Seed Treatment of Segmented Seed

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Dusting the seeds with fungicides to protect sugar-beet seedlings against infection by soil or seed-borne fungi has become a standard practice in several areas. In California 85 percent of the Ventura County sugar-beet acreage is planted with treated seed. More than half of all the sugar-beet seed in the Delta region of the Sacramento and San Joaquin Valleys is also treated, while in the Imperial Valley and parts of the upper Sacramento Valley very little treated seed is used.

Before segmented seed is made available for large-scale field trials, it is important to know if the same seed treatments now used on whole seed are safe to use on segmented seed, and if these materials and dosages are effective in protecting plantings from segmented seed against damping-off infections, where these seedling diseases are limiting factors in securing satisfactory . stands. The investigations reported in this paper were conducted to secure information concerning the protective and toxic effects of seed treatments on segmented seed.

One striking difference between segmented and whole seed is that many of the seeds of the former are in an exposed position because of the removal of the corky sepals, portions of the pericarp, and in occasional cases, portions of the seed coat. At the same time the mechanical separation of seed units was found to have approximately doubled the surface area per unit weight of seed.

Sugar-beet seed treatment is primarily for the purpose of controlling damping-off, a seedling disease in which germinating seeds or young seedlings are attacked by certain fungi and killed before they emerge from the soil or topple over after they appear above ground. The fungus responsible for most of the damping-off of sugar beets in California is *Pythium ultimum,* although in certain areas, notably Ventura County and some areas of the Delta region, *Rhizoctonia solani* is of equal importance. A third organism, *Phoma hetae,* is seed-borne and while it is abundant in some lots of European origin it has not been found on domestically produced sugar-beet seed (2).

Unless infestations are exceptionally severe, satisfactory control on whole beet seed can be secured by treating with Ceresan (ethyl mercury chloride) at 1 pound per 100 pounds of seed, or with

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Numbers in parentheses refer to Literature Cited.

New Improved Ceresan (ethyl mercury phosphate) at 6 ounces per 100 pounds of seed. Red copper oxide is effective against *Pythium* damping-off but is only partially effective against *Rhizoctonia* or *Phoma* infection.

All of the trials reported in this paper were conducted in the greenhouse, and the infested soils contained a much higher inoculum potential than would be encountered in most field plantings.

Discussion of Experiments

The first experiments compared the relative emergence and surviving stands of whole and segmented seed nontreated and treated with Ceresan at 1 percent of seed weight when planted in steam-sterilized soil and in soil infested by both *Pythium* and *Rhisoetonia.* The results (figure 1) indicated that infection on nontreated segmented seed was more severe than on the nontreated whole seed, and that the protection afforded by a 1-percent dosage of Ceresan on segmented seed was considerably less than the same treatment on the whole seed. It appears, therefore, from this trial and from subsequent investigations that at least under some conditions segmented seed may be more susceptible to damping-off than whole seed.

The dosage of Ceresan was next increased in an attempt to compensate for the greater surface area and the apparent increase of susceptibility of the segmented seed. With whole seed it was found that protection was not increased by dosages above 1.5 percent (table 1), while germination was not decreased by dosages as high as 3 percent when the treated seed was planted immediately under favorable conditions. Numerous greenhouse and field experiments have demonstrated that a 1-percent dosage of Ceresan, originally recommended by LeClerg (3) in Minnesota, provides nearly as good protection as larger amounts, except under conditions of severe infestations.

With segmented seed it was found that dosages of 1.5 percent increased the protection considerably over that provided by 1 percent of Ceresan in soil infested with either *Pythium* or *Rhizoctonia* (figures 2, 3, and 4). In some trials a 2-percent dosage was still more effective, but plantings in noninfested soil indicated that this amount was somewhat injurious to germination.

Limited trials do not indicate that segmented seed is more readily injured by storage after treatment than is whole seed. It is well known, however, that whole seed treated with Ceresan may be injured by storing for several weeks, especially in close confinement or where moisture may be absorbed by the seed. It is suggested, therefore, that only limited amounts of sugar-beet seed be treated with organic mercury compounds at one time and that whenever possible the seed be planted within a few days after treating.

