Equipment for Beet Seed Treating

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During the past two decades, general acceptance by California sugar beet growers of the value of planting treated beet seed appeared to be more immediate and forthright than did processors' ability to acquire efficient equipment and develop standardized techniques of treatment to meet the demand for such treated seed.

The mandatory clause in the processor's sugar beet purchase contract which obligates the grower to acquire and plant sugar beet seed supplied by the processor is not a unilateral agreement. It certainly imposes upon the processor the moral responsibility for supplying the grower with the best seed obtainable, with every consideration given to all of the factors in seed production and processing which pertain to securing satisfactory seedling stands and high sugar production per acre at economical cost levels. The establishment of better stands of beets from treated seed has been proven and the acceptance of this means of obtaining such results by the grower emphasizes the obligation of the processor to supply treated sugar beet seed when it is demanded. Progressive processors have recognized this obligation and have done something about it.

With refinements in the processing of sugar beet seed during the past few years has come the trend toward lighter seeding rates. More recently, with the advent of and progress in mechanical thinning has come the planting technique of precisely spacing processed seeds one inch apart in the row. These trends have in mind the accomplishment of a single purpose—the emergence of a higher rate of evenly spaced, non-competitive, single seedlings. The importance of preventing the pre-emergence or post-emergence mortality of seedlings from any cause under these planting conditions cannot be exaggerated.

We are currently at the threshold of the production of monogerm sugar beet seed for commercial plantings. Precise planting of minimum quantities of this seed will be the obvious procedure. Here again preventive measures will have to be taken to insure against seedling losses from seed-borne and soil organisms or predators by means of seed treatment.

The apparent cautious attitude of processors towards seed treatment during the late thirties was justified. The general concept of the value of seed treatment was not new but the formulations of usable fungicides for the control of specific seedling diseases were not proven and efficient equipment for the proper application of these fungicides to seeds was non-existent. In some preliminary trials with some treating materials the delay in the emergence of and injury to the seed was severe enough to offset any possible advantages which might have resulted from the treatment. Another deterrent was the reluctance of individuals to handle some of our early treating materials since they were odious and poisonous. A further cora-

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plication arose when seed damage resulted from treating materials when applied too far in advance of the date of planting and the treated seed had to be stored.

Due in great measure to the untiring efforts of plant pathologists, fungicide manufacturers and beet sugar processors, many of the uncertainties which thwarted early efforts to introduce a safe and effective beet seed treating program have been surmounted. In this phase of sugar beet agriculture, the processor now finds himself in the position of having to keep abreast with new treating techniques and to make use of the most effective materials to satisfy his grower clientele. This is a healthy condition and in the long run can be conducive only to further improvement in the kind of treating we accomplish. A brief review of past and present methods of applying seed treating materials will show that we have made much progress. On the other hand, an objective survey indicates that some of our current methods of applying treating materials to sugar beet seeds are inefficient and could be the basic cause of failure of the fungicide to always give adequate protection.

Treating Methods

The generally accepted methods of applying fungicides and insecticides to sugar beet seeds are these: 1. as a dry dust or powder; 2. as a water-fixed dust; 3. as a slurry, and 4. as a spray.

Dry Dust Treating Equipment

In the first mentioned method, a dry dust formulation of the seed protectant is added to a batch of seed. The seed is weighed, placed in a rotary drum and the required quantity of fungicide added thereto. The seed is agitated for several minutes, or, at least until it appears that the seeds have been coated with fungicide dust. Many hundreds of pounds of sugar beet seed have been treated by California growers with an end-over-end rotary drum treater. This type of equipment is now outmoded. The procedure was slow, wasteful and undependable.

When processors first undertook to treat commercial quantities of seed, they purchased, or constructed, rotary dust treaters for the purpose. This type of treating equipment consisted essentially of a horizontally placed rotary cylinder into one end of which a controlled flow of seed was fed. A metering device fed the fungicide at a regulated rate into the same end of the cylinder. Proper treatment of the seeds was dependent upon the maintenance of a uniform flow of seed, the metering of the proper proportion of fungicide dust, and the thorough mixing of seed and dust as they traversed the length of the rotating cylinder. An arrangement of suction ducts at the sacking end of the cylinder permitted the removal of free dust by means of an exhaust fan. The treater was electric motor driven.

