

Control of Imported Fire Ants with Nonachlor¹

W. A. BANKS,² C. E. STRINGER, JR., W. F. BARTHEL, and C. S. LOFGREN²
Plant Pest Control Division, Agr. Res. Serv., USDA, Gulfport, Mississippi

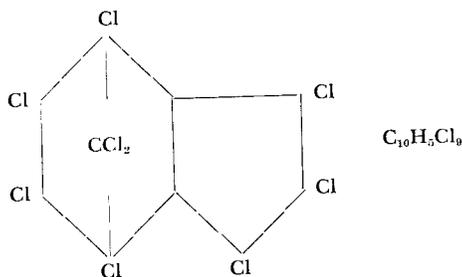
ABSTRACT

Field tests were conducted to evaluate Nonachlor (1,2,3,4,5,6,7,8-nonachloro-3a,4,7,7a-tetrahydro-4,7-methanoindan) as a residual insecticide in the soil and as a toxicant in the corncob grits-soybean oil bait for control of the imported fire ant, *Solenopsis saevissima richteri* Forel. Two field tests with 0.15% and 0.3% Nonachlor bait at 10 pounds per acre gave less control than 10 pounds per acre

of 0.075% mirex bait. However, these tests indicate some potential for Nonachlor as a bait toxicant. In residual studies, 1/4 pound per acre of Nonachlor consistently gave control equal or slightly superior to a comparable dosage of heptachlor. Dosages of 1 and 2 pounds of Nonachlor per acre provided 99 to 100% control of the imported fire ant through 1 year.

The effectiveness of heptachlor, aldrin, dieldrin, and chlordane as residual insecticides in the soil for the control of the imported fire ant, *Solenopsis saevissima richteri* Forel, was reported by Blake et al. (1959) and Lofgren et al. (1961, 1964a). Control of imported fire ants with a bait consisting of corncob grits, soybean oil, and the toxicant mirex was reported by Lofgren et al. (1964b) and Stringer et al. (1964). This paper presents the results of field tests against the imported fire ant with Nonachlor as a residual insecticide in the soil and as the toxicant in the corncob grits-soybean oil bait.

Nonachlor is a chlorinated hydrocarbon insecticide related to chlordane. It was first produced by Velsicol Chemical Corporation in 1948. The compound is a white crystalline solid with the chemical name 1,2,3,4,5,6,7,8,8-nonachloro-3a,4,7,7a-tetrahydro-4,7-methanoindan. The structural formula is:



Mammalian toxicity is relatively low, the LD₅₀ to rats is reported by the manufacturer to be 326 mg/kg.

Field tests with Nonachlor against imported fire ants were initiated in 1963 after preliminary laboratory screening indicated that it had potential as a bait toxicant and also as a residual soil insecticide.

TOXIC-BAIT STUDIES.—Procedures.—Field plots were established in June 1963, in a Bahia grass pasture in Hancock County, Miss., to evaluate Nonachlor as the toxicant in the corncob grits-soybean oil bait. Three 1-acre plots were treated with 10 lb/acre of a 0.15% Nonachlor bait. Three additional plots were treated with 10 lb/acre of 0.075% mirex bait as a standard for comparison. Application was made with a Buffalo turbine blower.

A 2nd series of plots to further evaluate Nonachlor as a bait toxicant was established and treated in

August 1963. These plots were situated in a Bahia and carpet grass pasture in Hancock County, Miss. In this series 3 1-acre plots were treated with 10 lb/acre of 0.15% Nonachlor bait and 3 were treated with 10 lb/acre of 0.3% Nonachlor bait. Mirex bait at 10 lb/acre of a 0.075% formulation was applied to 3 plots as a standard for comparison.

Posttreatment evaluations on the plots were conducted by digging into each mound within the plot. A mound was considered active as long as more than 20 worker ants could be found within the mound or if a wingless queen was found with less than 20 workers. Any mound not meeting these requirements was considered inactive. Percent control was deter-

Table 1.—Results of field tests to evaluate Nonachlor as the toxicant in corncob grits-soybean oil bait. (Application with Buffalo turbine blower.)^a

Formulation	Rate lb/acre	Avg pre-treatment count of active IFA mounds/plot	% reduction in active mounds at indicated weeks following treatment	
			4	8
<i>Series I</i>				
Corncob grits 85.00%	10	39	59	90
Soybean oil 14.85%				
Nonachlor 0.15%				
Corncob grits 85.00%	10	42	94	97
Soybean oil 14.925%				
Mirex 0.075% (standard)				
Check		53	3	9
<i>Series II</i>				
Corncob grits 85.00%	10	23	55	45
Soybean oil 14.85%				
Nonachlor 0.15%				
Corncob grits 85.00%	10	23	66	35
Soybean oil 14.7%				
Nonachlor 0.3%				
Corncob grits 85.00%	10	28	91	81
Soybean oil 14.925%				
Mirex 0.075% (standard)				
Check		33	0	0

^a Avg from 3 replicates.