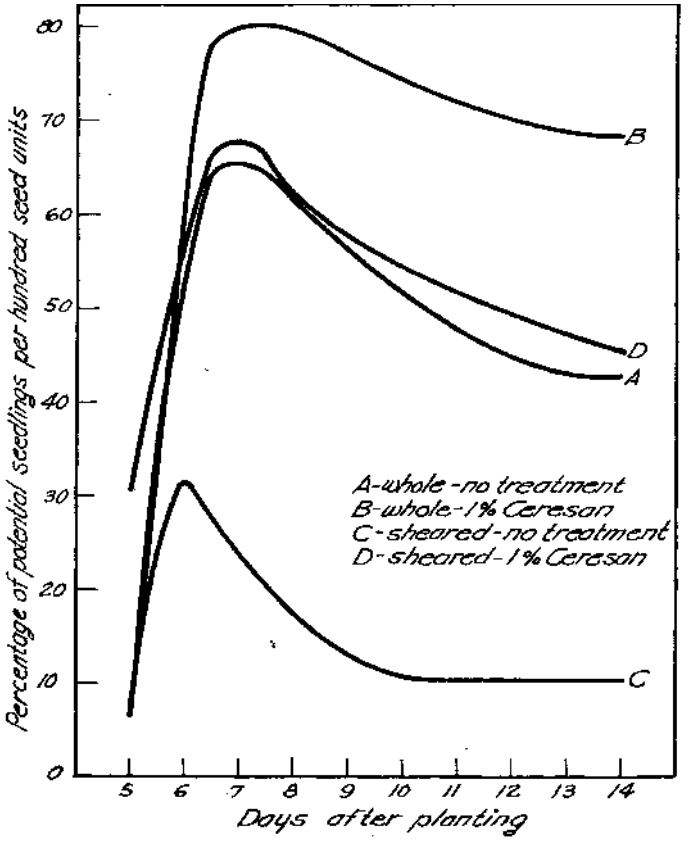

Figure 1.—Comparative trials of treated whole and sheared sugar-beet seed (U. S. 33) in infested soil (Rhizoctonia-Pythium).

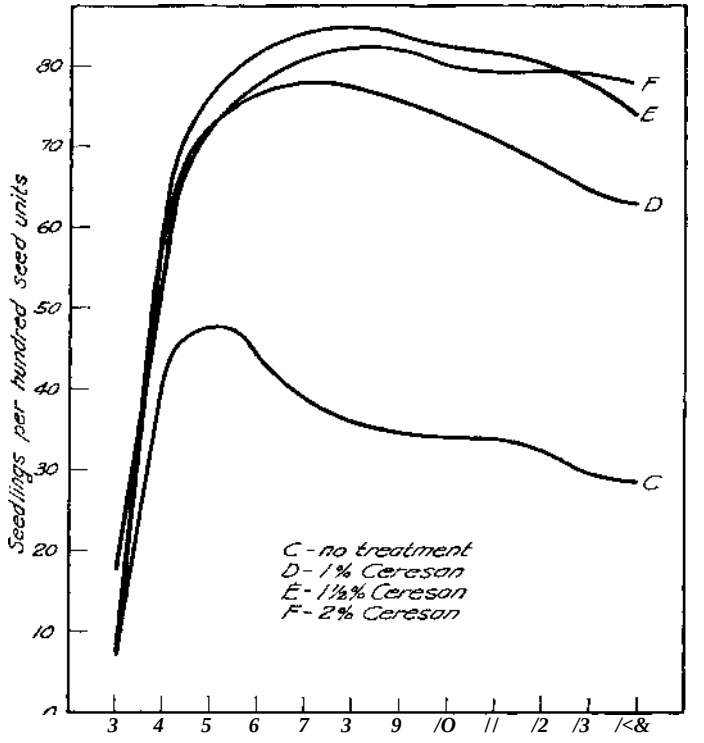

Figure 2.—Comparative trials of treated sheared sugar-beet seed (U. S. 12) in infested soil (Pythium-Rhizoctonia).

