Methods of Preparation and Results of Field Planting of Various Types of Processed Monogerm Sugar Beet Seed

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The plant breeders have given the beet sugar industry single germ beet seed which is the greatest single boost toward attaining complete mechanization of the sugar beet crop.

In itself, the total benefits of monogerm seed are not completely realized until the seed is properly prepared and properly drilled. Only a small part of the potentiality of this new seed can be realized by simply grading the unpolished seed for size.

Typical single germ beet seed is rather flat with five projections in a star-shaped periphery. The rough shape significantly interferes with the uniform planting of the seed. Also, this rough-shaped cork, which varies in amount with varieties and climate, contains inhibitors that cause irregularity in germination and emergence unless the cork is evenly removed by processing.

When The Great Western Sugar Company first obtained a sufficient amount of single germ seed for study, work commenced on developing devices that might remove this corky material on the periphery of the monogerm seed units. First efforts were with segmenting machines, then decorticating equipment, and from this, progressively to a cylinder with large carborundum stones placed close together on a variable incline arranged so as to rub the seed as it traveled through the drum. This latter piece of equipment had some possibility, but it took as much cork off of the flat seed surfaces as it did off of the harder edge of the periphery. This modification did, however, improve planting ability of the seed by taking off some projections. After being sized in 2/64-inch portions, the finished seed still did not produce the satisfactory metering wanted when tested in drills.

It was found that by taking the monogerm seeds and rubbing them between the palms of our hands, a seed shape something like was sought could be produced. A machine with two continuous rubber belts about 20 inches wide, with one running adjustably at a higher speed was then constructed. The contact surfaces were pressed together with varying amounts of pressure. This turned the seed over and over and, in some respects, accomplished what could be done by rubbing it between the palms of your hands. Thousands of acres were planted with this type of

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preparation but, still, the results were not satisfyng although a seed that planted fairly well was obtained.

The use of a machine that gently removed the skin from rice kernels was the next idea suggested. After observing a commercial rice installation, a McGill miller was purchased to study how much cork need be taken off of the monogerm seed and how much could be removed without damaging germination and emergence.

The next step was the testing of the commercial Engelberg rice polisher which did very gentle polishing without appreciable germ injury. A total of seven or eight different kinds of equipment had been tested before the technique using the Engelberg machine was settled upon. Speeds for operating the huller were worked out with different settings to get the best results with various lots and strains of seed, along with other changes in processing equipment.

A study of typical monogerm seed shown in Figure 1 well explains the progress in removing the corky material.

Polishing the seed makes proper sizing and removal of non-germinating seed pieces mandatory in order to produce the best seed possible for the final purpose of accurate planting. Various divisions of the finished product were all submitted to final planter tests with three makes of drills, which gave us a gauge as to how well they might perform in the field.

Two of our seed processing plants have been entirely rebuilt. Changes include individually-driven Engelberg hullers, new six-screen clipper cleaners, two new Oliver gravity tables, new elevators, and drum separators for edge separation of any double germ seeds. In addition to fungicide and insecticide treatments, a graphite treatment is being added in 1962 universally on monogerm seed for smoother drill operation and more uniform flow of seed as proved in 1961 in commercial testing.

The next question asked was, "How close or narrow should the seed sizes be?" Segmented seed of The Great Western Sugar Company for many years has been 7-10/64 of an inch. This question of segmented seed sizing was subjected to test many years ago, in which sizes were separated into 1/64-inch, 2/64-inch and 3/64-inch size limits. It was found that, with the segmented seed, to get a uniform pattern of singles and a strong, uniform pattern of emergence, a combination of 3/64-inch sizes was needed.

With the monogerm seed, however, the situation is quite different. The germ of monogerm presently is 50 percent heavier by weight than the average bare germs in multigerm seed. This fact has given a much greater proportion of seedlings emerged,

as shown in Table 1 for 100 percent, 90 percent, and 80 percent germinating segmented and monogerm seed.

Great Western monogerm unprocessed strains initially vary between about 85 to 97 percent singles, and Table 1 shows an average of 90. Later field-emergence tables will show slightly more than 50 percent emergence of the monogerm, which then would be compared with about 33 percent emergence for multigerm. For example, 90 percent blotter germination would give five seedlings emerged at ten seeds per foot, while multigerm would have 4.4 plants or less, even though 33 percent more actual germs were planted.

