Effect of Formulations And Rates of Insecticides on Sugar Beets

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Experimental results in 1955 indicated that aldrin, dieldrin and heptachlor at 1 pound per acre mixed with fertilizer effectively controlled the sugar beet root maggot (1955). At that time it was observed that insecticides mixed with fertilizer and applied directly in the row with beet seeds reduced germination and emergence. Whether this apparent phytotoxicity is caused by the insecticide, carrier, solvent or any combination of them is unknown. To study the effect of rates and formulations of insecticides on sugar beets the following experiments were designed.

Materials and Methods

Plots were established in fields where maggot damage was expected to be severe. Beets were planted with a commercial six-row beet drill. Randomized block design with four replicates was used in all cases. Each treatment consisted of 6 rows 50 feet long with 20 inch spacings. Stand counts were made on rows 2, 3, 4 and 5 of each treatment. Yields were selected from rows 3 and 4 of each treatment, thus eliminating the possibility of a border

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effect if there was considerable difference in adjacent treatments. Insecticides were applied with a dry chemical applicator[2] or sprayed directly on fertilizer.

Results

Stand counts were made on all plots prior to thinning. Beets in a 100-inch segment selected at random from rows 2, 3, 4 and 5 of each treatment were counted. These data are summarized below in tabular form (tables I and II).

Stand counts indicate phytotoxicity of some insecticides. In most cases germination and emergence were much lower in treated rows than in checks. If an insecticide is

TABLE I.—**Effect of Insecticide Formulations on Sugar Beets (H. Daniels' Farm).**

Treatment	Rate of insecticide (lbs./A)	Average stand count	Average number merchantable beets	Weight pounds	Tons/A
Aldrin sprayed on fertilizer	1	52	28	38	7.4
Dieldrin sprayed on fertilizer	1	47	27	42	7.9
Heptachlor sprayed on fertilizer	1	67	28	41	7.5
Hercules AC 528 sprayed on fertilizer*	1	55	26	44	8.4
Dieldrin treated seed**	1 lb./100 lbs. seed	43	30	40	7.5
Check for dieldrin treated seed**	0	74	24	31	5.8
40% aldrin granular	3.4	97	44	49	9.5
40% aldrin granular	12.8	87	36	49	9.5
25% heptachlor on Attaclay	6.5	25	24	37	6.9
25% heptachlor on Attaclay	11	6	10	26	4.8
Check	0	74	28	36	6.9
Heptachlor on vermiculite	9.5	49	20	38	7.4
Heptachlor on vermiculite	16	36	27	46	8.8
Dieldrin on Attaclay	6.2	4	1.5	3	1.1

*An experimental insecticide manufactured by Hercules Powder Company.
**Separate variety of beet seed.

TABLE II.—**Effect of Insecticide Rates on Sugar Beets (Green & Haug Farms Combined).**

Treatment	Rate of insecticide (lbs./A)	Average stand count	Average number merchantable beets	Weight pounds	Tons/A
Aldrin 20% granular	0.8	74	69	117	10.0
Aldrin 20% granular	1.7	41	57	111	10.4
Aldrin 20% granular	2.1	78	46	99	9.3
Aldrin 20% granular	5.4	28	33	80	7.5
Dieldrin 5% granular	0.5	57	65	98	9.3
Dieldrin 5% granular	1.9	60	31	61	5.8
Dieldrin 5% granular	2.5	9	11	25	2.5
Dieldrin 5% granular	6.2	2	4	13	.5
Heptachlor 25% granular	0.32	145	83	127	11.8
Heptachlor 25% granular	2.0	120	71	110	10.4
Heptachlor 25% granular	2.6	106	79	122	11.5
Heptachlor 25% granular	6.5	112	72	123	11.5
Check	0	142	57	75	7.0

[2]Furnished by E. S. Gandrud Company, Owatonna, Minnesota.

