Processing Monogerm Seed

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Monogerm seed will have an advantage over processed multigerm seed only if its viable germs can be more uniformly distributed in the row. Two monogerm seeds per cell in the seed drill can result in as closely a paired condition on emergence as would be obtained with double germed processed seed. It is therefore obvious that the processing and grading of monogerm seed must be improved to produce a degree of uniformity in size and shape that will permit precision planting. At the same time the diameter and thickness of the drill cell must closely match the diameter and thickness of such carefully processed and graded seed. There is also the additional practical necessity at this stage of eliminating contaminating multigerm from monogerm seed.

Monogerm seed has a different shape than multigerm seed. This is well illustrated in Figure 1, drawn by Mrs. Merle Pierpoint of the Agricultural Experiment Station, Corvallis, Oregon. As shown, monogerm seed is disc like in shape, while multigerm clusters tend to be round in general outline.

The Blackwelder decorticator, in general use for processing multigerm seed, rolls the seed between a stone and a rubber disc. In doing so it breaks up the larger seed clusters, removes part of the cork, and the resulting particles tend to be spherical in general shape. This machine does not work quite so well with flat monogerm seed since fracturing of a seed cluster is obviously not required. The soft cork to be removed is attached only on the edges of the flat monogerm seed while it is attached irregularly on all surfaces of the multigerm seed. It was therefore concluded that a processing machine of different design might give better results.

The accepted practice of using round-holed screens to grade multigerm seed has its disadvantages for use with flat monogerm seed. Such screens measure in one dimension only and do not eliminate seeds which are too thin or too long. The inclusion of these abnormally shaped seeds requires the use of larger drill cell openings which in turn increase the chances of getting two seeds per cell of a drill plate which defeats the purpose of monogerm seed. This situation has forced certain processors to issue as many as four sizes of seed by grading between screens differing by only one-sixty fourth of an inch in round hole dimensions.

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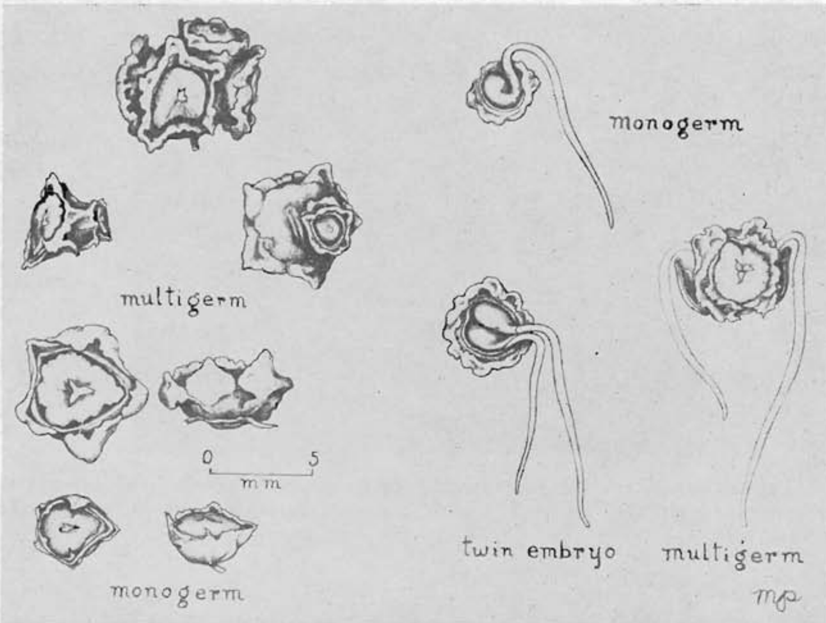

Figure 1.—A comparison of monogerm and multigerm seed size and shapes (drawings by Mrs. Merle Pierpont, Agricultural Experiment Station, Corvallis, Oregon).

Polishing and Two-Dimensional Grading

A special monogerm polisher was designed, built, and put into operation in Ladner, British Columbia, in conjunction with a two-dimensional grading system.

