A Mechanical Spray Treater for Sugar Beet Seed

AUSTIN ARMER[1]

THE FUNGICIDE treating of sugar beet seed has heretofore been the task of the grower at planting time. The prevalent dust treatments were inconvenient to all growers and involved the hazard of skin and mucous membrane irritations, severe in the case of certain individuals. Haphazard treating methods often failed to distribute fungicide dusts throughout the seed mass, and subsequent handling was suspected of shaking off adhering dusts.

The foregoing comments point up the need for changes in treating methods. They are in effect a negative definition of a problem—a problem which can be defined in the following positive terms:

1. Beet seed should be treated prior to issuing to the grower.
2. Such treatment must not lose effectiveness or damage the seed after reasonable storage periods.
3. The fungicide should adhere firmly to the seed.
4. Each seed should receive a coating of fungicide.
5. The treated seed should not be irritating or toxic to those handling it during and after treatment.

The problem thus defined was solved by the coordinated effort of three groups. These were:

The Spreckels Sugar Company, Agricultural Engineering Department.

The University of California, Plant Pathology Division.

The U. S. Rubber Company, Naugatuck Chemical Division.

Preliminary discussions led to the tentative conclusions that the solution of the problem should involve:

1. The formulation of a liquid fungicide.
2. Spraying of the fungicide onto a seed mass in a high state of agitation.

Selection of the Fungicide

The first phase of the problem was approached in the laboratory of the University of California Plant Pathology Division. The choice of the basic fungicide was made after determination of relative effectiveness and seed-keeping qualities of various commercial fungicides.

Organic mercury compounds proved most effective in controlling damping-off organisms, but showed evidence of reducing germination after relatively short storage periods.

[1]Agricultural Engineer, Spreckels Sugar Company.

The material most closely approaching the organic mercuries in protection and having no adverse effect on stored seed was Phygon (2, 3-Dichloro-1, 4-Naphthaquinone). This dust, in its commercial form, would not readily form a homogeneous suspension in water. The Naugatuck Chemical Division, however, succeeded in combining (with Phygon dust) wetting and stabilizing agents which yielded a semi-fluid paste readily miscible with additional water to any desired consistency.

Selection of a Sticking Agent

The requirement of sticking the fungicide to the seed (to prevent separation subsequent to drying the sprayed seed) presented a problem which was solved in a rather informal manner. Whereas the market affords numerous water-soluble binders (Methyl Celulose, Sodium Alginate,

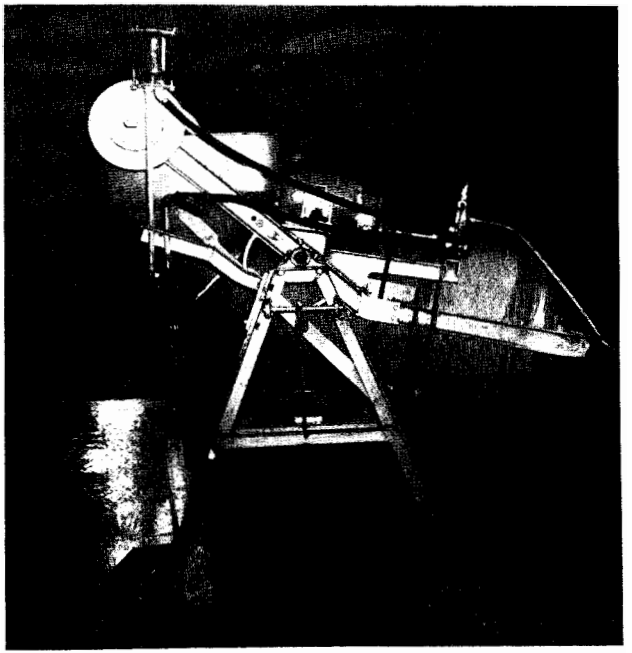

Figure 1.—A mechanical spray treater for sugar beet seed—Armer.

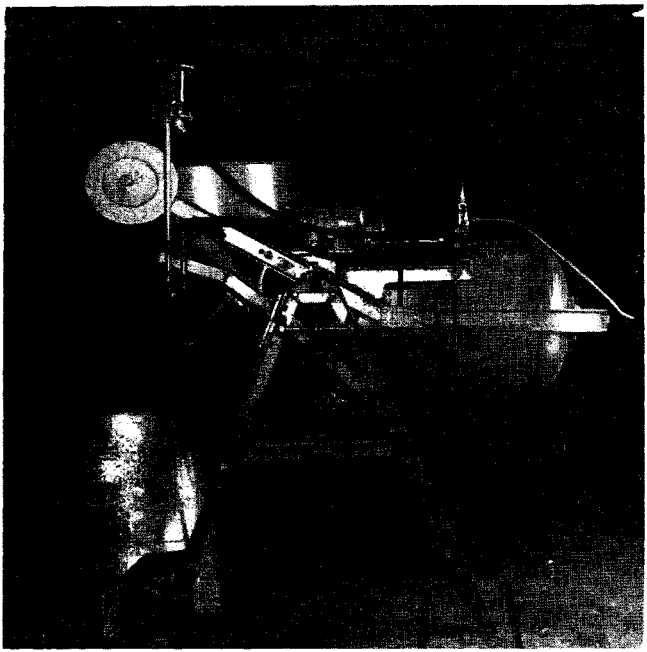

Figure 2.—A mechanical spray treater for sugar beet seed—Armer.

Vegetable gums, etc.), such materials lack the prime requisites of high adhesivity combined with high water permeability. The material selected to meet these requirements was discard sugar beet molasses. The choice of this readily obtainable material was fortuitous. It is of course highly adhesive ("sticky"), and is both water-soluble and water permeable. It is somewhat hygroscopic, but in the small quantities used, presents no problems arising from excess moisture pickup by the seed.

