

Segmenting and Processing Sugar Beet Seed

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Segmenting beet seed to obtain maximum quality and germination with minimum loss presents a tremendous problem to the seed plant operator. In this report I would like to present some of the problems confronting the operator and pass on to you experiences we have had in the past for possible mutual benefit.

The Great Western Sugar Company has set a standard of 70 percent germination, 60 percent singles, and a minimum of 30,000 seed balls per pound on segmented seed issued to farmers. All segmented seed is graded 7/64 to 10/64. In the germination laboratory all abnormal plants resulting from injury in the segmenting process are counted as non-germinating. We feel that this standard gives us a product of high quality for present planting equipment. Higher standards will be desirable when precision planters are perfected.

Pregrading of Seed and Its Effect on Segmentation

Theoretically, pregrading of whole seed before segmentation would be very desirable; small whole seed passing through the 10/64 screen would be added to the segmented large seed. Screen tests on two varieties of seed to be segmented this year were made at, each seed plant to find the range of seed sizes and determine whether the small whole seed passing through the 10/64 screen could be added to segmented seed coming from the segmenting units. The results obtained from the small whole seed (7/64 to 10/64) are given in table 1.

Table 1.—Results with small whole seed.

Factory	Kind of seed	Percentage germination	Percentage singles	Percentage of total
Billings	US 33	88.5	88.7	54.5
	GW 59	76.3	87.1	19.2
Sterling	GW 59	55.2	66.9	50.9
	GW 34	35.1	72.3	30.4
	GW 07	57.6	53.1	15.7
Scottsbluff	GW 59	59.7	45.7	13.6
	GW 87	49.8	68.4	24.2
Longmont	GW 59	48.4	88.9	12.9
	GW 49	62.0	59.7	15.3

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This table shows that each type or variety of seed presents a different problem in processing. The GW 59 located at Billings was the only seed meeting the standard of 70 percent germination and 60 percent singles. Some of the varieties represented would require segmentation to produce the desired singles or a greater loss in recovery of the larger seed when segmented would be necessary to offset this difference. Seed with low germination and a high percentage of singles could be built up to the standard by gravity table work. Low germinating seed such as the GW 34 located at Sterling would give a low recovery from the gravity table.

The following preliminary test on pregrading and segmenting was conducted at Longmont. One hundred bags of GW 49 were graded into small whole (7/64-10/64), medium whole (10/64 to 12/64), and large whole (12/64 to 19/64). The small whole seed was run over the gravity table to bring the germination to standard as the seed was graded.

Table 2.—Results of grading (11,100 pounds of seed introduced).

	Pounds	Percentage of total	Percentage germination	Percentage singles
Large seed recovered	3,857	34.75	90	
Medium seed recovered	3,984	35.89	72	
Small seed recovered	2,505	22.88	85	50
After gravity separation Loss	954	8.68		

The loss reported is rather large and is attributed to loss of small seed from gravity separation, dust and trash removed, and filling of elevator boots.

The medium and large grades of seed were segmented separately with the following results:

	Introduced	Segmented recovered	Percentage recovery	Percentage germinated	Percentage singles
Medium	3,984	2,170	54.47	74	56.8
Large	3,857	1,745	45.24	78	50.6

Combining the small whole, medium segmented, and large segmented gave a total of 6,210 pounds or 55.95 percent recovery of the original total, with a probable germination of 78.4 percent and 55.1 percent singles.

Fifty bags of the seed was segmented from the stack without grading for comparison. Results follow :

Introduced	Segmented recovered	Percentage recovery	Percentage germination	Percentage singles
5,550	2,500	45.05	74	68.9

Summary

Programing in this test gave an increase in recovery of 10.9 percent; the final mixture would fail to meet germination standards for percentage singles. To meet this standard, lower total recovery would be necessary. Germination results of the ungraded seed indicate an increase in recovery would meet the germination standard. On this basis, pregrading of this variety of seed would not increase recovery materially.

Segmenting of beet seed is primarily a reduction in the size of the seed ball to pass through the 10/64 screen and remain on the 7/64 screen, in this reduction we expect the seed ball to break along lines of cleavage, producing as many single germ seed units as possible. Large seed requires a greater reduction in size and results in lower recovery.

Small whole seed from varieties used in segmenting should be tested for germination and mixed with the larger seed as it is segmented if germination results indicate this process is feasible.

Types of Segmenting Devices and Their Effect Upon Quality of Product and Recovery

Two types of segmenting units are used in the Longmont plant, the original California type (Bainer), and a double wheel unit. Two changes were made on the California machine last year, resulting in increased capacity and quality of product. The shear bar was lowered 1 inch below the center of the stone and the hopper was rebuilt to utilize the full cutting edge of the shear bar and is adjustable for distance from the stone. Strips of carbaloy have been inserted in the shear bar for use this year, eliminating frequent changing of this bar.

The double wheel unit has two stones rotating in the same direction. One stone revolves at 880 r.p.m. the other at 18 r.p.m. The fast wheel is mounted on a stationary shaft and the slow wheel is adjustable for distance between the stones. The hopper is constructed to utilize the full surface of the stones. A general comparison of these two units on the following points follows:

Shearing Effect.—The California unit has a definite cutting effect upon the seed as it is forced between the stationary shear bar and the stone; as a result many seed units are flattened.

