Apple Breeding for Scab Resistance

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New apples similar in type to currently popular varieties but immune to apple scab *(Venturia inaequalis)*, would materially strengthen apple production in the northeastern quarter of the United States and its fringe area, and in many other production areas of the world. Such varieties appear to be attainable. The basis for this statement is the progress made in the past seven years by the joint efforts of fruit breeders and pathologists to evaluate the resistance of *Malus* species of oriental origin, and hybridize them with commercial apple varieties. A substantial number of the flowering crabs introduced fifty or more years ago from Japan and China for ornamental purposes, contain one or more major genes which confer field immunity to the common apple scab strains occurring in the United States, Canada, Europe and Australia.

Several small-fruited crabs were used by Crandall in his apple genetic studies at Illinois beginning in 1908. A group of 38 trees of a 1926 sib-cross of two F_1's of an earlier Rome Beauty x *M. floribunda* cross were observed in the field, in 1943, to have segregated for scab immunity. A detailed study followed and substantiated the observation. It came as quite a surprise to learn that this important character is conditioned by a single gene pair, for which all the resistant plants were heterozygous, including the original 821 *M. floribunda* clone. Selections from Crandall's sib-cross have been used in a backcross program, using different commercial varieties as recurrent parents. The first backcross was made in 1946. The resulting seedlings started fruiting in 1950, and the second blackcross generation was then initiated. It appears that a number of the second backcross seedlings will fruit in the 1954 season. Practically all of the first backcross seedlings have fruited. Thirty-five of them have been selected and crossed since 1950 with such varieties as 2N and 4N McIntosh, 2N and 4N Jonathan, 2N and 4N Golden Delicious, and the 2N varieties Crandall, Delicious, Lodi, Macoun and others. About 7,000 of these BX_2 seedlings are being grown for fruiting tests at Urbana and Carbondale, Illinois, Lafayette, Indiana and New Brunswick, New Jersey. Several hundred are also being grown at Ottawa, and Kentville, Nova Scotia in Canada, in Fjalkestad, Sweden and in Sydney, Australia.

The first backcross *M. floribunda* selections are at present the most promising among all the resistance sources being advanced in the program. The best of these selections are about 2½ inches average diameter, with fair quality and distinct resemblance to the parent variety. Since it is impossible to predict how long the *floribunda* resistance to *V. inaequalis* can be maintained if extensively planted, some 16 other sources of resistance are being advanced by the backcross method. Of these 16 sources, 14 are represented by about 15,000 first backcross seedlings being grown for fruiting in Illinois, Indiana and New Jersey. Several of these will begin to bear in 1954. One advantage of certain of the species is the ability to transmit precocious bearing. For example, about ten per cent of the seedlings of a 1947 Wolf River x *M.*

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zumi calocarpa cross flowered in 1950. All of those flowering were set with known pollen, and the seeds from the better F_1 seedlings were planted. One of the BX_1 seedlings, resulting from an F_1 x Jonathan cross, fruited in 1953. Thus, the scab resistance of *M. zumi calocarpa* was advanced two generations from fruits 0.4 inch to 1.8 inches in diameter in only six years. The improvement in fruit quality and appearance was even more striking than the increase in fruit size.

The task of introducing scab immunity into the several standard apple variety types is a formidable one and will require the continued attention of cytologists, geneticists, horticulturists and plant pathologists. The early generation results indicate, however, that substantial progress can be made in relatively few years.

Two Blushed Strains of McIntosh in British Columbia

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The McIntosh apple was heavily planted in British Columbia at the turn of the century, when the commercial fruit industry was becoming established.

Many other old varieties which were planted at that time have since disappeared, but McIntosh has been the most important variety in this region throughout the years, and still represents 40 per cent of the commercial apple tonnage.

About 30 years ago, it became evident that most McIntosh orchards were producing two distinct kinds of fruit in respect to color. Many trees produced only fruit of a striped type which was relatively unattractive. Other trees produced apples having a solid red blush and no stripes, and these fruits were more attractive. Most of the latter trees, however, showed a marked tendency to sport from the blushed to the striped type. This sporting could be found on individual spurs, on twigs or on large limbs. When sporting from blush to stripe occurred on a portion of a tree, the characteristic remained constant on that portion, and no instance of reversed sporting, from striped to blushed type, has ever been observed in this region.

As long ago as 1928, the Summerland Experimental Station began testing blushed strains of McIntosh which it was hoped would not show a sporting tendency. Two strains were used in this experiment, the Rogers strain, originated on the farm of J. C. Rogers, Dansville, New York, and the Summerland strain, originated as a single tree at this Station.

Throughout the intervening 25 years of testing, both strains have produced fruit of the solidly blushed type, and neither has shown more than a very slight tendency to striped sporting. In 1944, the two strains were considered sufficiently promising to merit commercial distribution. Since then, 67,739 buds have been distributed by this Station, mostly in British Columbia. In a few instances buds have been sent to foreign countries as well.

At present, the two strains appear equally desirable, and only the future can decide whether either is superior in freedom from striped sporting, or in such other factors as winter hardiness and resistance to disease.