Evaluation of Systemic Pesticides in Controlling Sugarbeet Leafhopper[1, 3]

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In recent years, systemic insecticides have become widely used to control the beet leafhopper, *Circulifer tenellus* (Baker), thereby reducing incidence of curly top of sugarbeet. *O,O*-diethyl *S*-[(ethylthio) methyl] phosphorodithioate (phorate) is extensively used to control the beet leafhopper in areas that consistently have a curly top problem.

Recently, systemic chemicals have become available which have both nematicidal and insecticidal properties. Some of these chemicals reduced curly top infection under conditions of natural exposure in New Mexico (1)[4]. These chemicals are now being evaluated for sugarbeet nematode control in the Intermountain West. Many of the areas in which these chemicals are likely to be used for nematode control are also areas where sugarbeets are subject to curly top damage. Therefore, two pesticides were compared with phorate to determine how soon after treatment they became effective in killing leafhoppers, how high leafhopper mortality would be after feeding on plants treated with these chemicals, and how long after treatment the chemicals remained effective with different methods of application.

Materials and Methods

Two pesticides, 2-methyl-2-(methylthio)propionaldehyde *O*-(methylcarbamoyl)oxime (aldicarb) and 2,3-dihydro-2,2-dimethyl-7-benzofuranyl methylcarbamate (carbofuran) were compared in field tests with phorate for effectiveness in killing sugarbeet leafhoppers. Chemicals were evaluated by a direct measure of leafhopper mortality from feeding on treated plants.

Preliminary information indicated that only aldicarb could be applied directly with the seed at planting without causing significant phytotoxicity. Therefore, aldicarb was tested by using each of three methods of application. It was applied with the seed at planting (with-seed applications), below the seed at planting (below-seed appli-

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[3]This paper reports the results of research only. Mention of a pesticide does not constitute a recommendation of this product by the USDA.

[4]Numbers in parentheses refer to literature cited.

cations), and as a side-dressing 16 days after planting (side-dress applications). Carbofuran and phorate were tested as below-seed and side-dress applications. All three chemicals were tested as 10% granular formulations at the rate of 2 lb active ingredient per acre.

Below-seed and side-dress applications were made by placing the chemical in furrows 3-4 inches deep. For below-seed applications, sugarbeet seed was planted at a depth of ¾ inch directly over the chemical. Side-dress furrows were within 1-2 inches alongside the row of seedlings.

Two leafhoppers were caged on the youngest expanded leaf of each of four randomly selected plants per plot. Each plot, which consisted of a 12-foot row of seedlings, was replicated four times. At weekly intervals leafhoppers were exposed to treated and untreated plants for 24 hr, after which the percentage of leafhopper mortality was determined. Weekly testing began 12 days after with-seed and below-seed applications, and 10 days after side-dress applications. Testing continued until the percentage of leafhopper mortality was greatly reduced.

One experiment was initiated on May 27; however, during this experiment, two replications were destroyed by flooding. The other two replications were continued. On June 24 a second experiment was begun. Results from the two experiments were similar; therefore, only data from the June 24 planting are presented in the results.

Seedling growth in treated and untreated plots was estimated by dry-weight determinations. Two weeks after planting, 10 randomly selected seedlings from each plot were harvested, dried in an oven for 24 hr, and weighed.

Results and Conclusions

Below-seed applications of each of the three chemicals produced over 85% leafhopper mortality 12 days after planting (Table 1). Because seedlings emerged about 7 days after planting, these chemicals were highly effective in killing leafhoppers within 5 days after emergence.

Table 1.—Percent leafhopper mortality in 24 hr from feeding on sugarbeets treated with systemic chemicals.

Treatment (2 lb/A)	Days after planting						
	12	19	26	33	40	47	54
Aldicarb[a]	72	63	16	0			
Aldicarb[b]	94	100	53	34			
Carbofuran[b]	88	97	100	97	88	13	0
Phorate[b]	88	100	94	100	100	25	3
Check	19	3	3	3	15	3	6

[a]With-seed applications.
[b]Below-seed applications.

Below-seed applications of aldicarb produced 100% mortality on the 19th day after planting, but dropped to 53% by the 26th day. Carbofuran and phorate produced over 85% mortality from the 12th through the 40th day and then dropped markedly on the 47th day.