¹ Accepted for publication November 18, 1965.
² Present address: Insects Affecting Man and Animals Research Laboratory, Entomol. Res. Div., ARS, USDA, P. O. Box 1268, Gainesville, Fla. 32601.

³ The assistance of Messrs. P. M. Bishop, N. Pierce, C. J. Mauffray, L. H. Rogers, and M. J. Cuevas was greatly appreciated.

Table 2.—Field tests to evaluate the residual effectiveness of Nonachlor in the soil in controlling imported fire ants. Series I. 1963.^a

Insecticide	Dosage (lb/acre)	Avg pretreatment count of active IFA mounds/ plot	% reduction in active mounds at indicated weeks following treatment					
			4	8	16	32	52	78
Nonachlor	1/4	26	38	92	94	100	85	70
Nonachlor	1/2	24	47	93	97	100	99	90
Nonachlor	1	25	47	96	100	100	99	96
Nonachlor	2	25	60	100	100	100	100	100
Heptachlor (standard)	1/4	27	58	89	95	80	76	19
Check		23	9	32	40	10	25	21

^a Average from 3 replicates.

mined by comparison with pretreatment mound counts.

Results.—The results of posttreatment counts on both series of bait tests are shown in Table 1. Nonachlor did not perform as well as mirex in either of the bait tests. In Series I, Nonachlor gave 90% reduction in active mounds after 8 weeks as compared with 97% reduction for mirex. As incipient colonies arising from mating flights occurring in the untreated area surrounding the plots were apparent on the plot after 16 weeks, further evaluation was not possible. In Series II, after 4 weeks Nonachlor gave 55% reduction at the 0.15% concentration and 66% reduction at the 0.3% concentration as compared with 91% for the mirex standard. By 8 weeks, control had declined to 45, 35, and 81%, respectively. This reduction in degree of control was due to division of surviving mounds, a condition sometimes occurring in the early weeks following a bait treatment. As in Series I, incipient mounds from mating flights were apparent on all plots in Series II after 16 weeks.

Discussion.—As a bait toxicant, Nonachlor is somewhat less effective than mirex. In neither of the tests did Nonachlor give as good control as a lower-concentration mirex bait. Nonachlor does present some possibilities for use in a toxic bait for control of imported fire ants and warrants further testing in this respect.

Table 3.—Field tests to further evaluate the residual effectiveness of Nonachlor in the soil in controlling imported fire ants.^a Series II. 1963.

Insecticide	Dosage (lb/acre)	Avg pre-treatment count of active IFA mounds/ plot	% reduction in active mounds at indicated weeks following treatment			
			8	26	38	52
Nonachlor	1/8	22	18	45	77	79
Nonachlor	1/4	22	49	70	95	95
Nonachlor	1/2	22	53	71	97	100
Nonachlor	1	22	37	72	97	100
Heptachlor (standard)	1/4	22	38	69	92	97
Check		21	0	16	22	59

^a Average from 3 replicates, except 1/8 and 1/4 lb, which were from 6 replicates.

SOIL RESIDUE STUDIES.—Procedures.—Field tests to evaluate Nonachlor as a residual insecticide in the soil for control of the imported fire ant were initiated in May 1963. One-half-acre plots were established in a Bermudagrass pasture in Stone County, Miss., and treated at dosages of 1/4, 1/2, 1 and 2 lb of Nonachlor/acre. Each dosage was replicated 3 times. Application was made with a small tractor-mounted applicator at a bulk rate of 10 lb/acre of a granular attapulgitic formulation. Heptachlor at 1/4 lb/acre was applied to 3 plots as standard.

A 2nd series of plots to evaluate Nonachlor as a residual insecticide in the soil was established in September 1963. A permanent pasture with varying proportions of Bahia and carpet grass, situated in Hancock County, Miss., was selected for this test. In this study 1-acre plots were treated with Nonachlor at 1/8, 1/4, 1/2, and 1 lb/acre. Each dosage was replicated 3 times with the exception of the 1/8- and 1/4-lb dosages, which were replicated 6 times. Heptachlor at 1/4 lb/acre was applied as the standard. Application was made with the same machine as in Series I at 10 lb of granules/acre.

