

ATTRACTIVENESS AND EFFICACY OF FIPRONIL AND SULFLURAMID BAITS FOR CONTROL OF THE TEXAS LEAFCUTTING ANT¹

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ABSTRACT

Citrus pulp baits containing fipronil or sulfluramid were evaluated for their attractiveness to the Texas leafcutting ant and effectiveness in halting ant activity. Texas leafcutting ants were more than twice as likely to retrieve the fipronil bait compared to the sulfluramid bait. Both citrus pulp baits were highly effective in halting ant activity within 8 weeks following treatment. However, the fipronil bait reduced ant activity at a faster rate.

RESUMEN

Cebos de pulpa de árboles cítricos que contenían fipronil o sulfluramid se usaron para evaluar la atracción de la hormiga cortadora de hojas de Texas y para ver la eficiencia en detener la actividad de esta hormiga. En comparación, las hormigas cortadoras de hojas de Texas sacaron el cebo de fipronil casi en doble proporción al cebo de sulfluramid. Ambos cebos de pulpa de árboles cítricos fueron extremadamente eficientes en detener la actividad de la hormiga en las ocho semanas después del tratamiento. Sin embargo, el cebo de fipronil redujo la actividad de la hormiga con más rapidez.

INTRODUCTION

Leaf-cutting ants in the genus *Atta* (Hymenoptera: Formicidae) are among the most destructive insects in the tropical and subtropical Americas. Crops particularly susceptible to defoliation include citrus, cocoa, coffee, maize, cotton, eucalyptus, and pines (Cherrett 1986). The Texas leafcutting ant, *Atta texana* (Buckley), is the most northern representative of this genus and is a serious pest in first- and second-year plantations of loblolly pine, *Pinus taeda* L., in eastern Texas and west-central Louisiana (Moser 1984, Cameron and Riggs 1985). It also attacks citrus groves in southern Texas (V. French, Texas A&M Citrus Board, personal communication). This insect was rated third in relative pest importance (behind the southern pine beetle, *Dendroctonus frontalis* Zimmermann, and fusiform rust, *Cronartium quarcuum* f. sp. *fusiforme*) in a 1981 survey of major forest industries of eastern Texas (Texas Forest Service 1982). Pine seedling mortality due to the Texas leafcutting ant occurs on nearly 4,900 ha per year with control and seedling replacement costs averaging \$2.3 million per year (Cameron and Riggs 1985). This insect also is a considerable pest to homeowners within its range. A recent survey of Texas Cooperative Extension county agents in 70 counties indicated that, on average, nearly 30 calls are received per county per year primarily from homeowners with complaints about ants foraging on shrubs, rose bushes,

¹ *Atta texana* (Buckley) (Hymenoptera; Formicidae)

and fruit trees or in vegetable gardens (B.M. Drees, Texas Cooperative Extension, personal communication).

Fumigation with methyl bromide (Brom-o-gas®) has been widely used during winter months for nearly 50 years to effectively control the Texas leafcutting ant. However, the potential contribution of methyl bromide to ozone depletion has led to the scheduled removal of its Environmental Protection Agency (EPA) registration by the year 2005. Due to the imminent methyl bromide registration withdrawal and the chemical's high toxicity to man, a citrus pulp bait containing sulfluramid (Volcano® leafcutter ant bait, Griffin L.L.C., Mexico, 0.5% ai) was registered in Texas and Louisiana in 1999 and 2000, respectively. The registered application rates are 4.0 g/m² for winter treatments and 10.0 g/m² for summer treatments. This sulfluramid bait is nearly 100% effective in halting ant activity year around with a single application (D. M. Grosman, unpublished data; Darwin Foster, Temple-Inland Forest Products, and Ken Addy, Louisiana Pacific, personal communications). However, due to EPA concerns about the potential health and ecological effects of perfluorooctyl sulfonate chemicals (including sulfluramid), products containing sulfluramid are scheduled to be phased out by 2011.

