

Recent Results with Sugar X Red Garden Beet Hybrids¹

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Two white F₃ hybrid beet varieties have been produced from crosses of sugar beet x red, globe garden beet. Several advanced generations of these hybrid varieties have been produced by both continuous selection and by random increases from the original F₃ seed stocks; one of the varieties having been advanced to the F₈ and F₇, respectively.

Table 1.—Yield of roots in tons per acre of sugar beet x red, globe garden beet hybrid varieties and a commercial sugar beet check variety. Data given as 6-plot averages.

Seed No.	Generation	Fort Collins., Colo., tests				Ault, Colo., tests	
		1939	1943	1945	1949	1948	1949
(First hybrid)							
1935—520	Sel. 3rd	14.45	15.78	14.84	21.94	13.30	24.05
1937—304	Sel. 4th	14.64	15.24	14.16	21.02		
1939—303	Sel. 5th		15.60	15.17	22.15		
1939—300	Sel. 5th		16.08		21.45		
1942—309	Sel. 6th		15.90	15.47	22.38		
1944—306	Sel. 7th			14.12	22.06	13.49	23.77
1946—311	Sel. 8th				22.08		24.60
1938—301	Rand. 4th	12.61	15.89	15.10	22.78		
1942—305	Rand. 5th		16.56	13.73	22.36		
1944—305	Rand. 6th			13.56	22.50		
1946—312	Rand. 7th				20.82	13.19	23.47
1938—302	Rand. 5th ¹	13.60	15.27		20.35		
1938—300	Sel. 4th	13.98	16.17		21.85		
(Second hybrid)							
1940—312	2nd						25.80
1942—306	Sel. 3rd		18.86	16.23		14.69	26.74
1945—312	Sel. 4th					14.51	26.05
1945—315	Rand. 4th					15.60	25.42
1948—312	Sel. 5th ²						24.16
Local commercial check		13.74	15.24	14.14	20.82	12.50	22.17
u. s. No. 226					19.52		
Two times the Standard							
Error of a Difference		1.87	1.48	1.36	1.74	1.01	1.83

¹ Random increase of selected 4th (1937-304).

² Selected for high sucrose with size of root given minor consideration.

Note: 1948 test at Ault, Colo., defoliated by hail July 30.

Yield trials of the hybrid varieties in comparison with a commercial sugar beet variety and their respective advanced generations, as the latter became available, have been conducted from time to time and at various locations since 1936.

¹ Conducted in cooperation with the Colorado A & M Agricultural Experiment Station.

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The selected F_3 hybrid varieties and their advanced generations have in general exceeded the commercial sugar beet check variety in yields of roots; have had slightly lower percentage sucrose and have seldom differed significantly from the commercial variety in yields of gross sugar.

When the advanced generations are compared among themselves and with the original F_3 hybrid variety the differences in yields and quality are generally well within the limits of probable error. While a few instances

Table 2.—Percentage sucrose of sugar beet x red, globe garden beet hybrid varieties and a commercial sugar beet check variety. Data given as six plot averages.

Seed No.	Generation	Fort Collins, Colo., tes				Ault, Colo., tests	
		1939	1943	1945	1949	1948	1949
(First hybrid)							
1935—520	Sel. 3rd	15.96	15.13	13.32	16.14	11.72	17.24
1937_304	Sel. 4th	16.27	14.91	13.42	15.79		
1939—303	Sel. 5th		14.92	13.96	15.66		
1939—300	Sel. 5th		15.25		15.61		
1942—309	Sel. 6th		15.42	13.76	15.71		
1944—306	Sel. 7th			13.92	15.83	11.74	17.61
1946—311	Sel. 8th				16.20		17.97
1938—301	Rand. 4th	15.61	14.38	13.02	15.51		
1942—305	Rand. 5th		15.64	13.41	15.50		
1944_305	Rand. 6th			13.47	15.61		
1946—312	Rand. 7th				15.82	11.58	16.86
1938—302	Rand. 5th ¹	15.85	15.38		15.98		
1938—300	Sel. 4th	16.05	14.87		15.38		
(Second hybrid)							
1940—312	2nd						14.53
1942—306	Sel. 3rd		15.16	12.52		11.84	15.91
1945—312	Sel. 4th					11.79	16.20
1945—315	Rand. 4th					11.72	16.14
1948—312	Sel. 5th ²						17.03
Local commercial check		16.95	15.18	13.26	17.12	11.92	18.62
U. S. No. 226					16.83		
Two times the standard error of a difference		0.57	0.76	0.78	0.74	0.80	0.60

¹ Random increase of selected 4th (1937-304)

² Selected for high sucrose with size of root given minor consideration.