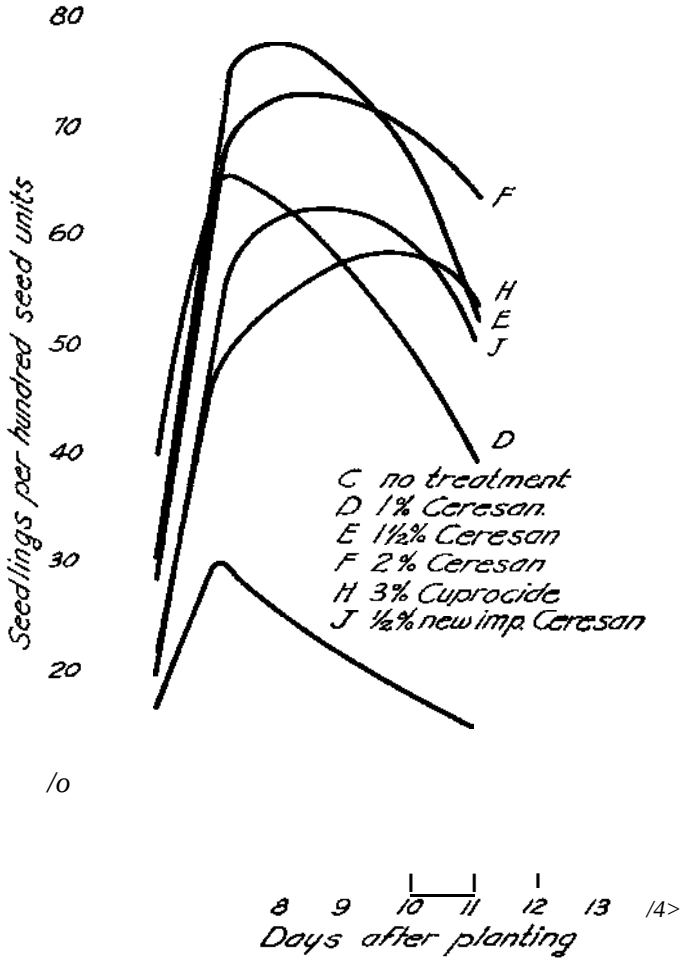

Figure 4.—Comparative trials of treated sheared sugar-beet seed in Rhizoctonia-infusted soil.

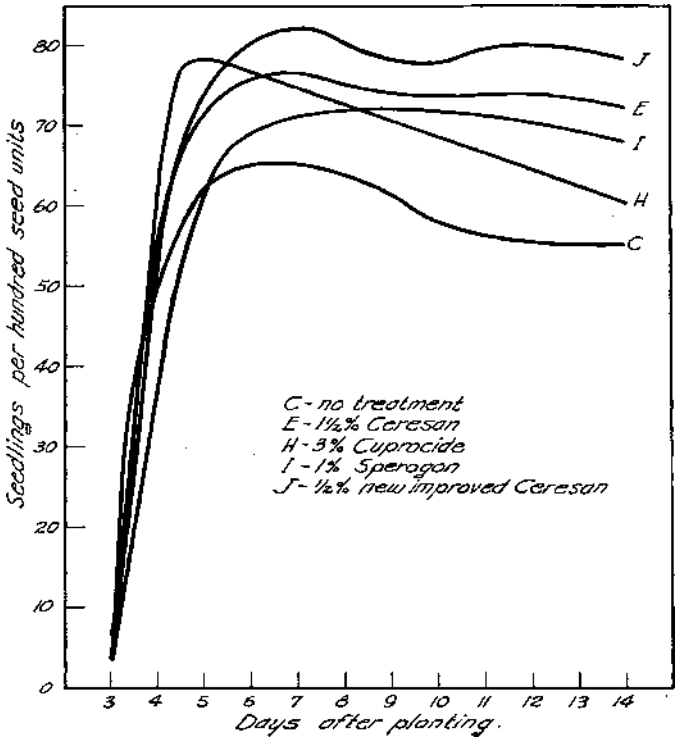

Figure 5.—Comparative trials of treated sheared sugar-beet seed (U. S. 12) in infested soil (Pythium-Rhizoctonia).

Comparisons with other fungicides (figure 5) indicated that Ceresan was more effective on segmented seed than either red copper oxide or Spergon and that a 1.5-percent dosage of Ceresan is about as effective as a 0.5-pereent dosage of New Improved Ceresan considered near the upper limit of effectiveness and safety for this fungicide (4).

Table 1.—Effect of Ceresan dosage on germination of sugar-beet seedlings in steam-sterilized and in Pythium-infested soils.

		Steam-sterilized soil*	Pythium-infested soils*	
Treatment	Dosage	Surface irrigated	Surface irrigated	Nonirrigated
	Percentage			
Control	none	201	19	43
Ceresan	0.5	214	126	148
Ceresan	1.0	216	146	160
Ceresan	1.5	210	187	196
Ceresan	2.0	200	183	192
Ceresan	3.0	224	194	197

*Seedlings per 100 seedballs.

Conclusion

In conclusion it can be stated that segmented seed responds in much the same way as whole seed to the protective effects of fungicides, but that possibly because of its greater surface area or its greater susceptibility to infection a somewhat higher dosage is required. Judging from these trials a 1.5-percent dosage of Ceresan or 0.5 percent of New Improved Ceresan should provide adequate protection even under moderately severe infestations. Red copper oxide and Spergon offer some protection, but in these trials were less effective than the organic mercury compounds.

Literature Cited

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3. LieClerg, E. LL Treatment of sugar-beet seed increases stand and yield. Minn. Agr. Exp. Sta. Cir. 57, 1937.
4. Reedy, C. S. and W. F. Buckholtz. Seed treatment of sugar beets. Iowa Agr. Exp. Sta. Ext. Cir. 240, 1937.