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Selection and Preparation of Seed Potatoes -- Size of Seed Piece and Bud Variation

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SELECTION AND PREPARATION OF SEED POTATOES—SIZE OF SEED PIECE AND BUD VARIATION.

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SUMMARY

(1) The average yield from potato seed pieces of equal size, was 5.55 bushels per acre, higher when select tubers were used for seed than when "culls" were used for seed. Page 103.

(2) Thus the present bulletin furnishes quantitative data, supporting the theory that the use of culls for seed, will cause a variety of potatoes to "run out", the effect being measurable in the first generation. Page 103.

(3) The present Bulletin enforces the conclusion of Bulletin No. 140, namely yield per acre definitely is influenced to vary definitely with increase in size of seed piece. Page 107.

(4) For the highest yield of the finest tubers, use select seed potatoes. Page 108.

SELECTION AND PREPARATION OF SEED POTATOES—SIZE OF SEED PIECE AND BUD VARIATION.

By A. N. Hume, Agronomist and Superintendent of Substations and Manley Champlin, Assistant Agronomist and Collaborator and *I. S. Oakland, Assistant Agronomist.

Results published in this Bulletin are a continuation of South Dakota Bulletin No. 140. In said Bulletin, the results of a one year experiment in comparing yields from large seed tubers and from small seed tubers are put down.

A given amount of seed potato tubers was divided into two portions, which portions were designated as made up of (1) large, and (2) small tubers respectively, both the large tubers and the small tubers were quartered lengthwise, resulting in two corresponding sizes of seed pieces, namely "large" seed pieces and "small" seed pieces.

Obviously in this instance the large seed pieces were large because they were cut from large tubers and the small seed pieces were small because they were cut from small tubers. The average yield as reported in Bulletin 140 was in one instance 28 per cent greater from large seed pieces than from small seed pieces, and in another instance 20.4 per cent greater.

It was stated in Bulletin No. 140: "Evidently in the present experiment the higher yield from large seed tubers may have been due in part to the size and in part to the heredity of the seed tubers. Suffice it to say here that for the practical potato grower, under the conditions of this experiment, the selection and use of only good sized seed tubers would prove more profitable than the use of culls.

The results of the present bulletin are designed to add some information concerning the relative influence which mere size of seed piece and heredity may have had in giving rise to the greater yield secured from the large seed pieces.

*Resigned, March, 1914

PLAN OF EXPERIMENT

In order to secure information which shall discriminate between the two factors suggested, namely, heredity of seed piece and size of seed piece, it was necessary to plant five separate kinds of seed pieces as follows:

(1) Seed pieces of a given size taken from selected tubers.

(2) Seed pieces of this given size taken from small tubers or culls.

(3) Small seed pieces cut from tubers of a given size.

(4) Medium seed pieces cut from tubers of a given size.

(5) Large seed pieces cut from tubers of a given size.

Two varieties of seed tubers were employed, namely, Early Ohio and Carmen No. 3. In the above classification into kinds of seed tubers, those called selected tubers in the case of Early Ohio weighed 6.15 ounces each, as an average. Those called selected of Carmen No. 3 tubers weighed 8.40 ounces each as an average. The Early Ohio cull tubers weighed 1.88 ounces each as an average and the Carmen No. 3 culls weighed 2.08 ounces each as an average.

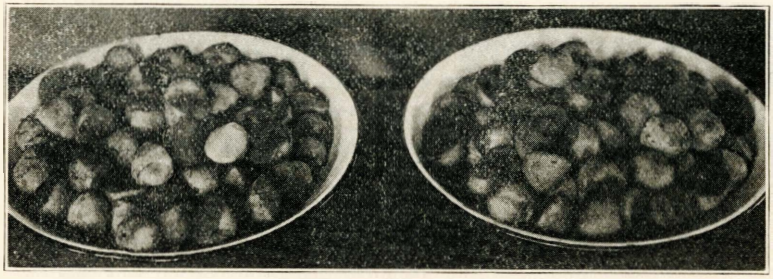

Fig. I.—Early Ohio seed pieces from "Cull" and "Large" tubers. The culls are on the left, and the large tubers on the right. Each seed piece has but one eye.