The first step in the process is to remove only a minimum amount of the soft cork surrounding the seed so that it will pass through a 10/64 round hole. This insures that the seed is below 10/64 in one dimension. This operation is accomplished by the machine illustrated in Figure 2. Here the seed is tumbled in a cylinder made of a screen with 10/64 round holes. Inside the cylinder are a set of discs with abrasive surfaces revolving in the opposite direction at about 800 R.P.M. When sufficient cork is removed the seed drops through the round openings. Since the seed is tumbling when ground, only the corky edges are worn down with no damage to the flat surface.

The dust and small seed is subsequently removed by passing the seed over a 7/64 round hole screen. The seed is then passed over a No. 13 indent cylinder which removes all of the seeds that are longer than 10/64 in any dimension. This is in essence sorting the seed for acceptance in a 10/64 drill plate opening.

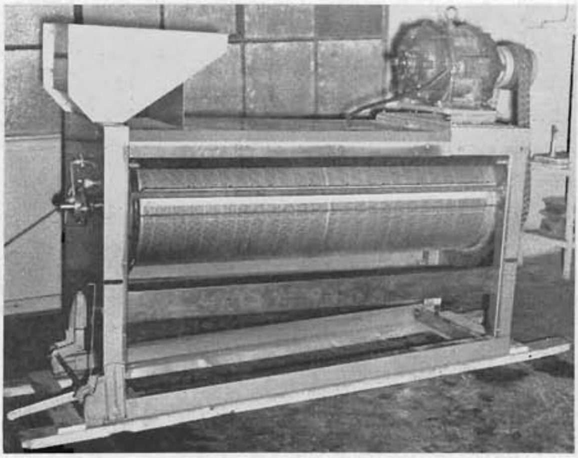

Figure 2.—A special monogerm polisher which removes a minimum amount of soft seed cork to permit passage through a 10/64 round-hole screen.

The rejected particles are recycled for further polishing while the selected seed is then ready for final grading. The monogerm fraction of the seed is a flat disc less than 10/64 in the largest dimension, while its other dimension varies from 5/64 to 10/64. Preliminary examinations of seed which tended to be close to 10/64 in both dimensions, or round in general shape, showed that this seed usually contained two or more germs, while the flatter seeds were always monogerm.

A wide selection of ribbed and slotted grading cylinders was made available for testing by the Hart Emerson Simon Company in Winnipeg. The ribs on these screens are designed to tip all disc-like objects on edge so that a genuine grading for thickness is achieved. The results of this grading are summarized in Table 1. It can be seen that seed passing through a 6¼/64 slot was 100% monogerm, while seed passing over a 7/64 was 91% multigerm.

The thickness range selected to suit the degree of precision required for planting under Alberta conditions was 1¾/64, and consisted of seed passing over a 5¼/64 ribbed slot and through a 7/64 ribbed slot. Seed thinner than 5¼/64 was discarded as it was found to have only 55% germination, while seed larger than 7/64 was round in shape and mainly multigerm in nature and was to be processed and sold as multigerm seed. The selected final sample (Table 2) was 94% monogerm and was used in the drill tests reported below.

Table 1.—Thickness Grading with Ribbed Slotted Precision Cylinders.

Description	Width of Slot	Percent of Ungraded Sample	Percent Monogerm	Percent Germination	Weight (grams) per 100 Germs
Ungraded		100	71	76	
Through	5/64	1.8	100	53	
Through	5¼/64	2.4	100	65	
Through	5½/64	6.7	100	61	.279
Through	5¾/64	13.6	100	61	
Through	6/64	7.6	100	64	
Through	6¼/64	13.4	100	69	
Through	6½/64	7.5	95	71	
Through	7/64	16.2	85	73	.277
Through	7½/64	14.5	41	83	
Through	8/64	11.1	6	82	.273
Over	8/64	5.5	3	91	

Table 2.—Commercial Thickness Grading.

