

UF|IFAS
UNIVERSITY of FLORIDA

PLANT BREEDING & VARIETY DEVELOPMENT
OVERVIEW









2019 UPDATE

THE PROGRAMS

Research at the University of Florida Institute of Food and Agricultural Sciences (UF/IFAS) is conducted under the auspices of the Florida Agricultural Experiment Station (FAES) with the mission to discover new scientific knowledge, encourage innovative study, and create applications based on sound science that address challenges facing agriculture, natural resources, and interrelated human systems in Florida, our country, and the world. The UF/IFAS plant breeding program is one of the most vigorous and diverse in the country, and through its actions, contributes to plant breeding efforts worldwide.

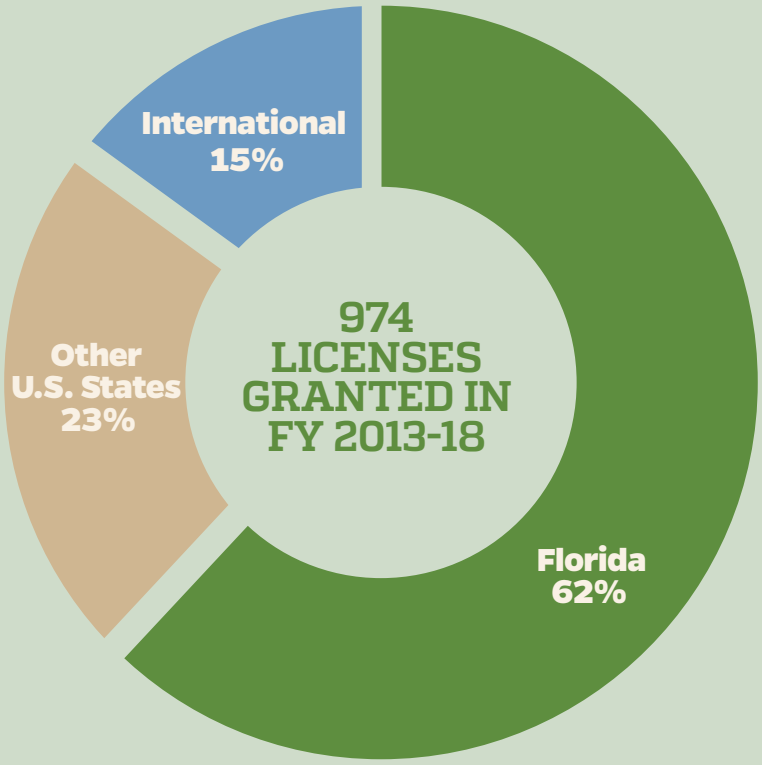
The strong partnership between FAES and Florida Foundation Seed Producers, Inc., formally established in 1973, has enabled cultivars developed by UF/IFAS breeders to be licensed and widely distributed to stakeholders. UF/IFAS is one of the top land-grant universities in terms of the numbers of active plant breeders, cultivars developed, and cultivars licensed.

THE PAST

Before the 1950s, new cultivars were mainly selected from introduced material, with the notable exception of the peanut breeding program. In 1928, the first successful artificial hybridization of peanut allowed breeders to select for disease resistance, increased yields, and better quality. Hybridization is a labor- and time-intensive process, so the first peanut cultivar developed using this method was not released until 1943. It was widely grown in the southeastern U.S. for many years thereafter.

As UF/IFAS plant breeding programs expanded and matured, they used a wide array of breeding processes including recurrent selection, hybridization, and induced mutation. By the 1960s, 77 new cultivars were released, a vast improvement from when only two or three varieties were released in a decade.

Vision: To be the global leader in plant breeding evaluation and cultivar development.



70% OF NET ROYALTIES FROM LICENSES ARE RETURNED TO UF/IFAS PLANT BREEDING PROGRAMS

STANDARD BREEDING PROCESS

THE PRESENT

Sequencing DNA genomes of most major plant species is revolutionizing genetic science and making the plant breeding process more effective and efficient. Innovations include marker-assisted selection (MAS), a method that allows breeders to easily track the genes that lead to improvements in plant characteristics, such as disease resistance and product quality.

The significance of the UF/IFAS plant breeding programs is demonstrated by the successes of many of Florida's agricultural industries. For example, approximately 85 percent of Florida's strawberry and 95 percent of its blueberry acreage are planted in UF/IFAS varieties. These industries continue to flourish with the support of new variety releases from the UF/IFAS plant breeding programs and the innovation of its breeders.

