The Effect of Single and Double Plants on Sugar Beet Yields

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One of the questions of major importance in connection with mechanized thinning of sugar beets is the effect on yields of single and double plants left by the thinning operation. A set of plots was put in this past spring at Fort Collins in cooperation with the Colorado A & M College to determine in part the answer to this question. Several others are also working on different phases of the same question and when all the information is brought together we hope to have an answer.

in mechanized thinning operations double plants frequently occur and they are usually counted in one of two ways in determining after-thinning stands. Sometimes the double is counted as two beets to give the total number of beets per hundred feet of row. Sometimes the double is counted as a hill along with the singles as separate hills to give the total number of hills per hundred feet. There has been a difference of opinion with mechanical thinning as to whether the number of beets or number of hills should be kept at the desired thinned stand, for example of 100 per hundred feet of row.

This matter of total number of beets versus total number of hills was taken into consideration when the set of plots was laid out. On part of the plots the total number of thinned beets was kept at 100 per hundred feet of row and the percentage of the beets which were singles and doubles was varied in 20-percent steps from 100 percent singles to zero percent singles and 100 percent doubles. This meant that the number of hills for these plots was 100 hills for 100 percent singles, 90 hills for 80 percent singles, 80 hills for 60 percent singles and down to 50 hills for 100 percent doubles. On the remainder of the plots the number of thinned hills was kept constant at 100 per hundred feet and the percentage singles as before was varied by 20-percent steps from 100 percent singles to zero singles and 100 percent of the hills as doubles. On this group of plots the number of beets was 100 beets for 100 percent singles, 120 beets for 80 percent singles and 20 percent doubles, and up to 200 beets for zero singles and 100 percent doubles.

The plots were carefully hand thinned by 10-foot sections of row so that each section had its desired number of single and double plants. The planting was with 7 to 10/64" segmented seed at 4 to 6

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pounds per acre, but germination was good and there were enough doubles to obtain the desired stands. Some of the double plants were right together when they were thinned, having evidently come from a double-germ segment or two segments dropped together. Other double plants were separated by an inch or two and evidently came from two segments. No attempt was made to try to get doubles of one type or the other, but there were perhaps about as many of one as the other. Plots were four rows wide and about 35 feet long so that 30 feet of the two center rows could be harvested and avoid border effect. Each treatment was replicated five times in randomized blocks.

These plots together with the rest of the field were carried through to harvest, being irrigated three times and being cultivated and hoed and otherwise treated all alike. They were harvested in early October.

The plots were harvested by hand, keeping the two 30-foot rows in each plot separate. The beets were washed to eliminate discrepancies of dirt tare. The data taken included number and weight of marketable beets, a marketable beet being taken as one of $1^1/_4$ inch or greater diameter, and the total number of beets including unmarketable roots so as to get a check on losses of numbers of beets from thinning to harvest time.

Table 1 shows the data taken on this set of plots. In general all the beets left at thinning time were accounted for at harvest either

Table 1.

Treatment No.	Thinned stand			Harvest stand		Yield	
	Percentage doubles	Beets per 100 feet	Hills per 100 feet »	Total beets per 100 feet	beets per 100 feet	Tons per acre	Percent of check
0	100	100	100.0	97.0	12.25	100	
20	100	90	100.0	94.6	12.31	101	
40	100	80	98.6	95.5	12.31	101	
60	100	70	105.0	97.6	11.66	95	
8O	100	60	95. 6	92.4	12.52	102	
100	1OO	50	I01.7	94.0	11.07	90	
20	120	100	119.0	111.0	11.75	96	
40	.140	100	139.0	122.3	10.27	84	
60	160	100	147.5	126.3	9.82	80	
80	180	100	163.2	131.6	9.21	75	
100	200	100	174.5	137.5	9.82	80	
Difference for significance					+ 1.17		

as marketable or unmarketable roots up to the point where the thinned stand was 140 beets per hundred feet of row. With heavier thinned stands part of the beets did not grow through until harvest to make roots large enough to find. When the number of thinned

beets per hundred feet was kept at 100, even though the percentage of doubles increased to 100, nearly all the beets came through to harvest as marketable beets. However, when the number of thinned hills was kept at 100 per hundred feet and the number of beets in the thinned stand increased as the percent of doubles increased, the number of marketable beets increased steadily but the number which did not make marketable beets also increased.

