

Breeding for Resistance to Root Rot Caused by *Sclerotium rolfsii*

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Southern root rot caused by *Sclerotium rolfsii* Sacc. is found in beet growing areas of the Sacramento River in California and in some areas of western Texas. In California very great loss has been experienced on many fields.

Present control measures are (a) the indexing of the soil to ascertain the number of *sclerotia* of the fungus present, (2)² for the purpose of determining whether beets can be grown safely, and (b) heavy nitrogen fertilization of those fields where the fungus is present (3) .

Breeding for resistance to the southern root rot was begun in 1946 at Clarksburg, Calif., by the Beet Seed department of the American Crystal Sugar company. The progress of this project is summarized in this paper.

Experimental Procedure

During the 1946 season plans were made to select surviving beets of the American 5 variety in areas where beets were dying of the disease. Fifty good beets were obtained in very severely infested areas, all of which could be considered as escaping the disease either because of resistance or because of lack of the organism where these particular beets were growing: These roots were placed in cool storage until November when they were replanted at Placerville, Calif., for production of seed. In 1947 a similar procedure was used and 167 beets obtained from the American 5 variety.

Harvest of seed from individual beets in these selections was planned for mother progeny tests in replicated plots, similar to the procedure used in *Aphanomyces* root rot resistance breeding (1) .

Experimental Results

Almost complete failure was experienced in the 1946 selection, since, of the 50 beets planted for seed, only four showed any life during the following spring, and only one of these produced seed. A few roots were obtained from seed of this plant in 1947 at Rocky Ford, Colo. A seed increase was obtained in 1948 and a large root selection made in 1949 for a bulk seed increase (and individual plant seed lots) in 1950.

From the 167 beets selected in 1947 and replanted for seed production 90 plants produced seed in 1948. The 10 highest seed yielding plants were harvested separately. A bulk seed lot of 14.2 pounds, representing the best of the 80 remaining flowering plants, was also obtained under the breeders' stock number 8-204.

In 1949 a field known to be severely infested with *Sclerotium rolfsii* was selected for tests of individual plant lines and of the bulk increase obtained the previous year. Seven plant lines along with the American 5 parent were planted in five replications of two-row plots 25 feet long, adjacent to which

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² Numbers in parentheses refer to literature cited.

were planted four strips each of the bulk increase 8-204 and of the American 5 percent. Because of the severity of the disease, a very great loss of beets resulted after thinning, and those which remained were of small size at harvest. All of the best beets in all plots were selected for seed increase purposes, in an effort immediately to improve any resistance which may have been previously obtained.

The performance of the selections as compared with the check variety was determined first by notes on vigor of growth after thinning, and later on the tenacity of the beets to live until harvest. These results are given in Tables 1 and 2.

Table 1.—Performance of 7 mother progenies selected for southern root rot resistance, along with parent variety; Clarksburg, Calif., 1949.

M-line Number	Emergence data		
	Seedling vigor ¹	Total beets per 100' of row	Percent Survival at harvest
8-204-1	2.8	73	50
8 204-2	4.8	47	53
8 201-3	3.8	64	56
8-204-4	6.6	33	62
8 204-5	4.8	64	51
8 204-6	5.4	52	48
8 204-7	3.8	70	54
Significant difference	4.0	62	38
odds 19:1	2.5		13.0

i j — vigorous 8 — weak

Table 2.—At harvest survival of breeders' stock 8-204 as compared to the parent variety in a 4 replicate strip test. Clarksburg, Calif. 1949.

Replicate	Percent survival at harvest	
	8-204	Amer. 5
1	39.3	24.0
2	71.4	43.9
3	61.5	45.0
4	70.6	47.6
Average	60.7	40.1

The results of the mother line test, Table 1, indicate significant differences in both vigor of seedling growth and percentage survival at harvest. Survival at harvest of the 7 M-lines ranges from 48 to 62 percent for an average of 53.4 percent as compared to 38 percent for the check variety. There is no indication that seedling vigor was associated with percentage survival at harvest.

In Table 2 the survival of the breeders' stock 8-204 is higher than the check variety in all four replications. Differences between these two varieties range from 15.3 to 27.5 percent.

Conclusions

The results of these two replicated tests indicate differences in percentage survival between individual mother lines, between mother lines and the check variety, and between the mass selection 8-204 and the check variety under severe root rot conditions. Differences between the resistance selections and the parent variety are similar in both tests. It is extremely unlikely that

this result could have occurred in both tests due to chance. As a result of these findings breeding for resistance to this disease is being expanded considerably in 1950.

Literature Cited

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