

# Experimental Studies Related to Seed Processing

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Mechanization of the spring work related to the growing of the sugar beet crop can only be successful if small amounts of seed per acre are planted accurately. This seed should be composed of a lower number of germs than normal sugar beet seed, which may contain three or four germs in each seedball.

Until such time as the plant breeder is able to supply a variety of sugar beets having a mono- or bi-locular type of seedball, along with other desired characters, it will be necessary to process the seed in some manner in order to separate the original seedball into more than one portion, each containing one or two germs.

Considerable work has been done by the various sugar beet companies to arrive at a desirable method for processing the seed, with the result that many different types of processed seed are now being used.

Germination results for several lots and types of processed seed in comparison with unprocessed seed, as well as some bi-locular types, have been previously presented<sup>2,3</sup> as field results compared with laboratory results. These tests indicate an increase of about 12.8 percent in singles for field germinations over that obtained in the laboratory. Segmented seed gave about the same results as whole seed of the same graded size, while commercially decorticated seed resulted in a 10 percent lower potential germination under the same comparable conditions. However, one lot of bi-locular seed which was polished only lightly in the decorticator gave as good results as unpolished seed from the same lot.

## MATERIALS AND METHODS

### Polishing

To understand more fully the physical characteristics of sugar beet seed, three commercial lots of Great Western seed were polished and screened by hand. The hand polishing was accomplished by rubbing the seed between **two** pieces of heavy rubber until the first germ caps were observed to be loosened. Probably this would be considered as light polishing. Both before and after polishing, the seed was graded as to size, using a nest of hand screens. These screens were of the round-hole type with 1/64-inch difference in hole size between each screen.

### Screening

Seed from five Great Western varieties of sugar beets, grown in several different years in Colorado, Arizona, Oregon, New Mexico and California,

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<sup>2</sup> Brewbaker, H. E., and H. L. Bush. Graded whole vs. segmented, pelleted, and single- and double-germ seed in field germination tests. Proc. A.S.S.B.T. Regional Meeting of Eastern Slope and Intermountain, 188-193, 1947.

<sup>3</sup> Bush, H. L. Field compared with blotter germinations for processed, graded, single- and double-germ seed. Proc. Amer. Soc. Sug. Beet Tech., 70-77, 1948.

were screened through the same nest of screens described above, in order to study the variation existing between different lots of seed from the same variety grown in different locations.

### Field Germinations

In addition to the results previously reported<sup>2n</sup>, tests were made in 1949 in which various lots of processed and unprocessed seed were compared, using the same scheme of careful hand planting described in the previous reports, where two separate tests were conducted. One of these hand planted tests was composed of 3 replicates planted at four weekly intervals, during April and May, for a total of 12 replicates, in which case germinating conditions were rather poor; the other was composed of 6 replicates planted July 18, where irrigation water was applied so that rather high germinations resulted. In addition to the hand planted tests, one planting was made using an experimental plot planter, and another where a commercial drill was used, at Longmont, Colorado. Plantings were also made at Windsor, Colorado, where a commercial drill was used with two different rates of planting. The various lots of seed included in all, or part, of these tests are as follows:

1. Commercial segmented seed. In this, the 7-10/64-inch sizes were pre-screened and mixed with the segmented portions of the larger seed.
2. Decorticated seed. All of the whole seed of this lot was passed through the burr and polishing unit of the decorticator.
3. Decorticated mixture. This consisted of whole seed from the 7-10/64-inch size, seed from the 10-12/64-inch size which had been polished only in the decorticator, and decorticated seed from the plus 12/64-inch sizes of whole seed.
4. Decorticator-polished whole seed, prepared by working whole seed through the polishing unit of the decorticator until the largest segments passed through a 10/64-inch screen.
5. Forsberg-polished whole seed, prepared by processing seed with the Forsberg huller until it could be screened to the 7-10/64-inch size.
6. Unprocessed seed graded to 7-10/64-inch sizes.
7. Unprocessed seed graded to 10-12/64-inch sizes.
8. Ungraded whole seed.
9. Bi-locular strain, B401.
10. Mono-locular strain, B402.

## RESULTS

### Polishing

The results for polishing the three commercial lots of beet seed are presented in Table 1.

The original GW59-41 seed would be classed as small, while the GW85-42 and GW72-46 are medium and large, respectively. The fraction passing through the 6/64-inch screen is considered trash, and it is noted that a considerably higher percentage of trash is removed from the larger sizes of original seed than from the smaller sizes. The two large grades of seed (through 13/64 on 12/64 and through 12/64 on 11/64) reacted to polishing in a similar manner, regardless of whether or not the original lot was of

Table 1. Seed fractions, expressed in percentage, remaining on varipus screen sizes after hand polishing three commercial lots of sugar beet seed.

