Single-Seed Planting of Sugar Beefs

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Experimental work with single seedball planting of sugar beets was begun in 1936. A report of the early work was made 4 years ago at the first general meeting of the American Society of Sugar-Beet Technologists, Further experiments were reported at the meeting of the Society 2 years ago at Denver. Commercial equipment, then becoming available, was also described at that meeting. Since then we have continued experimental work with this method of planting. Results show that material savings can be made in labor and other items in obtaining satisfactory thinned stands, particularly when the method is used in conjunction with the planting of the recenlly developed segmented or single seed as described in Mr. Bainer's paper at this meeting.

Advantages of Single-Seed Method

Pre-thinning stands obtained by the single-seed method, as compared to conventional planting, are more uniform, less thick, and contain more singles. Such stands are therefore better adapted to mechanical thinning, which is the primary object of single-seed planting. Incidentally the single-seed-planted beets also can be thinned by hand at **a** faster rate than can conventionally planted beets.

Comparative plantings with single-seed and conventional equipment were made again in 1940 and 1941, using whole, sack-run seed and whole seed sized by screening. The results for 1940 are summarized in table 1.

All plantings with each planter were averaged for that machine and the planters compared, using the germination stand-counts expressed in percentage of inches of row with beet seedlings and numbers of inch sections containing singles. As these two criteria of comparison are correlated with the seedling stand, they were summarized as the average stand for **all** planters, which was 62 seedlings per 100 inches. With comparable seedling stands, the planter which so distributes the seed that seedlings appear in the greatest percentage of inch sections and which produces the most singles does the best work. Differences required for significance are shown. The percentage of beet-containing inch sections that were singles is also shown for comparison later with the plantings of segmented or sheared seed. As shown in the table, the stands obtained with the single-seed machines were all significantly better than with the conventional planter.

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Table 1.—Planter germination stand-count (summary 1940).

Planter	Percentage of inch sections with beets	Singles per 100 inches	Percentage of beet-containing inch sections which were singles
Chain feed single seed	37.9	19.3	51.0
Single-seed plate planter with low hopper	35.0	16.4	40.9
Commercial single-seed plate planter	34.6	16.2	46.8
Conventional plate planter	31.5	14.0	44.5
Difference for significance	1.7	2.0	

Similar results obtained in 1941 with single-seed and conventional planters are shown in table 2. In this case only the percentage of beet-containing inch sections with singles and the percentage of single seedlings are shown.

These plantings were both put in at the rate of 10 to 12 pounds of seed per acre. On conventional plantings at 18 to 20 pounds of seed per acre the percentage of beet inches which contain singles is only about 35 or less. When the seeding rate is reduced to 10 or 12 pounds per acre, the percentage increases to 40 or 45, but the uniformity of seedling distribution is significantly poorer. The chances of having a singles seedling where it is desired for the thinned stand is therefore considerably better with single-seed planting.

Table 2.—Planter germination stand-count (summary 1941).

Planter	Seed size (64ths of inch)	Percentage of beet-containing inch sections with singles	Percentage of single seedlings
54-cell plate single seed	9-13	53.1	32.4
Chain single seed	Sack-run	48.8	30.1
50-cell plate single seed	Sack-run	46.0	29.3
16-cell plate conventional planter	Sack-run	42.8	25.3

Seeding rates with the single-seed planters range from around 7 to 12 pounds per acre. There has been some apprehension about using these lower-seeding rates. In order to learn, if possible, what might be a limit below which it was not desirable to go, plots with low-seeding rates were planted during the past 2 seasons. Table 3 gives the summarized results of the 1941 plots.

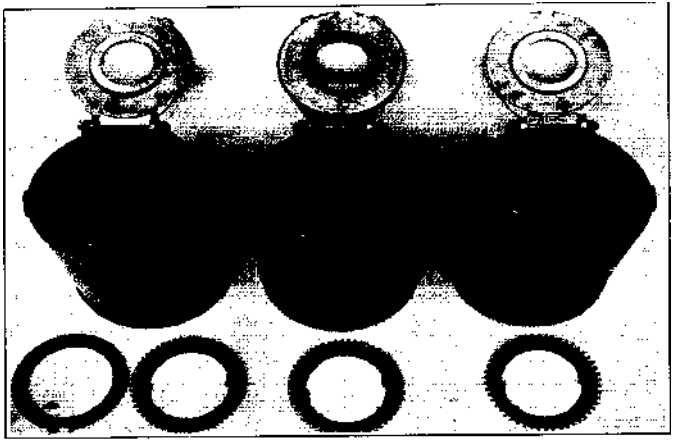

Figure 1.—Single-seed plate planting equipment: T.eft, 54-celI. 5/32-inch plate and center G-l-cell. 7/32-inoh plate, both for small-sized, screened whole seed; right, GO-cell, 7/32-inch plate for sack-run or large-sized, screened seed.

