EXPERIENCES WITH SEGMENTING MACHINE AND GRAVITY TABLE

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In the production of segmented seed two processes are employed. First, the segmenting which includes the cleaning of the seed after segmenting; and the remilling by the use of a gravity table or an aspirator. The function of the first is to separate the multiple germ seedballs into units containing but one germ and the object of the second operation is to improve the germination of the segmented seed.

In order to secure the best results the operator must be familiar with the possibilities and limitations of the machines used in both operations.

The Segmenting Machine

First let us consider the segmenting machine. In our work we use the Bainer machine.

In adjusting this machine to secure the best results the operator has four objectives toward which he is working.

1. A maximum percentage of single-germ units.

2. A minimum loss in germination.

3. A maximum recovery

4. A maximum capacity.

The first question confronting the operator is: Can perfection in all these points be secured at the same time? The answer is, no.

Unfortunately the nature of the process is such that perfection in all four points cannot be reached at the same time, therefore, a compromise must be reached which gives the best attainable combination of the points in question.

In order to arrive at the optimum adjustment of the segmenting machine we must have a starting point. Our experience indicates that the most logical point is the adjustment of the machine so as to secure the maximum recovery of the seed to be worked. In arriving at this point we use the "screen test."

Before the screen test can be applied the operator must determine what screens are to be used in preparing the segmented seed for planting. Our screen combination in the clipper is:

1/ In Charge Expxriment Station, Great Western Sugar Company, Longmont, Colorado.

First a 10/64-inch screen followed by 6/64, 8/64, and 7/64 in the order named. Seed passing over the 10/64 screen is returned to the segmenting wheel; the 6/64 screen removes the fine trash and the liberated germ material. This is sold for feed. The 8/64 screen relieves the load on the 7/64 screen, the seed passing over it uniting with that passing over the 7/64 screen, the two making up the seed for planting after it has passed over the gravity table. All material passing through the 7/64 screen is waste. With this combination of screens the 10/64 and the 7/64-inch screens are used in making the screen test.

In making the screen test the anvil of the segmentor is set so that it is very obvious that the seed is not cracked enough. A sample of seed is caught as it comes from the wheel. This is put over the screens mentioned and three fractions secured. The one remaining on the 10/64 screen is "return," the seed remaining on the 7/64 screen is called "recovery;" and the material passing through the 7/64 screen is "trash" or "discard." The anvil is then adjusted closer to the wheel by gradual stages. A sample is secured at each setting and screened. The several fractions are recorded as percentage of the total weight of the sample. The results of such a procedure are shown in the following table:

Anvil Set	Return	Recovery	Trash	Calculated recovery
1 *	69.5	22.5	8.0	38.13
2	60.5	28.0	11.5	44.94
3	40.5	42.5	18.5	47.23
4	23.0	52.0	24.0	65.19
5	5.5	52.0	43.0	51.16
6	2.0	37.5	123.0	38.25

* Set 1 is the widest and set 6 the closest.

The greatest recovery was secured at the fourth position of the anvil.

The calculated recovery takes into consideration the return seed and is secured by the following formula:

$$\frac{(xy)-y}{x} \quad \text{Calculated recovery}$$

x % return
y % recovery

This formula is based on the assumption that the same recovery is secured from the return seed as is shown by the screening of the original sample. This is not exactly correct, however, because there is a slight loss every time the return passes through the wheel. Therefore, the calculated recovery is slightly too large. The clipper may remove some material that remains on the 7/64 screen in which case this also would contribute to making the screen test too large.

In order to determine the error a test run was made which showed the actual recovery from the clipper was 5 to 6 percent lower than the screen test. This may vary with different lots of seed.

Having arrived at the optimum anvil setting for recovery at the wheel the next step is to determine the quality of the segmented product. This can only be done by a regular laboratory germination. Since this requires too much time and it is impossible to determine the percentage singles by the crack test about the only thing is to pass the seed from the segmentor through the aspirator or over the gravity table, whichever is being used. After this is done a crack test will serve to adjust the aspirator or gravity table so as to secure the desired germination in the finished product.

With the seeds we are working it has been found that the crack test must be discounted 12 to 15 points to give the laboratory germination. This correction probably varies with different lots of seed.

If the final results are not satisfactory, the question is, what can be done about it?

If the capacity of the plant is too low the first thought is to open the anvil so that more seed will pass through the wheel in a given unit of time. As a matter of fact such a procedure will reduce capacity. A test run showed that increasing the return seed 64 percent reduced the capacity 13 percent without materially affecting the recovery. The effect on germination has not been determined for the final product. The seed coming from the wheel would be affected as follows:

1. Loss in germination would be reduced.
2. Loss in seed would be increased.
3. The percentage singles would be reduced.

If the percentage singles is too low, this can only be raised by closing the anvil so as to crack the seed finer. This will result in the following changes in the seed as it comes from the segmentor.