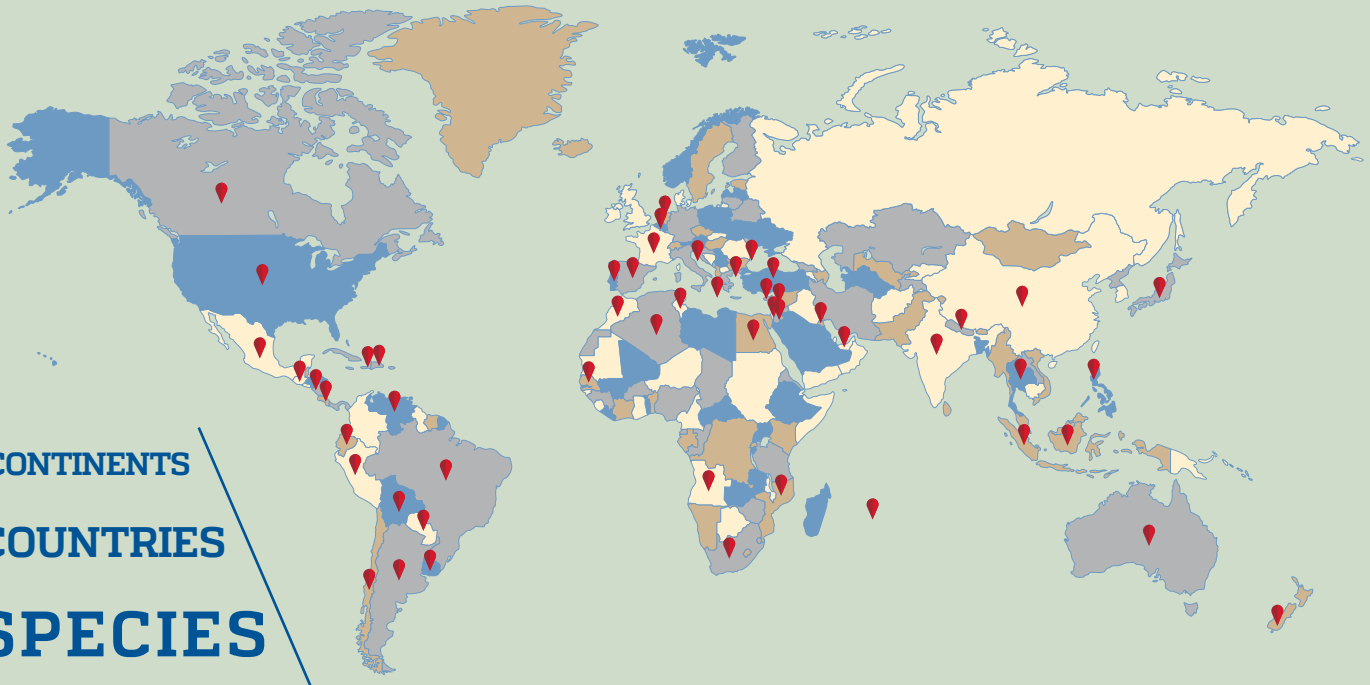
THE FUTURE

One of the most important ways that the UF/IFAS plant breeding program accomplishes its mission is by investing in plant breeding graduate education programs that equip students with knowledge and experience in the latest molecular techniques, experimental design, statistical analysis, and applied field breeding.

UF/IFAS plant breeding programs will continue releasing ever-improved cultivars bred for increased pest and disease resistance, yield, quality, nutrition, taste, maturity date, and appearance. As one of the most diverse plant breeding programs in the country, it will continue innovating and streamlining its breeding methods to better meet the needs of agricultural producers and our society.

Mission: To ensure the viability of agriculture through exceptional plant breeding programs.

CULTIVAR LICENSES BY COUNTRY



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30 BREEDERS

UF IFAS
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CITRUS

UF IFAS UNIVERSITY of FLORIDA

INTRODUCTION

Citrus fruit is Florida's signature crop, supporting a multi-billion-dollar industry with approximately 450,000 acres. Almost 90 percent of citrus grown in Florida is processed into juice, but the state also produces fresh citrus. Citrus is the most important agricultural commodity grown in Florida, with a rich history in the state and its culture. Spanish explorers introduced citrus trees near St. Augustine in the 1500s. Just after the Civil War, the citrus industry reached a production milestone of 100 million boxes and eventually peaked at a production of 250 million boxes in the early 2000s. Production has declined in recent years because of urbanization and devastating disease outbreaks, including huanglongbing (a.k.a. HLB or citrus greening) and citrus canker. But the Florida citrus industry still thrives south of Interstate 4, with 8,000 Florida growers responsible for more than 75,000 jobs.

FROM THE BEGINNING

The UF/IFAS citrus-breeding program began in the mid-1980s to develop scions and rootstocks that resist disease and withstand cold. Key discoveries included a hybridization program to develop seedless, triploid, fresh-fruit varieties adapted to the Florida environment and tree-size-controlling, disease-resistant rootstocks that allowed high-density planting and early production. Since 1991, UF/IFAS plant breeders have also been developing cold-hardy cultivars for North Florida, using a nonedible citrus called *Poncirus trifoliata* as the donor species for the cold-resistant trait. Cold-hardiness breeding efforts have incorporated commercial quality, a genetically controlled seedless trait, and cold resistance into the current generation of selections.

TODAY AND TOMORROW

The UF/IFAS citrus-breeding program is focused on breeding improved sweet oranges, fresh citrus, and rootstocks, while developing cultivars resistant to diseases threatening the industry.

The fresh-fruit breeding program has been developing easy-to-peel tangerine varieties with different maturity dates; grapefruit and pummelo varieties with a range of maturity dates and canker resistance, as well as low-content of phytochemicals responsible for the grapefruit-drug interaction; and seedless lime and lemon selections with improved quality, disease resistance, and cold-hardiness. These will provide new marketing opportunities for Florida growers.

The program has also been developing improved rootstocks for Florida with the goal of generating rootstocks that will allow sustainable and profitable production in various growing regions of the state. Rootstocks will need to have wide soil adaptation, cold hardiness, tree-size control, salinity tolerance, and disease and nematode resistance. The program has recently released its first rootstocks, including some semi-dwarf rootstocks with early production and improved disease resistance that can be used in emerging Advanced Citrus Production Systems.

The survival and long-term viability of the Florida citrus industry are being challenged because of the statewide spread of HLB. In response, the UF/IFAS citrus breeding program is sharply focused on providing genetic solutions to this disease by studying rootstock and scion performance from the many field trials established throughout the state. Already, some experimental rootstocks appear to be conferring significantly greater tolerance to HLB than those that are currently commercially available.

Information on released UF scion and rootstock varieties can be found by visiting http://ffsp.net/varieties/citrus and http://nvdmc.org.

2019 UPDATE

CITRUS VARIETIES RELEASED SINCE 2006

Release Date	Cultivars
Rootstocks	
07/30/13	'UFR-2' (USPP27,742), 'UFR-3' (USPP27,744), 'UFR-4' (USPP27,745), 'UFR-16' (USPP27,743), 'UFR-17' (USPP28,091), 'UFR-1' (USPP27,277), 'UFR-5' (USPP27,298), 'UFR-6' (USPP27,276), 'UFR-15' (USPP27,275)
Sweet Orange	
04/19/09	Valquarius® 'SF14W-62' (USPP21,535), 'N7-3' (USPP21,224)
01/25/11	'B9-65' (USPP27,144)
12/16/12	'OLL-8' (USPP26,087)
01/24/13	'N13-32' (USPP27,145), 'UF 11-1-24' (USPP27,777)
08/08/14	'OLL-4' (USPP27,829)
12/01/15	'Florida EV2' (USPP29,824), 'Florida EV1' (USPP29,791)
Mandarin	
04/13/06	Sugar Belle® 'LB8-9' (USPP21,356)
01/25/11	Seedless Snack 'N40W-6-3' (USPP29,091), '411', '900', '950' (USPP23,359)
07/26/13	'C4-15-19' (USPP26,086)
01/07/15	'UFSunrise', 'UFDawn', 'UFGlow' (USPP27,581)
02/12/15	'Bingo' (USPP27,778)
06/01/15	'711'
06/11/2018	'Marathon' (USPPAF), '13-51' (USPPAF)
Grapefruit, Pummelo	
01/25/11	'5-1-99-5' (USPP25,151)
12/16/12	'5-1-99-2', 'C2-5-12'
12/20/12	'914' (USPP26,177)
10/30/13	'N2-28'
Navel	
06/01/15	'RBB 7-34' (USPP30,324)

