

Report on 1947 Tests of U. S. 215 x 216, and of Other Varieties from Sugar Beet Leafspot Resistance Breeding Investigations of the United States Department of Agriculture

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AGRONOMIC EVALUATION tests were conducted in 1947 with U. S. 215 x 216 as represented by the variety, S.P. 4612-00, and with other varieties obtained in the federal leafspot resistance breeding project. Tests at a total of 17 locations were conducted by members of the staff of the Division in cooperation with State Agricultural Experiment Stations and by cooperators in the beet sugar industry. The cooperators in research organizations of the beet sugar industry who contributed data are Perc A. Reeve and Grant Nichol, Farmers and Manufacturers Beet Sugar Association (tests at Reece, Michigan, and Latty, Ohio), C. W. Doxtator, American Crystal Sugar Company (tests at Rocky Ford, Colorado, and Mason City, Iowa), C. E. Cormany and D. F. Peterson, Holly Sugar Corporation (test at Sidney, Montana), and H. E. Brewbaker and H. L. Bush, Great Western Sugar Company (tests at Brush and Longmont, Colorado).

The varieties included in the agronomic evaluation tests were as follows:

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| S.P. 4511-00 | U. S. 215 x 216 4n. Seed of U. S. 215 4n (S.P. 3-1041-0) was mixed with an equal quantity of U. S. 216, 4n (S.P. 3-1042-0) to provide the planting stock for the seed field. |
| S.P. 451034-0 | Synthetic variety. Produced by direct increase of S.P. 3-1834-00. |
| S.P. 4610-00 | Synthetic variety. Seed of 6 inbred lines pooled to provide planting stock for the seed field. |
| S.P. 4611-00 | Single cross, U. S. 216 Imp. (S.P. 451-0) × S.P. 455-0, a leafspot resistant strain not related to U. S. 216. |
| S.P. 4612-00 | Single cross, U. S. 216 M. S. (S.P. 45102-01) × Imp. U. S. 215 (S.P. 4-14-0). |
| Nebraska 30
S.P. 4-5-0 | Mass selected variety supplied by S. B. Nuckols. "Synthetic Check." Seed of 9 European varieties pooled to furnish initial planting stock. Seed produced in New Mexico in 1944 by field-over-wintering method. |

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“Local” Variety supplied by beet sugar companies for the purpose of relating performance of new candidates to currently used commercial stocks.

Cercospora leafspot was severe enough for readings to be made at Fort Collins (under sprinkler), Rocky Ford (under sprinkler), and Brush, Colorado; also at Mankato, Minnesota and Chatham, Ontario. At all other places, the disease was reported as ‘limited’, ‘late’, ‘slight’, ‘negligible’, or ‘absent’. Apparently only at the locations at which readings were made did the disease produce effects on yield and quality.

The data for sugar per acre, root yield and sucrose percentage are summarized in tables 1, 2, and 3, the tests being grouped on basis of leafspot exposure. In table 4, the 17 tests in 1947 are compared with tests in previous years with same or related varieties (2, 3).²

In the 5 tests in which leafspot was a factor, Synthetic Check (4-5-0) in comparison with the leafspot-resistant varieties showed strong reduction in sugar per acre, in root yield and in sucrose percentage. Production of gross sugar was from about 9 to 15 percent lower and root yield was similarly reduced. Sucrose percentages were lower, numerically, by 1 to 3 percents. The local variety, G.W. 59, at Fort Collins (under sprinkler), was about equal to Synthetic Check, whereas at Brush, G.W. 85-45, a resistant variety, was significantly superior. Differences in sugar production between local and Synthetic Check were not significant at Rocky Ford, Colorado., Mankato, Minnesota, and Chatham, Ontario. At Rocky Ford, the local variety was significantly better in sucrose percentage. Nebraska 30, obtained by selection from European varieties, chiefly, was not significantly different from Synthetic Check. In general, all leafspot-resistant varieties made a favorable showing in comparison with the non-resistant sorts.

But these favorable showings for the resistant varieties were not maintained in the tests in which leafspot was of minor importance. Synthetic Check without disease was, as in 1946, relatively high in tonnage and in sucrose. Varieties produced by breeding work of the beet sugar companies were usually not significantly different from it in the production of sugar per acre. In two cases they were significantly lower. U. S. 215 x 216 Commercial was used as “local” at East Lansing, Merrill, and Reece, Michigan, and at Latty, Ohio. In one case U. S. 215 x 216 Commercial was significantly below Synthetic Check in sugar per acre, in two other tests the differences were large and in favor of Synthetic Check, but did not reach significance. In the fourth test the yields were about equal.

