A Plot Seeder for Sugarbeet Field Experiments

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A seeder adapted to sowing sugarbeet nurseries and variety trials has been constructed at the U.S. Agricultural Research Station, Salinas, California. The seeder incorporates simple adjustments for different bed or row spacings and a wide choice of plot lengths. Prior to the adoption of this seeder, nurseries were usually sown by hand-dropping the seed. Variety trials were either sown by filling and emptying seed boxes or by utilizing special metering devices (2)[2]. These methods are either very time-consuming or provide an excessive seeding rate with irregular distribution. Seeders utilizing the cone-feed principle have been described by Berg (1) and Poehlman (3). The seeder constructed by us includes special features for sugarbeet seed and for sowing on beds.

Construction of plot seeder

Cone-feed units manufactured by the Seedrite Equipment Company, Bozeman, Montana, were attached by means of special brackets to standard International Harvester Company (I.H.C.) McCormick 185 seeders (Figure 1, A and B).[3] During the sowing operation, seed is directed into the plastic drop tubes of the seeders by funnels attached to the seed spout of the cone housings (Figure 1, A and B). The funnels fit about a ½ inch deep into the drop tubes.

Modification of the I.H.C. 185 seeder drive shaft and feed shaft sprocket assemblies permits sowing plots up to 86 feet long for each revolution of the cone. Examples of plot lengths, which can be sown with different combinations of drive shaft and feed shaft sprockets, have been determined and are illustrated in Figure 4. Easily-installed shaft extensions permit mounting the sprocket combinations required to seed a given plot-row length (Figures 1, A and 3). The hub of each sprocket is machined with the same size slotted hole as that of original equipment. The slotted sprockets fit snuggly on the machined shaft extensions and are held in place with 9/16" cap screws (Figure 3). Standard number 41 link chain and sprockets were used in place of original equipment.

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[2] Numbers in parentheses refer to literature cited.

[3] Mention of a trademark or proprietary product does not constitute a guarantee or warranty of the product by the U.S. Department of Agriculture, and does not imply its approval to the exclusion of other products that may also be suitable.

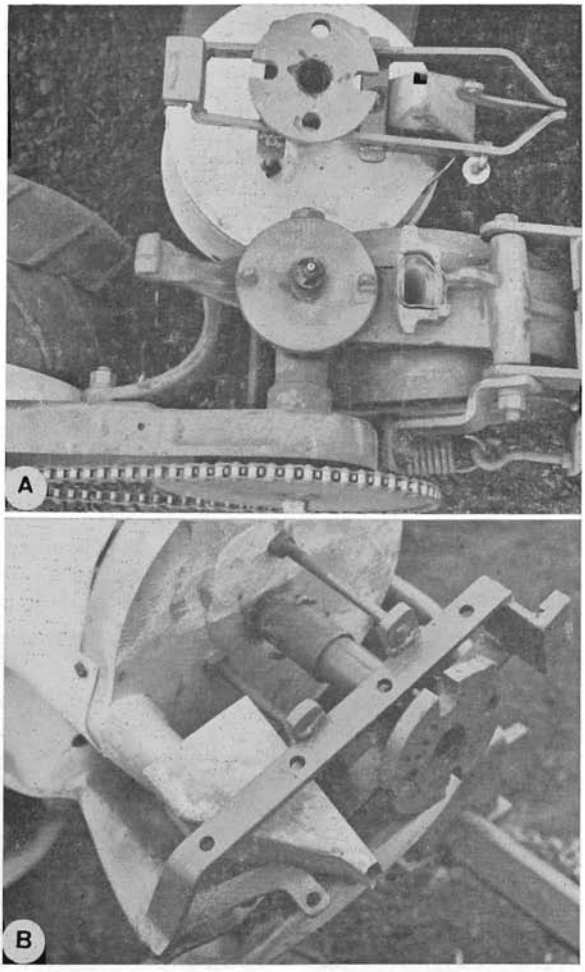

Figure 1.—A) Plot-seeder assembly composed of standard I.H.C. unit (bottom) and cone-feed unit (top). B) Specially constructed bracket, slotted pipe flange, and seed-drop funnel for attaching cone-feed unit to I.H.C. seeder.

When desired, the seeder units can be readily restored to original equipment by replacing the cone-feed units with the standard seed boxes and replacing the original sprockets and link chain.

