

M 1647

DUAL LOW DOSAGE APPLICATIONS OF HEPTACHLOR FOR CONTROL OF THE IMPORTED FIRE ANT

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Control of the imported fire ant, *Solenopsis saevissima richteri* (Forel), with two applications of heptachlor at dosages of $\frac{1}{4}$ or $\frac{1}{2}$ pound per acre applied at intervals of 3 or 6 months was reported by Lofgren et al. (1961). Murphy et al. (1962) reported that soil residue following two successive $\frac{1}{4}$ pound per acre treatments of heptachlor is equivalent after 10 months to the residue following a single 1 pound per acre treatment.

The purpose of this report is to present further data from subsequent small and large plot tests with dual applications of heptachlor.

SMALL PLOT TESTS: Two series of tests were initiated, one in December 1959 and one in April 1960. Formulations on 16-30 mesh, AARVM attapulgitic granules containing 7% deactivator, 10% solvent, and 2.5 or 5.0% heptachlor were used. They were applied with a Jeep-mounted Buffalo turbine blower at the rate of 10 pounds per acre on duplicate, randomized, 1-acre plots. The time interval between treatments was varied. The results are presented in Table 1.

In Series I, two applications of $\frac{1}{8}$ or $\frac{1}{4}$ pound per acre of heptachlor applied 6 months apart resulted in 100% control of imported fire ants after 12 months. The $\frac{1}{8}$ pound per acre plots were reinfested after 24 months (82% control). The $\frac{1}{4}$ pound per acre plot appeared reinfested after 24 months but at 30 months it again showed 100% control. Two applications of $\frac{1}{4}$ pound heptachlor per acre, applied 12 months apart, gave complete control through 30 months. In these plots the initial single application had given 100% control at the 9-month count. Two applications of $\frac{1}{8}$ pound per acre applied 12 months apart gave very good control after 18 months (98%), but the plots were becoming reinfested at the 24-month count. A single $\frac{1}{8}$ pound per acre application gave a maximum of 89% control, and one application of $\frac{1}{4}$ pound per acre gave 93% control.

In Series II, two treatments of $\frac{1}{8}$ pound per acre of heptachlor, applied 3 months apart, resulted in complete control after 6 to 8 months, but the control had decreased to 98% and 76% respectively after 12 and 24 months. Two $\frac{1}{8}$ pound per acre applications, spaced 8 months apart, gave a maximum reduction of 98% after 1 year.

After the $\frac{1}{4}$ pound per acre plots had been treated with what was believed to be a 2.5% granulated heptachlor formulation, it was discovered that the formulation contained only 0.37% heptachlor. Thus, the actual application rate was approximately $\frac{1}{32}$ pound per acre. Early observations showed that some kill was being attained, so the plots were maintained on the regular count schedule and retreatments were made with the same amount of heptachlor. Two treatments, 3 months apart, with $\frac{1}{32}$ pound per acre gave a maximum control of 93% after 8 months. When two applications at the same dosage were applied 8 months apart, the maximum reduction in active mounds was 63% after 12 months.

TABLE 1.—RESULTS OF SMALL PLOT TESTS AGAINST IMPORTED FIRE ANTS WITH DUAL APPLICATIONS OF LOW DOSAGES OF HEPTACHLOR.*

Dosage (lb./acre)	Retreatment schedule	Average pretreatment count of active mounds	Percent reduction in active mounds after indicated months following initial treatment:										
			1	3	6	8	9	12	15	18	24	30	
Series I **													
1/8	none	23	—	18	78	—	—	89	78	80	47	42	23
	after 6 months	28	—	38	89	—	—	98	100	100	100	82	80
	after 12 months	27	—	36	91	—	—	87	87	87	98	89	86
1/4	none	23	—	51	89	—	—	93	93	93	84	76	78
	after 6 months	12	—	57	91	—	—	100	100	100	100	96	100
	after 12 months	21	—	41	90	—	—	100	100	100	100	100	100
Check	—	25	—	12	22	—	—	24	39	10	31	22	26
Series II †													
1/8	none	30	45	98	92	85	—	—	77	—	43	42	—
	after 3 months	30	56	97	100	100	—	—	98	—	95	76	—
	after 8 months	32	50	98	84	92	—	—	98	—	91	83	—
1/32	none	40	56	66	61	71	—	—	59	—	1	0	—
	after 3 months	30	63	65	90	93	—	—	82	—	65	45	—
	after 8 months	28	61	64	45	50	—	—	63	—	18	34	—
Check	—	26	21	50	48	46	—	—	40	—	10	10	—

* Average of 2 replicates.

