Performance of F_1 Hybrids Between Curly-Top-Resistant and Curly-Top-Susceptible Sugar Beets

ALBERT M. MURPHY, GEORGE K. RYSER AND F. V. OWEN[1]

Introduction

Cytoplasmically inherited male sterility has made it possible to make a wide variety of F_1 hybrids on a sufficient scale for agronomic evaluation. Previous studies have shown advantages from F_1 hybrids between curly-top-resistant varieties and selected curly-top-resistant inbred lines **(1)**[2].

Material and Methods

Eight different hybrids between curly-top-resistant male-sterile females and curly-top-susceptible pollinators were made in field isolations near Salt Lake City. These pollinators (see Table 1) included the monogerm beet SLC 101 (2), inbreds made by brother-sister mating from Viggo Lund from Denmark, a new high-yielding source of the German variety Klein. E. (also known in U.S.A. as R. and G. Old Type) received from the late Dr. Fredrick Schneider of the Rabbethge and Giesecke Company in 1948, the German sugar-type Klein ZZ from a 1938 reproduction by the West Coast Beet Seed Company in Oregon; leaf-spot-resistant varieties including U. S. 216 and U. S. 225 from Dewey Stewart of the U. S. Department of Agriculture, and a tetraploid from Denmark from one of Viggo Lund's inbred lines. Seed of the male-sterile females was also sent to H. E. Brewbaker of the Great Western Sugar Company who made additional hybrids to high-yielding Great Western varieties as pollinators.

In 1951 comparisons were made with standard commercial varieties at three locations: under severe curly top at Jerome, Idaho; under a moderately severe natural curly-top exposure at Twin Falls, Idaho, and under an extremely light curly-top exposure at Granger, Utah, near Salt Lake City where the disease caused no measurable reductions in yield of the susceptible varieties except in the case of rare individual plants.

The curly-top-resistant varieties used for comparison were: U. S. 33, with intermediate curly-top resistance; U. S. 22/2, with relatively high curly-top resistance; U. S. 22/3, the most highly resistant variety now in commercial use, and the male sterile hybrid SL 92H1, which possesses still higher curly-top resistance. The new source of the Klein E variety was used in the comparison at Salt Lake City, but because of lack of seed the old source of Klein E (SL 1-300), reproduced in Oregon in 1941, was used in the other two tests.

[1] Agronomist, Agent and Senior Geneticist, respectively, Division of Sugar Plant Investigations, Bureau of Plant Industry, Soils and Agricultural Engineering, Agricultural Research Administration, U. S. Department of Agriculture.

[2] Numbers in parentheses refer to literature cited.

Table 1.—Performance of F_1 Hybrids between Curly-Top-Resistant and Curly-Top-Susceptible Sugar Beets Compared with Standard Varieties.

SL and G.W. numbers	Description and parentage	Acre Yields: Severe curly-top Jerome, Ida.[1] Tons beets	Moderate curly-top Twin Falls, Ida.[2] Tons beets	Moderate curly-top Twin Falls, Ida.[2] Gross sugar lbs.	Curly-top not a factor Granger, Utah[3] Tons beets	Curly-top not a factor Granger, Utah[3] Gross sugar lbs.
SL 1-300	Klein E. 1941 reproduction	0.6	21.7			
SL 09	Klein E. from Germany in 1948				35.0	9,758
SL 333	U. S. 33	10.3				
SL 222	U. S. 22/2	13.1				
SL 024	U. S. 35/2		23.9	7,926	28.9	8,543
SL 96	U. S. 22/3	15.4	27.4	8,698	29.3	8,333
SL 05H5	(U. S. 35 MS x CT9) x Monogerm SLC 101)		24.9	8,191	27.7	8,421
SL 06H5	(U. S. 35 MS x CT9) x Danish inbreds)				28.2	8,877
SL 09H5	(U. S. 35 MS x CT9) x Klein E, SL 09)		31.4	10,333	32.6	9,347
SL 010M5	(U. S. 35 MS x CT9) x Klein ZZ, SL 10		26.9	8,896	28.1	8,340
SL 030H5	(U. S. 35 MS x CT9) x LSR Composite				28.4	8,856
SL 049H5	(U. S. 35 MS x CT9) x Danish 4n				30.7	9,247
SL 09H2	MS of U. S. 22/3 x Klein E, SL 09	14.4				
SL 92H1	MS of CT9 x U. S. 22/3	17.2	27.8			
G.W. C-568	(U. S. 35 MS x CT9) x G.W. C-304				32.0	9,331
G.W. C-564	(U. S. 35 MS x CT9) x G.W. C-359				32.8	9,532
G.W. C-479	CT9 MS x G.W. C-304				32.4	9,380
Diff. for Sig. (19:1 odds)			2.32	804	2.38	820