With-seed applications of aldicarb produced 72% mortality on the 12th day, but were less effective thereafter.

Length of time these chemicals remained effective in treated plants was influenced by the method of evaluating. By caging leafhoppers on the youngest leaves, we were measuring how long the plants continued to pick up the chemicals. Six weeks after planting, when mortality of leafhoppers caged on the youngest leaves was decreasing, leafhoppers were caged on older leaves. Leafhopper mortality was greater on the older leaves with each of the chemicals.

Side-dress applications of all three chemicals produced lower leafhopper mortality than below-seed applications (Table 2). The results suggest that side-dress applications should be made at least 2 weeks before maximum control is desired. Maximum leafhopper mortality occurred 17 days after application with carbofuran and aldicarb and 24 days after with phorate.

Table 2.—Percent leafhopper mortality in 24 hr from feeding on sugarbeets side-dressed with systemic chemicals.

Treatment[a] (2 lb/A)	Days after treatment				
	10	17	24	31	38
Aldicarb	72	91	53	16	16
Carbofuran	56	78	75	28	22
Phorate	16	56	88	22	16
Check	3	3	15	3	6

[a]Side-dress applications 16 days after planting.

An infestation of potato flea beetle, *Epitrix cucumeris* (Harris), in our test plots permitted an evaluation of the three chemicals in preventing injury from this insect. Plants treated with each of the three chemicals had little or no flea beetle injury (Figure 1 A). Adjacent untreated plants had moderate to severe injury (Figure 1 B).

Dry weight of seedlings from phorate- and carbofuran-treated plots was 25% lower than that of seedlings from check plots. This suggests some phytotoxicity in early stages of growth and has been observed previously. Dry weight of seedlings from aldicarb-treated plots was not significantly different from that of the check. Dry weight of seedlings from plots that received with-seed applications of aldicarb was higher than that of the check. This supports other observations that aldicarb-treated plants sometimes show greater growth than untreated plants, apart from the effect of controlling nematodes or insects.

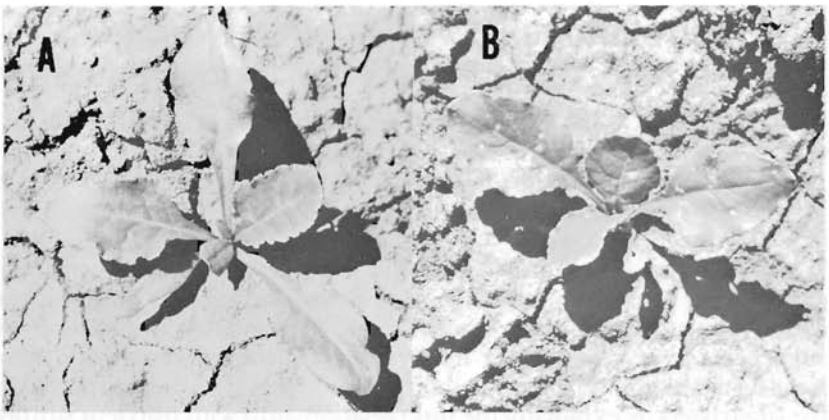

Figure 1.—A) Absence of flea-beetle feeding damage on plant treated with Aldicarb; B) Moderate injury on adjacent untreated plants.

Our data show that if aldicarb or carbofuran were used to control sugarbeet nematode, they would also provide considerable control of the beet leafhopper and potato flea beetle. Below-seed applications of aldicarb at 2 lb active ingredient per acre were highly effective for about 3 weeks; applications of carbofuran were effective for 6 weeks. With preplant below-seed applications, these chemicals would become effective within 5 days after sugarbeet emergence, when prevention of curly top is most important.

Summary

Below-seed applications of aldicarb, carbofuran, and phorate produced over 85% leafhopper mortality within 5 days after emergence of treated sugarbeet seedlings. Aldicarb was highly effective for 3 weeks after planting, and carbofuran and phorate were effective for 6 weeks. With-seed applications of aldicarb and side-dress applications of all three pesticides were less effective in killing leafhoppers than below-seed applications. All three pesticides prevented injury from flea beetle.

Literature Cited

(1) MALM, NORMAN R. and RALPH E. FINKNER. 1968. The use of systemic insecticides to reduce incidence of curly top virus disease in sugarbeets. J. Am. Soc. Sugar Beet Technol. 15(3):246-254.