A Research Cornucopia

Since 1888, the Florida Agricultural Experiment Station has partnered with the state's farmers to develop hundreds of new varieties of fruits, vegetables and other crops

By Joseph Kays

Florida has always been an enigma to farmers. The state's warm climate provides unique "market windows" when farmers can harvest crops like blueberries and tomatoes that are unavailable anywhere else. But that same climate lacks adequate "chilling days" needed to set fruit and the heat and humidity spawns a multitude of insects and diseases.

Since 1888, scientists with the Florida Agricultural Experiment Station, or FAES, have sought to exploit the advantages of Florida's climate and thwart its disadvantages. The dozens of new and improved fruits, vegetables and other crops made available to farmers through FAES have resulted in a $50 billion agriculture business in Florida.

As the research arm of the University of Florida's Institute of Food and Agricultural Sciences, FAES working in concert with federal and other state governments on research related to food and agriculture, natural resources, environmental quality, human nutrition, rural development and related areas.

"New plants developed at the Florida Agricultural Experiment Station have been vital to the state's agricultural industries and to consumers here and throughout the country and the world," says Richard Jones, director of the FAES. "Almost every crop variety grown in Florida came from plant breeding programs at FAES."

The FAES statewide research program is administered through 20 academic departments in Gainesville, 13 Agricultural Research and Education Centers throughout the state, eight multidisciplinary centers, the School of Forest Resources and Conservation, and the College of Veterinary Medicine.

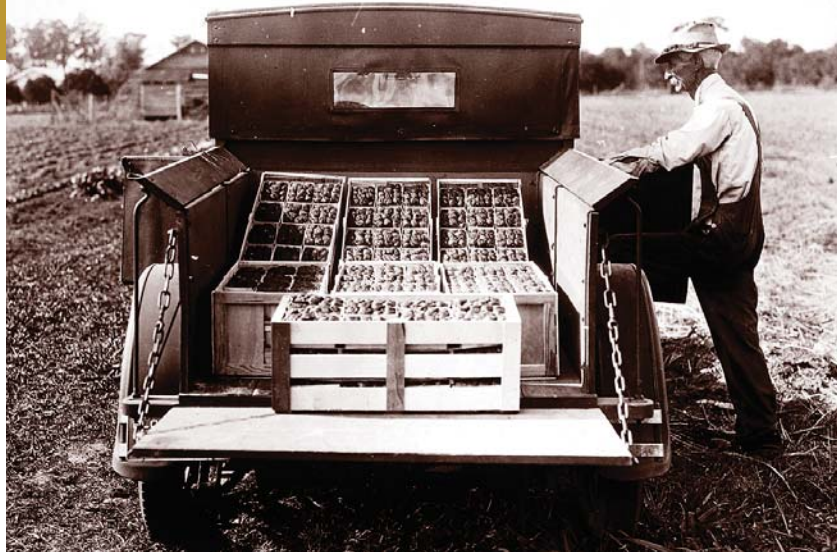
Since its inception, FAES has concentrated on breeding varieties that are adapted to Florida's unique environment. Until recently, all of this research was done through traditional plant breeding programs, cross-breeding the best examples of plants with unique characteristics, like heat or disease tolerance, through many generations to achieve superior varieties. Today, molecular genetics also is used to speed up the process of developing a new variety and to enable the introduction of novel traits.

Tomato Tune-Up

Anyone who has ever tried to grow tomatoes knows that all kinds of things can go wrong with this tasty, but finicky, fruit.

Since the release in 1925 of a variety called Marglobe, FAES has been instrumental in developing tomato varieties that are adapted to Florida's climate, taste good and are resistant to disease. Today, more than 50,000 acres of tomatoes are grown in Florida from October through June, with a value of more than $500 million annually.

Richard Jones, dean for research and director of the Florida Agricultural Experiment Station, displays some of the hundreds of varieties of fruits, vegetables and other agricultural products developed by FAES.



A milestone in tomato breeding in the 1950s was Manalucie, a variety developed by FAES breeder J.M. Walter that had improved fruit quality and was resistant to multiple diseases. In 1969, FAES released the world's first tomato variety with resistance to Fusarium wilt, a race 2 disease that was causing major losses to the Florida tomato industry. And a cooperative project in the 1960s between FAES and the H.J. Heinz Company led to varieties with firmer fruit that could more easily be shipped and even machine harvested.