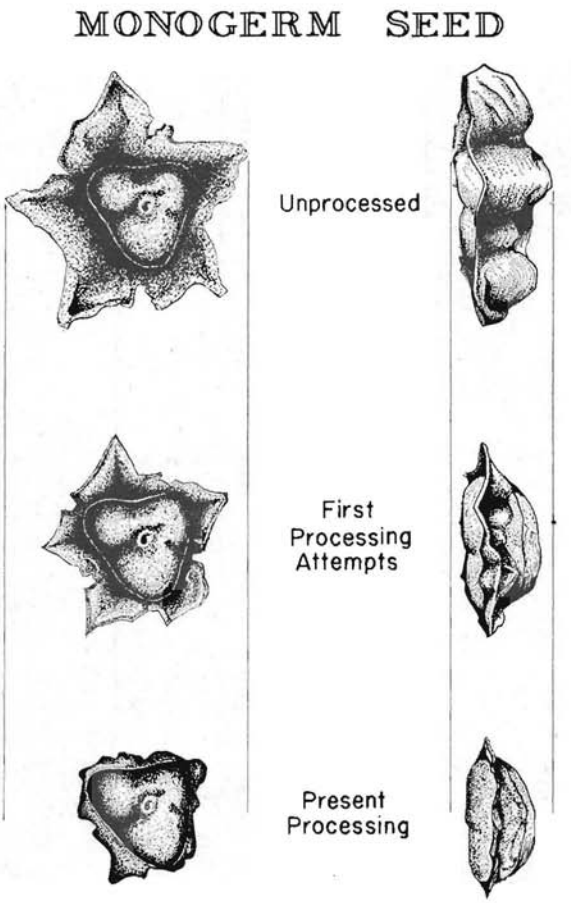

Figure 1

Table 1. — Field emergence comparison of 1960 processed mono—and multigerm seed.

% Blotter germination	Actual germs per 100 seeds		Actual germs at 10 seeds per foot		Emerged plants at 10 seeds per foot				Emerged plants at 6 seeds per foot			
					50% Emergence		33% Emergence		50% Emergence		33% Emergence	
	Monogerm	Multigerm	Monogerm	Multigerm	Monogerm	Multigerm	Monogerm	Multigerm	Monogerm	Multigerm	Monogerm	Multigerm
100	110	147	11.0	14.7	5.5	7.4	3.7	4.9	3.3	4.4	2.2	2.9
90	99	132	9.9	13.2	5.0	6.6	3.3	4.4	3.0	4.0	2.0	2.6
80	88	118	8.8	11.8	4.4	5.9	2.9	3.9	2.6	3.5	1.7	2.3

A study on emergence results was started in 1958 with monogerm seed, exploring the possibilities of a range of 1/64, 2/64 and 3/64 sizes. Skips were found in the beet row when sizes were widened beyond a range size of 1/64. When testing seed sizes in drills in the laboratory, more grinding was observed when as much as 2/64-inch seed size range was used and germination suffered as shown by blotter tests. Similar work was done at Colorado State University and by several implement engineering staffs in efforts to match seed plates and rotors to the finely-graded seed.

Accuracy in planting is confounded when monogerm seed is spaced two inches apart in the row and the planter is driven at a speed of three miles an hour, which means actually dropping 27 seeds per second. While the beet drill is not a discussion of this paper, engineers have proved that the beet seed needs to fit, not only the cell diameter of the plates, but also the thickness of the plate. Otherwise, too much cell fill (or too little cell fill) or grinding resulted. Many trials indicate the need for care in the sizing of seed, calibration, speed, etc., as well as careful machining and fitting of drill parts.

Testing of some seven devices for removing the outer cork, shows that a perfect round sphere can not be made out of all the seeds. You will note from Figure 1 that some of the seeds still have a slight amount of projecting cork attached. This means that in one direction those seeds may go through the same cell diameter just as well as a perfectly round polished seed. In another direction the projection will prohibit this and cause the seed to remain in the hopper. The best way to overcome this projection error is to dump the seed cans every eight to ten acres. The quantity of seed will not be great, but it will assist the grower in preventing skips in the field. In the past three years commercial plantings of some 280,000 acres of polished monogerm seed have given large-scale testing among growers.

The Great Western program was for the monogerm seed era to progress gradually with a policy of favoring growers who would agree to provide the type of drilling equipment necessary and adopt some chemical and mechanical practices to reduce labor requirements. This has made it possible to progress more rapidly in the direction toward total elimination of the need for field workers. In fact, in the last five years actual experience shows that Mexican Nationals, for example, now cover 36 percent more acreage during the thinning period than in the year just preceding these years. This type of program has kept failures with the new seed to a minimum.

Table 2.—Various factors as they affect labor performance.

