New Planters for Experimental Sugarbeet Plots

A precision planter for experimental sugarbeet plots

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[2]In 1971, a John Deere Model 33 Vegetable Planter was modified at the Plant Industry Station, Beltsville, Maryland for use in planting experimental sugarbeet plots. In 1972, the same type planter was modified at Fargo, North Dakota with the addition of several features not found on the Beltsville planter. The planter developed at Beltsville is described first, then the improved Fargo model.

Experimental sugarbeet plots are usually planted with high seed rates necessitating a laborious blocking and singling operation. Skoyen and McFarlane (1)[3] constructed a cone planter for experimental plots which reduced the amount of seed needed for planting and the labor required for thinning and singling. A precision planter allows the operator to select the hill spacing. Only occasionally are skips in the row caused by the failure of all cells to fill. Our goal was the avoidance of any hand labor in plots planted with monogerm sugarbeet seed except for hoeing of the alleyways between plots.

Adaptation of planter for experimental plots

To adapt this type of planter to experimental plots, a device was required to insure a good cell fill with small quantities of seed, and another device was needed for rapid and thorough clean-out at the end of a plot.

On the John Deere Model 33 planter, the seed plate and hopper are tilted at a 45° angle. When two or more seeds lodge in a cell at the bottom of the hopper, all except one fall off (with rare exceptions) as the cell moves toward the apex of its trajectory around the seed hopper. To solve the problem of handling a small quantity of seed, a metal insert was built originally to fit inside the seed hopper. This was discarded in 1972 for a better solution to this problem which was conceived quite independently and at about the same time at both

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[2]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.

[3]Numbers in parentheses refer to literature cited.

Beltsville, Maryland and Fargo, North Dakota. The valley of the planter plate was filled in with plastic automobile body filler at Beltsville (epoxy at Fargo) (Fig. 2 of Bugbee and Pazdernik's paper) so that small seed quantities would ride out next to the cells and drop into them. In addition, at Beltsville a piece of spring metal was attached to the seed hopper so that it would ride on top of the planter plate next to the cells about halfway between the lowermost point of the seed hopper and the drop tube (Fig. 1). The purpose of this metal tine is to cause the excess seeds to fall to the lowermost point of the seed hopper sooner than they otherwise would, thereby assuring a better cell fill at the end of the plot. An aluminum bar filled the space above the ledge inside the seed hopper.

Figure 1.—Metal tine installed in seed hopper to deflect excess seeds to bottom of hopper.

The installation of a one-way overriding clutch was required on the sprocket end of the seed hopper to permit rapid clean-out of excess seeds at the end of a plot. A faucet handle was installed on the other end of the seed hopper drive shaft for manual turning (Figure 2). The overriding clutch was a Bendix starter drive (part number 480110)[2].

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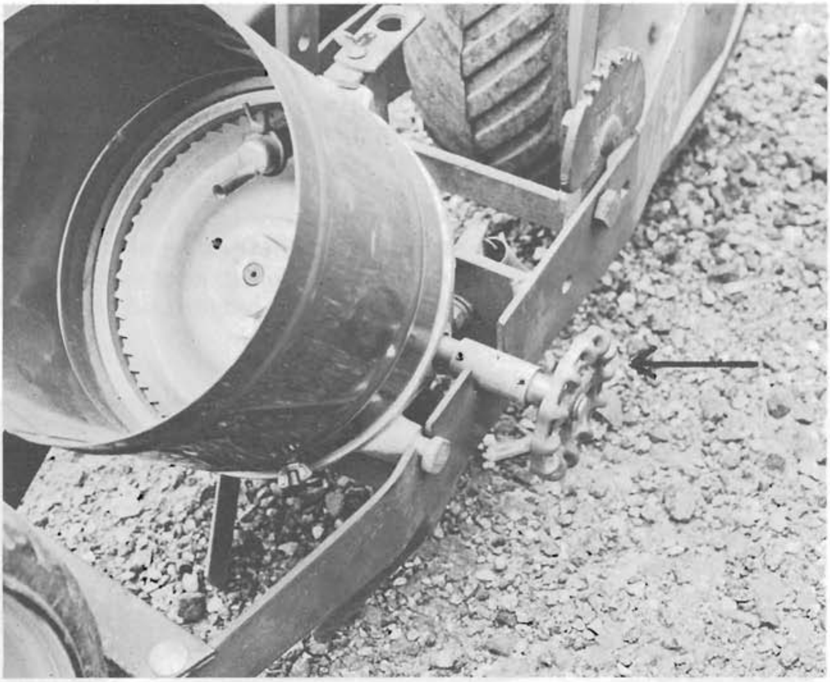

Figure 2.—Steam valve handle installed on right end of seed hopper shaft for manually turning seed plate.