While molasses presents a splendid culture medium for molds (as abundantly proved when beet seed was treated with a plain molasses solution) the presence of the Phygon is insurance against mold growth over reasonable storage periods.

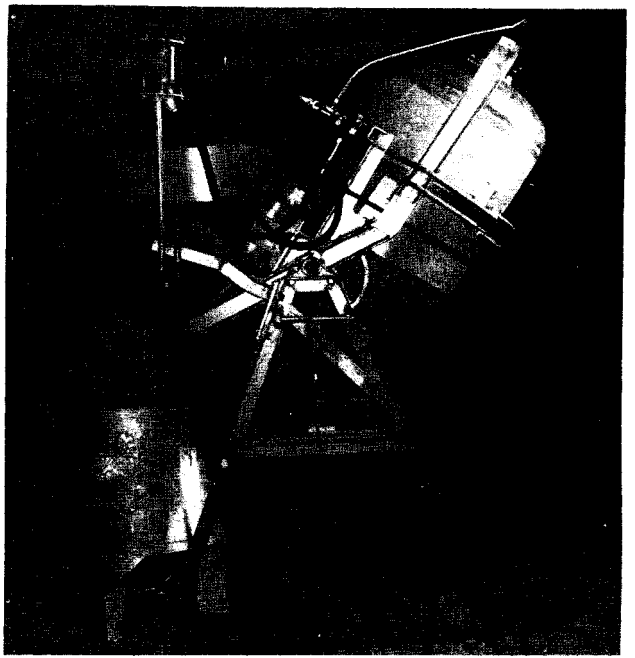

FIGURE 3.—A mechanical spray treater for sugar beet seed. Armer.

Development of Spraying Equipment

In the laboratory phases of the spray-treating development, a small cement mixer was used to contain and agitate the seed batch while subjecting it to the spray action. While yielding a product which showed up well in comparison to dust-treated seed, it was evident that such a crude agitating device fell far short of the requirement *that each seed be presented at least once to the spray stream.* Two devices in common use suggested the design eventually adopted. These were the sugar dryer and rice polisher. Both are drums rotating on axes inclined slightly from horizontal; having vanes which pick up a portion of the contents; and (as rotation proceeds) drop this portion progressively in a thin, falling sheet.

The inclined axis is not conducive to the formation of uniform, thin, falling sheets. It is a requirement for continuous feed and discharge. It was therefore determined that a batch mixer, holding 50 pounds of seed, would fit well into the seed-processing cycle, since bagging of the seed would follow immediately after treating.

The design data for a desirable treating machine could then be outlined as follows:

1. A cylindrical, inside-vaned drum rotating on a horizontal axis.
2. Spray nozzles within the drum, fixed in space and located so as to spray the falling sheets of seed.
3. Means for metering the volume (or weight) of spray material automatically released during each refilling of the drum with seed.
4. Means for forcibly discharging the spray material through the nozzles.
5. Means for storing and agitating a supply of fungicide suspension.
6. Means for storing and releasing a charge of seed into the drum.
7. Means for discharging the contents of the drum into a bag.
8. A general arrangement of components permitting the receiving of seed at a minimum height and discharging at a maximum height.

These design data were worked up into drawings of several possible mechanisms, and the simplest of these designs adopted for refinement and construction.

Two machines as illustrated were put into service and have performed in a highly acceptable manner. The cycle of operation may be briefed thus:

Operation	*Time Required*
1. Swing drum to charge position and admit seed. (Figure 1)	10 seconds
2. Swing drum to horizontal position and turn on spray valve. (Figure 2)	5 seconds
3. Allow one unit (about 1 quart) of spray material to discharge into drum	20 seconds
4. Allow drum to rotate after spray stops (to clean up and dry interior of drum)	30 seconds
5. Discharge contents of drum to bag. (Figure 3)	10 seconds
Total time for one cycle	75 seconds

It should be noted that the spray valve is a pair of three-way cocks so arranged as to pump spray material from the agitator-storage tank into an elevated measuring chamber which overflows (when full) back to the storage tank. Thus, during the entire cycle, except while spraying, the measuring chamber is kept full or overflowing, and is at any time thereafter ready to discharge its measured contents. Figure 4 illustrates individual seeds, sack-run, decorticated and spray treated, respectively.

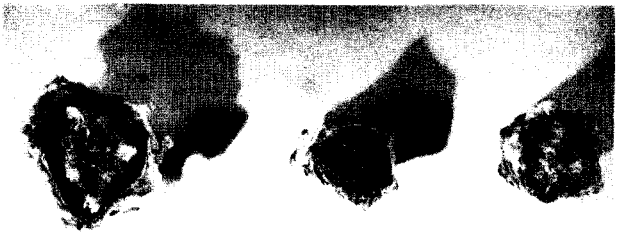

Figure 4.

Conclusions

The method and equipment described is operating on a commercial scale and is delivering a seed having:

1. Satisfactory resistance to damping-off organisms.
2. Freedom from irritation or toxicity to either processing or planting personnel.
3. Satisfactory storage qualities.
4. No discernible stickiness or dampness.

The development of methods and equipment leading to these results exemplifies the rapid and direct solution of a problem made possible by the close cooperation of specialists in plant pathology, fungicide chemistry and machine design. This development was therefore a cooperative engineering program aimed at a quick commercial solution to a problem and necessarily by-passed many research phases. Methodical research therefore holds the answers to such questions as:

1. How uniformly is each seed coated?
2. How necessary to field protection is uniform coating and dosage of each seed?