An Improved Method of Applying Fertilizer to Sugar Beets

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It is necessary, in the eastern area, to use a complete fertilizer with sugar beets. Experience has shown that the fertilizer is more efficient when applied at the time of planting. It has also been shown that "banding" the fertilizer close to and below the seed is much more efficient than "broadcasting" or drilling in ahead of the planter operation.

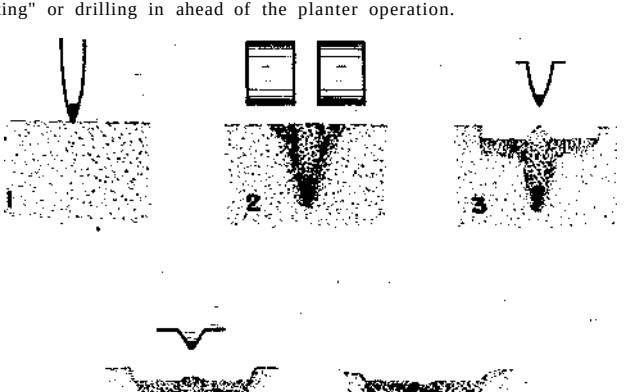

Figure 1.—Shows diagramatically the method of fertilizer and seed placement accomplished with the new drill. 1. Fertilizer placed 4 inches deep. 2. Dual press wheels firm soil on both sides of fertilizer placement. 3. Seed is planted directly over fertilizer. 4. V-shaped press wheel directly over seed. 5. Results in good seed-soil-fertilizer-moisture relationship.

Dr. **R.** L. Cook (1)[2] has shown that when fertilizer was placed directly with the seed or directly under the seed, the plants actually emerged from the soil quicker than they did when the fertilizer was placed some distance from the seed. He found that it was possible to see **a** difference in emergence when fertilizer was placed $1^1/_2$ inches from the seed as compared to $^1/_2$ inch. Dr. J. F. Davis (2) has found that 400 pounds of fertilizer directly

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[2] Numbers in parentheses refer to literature cited.

underneath onion seeds on muck soil were as efficient as 1,000 pounds of fertilizer broadcast prior to seeding. All conventional planters place the fertilizer in a band two inches to one side and two inches below the seed.

It has been shown that by placing a small quantity of fertilizer in direct contact with the seed an increased emergence and subsequent rate of growth will result. Since 200 pounds is the limit which can safely be placed in direct contact with the seed, and since this is not enough to bring a crop through to a maximum yield, methods other than the above for placing fertilizer must be used.

A new drill was developed and built, using Milton seeding units, whereby fertilizer was placed three inches **directly** below the seed. The fertilizer was placed in a restricted band by means of double disc openers followed by dual press wheels which exert pressure on each side of the fertilizer band. The seeding units follow, placing the seed dirctly over the fertilizer. These then are followed by V-shaped rubber press wheels directly over the seed. See Figure 1.

This method of placing fertilizer directly underneath the seed and then pressing around and directly over the seed results in more favorable seed-soil-fertilizer-moisture relationships. This compressed area will tend to draw moisture for better germination of seed as well as better utility of

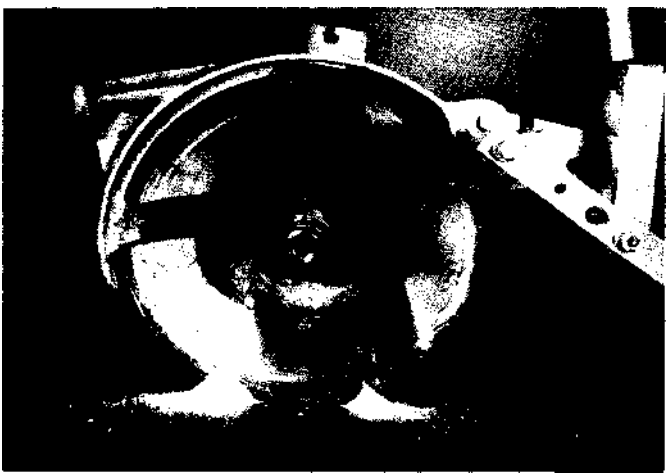

Figure 2.—Showing detail of fertilizer placement unit. Note that greatest portion of fertilizer falls *ahead* of disc center to insure restricted band placement.

fertilizer. The seedling rootlet grows directly into the fertilizer which is thus used more efficiently than when placed a considerable distance from the seedling root.