The fully-assembled plot seeder is shown in Figure 3. Toolbar clamps were used exclusively in assembling the frame to provide convenient adjustments for sowing at different row spacings. The frame consists of three 2-inch square tube toolbars and three steel bar frame supports positioned lengthwise. Seeder units

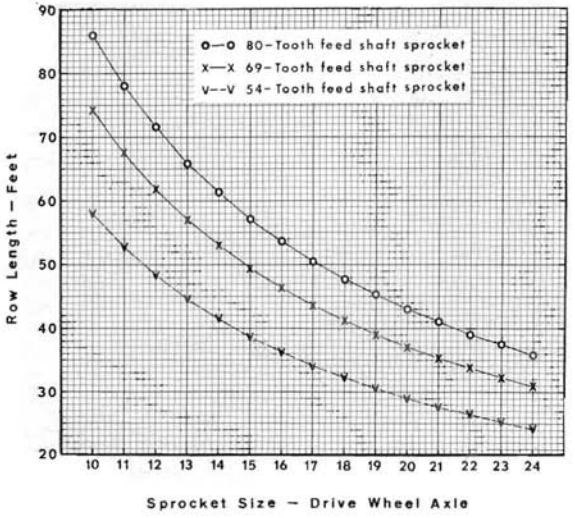

Figure 4.—Sprocket sizes needed to attain desired plot-row lengths. (Sprocket size refers to number of teeth per sprocket).

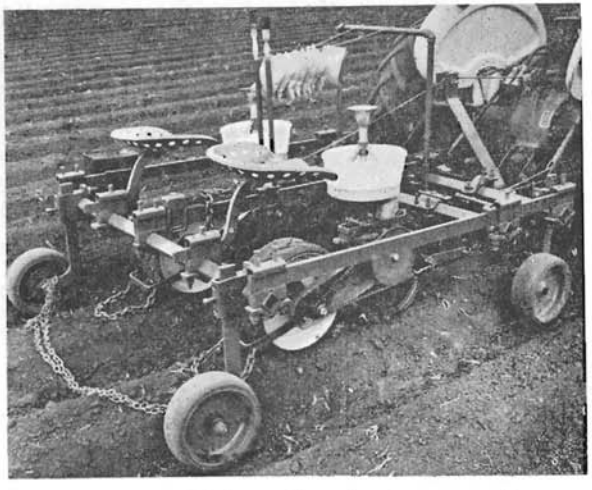

Figure 3.—Fully assembled seeder showing attendant seating, seed envelopes arranged on wire rods, and sprocket arrangement for sowing a 53-foot plot.

are attached to the middle toolbar. An A-frame is clamped to the front toolbar and permits attachment of the seeder to a tractor equipped with a three-point hitch. The seeder is raised and lowered by the tractor hydraulic system. A cable attached to the tractor and at the rear of the frame holds the plot seeder

horizontal during raising and lowering. Gauge wheels provide adjustment for variations in bed height and, in conjunction with depth bands on the disc furrow openers, increases precision of sowing depth. The seeder assembly incorporates only two cone-feed units but is readily adaptable to four or more units by installing longer toolbars and strengthening the frame.

Seeding operation

Seeder design provides for two attendants during sowing (Figure 3). Each attendant operates a seeder unit on single-row beds or two units on double-row beds. The pipe frame and pipe stubs shown in Figure 3 provide support for the heavy wire rods which carry the seed envelopes needed to sow a row of plots. Seed envelopes are strung on the wire rods in the laboratory in the proper sequence for sowing.

Seed placed in a funnel resting in a guide over the cone apex is distributed on the cone seed plate by lifting the funnel (Figure 2, A). A gate of rigid fiber material positioned across the seed plate diverts seed into the drop tube as the cone makes a full rotation (Figure 2, A and B). After sowing a plot, any seed remaining on the seed plates or cone housing rims is removed by sweeping with a small brush.

Use of this cone-seeder arrangement requires at least a 3-foot alleyway between blocks because of a long seed drop of about 20 inches. The seeder should be stopped so that the disc openers must travel at least 2 feet in the alleyway before entering the next plot to avoid a gap at the beginning of the plot. The effect of wind on the distribution of seed around a seed plate is minimized by a 6-inch high rim fastened to the cone housing (Figures 2 and 3). Tapered flexible plastic baskets of the proper diameter were used to construct the rim extensions.

When desired, the original I.H.C. 185 seed boxes can be used for spaced seeding without changing to the original sprockets and chain. For example, an 11-tooth drive sprocket and 54-tooth feed shaft sprocket used in combination with an 82-cell seed plate will space seed at 4-5 inches. Reducing the size of the feed shaft sprocket reduces the seed spacing.

