

Four Mirex Bait Formulations for Control of the Red Imported Fire Ant^{1,2,3}

W. A. BANKS,⁴ G. P. MARKIN,⁵ J. W. SUMMERLIN,⁴ and C. S. LOFGREN¹

ABSTRACT

Mirex bait (soybean oil and mirex) formulated on corncob grits (the standard), mirex bait formulated on corncob grits or Fur-Ag[®] granules and treated with latex, and microencapsulated mirex bait all gave control of *Solenopsis invicta* Buren ranging from 84 to 100% in 4 field tests.

Lofgren et al. (1962, 1963, 1964) showed that a bait composed of soybean oil and mirex formulated with corncob grits as the carrier (now the standard) was effective in eliminating natural infestations of the red imported fire ant, *Solenopsis invicta* Buren. Banks et al. (1970) showed that the bait formulated on Fur-Ag[®] granules was as effective as the standard in field tests. Markin and Hill (1971) found that microcapsules of the bait were as effective as the standard when weather conditions were normal and were more effective when they were adverse. In recent studies at the Insects Affecting Man Laboratory at Gainesville, Fla., (Banks et al.) we found that the oil content of the corncob grit bait could be increased from 15 to 20% by treating the completed formulation with latex. Earlier studies by Lofgren et al. (1963) showed that 15% oil was the maximum amount which could be used on the grits without causing the formulation to become too oily to flow well. Latex overcame oiliness and provided the desired characteristics. We found also in tests with individual colonies of ants that they were able to obtain more oil and mirex from the latex-treated formulation than from the standard formulation. Since no direct comparison of all 4 formulations had been made, we compared the effectiveness of the various formulations in the field in central Florida against natural infestations of the red imported fire ant. Results of the tests are reported here.

MATERIALS AND METHODS.—Standard and latex-treated corncob grit and Fur-Ag formulations were prepared by Allied Chemical Corp. The standard formulation contained 14.7% soybean oil, 0.3% mirex, and 85% corncob grits. The latex-treated corncob grit and Fur-Ag formulations contained 20.0% soybean oil, 0.4% mirex, and 79.6% corncob grits or Fur-Ag granules. These formulations were sprayed after formulation with a 40% aqueous solution of latex (AA-421 acrylic) at a rate of 100 ml/kg of bait. The latex solution contained also 1.0% by weight of sodium propionate to retard molding of the grits caused by addition of the water.

The microencapsulated bait was prepared by the Capsular Products Division, National Cash Register Co., Dayton, Ohio. It was designated "long-term capsules" and contained 88% soybean oil, 1.76% mirex, and 10.24% gelatin-plastic capsule wall material.

The standard and the latex-treated formulation baits were applied at 567 g/acre (1.7 and 2.26 g/acre mirex for standard and latex-treated baits, respectively). We omitted the Fur-Ag formulation from the last 2 tests and substituted a lower rate of application (154 g; 1.81 g/acre mirex) of the latex-treated corncob grit bait. The microencapsulated bait was applied at 100 g/acre (1.76 g/acre mirex).

All the tests were made in Hillsborough County, Fla., on 1-mile² blocks (1-3 replications for each material) in each of the 4 tests. Subplots were selected in each block for pre- and posttreatment counts of active mounds. The number and size of subplots varied, but an effort was made to include a minimum of 250 active mounds in each block. However, the small number of mounds in some areas made this impossible.

The 1st series of test plots was treated in late July and early August 1969, the 2nd in November 1969, the 3rd in March 1970, and the 4th in August 1970. Application of each treatment took from 4 to 10 days dependent upon the weather and technical difficulties with the aircraft.

All applications were made with aircraft. In the 1st test (corncob grit and Fur-Ag baits), we used a Stearman biplane under a commercial contract. This plane was equipped with a Texas A&M-type spreader which had an overall effective swath width of 85 ft. The operational swath spacing was 60 ft which gave an overlap of 25 ft on each swath. Microencapsulated bait in the 1st test and all formulations in the last 3 tests were applied with a Piper Pawnee[®] owned and operated by the Aircraft Operations Section, Plant Protection Division, Agric. Res. Serv., USDA. The Pawnee was equipped with a special spreader designed and built by the Aircraft Operations staff. It had an overall swath width of 110-120 ft and an operational swath spacing of 50 ft for the applications.

Table 1 shows a summary of weather conditions during bait applications. Excessive rainfall has been found to reduce the oil content of unencapsulated baits, and thus their effectiveness. Temperature influences foraging activity of the ant, and consequently the effectiveness of a given treatment. Kill of the

¹ Hymenoptera Formicidae.

² Received for publication Jan. 5, 1972.

³ Mention of a pesticide or a proprietary product does not constitute recommendation or endorsement by the USDA.

⁴ Entomology Research Division, Agric. Res. Serv., USDA, Gainesville, Fla. 32601.

⁵ Plant Protection Division, USDA, Gulfport, Miss. 39502.

⁶ W. A. Banks, D. P. Jouvenaz, C. S. Lofgren, and D. M. Hicks. Evaluation of coatings for corncob grit-soybean oil used to control imported fire ants. In manuscript.

Table 1.—Summary of weather conditions during mirex-bait applications for red imported fire ant control in Hillsborough County, 1969–70.

