EXPERIMENTS WITH HARVESTING MACHINERY

For the past five or six years we have been working on a machine that would lift and pile the beets preparatory to topping. In 1938 we harvested 35 acres with a one row machine and had an experienced Mexican crew topping, who volunteered the statement that one-third of their time was saved in harvesting this field behind the machine. Several machines were built in 1939 but due to a short and backward season and lack of time on the part of the operators we gained little experience from this harvest though intensive work was put on one unit and some changes were made. This unit took out approximately 40 acres and desired changes indicated from this year's operations will be incorporated in the other machines. A scalping device was arranged which removed most of the tops leaving only two or three inches of the stems. This made it possible to accumulate a larger pile and tended to make it a trifle more convenient for labor. Labor topped this field for one-third less than the regular labor rates.

EXPERIMENTS WITH TRUCK LOADERS

Two different methods of loading were tried out in 1939. One, where labor topped into a low hopper which held between four and five tons of beets with a bottom conveyor driven by a power take-off which loaded the beets into the truck. The other one was a small unit with a 1-1/2 horse power engine operating an inclined conveyor with a small boot located close to the ground. This was attached to the side of the truck and moved with the truck from pile to pile. This arrangement shortened the distance a shoveler had to move the beets as it was only necessary for him to raise the beets about eight inches from the ground. Time studies and costs are lacking on both machines and further experiences and study is needed before drawing any conclusions.

CROSS CULTIVATION AND CHECK ROW SEEDING PRACTICES IN USE IN IOWA, MINNESOTA AND EASTERN NORTH DAKOTA

by

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CROSS CULTIVATION OF SUGAR BEETS

The idea of cross cultivation was instigated because it was necessary after the severe decline of sugar prices in 1929, to find some means of reducing cost of production. In the area under discussion, experimentation with cross cultivation was started in 1929 and from these experiments, it was determined that a reduction of costs could be effected, because it eliminated part of the thinning and hoeing costs. It was further found that reductions of cost could be effected without a reduction of yields. As a result, the use of this method increased steadily until at the present time, it is accepted as a standard practice in the Red River Valley area, although its use is by no means universal.

CULTURAL BENEFITS

By continued cultivations both ways, the beet field can be kept cleaner which not only reduces the cost of hoeing, but also tends to increase yields as weeds not only absorb moisture, but use much nutrition which would otherwise be available for the beet plant. Cross cultivation reduces to a minimum size, the block which the labor must work. This expedites the thinning operation and makes it possible to complete this operation before the beets get too large. It is an established fact that beets planted and thinned early produce the best yields and by the use of this method, the thinning operation is speeded up to such an extent that all of the beets can be planted at one time instead of making two or three successive plantings as is necessary under the old method.

Cross cultivation also results in a quicker recovery of the plant after the thinning operation. In the old method of blocking and thinning with a hoe, a considerable amount of dirt is taken away from the seedling, leaving the root exposed, and in hot, dry or windy weather, many of these die. Under the cross cultivation method, it is seldom necessary to use the hoe; the surplus seedlings are pulled by hand; the roots are not exposed, and this enables the plant that is left to make a quicker recovery after thinning and a smaller proportion of the stand is lost.

Cross cultivation establishes a mulch around the plant and prevents cracking of the soil which results in better conservation of moisture. In fields infested with root rot, it has been found that if the top soil is aerated by cultivation, this disease can be checked. Cultivation both ways has been found to be more effective in this regard than one way cultivation.

TYPE OF DRILL EQUIPMENT, RATE OF SEEDING AND SPACING USED

When drilling for cross cultivation, the same type of drill can be used as for old method drilling. In the area under discussion, the double disc, flutted feed type drill is most commonly used.

Eighteen to twenty pounds of seed per acre has been found best when drilling for cross cultivation. Good stands have been obtained with lower seeding rates but under adverse conditions, poor stands may result.