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PEANUT

UF IFAS UNIVERSITY of FLORIDA

INTRODUCTION

Peanuts generate about $900 million in farm-gate value annually in the United States. In Florida, peanuts are grown on 140,000 to 190,000 acres, producing a crop worth $115 million to $154 million. Florida has been producing peanuts for more than 100 years, and the University of Florida has the oldest peanut-breeding program in the nation. Since 1920, research at the Florida Agricultural Experiment Station (FAES) has been responsible for many improvements to the crop.

FROM THE BEGINNING

One of Florida's first peanut breeders was Fred Hull, an agronomist at the University of Florida. In 1928, Hull was the first person to successfully artificially hybridize peanuts. He then collaborated with William Carver to release the cultivar 'Dixie Runner' in 1943, which was grown widely in the southeastern U.S.

After 'Dixie Runner' came 'Florunner', released by Allen Norden, who joined the peanut-breeding team in 1958. 'Florunner' quickly beat out competing cultivars because its yield was 20 to 25 percent higher. For more than 20 years, 'Florunner' dominated the market throughout the peanut-growing world, especially in the U.S. where it occupied more than 80 percent of the peanut acreage.

Daniel Gorbet joined the program in 1970 and began breeding peanuts for disease resistance. His efforts resulted in a new class of peanut cultivars that saved the industry when 'Florunner' succumbed to tomato spotted wilt virus. Today, all of the major cultivars in the southeast U.S. trace a large portion of their parentage to these disease-resistant cultivars.

In the 1980s, Allen Norden discovered the "high-oleic trait" which keeps peanuts fresh and delicious much longer than other peanuts. Manufacturers of peanut-based products prefer this trait.

TODAY AND TOMORROW

Today, the UF/IFAS peanut-breeding program is developing new methods to breed superior peanut cultivars even faster and more efficiently. One of these methods, called near-infrared spectroscopy, allows breeders to test single peanut seeds for fatty acids, enabling scientists to determine relatively quickly which peanut cultivars have the high-oleic trait. Another area of peanut-breading research is the use of genetic markers. DNA-marker technology promises to expedite cultivar development, but more importantly, it will allow breeders to assemble important traits into a single genetic line.

The focus of the UF/IFAS peanut breeding program is to combine as many desirable traits as possible into a single cultivar to produce top-grade, disease-resistant peanut plants with excellent yield and the healthy, high-oleic trait.

The UF/IFAS peanut-breeding program will continue to deliver promising new cultivars that allow farmers to produce a product that is easier to grow, more profitable, healthier, and more delicious to eat.

2019 UPDATE

PEANUT VARIETIES RELEASED SINCE 2006		
Release Date	**Cultivars**	**High-Oleic Trait**
Virginia type		
02/01/07	'Florida Fancy' (US PVP 200800231)	Yes
01/10/12	'Spain' (US PVP 201200394)	Yes
08/22/2018	'Walton' (US PVP filed)	Yes
Runner type		
01/26/06	'McCloud' (US PVP 200800232) 'York' (US PVP 200800186); 'Florida-07' (US PVP 200800186)	Yes
02/01/07	'AP-4' (US PVP 200800158)	No
02/22/10	FloRun™ '107' (US PVP 201100459)	Yes
06/26/11	TUFRunner™ '727' (US PVP 201300199)	Yes
06/26/11	Florida EP™ '113' (US Patent 8,178,752)	No
07/30/13	TUFRunner™ '511' (US PVP 201400249)	Yes
04/28/14	TUFRunner™ '297' (US PVP 201500201)	Yes
04/16/15	FloRun™ '157' (US PVP 201600140)	Yes
04/26/16	FloRun™ '331' (US PVP 201700120)	Yes

HIGH IMPACT RELEASES

Florunner (1969): This dominated the market, especially in the U.S. where it occupied more than 80 percent of the peanut acreage for two decades by out-yielding other varieties by 20 to 25 percent.

Southern Runner (1986): This was used as a parent to develop Georgia Green (released by the University of Georgia), a variety that dominated the market after Florunner succumbed to the tomato spotted wilt virus disease.

SunOleic 95R and SunOleic 97R (1994 and 1996): These were the first high-oleic peanut varieties released. SunOleic 97R was the foundational variety for high-oleic varieties grown around the world.

C-99R (1999): Because of its disease resistance, this has been used extensively as a parent in commercial varieties that have accounted for more than 90 percent of the southeastern U.S. peanut acreage in the past decade.

Florida-07 (2006): This disease-resistant, high-yielding, high-oleic variety has been the most widely planted high-oleic runner variety in the U.S. in the past decade.

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BLUEBERRY

UF IFAS UNIVERSITY of FLORIDA

INTRODUCTION

The Florida blueberry industry has grown rapidly in the past 20 years; today the state has more than 7,000 acres of commercial blueberries, producing approximately 20 million pounds with an annual farm-gate value of $75 million.

UF/IFAS played a pivotal role in the industry's growth by releasing southern highbush cultivars that ripen April through May, a time of year when few blueberries are available and market prices are high. Historically, rabbiteye blueberries were first cultivated in the early twentieth century in Florida, but because of competition with northern blueberry producers, acreage steadily declined to less than 100 acres until the 1970s when southern highbush cultivars were released.

Since 2005, nearly all acreage planted in Florida has been in southern highbush cultivars developed by UF/IFAS. The industry continues to move farther south into areas such as DeSoto, Highlands, and Okeechobee counties.

