Insect Control on Sugar Beets by Seed or Soil Treatments[1]

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Received for publication January 27, 1965

Control of certain insects in sugar beets by seed or soil treatment has been reported by various workers. For control of sugar beet root maggot [*Tetanops myopaeformis* (Roder)], Jones *et al.* (1)[3] reported that aldrin and heptachlor were effective, applied dry at ½ and ¼ pound respectively per 100 pounds of seed. Callenback *et al.* (3,4) found these insecticides were not effective unless seed was pelleted with wettable powder of the insecticide, to give 1 pound of toxicant per 100 pounds of seed. Allen *et al.* (6) in 1957 showed that heptachlor seed treatments increased yields, but aldrin and dieldrin did not.

Morrison (5) reported soil treatments to be superior to seed treatments for control of the garden symphylan [*Scutigerella immaculata* (Newport)].

Hills *et al.* (2,8) and Dorst (7) reported the effectiveness of phorate and Di-Syston® [*0, 0*-diethyl *S*-[2-(ethylthio)ethyl] phosphorodithioate] on sugar beet seed for beet leafhopper control on sugar beets grown for seed.

Monogerm sugar beet seed, which has almost entirely replaced the larger multigerm seed, was developed by the plant breeders to produce single plants to permit mechanical thinning. Precision planting involved in this operation has sometimes required that the seed be pelleted to make a more uniform size.

Insecticides and fungicides added to the exterior of seed as dry material or slurries for insect or fungus control, sometimes fail to adhere to the seed when handled and their value is often lost. Because of the smaller size of the monogerm seed, it is difficult to make enough of the insecticide adhere to the seed surface.

Pelleting sugar beet seed provides an inexpensive method of adding insecticides. In 1962 studies were conducted in northern Utah to determine whether the sugar beet root maggot, the garden symphylan, and the beet leafhopper [*Circulifer tenellus* (Baker)], could be controlled on sugar beets and whether such control would increase yields and reduce curly top disease. A factor considered was whether effective concentration of the

[1] In cooperation with the Utah Agricultural Experiment Station.
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[3] Numbers in parentheses refer to literature cited.

systemic insecticide could be introduced into the plant without causing excessive phytotoxicity. This is a report of the results of these studies and not a recommendation of any material used.

The two organophosphorus systemic insecticides, phorate, and Di-Syston, formulated in carbon powder, were included in the coating material used in producing the pellets. V-C 13[3] (*0*-2, 4-Dichlorophenyl *0,0*-diethyl phosphorothioate), another organophosphorus systemic insecticide was added to a portion of the pellets as a wettable powder; aldrin, wettable powder, was added to another portion. About two-thirds of the experimental work had been completed when it was discovered that a band or insulating layer between the seed and the phorate, Di-Syston, or V-C 13 insecticide provided a pellet that caused markedly less toxicity and damage to the planted seed than formulations without the insulating layer. Effectiveness of insecticide granules mixed in the top 2 to 3 inches of the soil in a 6-inch band along the row prior to planting was compared with that of using the pelleted seed.

The sugar beet seed (curly-top resistant) was furnished by The Amalgamated Sugar Company[1]. The seed was pelleted and treated with insecticide formulations by Germain's Incorporated[4]. Treatment plots were 8-rows wide and the length of the field or 72 rods. The seed was planted with a 4-row drill. Unthinned stands were compared by examining 100 inches of row in each plot and counting the number of such inches containing plants. Thinned stands were compared by counting the plants in predetermined sections of rows 33 and 34, and sections 33 feet long in the 2nd, 4th, and 6th rows, respectively, of the upper, center, and lower thirds of each plot. In determining stand losses, plants were counted in the sample areas at 3-week intervals from June to August. At each count dead plants were pulled up and examined to determine whether mortality was due to root maggot damage.

Symphylans feed on the germinating seed and roots of young sugar beets, weakening or killing the seedlings, and thus reducing the emerged or unthinned stand. They continue to multiply on the roots during the season, further reducing the yield of the crop. In late August or September symphylans were counted on seven beets taken at random from the top, center, and lower thirds of each plot. Soil samples were obtained by removing one heaping tablespoon of moist soil (approximately 50cc) from the root zone of the sugar beet approximately 6 inches below the surface. The soil was placed in 6-inch pans, mixed with water, and the containers set on a slope. The symphylans were counted as they came to the surface in an effort to escape excess moisture.