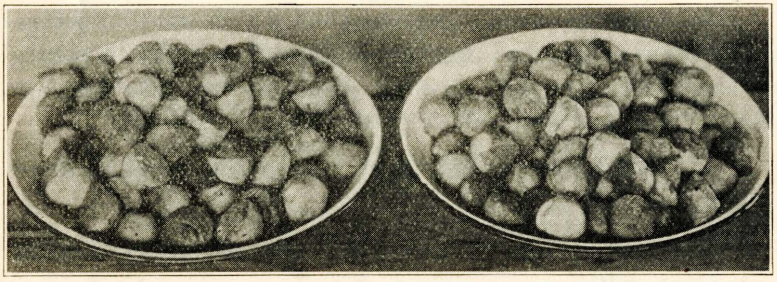

Fig. 2—Carmen No. 3 seed pieces from "Cull" and "Large" tubers. The culls are on the left, the large tubers on the right. Each seed piece contains but one eye.

The seed pieces of both first and second kinds in the classification above were all of a given size, namely, .42 ounces. They were all removed from the seed tubers, of whatever kind or variety, with a small hand circular knife or "skewer" adapted for the purpose.

BUD-VARIATION AND YIELD

Obviously yields from potato tubers of the first and second kinds, when compared, would give information upon the influence which different seed tubers might have upon yield, regardless of size of seed piece itself—this for the reason that the size of the seed piece was the same in all cases. The following table summarizes the yields of the rows planted alternately with the first and second kinds of seed pieces respectively, i. e. with (1) seed pieces cut from selected tubers and (2) seed pieces cut from culls.

TABLE I.

Comparison of Yields From Seed Pieces Taken From (1) Selected Tubers and (2) Culls.

Row No.	Name of Variety	Size of tuber from which seed piece was taken	Weight of tubers harvested, Lbs. from row	Bushels per acre	Average difference in favor of large tubers as compared with adjoining rows (bu. @ acre)
1	E. Ohio	1.88	5.8	77.3	
2	E. Ohio	6.15	7.3	97.3	20.0
3	Carmen No. 3..	2.08	6.3	84.0	
4	Carmen No. 3.	8.40	6.5	86.7	2.7
5	E. Ohio	1.88	9.1	121.3	
6	E. Ohio	6.15	7.6	101.3	—20.0
7	Carmen No. 3..	2.08	6.8	90.7	
8	Carmen No. 3..	8.40	8.0	106.7	16.0
9	E. Ohio	1.88	8.8	117.3	
10	E. Ohio	6.15	8.3	110.7	—6.6
11	Carmen No. 3..	2.08	8.0	106.7	
12	Carmen No. 3..	8.40	8.5	113.3	6.6
13	E. Ohio	1.88	10.8	144.0	
14	E. Ohio	6.15	12.3	164.0	20.0
15	Carmen No. 3..	2.08	10.0	133.3	
16	Carmen No. 3..	8.40	9.5	126.63	—6.7
17	E. Ohio	1.88	10.2	136.0	
18	E. Ohio	6.15	11.6	154.7	18.7
Aver.	E. Ohio	1.88	8.94	119.18	
Aver.	E. Ohio	6.15	9.42	125.60	6.42
Aver.	Carmen No. 3..	2.08	7.77	103.67	
Aver.	Carmen No. 3..	8.40	8.12	108.35	4.65
General Average					5.53

From the above table certain facts may be deducted as follows:

(1) Out of a total of nine pairs of rows, yields of six gave differences in favor of the use of selected seed tubers even though the seed pieces were of equal size in all instances.

(2) The three exceptions were not all of one variety.

(3) The average of all Early Ohio rows planted from

selected seed was 6.42 bushels per acre greater than the average of all rows of the same variety planted from culls.

