Metering Devices and Test Results of Some Foreign and Domestic Sugar Beet Planters[1]

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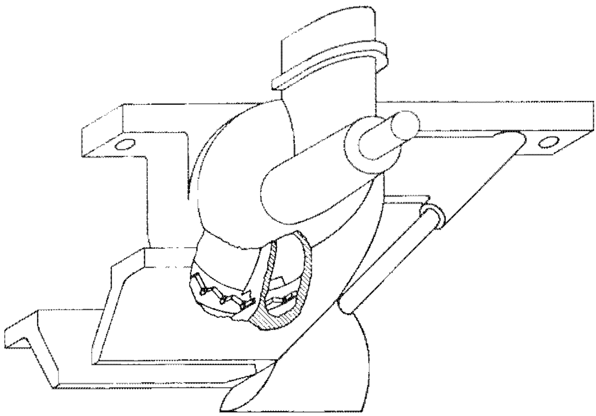
Precision planting of sugar beet seed is a goal that research men in this industry have had for a long time. If the seed could be made large, smooth, and dense, the problem of precision planting would be greatly reduced. This immediately suggests pelleting as the answer to all planting problems. Unfortunately, pelleting introduces new problems while it helps to solve the original problem of distribution. Since we are dealing with a seed that is not uniform in size, shape, or density, it is difficult to imagine a mechanical device flexible enough to plant non-uniform particles in a strictly uniform pattern.



TAXIGRAINE BEET PLANTER
(1951)

Figure 1.—Cut-away drawing of the Taxigraine planter showing part of the seed-metering plate and furrow opener.

Seed Damage and Distribution

The problems of precision planting have indicated that a search for new ideas might be in order. In addition to accurate spacing of seeds the damage to seeds from breaking and grinding must be kept to a minimum. In conventional planters there is damage done to the seed at the point of cut-off where the seed in the plate leaves the main body of seed in the hopper. To overcome this problem there seems to be two possibilities: (a) Make the seed plate fill with seed and pass out of the seed body in such a way that no cut-off is necessary, or (b) make the cut-off so flexible and gentle that seed will not be broken. In the first case the seed cells can be filled while traveling in an upward direction through the seed body, then through a confined passage to the point of discharge. The 1951 Taxigraine and Ventura planters

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use this type of metering device. The greatest trouble with this system is to get the cells to fill without skips or more than one seed per cell. Seed damage was practically zero with this system but distribution was poor especially in the Ventura planter.

In the second case some planters using rubber belts for metering devices have been tested with some interesting results. The English-made

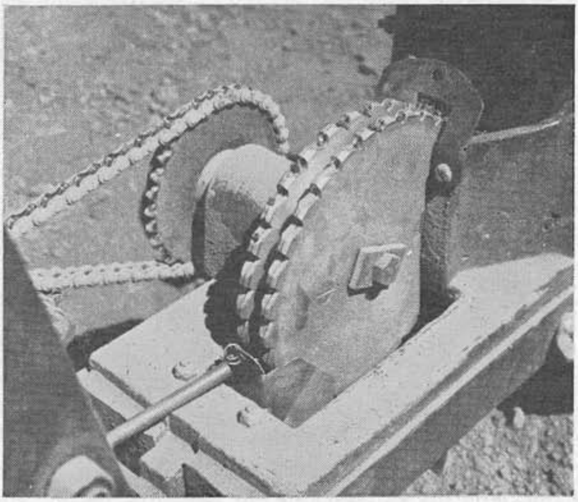

Figure 2.—Seed plates of the Ventura planter with the plastic cover removed to show the plates and cell arrangement.