The keeper, spring, and washers were all removed, along with the bushing from inside the small end. The end of the seed hopper drive shaft was turned on a lathe to make it fit inside the smaller end of the starter drive. The proximal end of the sprocket holder was also turned to fit inside the larger end of the starter drive. Holes were drilled through both ends of the starter drive, the end of the seed hopper shaft and the proximal end of the sprocket holder. Hollow split pins inserted through these holes fastened these pieces together. The installation of the clutch moved the hopper shaft sprocket outward about 1¼ inches. Spacers were required for the chain tightener and the chain guard, and an insert was required for the drive wheel sprocket holder in order to bring them in line with the seed hopper sprocket (Figure 3). A piece of galvanized pipe, fitted over the opposite end of the seed hopper shaft, extended it to a point outside the planter frame. A steam faucet handle was then attached to the outer end of the pipe.

Seeding operation

Accurate seed sizing is necessary to insure the occurrence of one and only one seed per planter plate cell. Large polished seeds were

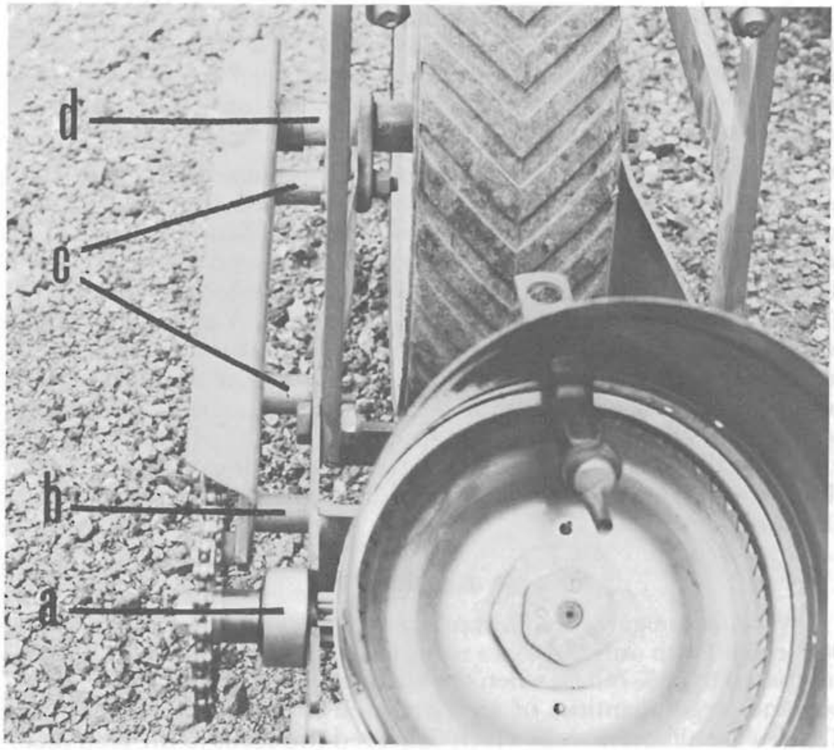

Figure 3.—One-way overriding clutch installed on John Deere Model 33 vegetable planter unit. a - Bendix starter drive; b - spacer for chain tightener; c - spacers for chain guard; d - machined spacer for drive wheel sprocket.

screened through round hole screens to obtain seeds from 10/64 to 11/64 of an inch in diameter. Smaller seeds were screened to obtain seed from 8/64 to 8½/64 of an inch in diameter. Only seed of a single size was used in an experiment. Experiments were arranged in the nursery so that a minimum number of seed plate changes was necessary. Four planter units were placed on a rear-mounted bar of the tractor. One attendant operated each of these units.

Single row plots 20 ft long were planted in our nursery. A packet of seed was prepared for each 20 ft plot. Each seed packet contained ten seeds more than the planter plate delivered while the planter was traveling the length of the plot. These excess seeds were "spun out" of the seed hopper at the end of the plot. Plots up to 40 or 50 ft long can be planted with these attachments, but an excess of ten seeds per packet is needed to insure proper cell fill at the distal end of the plot.