Fipronil, a phenyl pyrazole insecticide, is registered in the United States for several uses including turf pests, fleas, ticks, roaches, termites and ants. Another citrus pulp bait, containing fipronil (Blitz®, Bayer CropScience, Brazil, 0.03% ai), is registered in Brazil, Columbia, Bolivia and Paraguay for control of several leaf-cutting ant species including *Atta sexdens* L., *Atta laevigata* (Smith) and *Acromyrmex subterraneus subterraneus* Forel (K. Holmes, Aventis, personal communication). This formulation uses an orange peel-based matrix. The recommended application rate is 10.0 g/m² of central nest area. This formulation is not yet registered in the United States.

Field trials were conducted during the winter 2000/2001 and summer 2001 to evaluate the attractiveness of the fipronil bait to the Texas leafcutting ant and its effectiveness in halting ant activity in comparison to the sulfluramid bait (Volcano®).

MATERIALS AND METHODS

Preference and efficacy trials were conducted in Angelina, Cherokee, Jasper, Newton, Nacogdoches, Rusk, and Shelby counties in eastern Texas on land owned and/or managed by Temple Inland, Louisiana Pacific, International Paper, and the USDA Forest Service. Colonies larger than 30 m by 30 m, smaller than 3 m by 3 m, those adjacent to each other (within 100 m), or those lacking a distinct central nest area were excluded. The central nest area was defined as the above-ground portion of the nest, characterized by a concentration of entrance/exit holes (generally > 5 holes/m²), surrounded by mounds of loose soil excavated by the ants (Cameron 1989). Scattered, peripheral entrance/exit and foraging holes (mounds) were not included in the central nest area.

Bait Preference. The trials were performed by placing 5.0 g portions of different formulations of citrus pulp baits (sulfluramid, fipronil, and blank citrus pulp) in plastic petri dishes (Cameron 1990, Della Lucia et al. 1992). Both the fipronil formulation and blank were comprised of an orange peel matrix; whereas, the sulfluramid formulation is reported be made of a mixture of citrus pulp types, i.e., orange, lemon, lime, and/or grapefruit (J. Whatley, Griffin L.L.C., personal communication). Five replicates, containing one dish for each treatment, were evaluated on one colony on September 23, 2001 and five more replicates were evaluated on a second colony on October 2, 2001. The replicates were distributed at random at about 10:00 hours CST within the central nest area or along active foraging trails of the two colonies. All dishes within each replicate were retrieved when the most attractive bait was nearly gone or at the end of the test period (4 hours). The bait not

removed by ants from each petri dish was weighed and mean weight of bait removed was computed.

Bait Efficacy. All trials were conducted using procedures developed by Cameron (1989). The sulfluramid bait was applied to the central nest area at 4 g/m² in winter and 10 g/m² in summer; whereas, the fipronil bait was applied at 10 g/m² for both seasons. Application rates were based on the area (length X width) of the central nest. Treatments were randomly assigned to the selected ant nests with 10 - 12 replicates per treatment per season. The baits were applied to central nests only. In all trials, applications were timed to avoid wet soil conditions and rain within 24 hr following application of baits.

For all efficacy trials, treatment effectiveness was evaluated by counting the number of active entrance/exit holes prior to treatment and at 2, 8, and 16 weeks following treatment. Ten untreated colonies were included each season in the efficacy trials as checks and monitored to account for possible seasonal changes in ant activity. In addition, observations were made on several colonies just after treatment with fipronil or sulfluramid baits to determine the length of time necessary for the ants to retrieve all of the applied bait. For each colony, the percentage of initial activity was calculated as the current number of active holes divided by the initial number of active holes at each post-treatment time period. Also, the percentage of colonies deemed to be totally inactive was calculated for each treatment at each post-treatment evaluation. Data were transformed using the arcsin $\sqrt{\%}$ transformation and analyzed by the GLM procedure. Fisher's Protected LSD test was used to detect significant differences among treatments at the $\alpha = 0.05$ probability level (StatView 1999).

RESULTS

Bait Preference. In preference trials (10 replicates) conducted in late September and early October 2001, the Texas leafcutting ant retrieved an average of 79% of the available fipronil bait compared to only 35% of the sulfluramid bait (Table 1). The ants retrieved 64% of a blank citrus pulp bait (no active ingredient), known to be composed of orange citrus pulp. Although the true citrus pulp composition of the sulfluramid bait is not known to the authors, communications with Griffin L.L.C. and the above results suggest that the Texas leafcutting ant prefers baits composed primarily of orange citrus pulp and are less attracted to baits composed of other types of citrus pulp (e.g., lemon, lime, grapefruit).

