®/Award®) and the experimental insect growth regulator

(IGR) pyriproxyfen (V71639) bait began to show numerical reductions by week four, though no statistical differences had been found by that time. Observations indicate a lack of worker brood in plots of all three treatments so a continued decline was to be expected. Speed of ant mound activity reduction from IGR-type (juvenoid) insecticides (fenoxycarb and pyriproxyfen) is partially determined by prevailing weather conditions, which had been very dry and warm since the one-week evaluation.

None of the pyrrole AC 303,630 formulations showed significant or consistent numerical reduction in mound activity versus either pre-counts, the blank treatment, or untreated control plots. Observations indicate large amounts of worker brood present in the mounds of these plots. Activity ratings had actually increased in some of these plots versus those from the one and two-week evaluations. It appeared that this bait formulation was either ineffective on unattractive to the ants and would result in little or no reduction in mound numbers or activity. Monitoring activities in plots treated with AC 303,630 were abandoned in 1997.

By 6 months after treatment (20 March 1997), all chemical treatment plots monitored contained significantly fewer active ant mounds than did untreated plots. However, the active fire ant mounds in the hydramethylnon (Amdro®/Siege®) bait treated plots were of the same average size and rating (3) as mounds in untreated plots. To a lesser extent, and with more variability, mounds in the abamectin (Affirm™/Ascend®) bait treated plots also had some well-developed colonies. On the other hand, mounds in the insect growth regulator treatment (IGR) plots (Logic®/Award® and V71639) were very small (rating 1 to 2), and had very little evidence of freshly excavated dirt on top of the colony site. In short, they were hardly noticeable, but still present.

Evaluations were continued for one year for the remaining products. By mid-March (6 months) during an unusually cool, wet spring, mound activity still appeared to be declining. All treatments were significantly different from untreated plots and statistically similar to each other. The May evaluation showed roughly 75 percent reduction of ant mound numbers versus untreated plots for the IGR (Logic®/Award® and V71639) bait products. All were similar statistically and significantly less than both untreated plots and hydramethylnon bait treated plots. Active mound numbers in hydramethylnon bait treated plots were on the rise.

The final, one-year post-treatment evaluation was conducted in late August 1997 during a very dry, hot summer. Mound numbers in untreated plots were about 30 percent less than in May. Fenoxycarb (Logic®/Award®) bait treatments produced its maximum suppression at this point. Abamectin (Ascend®/Affirm™) and pyriproxyfen (V71639) baits appeared to be either holding steady at their maximum suppression level or beginning a re-infestation trend. Hydramethylnon (Amdro®/Siege®) bait treated plots still had significantly lower ant mounds than untreated plots, but had three times the number of mounds recorded at its point of maximum suppression at 4-weeks post-treatment in October 1996.

In conclusion, it appears that hydramethylnon (Amdro®/Siege®) bait worked unusually fast and somewhat more poorly than is usually encountered initially. At one year it was up to only 38 percent reduction in ant mound numbers versus those in untreated plots. Fenoxycarb (Logic®/Award®) bait was very slow to reach maximum suppression, but provided the best

control of all the products at one year post-treatment, about 74 percent reduction in ant mound numbers versus those in untreated plots. Abamectin (Ascend®/Affirm™) bait had a rapid drop in numbers initially, followed by a bounce-back. It then followed the decline of pyriproxyfen (V71639) bait almost exactly. Pyriproxyfen bait lacked the initial drop of hydramethylnon and abamectin baits. It appears that both these compounds reach maximum suppression within about 6 months, intermediate to hydramethylnon and fenoxycarb. They showed roughly 58 percent reduction in mound numbers versus untreated at one year.

The results of this test emphasize the need for planning when treating an area with bait. On one hand, hydramethylnon bait can show impressive activity within a month, but ants may re-infest to unacceptable levels within six or eight months. Fenoxycarb bait, on the other hand, may not provide acceptable control for four to six months, particularly if weather conditions are favorable for ant survival. The two other compounds (abamectin and pyriproxyfen) appear to fall somewhere in between, but their suppression patterns are not as well understood due to a lack of data compared to the other commercially-available bait products.