FROM THE BEGINNING

The UF/IFAS blueberry breeding program started in the 1940s to develop low-chill, early-ripening, high-quality blueberry cultivars. One initial obstacle was developing competitive cultivars at the edge of the natural adapted range for highbush blueberry. This was accomplished by crossing high-quality, northern blueberry cultivars with the native Florida Vaccinium species and selecting for low-chill requirements. The resulting cultivars, known as southern highbush, revolutionized blueberry production in Florida and worldwide, allowing production in low-chill areas and creating a year-round supply of fresh blueberries. The first southern highbush cultivars were 'Sharpblue', 'Flordablue', and 'Avonblue', released in the late 1970s.

Since then, UF/IFAS has released 35 southern highbush cultivars, and the initial germplasm developed has contributed to all southern highbush cultivars released worldwide.

TODAY AND TOMORROW

Moving forward, the UF/IFAS blueberry-breeding program will continue releasing cultivars that help Florida growers become more efficient and economical. One goal will be breeding low-chill blueberries that can grow in a complete evergreen production system. Other desirable traits include improving pH requirements and drought tolerance, developing machine harvest-capable cultivars to reduce labor costs, and producing cultivars with crisp texture and better flavor. The program also breeds for important fruit qualities such as a small, dry stem scar, firm texture, optimal sugar-to-acid balance, large size, and a light-blue color.

The UF/IFAS blueberry-breeding program will continue to produce cultivars with a low-chill requirement, early fruit maturity, disease tolerance, and high yield of quality fruit.

The program is also beginning to use marker-assisted breeding, which uses DNA markers associated with important traits in blueberry to make selections and improvements more efficiently. The search is under way for molecular markers associated with these desirable traits.

Additionally, researchers in this program will continue their innovation and exploration of new uses for blueberries such as ornamental blueberry cultivars for the landscape.

2019 UPDATE

BLUEBERRY VARIETIES RELEASED SINCE 2009	
Release Date	**Cultivars**
07/09/09	Flicker™ 'FL96-43' (USPP21,554) Meadowlark™ 'FL01-173' (USPP21,553) Chickadee™ 'FL04-235' (USPP21,376) Raven™ 'FL05-627' (USPP21,374) Vireo™ 'FL05-107' (USPP21,375) Bobolink™ 'FL03-291' (USPP21,377) Kestrel™ 'FL02-40' (USPP21,719)
08/27/14	Indigocrisp™ 'FL98-325' (USPP26,523) 'FL03-228' (USPP27,576) 'FL98-423' (USPP27,325)
01/26/15	Avanti™ 'FL06-203' (USPP26,312) Endura™ 'FL06-377' (USPP26,679) Arcadia™ 'FL07-399' (USPP26,313)
02/01/16	Keecrisp™ 'FL06-556' (USPP27,771) 'Patrecia' (USPP27,740)
04/25/17	'Magnus' (USPPAF) 'Wayne' (USPPAF) 'Optimus' (USPPAF)
09/20/17	'FLR1211' 'FLR1289'
10/10/2018	'FLR14372'

HIGH IMPACT RELEASES

Sharpblue (1976): This was the first southern highbush variety ever released and is what launched the Florida blueberry industry. It has been widely grown around the world and is the foundational cultivar for southern highbush blueberry production.

Star (1996): This is widely adapted in the southeastern U.S. and is one of the most popular southern highbush varieties worldwide. It has desirable bush habit, high vigor and survival, concentrated early ripening, and high-fruit quality.

Jewel, US PP11,807 (1998): This is the second-most commonly grown blueberry variety in Florida and is widely grown in other low-chill production regions around the world. It has copious flower-bud production, excellent picking scar, and firm fruit.

Emerald, US PP12,165 (1999): This is well-adapted to Central Florida and is the most commonly grown blueberry variety in Florida. It has high vigor, large fruit size, and has produced very high yields in blueberry production regions around the world.

Snowchaser, US PP19,503 (2005): As one of the earliest-ripening southern highbush varieties in the world, this variety has given producers the ability to produce high-quality fruit in a window when market prices are often high. Its fruit has excellent flavor and aroma, and it has performed well in evergreen production systems.

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FORAGE

UF IFAS UNIVERSITY of FLORIDA

INTRODUCTION

The UF/IFAS forage breeding program is the oldest cultivar-development program at UF/IFAS. Both cool- and warm-season legumes and grasses are vital parts of the Florida landscape, including bahiagrass, bermudagrass, limpograss, perennial peanut, clovers, and other species. Because a wide variety of plant species is used for forage production in Florida, this breeding program has focused on a number of major forage crop plants, with an emphasis on adapting and improving non-native plants that have great potential.

FROM THE BEGINNING

UF/IFAS research in forages began in the earliest days of the Florida Agricultural Experiment Station (FAES). The station released its first forage grass variety in 1892 and first forage legume variety in 1896. By 1915, FAES had tested nearly 1,700 plants as potential new varieties. In the 1940s, 'Pangola' digitgrass, 'Pensacola' bahiagrass, and 'Argentine' bahiagrass were important early forage releases that helped build Florida's beef-cattle industry. Currently, the dominant pasture grass used by the beef-cattle industry in Florida is 'Pensacola' bahiagrass, estimated to be produced on more than 70 percent of Florida pastures.

Throughout its history, the UF/IFAS forage breeding program has released many cool-season varieties, notably 'Osceola' white clover (1977), 'Cherokee' red clover (1990), 'Southern Belle' red clover (2002), and many commercially popular, annual ryegrass cultivars. During the 1970s and '80s, a group of UF/IFAS scientists across the state developed a four-phase, coordinated scheme to breed, evaluate under clipping and grazing defoliation, and release new cultivars. They increased forage improvement research throughout the state by actively testing and breeding new plant introductions from around the world. Three grass cultivars from these efforts – 'Florico' stargrass, 'Florona' stargrass, and 'Floralta' limpograss – are estimated to be grown on more than 600,000 acres in Central and South Florida. These grasses have shortened, and sometimes eliminated, the winter forage gap for beef-cattle producers in these areas. In 2002, UF/IFAS began a program that resulted in the release of 'UF-Riata' in 2007, an improved bahiagrass cultivar with superior early-spring and late-fall productivity.