(4) The average of all Carmen No. 3 rows planted from large tubers was 4.65 bushels per acre greater than those planted from culls.

(5) Thus the general average of both varieties indicates that with seed pieces of equal size, rows planted from large seed tubers yielded 5.53 bushels per acre higher than rows planted from culls.

SIZE OF SEED PIECES

According to the results reported in South Dakota bulletin No. 140 and of similar experiments conducted in other states, large seed pieces have produced increased yields over small seed pieces. In the present experiment the effort was made to eliminate all other variable factors than the one in question.

It was desired to find out whether, all other things equal, increase in size of seed piece increases yield, and if so, how much.

In order to arrive at the conclusion, the three kinds of seed pieces, 3, 4 and 5, were used as numbered under the Plan of Experiment.

The method of preparing (1) small, (2) medium, and (3) large seed pieces was as follows:

A medium sized tuber was selected and a single eye seed piece extracted with a circular knife. Such a seed piece would, therefore, be similar to the others extracted with the same instrument, and would weigh .41 ounces. After taking this first seed piece, the same tuber was cut into halves lengthwise. The half from whence the first small seed piece had been taken was then cut crosswise into quarters and the quarter from whence the first seed piece had been extracted was discarded. The quarter remaining was used for a medium sized seed piece, and the half remaining was used as a large seed piece.

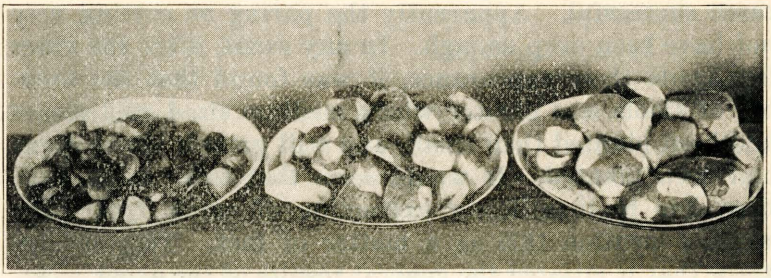

Fig. 3—Early Ohio small, medium and large seed pieces from identical tubers.

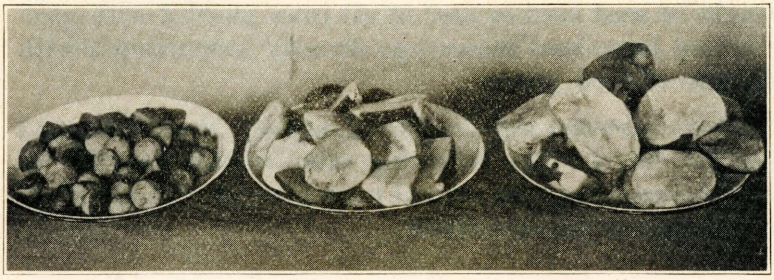

Fig. 4—Carmen No. 3, small, medium and large seed pieces, from identical tubers.

Thus one small, one medium and one large seed piece were taken from a single tuber. This provided that the same set of tubers furnished all three kinds of seed pieces used, namely, small, medium and large. Thus the heredity of all three kinds of seed was the same so far as the selection of tubers was concerned.

In order further to provide for only one "variable" the medium and large seed pieces were pared in such a way as to remove all eyes but one in each seed piece. Thus the effect was to provide that there should be no difference in the number of eyes on the several seed pieces, only one remaining on each. It is the belief of the writers that the process used in removing the extra eyes was not in all

cases successful. Apparently the paring or cutting may not have been deep enough. In any event, after the vines had made their appearance, it was found that the number of stools was greater where medium sized seed pieces had been planted than small, and still greater where large had been planted. It would seem that this may have been due to insufficient extraction of extra eyes. The writers mention this as a matter of fact. They do not know that it vitiated the general results of the experiment.