[1] Data from Jerome obtained from single plots, four rows wide and 100 feet long without replication.

[2] Test at Twin Falls, Idaho, had 10 replications of randomized block with 12 varieties, but the yield from Klein E (SL 1-300) was taken from an adjacent eight-row strip.

[3] Test at Granger, Utah, was a balanced lattice design with six replications of 25 varieties.

Experimental Results

Tests at Three Locations

At Jerome, Idaho, (Table 1) under the severe curly-top exposure, where Klein E was reduced to less than 1 ton per acre, the male-sterile F_1 hybrid SL 09H2 (MS **x** Klein E) yielded 14.4 tons per acre, which was definitely better than the 10.3 tons per acre produced by U. S. 33 and was within one ton of the highly resistant variety, U. S. 22/3. Most of these F_1 hybrid beets showed conspicuous curly-top symptoms but made a vigorous growth in spite of the disease.

Under the moderate disease exposure at Twin Falls, Idaho, the F_1 male-sterile hybrid SL 09H5, with Klein E as pollinator, produced 31.4 tons per acre. With this very high yield these beets analyzed 16.43 percent sucrose as compared with 15.89 percent from U. S. 22/3. An eight-row strip of Klein E (SL 1-300) adjacent to the test was moderately injured by curly top and yielded 21.7 tons per acre.

In the test near Salt Lake City where curly top was not a factor most of the F_1 hybrids also produced relatively high yields (Table 1). The hybrids with the Great Western varieties were essentially equal to the Klein

E hybrid. The yield of the triploid male-sterile hybrid made with Viggo Lund's tetraploid as pollinator also was excellent.

Hybrids to the Monogerm Inbred SLC 101

In cooperation with V. F. Savitsky several male sterile hybrids were made with the monogerm inbred line SLC 101 used as the pollinator. Results from the hybrid SL 05H5 are shown in Table 1. These beets were rather short but were relatively vigorous sugar beets without any serious defects which would remind one of the small beets from the inbred pollen parent. The yield of SL 05H5 was not outstanding but the sucrose percentage was high, indicating agreement with other results which showed that the inbred SLC 101 imparts high sugar percentage to its hybrid offspring.

Another hybrid, with SLC 101 as pollinator, was designated SL 05H89. It was not included in the replicated plantings but in a single observation plot of two rows 42 feet long SL 05H89 produced a yield which corresponded to 37.1 tons per acre with 13.40 percent sucrose. This was slightly higher than the yield from U. S. 22/3 in adjoining plots with a comparable sugar percentage. Apparently better combining ability was represented in the hybrid SL 05H89 than in the hybrid SL 05H5, the difference being due to the male sterile female parent.

Conclusions

F_1 hybrids between curly-top resistant and curly-top susceptible varieties showed an intermediate degree of curly-top resistance, but sufficient for commercial use in areas which have a mild to moderate curly-top exposure.

Hybrids between a new source of Klein E from Germany and curly-top resistant male steriles produced F_1 hybrids which gave an outstanding performance. One of these F_1 hybrids produced yields slightly higher than that of the U. S. 22/2 variety under a severe curly-top exposure at Jerome, Idaho.

At Twin Falls. Idaho, under a moderate curly-top exposure, and at Salt Lake City, Utah, under a mild curly-top exposure, these F_1 hybrids had ample curly-top resistance to produce excellent yields in both tons beets and sugar per acre.

Some of the F_1 hybrids with curly-top susceptible varieties produced higher yields than were obtained by the best combinations within curly-top resistant varieties.

Literature Cited

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