Figure 2.—Germination stand of sugar beets planted with a single-seed planter.

Table 3.—Stands with low-seeding rates (summary 1941).

Seeding rate (lb. per acre)	Seedlings per 100 inches	Percentage inch sections with beets	Singles per 100 inches	Percentage of beet-containing inch sections with singles	Thinned stand beets per 100 feet
3.3	21.9	15.1	9.3	61.8	122.4
4.4	29.0	19.3	11.4	58.8	131.0
6.3	33.4	24.0	14.9	62.6	145.4
7.5	42.6	28.2	16.5	59.0	143.8
9.1	48.5	30.7	16.6	52.5	106.5
11.1	61.2	37.0	19.4	53.1	114.1

The plots were hand thinned in the usual manner and laborers were instructed to save the best stand possible up to 120 or more beets per 100 feet on the plots with the 4 lowest-seeding rates. The plots with the 2 heavier-seeding rates were in adjacent sets where the laborers were instructed to thin to a stand of about 110 beets per 100 feet. Thinned stands on the similar 1940 plots were lighter as a stand of 100 or 110 beets per 100 feet was attempted. Seeding rates of more than 5 pounds per acre were necessary to produce a 100-beet stand.

Two sets of single-seed-planted plots were also planted in 1941 using the recently developed segmented or sheared seed. Special seed plates were made up last spring to be used in a regular-plate planter with this seed. These plates were 3/32 inch thick and had 55 cells consisting of 3/16-inch holes which were taper-reamed on the bottom side of the plate to allow the seed segments to drop out more freely. Special notched knocker wheels were shaped to drop into the plate cells and dislodge the seeds by positive action. Spacers were made to use with these thin seed plates, but since then special hinged seed-hopper bottoms have been made by the manufacturer to accommodate these plates.

One planting was made at Davis, California, using treated and untreated segmented seed with these special plates used in a planter provided with a special drive to increase the seeding rate. A plate speed was used which gave a forward travel of 1.45 inches per seed cell and this gave a seeding rate from 4.55 to 4.75 pounds per acre.

A portion of the segmented seed was pelleted in soil, the pellets averaging about 0.3 inch in diameter. These pellets were planted with the experimental chain-feed, single-seed planter. About 50 to 60 pounds of pelleted seed per acre were used to get a 1.5-inch spacing of pellets in the row. A comparative planting with small-sized, whole seed was also included in these plots.

The germination-stand-count data for this planting is shown in table 4. The results show that the percentages of beet-containing

inch sections with singles and of single seedlings are much higher with the segmented seed than with the whole-screened seed. Comparison with the percentages of singles in the germination-stand-count data in table 2 shows that the percentage of singles is even lower with the sack-run seed than with the small-screened seed. The percentages of singles with the pelleted seed are lower than with the unpelleted sheared seed, indicating the inclusion of more than one segment in some of the pellets. This seed germinated well under the moist conditions in the field, but germinated very poorly in flats in the greenhouse. All considerations would seem to eliminate the pelleted seed.

Table 4.—Sheared seed ball germination stand-counts.

Planter, seed, and equipment	Seeding rate lb. per acre	Seedlings per 100 inches	Inch sections per 100 inches containing beets	Singles per 100 inches	Percentage of beet-containing inch sections with singles	Percentage of single seedlings
Plate planter, 55-cell plate and sheared seed						
Untreated seed	4.55	18.0	15.0	12.7	84.0	70.4
Treated seed	4.77	23.0	18.8	15.4	82.0	08.1
Increase from treating		27.8%	25.3%	21.3%		
Chain-feed, single-seed planter, pelleted seed						
Unlreated seed	50-60	30.1	21.0	13.7	65.2	46.2
Treated seed	50-00	33.9	25.1	17.8	70.7	53.1
1ncrease from treating		12.6%	19.5%	30.0%		
Plate planter, 54-celI 7/32-inch plate, 9-1". screened seed						
Untreated seed	0.13	37.3	25.3	14.4	58.2	40.9
Treated seed	9.13	48.5	30.7	16.6	52.5	33.5
Increase from treating		30.0%	21.4%	15.3%		

These field plantings with the sheared seed were later thinned with a long-handled hoe only. It was found possible to secure very satisfactory after-thinning stands with a comparatively high percentage of singles in this manner. After-thinning stand-counts are shown in table 5.