** Treated in December 1959; retreatments in July 1960 and December 1960.

† Treated in April 1960; retreatments in June 1960 and December 1960.

In addition to the preceding tests, a dual application of $\frac{1}{4}$ pound per acre of heptachlor was employed as the standard in three other experiments. In each test 100% control was obtained 1 year after the initial application. The interval between treatments ranged from 2 to 8 months. Two of the treatments (2 to 7 months between treatments) were becoming reinfested after $1\frac{1}{2}$ years, while the third (8-month interval) was free of ants after 2 years.

LARGE PLOT TESTS: In the fall of 1959, an area north of Gulfport, Mississippi was selected for a test to evaluate aerial treatments of (1) dual applications of $\frac{1}{4}$ and $\frac{1}{2}$ pound per acre of heptachlor and (2) various bulk application rates at each dosage level. The area was subdivided into 6 plots, 5 of which were about 180 acres in size and 1 about 120 acres. The ground cover on each plot consisted of varying proportions of bahia-grass, idle or heavily weeded land, and pine forest—portions of each plot were low and wet. Four subplots, or count areas, were located within the boundaries of each plot; three were approximately 2 acres in size (200 x 400 ft.) and were in open areas, usually pasture, and the fourth was approximately 1 acre (200 x 200 ft.) and was located in a wooded area. The subplots were located in the plots in such a manner that all the plane application swaths would cross at least one of them. The pretreatment counts of active ant mounds on the subplots ranged from 7 to 66.

The treatments evaluated are listed in Table 2. The first application was made in November 1959 with a 450 hp Stearman and the second in May 1960 with an AG-2. Both were equipped with Swathmaster distributors. The planes were flown on a 60-foot swath which theoretically allowed a 5 to 10-foot overlap of the swaths. The 10% heptachlor employed on the plot treated with $2\frac{1}{2}$ pounds per acre of 10% granules was made with a finer mesh granule (24-48 mesh vs. 16-30 mesh for other formulations). This was done to insure easier calibration and more uniform flow of the granules at this low application rate.

The results of the test (Table 2) show that after 12 months complete control had been attained on the plots treated with $\frac{1}{2}$ pound per acre at bulk application rates of 10 pounds per acre of 5% granules (Plot 1) and 5 pounds per acre of 10% granules (Plot 4). Complete control was also obtained with $\frac{1}{4}$ pound per acre when it was applied at the bulk rate of 10 pounds of 2.5% granules. After 24 months some of the subplots on all of the plots were becoming reinfested with incipient imported fire ant colonies; however, the percentage reduction in active mounds was still very high (92 to 100%), with the exception of one subplot in the area that had been treated with 5 pounds of 10% granules (57%).

The subplots in Plot 2, treated with $2\frac{1}{2}$ pounds of 10% granules ($\frac{1}{4}$ lb. heptachlor per acre), were all free of ants after 9 months, but after 12 months one colony was found on one of the subplots. After 2 years all of the subplots except the one in the woods were heavily reinfested with incipient colonies. As stated before, a 24-48 mesh granule was used instead of the regular 16-30 mesh. Other tests have indicated that heptachlor, formulated on fine mesh granules, does not provide as long a residue as that formulated on large or coarse mesh granules. This fact probably explains partially the reason for the faster reinfestation on this plot.