Description	Width of Slot	Percent of Ungraded Sample	Percent Monogerm	Percent Germination
Ungraded	....	100	71	76
Through (Test II)	5¼/64	4	100	55
Through (Test II)	7/64	61	94	72
Over (Test II)	7/64	35	22	83
Through (Commercial)	5¼/64	8	100	
Through (Commercial)	7/64	67	92	
Over (Commercial)	7/64	25	6	

Pollution of monogerm with multigerm can arise from several sources. There is a planned pollution when a multigerm pollinator is used with a male-sterile monogerm. About 7% of the blend planted is multigerm pollinator but it usually produces more than 7% of the plants at harvest time. There is also the possibility of pollution by volunteer multigerms, with the further possibility that the original stock seed was not genetically pure monogerm. In all of these situations the need to separate multigerm from monogerm is obvious. Now that they can be separated it may be advantageous in many cases to use a multigerm pollinator with assurance that it can be cheaply removed from the hybrid seed. This would be of particular value where the yielding ability of the pollinator was greatly inferior to the hybrid as is usually the case, particularly if the pollinator is an inbred strain.

Germination of Monogerm Seed

The minimum germination for beet seed under the Canada Seeds Act is 75%. This was easily achieved under normal conditions. However, such will not be the case with monogerm seed as seen in Tables 1 and 2. Here the highest germination of pure monogerm was 69% while multigerm grown in the same field under identical growing and processing conditions germinated up to 91%. On a mathematical probability prediction basis where the germinability of single germs was 75% then the germination of multigerm seed would be 96%. These calculations were based on multigerm seed having 50% doubles, 30% triples, and 20% quadruples. Our experience to date, therefore, indicates that the standards of germination in monogerm may have to be modified in line with practical experience.

Germ Size

The weight per 100 germs was established for three thickness grades as shown in Table 1 by excising and weighing the germs. It was somewhat surprising to find the germ weight similar in all the samples. We expected to find that the monogerm germs would be heavier than the multigerm germs. While there was a slight trend in this direction it was likely too small to be of significance. There is no explanation as to why the 5½/64 seed should have as heavy a germ as the 7/64 seed.

Monogerm Drill Tests

Extensive laboratory drill tests were run by the Agricultural Department of Canadian Sugar Factories in Alberta, using drill cell dimensions to match closely the diameter and thickness of the monogerm seed processed by the new equipment. I.H.C. and John Deere drill units were mounted over a belt conveyor so that the moving belt approximated ground travel speed and drove the seed drill mechanism. The seed was dropped on to greased boards and its distribution was determined. Operating the units on the belt without the grease board for the equivalent of 1/100 acre drill travel permitted the seed and grindings to be collected and weighed. In these tests the 1960 thickness-graded seed was compared with the 8-10/64 round screen graded seed used in 1959. Although the trials included two ground speeds of 1.9 and 2.7 m.p.h. as well as spacings of 1, 1.5, and 2 inches, only the data on the faster speed of 2.7 m.p.h. and the widest spacing of 2 inches are reported in Table 3. Inclusion of the additional data would not alter the conclusions.

Table 3.—Monogerm Drill Tests.

Drill speed 2.7 M.P.H.