TODAY AND TOMORROW

Recently, the UF/IFAS forage breeding program has focused on improving annual ryegrass, red and white clover and alfalfa, rhizoma perennial peanut, bermudagrass, and bahiagrass. Today, more than 30,000 acres of perennial peanut have been established from UF/IFAS cultivar releases throughout the southern U.S.

Traditional breeding, as well as modern molecular genetic DNA-sequencing techniques, are being employed to improve the efficiency of these breeding programs.

Currently, 12 tetraploid apomictic hybrids are being evaluated for seed production with the goal of releasing a new tetraploid bahiagrass cultivar that has superior spring and fall forage production to replace the cultivar 'Argentine'. Recent clover releases that are becoming popular commercially include 'Barduro', a medium-maturity red clover; 'FL24D', an early maturity 2,4-D tolerant red clover; 'Ocoee', a root knot nematode-resistant white clover. Earlyploid, 'FL PE 2X', and 'FL Red 4X LATE' are three recent annual ryegrass releases. 'Kenhy' and 'GibTuck' limpograss cultivars are becoming established on significant Florida acreage for use by the beef-cattle industry. Forage-type triticale and oat cultivars have also been released from these programs and have been widely grown throughout the southeastern U.S. for winter grazing and silage. Current efforts on final testing of a new Florida-adapted alfalfa and a new early-season, high-quality bermudagrass are ongoing in the UF/IFAS forage breeding program.

2019 UPDATE

FORAGE VARIETIES RELEASED SINCE 2006	
Release Date	**Cultivars**
Bahiagrass	
10/25/07	'UF-Riata' (US PVP 200800057)
Clover	
01/26/06	Ocoee 'UFWC5' (US PVP 201000002)
07/13/09	'Barduro' (US PVP 201100126)
09/02/14	'FL24D' (US PVP201500006)
Limpograss	
4/28/14	'GibTuck' (Hybrid 10); 'Kenhy' (Hybrid 4F)
Perennial Peanut	
07/29/08	'UF-Tito'; 'UF-Peace'; 'Arblick'
08/06/08	'Ecoturf'
Annual Ryegrass	
10/04/06	Chuckwagon, FL1995 (4X), Angus I, Grazer Nova, Winter Hawk, Ocala
08/14/10	Earlyploid 'MAR Early 4X' (US PVP 201000584)
07/11/14	'FL PE 2X' Diploid 'FL RED 4X Late' Tetraploid

HIGH IMPACT RELEASES

Osceola (1977): This ladino-type, white clover variety has been widely grown over the past four decades due to its superior persistence and high forage yields.

Florigraze (1981): This perennial peanut variety has been widely planted in Florida over the past three decades due to its high yield, quality, persistence, disease resistance, and drought tolerance.

Big Daddy (1996): This vigorous, tetraploid annual ryegrass variety has been widely planted as a forage over the past two decades. It has excellent crown- and stem-rust resistance and produces excellent yields with outstanding regrowth.

Jumbo, US PVP 200000196 (1999): This tetraploid annual ryegrass variety has been widely planted around the world due to its excellent rust resistance, great cold tolerance, and high forage yields.

Prine (2001): This late-maturing, tetraploid annual ryegrass variety has been widely planted in the southern U.S. over the past decade due to its excellent disease resistance and high forage yields.

Fria (2004): This late-maturing, diploid annual ryegrass variety has been widely planted over the past decade. It has excellent forage yields and cold tolerance that helps with fall establishment and winter survival throughout the transition zone and further north in the U.S.

Ocoee (2006): This ladino-type, white-clover variety has been widely grown over the past decade due to its resistance to the southern root knot nematode, a pest that causes decline in clover stands.

UF-Riata (2007): This bahiagrass variety was released due to its improved forage growth during short daylengths and the cool season, which allows grazing longer into the fall and earlier in the spring.

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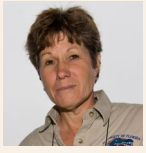

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SMALL GRAINS

UF IFAS UNIVERSITY of FLORIDA

INTRODUCTION

Florida has dynamic beef, dairy, and equine industries with an increasing demand for sheep and goat production, but this production is hampered by a lack of nutritious forage from October to March when subtropical forage species are dormant. Small grains can provide an alternative high-quality feed, hay, or silage during these months.

In recent decades, producers in the southeastern U.S. have increased small grains production for forage, and sometimes silage and hay, rather than growing these crops strictly to produce cereal grains. These small grains include oat, wheat, barley, rye, and triticale (a man-made cross between wheat and rye).

FROM THE BEGINNING

UF/IFAS has a long history of small grains cultivar development, beginning with the release of several oat cultivars in the early 1940s. In response to commercial interest, in 1998, the UF/IFAS small grains breeding program began putting more emphasis on developing cultivars with superior forage characteristics. Since that time, UF/IFAS has released more than a dozen cultivars.

Many advances in small grains breeding and genetics have occurred, aiding in the development of more productive, nutritious, pest-resistant, and environmentally friendly cultivars. Florida's mild winters create favorable conditions for pest insects and fungal diseases, which are the major factors limiting production of small grains in Florida. Knowing this, researchers identify germplasm that provides new sources of genetic resistance and use this germplasm to develop new cultivars.

TODAY AND TOMORROW

Cereal rye is often grown in Florida for winter grazing or as a cover crop for erosion control. Inheritance studies have shown that development of dwarf rye cultivars should be possible and may be useful as a cover crop or a cereal grain.

Oat breeding remains a priority for the program as a forage and as a grain. Most of the breeding emphasis has focused on resistance to crown rust and barley yellow dwarf virus, as well as the development of a hull-less variety.

Triticale has considerable potential as a forage crop and is becoming a popular silage crop for the dairy industry. Varieties released in 2003, '342' and 'Monarch', and more recently 'FL01143', an awnless triticale, are now widely grown in the southeastern U.S.

As the UF/IFAS small grains-breeding program advances, new grain-type releases are anticipated, particularly novel wheat varieties developed for milling purposes and for tropical and subtropical environments. Moving forward, a strong focus will be on pest resistance, particularly resistance to Hessian fly, one of the most significant pests of wheat.

With new breeding methods developed through the use of molecular genetics and the availability of novel exotic germplasm, commercial hybridization technology is on the near horizon.

