Strawberry Breeding In New Jersey

J. N. MOORE and L. F. HOUGH*
New Brunswick, New Jersey

Since the initiation of the strawberry breeding program in 1928, seven strawberry varieties have been introduced by the New Jersey Agricultural Experiment Station, namely, Pathfinder, Redwing, Julymorn, Crimson Glow, Sparkle, Redcrop, and Jerseybelle. At the present time Sparkle and Jerseybelle are planted on over 60 percent of the strawberry acreage in New Jersey.

The objectives of the program do not differ greatly from other strawberry breeding programs in this country. Some of the objectives currently receiving emphasis are as follows:

(1) To develop superior fresh market varieties having large size, firm flesh, attractiveness, productiveness, high quality and disease resistance.
(2) To develop varieties suitable for processing by freezing with stems that are easily removed, flesh firm enough to maintain slices after thawing, uniform red flesh color, good flavor in sugar syrup, and heavy production.
(3) To extend the strawberry harvest season by the development of both earlier- and later-maturing varieties.
(4) To develop acceptable everbearing varieties particularly adapted for the home gardener.

Other objectives include frost hardiness with early blossoming, very large fruit size, fairly true breeding lines suitable for the production of F_1 hybrid seed-propagated varieties, and runnerless plants that can be propagated by seed.

One of the goals is combining disease resistance with good horticultural characters. This phase of the program is relatively new in New Jersey, having been activated only two years ago. Dr. E. H. Varney, of the Rutgers Plant Pathology Department, is cooperating in this work.

We are interested primarily in breeding for resistance to two soilborne, root-infecting fungus diseases —Verticillium wilt *(Verticillium alboatrum* R. & B.), and the red stele disease *(Phytophthora fragariae* Hickman). Both have become serious in certain areas of New Jersey and, on some farms, have made strawberry production unfeasible. At the present time the only practical control of these diseases appears to be through the use of resistant varieties (1, 3).

The first step in breeding for resistance to *Verticillium* was to determine sources of resistance. In 1958 a preliminary field screening of 50 strawberry varieties and selections was conducted (3), and in 1959 (4) an additional 29 varieties and selections were screened. The varieties Catskill, Surecrop and Vermilion were found to be quite resistant and were used in crossing. Seedlings are being screened in a field with a past history of severe *Verticillium* infestation, and the inoculum potential in the soil is maintained at a high level by alternating with tomatoes. In addition, a detailed study of the inheritance of resistance to *Verticillium* is being initiated this year.

In breeding for resistance to the red stele fungus, we are using as

*Research Associate and Professor, respectively, Dept. of Hort., New Jersey Agr. Exp. Station.

sources of resistance principally those varieties and selections having multiple race resistance. Since multiple races are known to exist in New Jersey, and the race picture is potentially more complex than is currently known, the best approach seems to be to combine as many types of resistance as possible. This phase of the program has been and will continue to be coordinated with the red stele resistance breeding program of the Fruit and Nut Crops Research Branch of the United States Department Agriculture.

Techniques of seedling screening for red stele resistance are essentially the same as reported by Waldo *et al.* (5) and Scott *et al.* (2). Following this preliminary screening, seedlings classed as resistant are transplanted to a red-stele-infested field for further screening and evaluation of horticultural characters. Both the soil used in the greenhouse and the field screening is infested with more than one race of the pathogen.

A Rutgers graduate student, Mr. A. B. Wills, from the Scottish Horticultural Research Institute, is currently conducting an experiment designed to shed more light on the inheritance of resistance to red stele. It is expected that the results obtained from this and similar experiments can be utilized to make this phase of the breeding program more efficient.

In an effort to attain the objectives outlined above, we are at present screening approximately 10,000 seedlings each year for selections either of commercial value or with characters of value for use in breeding. When an outstanding selection is noted, plants are immediately turned over to Dr. C. R. Smith, of the Department of Horticulture, for virus indexing. If virus-free, the selection is established in a screenhouse where foundation plants are maintained until some disposition is made of the selection. By following this procedure it is hoped that all varieties released in the future will be initially virus-free. At the present time, we have a number of selections which are considered promising enough to maintain under virus-free conditions.

The genetic material currently being used in breeding comes from many sources. A variety planting is maintained and new varieties are added as they are released. In addition, through the cooperation of the Plant Introduction Division of the United States Department of Agriculture, a total of 23 varieties and species from many parts of the world have been received. These should provide a source of new and unusual characters for the varieties of the future.

Literature Cited

1. Moore, J. N. and E. H. Varney. 1959. Verticillium wilt of strawberries. Hort. News. 40(4):3438–3439.
2. Scott, D. H., G. M. Darrow, W. F. Jeffers, and D. P. Ink. 1950. Further results on breeding strawberries for resistance to red stele disease. Trans. Penin. Hort. Soc. 40:130–138.
3. Varney, E. H., J. N. Moore, and D. H. Scott. 1959. Field resistance of various strawberry varieties and selections to Verticillium. Plant Disease Reptr. 43(5):567–569.
4. Varney, E. H., J. N. Moore, and D. H. Scott. 1960. Field resistance of 29 additional strawberry varieties and selections to Verticillium, 1959. Plant Disease Reptr. 44(5):370–371.
5. Waldo, G. F., G. M. Darrow, W. F. Jeffers, J. B. Demaree, and E. M. Meader. 1947. Breeding strawberries for resistance to red stele root disease. Trans. Penin. Hort. Soc. 36:22–23.