Table 5.—After-thinning standi sheared-seed plantings thinned with long-handled hoe only.

	Beets per 100 feet	Singles per 100 feet	Percentage of beets as singles
Sheared-untreated	120.7	75.7	62.7
Sheared-treated	138.5	85.5	64.0
Pelleted-untreated	133.3	76.8	57.5
Pelleted-treated	186.2	87.0	

Another planting was made this spring (1941) near Dixon, California, using segmented seed and the special plates in the farmer's own planter. The maximum seeding rate obtainable with the 55-cell plates in that planter was 31/4 pounds per acre, A planting was also put in with the segmented seed using a commercial, 54-cell, 5/32-inch thick single-seed plate at the 31/4pound seeding rate and at a 5-pound rate. The results of this planting are given in table 6.

Table 6.—Sheared seed germination stand-eounts.

Planter equipment	Seeding rate lb. per acre	Seedlings per 100 inches	Inch sections per 100 inches containing beets	Singles per 100 inches	Percentage of beet-containing inch sections with singles	Percentage of single seedlings
55-cell, 3/32-inch plate	3¼	19.7	16.4	13.9	84.6	70.6
54-cell, 5/32-inch plate	3¼	30.0	23.9	18.7	78.0	62.2
54-cell, 5/32-inch plate	5	48.4	34.4	23.3	67.3	48.0

The percentages of singles in the Dixon planting are lower with the 54-cell plate than with the 55-cell, thinner plate. However, these figures are misleading for there is a negative correlation between the seedling stand and the percentage of singles. If the curve for the two sets of data with the 54-cell plate are extrapolated to the 20 seedling per 100-inch point, the percentages of singles are practically the same as with the 55-cell plate. This would indicate that the commercially available 54-cell, 5/32-inch single-seed plate may be just as satisfactory for the segmented seed as some new special plate.

It is also interesting to note that the 31/4-pound per acre seeding rate with the 54-cell plate produced approximately half again as many seedlings as a comparable seeding rate with the thinner 55-cell plate. Part of this difference may be due to errors in calibration of the plate, but the difference led to some further tests recently of the plates in the laboratory in connection with a series of tests being run to determine the most desirable type of seed plate for use with segmented seed.

Type of Seed Plate to Use

It was apparent that the 55-cell, 3/32-inch plate was doing more damage to the seed which went through it than did the 54-cell, 5/32-inch plate. The former plate was breaking 12.3 percent of the seed into portions that would pass through a 3/32-inch round-hole screen while the 54-cell plate was breaking 7.4 percent of the seed. Germination tests brought out this damage to the seed even more strikingly as they showed an average of 69.75 sprouts from 1-gram sam-

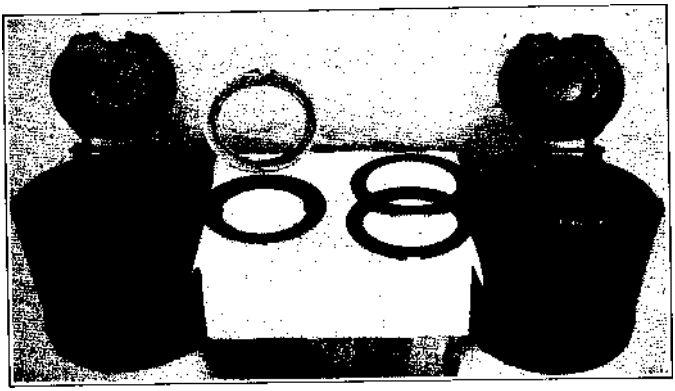

Figure 3.—Fifty-five roll 3/32-inch seed plates developed for use with segmented sugar-beet seed. Plate the left used wifh false ring and experimental, spring-pressuri!. hinged-hopper ttoni. Plate a+- the right used with false ring and shim spacer.