Future cultivar development in all small grains used as feed, forage and fuel will be aimed at improving heat tolerance during seed fill, as well as adaptation to subtropical and tropical environments.

2019 UPDATE

SMALL GRAIN VARIETIES RELEASED SINCE 2006

Release Date	Cultivars
Oat	
04/13/06	'Trophy' (US PVP 200700421)
07/23/07	'Horizon 201' (US PVP 200900466) Plot Spike 'LA99016' (US PVP 200900462)
08/07/07	'Horizon 270' (US PVP 200900002) 'Horizon 976' (US PVP 200900012)
10/05/10	'FL02011' (US PVP 201600093)
01/27/14	'Cantara' (Uruguay PBR 201402/723)
06/27/14	'FL0567' (US PVP 201500298)
08/28/14	'Horizon 306' (US PVP 201400512)
03/30/15	'Buck' (US PVP 201300380)
08/12/16	'FL0720' (US PVP 201600313), (US utility patent no. 9,961,852)
Triticale	
12/07/16	'FL01143' (US PVP 201700035)

HIGH IMPACT RELEASES

'Florida 501' (1968): This oat variety has been widely planted for nearly five decades and is known for its uniformity, high grain quality, and early forage yields.

'Florida 302' (1984): This high-yielding variety was the dominant wheat variety across the southern U.S. in the late 1980s. By 1988, it was grown on at least 3 million acres a year from eastern Texas to southeastern Pennsylvania.

'342', US PVP 200600020 (2003): This triticale variety was jointly released by UF/IFAS and the University of Georgia and has been very popular throughout the southeastern U.S. over the past decade. It can be used as a grain crop and a forage crop.

'Horizon 270', US PVP 200900002 (2007): This oat variety was jointly released by UF/IFAS and Louisiana State University and was popular due to its excellent grain yield and resistance to crown and stem rust.

'Horizon 201', US PVP 200900466 (2007): This oat variety was jointly released by UF/IFAS and Louisiana State University and has been an excellent forage-type oat because of its vigorous growth and high-tillering capacity. It is broadly adapted to the southeastern U.S.

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TOMATO

UF IFAS UNIVERSITY of FLORIDA

INTRODUCTION

Fresh-market tomato is the No. 1 vegetable crop in Florida, with 32,200 acres harvested for a total farm-gate value of $453.1 million in 2015. Cultivars from the UF/IFAS tomato breeding program have been a primary reason for the tomato industry's commercial success in Florida, and several of UF/IFAS' varieties have had major impacts worldwide. However, the Florida tomato industry faces several challenges today, including import competition, water-use concerns, low market prices, and increasing costs to produce a tomato crop.

FROM THE BEGINNING

The UF/IFAS tomato-breeding program began in 1922 when a grower donated five acres of land to the University of Florida for the purpose of developing disease-resistant cultivars. Early work resulted in the release of a variety resistant to nailhead rust. As a result, the disease was eradicated before the full-fledged tomato-breeding program was established in 1942.

UF/IFAS plant breeders released 'Walter', the first cultivar with resistance to Fusarium wilt race 2, in 1969. The discovery and use of the Fusarium wilt race 2 gene saved the Florida tomato industry an estimated $200 million or more per year in losses and is among the most widely used gene in tomato breeding worldwide. The program discovered resistance to Fusarium wilt race 3 in the 1980s, and this gene is now widely deployed in varieties grown in Florida and around the world.

Cooperative work between the UF/IFAS tomato breeding program and the H. J. Heinz Company in the 1960s resulted in the development and release of 'Florida MH-1', the first fresh-market cultivar that allowed for mechanical harvest because of its high fruit firmness and jointless pedicels. More recently, the Tasti-Lee® brand 'Fla. 8153' hybrid, released in 2006, is being marketed in supermarkets in the eastern U.S. with considerable success as a vine-ripened, high-lycopene tomato with superior flavor and internal color.

TODAY AND TOMORROW

A marker-assisted, hybridization program is under way primarily to incorporate disease-resistant genes into elite, recurrent parental lines and select for resistance in new breeding materials. Considerable progress has been made with respect to resistance to begomoviruses (such as tomato yellow leaf curl virus). UF/IFAS breeders and a cooperating lab in the Netherlands have identified one of the major genes for resistance (Ty-1), and the program has recently developed horticulturally improved materials containing this gene.

An exciting recent development in the UF/IFAS tomato breeding program has been the discovery of the Ty-6 resistance gene, a gene that is being widely used commercially and provides resistance against a broad range of begomoviruses.

Genomic markers are also being used to facilitate breeding for resistance to bacterial spot, bacterial wilt, and graywall.

The UF/IFAS tomato breeding program is also focusing on releasing more heat-tolerant cultivars and developing compact growth habit (CGH) tomatoes that do not require staking, pruning, or tying. These CGH lines have concentrated fruit set, firmness, and jointless pedicels that could allow for once-over mechanical harvest and much less labor input.

The UF/IFAS program has also initiated work to provide a portfolio of superior varieties (such as 'Garden Gem' and 'Garden Treasure') with superior flavor and high yield to the home gardener. Several additional varieties are in advanced trials. The program utilizes hybrids between modern, high-yielding parents and the best-tasting heirloom varieties.

2019 UPDATE

TOMATO VARIETIES RELEASED SINCE 2013	
Release Date	**Cultivars**
06/18/13	Fla. 8233
09/14/13	Fla. 8111B
11/13/13	'Garden Gem' (US PVP 201400052), 'Garden Treasure' (US PVP 201400065)
12/01/14	Fla. 8638B, Fla. 8624, Fla. 8923
01/31/17	'FLA7907C', 'FLA7781B', 'FLA8970', 'FLA8872B', 'W-55' (US PVP Pending)

HIGH IMPACT RELEASES

'Manalucie' (1953): This variety has a combined resistance to more than five diseases and was one of the earliest releases from the UF/IFAS tomato breeding program.

'Walter' (1969): This was the first tomato variety with resistance to fusarium wilt race 2, a discovery that saved the Florida tomato industry an estimated $200 million or more per year in losses.

'Florida MH-1' (1971): This variety was the first machine-harvest, fresh-market tomato variety ever released. It combined firmness with the jointless pedicel trait that allowed stemless harvesting.

