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Effect of Some Variations in Formulation or Application Procedure on Control of the Imported Fire Ant with Granular Heptachlor¹

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ABSTRACT

The results of field tests against the imported fire ant (*Solenopsis saevissima* v. *richteri* Forel) with various application rates, formulations and split applications of granulated heptachlor showed that: (1) there was no appreciable difference in the immediate kill obtained with bulk granular applications at rates of 5 pounds of 20% heptachlor versus 20 pounds of 5%, and 10 pounds of 20% heptachlor versus 20 pounds of 10%; (2) formulations with calcined attapulgitic granules gave slower initial kill than ones with regular granules but there was not an appreciable difference after 1 year; (3) formulations with a large mesh size granule (8 to 20) gave slightly slower initial kill than a fine mesh granule (30 to 60), but after 2 months there was no appreciable difference and at the end of 1 year they showed a slightly greater kill; (4) two applications of heptachlor at dosages of $\frac{1}{4}$ or $\frac{1}{2}$ pound per acre put out at intervals of 3 or 6 months were completely effective in controlling imported fire ants. Two applications of one-eighth pound per acre gave a very high degree of control.

The published research work on control of the imported fire ant, *Solenopsis saevissima* v. *richteri* Forel, prior to 1957 has been reviewed by Blake *et al.* (1959). This work had shown that good control of imported fire ants could be obtained with chlordane, when used as a broadcast treatment. Unpublished work by the U.S. Department of Agriculture (Coarsey 1952) had shown that aldrin, heptachlor and dieldrin would also give control. Green & Hutchins (1958) reported that dieldrin and heptachlor, pound for pound, gave similar results when

applied as sprays, granular, or fertilizer mixtures. Blake *et al.* (1959) obtained highly effective control with granular formulations of 2 pounds of actual dieldrin and heptachlor and 4 pounds of chlordane per acre. In one test granular dieldrin gave a better residual than a dieldrin emulsion spray. Lower dosages gave good control for 1 year after treatment. An insecticide-fertilizer mixture was as effective as the insecticides applied alone.

After the imported fire ant eradication program was initiated by an act of the United States Congress in 1957, the preceding information was used as the basis for establishing the standard treatments which were 2 pounds of heptachlor or dieldrin as granular formulation.² They were applied at the rate of 20 pounds of 10% granules per acre as a surface treatment. The formulation consisted of 18- to 60-mesh attapulgitic granules, a solvent (methylated naphthalene), deactivator and insecticide. At this time there was little or no information available regarding the effect on imported fire ant control of variations in the formulation, bulk application rates and low dosage applications.

This paper presents the results of tests conducted to determine the effect on control of imported fire ants by granular heptachlor when (1) various mesh sizes of regular and calcined attapulgitic granules were used, (2) the

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² On the basis of this and subsequent work the recommended dosage is now two applications of $\frac{1}{2}$ pound of heptachlor, each applied as 12 $\frac{1}{2}$ pounds of 2% granular material.

Table 1.—Effect of different bulk application rates on the control of imported fire ants with granular heptachlor when the actual insecticide dosage per acre remained constant.

GRANULE APPLICATION RATE (LB./ACRE)	DOSAGE (LBS./ACRE)	AVERAGE PRE-TREATMENT COUNT	PER CENT REDUCTION IN ACTIVE COLONIES AFTER FOLLOWING WEEKS								
			1	2	4	8	16	26	32	52	78
5	1	40	48	67	88	99	93	93	89	63	76
20	1	36	55	67	90	99	98	98	96	94	96
10	2	41	48	79	90	100	100	100	99	100	98
20 ^a	2	34	33	40	82	97	97	97	81	63	87
Check	—	31	11	15	48	34	26	13	6	2	2

^a Average of 2 replications. All others are the average of 3 replications.

application rate of total granular formulation was varied and (3) two low dosage applications were made at 3- or 6-month intervals.

TEST I.—In May 1958 an experiment was initiated to determine if the control obtained with granular heptachlor would be altered when the pounds of total formulation applied was varied while the pounds of actual insecticide per acre was kept constant. In other words, this test would help to determine the actual number of granules of insecticide or coverage necessary to obtain imported fire ant control. Application rates of 10 pounds of 20% heptachlor granules per acre and 20 pounds of 10% (2 pounds per acre of active ingredient) were compared as well as rates of 20 pounds of 5% material and 5 pounds of 20% (1 pound per acre of active ingredient). The granule used was 18- to 60-mesh attapulgitic clay. In both tests enough untreated granules were added to the 20% material to permit application of the formulations at the rate of 20 pounds per acre. The applications were made with a Buffalo turbine blower. Two of the fields treated were open pastures and the third was a pecan grove and pasture. The average pretreatment counts of active imported fire ant mounds per plot, and the per cent reduction at various intervals after treatment, are recorded in table 1.

After 2 months the control obtained with the various treatments was about equal, which indicates that the bulk application rate had no apparent effect on the immediate control obtained. Eight months after treatment a noticeable decline in control was noted with the 20 pound-rate of 10% heptachlor and the 5-pound-rate of 20% heptachlor. This was caused principally by a reinfestation in one plot of each set. The field in which this series of replications was run did not receive any rainfall for about 3 weeks after treatment. Control lagged during these 3 weeks but climbed rapidly after the first rain. It is now known that heptachlor can be lost from intact granules which are exposed to hot, dry conditions (Barthel *et al.* 1959). Since these conditions did occur during the first 3 weeks after treatment there was probably a considerable loss of insecticide. This theoretical rapid loss of heptachlor could account for the early reinfestation of these plots.

