Summary and Conclusions

Under the conditions of this experiment, relative root size and sucrose percentage of transplanted beets closely paralleled root size and sucrose percentage of beets grown directly from field seeding. Root shape of plants started in 1 x 8-inch paper tubes was more nearly normal than that of plants started in 3-inch flower pots, but in weight of root the latter class of plants more nearly approached the performance of field-seeded beets.

The data presented suggest that satisfactory preliminary evaluation of the root-yielding ability and sucrose percentage of new strains of sugar beets can be made, under suitable conditions, and in the relative absence of competition, by means of transplanted seedlings.

The occurrence of root diseases was negligible in this experiment, but the greater possibility of root infection afforded by rootlets broken during the transplanting process should not be overlooked.

Literature Cited

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Mosaic and Seed Production

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When Gaskill reviewed previous literature and presented experimental data obtained in 1938 and 1939 bearing on the effect of mosaic upon seed production in the sugar beet, he found from 23 to 39 percent loss in seed production for mosaic-affected plants as compared with those not affected, the infection having occurred during the vegetative year.[2] In one test, apparently healthy plants were inoculated with mosaic 1 month after planting out for seed production with a measured loss of 26 percent in seed production. There was no significant effect on germination in any of his tests.

[1] Agronomist, The Great Western Sugar Company.

[2] Gaskill, John O. Effect of Mosaic Upon Yield of Seed by Sugar-beet Roots, Proc. of A. S. S. B. T. 2:190-207. 1940.

In the sugar-beet improvement and seed-production program of The Great Western Sugar Company the possible seriousness of losses in seed production due to mosaic was first recognized in 1937 when roots grown and stored under quite widely different conditions showed striking differences in seed production, the one lot, being apparently heavily affected with mosaic while the other lot. appeared quite healthy. In this case, the healthy beets grew more vigorously, were much earlier and more uniform in seedstalk production, and produced more seed than did 1hc diseased beets.

Comparative observations were possible in various breeding groups during 11)38, 1940, and 1941 where obvious variations were apparent in mosaic infection. The individuals were rated categorically on the following basis: O—no mosaic, L—light mosaic, M—medium mosaic, H- -heavy mosaic.

The plants were harvested individually, the seed processed uniformly and the results later classified for this particular study.

It should be specifically recorded that the breeding groups on which these studies were made were a pact of the regular breeding work, the mosaic observations being only incidental. The roots were planted in these groups from 3 to 4 feet apart in each direction, and were uniformly spaced within each group.

Table 1.—Average weight, of seed in ounces per individual plant for mosaic classes.

		O mosaic		L mosaic		M mosaic		H mosaic	
Group	Year	No. of plants	Average weight	No. of plants	Average weight	No. of plants	Average weight	No. of plants	AA-erage weight
381	1938	15	11.00	C	10.92	24	9.54	24	9.04
383	1938	64	7.06	22	7.36	68	6.25	12	5,79
384	1938	66	6.59	8	8.06	52	6.68	9	3.28
3810	1938	10	8.44	10	7.55	23	8.02	28	5.09
3811	1938	12	11.13	9	9.06	19	6.84	7	8.07
738	1938	0		8	4.25	18	3.64	18	2.47
403	1940	39	3.55	35	3.54	66	2.36	34	1.50
404	1940	34	3.37	33	2.67	48	2.38	9	1.67
405	1940	48	3.16	25	3,50	62	2.67	31	2.05
4011	1940	6	2.75	65	2.38	62	2.20	13	1.96
4035	1940	0		9	1.78	36	1.79	12	1.67
4120	1941	6	2,83	18	3.17	33	2.73	9	2.67
4139	1941	50	2.82	43	2.48	S3	2.54	20	2,30
Total number of plants and average weight of seed*		350	5.75	274	5.52	540	4.75	196	**8.05**
Total **number** of plants and average weight of seedt				201	5.13	594	4.43	226	3.66

*Not including groups 738 and 4035.
fAll groups.

The breeding groups were located visually in garden patches and were isolated by space from each other. Originally they were grown, so far as possible, on the Experiment Station where also was located the progeny tests and lots planted for selection or steckling production. Since the importance of mosaic has been recognized, however, all seed production during the summer has been isolated by at least 1 mile from the vegetative generation. While this distance is not sufficient to prevent completely all re-inoculation spread by plant lice it appears probably sufficient to hold the disease down to where its effect is of no great consequence.

Experimental Results

The average weight of seed in ounces per plant, percentage germination and number of seedballs per ounce for all plants classified into several groups for 3 years are summarized in tables 1, 2, and 3, respectively. Again in table 4 these data are expressed in percentage of the O mosaic class, and in table 5 the loss or gain in percentage of O mosaic between each class is given.

