

Cross Blocking Studies on Yield of Beets and Reduction of Hand Labor in Southern Colorado

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Mechanization of field operations with sugar beets has been a subject for experimentation for many years in southern Colorado. As early as 1928 the research department of the American Crystal Sugar Company conducted experiments of cross blocking and hand thinning as compared to hand thinning alone, and found a slight increase in yield of beets in the cross blocked plots. In 1931 and 1932 in tests conducted by the United States Department of Agriculture and reported by Skuderna et al (1)², yields of cross blocked and thinned beets were higher, but not significantly so, than those which were hand thinned. In 1939 experimental work conducted by the Company showed that at least 19 percent of hand thinning labor could be saved by cross blocking whole-seed plantings with ordinary cultivator equipment.

1942 Experiments

A 13-acre field was used in 1942 for mechanical blocking and thinning studies. This Experiment was in cooperation with the United States Department of Agriculture. Five rates of planting were used as follows: 3 pounds, 5 pounds, and 7 pounds of segmented seed per acre; 11 pounds per acre of whole seed (using single-seed plates), and 17 pounds per acre using standard plates. Each of these 5 plantings was made in 16-row strips replicated 3 times. Because of adverse spring weather the seed bed was very cloddy and the planting was delayed until April 29. Counts taken after emergence showed an extremely uneven stand.

Cross blocking and thinning treatments were planned as follows: (1) cross block 2-inch cut, 4-in block followed by long hoe; (2) cross block 1-inch cut, 2-inch block, followed by long hoe; (3) long hoe only; (4) check, hand thinning. These treatments were in two replications as bands across the planted strips, each band being 60 feet wide. After the mechanical blocking was completed, time studies were made on the long handle hoe thinning and the hand thinning in the checks, for all plots.

Yield data were obtained by harvesting 65 feet of row in each plot. Sucrose percentage was obtained from two 20-beet samples per plot. Because of extremely poor initial stands (caused by flooding), the plots planted with 3 and 5 pounds per acre and cross blocked 1-inch-

¹Plaut Brwiler. American Crystal Sugar Conijjnniy, Kocky Ford, Colo.
²Italic numbers in parentheses refer to literature cited.

Table 1.—Thinning time and beet yields in 1942 mechanical blocking experiment, Rocky Ford, Colo.

Treatment No.	Planting rate per acre, pounds	Type of seed	Method of:		Percentage time required for thinning	Tons beets per acre	Percentage sucrose	Pounds sugar per acre
			Blocking	Thinning				
1	3	Segmented	....	Long hoe	36.1	16.36	14.80	4,586
2	5	Segmented	....	Long hoe	42.6	16.67	16.05	5,363
3	7	Segmented	....	Long hoe	50.3	16.23	16.50	5,307
4	11	Single whole	....	Long hoe	50.5	16.90	16.22	5,484
5	17	Whole	....	Long hoe	57.4	15.14	16.08	4,875
6	3	Segmented	....	Hand thin	59.0	17.62	15.92	5,011
7	5	Segmented	....	Hand thin	77.1	18.13	16.13	5,825
8	7	Segmented	....	Hand thin	82.9	17.16	16.66	5,468
9	11	Single whole	....	Hand thin	92.9	17.74	15.75	5,598
10	17	Whole	....	Hand thin	100.0	16.34	16.25	5,214
11	7	Segmented	2"-4"	Long hoe	47.0	17.13	15.55	5,215
12	11	Single whole	2"-4"	Long hoe	60.6	15.83	15.70	4,964
13	17	Whole	2"-4"	Long hoe	57.9	14.64	16.62	4,812
14	7	Segmented	1"-2"	Long hoe	30.7	12.24	15.31	3,815
15	11	Single whole	1"-2"	Long hoe	51.4	12.89	16.17	4,103
16	17	Whole	1"-2"	Long hoe	58.0	13.43	16.28	4,397
Significant differences (odds 1R:1)						2.81	1.20	978

2-inch and 2-inch-4-inch had to be abandoned. Results of the test are given in table 1.

In this test the time required for thinning beets was reduced by planting segmented seed at proper seeding rates and by the use of (a) long handle hoe thinning on thin stands and (b) cross blocking and long hoe on thick stands. Although differences required for significance are high because of the extensiveness of the test, it is noted that a 5- or 7-pound planting rate per acre followed by a 2-inch-4-inch blocking and long hoe, or long hoe alone (treatment numbers 2, 3, 1.1), produced sugar per acre yields of 5,363 pounds, 5,307 pounds, and 5,315 pounds respectively, as compared to the check (treatment number 10) of 5,314 pounds. The hand labor required in these three treatments for thinning was 42.6, 56.3, and 47.0 per cent, respectively, of the check.

1945 Experiments

Two experiments on mechanical blocking were conducted in 1945 by the American Crystal Sugar Company. Field A. was planted for tests of the Dixie Beet Chopper and Field B for cross blocking using knives and duck feet. In Field A a new International four-row drill was used to plant segmented seed in two replications of 16-row strips. In Field B the Rassmann precision beet drill was used to plant segmented seed at 2 different rates in 2 replications of strips 12 rows wide. American Number 1, seed segmented 7/64 to 10/64 inch and germinating 88 percent was used in both experiments.