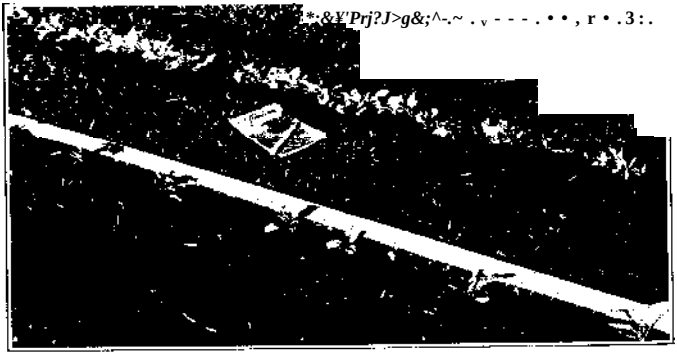

Figure 4.—Sugar beets planted with 55-cell plate and segmented seed at 3 pounds per acre. Background rows planted with 50-cell single-seed plates and 15 pounds per acre of sack-run seed.

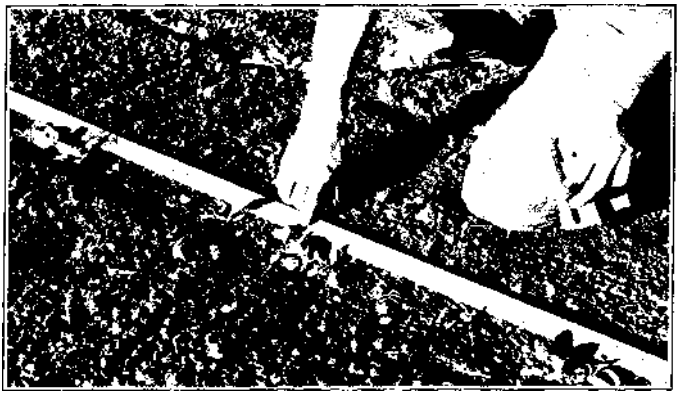

Figure o.—Sugar beets planted -with 54-cell, 5/32-inch single-seed plate and segmented seed at 5 pounds per acre.

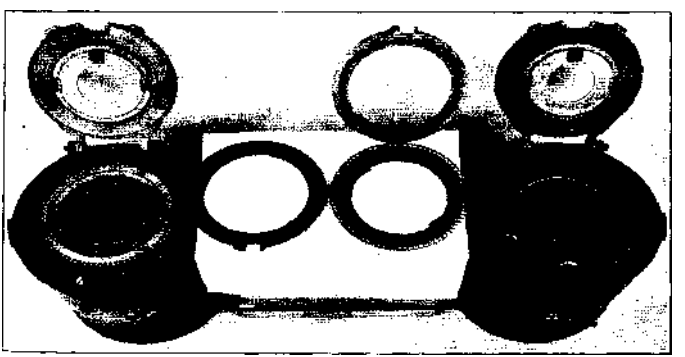

Figure <>.—Eighty-col], 3/16-inch hole, %-inch thick seed plates developed for use with segmented, sugar-beet seed. Plates are used with special seed cut-offs, knocker wheels, false rings, and spring-pressure hinged hopper bottoms.

pies of seed run through the 55-cell plate compared with 81.75 sprouts (or 17.2 percent more sprouts) from 1-gram samples run through the 54-cell plate.

The series of laboratory tests now being made to determine the most desirable plate for use with this segmented or sheared seed, which is sized between 8/64-inch and 11/64-inch round-hole screens, indicate that the plate thickness should be between 7/64 and 1/8 inch in order to provide adequate cell filling, to avoid excessive numbers of doubles, and to minimize the seed damage. These tests have not been completed and germination tests are still being run on seed samples from plates of intermediate thicknesses. The largest number of cells practicable should be used to obtain desired seeding rates with the lowest possible plate speeds. This seems to be about 80 cells and a 3/16-inch diameter hole reamed up from the bottom with a 10- to 12-degree included-angle reamer to give the desired cell size and and shape. This 80-eell, 3/16-inch hole, 1/8g-inch plate will give a seeding rate with present commercial planters and plate speeds ranging both above and below 6 or 7 pounds per acre. So far this seems to be about the seeding rate desired for the segmented seed under average germination conditions. Under ideal germination conditions in the Imperial Valley, California, a somewhat smaller seeding rate seems more desirable. Further experimental work may change this desired seeding rate.

So far no laboratory tests have been run on side-notched plates in comparison with drilled-hole plates for this seed except for tests run on the 54-cell commercial single-seed plate. The cells in this plate are somewhat too large as they pick up an average of 2.66 segments per cell. However, it seems probable that the side-notched plates, particularly those running on recessed false plates with machined surfaces, will be eqtially as satisfactory as the drilled-hole plates.