Various widths of spacings have been tried but studies to date indicate the 18 by 18 in. or 20 in. by 20 in. spacings to be the most practical. Several attempts at closer spacings have been tried but it is practically impossible to cross cultivate these fields the second time. The benefits of cross cultivation are, therefore, lost and no increase in yield is effected. Where six row planter and cultivators are used, the 18 by 18 in. spacing reduces the width of the machines used and this makes for better and easier handling of field equipment.

COMPARISON OF ACRES THINNED PER MAN, AND LABOR RATES, BETWEEN CROSS CULTIVATION AND OLD METHODS

By numerous tests, it has been proven that on a properly cross cultivated field, one man can thin 50% more acreage than under the old method.

Since 1932, the rate for thinning and hoeing under the cross cultivation method has been from $2.00 to $3.00 per acre less than for this same work under the old method. At the present time, this difference is $2.50 per acre.

THREE YEAR COMPARATIVE RESULTS, CROSS CULTIVATION VS. OLD METHOD
RED RIVER VALLEY AREA 1937, 1938, 1939.
COMPILED FROM RETURNS ON 59,128 ACRES HARVESTED.

METHOD	AVE. YIELD	AVE. WT. PER BEET	NO. BEETS 100% STAND	ACTUAL NO. BEETS PER ACRE	% STAND
Cross Cult.	9.62	1.55	18826	12406	65.90
Not crossed	9.44	1.45	24131	13020	53.96

TWO YEAR COMPARATIVE RESULTS, CROSS CULTIVATION VS. OLD METHOD
MASON CITY, IOWA AREA, 1938, 1939.
COMPILED FROM RETURNS ON 23,243 ACRES

Cross Cult.	10.59	2.01	17922	10573	58.99
Not Crossed	10.44	1.82	25479	11472	45.02

CHECK ROW SEEDING OF SUGAR BEETS

The first check row planter was manufactured by the John Deere Co. in 1934 and in the fall of that year, a field was planted with this machine to see whether or not it would be possible to check beets in 18 in. squares. Very good results were obtained and in 1935, the John Deere Company manufactured several more planters which were put into operation. From that time on, check row seeding of sugar beets became an established practice in the area under discussion and three different makes of planters are now being used.

The John Deere planter is a plate feed, accumulative hill-drop type with a two valve control. The valves are so timed that the seed drops from the seed plate to the upper valve and enough seed is accumulated on this valve for one hill during the interval that the machine travels from one button on the check wire to the next. During the same interval, the hill previously accumulated on the upper valve. drops to the lower valve and in the next interval is deposited from the lower valve to the soil. This machine has a stop and go clutch which controls the travel of the seed plate. Several sets of seed plates are furnished and rate of seeding can be varied by changing plates.

The Oliver check row planter is somewhat similar excepting that it does not have a stop and go clutch and the travel of the seed plate is regulated by change of sprockets. This eliminates some of the working parts and simplifies the machine. This machine is also made so that the fertilizer may be checked if desired.

Both of these planters place the seed in a compact hill, if operated at the proper speed although the Oliver planter places the seed more compactly.

The Moline check-row planter differs from the other planters in that it uses the flutted feed and has only one valve. This arrangement does not permit as low rate of seeding per acre and causes the seed to be scattered in the hill. However, this planter is much lighter and very simple in construction and if operated properly has been found to perform quite well.

All three planters have the double disc furrow openers, similar press wheel arrangements and come equipped with fertilizer attachments.

After cross cultivation became established, check row planting followed as a natural development. By the use of the check-row planter, a considerable saving in seed could be obtained and the benefits of cross cultivation still retained. Many growers were going into tractor equipment because this was found to be more efficient and more economical. This created a demand for a six row planter and as a result, most of the check-row planters were made to plant six rows.

Inasmuch as the machine companies had had considerable experience in the manufacture of check-row corn planters and the beet planters were patterned pretty much after them, the check-row beet planter was pretty well perfected when it came out and not many changes have been necessary.