TEST II.—A comparison was made of the effect of granule mesh size range and water breakdown properties of granular attapulgitic heptachlor formulations on control of imported fire ants. Four different mesh sizes (8 to 20, 16 to 30, 20 to 40, 30 to 60) of the regular and calcined

Table 2.—The effect of variations in granule mesh size and water breakdown properties of heptachlor granular formulations on their control of imported fire ants in field plots.^a

GRANULE MESH SIZE (RANGE)	AVERAGE PRE-TREATMENT COUNT	PER CENT REDUCTION IN ACTIVE COLONIES AFTER FOLLOWING WEEKS							
		1	2	4	8	16	32	52	78
<i>Regular Granules—AARVM</i>									
8-20	22	61	74	82	97	98	95	100	91
16-30	14	60	86	86	100	93	93	95	97
20-40	13	59	80	95	100	100	92	97	98
30-60	18	69	87	98	100	94	91	94	81
<i>Calcined Granules—AALVM</i>									
8-20	17	40	48	71	92	94	90	100	98
16-30	20	42	63	85	97	100	95	95	92
20-40	15	36	64	84	100	100	95	95	89
30-60	18	38	72	91	94	96	92	89	89
Check	15	17	30	9	20	0	0	16	0

^a Average of 3 replications; heptachlor dosage 0.5 pound per acre.

granules were compared. The latter type of granule does not break down in water. The heptachlor content of each formulation was 2.5%. The granules were applied to small plots ($\frac{3}{4}$ to 1 acre) with an 8-ft. Gandy fertilizer distributor at the rate of 20 pounds per acre or 0.5 pounds per acre of actual heptachlor. The plots were located in a Bahia grass pasture. The tests were run in triplicate. The treatments were made in July 1958. The rainfall during the first 8 weeks after treatment was very high (20.5 inches).

The results based on the per cent reduction in active imported fire ant colonies before and after treatment (see table 2) show that during the first month after treatment the control obtained with the formulations of the coarser mesh granules (8 to 20) was slightly slower than with the finer mesh granules (30 to 60). This was also true with the calcined granules when compared with the regular granules. After 4 months there was no appreciable difference in the control obtained with any of the formulations. The 1-year counts showed a definite trend toward better control with the coarser granular formulations. The same trend was evident after 1½ years except for the 8 to 20 mesh AARVM granules. The decrease in control with this formulation was caused principally by a slight reinfestation in one plot. It is noteworthy that 4 of 5 of the colonies present were either on the edge or in the treatment overlap area where there might possibly have been a skip.

TEST III.—Three series of test plots were set up to evaluate the effectiveness of two treatments of $\frac{1}{2}$, $\frac{1}{4}$ or $\frac{1}{8}$ pounds of heptachlor per acre for controlling imported

fire ants. One series of plots was retreated after 3 months, a second series after 6 months and a third series received only one treatment. The test plots were located in a Bahia grass pasture and were about 2 acres in size (200 ft. × 400 ft.). The granular insecticide formulations (1.25%, 2.5% and 5.0%) were applied with a 20-ft. Gandy fertilizer distributor at the rate of 10 pounds of granules per acre. The first application was made in January 1959. The first series was retreated in April and the second series in August. All tests were run in triplicate. Pretreatment and posttreatment counts of active imported fire ant colonies and the average per cent reduction after treatment are recorded in table 3.

After 1 year 100% control was obtained on all plots receiving two treatments of $\frac{1}{4}$ or $\frac{1}{2}$ pound of heptachlor per acre. Four of the $\frac{1}{2}$ pound per acre retreatment plots were free of imported fire ants; the remaining 2 plots had 2 and 1 active mounds, respectively, directly on the edge of the plot. In the series of plots which received only one treatment, the $\frac{1}{2}$ -pound per acre dosage gave 99% control, the $\frac{1}{4}$ -pound per acre, 100% and the $\frac{1}{8}$ -pound per acre, 79%.

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Table 3.—Results of field tests against imported fire ants with two low-dosage treatments of heptachlor applied at intervals of 3 or 6 months.^a

DOSAGE (LB./ACRE)	NO. OF TREAT- MENTS	INTERVAL BETWEEN TREATMENTS (MONTHS) ^b	AVERAGE PRE- TREATMENT COUNT	PER CENT REDUCTION IN ACTIVE MOUNDS AFTER MONTHS SHOWN			
				3	6	9	12
0.125	1	—	24	18	63	82	79
	2	3	45	24	94	98	99
	2	6	53	36	82	99	99
0.25	1	—	34	51	88	98	100
	2	3	32	46	99	100	100
	2	6	49	47	97	100	100
0.5	1	—	32	60	96	98	99
	2	3	31	56	100	100	100
	2	6	47	49	98	100	100
Check	—	—	48	7	13	31	34

^a Average of 3 tests.

^b Initial application made on January 26, 1959, and the retreatments on April 16, 1959, and August 7-8, 1959.

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