While this type of treater had ample capacity to meet the demand at the time for treated seed and gave fairly good results, it was frequently subject to quantitative inaccuracies in the mechanical measurement of the fungicide. Regardless of the type of metering device, troubles were con-

stantly encountered with this part of the treater. Today, campacting or channeling of dust in the feed hopper, which caused much of the trouble, would be eliminated by the use of a vibrator feed. Several excellent makes of these are currently manufactured.

In spite of every precaution and mechanical means to prevent it, the atmosphere around the treater became laden with fungicide dust particles and obnoxious fumes. Labor became disgruntled and, understandably, obstinate about working under these conditions. Also, this method of treating seed with what we considered an improved rotary type of applicator did not lessen the amount of fungicide which was wasted due to non-adherence to the seed coat. At this time there are no dry dust treaters being used by any processor in California for the treatment of sugar beet seed, and, so far as we know, none will be used for beet seed treatment in the future.

Dust-Fixation Treating Equipment

In this method of treating sugar beet seed, a wettable powder formulation of the fungicide is added to the seeds. The fine particles of the fungicide which adhere to the seed coat are "set" by praying the dusted seeds with a fine mist of water. To promote better adherence, a soluble sticker is sometimes added to the spray water.

The Clute treater embodies this principle of applying fungicides to beet seeds. A treater of this type is currently being used by a California processor. Briefly described, it consists of two horizontally mounted cylinders which compose a feed chamber and a mixing chamber, respectively. The smaller of the two cylinders (the feed chamber) contains a scroll which feeds seed and fungicide into the front end of the larger cylinder (the mixing chamber). This mixing chamber contains a broken scroll which tends to mingle seeds and fungicide as the mass is being conveyed to the discharge, or sacking, end of the chamber. Into one side of the mixing chamber, at a location approximately halfway between points of entry and discharge of this chamber, a fine spray of water is introduced to wet down and "set" the fungicide to the seed coat. Flat pattern 50-degree spray nozzles which deliver varying volumes of water at various controlled pressures are supplied by the manufacturer. By means of these calibrated nozzles the amount of moisture added can be controlled within tolerable limits. Fungicide and seed hoppers are mounted upon the feed chamber. Conventional auger-type feeds actuate and control the flow of the fungicide and seed. An electric vibrator is mounted on the fungicide hopper to minimize bridging-over or channeling. The entire treater is simply constructed and is built into a single compact unit. It is powered by a small electric motor. Satisfactory coverage of seeds at the treating rate of 900 pounds per hour gave adequate protection of seedlings against damping-off organisms. Caking of treating materials on the walls of the mixing chamber and the agitator paddles pose a cleaning problem.

Slurry Treating Equipment

In the slurry treatment of sugar beet seed, the wettable powder formulation of the fungicide is made up into a dense aqueous suspension

which is added to the seed mass. Seed surface coverage is accomplished by means of a weir which spreads a struck-measure volume of slurry over a weighed volume of seed. This is followed by thorough mixing as the seed mass is moved through a mixing chamber towards the sacking-off end of the treater.

While there are many slurry treaters being used in California for the treatment of various kinds of crop seeds, this type of treater has not been used by processors for the treatment of commercial quantities of sugar beet seed. The method is a vast improvement over any form of dry dust treatment for it gives seed protection comparable with that given by good dry dust treatment without the disadvantages previously enumerated.

Both the Caulkins and the Gustafson slurry treaters are well designed, compact, electric motor driven units. They are small and occupy a floor space measuring approximately 5 x 5 feet. Treating capacity is more than ample to meet the requirements of the average beet seed processing plant.