Table 2.—Average percentage germination for mosaic classes.*

		O mosaic		L mosaic		M mosaic		H mosaic	
Group	Year	No. of plants	centage germ.	No. of plants	centage germ.	No. of plants	centage germ.	No. of plants	centag germ.
381	1938	15	64.5	6	70.2	24	57.8	21	57.0
383	1938	64	61.7	19	63.3	65	60.0	11	58.3
384	1938	61	56.7	8	65.6	45	59.4	4	54.8
3810	1938	10	81.9	10	71.2	21	72.0	24	68.7
3811	1938	12	70.7	S	75.4	19	63.2	7	71.4
738	1938	0		S	73.5	16	74.6	12	78.4
403	1940	39	93.0	35	90.1	66	90.4	34	88.0
404	1940	18	94.7	18	95.7	18	94.4	1	74.0
405	1940	27	92.0	16	90.5	24	91.0	10	89.3
4011	1940	3	99.0	26	97.8	17	97.4	4	96.8
4G35	1940	0		9	97.1	36	96.1	12	94.7
4120	1941	2	89.5	14	89.0	17	89.8	4	92.8
Total number plants and average percentage germ.**		252	80.4	160	80.0	316	77.5	120	75.1
Total number plants and average percentage germ.‡		....	....	177	81.6	368	78.8	344	77.0

*In most cases germinations were not run on individuals which produced less than 3 ounces of seed.
All individuals germinated. >
**Not including groups 738 and 4035.
‡ All groups.

Table 3.—Average number of seedballs per ounce for mosaic classes,*

Group	Year	O mosaic		L mosaic		M mosaic		H mosaic	
		No. of plants	Seedballs per oz.	No, of plants	Seedballs per 065.	No. of plants	Seedballs per oz.	No. of plants	Seedballs per oz.
381	1038	15	1877	Q	1913	24	1909	21	1988
383	1938	64	2077	19	2214	65	2184	11	2220
384	1038	01	2034	8	1925	45	2197	4	2341
3810	1038	10	1790	10	1797	21	1896	24	1812
3811	1038	12	1717	8	1781	19	1929	7	1880
738	1938	0		8	2111	16	2009	12	2104
403	1040	39	1633	35	1600	G6	1675	34	1682
404	1040	19	1494	18	1530	18	1531	1	1750
405	1040	27	1651	1ft	1623	24	1614	10	1558
4011	1940	3	1388	26	1515	17	1552	4	1453
4035	1040	0		2	1663	6	1617	2	1438
4120	1941	2	1807	14	1851	17	1759	4	1678
Total number plants and average number seedballs**		252	1747	160	1775	316	1825	120	1836
Total number plants and average number seedballs‡				170	1794	338	1823	134	1825

*In most cases counts were not made for individuals which produced less than 3 ounces of seed.

All individuals counted.

** Not including groups 738 and 4035.

‡ A11 groups.

Table 4.—Means for weight, percentage of germination, and number of seedballs per ounce in percentage of O mosaic.

Mosaic classes	Percentage of O mosaic		
	Yield*	Percentage germ	No. seedballs per oz.
0	100.0	100.0	100.0
L	96.0	100.6	101.6
M	82.0	96.4	104.5
H	68.7	93.4	105.1

•Eleven groups.

Ten groups.

Table 5.—Variation between mosaic classes.

Mosaic class Comparisens	Loss or gain in percentage of O mosaic between classes		
	Yield*	Percentage germ.	No. seed-balls per oz.
O—L	— 4.0	+0.0	+1.6
L—M	—13.4	—3.6	+4.5
M—II	—13.9	—6.6	+5.1

* Eleven groups.
Ten groups.

There is a definite and consistent decrease in ounces of seed per beet, this loss averaging* 4.0, 17.4, and 31.3 percent, respectively, for L, M, and H classes of infection (table 4).

In germination, the L class showed no loss, the M class a 3.6 percent loss, and the H class a 6.6 percent loss as compared with the O class.

The number of seedballs per ounce increased almost in direct proportion to the decrease in germination.

The loss in weight of seed due to mosaic, particularly for the heavy class of infection, is similar to losses reported by Gaskill. In germination, however, it appears probable that the data reported herein indicate a real, although comparatively small, loss due to medium or heavy infection with mosaic. Gaskill did not find any significant loss in germination.

Summary

A 3-year study of the effect of mosaic on seed production was made incidental to the sugar-beet improvement program of The Great Western Sugar Company. A total of 1,461 plants were classified for mosaic on the basis of none, light, medium, and heavy, and for weight of seed per plant, germination, and number of seedballs per ounce of seed.

In weight of seed per plant there was an average loss of 4.0, 17.4, and 31.3 percent, respectively, for light, medium, and heavy mosaic.

There was a loss of 3.6 percent in average germination for medium and a corresponding loss of *6.6* percent for heavy mosaic.

The seedball count per ounce of seed increased in almost direct proportion to the decrease in germination.

These possible losses due to infection with mosaic, particularly in yield, are of sufficient importance to necessitate segregating the seed-production work of any sugar-beet improvement program some distance from the testing and selection plots in those areas where mosaic is present.