# PLANTING EQUIPMENT FOR SHEARED SEED

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In the process of planter development work for sheared sugar-beet seed the objective has been to plant sheared seed in such a manner that hand thinning could be made easier or preferably that it could be completely eliminated. In 1943 the major portion of the acreage within the Utah-Idaho Sugar Company was planted to sheared seed with conventional type planters being modified in such a manner as to do what was considered a reasonably satisfactory job of planting sheared seed. It was realized, in planting the seed in this manner, that while a considerable savings would probably be effected in thinning, complete mechanization of the spring work would probably not take place. Since that time further planter development work has been carried out with the objective in mind of completely eliminating the hand thinning.

After large scale sheared seed plantings had emerged in the spring of 1943 it was possible to review and correlate the experimental work which had been done on the planters employed with the field results and evaluate the quality of the work. Two major types of planters were used in the areas of the company in 1943: One, the plate type of positive displacement feed; and two, the dribble feed represented by various makes of flute feeds and internal run force feeds. In all of these drills there were several features that seemed to deter from the quality of work done. In all cases the feed mechanism was high on the drill and the seed had to fall a considerable distance before reaching the ground. In the case of feeds that had a tendency to displace seed segments in bunches this probably worked to advantage, while with planters having a tendency to feed seed segments singly this long drop undoubtedly was a disadvantage. In all cases the long drop through a seed tube had one disadvantage in that where planting was done on a windy day a draft would pass up through the seed tube periodically, holding the seed in the tube more or less in suspension, with the result that rather long gaps were left and seed was bunched. This was particularly true where there was a large opening between the discharge of the feed mechanism and the entrance into the seed tube. With practically all planters a rather high slippage of the drive wheel existed due to the high power requirements of the seed and fertilizer feed mechanisms as well as poor alignment of bearings, shafts and gears. This did not appear to be a steady slippage but was observed to be somewhat erratic.

With the plate feed planters used considerable difficulty was expxrienced in accurately controlling seeding rate. A method of checking seeding rate was devised for use in the field and practically all drills were checked very day or two during the period they were in operation. It was found that unless the feed mechanism was carefully cleaned frequently and kept in proper

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working condition the seeding rate could and did fluctuate to a large degree. It was also found that seeding rate was materially affected by the speed at which the plate traveled or the forward speed of the planter. A considerable amount of mechanical damage to the seed was noted in many cases although it varied widely from unit to unit. Upon checking these various items it was found that they practically all resulted from a definite lack of precision dimensions of the various parts of the feed mechanism. In most cases rough castings were used and in cases where the bottom surface of the seed plate had been machined it resulted in a varying thickness of the seed plate around its periphery. Many of the plates were warped to varying degrees, with the result that ofttimes seed was being fed from between the plates as well as through the cells. This undoubtedly resulted in excessive mechanical injury to the seed. It was found that in many instances the knock-out wheel did not follow the cells of the plate properly and would get out of line from time to time with the result that in sections of the row too little seed was deposited.

With the dribble type feeds the entire feed mechanism consisted of rough castings. This again resulted in a difficulty in controlling seeding rates and an erratic flow of seed from the feed mechanism. It was noted in many instances that identical settings on two feed mechanisms of the same make and model did not result in identical seeding rates. These feed mechanisms were designed for planting quantities of seed far in excess of those being planted with the result that the feed rate was very sensitive and difficult to control. One of the greatest disadvantages coming from the dribble feeds was the fact that as the seeding rate was lowered the distribution was constantly poorer. Reasonably good distribution was attained at seeding rates of 5 and 6 pounds per acre but at the more desirable seeding rates of 3 and 4 pounds per acre the distribution was very erratic with long skips and bunching of the seed.

It was noted that with practically all types of equipment used during the 1943 planting season a change in the seed size made a material difference in the rate of seeding. Experimental work prior to the 1943 planting season indicated that with the equipment available reasonably good distribution and seed rate control could be obtained using seed sized from 7 - 11/64 inch, whereas if the seed size was decreased somewhat the distribution at a given seeding rate was poorer and the seed rate control was more difficult.