Grade Before Polishing	% Each (a) Fraction Before Polish	Percentages for Each Fraction After Polishing						
		Thru 12/64 on 11/64	Thru 11/64 on 10/64	Thru 10/64 on 9/64	Thru 9/64 on 8/64	Thru 8/64 on 7/64	Thru 7/64 on 6/64	Thru 6/64 on 5/64
<b>GW59-41 Colo.</b>								
On 13/64 (h)	14							
Thru 13/64 on 12/64	19	38.9	27.8	11.1	2.8			19.4
Thru 12/64 on 11/64	22		46.6	33.3	9.5	0.2		10.4
Thru 11/64 on 10/64	16		0.3	42.1	36.8	10.5	.5	9.8
Thru 10/64 on 9/64	16			60.6	26.1	4.3	2.0	7.0
Thru 9/64 (b)	13							
<b>GW85 42 Colo.</b>								
On 13/64 (b)	32							
Thru 13/64 on 12/64	24	37.5	25.0	12.5	4.2			20.8
Thru 12/64 on 11/64	16		40.9	36.4	9.1	0.5		13.1
Thru 11/64 on 10/64	10		5.9	64.7	11.8	5.9		11.7
Thru 10/64 on 9/64	10			58.8	23.5	5.9	3.3	8.5
Thru 9/64 (b)	8							
<b>GW72-46 Colo.</b>								
On 13/64 (b)	53							
Thru 13/64 on 12/64	21	33.3	27.8	11.1	2.8	0.3		24.7
Thru 12/64 on 11/64	10		41.2	35.3	10.8	0.3		12.4
Thru 11/64 on 10/64	8		7.7	46.2	23.1	3.8		11.6
Thru 10/64 on 9/64	5			33.3	54.6	5.6	1.0	5.5
Thru 9/64 (b)	3							

(a) Data from Seed Screening Test, 1948.

(b) Not polished.

the small, medium or large size category, but for the smaller grades (through 11/64 on 10/64 and through 10/64 on 9/64) the variations due to polishing do not appear to be consistent with the original sizes of the three seed lots.

A considerably higher percentage of corky material was removed from the larger grades of original seed than from the smaller grades. Considering averages for the three varieties, at least 1/64-inch of corky material was removed by polishing from 10 percent of the large size seed graded "through 13/64 on 12/64" screen and 2/64-inch from 36.6 percent of the same grade; this in contrast with smaller seed graded "through 10/64 on 9/64" where 50.9 percent was not reduced as much as 1/64-inch in size by polishing.

Considering the three varieties used in this polishing test, it was found that, as an average, 11.3 percent of the unpolished seed graded "through 11/64 on 10/64" in the screening test. After polishing and re-screening, 4.6 percent of this portion, as an average for the three varieties, still remained on the 10/64-inch screen. This small fraction of polished seed accounted for only one-twentieth, or 5 percent, of the original seed lot. This might appear to be the logical division to consider as the largest size for graded seed which might be polished only, as compared with larger seed which would require some form of cracking to maintain a standard size of 7/64-10/64-inch for commercial seed.

### Screening

The results for the screening test are presented in Table 2.

**Table 2. Results for screening seed of several varieties grown in different locations in different years.**

Variety	Where Produced	Year	Percentage of seed remaining on screens							Thru 7/64
			13/64	12/64	11/64	10/64	9/64	8/64	7/64	
GW59	Colorado	1941 (a)	14	19	22	16	16	10	2	1
GW59	Arizona	1944	<b>13</b>	<b>18</b>	25	19	<b>18</b>	6	1	
GW59	Oregon	1944	<b>10</b>	15	26	<b>20</b>	17	10	1	1
GW59	Colorado	1944(a)	<b>28</b>	26	16	12	12	5	1	
GW59	Colorado	1945(a)	16	<b>18</b>	<b>20</b>	15	15	12	3	1
GW59	Oregon	1945	12	<b>18</b>	24	<b>18</b>	17	9	1	1
GW59	California	1947	24	26	22	14	<b>10</b>	3	1	
GW59	Oregon	1947	14	19	22	<b>18</b>	16	8	2	1
GW64	Colorado	1941(b)	<b>33</b>	24	17	<b>10</b>	<b>8</b>	4	2	2
GW64	Oregon	1946	<b>6</b>	15	27	19	<b>20</b>	10	2	1
GW64	Arizona	1947	11	19	27	<b>18</b>	<b>18</b>	6	1	
GW72	California	1946	<b>32</b>	<b>28</b>	15	<b>10</b>	<b>8</b>	4	2	1
GW72	Colorado	1946(a)	<b>53</b>	21	<b>10</b>	<b>8</b>	<b>5</b>	2	1	
GW85	Colorado	1942(b)	<b>32</b>	24	16	<b>10</b>	10	6	1	1
GW85	Oregon	1945	12	17	26	<b>18</b>	18	8	1	
GW85	Arizona	1947	<b>10</b>	<b>23</b>	26	<b>18</b>	16	6	1	
GW201	Colorado	1944(b)	<b>50</b>	19	14	<b>8</b>	5	3	1	
GW201	Arizona	1946	24	<b>23</b>	22	15	11	4	1	
GW201	New Mexico	1946	26	24	<b>23</b>	14	10	2	1	
GW201	Oregon	1946	14	<b>20</b>	<b>24</b>	<b>18</b>	15	8	1	
GW201	Arizona	1947	<b>8</b>	17	25	21	19	8	1	1

(a Grown by two-year steckling method.