Plot no.	Seeds per foot	Weed chemical	Inches containing beets	Percent singles	Machine work	Stand after thinning	No. hrs. labor per acre		
							Thinning	Weeding	Total
1	3	1 Lb. Endothal	12.6	94.45	No	109.8	0	14.5	14.5
2	8	1 Lb. Endothal	27.2	91.91	No	122.0	5.3	8.0	13.3
3	10	1 Lb. Endothal	32.3	83.90	Yes	131.2	5.5	3.1	8.6
4	10	None	34.3	84.55	Yes	119.4	6.0	4.0	10.0
5	10	None	34.3	84.55	No	123.6	9.1	5.3	14.4
6	10	None	30.8	61.69	Yes	113.6	14.1	3.3	17.4

Plots 1 to 5, 7-8/64" Monogerm Seed; Plot 1, Weeded Once.
Plot 6, 7-10/64" Segmented Seed; Plots 2 to 6, Hoe Thinned & Weeded

Table 3.—Comparative results, polished monogerm vs. pellets.

No. of comparisons	Polished Monogerm			Pellets		
	Size	Inches/100 with beets	% Singles	Size	Inches% with beets	% Singles
13	6-7/64	26.7	89.6	10/64	23.9	94.1
2	7-8/64	29.7	89.9	12/64	25.3	91.4
22	7-8/64	26.5	87.5	10/64	22.3	91.3
9	8-9/64	24.9	81.9	12/64	23.6	79.1
8	9-10/64	26.5	82.8	10/64	20.2	92.0

Table 4.—Field comparison of processed seed.

Number of Tests	Polished monogerm sized to 1/64" range		10/64" Pellets[1]		7-10/64" Segmented	
	Inches containing beets	Percent singles	Inches containing beets	Percent singles	Inches containing beets	Percent singles
8	28.7[2]	90.6[2]	25.1	94.2		
22	26.5[3]	87.5[3]	22.3	91.3		
9	26.5[4]	82.8[4]	20.2	87.2		
4			25.7	88.9	21.6	61.9

[1]Pellets Made from 7-8/64" Polished Monogerm
[2]6-7/64" Polished Monogerm
[3]7-8/64" Polished Monogerm
[4]8-9/64" Polished Monogerm

Table 2 shows a comparison of five monogerm and one segmented seed plantings with different seeding rates. Three were herbicide-sprayed and three were machine-thinned. A 20-acre field was devoted to this work. The Endothal chemical gave full weed control up to normal thinning size. As can be seen in the column showing total hours for labor, planting to a stand and using Endothal required more time than when more seeds were planted and the mechanical thinner was used.

In 1959 there were 54 field comparisons of four sizes of single germ seed and two sizes of pellets (Table 3). In total, over one thousand 100-inch counts were made. At the same planting rates, the polished monogerm came up an average of 2.45 days quicker and gave 16.3 percent more emerged seedlings, although with slightly less singles in consequence.

In 1960, on 43 field tests, polished monogerm (in four 1/64-inch size ranges) was compared with 10/64-inch size pellets (coated 6-7/64-inch polished monogerm) and 7-10/64-inch segmented multigerm seed. These were planted in Montana, Wyoming, Nebraska and Colorado. As shown in Table 4, the bare monogerm again was highest in emergence and comparable in singles with the coated seed.

Averages of 1960 Results

Seed	% Stand	% Singles	Complete emergence
Polished Monogerm	26.95	87.05	53.9
10/64" Pellets	22.70	90.70	45.4
7-10/64" Segmented	21.60	61.90	27.7

Conclusions

1. After several years of laboratory field tests and commercial use on large acreages, The Great Western Sugar Company is convinced that it is possible to plant the new rice huller polished monogerm seed with considerable success if the seed is sized carefully and the drill seed plate or rotor used has proper tolerances, both in depth and width.
2. It has been advantageous to size the open-pollinated, back-cross-bred monogerm seed to 1/64-inch size ranges in order to have close tolerances for proper drilling which results in precision seed distribution.

3. Seeds less than 4/64-inch in thickness are removed by careful operation of the Oliver Steele gravity table. Each size seed is put over the gravity table before final treatment to bring about maximum germination.
4. Multiple or double germ units are separated from the singles easily in a Carter drum separator.
5. Treatment of the seed with graphite, in additon to ordinary fungicide and insecticide, improves flowability and drill operation.
6. Removal of most of the corky material reduces the effect of inhibitors retarding germination, and uniformly speeds emergence of seedlings two to three days faster than original seed.
7. In over one hundred field comparisons, the rice huller polished seed proved superior to both segmented and coated monogerm in percentage of seedlings emerged.