TESTS WITH SHEARED SEED IN 1943

AT FORT COLLINS, COLORADO

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In 1943, whole and sheared seed were compared in one experiment in which fertilizer treatments also were included as a variable and in another experiment the sheared seed was planted at seven rates of seeding.

The tests were located on the Agronomy Farm of the Colorado Agricultural Experiment Station (1) adjacent to the city of Fort Collins. The soil is a moderately heavy loam of the Fort Collins soil series. Spring wheat was grown in 1942, approximately 12 tons per acre of rotted manure was applied to the stubble and the land irrigated and fall plowed. Superphosphate (45 percent) at the rate of 120 pounds per acre was drilled in at the start of seedbed preparation in March 1943.

Seed

The seed used in these tests was Great Western 63. The sheared, or segmented, seed was obtained from the Great Western Factory at Fort Collins from the same stock as issued to growers in 1943. Ten pounds of whole seed of this strain were obtained from the Longmont Station of the Great Western Sugar Company. Both lots of seed were of satisfactory germination, that of the whole seed being recorded as 92. Germination tests of the sheared seed made by the Colorado Seed Laboratory showed approximately 105 sprouts from 73 seed pieces per hundred. The averages of nine germination tests indicate that 44 percent of the germinating seed pieces produced doubles.

Experiment 1.- Comparison of Whole and Sheared Sugar-Beet Seed.

Plan of Test

The seed comparisons were combined with fertilizer treatments to make six treatments for this test. The plots were of eight rows each and 100 feet in length. There were six replications; a 6 x 6 Latin square design was used.

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(1) Agronomic investigations are cooperative with the Agronomy Section of the Colorado Agricultural Experiment Station.

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Seeding

This test was planted April 27 with a Planet Jr. hand drill. The whole seed was planted at the rate of 18 pounds per acre and the sheared seed at an actual rate of 9.35 pounds per acre. The planting rate for the sheared seed was heavier by 2.35 pounds per acre over the rate of seeding originally planned. Only a few seedlings emerged in this test prior to the rains starting May 6. It was evident when the initial stands emerged that both rates of seeding were greatly in excess of rates that would have produced adequate stands under the field conditions.

Stands

Data on initial and harvested stands are given in table 1.

Initial and Harvested Stands from Whole and Sheared Sugar-Beet Seed
(Data given as 6-plot averages)

Treatment	Initial stands 1/ Total	Initial stands 1/ Singles	Harvested 2/ stand
1. Whole seed; no fertilizer	77.2	5.8	98.5
2. Whole seed; fertilizer No. 1	78.4	5.1	96.6
3. Whole seed; fertilizer No. 2	74.1	5.4	99.8
4. Sheared seed; no fertilizer	59.8	12.5	97.9
5. Sheared seed; fertilizer No. 1	60.0	12.7	106.5
6. Sheared seed; fertilizer No. 2	60.5	12.3	99.5
Mean of test	68.3	8.95	99.8
F value	33.27**	44.46**	1.72
2.086 times the S.E. of a diff.	4.7	1.7	-

1/ Inches in 100-inch row length containing 1 or more sugar-beet plants.
2/ Number of roots in 100 feet of row length.

Skips in excess of 5 or 6 inches were rare in the initial stands from both types of seed, but the stand counts reveal that the stand from the whole seed was significantly heavier and contained significantly fewer singles. Time studies were made on the thinning of one block, i.e., three plots each of the whole and sheared seed. Thinning was by the conventional method with a short handled hoe. The average time required for thinning was 77.3 minutes per plot where whole seed had been used and 60.3 minutes per plot for the sheared seed. This represents a saving in thinning time in excess of 20 percent when sheared seed was used in this test. Most of the saving in time in thinning the stands obtained from sheared seed was due to the fact that, usually, a single plant could be left at approximately the

desired spacing without any finger work whereas in the stands from the whole seed it was seldom possible to leave a single plant without removing one or more seedlings with the fingers after blocking as carefully as possible with the hoe. Excellent harvested stands were obtained from all the treatments and such differences as were found appear to be wholly due to chance.

