Performance of Three Male-Sterile Sugar Beet Hybrids

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The good performance with respect to yield and other qualities as obtained with the first male-sterile hybrid sugar beet variety, in which the inbred CT9 was the pollen parent, was reported in the 1946 Proceedings of this Society[2]. Three years' results with additional hybrids involving the same highly self-fertile inbred are shown here in Table 1 and in descriptions which follow.

Although the first hybrid appeared very promising, it was believed advisable to emphasize sucrose percentage in later work. This was accomplished by a series of hybridizations of inbred CT9 with varieties of the sugar type. The hybrid S.L. 6105, shown in Table 1, was derived by utilizing male steriles from the high-sugar, curly-top-resistant variety U.S. 35 as the female parent. The hybrid S.L. 6106 was derived by utilizing male steriles from U.S. 41 (U.S. 35 x U.S. 22/3) as the female parent. The hybrid S.L. 7101 was a reverse combination and was designed to incorporate maximum disease resistance. It was produced by utilizing CT9 MS (a third backcross generation stemming from CT9) as the female and S.L. 72 (second curly top resistant selection of U.S. 22/3) as the pollen parent. The curly top resistance of S.L. 6105 and S.L. 6106 was good and roughly comparable with that of U.S. 22/3. The curly top resistance of S.L. 7101 was remarkably high. This is explained by the high disease resistance derived from both parents combined with the vigorous growth of the F_1 hybrid beets.

In Table 1 the average over-all gain in sugar per acre shown in the Utah and Idaho tests for S.L. 6105 amounts to about 15 percent as compared with the variety U.S. 22/3, while S. L. 6106 shows a gain of about 18 percent. In every case these hybrids exceeded U.S. 22/3 in tonnage and also in sugar percentage. S.L. 6105 was somewhat superior to S.L. 6106 in sucrose percentage. S. L. 6105 exceeded the yield-type variety, U.S. 22/3, in tonnage and was nearly comparable to the sugar-type variety, U. S. 35, in sugar percentage.

The hybrid S.L. 7101 was also superior to U.S. 22/3 in the agronomic tests with results shown in Table 1 but was inferior to S.L. 6105 and S.L. 6106. In additional tests at Jerome, Idaho, where the curly top disease was more severe, S.L. 7101 excelled all other varieties tested. Since the extreme disease resistance of S.L. 7101 is not needed in most areas, hybrids resembling S.L. 6105 and S.L. 6106 would be more generally preferred.

Advantages and Disadvantages

The CT9 hybrids have other favorable characters in addition to increased yield and curly top disease resistance. Like the inbred parent the

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[2] Owen, F. V. Inbred lines from curly-top-resistant varieties of sugar beets. 1946 Proceedings American Society of Sugar Beet Technologists, pp. 246-252.

hybrid beets have shown an especially smooth clean root with low dirt tare as it is pulled from the soil. In the Utah tests the CT9 inbred and its hybrids have shown resistance to a petiole and crown rot which often takes a toll of two or three percent or more of beets in the variety U.S. 22. These good characters probably can be improved upon because there are now many different sub-lines from CT9 in the sixth generation of inbreeding. Tests in California, conducted by Charles Price and J. S. McFarlane, have shown that CT9 and its hybrids are extremely susceptible to the downy-mildew disease. Likewise, tests by Dewey Stewart at Beltsville have indicated a high degree of susceptibility to *Cercospora* leaf spot for the CT9 inbred. There may be other difficulties as more experience is gained. At Toppenish, Washington, the CT9 hybrids, in tests conducted by the Utah-Idaho Sugar company, gave good yield increases in 1947 and 1949, but in 1948 the yield was no better than that for U.S. 22/3. Much injury by lygus bugs occurred in 1948, and it is possible that the CT9 hybrids were relatively more susceptible to this injury than other varieties.

Table 1.—Gross sugar per acre of three male-sterile hybrids compared with U.S. 22/3.

Location	Year	U.S. 22	Male-sterile hybrids[1]		
			S.L.6105	S.L.6106	**S.L.7101**
		Lbs.	Percent	Percent	Percent
Twin Falls, Idaho	1947	5,457	100	106	109
	1948	7,403	100		116 **110**
	1949	9,158	100	116	120 109
Granger, Utah	1948	6,994	100		122 111
	1949	7,240	100	123	122 110

[1] Description of hybrids:
S.L.6105 = U.S. 35 MS x CT9
S.L.6106 = U.S. 41 MS x CT9
S.L.7101 = CT9 MS x S.L. 72, a curly-top-resistant selection of U.S. 22/3—has been designated as S.L. 72.

Future Possibilities

The male-sterile hybrids derived from the CT9 inbred are not immediately available for commercial use. However, they are regarded as illustrative of the possibilities in this line of work. The male-sterile equivalent of an inbred, produced by successive backcrosses, has many advantages for hybridization work as compared with the use of the inbred as a pollinator. However, the obtaining of complete male sterility in the backcross populations from CT9 has involved some difficulty. The fourth backcross generation utilized in 1949 showed approximately three percent pollen producers which necessitated careful roguing of the seed field at the bud stage prior to the opening of the flowers. Necessity for this roguing work may be avoided by careful progeny tests. Some selections from CT9 have already produced lines which in hybrid combinations appear to *give* 100 percent complete male sterility. New sub-lines from CT9 have also been obtained which in their respective phases appear to be much better as either pollen or seed producers. Many other new curly-top-resistant inbreds which carry the proper Mendelian characters are also being produced and compared.

The production of desirable inbreds and their utilization in hybridizations offer a great challenge to the sugar beet breeder. The cytoplasmically-inherited male-sterility factor affords an efficient method for utilization of inbreds. Male sterile equivalents as obtained by backcrossing should greatly facilitate exchange of materials between sugar beet breeders. Such cooperation should serve to bring all efforts in this direction together for maximum benefit to the entire sugar beet industry.

Summary

Results obtained with three male-sterile hybrids, S.L. 6105, S.L. 6106, and S.L. 7101, are summarized. The new hybrids were significantly better in yield of sugar per acre than the commercial variety U.S. 22/3. The cytoplasmic male-sterility factor offers excellent possibilities for utilization of inbreds in the breeding program.