

PERFORMANCE OF DIRECT INCREASES OF PEDIGREED
AND COMMERCIAL LOTS OF SUGAR BEETS

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Reversion in type, or "running out", has been taught by biologists and emphasized by seedsmen and breeders until it is almost axiomatic to the average person. In self-pollinated crops such as wheat, oats, barley, and beans there is no logical reason to suppose that any material change will take place within a variety which originated as a pure line so long as ordinary care is exercised to prevent seed mixtures.

The problem is not so clear with naturally cross-pollinated crops such as corn and sugar beets, for the ordinary commercial variety consists of a heterogeneous mixture of types. So diverse is this mixture, in fact, that when self-fertilized to produce inbred lines it is difficult to find any two such lines which bear much resemblance.

With corn it might conceivably be supposed that the same genetic factors that contribute to high yield of seed would tend to a gradual increase of the higher producing types, but even the most refined ear-to-row methods failed to show improvement in experiments conducted by Hayes and Alexander (2)2/. Moreover, mutations probably occur so seldom and are usually abnormal recessives, thus tending to be self-eliminating, that it is hardly conceivable they can contribute to any evident "running out" (3).

With sugar beets the possibility of change in yield through mass increase would seem to be less than in corn for there is very little if any correlation between yield of roots or sugar and production of seed (1). This does not apply, however, to the character of bolting or seed production, it having been sufficiently demonstrated in recent experience that incomplete bolting in the Southwest may result in an increase of the quickly bolting types. This has become evident in some increase in bolters in commercial beet fields planted to seed produced in Arizona. While this has rarely resulted in over 1% of bolters in Northern Colorado, that in itself being of little importance except from the esthetic standpoint, it has served as a precaution against continued increases of commercial to commercial in seed-producing areas where this type of natural selection may take place.

The results which I am to report were obtained during the 1939 season at Longmont, Colorado. Both the parental variety and the mass increase were included in a variety test with 9 replications of 49 varieties. The arrangement was a two dimensional quasi-factorial scheme with three groups of sets. Plots were 4 rows by 30 feet at harvest, approximately half of the beets being taken at random for sugar determinations and all beets for yield of roots. The yields and sugar were calculated in per cent of Great Western commercial (GW18) used as the Standard. The results are given as loss or gain in per cent of the Standard, for the increase as compared with the original, as follows:

1/ Agronomist, Great Western Sugar Company.

2/ Figures in parenthesis refer to "Literature Cited".

Varieties		Loss or gain, % of Standard		
Original	Increase	Yield	Per cent Sugar	Total Sugar
GW1011	GW1044(b)	-2.85	-0.27	-3.16
GW1011	GW3 (c)	+0.80	-1.63	-0.87
GW1020	GW38 (d)	-3.25	-2.24	-5.47
GW1009				
GW1011	GW34 (b)	-4.73(a)	-0.33(a)	-4.42(a)
GW25	GW33 (d)	-1.48	-2.58	-4.10
GW31	GW32 (e)	-5.31	-2.11	-7.30
GW20	GW23 (f)	+3.25	+1.90	+5.09
GW21	GW27 (f)	+4.83	+0.47	+4.43
Diff. for Sig.(single comparison)		-6.33	-4.21	-8.44
Mean difference		-1.09	-1.32	-1.98
t test, P = between		0.4 & 0.5	0.1 & 0.2	0.2 & 0.3
		Not sig.	Not sig.	Not sig.

- a) Average for original weighed for relative proportion in seed mixture used.
 b) Produced in Colorado by steckling method.
 c) Produced in New Mexico by overwintering method.
 d) Produced in Arizona by overwintering method.
 e) Produced in Texas by overwintering method.
 f) Produced in Colorado by overwintering method.

The mean loss in per cent of Standard was 1.09 for yield of roots, 1.32 for per cent sugar, and 1.98 for total sugar. Comparisons of the increase with the original were made using Student's method, the t test indicating differences less than expected on the basis of odds of 19:1, hence, are generally considered not significant. This is to be expected since the individual comparisons are not consistent, there being some losses and a few gains. It is of further interest that for no single comparison was significance established. It can only be suggestive that the gains of appreciable magnitude for yield and per cent sugar, viz., for GW23 and 27 from GW20 and 21, respectively, were seed increases made by the overwintering method in Colorado. All other seed increases were made either in the Southwest by the overwintering method or in Colorado by the steckling method. It is also of some interest that losses of yield were accompanied by losses in per cent sugar in all cases, and gains in yield by gains in per cent sugar in two out of three cases.

Further tests will be necessary before any definite conclusions can be established. Since this problem is one which every sugar beet breeder or seed producer cannot easily ignore, it is hoped that sufficient evidence will be obtained before the next general meeting of this Society to establish the facts with respect to the loss or gain which may be expected with mass increases of sugar beet varieties.

LITERATURE CITED

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