Yields

The results of this experiment are not given in detail with respect to the fertilizer treatments. The average yield of the 18 plots planted with sheared seed was 3,782 gross pounds of sugar per acre from 12.46 tons of roots of 15.12 percent sucrose. The average yield of the 18 plots planted with whole seed was 3,616 gross pounds of sugar per acre from 11.89 tons of roots of 15.21 percent sucrose. Although these differences, with the exception of the sugar percentages, are in favor of the sheared seed they are small and are, probably, not statistically significant.

Experiment 2.- Rate of Seeding Sheared Seed.

Materials and Methods

In this experiment, seven planting rates were used, replicated seven times. The field arrangement was a 7 x 7 Latin square. Each plot consisted of 16 rows, 60 feet in length.

The drill available for planting this test was a Planet Jr. hand drill with an adjustable opening at the bottom of the seed hopper. Accurate adjustment of seeding rate with this drill is somewhat difficult, and uniform seeding at very low rates is not possible. To avoid these difficulties it was decided to prepare mixtures of differing proportions of live and dead seed and plant all mixtures at a uniform rate to give the desired rate of planting of normal seed for each treatment. The dead seed was prepared by presoaking a quantity of the sheared seed then drying the soaked seed in an electric oven at approximately 90° C. This treatment was effective in killing the germs of the seed without materially changing the physical condition of the seed pieces. However, in this test the expected uniformity in seeding rates for these seed mixtures was not attained. The seed mixtures used and the actual rates of planting that resulted are summarized in table 2.

It is evident that the rates of seeding attained were far from satisfactory; however some reliable comparisons are possible. Instead of the seven rates of seeding, as planned, the test consists, essentially, of two low rates, four intermediate rates and one excessive rate.

The test was planted April 22. A considerable portion of the seedlings emerged about May 1 to 3 with the balance emerging after the rains which started May 6.

Table 2

Seed Mixtures and Planting Rates Used in Rate of Planting Test

Treatment	Seed mixture (Proportions) Untreated	Dead	Germination* of mixture	Seeding rate (lb. per A.) Mixture	Equivalent to untreated seed
1	1	6	15	8.49	1.21
2	2	5	35	7.65	2.18
3	3	4	38	9.04	3.87
4	4	3	55	7.69	4.39
5	5	2	82	6.23	4.45
6	6	1	95	5.66	4.85
7	7	0	100	9.35	9.35

* Values given are average of averages of two tests. Each test was of four lots of 100 seed pieces each of each mixture.

Data on stands and thinning time are summarized in table 3.

Table 3

Stands and Thinning Time for Different Rates of Seeding Sheared Sugar-Beet Seed
(Data given as 7-plot averages)

Treatment	Stand: Initial 1/	Harvested 2/ Hills	Harvested 2/ Total roots	Thinning Time: Actual (min.)	As percentage of treatment 7 %
1	12.8	84.3	95.7	39.4	55
2	19.5	95.6	104.5	46.7	65
3	32.3	101.7	107.5	53.1	74
4	35.5	102.0	107.8	55.1	77
5	34.9	102.8	109.1	52.0	72.5
6	37.5	100.1	105.9	54.7	76
7	58.1	103.2	107.2	71.7	100
Mean of test	32.9	98.7	105.4	53.3	
F value	214.79**	21.66**	7.94	23.41**	
2.042 x the S.E. of a difference	15.6	4.1	4.6	5.9	

1/ Inches in 100-inch row length containing one or more sugar-beet plants.
2/ Number of hills or roots in 100 feet of row length.

Initial Stands

Counts were made of the plant-containing-inches in 50 inches of each row of each plot taken at random. No record was made of singles, but it was observed that there was an unexpectedly high proportion of doubles (obviously two plants from a single-seed piece) in the plots planted at the lower rates of seeding. This observation was confirmed later, when the germination tests were made on this particular lot of sheared seed. In making these stand counts only one 50-inch space was encountered that contained no plant and in general the distribution of the seedlings in the row for all rates of seeding was reasonably uniform, but varied in density with the different seeding rates. Treatment 1 and 2, the low rates of seeding, had initial stands that appeared too thin for the use of any type of mechanical thinner, but these stands could have been quickly and efficiently worked with the long-handled hoe. Treatments 3 to 6 had initial stands that were probably slightly too thick for mechanical thinning without some additional cutting down of the blocks after machine working and too thick for fast work with the long-handled hoe. Treatment 7 had initial stands that were too thick for fast, efficient thinning by any method. Apparently, under the conditions of this test a seeding rate of about 3 pounds per acre would have given initial stands suitable for machine thinning or for thinning by means of the long-handled hoe without additional hand work.