(b Grown by overwintering method.

There appears to be a large variation, due to environment, in seed sizes between various lots of seed produced in different years at different locations for each of the varieties tested. Seed produced in Colorado or California tends to be larger than that produced in Oregon, Arizona, or New Mexico for each varietal comparison.

GW 59 appears generally to produce smaller seed with less variation in size than the other varieties, and GW72 might be classed as a large-seeded variety, based on the two comparisons for this variety. However, it is quite apparent that no definite prediction can be made relative to the seed size of any variety produced at any location.

### Field Germinations

The results for the field germination tests, where each seed unit was carefully planted by hand, are presented in Table 3.

Table 3. Field germination tests. Percent singles, % germination and % potential seedlings as obtained in the field compared with results obtained on blotters for both 12- and 6-replicated tests.

Variety	Treatment	Size	Blotter		Field					
			% Singles	% Germ.	% Singles		% Germ.		% Potential	
					12 rep.	6 rep.	12 rep.	6 rep.	12 rep.	6 rep.
GVV201	Segmented	7-10/64	46.2	94.8	66.9	53.4	37.7	63.7	32.9	<b>67.2</b>
GVV201	Decorticated	7-10/64	36.1	93.5	63.4	50.4	39.1	59.2	33.9	63.3
GW201	Decort. Mixture	7-10/64	41.7	93.5	64.4	44.8	41.3	63.2	37.3	<b>67.6</b>
GW201	Decort. Polished	7-10/64	33.6	96.8	60.0	50.1	38.3	55.5	32.3	<b>57.4</b>
GW201	Forsberg Polished	7-10/64	23.2	90.5	60.7	46.0	30.7	45.7	23.8	<b>50.5</b>
GW201	No Processing	7-10/64	36.8	91.0	60.6	43.8	34.2	62.8	30.8	<b>69.0</b>
GW201	No Processing	10-12/64	<b>16.2</b>	97.3	53.1	29.0	39.3	70.0	29.0	<b>72.0</b>
GW201	No Processing	Ungraded	17.9	95.0	53.2	34.2	43.4	<u>70.2</u>	32.8	<u><b>73.9</b></u>
B401	Polished	Over 6	46.3	80.0	69.6		32.7		34.8	
B402	No Processing	Thru 6 slotted over 6 round	99.0	43.5	99.5		<b>14.6</b>		33.3	

The "Forsberg-polished" seed appears to have been injured somewhat in processing, since seed for this lot gave the poorest results, both in the field and on the blotters. The "Decorticator-polished" lot gave some reduction in % potential in the 6 replicated test; otherwise, none of the processed lots, except the "Forsberg-polished," show any consistent or definite indication of having been injured in processing, as no essential difference in % potential is indicated for any of these other lots.

The inherent possibilities with regard to single-germness are indicated by the results obtained from the mono and bi-ocular strains (B402 and B401), where 99.5 and 69.6 percent singles, respectively, were obtained in the field.

The results for the tests planted with the various drills are presented in Table 4.

Table 4. Field potential germination, expressed in percentage, for various lots of processed and unprocessed seed.

Treatment	Size	Exp.(a Drill	Comm.(b Drill	Commercial Drill	
				2+ lbs./A	4+ lbs./A
Segmented	7-10/64	63.2	53.7	60.8	66.0
Decorticated	7-10/64	65.4	44.2	59.3	63.9
Decorticated Mix.	7-10/64	68.1	<b>51.1</b>	58.4	62.1
Decorticator Polished	7-10/64	52.9	43.5	57.8	58.1
Forsberg Polished	7-10/64	50.7	39.0	54.0	52.6
No Processing	7-10/64		<b>46.0</b>		
No Processing	Ungraded	65.7			

a Planted at rate of 12 germinating units per foot of row.

b Average rate of planting—5.99 pounds per acre.

The "Decorticator-polished" and "Forsberg-polished" seed gave comparatively low percentages of potential in the Longmont plantings, but only the "Forsberg-polished" seed appeared inferior at Windsor. Also, com-

pared with unprocessed seed, there is some indication that these two products suffered some injury due to processing. Other comparative differences are small, and since there are fluctuations in the results between the different tests, in all probability there was not a real difference between the segmented, decorticated or "Decorticated mix" lots.

### SUMMARY AND CONCLUSIONS

1. Polishing studies indicated that whole seed which graded 10/64-inch in size, or smaller, might need only a light polishing to prepare it for commercial use, while larger seed must be cracked in some manner if the commercial product is to be graded to a 7-10/64-inch size.

2. Large variations were found *in* sizes between various lots of seed produced in different years at different locations for each of several varieties tested.

3. Segmented and decorticated seed produced, essentially, the same percentage of potential seedlings when planted in the field. Polished seed resulting from processing in the Forsberg Huller appeared to be of inferior quality compared with segmented or decorticated seed.