

Imported Fire Ants:¹ 10-5, An Alternate Formulation of Mirex Bait²

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ABSTRACT

The formulation of mirex bait was modified so the soybean oil was applied to the corncob grits at 2 times; mirex was included in only the 2nd application. The bait (called 10-5) contained only 1/3 (0.1%) as much toxicant as the standard 4X bait (0.3%). The procedure concentrated the toxicant on or near the surface of the

grits, which made the mirex more available to *Solenopsis invicta* Buren and *S. richteri* Forel. In 3 field tests against natural infestations of *S. invicta* with 10-5, the control obtained was comparable to that obtained with the standard.

The development of mirex bait and the concentrations that proved effective against the red and black imported fire ants, *Solenopsis invicta* Buren, and *S. richteri* Forel, respectively, is summarized in Table 1. Since 1963, the bulk rate of application and the amount of actual toxicant applied has been reduced substantially without reducing the degree of control obtained. For example, use of latex coatings (Banks et al. 1972, 1973a) and a modification of the formulation that caused the mirex to be bound in the latex on or near the surface of the corncob grits (Banks et al. 1973b) made the oil and mirex more available to the ants. However, technical difficulties in the application of the coated bait with aircraft and problems in registration of the bait with the Environmental Protection Agency prevented its use in large-scale control operations.

Reported here is another modification of the formulation and the procedure to produce the bait whereby the mirex is concentrated on or near the surface of the corncob grit without using latex coating. Field tests were made with the modified formulation against natural infestations of imported fire ants.

MATERIALS AND METHODS.—The experimental formulation, 85% corncob grits, 14.9% once-refined soybean oil, and 0.1% mirex, was prepared as follows: Corncob grits (12–30 mesh) were sprayed with 2/3 of the soybean oil (containing no mirex) as they were tumbled in a large mixer. After the mixture was tumbled another 10 min, it was removed to a holding bin for 24 h to permit the oil to penetrate to the core of the grits. Then the oil-soaked grits were returned to the mixer, sprayed with the remaining 1/3 of the oil (containing mirex at 2% by weight), and tumbled for ca. 10 min to assure thorough coating of the grits with the 2nd batch of oil. This modified formulation has been called "10-5" in view of the 2-stage application of 10% of the oil and then 5%. The coined name will be used throughout this paper to designate the experimental formulation.

The standard 0.3% (4X) mirex bait prepared in the usual manner (Banks et al. 1973b) was compared with the 10-5 bait in 3 field tests against natural in-

festations of *S. invicta*. Both the 4X and 10-5 baits used in the 1st test were formulated by the Allied Chemical Corp. For the other 2 tests, we formulated the 10-5 bait in our laboratory and compared it with commercially formulated 4X bait.

Test 1.—Test 1 was made in 1972 in 2 blocks of ca. 8100 ha (20,000 acres) each located within a larger treatment area in Colquitt and Thomas Co., GA. Eighteen plots, 0.2–1.0 ha (1/4–2 1/2 acres), were selected within each block, and the number of active mounds of imported fire ants on each was determined before treatment. The size of the total treated area precluded establishment of untreated check plots within a reasonable distance.

The baits were applied by commercial aerial applicators from multi-engine Lockheed PV-2's equipped with auger-fed dispersal systems. Electronic guidance for the aircraft was provided under contract by Decca Survey Systems, Houston, TX. Personnel of the Animal and Plant Health Inspection Service, USDA, supervised application. The 10-5 bait was applied to 1 block at a rate of 1.12 kg/ha (1.0 lb/acre), and the standard 4X bait was applied to the other block at a rate of 1.4 kg/ha (1.25 lb/acre).

Test 2.—The 2nd test was made in September 1973 in a permanent pasture just north of Plant City, Hillsborough Co., FL. Each bait was applied to plots of ca. 2.0 ha with a tractor-mounted Cyclone® seeder at a rate of 1.4 kg/ha (1.4 and 4.2 g/ha actual mirex for the 10-5 and 4X baits, respectively). Three subplots ca. 0.2 ha each were established within each plot, and pre-, and post-treatment counts of the number of active mounds of fire ants were made. Three plots were established in an adjacent untreated area as checks.

Test 3.—This test was made in September 1974 in a permanent pasture just east of Tallahassee, Leon Co., FL. Each of the baits was applied to 3 plots (ca. 0.4 ha each) at a rate of 1.4 kg/ha with the same applicator used in test 2. Three plots were left untreated as checks. A circular count area of ca. 0.2 ha was used within each plot for pre-, and post-treatment counts of the number of active mounds of the ants.

The effectiveness of all treatments was determined by the procedures described by Banks et al. (1972, 1973b).

RESULTS AND DISCUSSION.—Table 2 shows post-treat-

¹ Hymenoptera: Formicidae.
² This paper reflects the results of research only. Mention of a pesticide or a commercial or proprietary product does not constitute a recommendation or an endorsement by the USDA. Received for publication March 22, 1976.

