Testing of Wheat-based Baits for Use in the Australian Fire Ant Eradication Program

Palestine Airport, Anderson Co., Texas - 2002

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In 2001, an established infestation of red imported fire ants (*Solenopsis invicta* Buren) was identified in the Brisbane, Queensland, Australia metropolitan area. The Queensland and Commonwealth governments initiated an eradication program that involved treating, initially, about 78 square miles with broadcast ant baits. Since the plan's inception, additional area has been included due to outlying infestations with an accompanying increase in expenditures. The only bait products available in such large quantities had to be imported from the United States at considerable cost. In an effort to cut costs (with accompanying other economic benefits) the Queensland Department of Primary Industries decided to try to formulate fire ant bait locally. Corn-based carrier grit was unavailable in Australia, but a wheat-based form could be manufactured.

In cooperation with Sumitomo Australia, this wheat-based granule was used to formulate two baits containing pyriproxyfen and s-methoprene. Large scale field trials were not possible or desirable in Brisbane, so the formulated baits were shipped to Texas for field testing.

Objective: Determine the effectiveness of a wheat-based carrier for broadcast fire ant baits.

Materials and Methods

The test site was located at the municipal airport of Palestine, Texas in the central east Texas Piney Woods region. 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 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, thus avoiding disruption by mowing. 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. Therefore total sample area was 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® E-Z-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 (**Table 1**) were assigned based on pre-count active mound numbers using the method outlined in Barr et. al (2002) to help compensate for initial mound count variability. All treatments were replicated four times. One Amdro plot was paved over during airport renovation after the four week evaluation. For Week 6 through Month 6 this missing observation was calculated using the formula tT + bB - G / (t-1)(b-1) where t = number of treatments (6); T = sum of observations in treatment; b = number of blocks (4); B = sum of observations within block and; G = sum of all measurements (Ott 1988). Appropriate raw data were extracted from the larger trial (Palestine Airport, 2002) and analyzed using SAS ANOVA procedures with means separated using Tukey's Studentized Range (HSD) Test, $P < 0.05$.

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

Active ingredient	Product/carrier	Formulation	Application Rate
pyriproxyfen	wheat granule	0.5% bait	1.5 lbs./acre
s-methoprene	wheat granule	0.5% bait	1.5 lbs./acre
hydramethylnon	Amdro®	0.73% conv. bait[1]	1.5 lbs./acre
s-methoprene	Extinguish™	0.5% conv. bait	1.5 lbs/acre
pyriproxyfen	Distance®	0.5% conv. bait	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

The three commercial baits (Amdro®, Distance® and Extinguish™) performed in accordance with general experience in the U.S. and Texas. Amdro showed a significant ($P < 0.05$) reduction versus the untreated plots beginning at only one week (**Table 2**). This trend continued until the three month count (see below regarding week four) when reinvasion began in earnest. As expected, the two IGR baits were slower acting but reduced mound activity to close to zero in two to three months.

The wheat-based pyriproxyfen bait gave a significant ($P < 0.05$) reduction in active ant mounds versus untreated plots by six weeks (81% control). The number of active mounds in these plots dropped to zero at six months, then began a slow rise as reinvasion occurred. The performance of this formulation is similar to Distance, the commercial formulation of 0.5% pyriproxyfen.

Wheat-based s-methoprene showed significant ($P < 0.05$) active mound reductions by two months post-treatment. Though not statistically different from Extinguish, control was numerically not as great as the commercial bait. The reason for this is unclear and difficult to explain in light of the performance of the wheat-based pyriproxyfen bait.

The evaluation at four weeks should be considered anomalous when the area was in the process of being mowed. Some plots still had tall, standing grass and others were covered by a thick layer of clippings while still others had been cleared of clippings. By six weeks all plots had been mowed and cleared making for much more reliable, consistent mound counts. Weather

conditions throughout the test were particularly favorable for fire ant mound building with regular rains and temperatures exceeding 100°F on only one or two days. The result was mounds that were easily detectable, even during the summer months, thus improving the quality of the data.

Table 2. Results of red imported fire ant mound evaluations: 3,200 ft.^{2} plots, 4 replications. Palestine, Texas, USA. Treatments applied June 6, 2002.

	Mean number of active mounds								
Treatment	Pre	1 wk	2 wk	4 wk	6 wk	2 mo	3 mo	4 mo	6 mo
untreated	16.50 a	16.75 a	14.75 a	11.25 a	15.75 a	12.50 a	11.75 a	16.50 a	17.50 a
wheat pyriproxyfen	16.00 a	11.25 ab	8.50 abc	4.00 a	3.00 b	0.25 b	0.00 b	1.25 b	3.50 b
wheat methoprene	16.00 a	15.00 a	8.75 ab	8.50 a	10.25 ab	4.25 b	2.75 b	5.00 ab	5.75 b
hydramethylnon (Amdro)	15.75 a	4.00 b	0.75 c	3.50 a	5.50 b	3.75 b	7.25 ab	10.75 ab	10.00 ab
methoprene (Exting.)	16.00 a	16.25 a	8.25 abc	5.25 a	2.25 b	1.00 b	0.00 b	3.50 b	3.25 b
pyriproxyfen (Distance)	16.00 a	9.25 ab	6.00 bc	1.25 a	3.25 b	1.00 b	1.00 b	3.00 b	4.25 b
F*	0.03	6.97	9.66	1.41	6.68	5.84	6.09	3.50	5.01
P	0.9993	0.0007	0.0001	0.2704	0.0008	0.0017	0.0014	0.0176	0.0036
R^2	0.8767	0.7879	0.8374	0.4288	0.7808	0.7570	0.7645	0.6511	0.7278
MSD	6.211	9.438	7.966	14.089	9.825	7.592	7.820	12.678	10.179

Means in the same column with the same letter are not significantly different. Means separated by Tukey's studentized range (HSD) test, $P < 0.05$. df = 15.

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

Literature Cited

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Ott, L. 1988. An introduction to statistical methods and data analysis. PWS-Kent Pub.Co., Boston. p.732.

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