

GRADED WHOLE VS. SEGMENTED, PELLETED, AND SINGLE- AND
DOUBLE-GERM SEED IN FIELD GERMINATION TESTS

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Segmented seed was the logical result of a need for a reduced number of germs per seed unit. Practical methods for cracking or segmenting were quickly developed and were accompanied by processing refinements to the extent that segmented seed was widely adopted by the sugar beet industry since it resulted in net savings in hand labor for the spring work.

Some injury to the segmented seed pieces in the finished product was recognized, however; and because of this injury, plus the fact that the segmenting process is costly and wasteful of good seed, other alternatives are being considered.

There appear to be several possibilities for improving the processing of sugar beet seed, still maintaining the basic requirement of uniform size and small seed units. These are:

1. Grading of whole seed to remove the small seed units, perhaps up to 10/64" in size leaving only the larger seed balls to be segmented.
2. "Burring" or "decorticating" by various methods to remove the corky tissues from seed balls and to reduce their size.
3. Breeding for reduced number of locules in the seed ball.

Materials and Methods

Several lots of seed were used for this experiment, grading or processing having been done as indicated in the table of results. Most of the graded lots were prepared in the laboratory using hand screens. The burr reduction used for treatment 14 and the decortication for treatments 15-17 were done by the Engineering Department of the California Experiment Station at Davis. The Dow pellets were made by the Dow Chemical Company and the Filtrol pellets by the Filtrol Corporation.

The "single-" and "double-germ" material (B333) represents the F₂ generation from one open-pollinated single-germ plant (about 70% singles) found at Billings, Montana, in 1944. About half of the F₂ had been discarded as having more than 5% of multiple-flowered clusters. Locule counts for B333:

TABLE I

Treatment No.	Seed Lot	Locule No., % of Total			
		Singles	Doubles	Triples	Four
18	Over 7/64	9.4	87.0	3.4	0.2
19	Through 7/64 slotted	48.6	51.4	0	0
20	Through 7/64 slotted through 9/64 round	54.0	46.0	0	0
	Total population (calc.)	14.0	32.8	3.0	0.17

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It is of particular interest in this connection that of the entire seed lot (B333), only about 3.17% had more than 2 locules, 14.0% being singles and 82.8% doubles.

Plantings were made in the field in the spring of 1946 with 2 replicates on April 22, 2 more replicates May 10 and 8 replicates May 20. These were carefully planted by hand, 100 seed units per plot with a 6" spacing between units in the row. The stand counts for all 12 replications are Averaged in Table 2.

TABLE 2

GERMINATION STUDY - LONGMONT, 1946

Blotter germinations, averages for 2 samples of 100 seed portions, each.
Field germinations, averages for 12 replicates of 100 seed portions each.

Key No.	Variety and treatment of seed	How Germ.	No. Seedl. per Seed Unit				Total Seedl.	% Singles	Germ. %	% of Potential
			1	2	3	4 or More				
<u>GW83 - Segmented compared with whole ungraded:</u>										
1	Segmented, 7/9	Blotter	45.0	31.0	6.5	0.5	128.5	54.2	83.0	
		Field	19.7	11.4	1.4	0.1	47.1	60.4	32.6	36.7
2	Segmented, 7/10	Blotter	35.5	41.0	7.5	0.0	140.0	43.0	82.5	
		Field	24.1	12.8	1.2	0.1	53.4	63.3	38.1	38.1
3	Whole, ungraded	Blotter	28.0	38.5	14.5	4.0	164.5	32.9	85.0	
		Field	23.3	18.3	4.9	0.4	76.2	49.8	46.8	46.3
<u>GW49 - Whole graded compared with whole ungraded:</u>										
4	7/9	Blotter	46.5	21.0	1.0	0.0	91.5	67.9	68.5	
		Field	22.3	6.7	0.7	0.8	38.0	74.8	29.8	41.5
5	7/10	Blotter	46.0	26.5	1.0	0.0	102.0	62.6	73.5	
		Field	20.8	12.8	0.6	0.8	45.4	63.4	32.8	44.5
6	9/11	Blotter	35.5	39.5	4.5	0.0	128.0	44.7	79.5	
		Field	23.0	13.1	1.1	0.0	52.4	61.8	37.2	40.9
7	Over 11	Blotter	30.0	42.5	11.0	1.0	152.0	35.5	84.5	
		Field	22.9	20.7	5.4	0.5	82.8	46.3	49.5	54.5
8	7/8	Blotter	44.0	13.5	0.5	0.0	72.5	75.9	58.0	
		Field	18.4	5.0	0.3	0.0	29.2	77.6	23.7	40.3
9	8/9	Blotter	42.5	22.0	1.5	0.0	91.0	64.4	66.0	
		Field	22.6	8.4	0.5	0.0	40.9	71.7	31.5	44.9
10	9/10	Blotter	41.0	33.0	2.5	0.0	114.5	53.6	76.5	
		Field	25.3	12.0	0.3	0.0	49.5	68.8	36.8	43.2
11	10/11	Blotter	35.0	40.5	6.5	0.5	137.5	42.4	82.5	
		Field	23.0	14.2	1.5	1.6	56.0	59.3	38.8	40.7