Curly top counts were obtained in August by examining 100 plants per plot. Yield records were obtained by harvesting the beets by hand in 15 feet of row in the second, fourth, and sixth rows of the upper, center, and lower thirds of each plot. The sampled sugar beets from the best leafhopper control plots were sacked in labeled rubberized bags, weighed, and a composite of the pulp obtained for a sucrose reading by the Central Laboratory of the Utah-Idaho Sugar Company[4].

The results of sugar beet root maggot and symphylan control are reported in Table 1. These data show substantial reductions in the number of plants killed by root maggots from pelleted seed containing aldrin, Di-Syston, phorate, and V-C 13. Band treatments of phorate, V-C 13, and parathion granules at much higher dosages were comparable to the pelleted seed treatment in protecting the seed from the sugar beet root maggot. In the field where 4.0-ounce rate of V-C 13 in pelleted seed was applied, the treatment resulted in phytotoxicity and reduced the emerged stand of beets by 60% and the thinned stand by 35%. Seed pelleted with the other insecticides did not cause reduction of the thinned stand and when the seed was treated with aldrin, the stand increased by 24%.

Table 1.—Sugar beet root maggot and symphylan control on sugar beets in field plots with insecticide incorporated in the pelleted seed and with row band applications of insecticide granules. Stevenson Field, Lewiston, Utah. 1962.

Insecticide and dosage in ounces per acre in pelleted seed and pounds per acre in granules		Number of thinned plants per 100 feet	Number of plants killed by maggot per 100 feet	Number of symphylans per 7 samples each plot	Yield tons per acre
In Pelleted Seed					
Phorate	2.0	69	1.2	1.5	27
V-C 13	4.0	69	1.7	1.0	31
Aldrin	0.8	75	0.7	3.7	26
Di-Syston	0.9	65	1.0	4.7	25
Granules in Soil					
Phorate	2.0	66	0.2	4.0	24
V-C 13	2.0	70	2.2	3.2	24
Parathion	2.0	68	2.5	3.0	26
Check (Unpelleted Seed		60	19.7	6.5	22
LSD at 5 percent		14.6	3.3	1.8	4

At the time of emergence, the young seedlings were apparently protected from symphylan damage by both the pelletized seed and the row-band treatments. Seed pelleted with phorate and

[4] Mention of a company name does not necessarily imply endorsement of this company's product by the U. S. Department of Agriculture.

V-C 13 were superior to those pelleted with aldrin and Di-Syston, but the dosages were higher. The band treatments with insecticide granules were inferior to the pelleted seed for symphylan control.

Even on resistant sugar beets, curly top transmitted by the beet leafhopper causes some reduction in yield. Results of experiments to control the leafhopper and reduce curly top with systemic insecticides in pelleted seed and phorate granules are given in Table 2. Phorate pelleted seed treatment at 2 ounces per acre reduced the stand of thinned beets 21%. The other pelleted seed treatments also tended to reduce the thinned stand as compared with that in the untreated check. Curly top incidence was reduced and the total sugar per acre increased by all treatments. The percentage of sucrose was similar for all treatments and ranged from 15.2 to 15.5.

Table 2.—Beet leafhopper control on sugar beets in field plots with insecticide incorporated in the pelleted seed or granules applied in a 6-inch band of row. Two fields, Gardner and Johnson. Delta, Utah. 1962.

Insecticide and dosage in ounces per acre in pelleted seed and pounds per acre in granules		Number of thinned plants per 100 feet	Percentage obvious curly top	Pounds of raw sugar beets per 45 feet	Net sugar tons per acre
In Pelleted Seed					
Phorate	.25	76	7	69	2.80
Phorate	.5	76	7	69	2.78
Phorate	1.0	77	7	69	2.88
Phorate	2.0	58	5	74	2.92
Di-Syston	.9	75	9	67	2.72
V-C 13	2.0	72	6	70	2.93
V-C 13	4.0	67	5	74	3.02
Ganules in Soil					
Phorate	2.0	81	7	70	2.89
Check		73	33	63	2.56
LSD at 5 percent		8	3	5	0.07

Summary

In field experiments in Utah in 1962 low dosages of V-C 13, Di-Syston, and phorate incorporated into the coating material of pelleted sugar beet seed gave promising results in the control of the sugar beet root maggot, the garden symphylan, and the beet leafhopper on sugar beets. Similar treatments with aldrin were also promising against the root maggot and symphylan. Indications were that phytotoxicity may be a limiting factor in this type of treatment.

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