The rows of small seed pieces, medium seed pieces and large seed pieces were planted successively. In all cases they were one rod in length and the same number of hills was used in all instances. Therefore, the increase in total weight of seed used in case of all rows planted with medium and large seed pieces was directly proportional with the size of seed pieces.

Two varieties were employed, namely, Early Ohio and Carmen No. 3. The following table summarizes the results secured from the several rows planted with the kinds of seed pieces just described.

TABLE II.

Yields Produced by Seed Pieces of Varying Size, Namely Small, Medium and Large.

Row No.	Name of variety	Weight of seed piece ounces (av.)	Yield of row, pounds	Yield bushels per acre	Increased yield over small seed piece
19	Carmen No. 3..	.38	12.6	168.0	
20	Carmen No. 3..	2.10	19.8	264.0	96.0
21	Carmen No. 3..	4.40	21.1	280.0	112.0
22	E. Ohio	.35	11.1	144.7	
23	E. Ohio	1.40	18.6	244.3	99.6
24	E. Ohio	2.66	21.0	280.0	135.3
25	Carmen No. 3..	.38	10.1	134.7	
26	Carmen No. 3..	2.10	19.1	254.7	120.0
27	Carmen No. 3..	4.40	21.3	284.0	149.3
28	E. Ohio	.35	13.8	184.0	
29	E. Ohio	1.40	20.1	268.0	84.0
30	E. Ohio	2.66	23.0	306.6	122.6
31	Carmen No. 3..	.38	14.6	194.3	
32	Carmen No. 3..	2.10	22.3	294.0	99.7
33	Carmen No. 3..	4.40	24.8	330.7	136.4
34	E. Ohio	.35	16.7	222.7	
35	E. Ohio	1.40	22.9	305.3	82.6
36	E. Ohio	2.66	23.2	309.3	86.6
Aver.	Carmen No. 3..	.38	12.43	165.66	
Aver.	Carmen No. 3..	2.10	20.40	270.9	105.24
Aver.	Carmen No. 3..	4.40	22.40	298.23	132.57
Aver.	E. Ohio	.35	13.86	183.8	
Aver.	E. Ohio	1.40	20.53	272.53	88.73
Aver.	E. Ohio	2.66	22.4	298.59	114.79
General Aver. Small			13.14	174.73	
General Aver. Medium			20.46	271.71	96.98
General Aver. Large.....			22.40	298.59	123.86

DEDUCTIONS FROM TABLE II.

The figures of Table II. may be generalized as follows:

(1) In every instance of this experiment testing the relative productiveness of small, medium and large seed pieces, the difference has been pronounced in favor of the

large seed pieces. Moreover, the increases in production have varied directly with the increases in size of seed pieces.

(2) From Early Ohio seed, the average yield from seed pieces of .35 ounces was 183.8 bushels per acre. The use of seed pieces weighing 1.40 ounces as an average produced a yield of 272.53 bushels, an increase of 48.27 per cent. The use of seed pieces of 2.65 ounces weight produced an average of 298.59 bushels, and increase as compared with the use of small seed pieces of 70.8 per cent.

(3) With Carmen No. 3 seed, the use of seed pieces of .35 ounces weight produced an average of 165.66 bushels. The use of seed pieces of 2.10 ounces weight produced 270.90 bushels per acre, an increase of 105.24 bushels or 63.5 per cent. The use of seed pieces weighing 4.40 ounces produced 298.23 bushels per acre, an increase as compared with the yield from small seed of 132.57 bushels, 80 per cent.

(4) As a general average, small seed yielded 174.73 bushels per acre. Medium seed yielded 271.71 bushels, an increase of 55.5 per cent. The use of large seed pieces produced 298.59 bushels per acre, an increase of 123.86 bushels or 70.9 per cent, as compared with the yield from small seed.

(5) As a general average, the use of medium sized seed pieces (quarters) produced 271.71 bushels per acre. Large seed pieces (halves) produced 298.59 bushels per acre; an increase of 26.9 bushels per acre or 9.9 per cent in favor of use of halves instead of quarters.

