

Fruit Breeding in Arkansas

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The performance of a fruit variety is dependent upon an interaction between the genotype of the plant and the environment in which it is grown. The plant genotype sets the broad limits of production and quality performance, and the prevailing environment determines the performance within the genetically controlled limits of the variety. For this reason, a variety may perform altogether differently when moved to a new environment. Some varieties, such as the Blakemore strawberry, the Concord grape, and the Elberta peach, are relatively stable, phenotypically, over a rather wide range of soil and climatic conditions. Such varieties are believed to be somewhat insensitive to minor environmental fluctuations as a result of having "homostatic" genes which buffer the variety to changes in environment. Most fruit varieties, however, are quite sensitive to even small environmental changes. New, highly specialized fruit varieties being developed in modern breeding programs appear in many cases to have more narrow ranges of adaptation than many of the older, less specialized varieties. It appears that in selecting for very high performance under one environment, genes for adaptation to other environmental conditions are in many cases being sacrificed.

The first major step in establishing a new fruit industry, or in helping an existing industry achieve its full potential, is to properly match the fruit varieties to the environment in which they are to be grown. One approach is to test varieties that have been de-

veloped in other areas in the hope of finding material that will perform satisfactorily under the new set of conditions. This approach may produce the desired results and is relatively inexpensive. A continuing program of variety testing should, by all means, be an integral part of all fruit production research programs. However, a more sure and generally more efficient (albeit more expensive) approach to the variety problem is the directed breeding and selection of new varieties in the environmental region in which they are to be grown.

Extensive fruit variety testing at the Arkansas Agricultural Experiment Station for many years has shown that most varieties developed in other areas have one or more serious faults in either production or quality when grown under Arkansas conditions. Even the varieties that perform well enough to be commercially acceptable generally do not perform as well as in the area in which they were developed. In an effort to develop fruit varieties uniquely adapted to the soils and climate of Arkansas, an extensive fruit breeding program has been developed within the past 5 years at the Arkansas Agricultural Experiment Station. Breeding projects are being conducted on grapes, strawberries, blackberries and raspberries, apples†, and peaches‡. Through this approach, it is expected that the full potential for quality fruit production in Arkansas can be more quickly realized.

Some of the objectives of the various breeding projects are:

Grape:

- 1) To develop adapted, high quality,

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attractive, hardy table grapes, with long shelf life, both seeded and seedless.

- 2) To develop a series of even-ripening, high methyl anthranilate, Concord-type juice grapes, ripening from two weeks earlier than or in same season as Concord.
- 3) To investigate the use of inter-specific hybridization, particularly *V. labrusca* x *V. rotundifolia* and *V. vinifera* x *V. labrusca* in developing new types of grape adapted to the upper South.
- 4) To investigate the use of polyploidy in grape breeding, particularly in the development of large-fruited, seedless table grapes.

Strawberry:

- 1) To develop a series of varieties suitable for fresh market. Characters to be especially considered include: vigorous, disease resistant, productive plant; large to very large fruit size, firm flesh, tough skin, light red, glossy skin color, showy calyx, high aroma and good dessert quality, long shelf life.
- 2) To develop a series of varieties suitable for processing. Characters to be especially considered include: vigorous, disease resistant, productive plant; large fruit size, uniform red flesh color, firm flesh, high aroma and moderately tart flavor, small, dry scar, ease of separation of calyx.
- 3) To develop varieties suitable for mechanical harvest. Characters to be especially considered include: concentration of fruit ripening for once-over harvest, very easy abscission of calyx upon fruit maturity for possible multiple harvest, very firm fruit with tough skin to withstand harvester abuse.

Blackberry and Raspberry:

- 1) To develop varieties of erect blackberries adapted to the upper

South, suitable for fresh market and processing.

