Yield Studies of Mechanically Thinned Sugar Beet Trials in California

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During the spring of 1949 a series of experiments was conducted in an attempt to determine the effects of mechanical stand reduction on yields of sugar beets, and to provide a reasonably accurate answer to the question: "Does mechanical thinning depress yields?"

The actual method of mechanical thinning varied according to field conditions. Where stands of beet seedlings were excessively heavy or badly infested with weeds, the Eversman or Milton finger weeders were used. In the thinner and more regular stands, blocking was accomplished with Eversman, Milton or Blackwelder (experimental chemical spray) blockers.

It must be emphasized that the success of mechanical methods rested heavily on the judgment used in selecting equipment, methods, size of beet seedlings and condition of seed bed.

In order to evaluate the efficiency of these various devices, a number of trials was harvested both by hand and by machine.

Methods and Procedure

Two approaches to the problem were employed.

The first approach was to conduct replicated trials, the experimental design for which would yield results of relatively high significance.

The second approach consisted of a relatively large number of single strip treatments in commercial fields. These trials would put the mechanisms in the hands of practical beet growers, who would put mechanical methods on trial under a wide range of actual field conditions.

Replicated Field Trials

Two locations were selected for replicated field trials: one at King City, California, and the other at Spreckels, California. Three different thinning treatments were used: Hand, Milton weeder blocker and Blackwelder spray blocker. These treatments were replicated five times in strips throughout the field. The plots were eight rows wide (four beds). Row length was 816 feet at King City and 600 feet at Spreckels.

The Blackwelder spray blocker was used when the beet seedlings were at the 2-leaf stage. The Milton finger weeder was used at the same time; then a week later the Milton weeder blocker, which left $1\frac{1}{2}$ inch blocks on approximately 4 inch centers, was used on the treatment. The hand thinned treatments were thinned at normal thinning time.

Stand counts were made after thinning in which the single, double and multiple blocks were tabulated.

The trials were harvested with a 2-row Marbeet harvester and 25 samples were taken from each treatment to check the percent sugar and percent tare.

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Results of the trials are here tabulated:

Table 1.—King City.

Treatments	Tons per Acre		%	Beet Containing Blocks	Single Containing Blocks
	Gross Sugar	Beets	Sucrose	per 100 ft.	per 100 ft.
Hand thinned	5.698	23.46	15.78	147.0	96.5
Milton blocker	3.520	21.12	15.76	154.4	50.2
Blackwelder spray blocker	3.314	20.94	15.82	98.0	56.2
Sig. dif. 19:1	0.185	0.99	N.S.	23.9	5.7

Table 2.—Spreckels.

Treatments	Tons per Acre		%	Beet Containing Blocks	Single Containing Blocks
	Gross Sugar	Beets	Sucrose	per 100 ft.	per 100 ft.
Hand thinned	2.888	20.68	13.96	138.4	97.3
Milton blocker	2.798	19.68	14.22	151.1	46.1
Blackwelder spray blocker	2.272	16.26	13.98	110.0	57.5
Sig dif. 19:1	0.253	1.63	N.S.	9.98	3.2

Strip Trials in Commercial Fields

Seven strip trials located in the Salinas valley area were used in this study.

The Milton blocker and the Eversman blocker were used with a variety of different tool attachments.

The plots in each field consisted of: Two beds or four rows thinned by one of the above mentioned mechanical thinners and two beds or four rows adjacent to them thinned by hand.

At harvest time in six of the trials, portions of these strips were harvested by hand. Five 50-foot blocks were measured at random throughout the field making a total of 1,000 feet of row from each treatment harvested. All the beets were topped and placed on the beds. The non-marketable beets (less than 1 inch in diameter) were picked out and counted, then discarded. The remaining marketable beets were then counted and weighed. Two samples consisting of ten beets each were taken from each replication for sugar and tare deteriorations.

The remaining strip trial was harvested by a Marbeet harvester. The entire length of the strips was harvested, and ten samples from each treatment were taken for sugar and tare determinations. Results of these strip trials follow in tabular form:

Table 3.—Hand Harvested Strip Trial.

Treatments	Tons per Acre		%	Total Beets per 100' Row	Marketable Beets per 100' Row	[1]Value of Beets per Acre
	Beets	Sugar	Sucrose			
Hand thinned	26.48	4.23	15.9	120.1	114.4	$296.18
Machine thinned	23.75	3.87	16.2	142.8	124.1	271.04

[1] Based upon the net selling price of sugar at $5.85 plus government payments.

Table 4.—Machine Harvested Strip Trial.

Treatments	Tons per Acre		%	Average %	[1]Value of
	Beets	Sugar	Sucrose	Clean Beets	Beets per Acre
Hand	30.13	4.72	15.6	96.5	$329.75
Milton	26.03	4.41	16.9	92.8	309.53
Milton plus hand trimming	25.84	4.24	16.5	92.5	297.15

[1] Based upon the net selling price of sugar at $5.85 plus government payments.

In localities such as the Salinas valley thinning and hoeing costs are exceptionally high. Under these conditions, a loss of $25.00 in the value of beets per acre (as shown *in* Table 3) could well be offset by savings in labor.

Summary

Some of the pertinent points which were learned during the past year are as follows:

1. Beds should be rolled before using a mechanical thinning device. The more uniform the bed, the more accurately the machine will work.
2. Beet stands planted with precision planters are desirable to insure good results with stand reducers.
3. Any use of spring mechanization tools will tend to increase the length of skips in the beet row.
4. Stands which have more than 1,000 plants per 100 feet of row are difficult to thin mechanically. These can be reduced by going over them several times with a mechanical finger weeder, but the thinned stands are not uniform, and contain many multiple beets.
5. Seedling stands which range from 400 to 800 beets per 100 feet of row offer maximum possibilities in reducing costs of hand labor.
6. The Eversman weeder-blocker operates moderately well if the soil is friable. The tool is power take-off driven so the weeder head may travel faster than the ground speed. The weeder attachment works best in uniform heavy stand of small seedlings.
7. The Milton weeder-blocker does its best work when the soil is friable, the beds are smooth and when the beets are *in* about the 4-leaf stage. It is convenient to set up, and is adjustable over a wide range of block-widths and centers, but requires considerable judgment to obtain best results.
8. The Blackwelder spray blocker tends to leave the greatest number of single plants and has the important advantage of not disturbing the soil. It should be used when the seedlings are in about the 2-leaf stage. The uniformity of the bed is not important because it is free to move up and down with the irregularities *in* the rows. The machine is still experimental, but holds much promise.

9. Fourteen to twenty-one days following the mechanical thinning, good results were obtained by using short handled 4-inch hoes in order to clean out some of the larger clumps of multiple beets, and at the same time hoe out the weeds. In some cases this one. hoeing was sufficient for the season.
10. It was necessary to use small blocks in order to compete with the heavier stands which are customary in the Salinas valley. The average post thinning stand for the 1949 season was 125 percent.
11. Better results were obtained from mechanical thinning on soils of high fertility. Poorer soils cannot support the high population of mechanically thinned beets.
12. A mechanical harvest is necessary if beets are mechanically thinned. Hand crews will not pick up the small beets, whereas the machine harvester will.
13. A satisfactory and profitable crop can be grown by using a mechanical thinning device.