1. Increased loss in germination.
2. Increased loss in seed.
3. Decrease in capacity.

If the seed from the segmentor shows too much drop in germination, the only way to reduce this drop is to widen the space between the anvil and wheel. This will result in these changes.

1. A decrease in loss of seed.
2. A decrease in capacity.
3. A decrease in percentage singles.

It is very apparent that the results you secure in any given three points will depend upon what you demand in connection with the fourth point.

There are a number of questions in connection with the operation of the segmenting machine which our experience sheds some light on. These are:

Do all seeds segment in the same way?

Two lots of seed were segmented with the anvil set the same. These did not respond to segmenting at all the same as the following will show:

Kind of seed	Germination		Loss	% Recovery
	Original	After Segmenting		
A	78.7	54.3	21.4	64.7
B	53.0	38.0	15.0	56.0

In this study the anvil was set at the optimum for both seeds.

Does grading before segmenting help?

Seed was graded by 10/64, 8/64, and 6/64-inch screens. The seed remaining on the 10/64 screen was termed large and that passing through the 10/64 and remaining on the 8/64 screen was called medium. The seed passing through the 8/64 screen and remaining on the 6/64 screen was called small. This latter was worthless because of its extremely low germination. A portion of the seed was segmented before grading and the two fractions secured by grading were segmented separately, the anvil being adjusted so as to get the best results with each fraction. The results are given below:

	Recovery	% Germination	% Singles
Cracked before grading	60.64	50.0	-
Cracked separately and combined	73.5	41.3	83.6

These figures do not indicate any advantage in grading seed before segmenting.

Polishing Seed

Two seeds were used in the study to determine the effect, removing all excess corky matter from the seed before segmenting.

In both instances the germination of the rubbed seed was higher after segmenting than that of the unrubbed and the percentage singles was lower. This indicated that the rubbing had reduced the size of the seed so that the seed was not altered as much in passing through the segmentor as the unrubbed seed was.

Will double segmenting prevent loss in germination?

One portion was segmented with the anvil set at the optimum position. Another was segmented with the anvil set wider than optimum and then run through again with the anvil set at optimum.

The portion run through the segmentor only once lost 18 percent in germination and the one double segmented lost 16.1 percent.

Should seed be segmented before mixing or segmented separately and then mixed?

The evidence secured from studies indicates that it all depends upon the seeds to be mixed. When the components of a mixture are similar in physical makeup there appears to be no advantage. If they respond differently to the process of segmenting there is no doubt that segmenting before mixing is advantageous.

The Gravity Table

unchanged, Changing Longitudinal Slope.- With lateral slope remaining / changing longitudinal slope from 1-1/2 to 1-7/8 inches makes changes in recovery from the gravity table as follows:

Spout	Percentage Total		Germination	
	1-1/2 x 1-1/2	1-1/2 x 1-7/8	1-1/2 x 1-1/2	1-1/2 x 1-7/8
1	42.19	33.91	93.0	95.5
2	15.94	16.25	77.5	78.5
3	5.94	7.19	70.5	79.0
4	9.06	10.00	65.0	68.8
Total	73.13	67.35		
5	24.69	26.25	23.0	26.0
6	3.00	3.28	3.5	2.0

Increasing longitudional slope reduces recovery and increases germination.

Raising deflector on overhead air

Spout	Percentage of Total Height of Deflector		
	7/8"	1-1/4"	1-1/2"
1	33.61	39.23	38.61
2	8.56	14.80	15.36
3	2.49	6.34	6.62
4	7.32	10.57	11.27
Total	51.98	69.16	71.86
5	38.91	25.53	25.22
6	9.11	3.52	2.92

Raising the deflector increases the amount of seed in the heavy fractions (1 to 4) and reduces it in the light ones, (5 and 6).

Increasing air overhead.

Spout	Air Set 45 Degrees			Air Set 90 Degrees		
	% Total	Germ.	Singles	% Total	Germ.	Singles
1	30.00	91.5	48.10	20.61	89.5	45.80
2	3.44	85.0	63.53	2.50	82.0	57.30
3	3.13	78.5	-	1.88	84.5	52.60
4	10.63	69.5	-	9.06	79.0	66.46
Total	47.20			34.05		
5	49.38	38.0	89.5	61.25	41.0	76.8
6	2.50	8.0	87.5	3.75	10.0	100.0

Germination spouts 1-4 85.2, 45° - 85.8, 90°

Increasing volume of overhead air reduces amount of seed recovered from spouts 1 to 4 and increases the amount of waste, spouts 5 and 6.