Thinning

All treatments of the test were thinned with a long-handled hoe, with some finger work to reduce the thickest bunches and remove weeds. The time required for the working of each plot was recorded. Time of thinning treatment 1 was only slightly more than half that for thinning treatment 7 and less than three-fourths that used in thinning treatments 3 to 6, the initial stands of which were moderately heavy. Treatment 1 was thinned in approximately five-sixths the time required for treatment 2. By the usual standards the thinned stands of treatments 1 and 2 were slightly thin and the spacing of the plants as left lacked uniformity; however, even in treatment 1, there were few skips in excess of approximately 30 inches. Excellent stands with fairly uniform distribution in the row were obtained on all five of the other treatments.

Yields

At harvest data from this test are summarized in table 4.

The extreme difference in yield of roots is only 0.77 ton. It is probable that the yield of 12.08 tons from treatment 1 is significantly low in comparison with most, or all, of the other treatments. The extreme difference of 0.31 percent in sucrose content is certainly not statistically significant. The greatest difference in gross sugar among the treatments probably is not significant.

Table 4

Rate of Seeding Test of Sheared Sugar-Beet Seed
(Data given as 7-plot averages)

Treatment No.	Seeding rate (lb. per acre)	Acre Yields: Sugar (pounds)	Acre Yields: Roots (tons)	Sucrose (%)	Stand 1/ Harvested
1	1.21	3766	12.08	15.58	95.7
2	2.18	3994	12.85	15.84	104.5
3	3.87	3938	12.64	15.61	107.5
4	4.39	3990	12.56	15.88	107.8
5	4.45	4073	12.82	15.89	109.1
6	4.85	3996	12.70	15.74	105.9
7	9.35	3956	12.48	15.89	107.2
Mean of test		3959	12.59	15.73	105.4
F value		1.51	4.11**	#	7.94**
2.042 x S.E. of a diff.		224 lb.	0.37 T.	--	4.6 roots

1/ Number of roots in 100 feet of row length.
V_e exceeds V_t.

Discussion and Conclusions

In the first experiment whole and sheared sugar-beet seed of high quality were sown at heavy rates. More than adequate initial stands were obtained from each type of seed. In this test in spite of the heavy initial stands, the use of sheared seed made possible the saving of slightly over 20 percent in the time required for thinning. Although yields from the sheared seed slightly exceed the yields from the whole seed the differences were not statistically significant. The experiment points definitely to advantages from use of sheared sugar-beet seed.

In another test sheared sugar-beet seed of good quality was seeded at very low, low, intermediate and excessive rates. Average initial stands from these seedings were approximately 13, 20, 35, and 58 plant containing inches per 100 inches, respectively. Distribution of the plants in the row was good in all cases. The thinned stand from the very low rate of seeding was slightly low, 84 hills containing 96 beets per 100 feet of row at harvest. The thinned stands obtained from the other rates of seeding all slightly exceeded 100 beets per 100 feet of row at harvest. Distribution of plants after thinning in the plots in which very low and low rates of seeding were employed was less uniform than the plant distribution obtained in plots with heavier rates of seeding.

In this test the yield of roots from the very low rate of seeding was approximately 0.60 ton less than the average of the other rates of seeding. Though small, this difference is statistically significant. Differences in sucrose percentage were very small and not significant and there were no statistically significant differences in the calculated acre yields of gross sugar among the different rates of seeding.

Under the conditions of this test the sheared sugarbeet seed planted at the rate of 1.21 pounds of viable seed per acre produced yields slightly below the yields from heavier rates of seeding. However, it is probable that this small loss in yield was more than offset by a saving in labor in thinning the crop.

The results reported, taken in conjunction with other experimental evidence, indicate that if maximum efficiency is to be attained, the proper trend with respect to seeding rate should be toward relatively low rates that approach the calculated quantity necessary to give the desired initial stand. It is pointed out, however, that conditions for germination at Fort Collins in 1943 were satisfactory and for each district, experience over a number of seasons will be necessary to arrive at a generalized recommendation as to rate of seeding.