The Gustafson treater consists, essentially, of a seed-metering hopper, a slurry tank, a set of slurry measuring cups, a continuous flow pump and a mixing chamber. Seed which is to be treated is gravity-fed into the metering hopper of the treater. A counter-weighted tilting pan measures the seed and discharges its contents into the maxing chamber. Slurry is fed to the seed by the measuring cups which travel on an endless chain through the slurry tank contents. They fill and deliver a measured amount to the seed as it enters the mixing chamber.

These two actions are synchronized so that each time a pan of seed is discharged into the mixing chamber a measuring cup is brought up and its slurry contents discharged upon the seed. The movement of the measuring cups on the endless chain is actuated by the movement of the tilting seed pan each time a load is dumped. The slurry tank is quipped with an agitator. A circulating pump maintains a continuous flow of slurry through a small pipe directed into the measuring cup, thus effectively washing each cup after its discharge cycle. This prevents the gradual coating of the inner walls of the measuring cup with fungicide, the occurrence of which will result in the progressive error of measurement of slurry and undertrcatment of seed. The unit is easy to clean. Operators using slurry machines for the treatment of delinted cotton reed report good results and negligible operational difficulties.

Spray Treating Equipment

In the case of the spray method of applying fungicides to sugar beet seeds, the treating material is made up as an aqueous suspension and is sprayed on the seed mass as it is being agitated in a revolving drum. This method more completely eliminates dustiness and more nearly accomplishes uniformity of coverage with the treating materials than any other method devised for the treating of commercial quantities of sugar beet seed.

[2] Numbers in parentheses refer to literature cited.

There are two types of spray treaters in use at the present time. A semi-automatic batch spray treater designed in 1947 has been used by a California processor at two factory locations for several years. Several million pounds of sugar beet seed have been successfully treated with the equipment with very few changes in its original design. This type of spray treater was engineered by Armer (1)[2] who has explained its construction and principle of operation in a past publication (1948) of the Proceedings of the Society.

Another type of spray treater was designed in 1949 by Kepner and Leach (2) . This treater is the continuous spray type. The first commercial model of this treater has been used by a processor since 1949 to meet the seasonal requirements of growers for processed treated seed. Several million pounds of sugar beet seed have been double treated with fungicide and insecticide with this equipment since its installation. The design, principle of operation and preliminary testing of the continuous spray-type treater have been described in detail by Kepner and Leach in the 1950 Proceedings of the Society. Its commercial operation has been fully described by the author in this same publication (3) . There are five spray-type seed treaters being used for sugar beet seed in California. The purchase of the sixth by a processor is imminent. When this takes place, all processors in the state will be using spray-type treaters.

A very useful and efficient piece of supplementary equipment for a well planned and operated treating plant using spray-type equipment is the air-lift elevator. This type of elevator, used in connection with spray-type treaters for the transfer of untreated and treated seed, has many advantages over the conventional bucket elevator. Some of these advantages are:

1. less risk of mechanical damage to the seed; 2. additional cleaning during the transfer; 3. complete removal of any cork or fungicide dust which flakes off because of friction between seeds; 4. a minimum of moving parts; 5. self-cleaning, and 6. the beneficial drying action on seeds which have received moisture in the process of being treated. This type of elevator is easily installed and its operation is simplicity itself.

Summary

The planting of treated sugar beet seed by California growers has become standard practice in all of the production areas of the state. This accomplishment was no sudden development, but rather the result of research and hard work extended over a period of 20 years.

The transition from dry dust treating with its attendant waste and operational difficulties to less obnoxious methods of treating sugar beet seed was a gradual process and came with the development of slurry and spray treating equipment.

Dust fixation and slurry treating equipment have alleviated the problem of dustiness but have not given the complete uniformity of seed coverage

obtained by the use of spray treating equipment. Uniformity of coverage becomes increasingly important when minimum rates of planting are made *in* contemplation of mechanically thinning the. beet crop.

Spray-type treating equipment has supplanted other types in California principally because of its effective, uniform application of treating materials.

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