Since the 1980s, genetic markers have been instrumental in advancing the selection process for tomato varieties. Markers linked to resistance genes for Fusarium wilt, spotted wilt and geminiviruses were discovered by FAES scientists and are now incorporated into commercial hybrid varieties in Florida. In collaboration with U.S. Department of Agriculture (USDA) and industry, FAES scientists also have initiated a program to identify genes controlling tomato flavor. Molecular markers that track various chemicals contributing to flavor are being isolated.

Tomato breeders at UF's Gulf Coast Research and Education Center in Bradenton evaluate tomatoes for their taste, hardiness, yield and other traits in the course of developing new varieties.

Thomas Wright

Eric Zamora

UF strawberry breeder and horticultural sciences Professor Craig Chandler displays two new varieties of strawberries he developed — Earlibrite and Strawberry Festival.

Berries By The Bushel

1948 was a good year for berries in Florida. That year, FAES horticulturist Ralph Sharpe noted that the market for fresh blueberries in the United States was expanding rapidly but that no blueberries were available until late May, when harvest began in eastern North Carolina.

Sharpe also noted that the wild blueberry ripened in north Florida starting in late April. Although these wild berries had excellent flavor and aroma, the berries were too small and the plants too low-yielding to be cultivated profitably.

Commercial blueberry varieties from Michigan, New Jersey and North Carolina survived poorly and produced little fruit when planted in Florida. Florida winters were too warm to satisfy their chilling requirement, and the northern varieties were too susceptible to leaf, root and stem diseases that flourished because of Florida's long, wet summers.

After spending two years studying Florida's native wild blueberries, Sharpe selected the Florida evergreen lowbush blueberry to cross with the northern varieties. During his explorations, Sharpe found some wild blueberry plants growing around a lake near Winter Haven that produced unusually large berries with a powdery blue color. These plants became the source of the low chilling requirement and heat tolerance of Florida's highbush blueberry varieties.

During the ensuing years, researchers addressed berry quality and size, diseases and insects, and heat tolerance. Today, nearly all of the blueberries harvested in April and early May in the northern hemisphere and during October and early November in the southern hemisphere trace their ancestry back to this Florida lowbush blueberry.

Horticultural science Professor Paul Lyrene and his colleagues carry on Sharpe's work through an aggressive blueberry breeding program.

"We are trying to fill the market window with better-quality blueberries that are more disease resistant, require less care from the grower and produce fruit that is better able to withstand shipping," Lyrene says.

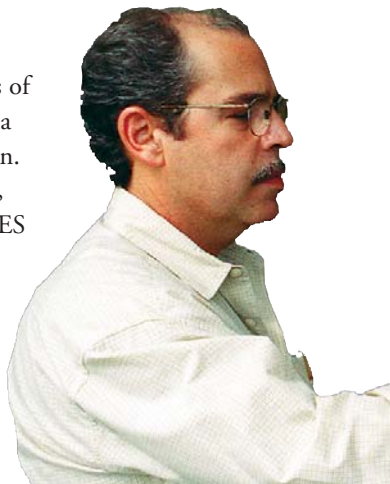
Today, a growing Florida blueberry industry produces more than 4 million pounds of fruit annually, with a value of $20 million.

At the same time Sharpe was developing Florida's blueberry industry, plant pathologist Albert Brooks was experimenting with improved varieties of strawberries at the Strawberry Investigations Laboratory at Plant City.

Brooks introduced Florida Ninety in 1952, and it quickly became the dominant variety grown in Florida. Its yields were as much as three times higher than those of the variety it replaced, and it had a moderately high degree of resistance to crown rot.

In 1992, Sweet Charlie debuted, with higher fruit yields from December through February than any other available variety. It was also the only variety adapted to central Florida that was resistant to anthracnose fruit rot.

There are now about 7,000 acres of strawberries grown in Florida, with a crop value approaching $200 million. This growth is being fueled, in part, by new variety releases from the FAES breeding program.