Modifying seed-plate width

The high cost of hand singling makes it imperative that we use minimum seeding rates in sugarbeet field experiments. Commercial seeders such as the I.H.C. 185 will accurately space sugarbeet seed, but they have no provision for positive clean-out of residual seed between plots. Limited control of the seeding rate is possible with the standard Berg cone-feed units by varying the amount of seed placed on the seed plate, but the distribution must be dense enough to insure a continuous flow into the drop

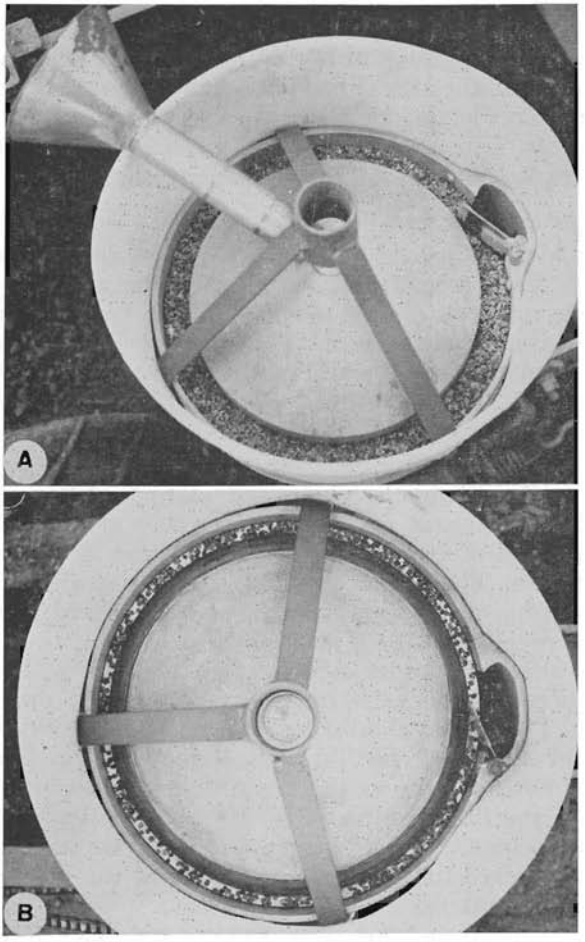

Figure 2.—A) Cone-feed unit, center guide, and funnel for distributing seed on standard-width seed plate. B) Cone-feed unit with plywood ring insert for reducing width of seed plate to 5/16 inch.

tube (Figure 2, A and B). When small quantities of seed are distributed on the plate, the seed tends to slide and to drop in groups. This results in clumps of seedlings with skips between clumps. This problem can be greatly reduced by narrowing the seed plate to approximately 5/16 inch. A close-fitting plywood ring is installed over the edge of the cone (Figure 2, B). The ring has approximately the same slope as the cone and extends to the seed plate. The gate across the seed plate was shortened about ½ inch (Figure 2, B). Seed distribution obtained with 4 grams of monogerm seed is shown in Figure 2, B. The narrower seed plate also minimizes wind effects associated with the thin seed distribution.

A replicated test was sown in November 1970 to determine the effectiveness of the modified seeder at various seeding rates (Table 1). Even though conditions for emergence were relatively poor, adequate stands were obtained with all but the 4-gram rate per 53-foot plot. An excess number of gaps 12 inches or more in length occurred with this seeding rate. The largest gap observed was 27 inches. As seeding rates increased, the number of seedlings in clumps also increased. The results of this test indicated that adequate stands could be expected when monogerm seed with good germination was sown with seeder units equipped with the narrower seed plates at a rate of 8-10 grams per 100 feet of row (7-9 seeds per foot). Some hand singling would still be required, but this could be done with a long-handled hoe.

Table 1.—Evaluation of stand for five seeding rates obtained with cone-feed seeders equipped with narrow seed plates.

Seeding rate[1]			Emergence/foot		Single seedlings[3]	Gaps > 12 in. per 100 ft. row
53 ft. plot Grams	Acre Pounds	Seeds/ft. No.	Observed[2] No.	Expected No.	%	No.
4	3.2	6.4	4.7 a	4.3	71	9.0
6	4.7	9.9	7.4 b	6.9	53	5.0
8	6.2	13.6	8.6 b	9.6	55	0.5
10	7.5	16.2	11.0 c	11.7	52	2.0
12	9.3	19.6	12.4 c	14.5	45	0.5

[1] The test was sown with unprocessed monogerm US H9 seed which germinated 74%. The seedlot averaged 87 seedballs/gram.
[2] Means of four replications. Means with same letter are not significantly different.
[3] Seedlings spaced more than ½ inch apart classed as single plants.

Summary

Cone-feed units were attached to commercial seeders and equipped with sprocket combinations to permit the sowing of various size plots up to 86 feet long. Seeder frame construction provided seating for attendants and permitted simple adjustment for different bed or row spacings.

The cone-feed units were adapted to low seeding rates by installing plywood rings which reduced the seed plate width from 15/16 to 5/16 inch. Adequate stands were obtained at seeding rates of 8-10 grams per 100 feet of row. When the narrower seed plate was used, hand singling requirements were greatly reduced.

Literature Cited

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