The yield data are shown in the last two columns of the table, one being expressed in tons per acre and the other in percent of the check treatment which was 100 beets per hundred feet of row, all beets being singles. The differences in yield between treatments in tons per acre required for significance at the 95-percent level is shown. This data shows that when the number of thinned beets is kept at 100 per hundred feet, the yield is not decreased by increased percentages of doubles until the percentage of doubles exceeds 50 or 60 percent. Beyond this point there is a downward trend of yield which barely reaches significance with 100 percent doubles. However, when the number of beets left at thinning increased as the percentage of doubles increased, the yield decreased even though the number of hills was kept constant at 100 per hundred feet. This decrease was significant with 40 percent or more doubles.

The trends of yields with increased percentages of doubles is shown even better by the curves in Figure 1 than by the tabulated data. The curves are estimated from the plotted data. The upper

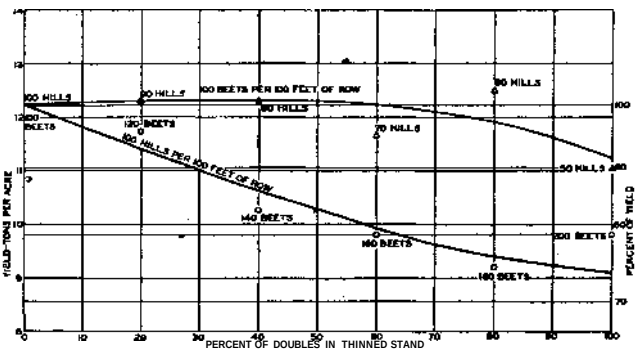

Figure 1.—Curves showing the effect on harvest yield of varying percentages of. single and double beets.

curve indicates that when the thinned stand is kept at 100 beets per hundred feet there is only a small decrease in yield even with a comparatively high percentage of doubles. On the other hand the lower curve indicates that with increased doubles and a corresponding increase in number of thinned beets per hundred feet there is a significant decrease in yield which reaches a 25-percent decrease at about 80 percent doubles.

It should be pointed out that this set of plots was grown on a field having a 12- to 13-ton-per-acre level of soil fertility. The data probably would have been different on soil of a higher or lower fertility level. The stand of 100 beets per hundred feet of row was taken as a check because that seems to be the commonly accepted desired thinned stand in this area.

Population and Distribution Studies With Sugar Beets

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Established sugar beet culture in the intermountain area centers around the planting of beets in 20- and 22-inch rows with a subsequent spacing of plants 11 to 12 inches apart in the row to give a population of approximately 25,000 beets per acre. Recent mechanization of sugar beet agriculture has raised the question as to whether the traditional pattern of distribution may not be changed without adversely affecting yields. The present paper is a report of some studies conducted to determine optimum populations in relation to different distribution patterns and also to determine the effect on yield of varied distribution patterns.

Experimental Procedure

The two major tests reported here include 20-inch, 26-ineh, 32-inch, and 38-inch row. widths with 8-inch, 10-inch, 12-inch, and 15-ineh spacings in the row. These two tests were split-plot experiments with four replicated plots of each of the 16 treatments. The results of these tests are supplemented by results from other spacing studies and population and distribution studies involving a comparison of hand and mechanical thinning.

Experimental Results

Results of the row width test at Granger, Utah, are shown in table 1. It is evident from these results that, under the conditions of this experiment, distribution pattern had more effect on yield and sucrose

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