Weather factor	Treatment day										
	1	2	3	4	5	6	7	8	9	10	
Rainfall ^a	T ^b	0.04	0.42	0.20	Test 1		1.96	0.43	0.47	0.45	0.13
Temperature ^c					T						
Min	72	73	72	73	72	70	71	70	70	70	71
Max	91	94	94	93	93	93	87	80	84	84	88
Rainfall ^a	0.07				Test 2		0.02	T			
Temperature ^c											
Min	42	47	48	50	55	50					
Max	64	68	73	76	77	77					
Rainfall ^a			1.37		Test 3						
Temperature ^c											
Min	47	57	61	56	41	49	42				
Max	81	76	82	73	59	66	69				
Rainfall ^a	.45	.02	.10	.75	Test 4						
Temperature ^c											
Min	74	72	72	70	74						
Max	87	93	91	93	93						

^a Rainfall in inches.
^b T = trace.
^c Temperature shown is air temperature in °F at 4 ft above soil surface.

ant is considerably slower at reduced temperatures and in some cases total kill is lower.

Pre- and posttreatment evaluations were made by opening the ant mounds on each plot with a spade. A mound was considered active if 20 or more worker

ants were present or if a queen was present with less than 20 workers. Control was calculated by determining the percentage reduction in number of active mounds.

RESULTS AND DISCUSSION.—Table 2 shows results of

Table 2.—Comparison of the average effectiveness of 4 mirex-bait formulations against natural infestations of the red imported fire ant in central Florida, 1969–70.

Bait formulation	Rate of application (g/acre)		No. sub-plots	Pretreatment no. active mounds	% reduction in no. active mounds after indicated weeks				
	Total bait	Toxicant			4	8	16	20	26
					Test 1				
Latex-treated corncob grit	567	2.26	22	730	80	79	84		
Latex-treated Fur-Ag granules	567	2.26	27	719	89	86	92		
Microencapsulated	100	1.76	14	441	96	99	98		
Standard	567	1.70	22	750	71	87	85		
					Test 2 ^a				
Latex-treated corncob grit	567	2.26	18	823	61	90	97	98	100
Latex-treated Fur-Ag granules	567	2.26	17	773	38	75	80	96	98
Microencapsulated	100	1.76	19	782	59	79	90	97	99
Standard	567	1.70	16	779	29	63	83	95	99
					Test 3 ^b				
Latex-treated corncob grit	567	2.26	15	751	88	99	100	100	
Latex-treated corncob grit	454	1.81	9	520	85	99	100	99	
Microencapsulated	100	1.76	11	596	64	93	98	96	
Standard	567	1.70	15	765	87	97	99	99	
					Test 4				
Latex-treated corncob grit	567	2.26	15	706	92	89	96 ^c		
Latex-treated corncob grit	454	1.81	4	213	92	96	96 ^c		
Microencapsulated	100	1.76	17	575	93	96	95 ^c		
Standard	567	1.70	17	435	91	97	99 ^c		

^a Initial counts in test 2 made at 5 weeks instead of at 1 week posttreatment.
^b Counts in test 3 made at 4, 9, 14, and 19 weeks.
^c Counts made at 15 weeks.

posttreatment counts. The data indicate that all the formulations were effective in controlling the red imported fire ant. Latex-treated formulations and the standard bait gave somewhat poorer control in the 1st test than in the subsequent 3 tests. We attributed this to non-uniform application of the bait. The 1st test was the only one made with the commercial applicator, and we noted that the pilot had considerable difficulty lining up on the kytoons used to mark the swaths. Also, evidence of skips was apparent in the posttreatment evaluations, because some plots and even portions of the same plot showed poor control, whereas the remainder of that plot and other plots receiving the same treatment showed complete control. Heavy rainfall during treatment may have decreased effectiveness of the bait somewhat, but it apparently was not highly significant, because some plots that received more than 0.4 in. of rain within 1 hr of treatment were free of ant colonies by 8 weeks after treatment.

In the last 3 tests, the formulations were about equal in effectiveness. Although temperatures were lower during and shortly after applications in the 2nd test and the latex-treated corncob grit formulation gave faster kill, all materials had about the same percentage reduction in number of active mounds. After 20-26 weeks, the 454-g/acre rate of the latex-

treated bait in the 3rd and 4th tests was as effective as the 567-g/acre rate.

No one formulation showed a decided superiority over the others. All were highly effective and should give excellent control of the red imported fire ant in most field applications.

ACKNOWLEDGMENT.—We gratefully acknowledge the assistance of D. M. Hicks and K. H. Schroeder, Entomology Research Division, and C. J. Mauffray, J. Henderson, Murl Miles, M. J. Cuevas, D. J. Adams, A. Ladner, and B. Clark, Plant Protection Division.

REFERENCES CITED

- Banks, W. A., C. E. Stringer, C. S. Lofgren, N. W. Pierce, and F. J. Bartlett. 1970. Fur-Ag[®], an alternate carrier for soybean oil-mirex bait for control of the imported fire ant. *J. Econ. Entomol.* 63: 1990-1.
- Lofgren, C. S., F. J. Bartlett, and C. E. Stringer. 1963. Imported fire ant toxic bait studies: Evaluation of carriers for oil baits. *Ibid.* 56: 62-66.
- Lofgren, C. S., F. J. Bartlett, C. E. Stringer, and W. A. Banks. 1964. Imported fire ant toxic bait studies: further tests with granulated mirex-soybean oil bait. *Ibid.* 57: 695-8.
- Lofgren, C. S., C. E. Stringer, and F. J. Bartlett. 1962. Imported fire ant toxic bait studies: GC-1283, a promising toxicant. *Ibid.* 55: 105-7.
- Markin, G. P., and S. O. Hill. 1971. Microencapsulated oil baits for control of the imported fire ant. *Ibid.* 64: 193-6.