Note: 1948 test at Ault, Colo., defoliated by hail July 30.

occur in which a difference between some two generations exceeds the difference required for significance in that particular trial, no one generation or line of selection is consistently high or low for any of these values throughout the series of trials.

The original selections of F_2 roots, from which the F_3 hybrid varieties were obtained, were on a rather broad base. In each case several hundred roots which were average or better in total gross sugar were grouped for the production of the F_3 variety. It seems possible that this selection eliminated most of the genes for very low sucrose content and retained a good share of the genes for higher sucrose content and large root size. Then, in advancing the generations by either method, segregations and new combinations of the factors determining sucrose content and root yield have maintained a general level of performance essentially like that of the original F_3 .

In a single case the selection of roots for an F_5 (1948 seed No. 312) was for high sucrose percentage and a desired root shape, size of root being given little consideration. A single test of this F_5 indicated the possibility that quality of the variety had been improved at some sacrifice of root yield, with the yield of gross sugar remaining essentially the same as for the F_3 and the two F_4 generations of this variety.

In a single test (Ault, Colo., 1949) the F_2 of one of these hybrids was

Table 3.—Gross pounds sugar per acre of sugar beet x red, globe garden beet hybrid varieties and commercial sugar beet check variety. Data given as 6-plot averages.

Seed No.	Generation	Fort Collins., Colo., tests				Ault, Colo., tests	
		1939	1943	1945	1949	1948	1949
(First hybrid)							
1935—520	Sel. 3rd	4,614	4,786	3,951	7,073	3,126	8,290
1937—304	Sel. 4th	4,792	4,531	3,802	6,625		
1939—303	Sel. 5th		4,663	4,230	6,954		
1939—300	Sel. 5th		4,904		6,705		
1942—309	Sel. 6th		4,908	4,244	7,017		
1944—306	Sel. 7th			3,924	6,961	3,166	8,371
1946—311	Sel. 8th				7,140		8,822
1938—301	Rand. 4th	3,960	4,557	3,925	7,038		
1942—305	Rand. 5th		5,155	3,685	6,910		
1944—305	Rand. 6th			3,644	7,006		
1946—312	Rand. 7th				6,601	3,045	7,911
1938—302	Rand. 5th ¹	4,308	4,698		6,488		
1938—300	Sel. 4th	4,490	4,785		6,720		
(Second hybrid)							
1940—312	2nd						7,492
1942—306	Sel. 3rd		5,713	4,054		3,484	8,502
1945—312	Sel. 4th					3,420	8,434
1945—315	Rand. 4th					3,646	8,200
1948—312	Sel. 5th ²						8,230
Local commercial check		4,663	4,628	3,748	7,116	2,987	8,270
U. S. No. 226					6,587		
Two times the standard error of a difference		693	530	378	704	297	645

¹ Random increase of selected 4th (1937-304)

² Selected for high sucrose with size of root given minor consideration.

Note: 1948 test at Ault, Colo., defoliated by hail July 30.

included. The yield of roots of this F_2 was not significantly different from the yields of the selected F_3 and the two F_4 generations. However, the percentage sucrose of the F_2 was significantly lower than that of the later generations. Apparently selection did eliminate factors for low sucrose.

Data from six of the more comprehensive tests of these hybrids and their advanced generations are summarized in Tables 1, 2 and 3.

Conclusions

1. These two selected F_3 sugar x garden beet hybrid varieties have produced high yields of roots with slightly lower sucrose percentages than the comparable commercial sugar beet variety.

2. Advancement of the generations of these hybrid varieties with continuous selection or at random has not materially changed the performance of the variety.

3. These trials indicate that a selected F_3 hybrid beet variety could be increased for commercial use, with or without further selection, without materially changing the character of the variety. If this conclusion is true the production of hybrid beet varieties for commercial use from even wide crosses becomes practical since the task of selecting and testing a large number of F_2 roots for the F_3 hybrid variety would not have to be repeated in the later generations while the seed stock, was being increased to commercial quantities.