Seed spacing is regulated by the size and combination of sprockets used. With a 54-cell plate, seeds may be spaced from 1.85 to 4.50 inches. With a 36 cell plate, seeds may be spaced from 2.75 to 6.8 inches. We spaced our larger sized seed 6.2 inches and our smaller seed 4.1 inches. This was a planting rate of approximately 2 lbs per acre.

At the beginning of the plot the attendant poured the seeds from his packet into the seed hopper. He then turned the hopper shaft manually with the faucet handle until the first filled cell of the seed plate reached the top of the hopper (i.e., the first seed was ready to fall down the seed tube). The tractor was driven the length of the plot. Excess seeds were spun out of the box manually. A pointed pot label was useful in assisting the last two or three seeds into the cells of the plate. When all seeds were spun out, seed from the next packet was poured into the seed hopper, and the procedure repeated. No space was skipped between plots, since "spun-out clumps" of seedlings were located in the alleys between plots. After the seedlings emerged, these clumps were removed along with additional hills to create 16-inch alleyways.

Results

When monogerm seed was properly sized, we obtained from 90 to 96% cell fill with only ten extra seeds in the seed hopper. This may be compared to 98% cell fill when the attachments are removed from the box and large quantities of seed are used for continuous plantings. There were almost no cells which delivered two seeds to the seed tube. When properly sized mulitgerm seeds were used, cell fill was only about 85% as compared to 96% cell fill when the attachments are removed for continuous plantings. The final stands of beets were satisfactory both years this planter was used. The application of preemergence and postemergence herbicides in conjunction with this seeding method resulted in the best weed control ever experienced in our nursery plots. No hoeing or cultivation was necessary before "lay-by" this year, the second year of its use. Weed control last year was somewhat less successful but still good. Two new factors contributed to the success of the herbicides: (1) quicker coverage of the soil surface by the closer spaced sugarbeet plants; and (2) leaving the soil surface undisturbed, thereby not moving viable weed seeds upward from lower levels to a zone where they could germinate.

An experiment was not set up in 1971 to determine the effect of close seed spacing on yield. Record yields in 1971 were probably attributable to extremely favorable climatic conditions.

Summary

A John Deere Model 33 Vegetable Planter was modified for precision planting of experimental nursery plots. An attachment was constructed for the inside of the seed hopper permitting the seed plate to

fill properly with small quantities of seed. A one-way overriding clutch was inserted in the seed hopper shaft of each planter unit so that each shaft could be turned manually for clean-out at the end of the plots.

Plantings to final hill spacings were made. Seed in most experiments were spaced 4.1 inches apart, but they were spaced 6.2 inches apart in a few experiments. Stands were singled to one plant per hill by hand pulling excess plants. Less than 5% of the hills in monogerm plantings contained extra seedlings. Weed control was good in 1971 and excellent in 1972. The effect of close plant spacing on yield was not determined.

Acknowledgement

The author acknowledges the efforts of Mr. Thomas P. Collins, Agricultural Research Service, U.S. Department of Agriculture, Beltsville, Maryland, who designed and machined parts and assembled the seed hoppers for this modified planter.

Literature Cited

(1) SKOYEN, I.O. and J. S. MCFARLANE. 1971. A plot seeder for sugarbeet field experiments. J. Am. Soc. Sugar Beet Technol. 16(5): 422-427.

A precision planter for sugar beet plots[1]

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Commercial sugar beet planters capable of precision placement of monogerm seed are used to produce a stand that can easily be thinned manually or mechanically. Planting to a stand is possible in the absence of soil crusting, excessive wind, and seedling disease. This report describes the modification of a commercial precision planter for use in experimental plots.

[1]Cooperative investigations of ARS and the North Dakota Agricultural Experiment Station. Approved by the Director, North Dakota Agricultural Experiment Station as Journal Series Article 527.

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.

