Soil Treatment for Control of Black-Root of Sugar Beets

N. R. GERHOLD, W. J. HENDERSON, J. A. TWOMEY[1]

In many of the sugar-beet-growing districts of eastern Colorado, pre- and post-emergence damping-oft of seedlings are responsible for either the abandonment or partial loss of stands in many fields each year. A disease, commonly known as "black-root," is a major factor in obtaining adequate and uniform stands of seedlings. Isolations from diseased beets collected from these districts yielded pure cultures of *Pythium, Rhizoctonia* and *Fusarium* sp. In many instances only one of these organisms responsible for black-root of sugar beets could be isolated from individual seedlings, while in other instances two or all three of them were obtained from a single plant. Although the organisms responsible for black-root infection in a given area are well known, it is difficult to determine by general field observations and inspection which of them, either singly or in combination, produces the greatest incidence of disease.

During the past three years, field tests have been conducted to determine the effectiveness of different fungicides applied at various rates in the row with the seed at the time of planting.

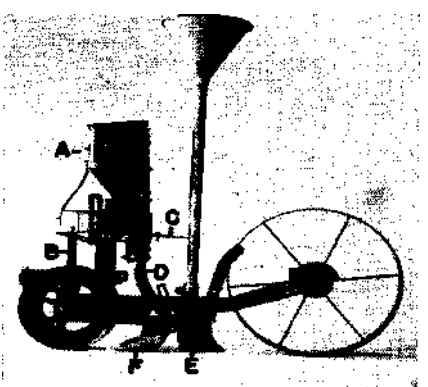

Figure 1. Planter Jr. equipped with a fertilizer attachment.

Procedure

The fungicides were applied to the soil with a Planter Jr. equipped with a fertilizer attachment (Figure 1). The fungicide to be applied was placed in hopper (A) at the rear of the planter. A mechanical device, operated by an off-set cam on the rear wheel (B), produced a shaking motion to the hopper. This insured an even flow of the fungicide material through an adjustable vent at the bottom of the hopper (C), into two flexible metal tubes (D) which directed the flow of material into the soil directly behind the seed applicator spout in the planter shoe (E).

The fungicide becomes mixed with the soil as the soil pushed over the top and sides of the planting shoe. The covering device (F) behind the

[1] Plant Pathologist, Extension Plant Pathologist, Research Graduate Assistant, Department of Botany and Plant Pathology, respectively, Colorado A & M College, Fort Collins, Colorado.

planting shoe also helps to mix the fungicidal material with the soil. This method of applying the fungicide forms a protective band approximately $2^{1/2}$ to 3 inches wide and $1^{1/2}$ to 2 inches deep around the germinating seedling.

Soil-treatment plots, of a triple-lattice design, were employed in the field to evaluate the comparative effectiveness of the various soil-disinfectant materials. Nine replications of three 25-foot rows each were made for each of the soil-disinfectant materials, and also the non-treated check. Each quantity of the various fungicidal materials used per linear acre of row was thoroughly mixed with a given amount of finely screened sand for bulking purposes. Then the required amount of bulked material was applied per each 25 feet of row. Stand counts were made prior to thinning. The differences in stand counts of seedlings for the non-treated soil check and the treated soil were an indication of the comparative effectiveness in the control of the black-root disease by the various soil-treatment materials employed in the experiment.

Table 1.—Effectiveness of Various Soil-treatment Compounds in the Control of Blackroot of Sugar Beet Seedlings as Manifested by Comparative Stand Counts.

Treatment[1]	Rate[2] lbs. per acre	Average number plants per plot
Check	---	62.20
Fertilizer	75	61.62
Arasan	4	86.34
Ceresan "M"	½	55.46
Ceresan "M"	1	72.26
Dow 9-B	4	56.12
Orthocide 406	4	71.78
Yellow Cuprocide	4	66.44
Dithane Z-78	4	79.23
Phygon	2	67.44
Spergon	4	59.94
Crag 658	4	70.49
Dow D.H.A.	4	80.20
Parzate	4	56.11
Cadminate	4	73.80
Arasan	3	75.63
LSD 5% = 13.12		
LSD 1% = 17.31		

[1] Fertilizer, 12-24-0, at the rate of 75 lbs. per acre was added to each treatment with the exception of the check.
[2] Based on linear feet of row.

Experimental Results

The data compiled in Table 1 are the result of the 1951 field test and are quite typical of the results which were obtained in similar tests conducted in 1949 and 1950. The data, as given in Table 1, show that Arasan, Dow D.H.A. and Dithane Z-78, at the rates of four pounds per acre, significantly increased the stand of sugar beet seedlings over the non-treated soil check. These data further substantiate the results obtained in 1949 and 1950, except for Dow D.H.A., which was not included in the 1949 and 1950 tests. Ceresan "M," at the rate of one pound per acre, was found to be as effective as Arasan at the rate of four pounds per acre during the 1949 growing season. In the 1950 tests, Ceresan "M" at the rate of *one* pound

per acre decreased the average number of plants per treatment block compared to the non-treated check. The reduction in the number of seedlings compared to the non-treated check in 1950 was believed to be due to dry field conditions. Ceresan "M" being a mercury compound perhaps sublimed more readily under dry field conditions and caused injury to the germinating seedlings.

Of all the soil-disinfectant materials evaluated in the greenhouse and in the field, Arasan (50 percent) at the rate of four pounds per acre, gave the most consistent increase in the number of seedlings either in artificially infested soil or under natural soil-infested conditions in the field.

There were no significant differences in stand counts for any of the soil treatments after thinning and again prior to harvest.

Summary

1. In Colorado, "black-root" may be caused by pythium, rhizoctonia, fusarium, or an interaction between two or more of these organisms.

2. Soil-disinfectant materials were applied to the soil in the rows at the time of planting with a Planter Jr. equipped with a fertilizer attachment.

3. Arasan, Dow D.H.A. and Dithane Z-78, at the rate of four pounds per acre, significantly increased the stand of sugar beet seedlings over the non-treated soil check. These increases were significant at the 5 percent level. Arasan and Dow D.H.A. were significant at the 1 percent level. Ceresan "M," at the rate of one pound per acre, was as effective as Arasan at the rate of four pounds per acre in the 1949 tests in a season when there was an adequate soil moisture supply. However, because of dry soil conditions, Ceresan "M" at the rate of one pound per acre decreased the number of seedlings over the non-treated soil check in the 1950 tests.

4. Stand counts made after thinning and again prior to harvest failed to give significant differences.

5. Tests during the past three years show that Arasan applied in the row at the time of planting and at the rate of four pounds per acre, based on linear feet of row, gave the most consistent and significant results in controlling black-root of sugar beets and resultant increases of stand.