'Floramerica' (1977): This variety won a bronze medal in the All America Vegetable Trials and has been widely grown for decades by home gardeners throughout North America.

'Solar Set' (1989): This variety was released due to its exceptional heat tolerance, a trait that improved fall crop yields. It was widely grown commercially in the 1990s.

'Fla. 7804' (2002): This disease-resistant inbred line has been used widely as a parent in several commercial hybrids developed by seed companies. It has been popular due to its resistance to Fusarium wilt races 1, 2, and 3; Verticillium wilt race 1; and gray leafspot. It also has the recessive crimson gene that provides high lycopene.

Tasti-Lee® 'Fla. 8153' (2006): This hybrid has been very popular due to its superior flavor, beautiful internal color, and excellent performance as a field-grown, vine-ripened tomato. The branded marketing program and high consumer acceptance of this variety led to it becoming the No. 1-selling round tomato nationally (Nielsen, 2015).

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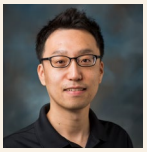

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TURFGRASS

UF IFAS
UNIVERSITY of FLORIDA

INTRODUCTION

From pristine golf courses to home lawns, Florida has nearly 4 million acres of maintained turfgrass with an estimated total economic output of $7.82 billion annually. Florida is ranked first nationally in sod production, employment in the sod industry, number of golf courses, and employment within the golf sector (>50,000 jobs). Florida's lawncare and landscape-maintenance industry ranks second in the nation, after California's. It is a priority to develop cultivars that are tolerant to disease, insects, nematodes, shade, drought, heat, and traffic wear, and also meets Florida's current water-use and nutrient-application regulations.

FROM THE BEGINNING

Throughout its history, UF/IFAS has been involved with the release of 17 cultivars of six different turfgrass species. The formal UF/IFAS turfgrass breeding program was developed in the 1950s when researchers began breeding for turfgrass quality and resistance to biotic stresses such as insects, nematodes, and diseases, and abiotic stresses such as drought, shade, heat, and nutrient availability. In the 1960s and '70s, 'Floratam' was co-developed with Texas A&M University and remains the most popular St. Augustinegrass cultivar, accounting for 69 percent of Florida's sod production.

In 1997, the UF/IFAS warm-season turfgrass breeding program moved to the Everglades Research and Education Center in Belle Glade. Throughout the next decade, researchers released cultivars such as 'Aloha', a seashore paspalum recommended for golf courses and sports fields; 'BA-417', the only centipedegrass developed and intended for use in South Florida; 'BA-189', a zoysiagrass for landscape settings; Toccoa Green® 'BA-305', a zoysiagrass for high-maintenance turf areas; and Captiva® 'NUF-76', a dwarf St. Augustinegrass with improved tolerance to southern chinch bugs.

TODAY AND TOMORROW

The UF/IFAS turfgrass breeding programs are focused on improving turfgrass quality and developing tolerance to several biotic and abiotic stresses. The biotic-stress programs are examining responses to sting nematodes, large patch disease, dollar spot, chinch bugs, and hunting billbugs. The abiotic-stress programs are testing the shade and drought responses of zoysiagrass, St. Augustinegrass, and bermudagrass; identifying lines that can persist under long-term shade; and identifying lines that will hold color and quality in dry conditions. Key to the success of these evaluations is involvement from other University of Florida turfgrass scientists who are experts in management/physiology, diseases, insects, and nematodes. The success of this involvement has resulted in the release of three new zoysiagrass cultivars and a new St. Augustinegrass cultivar in 2018, and an additional release of a new zoysiagrass cultivar in early 2019.

The turf-type bahiagrass program aims to enhance turf quality of bahiagrass using traditional and mutagenic breeding approaches. Making up 24 percent of the sod produced in Florida, this low-input turfgrass is used along highways and in reduced-value landscapes because it tolerates heat, drought, and marginal soil while resisting insects and disease. Researchers are evaluating genetically improved bahiagrass plants in controlled environments to identify lines with improved turf quality.

An important component of the turfgrass breeding program is engaging sod producers and golf-course superintendents prior to cultivar release, ensuring that cultivars meet production and performance standards.

Involving multiple scientists in a team approach will result in more successful cultivars with greater potential to enhance the turfgrass industry.

2019 UPDATE

TURFGRASS VARIETIES RELEASED SINCE 2006	
Release Date	**Cultivars**
Centipedegrass	
10/31/06	‘BA-417’ (USPP20,812)
Seashore Paspalum	
05/17/07	‘Aloha’ (USPP23,333)
St. Augustinegrass	
07/20/06	FloraVerde ‘1997-6’
07/23/07	Captiva® ‘NUF-76’ (USPP21,280)
01/31/18	CitraBlue™ 'FSA1602' (USPPAF)
Zoysiagrass	
05/17/07	Toccoa Green® ‘BA-305’ (USPP18,415)
05/17/07	‘BA-189’ (PP23,716)
01/31/18	'FAES 1312', 'FAES 1313', 'FAES 1319' (USPPAF)
01/15/19	'FAES 1307' (USPPAF)

HIGH IMPACT RELEASES

Floratam (1973): This improved St. Augustinegrass was released jointly by the University of Florida and Texas A&M University. 'Floratam' is the most widely produced and used St. Augustinegrass in Florida and is widely produced and used throughout the southern U.S. It has been a dominant variety for decades.

Toccoa Green® 'BA-305' (2007): This improved, fine-textured zoysiagrass produces a carpet-like, uniform canopy with reduced seed-head production, a dark leaf color, excellent shade tolerance, and a fast rate of establishment and ground coverage.

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STONE FRUIT

UF IFAS UNIVERSITY of FLORIDA

INTRODUCTION

Stone fruit is a term used to describe fruit that feature a layer of fleshy, edible pulp surrounding a relatively large, hard pit (the “stone”) that protects a seed, such as peaches, nectarines, plums, and cherries.

Many stone fruit varieties will not flower and produce fruit until the trees are exposed to temperatures lower than 45 degrees Fahrenheit for a minimum number of hours. This phenomenon, called a "chill requirement," poses production challenges for stone fruit in areas like Florida with mild winters. Only in the past 60 years have breeders developed commercially viable, stone-fruit varieties in Florida.