Spacing JD = 2.1 I.A.C. 2.0 inches
Seed/Ft. JD = 5.7 I.A.C. 6.0 inches

Type of Seed	Drill	Seed Plate Cell Size	% Grindings	Seed Distribution 100" Grease Board								
				Singles	Doubles	Multi.	Actual No. Seeds	Est. No. Seeds	Ratio A/E	Seeds per Foot	Actual Lbs. A.	Est. Lbs. A.
1959 8-10	JD	10x8	3.84	39.5	10	0	59.5	47.6	1.25	7.14	3.10	2.48
1959 8-10	JD	10x7	3.47	44.5	2	0	48.5	47.6	1.02	5.82	2.52	2.48
1959 8-10	JD	10x6	2.80	41.5	3	0	47.5	47.6	1.00	5.70	2.47	2.48
1960 5¼-7/-10	JD	10x8	3.20	40.5	4	0.5	50.0	47.6	1.05	6.00	2.90	2.76
1960 5¼-7/-10	JD	10x7	4.09	41.5	3	0	47.5	47.6	1.00	5.70	2.76	2.76
1960 5¼-7/-10	JD	10x6	3.47	44.5	1.5	0	47.5	47.6	1.00	5.70	2.76	2.76
1959 8-10	IHC	10x8	5.95	41.5	11	2.5	71.0	50.0	1.42	8.52	3.70	2.60
1959 8-10	IHC	10x7	4.82	35.5	9	0.5	55.0	50.0	1.10	6.60	2.87	2.60
1959 8-10	IHC	10x6	2.52	39.5	6	0	51.5	50.0	1.03	6.18	2.68	2.60
1959 8-10	JD	10.7x8	4.87	44.5	6	0.5	57.0	47.6	1.20	6.84	2.97	2.48
1959 8-10	JD	10.7x6	2.65	43.5	2.5	0.5	49.0	47.6	1.03	5.88	2.55	2.48
1960 5¼-7/-10	JD	10.7x8	3.62	44.5	4	0	52.5	47.6	1.10	6.30	3.05	2.76
1960 5¼-7/-10	JD	10.7x7	3.14	39.5	4	0	47.5	47.6	1.00	5.70	2.76	2.76
1960 5¼-7/-10	JD	10.7x6	4.34	40.5	2	0	44.5	47.6	0.93	5.34	2.58	2.76
1960 5¼-7/-10	IHC	11x8	6.74	41.0	10	0.5	62.5	50.0	1.25	7.50	3.63	2.90
1960 5¼-7/-10	IHC	11x7	1.40	43.5	6.5	1.0	59.5	50.0	1.19	7.14	3.45	2.90
1960 5¼-7/-10	IHC	11x6	2.20	38.5	6.5	0	51.5	50.0	1.03	6.18	2.99	2.90
1960 5¼-7/-10	JD	11.2x8	2.59	46.0	8.5	1	66.0	47.6	1.38	7.92	3.83	2.76
1960 5¼-7/-10	JD	11.2x7	2.09	48.0	4	0	56.0	47.6	1.17	6.72	3.25	2.76
1960 5¼-7/-10	JD	11.2x6	2.38	38.5	3	0.5	46.0	47.6	0.96	5.52	2.67	2.76

Plate thickness—In all of the comparisons, 8/64 was found to be too thick and permitted the sowing of too many doubles. When plates with 10/64 diameter holes were used, a plate thickness of 6/64 or 7/64 gave almost perfect distribution in most cases with the actual number of seeds and pounds per acre matching the estimated amounts very closely. Where cell diameters of 10.7, 11, and 11.2/64 were used the thinnest plates gave the best results in all but one instance.

Cell diameter—The preferred cell diameter is 10/64 with acceptable results from the 10.7/64 dimension. Diameter dimensions appear to be less critical than thickness dimensions. It is suspected that the use of the indent cylinder to remove off-shaped seeds has permitted the close matching of the drill size with the maximum seed diameter.

Type of drill—The results did not indicate any preference as regards to make of drill. Both gave equally satisfactory results when the proper plate thickness and cell diameter were used.

Grading procedures—The processing procedure followed in 1960 is recommended over that used in 1959, as the thickness grading of seed eliminated the thin seeds below 5¼/64, and the round multigerm above 7/64. It also permitted the inclusion in the same commercial seed of plump germs with a diameter below 8/64 which had to be discarded in the 1959 seed.

Conclusions

1. A method of monogerm seed processing and grading has been developed which has the following characteristics:
   a. Removes unnecessary cork without any apparent damage to the germ.
   b. Maintains the diameter of the seed as close to 10/64 as possible.
   c. Eliminates off-shaped particles through the use of indent cylinders.
   d. Eliminates thin germs by the use of ribbed cylinders with slots 5¼/64 wide.
   e. Eliminates a high proportion of the multigerms by the use of ribbed cylinders with slots 7/64 wide. The elimination of round particles permits the use of thin plates to match the disc shape of the monogerm.

2. Drill tests indicate the suitability for precision planting of drill plates 6/64 to 7/64 thick with cells 10/64 in diameter.

3. The practice of subdividing monogerm seeds into two or more size classes through the use of standard screens now appears unnecessary.