About Our Cover

Fruit Breeding in Arkansas

The fruit breeding program of the Arkansas Agricultural Experiment Station was begun in 1964. Crops initially targeted for improvement were strawberry, grape, and blackberry. In 1966, projects were approved for the breeding of peaches, nectarines, and apples; blueberries were added in 1976. The overall objective of the fruit breeding program is to develop cultivars uniquely adapted to the soils and climate of Arkansas to maximize production efficiency and that produce high-quality fruits for effective market use. To date, 16 cultivars have been developed and released from this program (Table 1). Many of these have become major commercial cultivars, not only in Arkansas but also in many other states.

Grape. Arkansas has been a producer of grapes for more than 100 years, and currently ranks eighth in the United States in grape production. Until recently, almost the entire Arkansas production was processed, either into wine or juice, and these industries have been relatively stable. We perceived that a third major grape industry, table grapes for fresh market, had potential, provided adapted, high-quality, seedless cultivars could be developed that would compete in the marketplace with vinifera grapes produced elsewhere. This potential is now becoming reality. Within recent years, a small but rapidly expanding table grape industry has developed in Arkansas, based on the production and market acceptance of 'Venus', 'Reliance', and 'Mars'. The new seedless 'Saturn' (see cover and p. 861 of this issue of *HortScience*) is expected to further stimulate industry growth. In addition, interest in growing table grapes is increasing in Ohio, New York, and other northern states, based in part on the cold-hardy 'Reliance'.

While efforts will be continued in the development of additional improved seedless cultivars in support of the table grape industry, some emphasis is now being given to the improvement of wine and juice cultivars, in cooperation with the Food Science Dept. at the Univ. of Arkansas.

The breeding approach mainly has involved interspecific hybridization between *Vitis vinifera* L. and *V. labrusca* L. types, in which the good fruit quality of *V. vinifera* is combined with the climatic adaptability and disease resistance of American bunch grapes. Recent innovations in the program include the development and use in breeding of tetraploid clones to enhance fruit size of seedless grapes and the use of ovule rescue techniques to allow seedless x seedless hybridizations.

Table 1. Fruit cultivars developed at the Univ. of Arkansas.

Species and cultivar[z]	Year released
Grape	
Venus	1977
*Reliance	1983
*Mars	1984
*Saturn	1988
Strawberry	
Cardinal	1974
Comet	1975
ArKing	1981
Blackberry	
Cherokee	1974
Comanche	1974
Cheyenne	1977
Ebano[y]	1981
*Shawnee	1984
*Choctaw	1988
*Navaho	1988
Peach	
Allgold	1984
Goldilocks	1984

[z]* = Patented.
[y]Joint release with Brazil.

More than 10,000 seedlings are produced from controlled crosses each year and 445 selections are now in various stages of evaluation. Elite selections have been provided to experiment stations in 24 states and several foreign countries for regional testing. A collection of >500 clones, including cultivars from 16 countries, provides valuable germplasm for the breeding program.

Blackberry. Arkansas conducts one of the largest blackberry breeding programs in the world, and the "Indian Tribe" series of cultivars are widely grown. Initially, a major objective was to develop erect-growing cultivars that were adapted to mechanical harvest; this was achieved with the release of 'Cherokee', 'Comanche', 'Cheyenne', and 'Shawnee'. However, since most blackberries in Arkansas are still hand-harvested for fresh market, recent emphasis has been directed at developing erect-growing thornless cultivars. 'Navaho' (see p. 863 of this issue of *HortScience*) is the first thornless release from the program and is the first fully erect thornless blackberry ever developed. Emphasis at present is to develop additional thornless types that ripen at different times to allow expansion of the blackberry harvest period. Continued releases of thorned cultivars, such as the early ripening 'Choctaw', (see p. 862) will be made to further expand the harvest period.

Much genetic variability still exists for increasing fruit size and productivity in blackberries. Other objectives include the development of cultivars resistant to rosette [*Cercosporella rubi* (Wint.) Plakidas], the incorporation of genes for greater cold hardiness, and the genetic improvement of fruit firmness for better marketability. From 10,000 to 15,000 seedlings are produced from controlled crosses each year. At present, 387 selections are being evaluated, and several elite selections have been sent to other states for regional testing. Given the very limited breeding activity in blackberries worldwide, we feel that our program will continue to serve as a source of improved cultivars, both nationally and internationally.