It is necessary to place the fertilizer as deeply as possible with a minimum disturbance of the seed bed prior to planting of the seed. This is accomplished by a dual disc opener through which fertilizer passes and is placed in a very restricted area. See Figure 2.

The drill itself is designed to raise and lower by means of a hydraulic lift. The fertilizer drive mechanism ceases to operate when the drill is raised from the ground. The Milton seeding units are selfdriven and cease to operate when the drill is raised. See Figure 3.

Results

The drill was tested under many varying conditions ranging from very loose soil resulting from minimum seed bed preparation to well packed, firm seed beds. Fields ranged from light sandy loam soils to heavy clay soils and included fields with relatively poor drainage as compared with

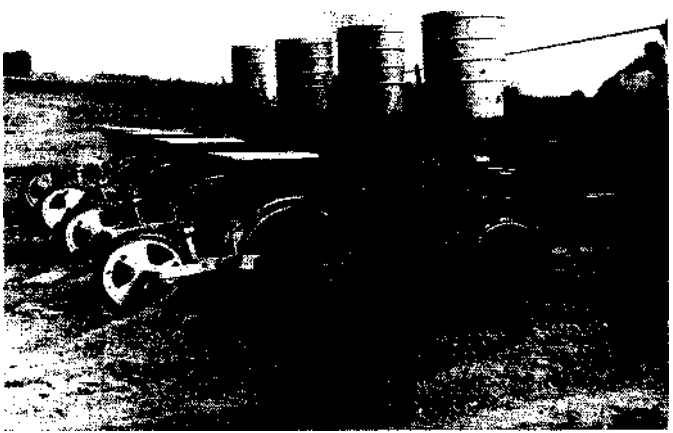

Figure 3.—Showing new drill. Note fertilizer placement discs, dual press wheels, Milton seeding units, V-shaped press wheel.

good drainage. Also, fields containing high organic matter as compared with fields low in organic matter were included. Early plantings were made was well as late plantings and the results obtained from the use of the drill

were satisfactory in every case. The drill was used side by side in the same field with the conventional type drill.

Some of the results obtained are as follows:

1. Pre-Thinning Stand

New Drill	50.1	Beet Inches per 100 Inches
Regular Drill	31.1	Beet Inches per 100 Inches
Increase	19.0	(62 percent better stand)

These figures are an average of 48 different comparisons of counts made in fields where the new drill and the regular drill was used side by side. These counts were made before thinning and indicate a 62 percent average increase in the number of beet-containing inches per 100 inches in the favor of the new drill. It was noted in many cases that these beets not only came up earlier but their initial growth was more rapid than those planted *in* the regular manner. In several instances labor went into the field and worked every other four-row strip planted with the new drill and came back a week later to work the remaining alternate four-row strip which had been planted with the regular drill.

It was observed that emergence of sugar beets when planted with the new drill was so superior that the last few fields were planted with special plates in which beets were space-planted. Plates were used by which three seeds were dropped one inch apart at 12-inch intervals. In almost every case we obtained too many beets and it was necessary that they be thinned.

2. Yields

New Drill	15.579	Tons per Acre
Regular Drill	13.180	Tons per Acre
Increase	2.399	Tons per Acre

These figures are an average of 20 comparisons in which the new drill was used side by side with the regular drill. When harvesting the beets on some of the fields, it was found that there was a noticeable difference in the number of "sprangly" roots. There were a greater number of "sprangly" roots in those plots planted with the regular drill than in those planted with the new drill. This phenomena did not extend to all of the fields tested but to a great many of them. It is obvious that the ability of the small plant to extend the taproot deep into the subsoil is a very decided advantage in the later growth and development of that plant.