Key No.	Variety and treatment of seed	How Germ.	No. Seedl. per Seed Unit				Total Seedl.	% Singles	Germ. %	% of Potential
			1	2	3	4 or More				
<u>GW49 - Whole graded compared with whole ungraded: (cont.)</u>										
12	Whole, ungraded	Blotter Field	32.5 22.3	38.5 13.2	8.0 2.1	0.0 0.1	133.5 55.2	41.1 59.3	79.0 37.6	41.3
<u>GW267 - Whole ungraded compared with burred and decorticated:</u>										
13	Whole, ungraded	Blotter Field	39.0 17.0	31.0 9.2	4.5 2.9	0.0 0.1	114.5 44.3	52.3 58.2	74.5 29.2	38.7
14	Burred 8/11	Blotter Field	30.0 21.5	42.5 9.1	7.0 1.4	1.0 0.1	140.0 44.3	37.3 67.0	80.5 32.1	31.6
15	Decorticated over 10	Blotter Field	27.5 7.8	22.5 3.0	3.5 0.3	0.0 0.0	86.0 14.6	51.4 70.3	53.5 11.1	17.0
16	Decorticated 7/10	Blotter Field	47.0 17.3	29.0 7.3	1.0 1.1	0.0 0.1	108.0 35.3	61.0 67.3	77.0 25.7	32.7
17	Decorticated 6/7	Blotter Field	71.5 21.4	17.5 4.3	0.0 0.1	0.0 0.0	106.5 30.2	80.3 82.9	89.0 25.8	28.4
<u>B333 single- and double-germ strain, screened to size:</u>										
18	Over 7/64, slotted	Blotter Field	35.5 26.8	26.0 12.2	1.0 0.7	0.0 0.0	90.5 53.2	57.3 67.3	62.0 39.8	58.8
19	Thru 7/64, slotted	Blotter Field	35.5 23.3	6.5 3.3	0.5 0.0	0.0 0.0	50.0 30.0	83.5 87.3	42.5 26.7	60.0
20	Thru 7/64 slotted thru 9/64 round	Blotter Field	8.0 9.1	0.0 0.4	0.0 0.1	0.0 0.0	8.0 10.2	100.0 94.8	8.0 9.6	127.5
<u>Segmented 7/9 Dow pellets compared with unpelleted (GW34 + GW201): (a)</u>										
21	803-2-GW	Blotter Field	40.0 22.3	6.5 2.2	0.0 0.0	0.0 0.0	53.0 26.6	86.0 91.4	46.5 24.4	50.2
22	801½-1-GW	Blotter Field	47.0 21.9	14.0 5.5	0.0 1.6	0.0 0.0	75.0 33.4	77.0 78.8	61.0 27.8	44.5
23	803-1-GW	Blotter Field	39.5 24.1	25.5 8.7	1.5 0.1	0.0 0.0	95.0 41.7	59.4 88.1	66.5 32.8	43.9
24	Check	Blotter Field	53.0 21.1	24.5 4.7	0.0 0.5	0.0 0.0	102.0 31.9	68.4 80.2	77.5 26.3	31.3

(a) No. 21 treated with 10% Arasan + 10% superphosphate + graphite.
 No. 22 " " 7½% yellow cuprocide + 10% superphosphate.
 No. 23 " " 10% Arasan + 10% superphosphate.