Strawberry. The introduction of 'Cardinal' strawberry in 1974 greatly stimulated the planting of strawberries in many parts of Arkansas for "pick-your-own" marketing. The large size, attractive, high-quality (including processed quality) fruits of 'Cardinal' quickly gained popularity among customers. Today, ≈85% of strawberries grown in Arkansas are 'Cardinal', and it is a major cultivar in many other southern states. 'ArKing' is also popular where red stele root rot is a problem and where growers wish to extend the strawberry harvest season later. The major thrust at present is to develop a 'Cardinal'-type cultivar that ripens very early in the season to further expand the harvest period in Arkansas.

Between 5000 and 10,000 seedlings from controlled hybridizations are fruited each year, and there are 295 selections being evaluated.

Peach and nectarine. The major goal in the peach breeding program is to develop adapted, high-quality clingstone cultivars to support the Arkansas processing industry. 'Allgold' and 'Goldilocks' are being used by the Gerber Products Co. in their expansion of peach processing in Arkansas. Additional cultivars that ripen both earlier and later than those currently used are needed for better use of facilities in processing. To achieve earlier ripening seedlings, embryo culture is extensively used in early x early crosses. Another major objective is to develop disease-resistant nectarine cultivars adapted to Arkansas. Such developments could result in a new fresh fruit industry in the region. The development of clonal rootstocks for peach is also a breeding objective.

From 3000 to 5000 seedlings are produced from controlled crosses each year. Several selections of both nectarines and clingstone peaches are in prerelease testing.

Apple. Major objectives are the development of early season summer cultivars that will develop good color and quality under high temperatures and the development of good-quality fall-ripening cultivars that do not russet. Several promising selections have been identified for possible future release.

Blueberry. The major objective in blueberry breeding is to combine the large fruit size and good quality of northern highbush with adaptation to the upland, mineral soils of Arkansas and neighboring states. Genes for upland adaptation and tolerance to high summer temperatures and moisture stress are being transferred from native species into cultivated types. Several very early ripening selections show good potential for future release.

(continued on inside back cover)

Received for publication 6 Apr. 1989. The cost of publishing this paper was defrayed in part by the payment of page charges. Under postal regulations, this paper therefore must be hereby marked *advertisement* solely to indicate this fact.

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Breeding Strategy

The approach used in our fruit breeding program has been defined as "recurrent mass selection" and is characterized by 1) identification of superior phenotypes to be used as parents, 2) controlled intermating based on complementarity of parents, 3) selection of superior offspring in segregating populations, 4) selection of superior phenotypes for use as parents for producing the next generation of seedlings or for release as new cultivars. This process is continued indefinitely in a pyramiding fashion.

We are dedicated to the philosophy that success in fruit breeding requires a large gene pool from which to draw, and we maintain large germplasm collections. These collections are continually evaluated and new genotypes are added as they become available. We believe that broad-area adaptation of a genotype is related to the dissimilarity of adaptation of its parent clones. Thus, a cross of a New York blackberry ('Darrow') with a Texas cultivar ('Brazos') resulted in offspring ('Cherokee', 'Comanche', 'Cheyenne') with very wide climatic adaptation. Also, the good performance of 'Cardinal' strawberry over a wide geographic area may be attributed to its combination of northern and southern progenitors. Also, since most of the fruit species involved in our breeding program suffer inbreeding effects, we must consider the consanguinity of specific parents chosen for mating.

Concomitant with the cultivar development program, various genetic studies have been conducted to ascertain the inheritance of important fruit and plant characters in these fruit crops. This information is used to accelerate breeding progress and has been published to benefit the programs of other fruit breeders. Cultural research is also conducted to determine the best production practices for exploiting the full genetic potential of new cultivars developed in the program.

It is an accepted fact of fruit science that the genetic composition of the fruit cultivar sets the upper limits of performance. Cultural practices, such as fertilization and irrigation, are important in achieving full genetic expression of a plant, but unless the genetic capability is present in a cultivar for high yields, large fruit size, good quality, or other important characteristics, they will not be achieved. It is the continuing objective of the Arkansas fruit breeding program to genetically "tailor-make" fruit cultivars that will excel in the field and in the marketplace. These, then, can be used as the foundations on which to build profitable and successful fruit enterprises.

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