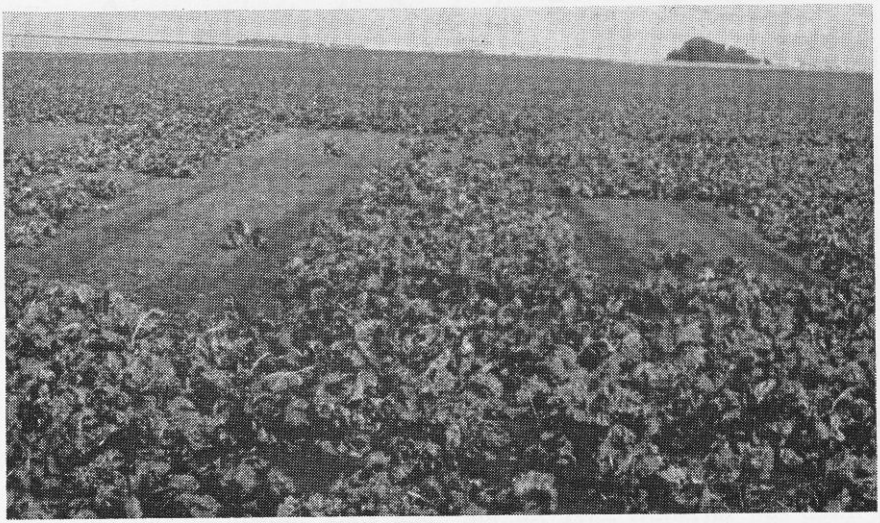

FIGURE 1.—*Bare spots indicate where insecticide was applied at high dosage.*

applied at too high a level a serious reduction or complete kill of sugar beets can be expected. This is illustrated in fig. 1.

Based on the above data, dieldrin appeared to be more phytotoxic than aldrin or heptachlor. Since dieldrin was applied at a greater volume (same amount of actual) than aldrin or heptachlor, it appears that the solvent and carrier could contribute to the phytotoxicity. There would be more solvent in the carrier in a 10 percent granular than in 25 percent material. It is of interest to note that heptachlor on vermiculite used at 16 pounds per acre did not appear too phytotoxic when compared with other insecticides.

Spraying insecticide directly on fertilizer affords uniform and fairly accurate distribution of insecticides. The fertilizer used on Daniels' farm in treatments 1, 2, 3 and 4 contained 1 percent insecticide. Since the fertilizer was applied at 100 pounds per acre, the insecticide was distributed at 1 pound per acre. Data obtained from these four treatments indicate heptachlor is less phytotoxic to beets than is aldrin, dieldrin, or Hercules AC 528.

At harvest time two 35-foot segments from rows 3 and 4 of each treatment were harvested. The average numbers of merchantable beets obtained from each treatment are listed in tables I and II. It is evident that thinning eliminates some of the differences caused by insecticides. However, where the stand was reduced drastically, fewer merchantable beets remained to be harvested. The difference between treatments and check on the Daniels' farm is not great. This experimental plot was not planted on summer fallow. It is possible that if these beets were on summer fallow the beets in the treatments would have done considerably better. The difference between treatments and check on the Green and Haug farms was considerable. Where the stand was not drastically reduced by insecticides, the increase in yield ranged from 3 to 4½ tons per acre. The difference is also illustrated in fig. 2.

The tests on the Haug and Green farms confirm the results obtained

FIGURE 2.—*Beets at left are without insecticide. Beets at right had 1 pound of insecticide per acre mixed with fertilizer.*

in 1955 that the use of insecticide-fertilizer mixtures where maggots are a problem yields a high return. If sugar beets brought $13.50 per ton, an increased income ranging from $40 to $60 per acre can be expected with an expenditure of approximately $3 per acre which covers cost of material. No additional labor or machinery is required if the insecticide-fertilizer mixture is purchased commercially.

If dry chemical applicator is available, buy granular insecticide. This eliminates the mixing costs. Because of the serious phytotoxicity, however, care must be used when a machine of this type is employed as too large amounts of insecticides will seriously affect sugar beets.

Summary and Conclusions

Aldrin, dieldrin, and heptachlor at a high rate of application reduced germination and emergence of sugar beets. Thinning did not entirely eliminate these differences in stands where high rates were applied. Insecticides sprayed on fertilizer or mechanically distributed in rows with beet seeds were effective in controlling sugar beet root maggots. If beets bring $13.50 per ton, an increased income ranging from $40 to $60 **per acre** can be expected with an expenditure of approximately $3.

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