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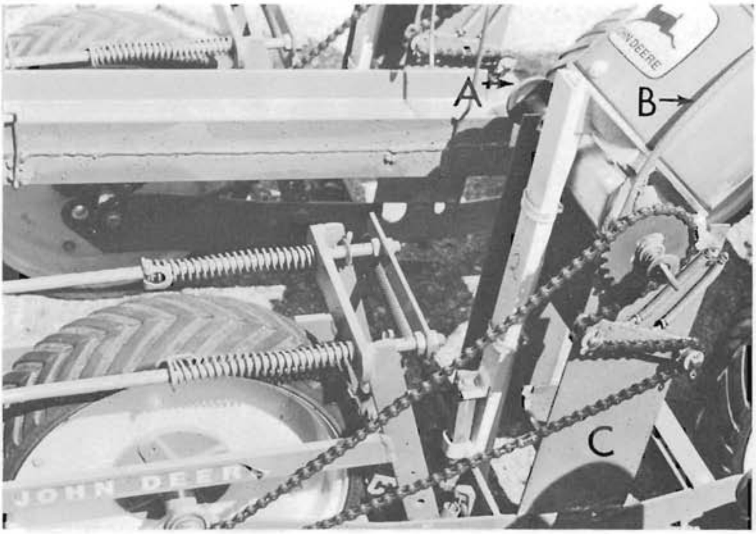
A John Deere Model 33 vegetable planter was selected, because its inclined seed box could be altered to permit removal of excess seed at the end of each plot. The seed box was raised about 14 inches (36 cm) by mounting it on a ⅛-inch (3-mm) steel plate 5 ¼ inches (13.3 cm) wide (Fig. 1, C, top). The seed-drop tube was lengthened and supported by 1.5-inch (38-mm) channel iron and aligned with the seed-drop port of the hopper. The hopper could then be tipped to empty excess seed (Fig. 1, bottom). The driven sprocket, which had a slotted hole, was mounted on the hopper axle with a spring-loaded thumb screw. The driven sprocket could be disengaged from the hopper axle and the seed plate turned by rotating a handle mounted on the axle opposite the sprocket end (Fig. 2, top). This allowed the positioning of seed over the drop tube when a new plot began.

Seed plates were modified. Cell fill was poor when small quantities (30-60) of seed were used in stock plates, because the seed rode in the valley of the plate. This valley was filled with epoxy up to the cells (Fig. 2, bottom), so that even small quantities of seed would ride directly over the cells. Groups of three cells also were filled with epoxy to give 18 open cells. This plate will space-plant at ten different settings, ranging from 5.5 inches to 13.5 inches between seeds. In practice, cell fill was complete until only 6-10 seed remained.

Uniform seed size was essential for desirable stands. A commercial lot of seed was resized through round-hole screens to obtain seed of two sizes: seed that passed through a number 9 (9/64 inch = 3.57 mm) screen and remained on a number 8 (8/64 inch, 3.16 mm) screen, and seed that passed through a number 8 screen and remained on a number 7 (7/64 inch, 2.78 mm) screen. When a John Deere number 31029 planting plate (Fig. 2) was used for planting 8/64 seed, and the spacing was set at 5.5 (14 cm) or 7.9 (20 cm) inches between seed, the stand count ranged from 14 to 42 plants/100 ft (30.5 m). When 7/64-inch seed was used, some of the cells contained two seeds. The final stand ranged from 68 to 94 plants/100 ft, of which 45-62% were doubles. Final stands of 100-120 plants/100 ft are desired in our area. The poor results of these attempts to plant to a stand were caused by soil crusting and uneven seedbed. Better stands resulted when 8/64-inch seed was used, and a 31189 planting plate was set at 3.4 inches (8.6 cm) between the seed. The frequency of two seed/cell was greater here than with 7/64-inch seed and a 31029 plate. The stand ranged from 102 to 342 plants/100 ft, of which 43-97% were doubles. This seed size and plate combination seems most desirable to insure an adequate stand in the Red River Valley of North Dakota and Minnesota, where soil crusting and wind often are problems. In the absence of these limiting factors, and with the use of high-quality seed, this planter would be capable of planting to a stand. Tractor speeds can vary from 1.5 to 2.5 miles/hr (2.4 to 4.0 km/m), depending on seed spacing.