The double wheel unit has more of a crushing effect upon the seed. The slow wheel acts as a movable shear bar and rotates the seed as it passes through the opening between the stones; as a result the seed units are rounded.

Discard or Trash.—Trash from the California type unit is more finely ground with a large percentage of dust. More cork remains on the seed from the double wheel unit.

Return (Seed passing over the 10/64 screen and reintroduced to the segmenting units).—Return from the California type unit is definitely greater because more of the seed is flattened in the shearing process, making the seed less adaptable for screening.

Adjustment.—The double wheel unit is more sensitive to adjustment and requires more frequent checking.

Recovery.—Recovery from the double wheel unit is slightly greater when set to produce the same germination. This point will be tested further for final analysis.

Screen Sizes.—Seed from the double wheel unit is larger than that from the California type.

Capacity.—The California type unit had a greater capacity by 30 pounds of whole seed per hour on one comparative test.

Germination and Percentage of Singles.—Tests indicate from 2 percent to 6 percent greater singles from the double wheel unit when settings are made for the same germination.

Table 3 gives comparative results of recovery, percent germination, percent singles, and screen size of the final product. "Whole seed used in this test germinated 71.5 percent.

Table 3.—Results with California type unit.

Recovery setting	Percentage Germ.	Percentage singles	Size of seed in percentage of total		
			10/64-9/64	8/64-7/64	9/64-8/64
60.5	68	62.6	15	43	42
66.4	68	61.8	23	40	31
68.7	68	60.3	23	29	28
Double wheel unit					
66.0	67	62.2	22	40	29
66.8	67	72.8	38	41	21
68.0	62	72.6	40	40	20
64.0	56	65.2	42	45	18
68.0	67	60.4	44	39	17
70.0	66	66.7	44	39	17

Grading and Cleaning of Segmented Seed

Seed from the segmenting units is screened over a Clipper Cleaner (Model -Super 29 D). The combination of screens used are 10/64, 6/64, 8/64, and 7/64. Seed passing over the 10/64 screen is reintroduced to the segmenting units for further sizing; germ material passing through the 6/64 screen is sold for livestock feed. Seed passing through the 10/64 screen and remaining on the 7/64 screen is run over the gravity table to bring the germination up to standard. Everything through the 7/64 screen is discarded. In segmenting seed of low germination, we remove all the low germinating seed possible by air adjustments on the Clipper; this makes it possible for a better separation on the gravity table.

Gravity Table.—In 1945 the gravity table was used in three of the plants producing segmented seed for the Great Western Sugar Company. The purpose of the gravity table in our operation is to produce the 70 percent standard of germination.

Maximum results are obtained from the gravity table when all adjustments are working in perfect harmony with each other. These adjustments include lateral slope, longitudinal slope, lower air blast, upper air blast, rate of feed, and rate of oscillation. At Longmont we have found that a longitudinal elevation of 2 1/2 inches and a lateral elevation of 1 1/2 inches gives good results in most cases; however, these elevations are changed as the need arises. Using this as a base to work from, adjustments of air blast, rate of oscillation, and rate of feed are used to give the proper distribution of seed over the table. We rely entirely upon the "starch test" in setting this machine, preliminary germination tests give a fairly accurate difference to expect from the "starch test" and the actual germination.

Seed from the lower end of the table having a germination of 10 to 15 percent is discarded. If it is necessary to remove a portion of the seed from the center section of the table to secure the desired germination on the upper end, this seed is re-run over the table with different adjustments and later blended with other seed.

Most varieties of seed react quite favorably to gravity separation. Segmented seed gives better results than whole seed because of less resistance to the air blasts as a result of removal of the cork. In our operation here I feel we have experienced both extremes for separation. One particular variety would not respond favorably to gravity separation as whole seed or as segmented seed, regardless of adjustment.

Aspirators.—Aspirators were used at Sterling, Colo., and Billings, Mont., last year. My experience with an aspirator was on an

experimental basis 2 years ago. the results of which were quite gratifying.

New Methods of Seed Processing

Decortication and Burr Reduction.—During the summer a number of lots of whole seed low in germination were reprocessed to build up germination by gravity table separation for use in segmenting this winter. Some lots of whole seed do not respond to gravity separation favorably because of an excessive amount of cork which offers a high resistance to the air blasts of the gravity table. Decortication or burr reduction would be very desirable in processing seed of this character. To accomplish burr reduction, seed was put through the double wheel segmenting unit, using an opening between the stones that would let the larger seed pass through without breaking the seed ball. The contact of the seed on the stones resulted in burr reduction which definitely improved the performance of the gravity table. Light seed low in germination was pulled off by the clipper cleaner fans before it entered the gravity table. An example of the work done follows (Seed used was GW 94, California production, having a germination of 43 percent) :

Seed introduced, Seed recovered	Percentage of total recovered	Percentage germination
974	625	64.3
Germination of seed discarded by gravity table		26 percent
Germination of seed discarded by clipper cleaner		25 percent

Results of other lots of seed processed in the same manner were quite comparable to this test. In using the double wheel segmenting unit for decortication or burr reduction we realize the larger seed is affected more than the smaller and that it is not a perfect method of decortication. Results indicate decortication by improved methods would be very desirable when germination of whole seed must be raised by the gravity table or aspirator.

Preliminary tests in segmenting decorticated seed indicate a high recovery.