3. Harvested Stand

New Drill	94.70	Beets per 100 feet
Regular Drill	77.95	Beets per 100 feet
Increase	16.75	Beets per 100 feet

These figures are an average of 20 comparisons and indicate a substantial increase in the number of marketable beets per 100 feet of row in favor of the new drill. This may result frome one of two facts: that the stand

is more uniform so that labor can leave a better stand originally; or that there was less dying out of beets between the blocking and thinning and time of harvest. It was found, on an average of 32 comparisons, that the sugar content showed an increase of .40 and purity of the beets showed an increase of 1.16.. Coupled with an increase of 2.399 tons per acre, this indicates an increase of 633.75 pounds of sugar per acre (recoverable) in favor of the new drill over the regular drill.

4. Varying Fertilizer Placement with New Drill

Directly under seed	($2^1/_2$")	23.918 Tons per Acre
2" beside and $2^1/_2$" below seed		21.681 Tons per Acre
Increase		2.237 Tons per Acre

These figures are an average of four comparisons. These tests were conducted with the new drill, in order to compare the placement of fertilizer directly below the seed as compared with 2 inches beside the seed, when the fertilizer was placed at the same depth in each case. In the previous comparisons with the new drill with fertilizer placed directly beneath the seed as compared with the regular drill which places the fertilizer beside the seed, it was found that the regular drill does not place the fertilizer nearly as deep as does the new drill. These figures, however, indicate that regardless of depth of fertilizer it would appear advantageous to have it placed directly beneath the seed.

5. Difference due to Field Fertility

	Fields Ave. Over 15 Tons per Acre[1]	Fields Ave. Under 15 Tons per Acre[2]
New Drill	17.96	12.02
Regular Drill	16.00	8.96
Increase	1.96 (12.3%)	3.06 (34.2%)

[1] Ave. of 12 fields
[2] Ave. of 8 fields

In breaking down the data into those fields which averaged more than 15 tons per acre as compared with those fields averaging under 15 ton per acre, it is interesting to note the following: That of the 12 fields averaging more than 15 tons per acre (based on yield obtained from the new drill) the increase was 1.96 tons per acre, or 12.3 percent increase, as compared with 3.06 tons per acre, or 34.2 percent increase, on those fields which averaged less than 15 tons per acre. These tests are perhaps not extensive enough to draw any definite conclusions; however, they seem to indicate that we could probably expect greater increases by the use of the new drill on those fields which produce 10 to 12 tons per acre than we can on those fields which produce 17 to 18 tons per acre.

Most of the fields reported in this paper received fertilizer applications of 400 to 550 pounds per acre. The same amount of seed (5 pounds per acre) was applied with both drills in all cases, as well as the same amount

of fertilizer. All fields were planted in 28-inch rows. There was no supplemental irrigation on any of these fields.

In order to determine whether or not we would obtain any damage by placing fertilizer directly underneath the seed if we used a high nitrogen-containing fertilizer, we ran a series of tests in which 600 to 900 pounds of 8-8-8 fertilizer were placed in bands directly underneath the seed as described. In no instance did we find any damage to germination, emergence or subsequent growth of the sugar beets.

It should be pointed out that in Michigan in the area in which these tests were conducted, there is sufficient rainfall in most seasons for growth of plants and supplemental irrigation is very seldom used. In those areas where supplemental irrigation is required and natural evaporation of moisture is greater than perculation, it may be that some injury may occur to germinating sugar beet seedlings.

Under Michigan conditions of ample spring rainfall, we encountered no detrimental effects from placing fertilizer, which in most cases included borax, in a restricted band $2^1/_2$ inches directly underneath the seed. In all cases, germination was faster and emergence quicker where seed was planted with the new drill. The results presented in this paper suggest that further extensive trials are warranted. The Michigan Sugar Company has purchased 35 of these drills for use with the 1954 crop and will make them available on a rental basis to growers for planting.

The Milton seeding units are manufactured by Harbison-Paine, Inc., Loveland, Colorado. The remainder of the drill with fertilizer units is manufactured by Palsgrove Manufacturing Company, Canal Winchester, Ohio.

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