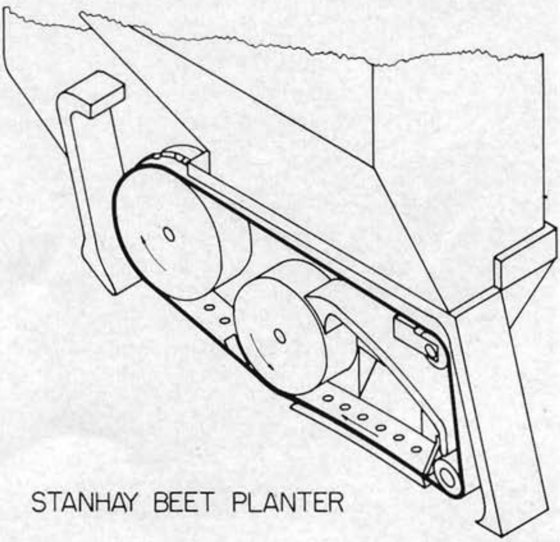

Figure 3.—A drawing of the Stanhay planter showing the method of seed metering with a flat rubber belt and rotating seed cut-off wheel.

Stanhay planter uses a very flexible rubber belt with seed cells that perforate the belt. A rubber-faced, cut-off wheel, which rotates in a direction opposite

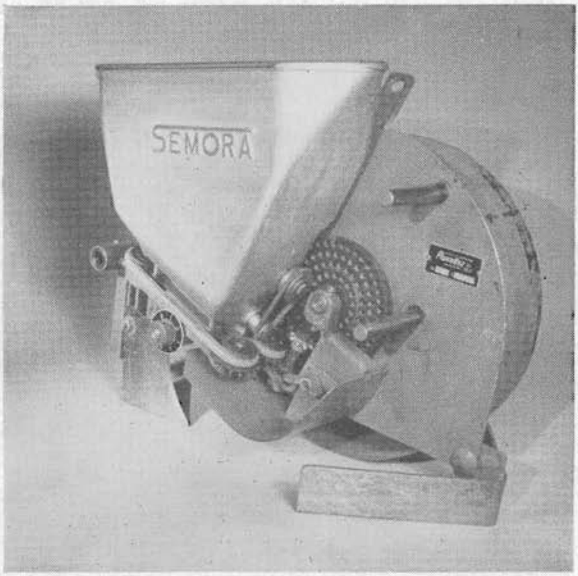

Figure 4.—General view of the Semora planter unit showing the drive for the seed belts and the agitator and the shoe-type furrow opener.

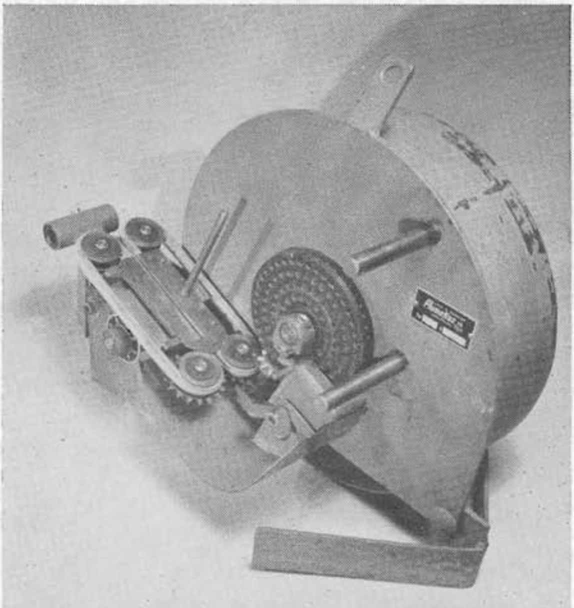

Figure 5.—View of the Semora seed belts with the seed hopper removed.

to the direction of belt travel, wipes off any excess seed from the seed belt. The Swiss-made Semora planter uses two soft rubber belts in another way to meter the seed. Seed is grasped between them after it has been lined in a single row by a slot in a thin metal plate. This machine does not have definite seed cells. The seeds are dropped off the end of the rubber belts in a continuous row. Spacing in the row is controlled by the speed of the belts in relation to the ground.

Both of these rubber-belt machines handle the seed very gently and cause no seed damage. Distribution from the Stanhay is very good while the Semora gives rather poor distribution since there is no positive mechanical ejection from the metering belts.