At the completion of the 1943 planting season a project was undertaken to work out a precision planter which would facilitate the complete elimination of hand thinning. In studying the desirable characteristics in such a planter it was decided that it should embody several features not included in any of the 1943 planting equipment. Among these were: 1, A positive seed pattern; 2, the discharge of the feed mechanism as near the ground as possible; 3, a low power requirement; 4, a positive feed rate control; 5, a feed mechanism discharging a relatively constant amount of seed at varying speeds; 6, a feed mechanism which would distribute the seed as well at low seeding rates as at high seeding rates;

and 7, a feed mechanism embodying a fool-proof design or having a minimum of parts requiring careful adjustment and depending upon springs for their satisfactory operation.

Some years ago Messrs. Charles Cobbley and John Bone of the Utah-Idaho Sugar Company, developed a single-seed planter for use with whole beet seed that offered considerable promise from a design standpoint. This machine was of the vertical plate type with the discharge of the feed mechanism very near the ground and was of such a design that the various parts could easily be machined to precise dimensions. It was decided that this unit embodied many desirable characteristics and would provide a good starting point in the development of the desired sheared seed planter.

In determining the size of cell necessary to discharge seeds singly it was necessary to start out with some given seed size. Inasmuch as the object was to plant seeds singly in a definite pattern the quality of the seed to be planted was of great importance. It was necessary for the seed to contain a minimum number of multiple-germ seedballs and still be very high in germination. It was determined that with the seed to be used during the 1944 season sheared seed larger than 9/64 inch contained a rather high percentage of multiple-germ seed segments while the seed segments smaller than 7/64 inch were of rather low germination. It was, therefore, decided that the proper portion of the seed to use was that sized between 7 - 9/64 inch. A gravity table separator was being used to classify the seed in order to build up germination. It was found that in the process of this gravity separation a considerable amount of scarification takes place which increases the flowability of the seed and makes it easier to handle in the planter.

Various sizes and shapes of seed cells were tried to give the desired results. A cell size and design was finally found that would give a high percentage of cell fill with a high percentage of single segments at seed wheel speeds from 20 to 50 r.p.m. It was found that 50 cells of this design could conveniently be placed in the 6-inch seed wheel so that the speed range of 20 to 50 r.p.m. would take care of a rather wide range of seeding rates and drill forward speeds. It was found that the type of knock-out mechanism employed has a considerable bearing upon the seed pattern obtained. With certain types tried rather erratic patterns resulted from seeds which were loose in the cell leaving the seed wheel at a position different from that where the seeds were tight in the cell and required being knocked out mechanically. A knife-type knock out was finally selected as being most satisfactory.

It was discovered that the various dimensions of the feed mechanism must be very accurately controlled in order to insure satisfactory performance of the equipment. It was determined that the depth of the cells should not vary more than 0.005 inch and that the clearance between the seed wheel and the seed case likewise should not vary more than 0.005 inch. Likewise it was found that the size of the seed must be controlled within equally

close limits. As the range of seed size is increased the efficiency of the feed mechanism is decreased. The percentage of cells carrying two seedballs becomes greater and mechanical injury to the seed becomes greater. After considerable experimental work it is felt, however, that a range of 7/64-inch to 9/64-inch seed is not excessive for practical purposes although better planter performance can be obtained with seed sized between 8/64 inch and 9/64 inch.

Following are typical distribution charts for various types of planters using various sizes of seed as indicated, comparing them with the performance of the improved Cobbley mechanism using seed sized between 7/64 inch and 9/64 inch.

It should be noted that with the conventional equipment, the seed distribution is such that at higher seeding rates good thinned stands can be obtained with normal emergence. As the seeding rate is lowered, however, the distribution becomes poorer. With conventional equipment the factor determining seeding rates which can be used is not the number of seedballs laid down, but the manner in which they are laid down. Cobbley plantings made at 3.9 pounds per acre would probably make a better after-thinning stand than conventional flute feed plantings at 6 pounds per acre where other conditions are equal.

With these single-germ seeds planted singly at low seeding rates the emergence of plants is not going to form the ribbon down the row that the grower is accustomed to seeding. With normal emergence he will have plenty of plants properly located to make a stand, however.