

A STUDY OF THE PRINCIPLES AFFECTING THE PERFORMANCE
OF MECHANICAL SUGAR-BEET SEED PLANTERS

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Work was started at Michigan State College last spring in an attempt to determine the causes of the low emergence rate of sugar-beet seed. At the present time the emergence rate is about 40%.

In attacking this problem, there are a number of points to be investigated. It was decided that the first problem was to study the basic principles affecting the performance of Mechanical Sugar-Beet seed planters.

The main problem in carrying out this study was to build a planting machine to incorporate a number of variable units to test various planting methods, techniques, and equipment. In order to determine the various components of the machine, the points to be investigated were outlined as follows:

1. To study the effects of varying degrees of soil fineness.
2. To study the effects of soil compactness prior to planting.
3. To study the effects of various degrees of soil-seed contact.
4. To study the effects of soil compactness over the seed.
5. To study the effects of various types of furrow openers.
6. To study the effects of various methods of seed covering.

In order to carry out these investigations, it was decided to construct a machine having provisions for the use of a tillage unit, various compacting units, a number of different types of furrow openers, seed covering units, and various types of press wheels.

The planter was constructed in the research laboratories of the Agricultural Engineering Department of Michigan State College. For the preliminary trials and tests, it incorporated the use of a rotary tillage unit for better fitting of the seed bed; two interchangeable compacting units in the form of a cultipacker and a heavy flat roller, to test the effects of soil compactness prior to planting; two interchangeable furrow openers, to study the effects of different methods of opening the furrow; and a furrow closing and press wheel unit to test the various degrees of soil-seed contact, soil compactness over seed, and seed covering methods.

The rotary-tillage unit was of the rigid type having eight L-shaped teeth bolted to each of two square discs. The cut of the rotor was $4\frac{1}{2}$ inches and the depth adjustable down to $4\frac{1}{2}$ inches. Power to drive the rotor was supplied by the power take-off of the tractor through a drive shaft, V-blets, and a roller chain.

For one of the compacting units a three wheel section of a cultipacker was assembled, in much the same manner as the commercial cultipacker, to supply approximately the same pressure as each section of the commercial machine.

A flat roller-type compacting unit was also assembled for various tests. This unit was eight inches in diameter, and four inches wide, weighing 47 pounds. It was interchangeable with the cultipacker.

The compacting unit was attached to the planter to follow the rotary tiller. It was suspended in a manner that would permit varying the pressure from zero to as much as desired.

Two types of furrow openers were used in the preliminary trials. The standard shoe-type furrow opener, as used in the older model beet drills, and a laboratory designed model known as the boat-type furrow opener were used. The boat-type model was designed to resemble the prow of a boat that would open a furrow by pushing the soil aside and down, giving a rather firm bottom to the furrow. It was expected that a rather firm compact furrow bottom would provide better soil-to-seed contact and would allow the soil moisture more freedom of movement, in the vicinity of the seed, to improve germination under dry conditions.

Seed was metered to the furrow openers by a commercial unit known as the Cobley metering unit as developed by the Utah-Idaho Sugar Company. It was bolted rigidly to the planter frame with provisions for the furrow opener to be suspended below it in a manner that would facilitate changing from one type opener to another. Adjustments for changing the depth of planting were also included in the planter.

The furrow closing equipment consisted of two separate units to test the affects of soil-seed contact, soil compactness over the seed, and seed covering methods.

One unit consisted of a rubber tire-wheel, as commonly used on lawn mowers, to follow in the furrow to press the seed into the furrow bottom before the seed was covered with soil, and also to follow after a closing unit to press the soil on the seed.

The furrow closing unit was a reversed V-type plow, open at both ends, to carry loose soil into the furrow. The press wheel and closing unit were made interchangeable so that trials could be planted with the units in either of the two positions.

The planter was designed to plant two rows at a time; an experimental row and a standard row. The standard planter unit, a disc-type furrow opener with covering and compacting wheels, was attached to the machine 28 inches to the left of the experimental unit in a manner that would permit it to operate much the same as the units on the machines in the field at present. The two rows of the planter were fed seed from two Cobley metering units. Both metering units were driven at the same speed by a common shaft that was driven by a spiked wheel rolling on the ground. Seed was metered to both rows at the same rate.

The construction of the planter was completed by the middle of June with the preliminary field trials and test getting under way June 25.

Better than a hundred trials were run during the summer, but the dry weather and the late start gave us some rather erratic results.

Since the trials were more or less exploratory this year very little can be reported on the results, however, most of the trials do indicate that the use of the rotary tillage and compacting units did not aid in improving the emergence rate.

The boat-type furrow opener gave consistently better emergence rates than the shoe-type furrow opener, but the emergence rates were not consistently better than the ones obtained with the standard planter.

Plans are now being formulated whereby extensive field trials and tests will be conducted early this spring on a more desirable beet soil.