Laboratory Technique

A comparison of distribution results can best be made with numerical terms. A system of measurement was developed, based upon the following assumptions: (a) Half of the seeds dropped in a most crude manner, either by hand or machine, would fall in the desired place, regardless of seeding rate; (b) with the above assumption, planters which place only half of the seeds in their theoretically calculated position would have a rating of zero and would not be considered a precision machine. Planters which place all of the seeds in the proper position would have a rating of 100. A planter should be penalized for planting seeds too close together and for skips (seeds too far part).

The method of evaluation based on 100 seed intervals is as follows: For simplicity, a theoretical seeding rate was assumed. That rate was one seed per inch and 100 inches of row distribution. For seeds one inch apart a positive value of 1 was assigned. If a seed was ½ of a seed interval from the last seed counted (in this case ½ inch), it was still given a positive value of 1. If the distance was less than ½, a negative value of 1 was assigned. This penalized the planter for too many seeds and for bunching of the correct number of seeds. Further penalty was placed on the planter for long skips. For each space of more than 1½ seed intervals (1½ inches in this case), a negative value of 1 was assigned.

All the positive values and all the negative values were added and the difference was the score for that particular machine. The highest score possible was 100 and a poor planter would have a negative value which is too poor to be classed as a precision planter according to the original premise. Corrections must be made for different seeding rates. If the theoretical seed spacing is 2½ inches, for instance, the final score would be multiplied by 2½, etc., to keep the score comparable regardless of the seeding rate. A greased board was used to catch the seed as it came out of the planter shoe in the same relative position as the bottom of the seed furrow. A greased board proved satisfactory for this study since the seeds remained exactly where they fell.

The system described has been used in the laboratory with all our planters for the past two years. The system is a critical measure but has been satisfactory and is relatively easy to use.

Laboratory Results

From the distribution point of view, the Stanhay and Taxigraine planters rate at the top of the list. Changing the seed cut-off in the Milton planter to a spring-loaded type raised the score for this machine. The poor distribution from the Milton planter using a fixed cut-off appeared to be caused by a wedging of seed into the cells and the throwing effect of the knock-out as these seeds are forced out. The low score for the Semora planter probably is caused by the lack of a positive mechanical discharge at the end of the

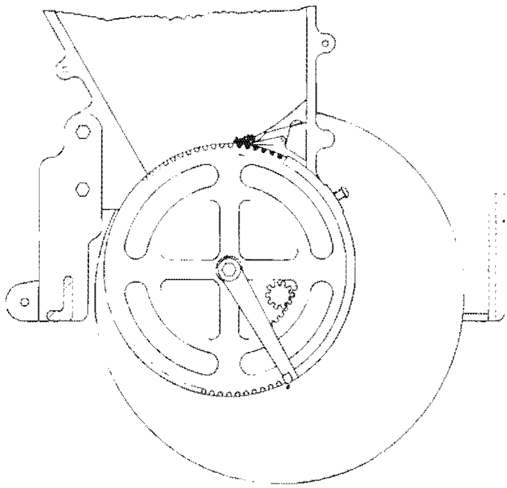

Figure 6.—Right hand disc removed from the Milton planter to show the seed plate and the position of the seed discharge.

rubber belts and also by the agitator which is used in the hopper. Changes made in the false bottom of the John Deere seed hopper raised the score for this machine materially but these changes required very careful hand fitting and adjustment which probably would not be possible from the manufacturer's standpoint. No score was made for the Ventura planter since bunching of the seed was so apparent that it was not considered worthwhile.

Cell-fill data, seed damage figures, and distribution scores are shown in Table 1. The measure of damage shown in the table was determined by the percent of seed, by weight, which passed through a 6/64-inch, round-hole screen. All of the original seed was passed over a 7/64-inch, round-hole screen. In some cases germination has been depressed 8 percent by passing through a planter. Some dust always rubs off the seed and if this amounts to less than one percent it may be assumed that no real harm has been done in passing through the metering device. Vertical plates arranged so no cut-off was necessary and a rubber belt, or belts, caused no measurable damage to the seed. Plate speeds and cell sizes were chosen to give an approximate average fill of one seed per cell.

Field Results

Field results are the final measure of the performance of any sugar beet planter. Most of the planters mentioned, with the exception of the Semora, have been used in the field more than one year. The Semora was

Table 1.—Laboratory Planter Performance.