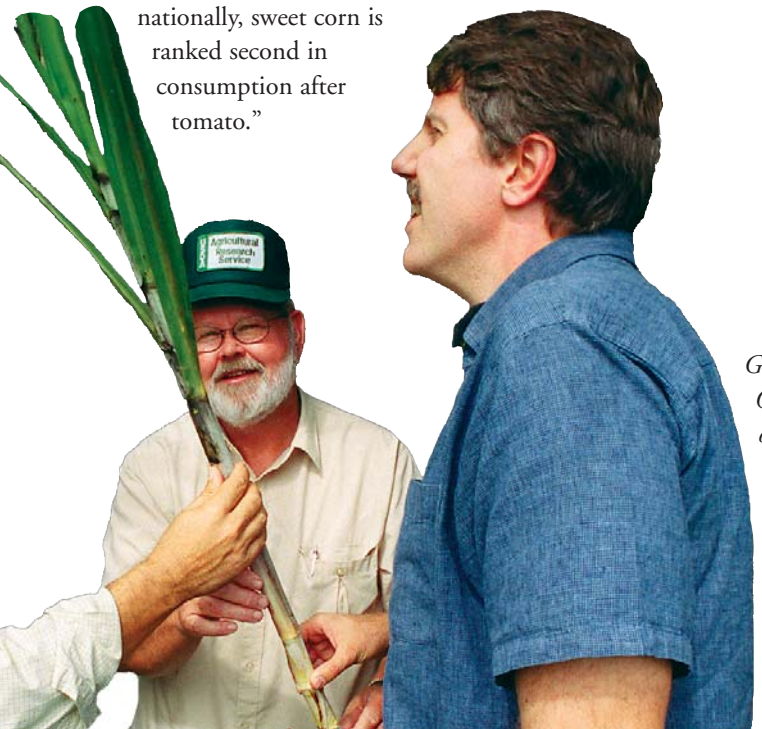
Corn Collaborators

Florida is now the largest producer of fresh-market sweet corn in the country, with annual sales of about $100 million. This success is directly attributed to a collaborative research effort dating back to 1959 between UF researchers at the Everglades Research and Education Center (EREC) in Belle Glade, Illinois Foundation Seed and Crookham Seed in Idaho.

Researchers working for these original collaborators believed Americans would consume more sweet corn if it tasted better and was available for a longer portion of the year. Although it took nearly three decades, a gene discovered in 1949 called the shrunken-2 gene provided the genetic foundation for the now ubiquitous "Super-Sweet" hybrids that dominate the market.

Since 1975, FAES has developed and released 13 varieties of sween corn.

"The sweet corn industry went through a massive growth phase in the 1970s, primarily due to the development of super-sweet varieties at EREC," says Brian Scully, professor of plant breeding."Today, this industry is one of the most robust vegetable industries in Florida, and nationally, sweet corn is ranked second in consumption after tomato."