- 2) To develop raspberry varieties with heat tolerance and disease resistance adapted to the conditions of the upper South .
- 3) To develop blackberry varieties especially adapted to mechanical harvesting. Characters to be considered include: concentration of ripening, ease of fruit abscission upon maturity, rigidly erect plant type, very firm fruit, very early and very late ripening types to expand the harvest season.
- 4) To develop erect, thornless varieties of blackberry.

Apple:

- 1) To develop a series of high quality, early ripening, dual purpose apple varieties. Emphasis will be on achieving color, flavor, texture, and durability for use either as early season fresh market or for processing.
- 2) To develop a series of clonal apple rootstocks which will impart size control of tree when in combination with acceptable varieties. Emphasis in selection will be on heat, drought, and disease resistance, early dormant season hardening off, and anchorage.

Peach:

- 1) To develop a series of large-fruited, productive, clear-fleshed, high quality, non-shattering, small seeded, clingstone peach varieties suitable for processing.
- 2) To develop a series of adapted, large-fruited, productive, yellow-fleshed, freestone nectarines.

The incorporation of disease resistance into good horticultural varieties is a common objective with all these crops. Special emphasis is being given resistance to black rot (*Guignardia bidwellii*) in grape, leaf spot (*Mycosphaerella fragariae*) in strawberry,

anthracnose (*Elsinoe veneta*) of blackberry and raspberry, bacterial spot (*Xanthomonas pruni*) of peach, and fireblight (*Erwinia amylovora*) of apple. Several other important diseases of these crops are also receiving attention. The evaluation of material for disease resistance is done in cooperation with the Department of Plant Pathology of the University of Arkansas.

Cooperation is also received from the Physiology and Processing Laboratory of the Horticulture Department, University of Arkansas, in the evaluation of material for processed quality. Both objective and subjective measurements of processed quality are conducted on fruit samples of selected materials.

A necessary initial accomplishment in the breeding program has been to make an extensive collection of germ plasm of diverse genetic background to evaluate for characters of value in breeding. Material has been received from many experiment stations, and, through the Plant Introduction Service, from many foreign countries. The experiment stations of New Jersey, New York, and Illinois, and the Small Fruit and Grape section of the USDA have been especially generous in sharing genetic material from their extensive collections. The collection and evaluation of new material will be a continuing part of the program.

The mechanics of the breeding program essentially consists of hybridiz-

ing the best genetic material available from the standpoint of quality and area adaptability and selecting the most promising seedlings for further evaluation. Other breeding techniques such as colchipoidity, interspecific hybridization, and high energy irradiation are being employed as needed to produce desirable genotypes not readily obtained by conventional plant breeding methods. Genetic studies are planned to shed light on the inheritance of important characters in these crops.

Due to the heterozygous nature of these fruit crops, large populations of seedlings are being grown. Seedling populations are grown, fruited, and evaluated in the areas of commercial production of the respective crops within the state. Grape, apple, peach, and bramble seedlings are grown at the Clarksville Fruit Substation, and strawberry seedlings are grown at the Bald Knob Strawberry Substation. Promising selections are propagated and test plots established in other climatic areas of Arkansas. Propagations of promising selections will also be made available to interested experiment stations in other states.

Preliminary results obtained to date are very promising and support the concept of locally "tailor-making" varieties to fit specific soil and climatic areas as being the best approach to solving the variety problem of fruit growing.

New Yorker Nectarine

New Yorker is a white-fleshed nectarine recently named by the New York Fruit Testing Assoc., mainly because of its popularity in New Zealand. The fruit is medium-sized, round to oblate, with 80% red over greenish white ground color. Its white flesh is juicy, medium-firm, sweet and rich in flavor, and freestone. The tree

is productive, vigorous, and equal to the Redhaven peach in hardiness, if not hardier. It should be trained carefully due to its tendency to develop narrow-angled crotches.

New Yorker is the result of crosses made by Richard Wellington in 1929 and 1937, and was selected by H. O. Bennett, and widely tested.