Pre-thinning stand counts made in Field A were as follows :

Type of seed and planting rate per acre	Number of beet-containing inches per 100					Percentage of inches with single plants
	Total	Inches per 100 with:			Total plants	
		1 plant	2 plants	3 plants		
3.01 pounds	22.7	18.6	1.0	0.1	26.8	81.0
4.67 pounds	30.2	24.0	5.8	0.4	36.8	79.5

For the 3.01 pounds planting rate, the Dixie Chopper was set for 3-inch cut, 3-inch block, and for the 4.67 pounds planting rate the set was 4¹/₂-inch cut, 1¹/₂-inch block. This blocking was designed to leave 105 to 115 beet-containing blocks per 100 feet of row. Eight of the 16 rows of each strip were blocked and not thinned and the other 8 rows thinned by hand as a check. One extra hoeing operation to eliminate weeds was required on the blocked plots. Total harvest of each strip was made for yields, and sucrose percentage was obtained from six 10-beet samples in each strip. The data are given in table 2.

It will be noted that a higher sucrose percentage was obtained from the mechanically handled strips, but in the 3-inch cut 3-inch block

Table 2.—Yield obtained from mechanically blocked and thinned strips as compared to hand blocked and thinned strips, Rocky Ford, Colo., 1945.

Pounds segmented seed planted per acre	Treatment	Tons beets per acre	Percentage sucrose	Pounds sugar per acre
3.01	Mechanical 3"-3"	19.08	17.30	6.602
3.01	Hand labor	22.32	16.41	7.539
4.67	Mechanical 1½"-1½"	20.68	17.24	7.130
4.67	Hand labor	21.00	16.40	6.951

there were too many plants in the blocks, and thus a lower yield was obtained. The net labor saving on the mechanically handled strips was the hand thinning, less one weed hoeing operation.

In field B the prethinning stand was as follows:

Type of seed and planting rate per acre	Drill used	Beet-containing inches per 100					Total plant population per 100 inches	Percentage of inches with single plants
		Total	Inches per 100 with:					
			1 plant	2 plants	3 plants	4 or more plants		
Seg. 4.93 lbs.	Rassmann	27.5	21.6	5.7	0.2	33.6	78.5	
Seg. 7.78 lbs.	Rassmann	44.8	30.3	13.1	1.3	60.8	67.8	

From these counts it was calculated that the cross blocking for the 4.93-pound planting should be an average of 2-inch blocks and 6-inch cuts, and for the 7.78-pound rate an average of 2.5-inch blocks and 10.8 cuts. In the blocking, adjustments were made of the tools on the tool bars of the tractor so that the tractor wheels would not go over blocks. All four strips were crossed using knives with the above two blocking arrangements. Each blocking band was 107 feet wide, and two replications were made. No thinning was made on the blocked plots, nor was it necessary to make an extra weed hoeing operation. A 107-foot band of the four planted strips was hand thinned for a check treatment.

Stand counts, using 100 feet of blocked row, were made in each plot after blocking. At harvest 200 feet of row from each plot were harvested, and marketable and non-marketable beets were selected and weighed. Two 10-beet samples of marketable beets were taken for sucrose percentage from each plot. The data obtained are given in tables 3a and 3b.

The data obtained in both Fields A and B demonstrate that cross blocking to final stand without loss of yield can be achieved. However, this result was not obtained on certain of the planting rates and blocking methods, indicating that very careful study must be given to the pre-thinning stand so that the proper blocking method is used. When a high count of beet-containing inches in the pre-thinning stand is

Table 3A.—Stand counts after mechanical blocking or hand thinning, Field B, 1945.

Blocking and Thinning Method	Blocked or thinned stands per 100 feet of row							
	Total beet-containing hills		Hills per 100 feet with:					
	Possible	Obtained	0 plants	1 plant	2 plants	3 plants	4 or more plants	
2.5"-10.8"	90	70	20	25	26	13	6	141
2"-8"	150	97	53	35	29	8	5	167
Hand thin	—	112	0	109	3	—	—	115

Table 3B.—Yield data from mechanical blocking, and hand thinning, Field B, 1945.

Blocking and thinning method	No. marketable beets per 100 feet of row	Tons beets per acre	Percentage sucrose	Pounds sugar per acre
2.5"-10.8"	93.5	13.71	17.39	4,756
2"-8"	90.5	11.23	18.41	4,144
Hand thin	94.3	13.77	17.46	4,806
Significant difference (odds 19:1)		2.04	.78	601

obtained, blocks can be reduced in width and cuts made wider, thereby reducing hill population, to an acceptable level. The 1945 experience indicates that severe losses will be obtained if the blocks obtained have too high a population of beets.

The blocking methods which produced yields equal to hand thinning left a large percentage of double (and occasionally triple to quintuple) plant hills. The beet population at harvest contained a higher than normal proportion of unmarketable beets. Such stands would increase the amount of topping labor required but can be handled satisfactorily with some mechanical harvesters.

Conclusions

The 1942 experiments demonstrated that segmented seed planted 3 to 5 pounds per acre could be thinned with a long handle hoe, or by cross blocking plus long handle hoe, without reduction of yield of sugar per acre when compared to normal planting rates of whole seed with hand thinning. By the use of these methods, hand work was reduced by approximately one half.

The 1945 experiments have indicated that it is possible to block to final stand with the Dixie beet thinner, or by across-the-row blocking, thereby eliminating thinning labor and with little or no reduction in yield. To attain this result, however, most efficient farming must be practiced.

Further study on seed, drills, and planting rates with blocking methods is necessary before complete elimination of thinning can be generally accepted.

Literature Cited

1. Skuderna, A. W. et al. Agronomic Evaluation Tests on Mechanical Blocking and Cross Cultivation of Sugar Beets. U. S. Dept. Agric. Cir. 316, Aug. 1934.