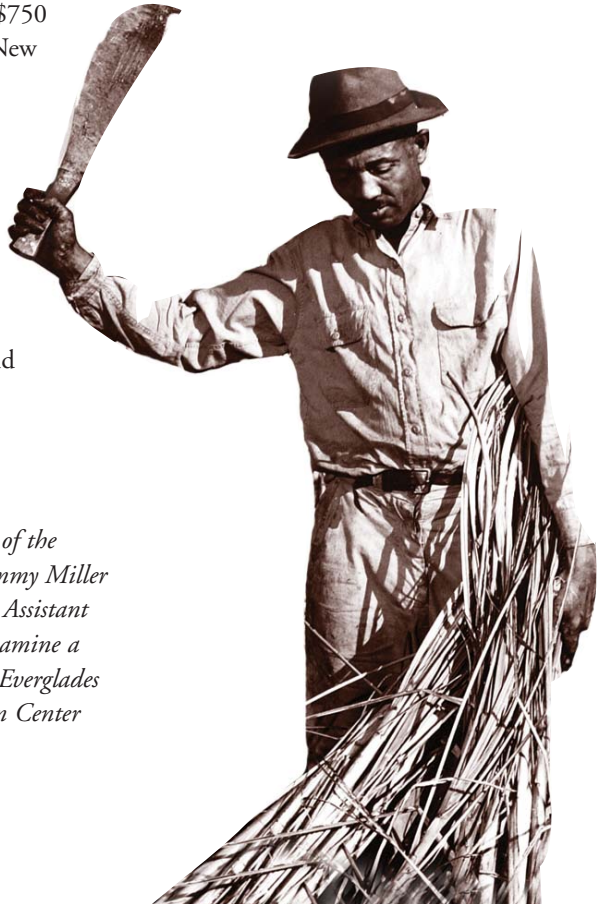
Naturally Sweetened

Although sugarcane was first grown in Florida by the Spanish founders of St. Augustine in 1572, major commercial sugar production in the state did not begin until the early 20th century. After several companies went bankrupt due to disease outbreaks and soil nutrient issues, the USDA established a sugarcane field station at Canal Point, Florida, in 1920 to develop new cultivars. In 1921, the Florida legislature established the EREC in Belle Glade. Since 1930, a collaborative breeding agreement has existed among UF, USDA and either the U.S. Sugar Corporation (1930-1966) or the Florida Sugar Cane League (1966-present).

Sugarcane seeds are very delicate and usually do not breed true to their parents, so sugarcane must be cloned from stem pieces to produce a predictable crop. Through the years, sugarcane breeding programs have focused on cultivars with high yields and disease resistance. Cultivars originating in the Everglades Agricultural Area south of Lake Okeechobee have substantially improved sugar production in Florida, Louisiana, Texas, Latin America and other regions throughout the world.

UF geneticists and agronomists are currently broadening their programs to seek cultivars that are more phosphorus efficient and more tolerant to high water tables.

"Sugarcane is Florida's leading row crop in acreage and economic value," says Robert Gilbert, an assistant professor of agronomy at EREC, noting that Florida produced 450,000 acres of sugarcane with an estimated value of $750 million in 2000. "New varieties need to be developed to improve yield and to meet changing conditions such as wetter and shallower soils, reduced soil fertility and pest and disease outbreaks."



Geneticists Modesto Ulloa of the Okeelanta Corp., left, Jimmy Miller of USDA and agronomy Assistant Professor Rob Gilbert examine a sugarcane stalk at UF's Everglades Research and Education Center in Belle Glade.

Milt Putnam

Tara Piasio

Environmental horticulture Professor Jake Henny checks flower quality on Anthurium "Red Hot" which he developed in 1995. The cultivar is one of the most popular in Florida.

Tropical Paradise

Since FAES first began breeding tropical foliage in 1976, Florida has grown to lead the nation in the production of foliage plants, whose value has increased from $29 million in 1969 to $585 million in 2001.

Among the more than 500 species grown as foliage plants in Florida are the popular anthurium and caladium.

Most of the world's caladium tubers are produced on about 1,500 acres in Highlands County in Central Florida on the muck and sandy soils around Lake Placid and Sebring.

Until FAES initiated a caladium breeding program in 1976, the industry had been without new varieties since the 1950s. Since 1988, FAES has released 13 varieties of caladium with bright, colorful leaves and large, good-quality tubers.

"Florida growers compete with a global floriculture industry that is constantly changing," says Brent Harbaugh, a professor of horticulture at the Gulf Coast Research and Education Center in Bradenton. "To remain competitive, Florida's floriculture industry must use the most efficient production systems, superior genetic germplasm, and advanced pest management strategies while conserving natural resources and protecting the environment."

Molecular Manipulation

Until the 1980s, the creation of new varieties was done almost exclusively through the age-old method of cross breeding. But as scientists have come to better understand plants' molecular structures, they have learned to manipulate genes to make breeding programs more efficient and to introduce beneficial traits.

Among the plant genetic research efforts under way are the creation of disease-resistant varieties of grapes, flowers that will last longer, better rye for bread-making, genetic markers to select disease-resistant tomatoes, and rice and wheat with greater yield.

Related web site:
http://research.ifas.ufl.edu

Developmental biology Professor Dennis Gray has inserted a peptide gene tagged with a green fluorescent protein marker gene from jellyfish into seedless grape plants. The peptide gene helps stave off Pierce's disease, which has precluded the production in Florida of bunch grapes used in wine.

Milt Putnam