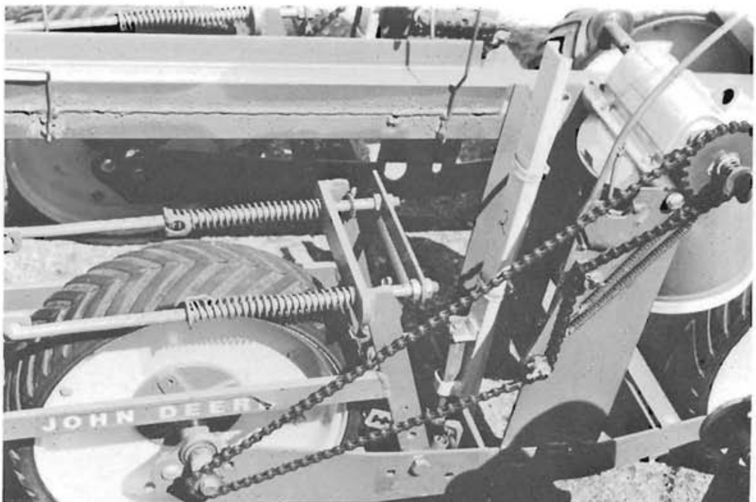
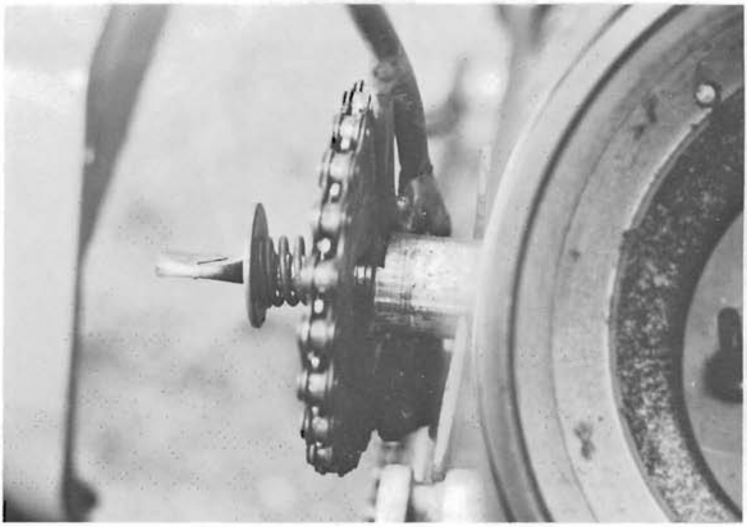


Figure 1.—(Top). Modified planter assembly in operating position; A: steel disc welded to hopper shaft to serve as a handle to turn the planter plate when the driven sprocket is disengaged; B. lever used to disengage driven sprocket; C. steel plate used to support the hopper about 14 inches above the original site.

(Bottom). Assembly with hopper tipped to remove excess seed.



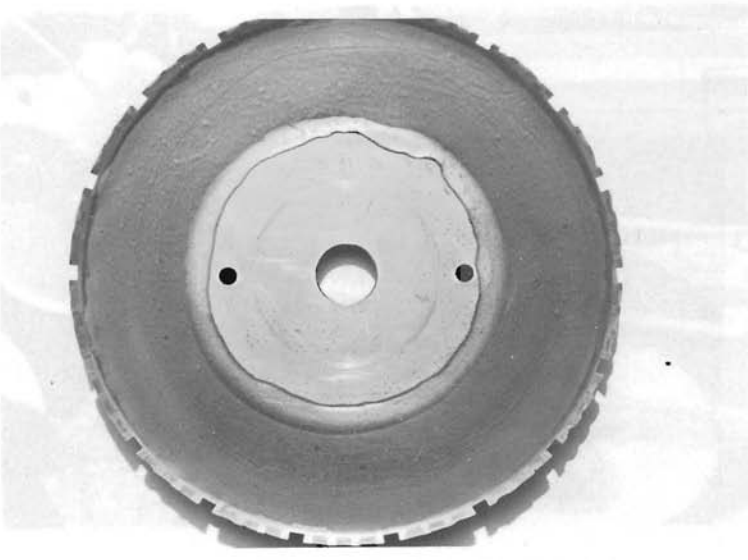


Figure 2.—(Top). Spring-mounted driven sprocket disengaged from the hopper axle so the seed plate can be turned to position seed over the drop tube.

(Bottom). Seed plate filled with epoxy up to the cells.

Seed plates having cells large enough to accept raw multigerm seed have been used to space-plant seed produced in the greenhouse.

The uniform spacing of seed will result in seed conservation and reduced thinning costs in experimental plots.