Results of Field Tests with Triploid Sugar Beets in 1951

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Triploidy has been indicated as the chromosome complement giving the most vigorous growth in the sugar beet. The Swedish sugar beet breeders at Hilleshog, under the direction of Dr. J. Rasmusson, have found triploidy a promising method of producing improved varieties.

Autotetraploids of two leaf spot-resistant lines, U. S. 215 and U. S. 216, were established by Dr. F. A. Abegg by colchicine treatment. Results of field tests with these and other autotetraploid varieties were given at the 1946 meeting of this Society (1)[2]. It was concluded that the autotetraploids were generally slow in maturity and low in sucrose percentage but the acre-yield of roots and gross sugar was not significantly below that found in comparable diploid lines.

The autotetraploids of U. S. 215 and U. S. 216 have been hybridized with unrelated diploid lines, producing triploid sugar beets. In each of the matings to be reported, it has been possible to identify the triploid by color of the hypocotyl of the seedlings or by bud color in the larger plants. Stands of identified 3 *n* plants were left at thinning time insofar as possible. Ploidy was disregarded at harvest except that the percentage of triploid plants in each plot was recorded.

A productive inbred, Line U, which has shown excellent combining ability when crossed with the two U. S. varieties on the diploid level, has been mated with the two tetraploids. A comparison of the two triploid hybrids as given in Table 1 indicates a significantly greater acre-yield of of roots and gross sugar for U. S. 215 (4«) than for U. S. 216 (4n), as a pollen parent with Line "N." These differences in yield are considerably greater than reasonably could be expected as a result of the difference of 10 in percentage of identifiable triploid plants in the harvested population.

It can be stated from field tests, conducted in other years, with hybrids produced from the same combinations of these inbreds on the diploid level, that a higher productivity was obtained when U. S. 215 was mated with Line U just as found for the triploid. That is, triploidy as such has not changed apparently the relative breeding value of U. S. 215 and U. S. 216 as parents in combination with Line "U."

The triploid obtained by mating U. S. 216 MS, (2n) and U. S. 215 (4n) was not significantly unlike the commercial U. S. 215 x U. S. 216/3 (diploid) in any of the attributes evaluated.

The highest acre-yield of roots and gross sugar given in this report was shown by Line "U" (2n) x U. S. 215 (4n), but this triploid was not significantly unlike the diploid F_1 obtained from the mating of Line U and the male sterile phase of U. S. 225.

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[2] Numbers in parentheses refer to literature cited.

Table 1.—Comparison of Triploids and Related Diploids with Respect to Acre-Yield of Gross Sugar and Roots and also with Respect to Sucrose Percentage.

	Ploidy	Acre-Yield		Sucrose	Triploi
		Gross Sugar	Roots		
		Tons	Tons	%	%
Line U (*rr*) x U. S. 216 (4*n*)	Triploid	3.264	18.61	17.51	68
Line U (*rr*) x U. S. 215 (4*n*)	Triploid	3.864	22.42	17.21	78
U. S. 216 (*rr*) MS x U. S. 215 (4*n*)	Triploid	3.693	21.58	17.03	100
U. S. 215 x 216/3 Com'l	Diploid	3.521	21.11	16.72	. . . .
U. S. 225 MS x Line U	Diploid	3.761	21.15	17.28	. .

Diff. Req. for Sig. (odds **19:1)**

[1] In harvested population, Triploids identified by bud color.

Attention should be directed to the sucrose percentage of the triploid hybrids. It has been indicated (1) that the tetraploids were generally low in sucrose percentage but these triploids compare favorably with the diploids. Two of the triploid hybrids are significantly higher in sucrose percentage than the commercial U. S. 215 x 216/3.

There is little in this preliminary report to permit one to evaluate triploidy as a means to new levels of productivity in the sugar beet since the hybrids under test did not afford the most critical comparisons. The two autotetraploids used as a parent in triploid hybrid production gave unlike combining ability in matihgs with Line U, which is in accord with their performance as diploids. Thus, to obtain productive triploids, it appears that autotetraploids are required as parents which have been obtained from diploids having good combining ability. Triploidy adds another step in the evaluation of inbreds as parental lines in the production of hybrid sugar beets and this new approach to varietal improvement is worthy of further investigation.

Conclusion

The results of a field test with three triploid sugar beet hybrids indicated equivalent productivity in acre-yield of roots and gross sugar to that of hybrids which can be produced from matings of related lines on the diploid level.

Literature Cited

(1) ABEGG, F. A., DEWEY STEWART and G. H. COONS
1946. Further studies on sugar beet autotetraploids. Proc. Amer. Soc. Sugar Beet Tech. pp. 223-229.