S.P. 4612-00 is a phase of U. S. 215 x 216 in which the male-sterile factor is utilized to enforce a greater degree of hybridization. If compared with 4-5-0, then on the basis of the 12 tests in which leafspot was absent, the variety produced 96.2 percent as much sugar per acre as Synthetic Check. It is doubtful if this difference is to be interpreted as significant, although significant differences were obtained in two tests.

²The numbers in parentheses refer to literature cited.

These results are in line with those reported previously and emphasize the challenge made to American sugar beet breeders. Synthetic Check is about representative of good European yield types of sugar beet. It shows a great range of adaptation and excellent crop returns when leafspot is not a factor. It appears that any superiority of American varieties in these tests is to be assigned to increased leafspot resistance rather than to innate productivity.

At the majority of the places at which tests were conducted *Cercospora* leafspot commonly occurs in epidemic form. The last three seasons have been characterized by the relative absence, or by the limited and late attack of *Cercospora* leafspot in the greater part of the tests. The general mean (table 4) shows that the gains from resistant varieties in the 5 tests with leafspot in 1947 more than offset the slightly lower average performance in the 12 tests without leafspot. By and large, then, no great cost is involved in using these leafspot-resistant varieties as insurance against crop loss from this disease.

A further consideration particularly applies to the districts that use the Scott-Urschel combine for harvesting the crop. The leafspot-resistant varieties give assurance that at harvest time a bouquet of leaves will be present to permit this type of machine to operate. Varieties whose tops are blighted and destroyed by leafspot cannot be harvested by a machine that operates on the principle of clasping the foliage between belts and elevating the plant to the topping disks.

The tetraploid U. S. 215 x 216, S.P. 4511-00, was made by mixing seed of U. S. 215 4n and U. S. 216 4n and then using the pooled seed to plant the seed field. The variety was of extreme interest to all viewing the tests. The large and heavy tops and the general vigor of growth attracted attention. In only a few tests, however, was the stand equivalent to that of the other varieties. Data as obtained for this variety conform to other experiences of the Division with tetraploids (1). The tetraploid showed that any increase in root yield was about offset by a lower sucrose percentage. The tendency of tetraploid seed to show a sprout count about equivalent to sheared seed has been reported (1). Exploration of advantage from establishing new varieties on the tetraploid level appears to be warranted.

Attention is called to the outstanding performance of a synthetic variety, S.P. 451034-0 (tables 1, 2, and 3). Under conditions of leafspot exposure, it was 15 percent better in gross sugar than Synthetic Check, achieving this because of its superior tonnage. In sucrose percentage it was equivalent to the check. Without leafspot, it yielded, on the average, as much as Synthetic Check and was not significantly lower in quality. In table 4, the good performance of the variety in 1947 is compared with similar good performance of its parent, S.P. 3-1834-00 in 1945. The last named variety was also increased as S.P. 4713-0 and seed is being supplied to cooperators for further increase. The variety, if and when formally released, will be designated as U. S. 226. It is proposed to utilize the variety as pollinator to produce U. S. 216 x 226. U. S. 226 by reason of the many

moderately leafspot-resistant varieties combined to produce it, has a broad genetic base and, therefore, wide adaptability. In U. S. 216 x 226, the male-sterile U. S. 216 will supply additional leafspot resistance, and the high degree of male sterility assures that the variety will be prevailing hybrid. Advantage from heterosis is expected (4).

In tables 1, 2, 3, and 4, data are given respecting S.P. 4610-00, a synthetic variety of much the same composition as U. S. 226. S.P. 4610-00 differs from S.P. 451832-00 tested in 1946 in that the latter was produced from identified F₁ roots planted together in the seed field, whereas the former was grown from seed obtained by pooling equal quantities of the 6 constituent inbreds. There was opportunity for sibbing in S.P. 4610-00, but any reduction in yield because of this was not noted. Since the two synthetic varieties have many inbreds in common, the similarity in performance is fully understandable. The results with S.P. 4610-00 are of value in supporting those obtained from S.P. 451034-0 (U. S. 226).

Summary

Five leafspot-resistant varieties and one variety selected for high root yield from federal breeding investigations were compared in 17 tests with a check variety representative of European yield types of sugar beet. A variety currently being used locally in commercial sugar beet plantings was included in the tests at the various places. In those tests in which *Cercospora* leafspot was a factor, the 5 resistant varieties showed a superiority in sugar production of about 9 to 15 percent over the non-resistant varieties. In tests in which leafspot was a minor factor or absent, the varieties frequently did not show significant differences when compared with the checks. American bred varieties have been improved over European sorts in leafspot resistance and apparently derive their advantage from these factors rather than from a general increase in productivity. There are hopeful indications that highly productive varieties may be made leafspot resistant. These varieties would show significant advantage not only under conditions of leafspot exposure but under non-disease conditions as well. A variety, U. S. 216 x 226, giving such promise is being considered for release to the sugar beet industry.

Literature Cited

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