Key No.	Variety and treatment of seed	How Germ.	No. Seedl. per Seed Unit				Total Seedl.	% Singles	Germ. %	% of Potential
			1	2	3	4 or More				
Segmented 7/9 Filtrol pellets compared with unpelleted (GW92): ^(b)										
25	Pellets	Blotter	58.5	20.5	0.5	0.5	103.0	73.1	80.0	
		Field	20.6	7.0	0.8	0.0	36.8	72.8	28.3	35.7
26	Segmented check	Blotter	58.5	22.0	0.0	0.0	102.5	72.2	81.0	
		Field	17.9	6.0	0.7	0.0	31.9	72.8	24.6	31.1
Commercial lots of seed, widely varying in ave. locule number: (ungraded seed)										
27	GW59-43A1 High locule No.	Blotter	39.0	23.5	5.5	1.0	106.5	56.5	69.0	
		Field	16.3	10.8	3.0	0.3	48.1	53.8	30.3	45.2
28	GW49-42A High locule No.	Blotter	27.5	27.0	7.0	1.0	106.5	44.0	62.5	
		Field	18.3	11.3	2.4	0.3	49.4	56.7	32.3	46.4
29	GW49-41A 87.4% doubles	Blotter	35.0	19.5	7.5	1.0	101.0	55.1	63.5	
		Field	20.3	9.1	1.8	0.2	44.6	64.6	31.4	44.2
30	GW59-45R 87.2% doubles	Blotter	41.0	32.0	5.0	0.0	120.0	52.6	78.0	
		Field	26.1	17.8	2.7	0.1	68.6	56.9	45.9	57.2
31	GW59-44NM High in triples	Blotter	28.5	31.5	15.5	4.0	146.5	35.8	79.5	
		Field	18.1	12.9	4.3	0.8	59.7	50.3	36.0	40.8

^(b) No. 25 coated with 38% P₂O₅ equal to 5% of uncoated seed.

The germination was excellent (about 90% of potential) for the first date of planting (2 repl.), good (about 70% of potential) for the second date (2 repl.) and medium to poor (about 30% of potential) for the last planting (8 repl.). These being averaged, the results are probably fairly representative of a rather wide variety of conditions as may exist in practise in areas where rainfall is depended upon for germination.

It is somewhat interesting, although not necessarily unexpected, to obtain a relatively high percentage of singles (50 to 65%) from the various lots of whole ungraded seed used in this study, even though the percent of single-locule seed balls was less than 3% for each of these. These results are summarized in Table 3 in which the number of seed balls are classified by number of locules and the field germination by number of seedlings per seed planted.

TABLE 3

Seed balls classified by number of locules and field germination by number of seedlings. Figures are in percent. Only lots with ungraded whole seed included.

Variety		No. of locules or seedlings					
		1	2	3	4	5	6
GW49	Locules	2.2	62.4	32.0	3.2	0.2	0
	Seedlings	59.1	35.0	5.6	0.3	0	0
GW49-41A	Locules	2.4	87.4	10.0	0.2	0	0
	Seedlings	64.7	29.0	5.7	0.6	0	0
GW49-42A	Locules	0.6	40.2	39.0	19.6	0.4	0.2
	Seedlings	56.7	35.0	7.4	0.9	0	0
GW59-43A1	Locules	0	35.4	38.4	22.6	3.0	0.6
	Seedlings	53.6	35.5	9.9	1.0	0	0
GW59-44NM	Locules	1.0	41.6	56.2	1.2	0	0
	Seedlings	50.2	35.7	11.9	2.2	0	0
GW59-45R	Locules	2.2	87.2	9.6	0.8	0.2	0
	Seedlings	55.9	38.1	5.8	0.2	0	0

It is also of considerable interest that lots of seed of the same variety when produced under widely different conditions may vary considerably in the number of double- or multi-locular seed balls. Included in this table are data on 3 lots of GW49 and 3 of GW59, each of which was produced by mass increase as a commercial lot without selection. For example, the seed lot GW59-44NM had, by actual count, 41.6% of doubles and 56.3% of triples while GW59-45R had 87.2% doubles and only 9.6% triples. The percentage of singles remained low in all cases, although it is probable that most of the singles were lost through the slotted screen or over the draper in the original processing, and the real difference in singles might have been much larger than would appear from these data.

Summary and Conclusions

1. Grading whole seed results in an increase in % of singles similar to that observed for segmented seed.

2. The % of singles in the field was relatively high, even from the whole seed lots which varied from about 50 to 65%.

3. Under the conditions of this experiment the principal value indicated for segmented or graded whole seed would seem to be in the uniformity which facilitates precision planting. The % of singles arising from whole ungraded seed was probably high enough for practical purposes. Under conditions of better germination the percentage of doubles would have been expected to increase, whereas, under less favorable conditions the percentage of singles would have increased.

4. The single- and double-germ seed lot (B333) saved on a 7/64 slotted screen showed 67.3% singles, while the seed through a 7/64 showed 87.3% singles.

5. This type of precise test provides more accurate data than can be obtained by planter studies.