Plot 3 was originally scheduled to be treated with 5 pounds per acre

TABLE 2.—RESULTS OF TESTS WITH AERIAL APPLICATIONS OF LOW DOSAGES OF HEPTACHLOR. LANDON, MISSISSIPPI.*

Plot No.	Treatment (lb./acre)	Subplot no.	Ground cover or usage	Pretreatment count of active mounds	Percent reduction in active colonies after indicated months following initial treatment			
					6	9	12	24
1	$\frac{1}{2}$ lb (10 lb of 5% granules)	A	Grass and weeds lightly wooded	28	32	100	100	93
		B	Grass and weeds lightly wooded	19	37	100	100	95
		C	Grass and weeds lightly wooded	7	43	100	100	100
		D	Grass and weeds lightly wooded	13	85	100	100	100
2	$\frac{1}{4}$ lb (2 $\frac{1}{2}$ lb of 10% granules)	A	Pasture and pecan grove—disked	54	89	100	98	22
		B	Unimproved pasture, partly disked	24	71	100	100	0
		C	Unimproved pasture	17	77	100	100	0
		D	Wooded	25	76	100	100	80
3	$3\frac{1}{16}$ lb (3 $\frac{3}{4}$ lb of 5% granules)	A	Pasture	42	36	100	100	29
		B	Pasture	43	40	95	98	91
		C	Pasture and pecan grove—disked	47	68	98	85	0
		D	Wooded	10	70	100	100	60
4	$\frac{1}{2}$ lb (5 lb of 10% granules)	A	Lightly wooded	42	76	100	100	100
		B	Open field, disked	28	71	100	100	57
		C	Pasture and tung grove	66	50	100	100	94
		D	Wooded pasture	35	77	100	100	100

TABLE 2.—Continued.

5	¼ lb (10 lb of 2½% granules)	A	Unimproved pasture	49	51	100	100	100	100
		B	Improved pasture	37	78	100	100	100	92
		C	Unimproved pasture	48	40	100	100	100	94
		D	Wooded pasture	27	56	100	100	100	96
6	1¼ lb (12½ lb of 10% granules)†	A	Wooded pasture	74	89	92	95	96	96
		B	Wooded pasture	111	91	97	98	96	96
		C	Wooded pasture	116	98	100	100	97	97
		D	Wooded pasture	37	87	95	89	89	89
Check		A	_____	14	0	0	—**	—	—
		B	_____	13	0	54	31	—	—
		C	_____	38	13	34	29	—	—
		D	_____	22	0	32	9	—	—

* First treatment applied in November 1959; second treatment during May 1960.

** Recently disked.

† Standard single application treatment.

of 5% heptachlor granules ($\frac{1}{4}$ pound per acre of actual insecticide). Due to calibration difficulties, the actual application rate was $\frac{3}{16}$ pound per acre. After 12 months, 2 of the subplots had shown complete control, while the other 2 subplots showed 85% and 98% control. After 24 months the control was very erratic and ranged from 0 to 91%. The poor control was undoubtedly associated with the lower dosage rate and the possibility that this lower dosage was associated with non-uniform, or uneven distribution, of the granules from the airplane. Plot 6, which was treated with one application of $12\frac{1}{2}$ pounds of 10% heptachlor granules per acre, or $1\frac{1}{4}$ pounds of heptachlor per acre, had only one of the 4 subplots within it free of ants after 12 months. The control on the other 3 subplots ranged from 89% to 98%. After 24 months the one subplot which had been free of ants was becoming reinfested, while the other 3 plots maintained about the same control. The control on the 4 subplots ranged from 89% to 97%.

CONCLUSIONS: The results of these tests show that eradication of the imported fire ant from a given area can be obtained with two applications of heptachlor at dosages of $\frac{1}{4}$ or $\frac{1}{2}$ lb. per acre applied at intervals of 6 to 12 months. The following factors must be controlled to obtain maximum effectiveness of the treatments:

1. The concentration of the heptachlor on the granulated formulations should be adjusted to allow sufficient bulk application rate to insure good distribution on the ground.
2. The heptachlor should be formulated at a relatively low concentration on a carrier of optimum particle size in order to yield the highest possible soil residue.
3. The equipment employed to apply the treatments must have a uniform delivery rate and swath pattern.
4. All precautions must be taken to insure that the entire surface area receives treatment.

LITERATURE CITED

- Lofgren, C. S., V. E. Adler, and W. F. Barthel.* 1961. Effect of some variations in formulation and application procedure on control of the imported fire ant with granular heptachlor. *J. Econ. Ent.* 54: 45-47.
- Murphy, R. T., W. F. Barthel, and C. S. Lofgren.* 1962. Residual studies in connection with successive applications of heptachlor for imported fire ant eradication. *J. Agr. Food Chem.* 10: 5-7.