At the present time, the rate of seeding with a check-row planter is about six pounds per acre. Some planting has been done with 4 pound plates, but more experimentation must be done along this line before this low rate of seeding can be recommended.

Only two spacings have been used so far in check-row seeding. These are the 20 by 20 inch and 18 by 18 inch spacings. Of these, the latter spacing is most commonly used.

THREE YEAR COMPARATIVE RESULTS, CHECK ROW VS OLD METHOD
RED RIVER VALLEY AREA. 1937, 1938, 1939.

COMPILED FROM RETURNS ON 47,838 HARVESTED ACRES

METHOD	YIELD	AVE. WT. PER BEET	NO. BEETS 100% STAND	ACTUAL NO. BEETS PER ACRE	% STAND
Check Row Cross Cult.	9.64	1.51	19360	12768	65.95
Old Method	9.44	1.45	24131	13020	53.96

TWO YEAR COMPARATIVE RESULTS, CHECK ROW VS OLD METHOD
MASON CITY, IOWA AREA, 1938 AND 1939.

COMPILED FROM RETURNS ON 22941 HARVESTED ACRES

Check Row Cross Cult.	10.71	2.02	18332	11594	63.25
Old Method	10.44	1.82	25112	11472	49.68

CONCLUSIONS

This report has dealt with the developments and results of the use of cross cultivation and check row seeding methods in Iowa, Minnesota and Eastern North Dakota and from the findings of this report, we can draw the following conclusions:

1. Cross cultivation was developed because it became necessary to find means of reducing costs.

2. A reduction of cost to the grower was effected by cross cultivation since 75% of the hoeing or weeding was eliminated and at the present time, this saving amounts to $2.50 per acre.

3. If cross cultivation is properly done, worthwhile cultural benefits are obtained.

4. The check-row planter resulted in a further savings because it reduced the amount of seed used which amounts to about $2.00 per acre at the present time.

5. In making a comparison of yields under the various methods in the Red River Valley and Mason City areas, it has been shown that beets grown under cross cultivated or check-row methods, slightly out-yield beets produced under the old method.

In conclusion, special recognition should be made of the work performed by the late C. T. Lund, who was Chief Agriculturalist of the American Crystal Sugar Company at the time, as it was largely due to his willingness to try new methods, that these methods were instigated and finally became adopted.

BASIC PRINCIPLES USED IN THE DEVELOPMENT OF AN IN-PLACE TYPE VARIABLE-CUT SUGAR BEET TOPPER

By

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The development of a satisfactory in-place topper has been attempted by many individuals and by a few organized groups. In general, efforts have been confined to the production of a finished machine with little emphasis placed on the fundamental nature of the problem. This paper will describe an investigation of some of the principles common to all in-place toppers, and an effort to apply the results to the design of a finished machine.

In-place topping consists of two essential operations. First, a gauging device must place a cutting mechanism in position to remove the proper amount of crown material from each beet. Second, the cut must be made without excessive damage to the root.

DETERMINATION OF GAUGING REQUIREMENTS

The tare charts issued by the sugar beet processing companies may be considered implied recommendations of the proper location of the topping cut. Since these recommendations are based on the location of the lowest leaf scar, it is evident that any satisfactory gauging system must make use of some dimensional characteristic of a beet which is a function of its crown thickness.

Data were taken in a number of fields in Utah, Idaho, and California under a wide variety of soil and climate conditions in an effort to discover a correlation between diameter or height and crown thickness. All measurements of height were made from a plane midway between the level of the ground adjacent to the beets and the level at the base of the furrows.

Curves representing the averages of these data are shown in Figure 1. Curve (A) shows the relation between the beet height and the greatest beet diameter. Curve (B) shows the distance above ground level of the lowest leaf scar as a function of beet diameter. In each case, the data are well represented by a straight line passing through the origin.