TABLE 1. Attractiveness of Fipronil and Sulfluramid Baits to the Texas Leafcutting Ant (*Atta texana*) - September and October 2001.

Treatment	N	Mean Percent Citrus Pulp Bait Removed from dishes \pm SE ^a
Fipronil	10	79.1 \pm 7.8 b
Sulfluramid	10	35.0 \pm 5.3 a
Blank citrus pulp	10	63.5 \pm 10.4 b

^a Means followed by the same letter are not significantly different (Fisher's Protected LSD, $P > 0.05$).

Bait Efficacy. In the winter 2000/2001 trial, both fipronil and sulfluramid baits were 100% effective in completely halting ant activity within 8 weeks post-treatment (Table 2). However, a comparison of the proportion of colonies inactive and the level of remaining ant

TABLE 2. Efficacy of Fipronil and Sulfluramid Baits Applied by Spreader to Control the Texas Leafcutting Ant (*Atta texana*) in Eastern Texas (Winter 2000-2001 and Summer 2001).

Treatment	No. of Colonies Treated	Mean Nest Area (m ²)	Mean No. Active Holes Per Nest @ Trt.	Mean % initial activity ^a (% inactive colonies):					
				2 wk		8 wk		16 wk	
<u>Winter 2000/2001</u>									
Fipronil (10.0 g/m ²)	12	31	90	3.7 a	(50)	0.0 a	(100)	0.0 a	(100)
Sulfluramid (4.0 g/m ²)	12	45	130	14.9 b	(0)	0.0 a	(100)	0.0 a	(100)
Check (no treatment)	10	40	91	88.9 c	(0)	92.8 b	(10)	64.4 b	(0)
<u>Summer 2001</u>									
Fipronil (10.0 g/m ²)	10	56	221	0.5 a	(70)	0.0 a	(100)	0.0 a	(100)
Sulfluramid (10.0 g/m ²)	10	53	181	9.9 b	(10)	0.2 a	(90)	6.7 a	(90)
Check (no treatment)	10	36	169	82.3 c	(0)	100.0 b	(0)	87.4 b	(0)

^a Means followed by the same letter within each season and column are not significantly different (Fisher's Protected LSD, P > 0.05).

activity at 2 weeks post-treatment for fipronil and sulfluramid bait treatments indicated that the fipronil bait was significantly faster in reducing ant activity.

The summer 2001 trial similarly indicated that the fipronil bait was highly effective during the summer months and can completely halt ant activity of most colonies within 2 weeks post-treatment (Table 2). Again, the fipronil bait significantly reduced ant activity faster than did the sulfluramid bait. However, there was no difference in efficacy between treatments after 8 weeks post treatment.

Field observations indicated that once ants become active (about 10:00 AM CST in the winter and 9:00 PM CST in the summer), worker ants readily found and retrieved both fipronil and sulfluramid baits. In August 2000, hourly observations made after the central nest areas of six colonies were treated with sulfluramid bait (10 g/m²) revealed that the ants consistently retrieved all bait particles within 5 to 6 hours. In October 2001, observations made after the central nest areas of two colonies were treated with fipronil bait (10 g/m²) found that the ants retrieved all bait particles in half the time (2.5 to 3 hours), compared to sulfluramid bait.

DISCUSSION

Overall, both the fipronil and sulfluramid baits were highly attractive to the Texas leafcutting ant and were highly effective in halting ant activity in both the winter and summer seasons. However, in side by side comparisons, the fipronil bait was noticeably more attractive to the ants and reduced ant activity at a more rapid rate than did the sulfluramid bait. Given the pending phase-out of both methyl bromide and Volcano®, a critical need for an effective alternative to control the Texas leafcutting ant exists, not only in pine plantations, but also in areas surrounding citrus groves and homes. The fipronil bait was a highly attractive and effective alternative for this purpose. As of August 2002, Bayer CropScience was pursuing EPA registration of this same fipronil bait formulation in the United States under the trade name BES 100.

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