Planter	Metering Equipment	Av. No. Seeds Per Cell	Percent Seed Damaged	Distribution Av. Score
Stanhay[1]	Rubber Belt 11/64" Diam. Cells	0.869	Nil	32.75
Stanhay[1]	Rubber Belt 3/16" Diam. Cells	1.07	Nil	54.89
Milton	Old Cut-Off, 240 Cells, Sixe 10-9-9	1.10	13.09	—42.53
Milton	New Cut-Off, 240 Cells, Size 10-9-9	1.04	10.52	16.63
Semora	Two Rubber Belts		Nil	—12.24
Taxigraine[2] (1951 Model)	36 Cell Vertical Plate	1.03	0.54	30.84
John Deere No. 64	11/64" Diam. Cells	0.994	2.97	9.51

[1] Maximum speed for satisfactory cell fill and distribution 2.5 MPH.
[2] Cell fill and distribution fairly uniform from 1.4 to 5.3 MPH.

Figure 7.—General view of some of the beet planters used in the 1955 field test. Left to right the planters are Ventura, Stanhay, Semora and Milton.

obtained from Switzerland and used for the first time in 1955. The modified John Deere was compared only in the 1955 test but John Deere planters with the same hoppers have been used for a number of years. Table 2 shows field results in 1954 and 1955. Care must be taken in comparing a given planter from one year to the other for two very good reasons. In 1954 commercial segmented seed was used and nearly ideal growing conditions prevailed. In 1955 monogerm seed was used and very poor germinating conditions existed. The field on which 1955 tests were conducted was irrigated four times but still it dried out and cracked too fast to permit good germination.

Table 2.—Field Planter Tests. Seed: 1954—Segmented 7 to 10/64 inch—Germination 91 Percent. 1955—Monogerm 7 to 10/64 inch—Germination 76 Percent.

	Percent Singles		Percent Doubles		Percent Multiples		Percent Emergence	
Planter	1954	1955	1954	1955	1954	1955	1954	1955
Taxigraine	47.1	74.7	32.8	21.5	20.1	3.8	70.5	58.7[1]
Stanhay	47.3	86.7	37.9	12.6	14.8	0.7	70.4	51.8
Milton	48.0	91.6	30.7	8.0	21.2	0.4	52.7	33.6
Ventura	45.8	75.0	30.9	22.1	23.2	2.9	64.3	36.8
John Deere No. 55 Modified		87.5		10.7		1.8		34.0
Semora		82.6		16.2		1.2		59.8

[1] 1955 Beets from the Taxigraine were larger than from any other planter.

Discussion of Results

A few results are notable. In 1955 the beet seedlings from the Taxigraine were larger and more vigorous in appearance than from any of the other planters. This was attributed to the type of shoe opener and presswheel used on this machine. The blunt opener used worked well in a good seed bed but may cause trouble when used under trashy seed bed conditions. The presswheel is rather narrow and heavy and runs directly over the seed. In 1955 there was a marked increase in percent singles and a decrease in double and multiple plants. This was caused largely by the use of monogerm seed and influenced to some extent by poor germinating conditions. In both 1954 and 1955 the Stanhay and Taxigraine planters were relatively high in percent emergence. For some unknown reason the percent emergence from the three foreign planters was appreciably higher than from the three domestic planters in 1955.

Future Plans

We have some new designs in mind which we hope to develop and test before monogerm seed comes into general use. Some of the different principles observed in the imported planters will serve as a guide in our thinking. For the most part the foreign-made planters are not as rugged as American-built machines. This might present a problem of maintenance if the foreign machines were used by our beet growers. The three foreign planters tested represent only a small sample of the many available from other lands and wider search may reveal more and better ideas.

The success of mechanical thinning depends to a large extent upon a uniform stand of vigorous seedlings. Uniformity of stand is more important than numbers of seedlings. The planter is largely responsible for the stand through accurate placement of seed and high emergence assuming that the seedbed is properly prepared. Anything we can do to improve the quality of seedling stands will be reflected in dollars saved at thinning time and higher profits at harvest time.