In January 1964, a 3rd series of field plots was established to further evaluate the effectiveness of Nonachlor as a residual insecticide. In this test dosages and methods were the same as in Series II; however, the plots were of 1/2 acre. This test was conducted in a coastal Bermudagrass pasture in Stone County, Miss.

Posttreatment evaluations on all plots were conducted in the same manner as previously described for the bait tests.

Results.—The results of posttreatment counts on the plots in residual studies in Series I are shown in Table 2. Maximum control was noted on the plots at 32 weeks after treatment. Nonachlor at all dosages gave complete control of the ants while the heptachlor gave 80% after having given a maximum reduction in active mounds of 95% at 16 weeks. After 1 year, some reinfestation had occurred and the reduction in active mounds had declined to 85% on the 1/4 lb/acre treatment while holding at 99% on the 1/2 and 1 lb and 100% on the 2 lb/acre treatments. After 1 1/2 years, control with Nonachlor was still complete at the 2 lb/acre level and reduction in number of active mounds was 96% at 1 lb, 90% with 1/2 lb, and 70% at 1/4 lb/acre. Percent reduction in active mounds on the heptachlor had dropped to 19%.

The results of posttreatment evaluations on the plots in Series II are shown in Table 3. In Series II maximum control was apparent after 1 year following

Table 4.—Additional field tests to further evaluate the residual effectiveness of Nonachlor in controlling imported fire ants. Series III. 1964.^a

Insecticide	Dosage (lb/acre)	Avg pretreatment count of active IFA mounds per plot	% reduction in active mounds at indicated weeks following treatment:					
			4	8	18	36	40	52
Nonachlor	1/8	19	7	9	62	83	88	79
Nonachlor	1/4	21	8	13	63	97	97	92
Nonachlor	1/2	19	4	14	78	95	97	93
Nonachlor	1	20	13	7	97	100	100	100
Heptachlor (standard)	1/4	20	0	7	81	69	90	69
Check		22	0	0	0	9	11	0

^a Average from 3 replicates.

treatment. In this test complete control was obtained only on the 1/2 and 1 lb/acre dosages while the 1/4 lb/acre dosages gave 95% and the 1/8 lb/acre dosage gave 79% reduction in active mounds. The heptachlor standard gave 97% reduction in active mounds after 1 year.

In the 3rd series of tests (Table 4) maximum control was obtained after 40 weeks. Complete control occurred on the plots receiving the 1 lb/acre dosage of Nonachlor while both the 1/2- and 1/4-lb dosages gave 97% and the 1/8-lb dosage gave 88% reduction in active mounds. The heptachlor standard gave 90% reduction.

DISCUSSION AND CONCLUSIONS.—Results of these tests indicate that Nonachlor is highly effective as a residual soil insecticide for control of imported fire ants. In all 3 of the field studies Nonachlor at 1/4 lb/acre performed as well or slightly better than a comparable dosage of heptachlor, which has been shown in extensive testing to be very effective as a control measure. Dosages of 1 and 2 lb of Nonachlor/acre provide complete control of the imported fire ant for 1 to 1 1/2 years. The effectiveness of this compound combined with its low mammalian toxicity should

provide a safer means of controlling the imported fire ant for extended periods than is possible for heptachlor.

REFERENCES CITED

- Blake, G. H., Jr., W. G. Eden, and K. L. Hays. 1959. Residual effectiveness of chlorinated hydrocarbons for control of the imported fire ant. *J. Econ. Entomol.* 52: 1-3.
- Lofgren, C. S., V. E. Adler, and W. F. Barthel. 1961. Effect of some variations in formulation or application procedure on control of the imported fire ant with granular heptachlor. *J. Econ. Entomol.* 54: 45-47.
- Lofgren, C. S., V. E. Adler, W. A. Banks, and N. Pierce. 1964a. Control of imported fire ants with chlordane. *J. Econ. Entomol.* 57: 331-3.
- Lofgren, C. S., F. J. Bartlett, C. E. Stringer, Jr., and W. A. Banks. 1964b. Imported fire ant toxic bait studies; further tests with granulated mirex-soybean oil bait. *J. Econ. Entomol.* 57: 695-8.
- Stringer, C. E., Jr., C. S. Lofgren and F. J. Bartlett. 1964. Imported fire ant toxic bait studies: evaluation of toxicants. *J. Econ. Entomol.* 57: 941-5.

Reprinted from the
JOURNAL OF ECONOMIC ENTOMOLOGY
Volume 59, Number 2, pp. 465-467, April, 1966