Table 1.—Effectiveness of mirex bait when various rates of application of bulk bait and toxicant were used against imported fire ants.^{a, b}

Concentration of mirex in bait (%)	Rate of application		% reduction in no. of active mounds	Reference
	Bulk bait kg/ha	Toxicant g/ha		
0.075	2.27-9.08	4.2-16.8	91-100	Lofgren et al. 1963
.075	5.7	10.5	92-100	Lofgren et al. 1964
.075	1.36, 2.27, 4.54	2.5-8.4	98-100	Lofgren et al. 1964
.15	1.36, 2.27, 4.54	5.0-16.8	98-100	Lofgren et al. 1964
.3	1.36, 2.27, 4.54	10.0-33.6	98-100	Lofgren et al. 1964
.075	4.54	8.4	95-100	Stringer et al. 1964
.15	4.54	16.8	93-100	Stringer et al. 1964
.15	1.12-6.72	1.68-10.1	91-100	Banks et al. 1971
.225	1.12-4.48	2.50-10.1	94-100	Banks et al. 1971
.3	1.12-4.48	3.36-13.4	93-100	Banks et al. 1971
.3	1.4	4.2	91-100	Markin and Hill 1971
.3	1.4	4.2	98-99	Banks et al. 1972
.4	1.4 ^c	5.58	96-100	Banks et al. 1972
.4	1.12 ^c	4.47	96-100	Banks et al. 1972
.3	1.4	4.2	97-99	Banks et al. 1973b
.38	.84	3.18	100	Banks et al. 1973b
.38	1.12	4.25	98	Banks et al. 1973b
.15	1.12	1.68	99	Banks et al. 1973b
.10	1.12	1.12	99	Banks et al. 1973b
.3	1.4	4.2	42-95 ^d	Markin et al. 1975

^a In early tests, the red and black imported fire ants were not separated.

^b All studies reported involved 1 application of bait to an area.

^c Baits coated with acrylic latex.

^d Effectiveness of bait reduced by application during winter months.

ment counts and the percentage reduction due to treatment. In Test 1, after 13 weeks the standard 4X bait had reduced the number of active mounds slightly more than the 10-5 bait, but the difference was not statistically significant in the paired "t" test since the calculated value of 1.246 was less than the t (0.05) value of 1.740 for 17 df. However, part of the difference in the effectiveness of the 2 formulations in test 1 may have occurred because of skips on some plots in the 10-5 treatment block. Surviving

colonies were found in rows parallel to the line of flight of the aircraft across plots, an indication that the aircraft had deviated from the prescribed line of flight. No counts were made on any plots in this test after 13 wk post-treatment because small new colonies resulting from nuptial flights made during or just before the treatment were seen at that time.

In the 2 small-plot tests, no significant differences were noted in the effectiveness of the 10-5 and 4X baits. Comparison of data with the t statistic for

Table 2.—Effectiveness of 10-5 (0.1%) and 4X (0.3%) mirex baits against natural infestations of red imported fire ants.

Formulation	Rate of application/ha		No. of plots	Pretreatment total of active mounds	% reduction in number of active IFA mounds after indicated weeks ^{a, b}						
	Bait (kg)	Toxicant (g)			4	6	8	13	16	26	36
<i>Test 1</i>											
10-5	1.12	1.12	18	1248	89.3			91.6*			
4X	1.4	4.2	18	1250	91.0			95.0*			
<i>Test 2</i>											
10-5	1.4	1.4	3	44			79.5		95.6**		
4X	1.4	4.2	3	76			98.6		98.6**		
Check			3	75			33.3		5.5		
<i>Test 3</i>											
10-5	1.4	1.4	3	61	26.2		62.3	67.2		77.0	86.9***
4X	1.4	4.2	3	55	34.5		69.1	72.7		69.1	85.4***
Check			3	55	7.2		18.2	9.1		14.5	20.0

^a Some plots contained small new colonies at time of final evaluation in each test. These were considered to be reinfestation from newly-mated queens flying into the plots and were not counted in computing % reduction.

^b Means followed by same number of asterisks do not differ significantly t (0.05).

the difference in 2 means obtained from small samples (Mendenhall 1971) showed that the calculated t values for both tests were much smaller than the critical t value. The calculated value of t in test 2 was 0.8264 and in test 3 was 0.1214 as compared with a value of t (0.05) of 2.132 for 4 df.

The reduction in the number of active mounds obtained with both formulations was somewhat less in test 3 than in the previous tests. The reason was not apparent, but it probably was related to temperature and foraging conditions at the time of treatment since the effectiveness of the 4X mirex bait has been demonstrated previously and amply documented.

The present study therefore indicates that the 10-5 formulation of mirex bait will provide control equal to that provided by the 4X bait in large-area treatments. The reduced amount of toxicant should reduce environmental contamination.

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