RELATIVE INFLUENCE OF CULLS AND SELECTED SEED UPON TYPE AND SIZE OF PROGENY

A total yield of tubers is a factor of prime importance in potato growing. It is, however, a matter of great importance that tubers produced, whatever their total weight, shall be of a usable type. It is practically and

scientifically important to have actual data for answering the question whether use of culls for seed tends to the deterioration of the type of tubers produced.

Accordingly the writers made a comparative study of the type of tubers produced from (1) cull seed and (2) selected seed. In this comparison the seed pieces themselves were the same size from both the cull seed and the selected seed.

The data were collected by means of arranging the individual tubers harvested from the (1) culls and (2) selected seed into an array according to the several weights. This method of making an array is illustrated on Pages 26 and 28 of South Dakota Bulletin 140. In the present bulletin arrays are not copied, but results are summarized.

In the following Table No. 3 is presented a summary of the weights of individual tubers harvested from equal sized seed pieces from (1) cull seed and (2) selected seed.

TABLE III.

A Comparison of Frequencies and Weights of Tubers Produced From (1) Cull Seed and (2) Selected Seed.

Weight of (oz.) produced Tubers	Tubers produced from culls		Tubers produced from selected seed	
	Frequency	Frequency times value	Frequency	Frequency times value
½	53	26.5	56	28.0
1	89	89.0	73	73.0
2	97	194.0	94	188.0
3	61	183.0	46	138.0
4	39	156.0	59	236.0
5	24	120.0	33	165.0
6	18	108.0	19	114.0
7	8	56.0	7	49.0
8	7	56.0	4	32.0
9	4	36.0	2	18.0
10			2	20.0
11				
12	3	36.0	2	24.0
Total	403	1060.5	397	1085.0

In the above table the word *Frequency* means the

number of the total population, i. e. number of tubers weighed which possess the given weight. *Frequency* times *value* means the product of the number times the weight, and is therefore the total weight of all the tubers possessing the given weight.

The type of tubers of greatest frequency weighed *two* ounces, both the product of culls and the product of selected seed. That means that the "type" of these particular tubers weighs two ounces in each instance.

Moreover, the proportion of tubers in the two instances which adhere to the type is nearly the same from selected seed. A large proportion of the total number of tubers produced weighed four and five ounces. Four ounces is considered as the weight of very desirable market tubers.

It appears that of a total of 403 tubers produced from culls, 261 weighed 2 ounces or more—64.8 per cent. Out of a total of 397 tubers produced from selected seed, 268 weigh 2 ounces or more—67.5 per cent. 2.6 *per cent more tubers from selected seed are of useable size, than of those* from culls. Such a difference is small, but it is measurable. It resulted strictly from difference in kind of seed and not from size of seed pieces. It seems fair to call it a result of bud variation. Such a conclusion is in line with South Dakota Bulletin No. 140, p. 31, and additional thereto, in that the conclusion here stated relates to an experiment with but one "variable," namely size of seed tubers.

The total weight of 403 tubers produced from "culls" was 1060.5 ounces—2.63 ounces as an average. The total weight of 397 tubers produced from selected seed was 1,085 ounces—2.73 ounces as an average. This difference in size of individual tubers of 0.10 ounces is small, as would be expected, but *it indicates that the beneficial effect of using selected seed tubers is actually measurable in the individual tubers produced. This again is in line with and additional* to Bulletin 140, pp. 30 and 31.

DEDUCTION FROM TABLE

(1) Under the conditions of this experiment, the use of sizeable seed produced a greater proportion of potatoes of desirable size than the use of culls. The type of potatoes produced from culls used as seed is measurably smaller, in the first generation than those produced from selected seed tubers. The results of this experiment furnish quantitative evidence that the use of "culls" for seed causes potatoes to "run out."

(2) Not only is the type of tubers produced from selected seed larger than from "culls", but also the average weight of tubers produced is greater.

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