

## Breeding for Resistance to the Sugar Beet Nematode

J.F. SWINK<sup>1</sup>

The sugar beet nematode *Heterodera schachtii* has long been a menace to the sugar beet industry in the Arkansas Valley and continues to become worse year by year. Control measures are urgently needed. The best solution would be a nematode-resistant beet variety. Breeding for resistance has been tried in Europe with some success (1)<sup>2</sup>, and Rietberg (2) also has reported differences in resistance between inbred lines. The purpose of this paper is to report the work done in the past three years on selection for resistance to this disease by the American Crystal Sugar Company<sup>3</sup>.

In 1950 a farmer<sup>4</sup> near Vineland, Colorado, had a heavily infested field from which he selected 59 roots which appeared to have tolerance to the disease. These roots originated from the variety U. S. 215 x 216 and were turned over to the American Crystal Sugar Company as breeding stock.

The roots were individually weighed and analysed for sucrose and sodium content. After careful selection 43 beets were planted in the greenhouse for breeding work. The plants were pair-bagged to obtain as much seed as possible for replanting in a nematode-infested field. Many plants did not bolt and at the time of seed harvest in the spring of 1951 only 16 plants produced self-pollinated seed and only four pair-bagged seed lots were obtained.

The open-pollinated plants were harvested separately and planted with the pair-bagged material and the parent variety in a field where the year before nematode had been severe. There was good emergence, but as the season progressed noticeable differences were evident in favor of the selections for both stand and vigor.

In October, 1951, roots were harvested from all lines which appeared to have tolerance to nematode. One hundred and five roots were harvested and from this selection 46 were planted in the greenhouse in December, 1951, and 59 were saved for a mother group seed increase for the 1952 spring planting.

Due to curly top in this material, only four inbred and four sib lines were obtained. These were planted in the summer of 1952 with the seed remnants of the 1951 greenhouse work (11 open-pollinated lines) plus four commercial varieties. Nematode was severe in 1952 and differences in the selected lines were noted. From this nursery 248 rather small roots were harvested. These roots were planted in the greenhouse in December, 1952. This included two self lines and four sib lines along with 11 open-pollinated lines and four checks.

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<sup>1</sup> Station Superintendent, American Crystal Sugar Company, Rocky Ford, Colorado.  
<sup>2</sup> Numbers in parentheses refer to literature cited.  
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<sup>4</sup> Earl Hartman, Vineland, Colorado. All selections to date have been made and tested on Mr. Hartman's farm.

All of these roots were pair-bagged *in* the greenhouse for seed production and 57 different sib lines were obtained for testing in 1953. These were planted in May with three mother lines from the group 2-413, and three inbred lines plus two commercial varieties for reselection purposes. Roots were harvested in September, 1953, from 29 of the 57 lines, three M lines and both commercial check varieties. These roots were planted in the greenhouses in December, 1953, for further breeding.

In 1953 six of the largest mother progeny seed lots obtained from the field group 2-413 were put *in* an M line test along with a bulk lot of all mother lines, and a commercial variety. This test was flooded, so no yield comparisons could be made. However, root selections were made, taking all beets possible from each line. One line was outstanding in the number of large beets produced when compared to the check, and the 2-413 bulk, as shown in Figure 1. The check and one other line were the poorest selections in number of large roots.



Figure 1.—Three of the lines selected from the replicated test. Left to right: bulk of six mother progenies, resistant line, and check variety.

In the summer of 1953 an area in a farmer's field south of Rocky Ford, Colorado, was observed to be severely and uniformly infested with nematode. Since there were a few live individuals which were surrounded by nearly dead plants, selections were made in this area. All 102 beets obtained were covered with nematode cysts, but the average weight was one and one-half pounds per beet. Figure 2 shows the most outstanding beet in the infested area.

#### Summary

Nematode has long been a disease which has caused severe loss to the grower of sugar beets. Soil fumigation has proved costly and only works under the most ideal climatic and soil conditions. Since breeding for resistance to disease has been generally successful in crop plants, it was decided to make a determined attempt to find out whether resistance, or tolerance, could be obtained. It is the opinion of the author that a reasonable degree of tolerance has been obtained in the past three years' work.

Because of the encouraging prospects, selection work in this project is being increased, and a permanent nematode disease nursery is being set up near Rocky Ford. Further, attempts to hybridize resistant wild types with sugar beets are being greatly expanded.



Figure 2.—The most outstanding beet in the 1953 selection field.

#### Literature Cited

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