If spring control of fire ants is desired, an hydramethylnon bait application in the late fall may be the best choice to ensure maximum suppression at that time. The severity of winters in Texas is very unpredictable, so relying on them for ant mortality is guesswork, at best. Had the winter of 1996-97 been dry or very cold, fenoxycarb bait would probably have performed better by spring. Texas summers, however, are notoriously reliable for being long, hot, and dry with high ant mortality. Fenoxycarb bait may best be applied in the spring for maximum control in the fall since high natural mortality is a virtual certainty. A summer or early fall application of fenoxycarb may also be effective for both fall and spring control since it still allows a period of high mortality and prevents reproduction during the mild fall months.

Table 1. Mean number and rating* of red imported fire ant mounds per 1/4 acre subplot before and following broadcast application of currently registered and experimental bait-formulated fire ant insecticides applied 10 and 12 September 1996, Brazos Co., Texas.

		Mean no. ant mounds per 1/4 acre**					
		1 week		2 weeks		4 weeks	
Product	pre-count	count	rating	count	rating	count	rating
Amdro®/Seige®	58.0a	13.8b	24.3b	12.0c	27.8c	9.5c	23.5c
Affirm®/Ascend®	58.5a	38.3a	96.0a	34.8b	82.3bc	24.0bc	56.8bc
V71639	59.3a	49.8a	131.5a	47.3ab	130.3ab	42.0ab	105.3ab
Logic®/Award®	59.3a	54.0a	152.0a	51.3ab	143.8ab	38.0ab	97.0abc
Untreated Control	57.8a	54.3a	157.5a	58.5a	173.3a	54.0a	158.8a
AC 303,630 .001%	58.0a	49.3a	142.0a	62.8a	183.3a	58.5a	169.5a
AC 303,630 .0025%	58.0a	48.8a	134.3a	49.0ab	144.0ab	58.0a	170.5a
AC 303,630 .005%	58.0a	47.0a	130.0a	43.3ab	126.0ab	53.3a	154.8a
AC 303,630 .0075%	58.0a	45.5a	126.0a	53.8ab	155.5a	54.8a	155.0a
AC 303,630 blank	59.3a	47.0a	132.5a	59.8a	172.3a	53.3a	154.3a
F	14.54	8.40	9.20	11.23	11.69	8.51	8.80
P	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Min. Sig. Diff.	12.029	22.234	65.202	21.949	67.524	25.698	78.134
d.f. = 27							
Critical value = 4.864							

	Mean no. ant mounds per 1/4 acre**				
	8 weeks		6 mo.	8 mo.	12 mo.
Product	count	rating	count	count	count
Amdro®/Seige®	19.5c	52.3d	28.3b	32.3b	28.5b
Affirm®/Ascend®	40.5b	83.5cd	26.0b	17.0c	18.8c
V71639	41.3b	80.5cd	22.3b	12.3c	19.3c
Logic®/Award®	58.3ab	129.0bc	36.0b	17.8c	12.0c
Untreated Control	68.5a	203.3a	65.3a	66.5a	45.8a
AC 303,630 .001%	62.0a	182.0 ab	--	--	--
AC 303,630 .0025%	66.3a	197.3a	--	--	--
AC 303,630 .005%	61.3a	171.5ab	--	--	--
AC 303,630 .0075%	73.3a	213.3a	--	--	--
AC 303,630 blank	66.0a	188.8ab	--	--	--
F	16.88	18.56	10.83	33.78	16.46
P	0.0001	0.0001	0.0002	0.0001	0.0001
MSD	18.774	60.599	18.153	13.465	12.002
d.f. =	27	27	12	12	12

* Upon disturbance mounds were rated as follows: 3 = over 1,000 ants; 2 = 100 - 1,000 ants; 1 = less than 100 ants.

**Means followed by the same letters are not significantly different using analysis of variance (ANOVA) and means separated using Tukey's studentized range test ($P \leq 0.05$). Both number of mounds and total rating [Ó(number of mounds X rating)] for each plot were analyzed.

Figure 1. Performance profile of currently registered and experimental bait-formulated fire ant insecticides applied 10 and 12 September 1996, Brazos Co., Texas.