FROM THE BEGINNING

In 1952, Ralph Sharpe initiated the UF/IFAS stone-fruit breeding program with the objective of developing peach and nectarine cultivars that had modest chilling requirements and ripened early, traits that could bring higher prices for growers and minimize post-harvest problems.

One of the program’s first successes was ‘Flordaprince’, a peach released by Wayne Sherman in 1981 that required about 150 chill hours. Sherman also released another 46 peach and nectarine scion cultivars and one peach rootstock cultivar in the years that followed.

Florida’s peach industry benefitted from this activity but suffered setbacks in the late 1980s from freezes and competition from California. Consequently, stone-fruit acreage in Florida fell from about 4,250 acres in 1978 to 1,140 acres in 1992. In 2004, UF/IFAS commissioned an economic analysis of the commercial potential for peach production in Florida with results suggesting that South Florida could produce 10,000 acres of peaches harvested between March and May. The breeding program redirected its focus, and the results have been promising as South Florida peach production has increased from about 25 acres in 2007 to approximately 2,000 acres today.

TODAY AND TOMORROW

To better support development of Florida’s stone-fruit industry, UF/IFAS established a satellite site for germplasm selection and evaluation at the Indian River Research and Education Center in Fort Pierce. This location typically gets about 75 chill hours per year, allowing for efficient selection of peaches suitable for South Florida production. The program also supports North Florida growers with research programs in Gainesville, Fla. and Attapulgus, Ga. Work at the Attapulgus site is a cooperative effort between UF/IFAS, the University of Georgia, and the USDA-ARS.

Since 2004, nine peach cultivars have been released, one nectarine cultivar, and two rootstocks. ‘UFBest’, a yellow-fleshed peach with a chilling requirement below 150 hours, is an example of the program’s success. It has good flavor, excellent fruit shape and size, a high-percent blush, and excellent tree structure.

The UF/IFAS stone fruit breeding program is currently focused on developing peaches with non-melting flesh for the fresh-fruit market.

In the future, the program will expand its work on white-fleshed peaches, which have received little attention compared with yellow-fleshed varieties. Several white-fleshed selections are currently being evaluated.

2019 UPDATE

STONE FRUIT VARIETIES RELEASED SINCE 2006	
Release Date	**Cultivars**
Peach	
07/20/06	'FlordaBest' (USPP20,294), 'Gulfcrimson' (USPP20,174)
07/29/08	'UFOne' (USPP21,607)
07/08/09	'UFGlo' (USPP21,837)
02/09/12	'UFBest' (USPP25,129)
11/08/12	'GulfAtlas' (USPP27,128), 'Gulfsnow' (USPP25,299)
07/31/13	'UFGem' (USPP26,057)
Peach Rootstock	
05/24/07	'Sharpe'
11/08/16	'MP-29' (USPP23,583)
Nectarine	
07/20/06	'UFRoyal' (USPP20,314)
02/09/12	'Flordarose', 'Southern Rose'

HIGH IMPACT RELEASES

'Okinawa' (1957): This low-chill peach rootstock has been a very important subtropical rootstock in Florida and Australia. It is resistant to root knot nematodes (*M. incognita* and *M. javanica*) but is susceptible to *M. floridensis*.

'Flordaprince' (1982): This melting-flesh variety is the most widely planted low-chill peach in the world. It is well known for its low-chilling requirement and good fruit size.

'Tropicbeauty' (1988): This melting-flesh variety is another very low-chill type with an estimated chilling requirement of 150 hours. It is approximately seven to 10 days later in ripening than 'Flordaprince' in Gainesville, Fla.

'Flordaguard' (1990): This low-chill peach rootstock is the foundational rootstock of the Florida stone-fruit industry today due to its resistance to root-knot nematodes (*M. incognita*, *M. javanica*, and *M. floridensis*).

'UFBeauty', USPP14,784 (2002): This low-chill, non-melting-flesh variety has an estimated chilling requirement of 200 hours. Its fruit are yellow, very firm, and it has a very symmetrical fruit shape.

'UFSun', USPP14,764 (2003): This low-chill, non-melting-flesh variety has an estimated chilling requirement of 100 hours. It has been popular due to its high yield of early-season, medium-sized fruit of excellent quality.

'UFBest' (2012): This low-chill, non-melting-flesh variety has an estimated chilling requirement of 100 hours. Its fruit are very large, and it has produced consistently high yields. It is approximately seven days earlier in ripening than 'UFSun' in Gainesville, Fla.

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STRAWBERRY

UF IFAS UNIVERSITY of FLORIDA

INTRODUCTION

Florida's strawberry crop currently covers 10,500 acres with an annual farm-gate value of $350 million. UF/IFAS strawberry cultivars are planted on approximately 9,000 of those acres. Florida is the major winter supplier of strawberry fruit to the eastern U.S. and is the nation's second leading supplier behind California. As of 2017, UF/IFAS strawberry cultivars are grown in 36 countries and on every continent except Antarctica.

FROM THE BEGINNING

The UF/IFAS strawberry breeding program began in 1948 under the direction of plant pathologist Albert Brooks at a Florida Agricultural Experiment Station (FAES) Center near Plant City, Fla. The first cultivar, 'Florida Ninety', was released in 1952 and became the dominant variety grown in Florida. At the time, it was known for its high yields and moderately high degree of resistance to crown rot. Subsequent breeding efforts were sporadic until 1968 when Charlie Howard began a systematic process for crossing and selection at the Gulf Coast Research and Education Center that continues to this day. 'FloridaBelle' was released in 1975, followed by 'Dover' in 1979. Both varieties showed improved yield and resistance to crown rot, but they suffered from fruit-quality problems. 'Sweet Charlie', released in 1992, produced higher yields from December through February than any other available variety, and it was the only Central Florida variety that was resistant to anthracnose fruit rot.

The release of 'Strawberry Festival' in 2000 was monumental because it combined steady yield with broad disease resistance, attractive shape and color, excellent firmness, and improved shelf life. It quickly rose to dominance, comprising at least 50 percent of Florida acreage by 2005 and is largely credited with the expansion of the Florida strawberry industry in that decade.

TODAY AND TOMORROW

The UF/IFAS strawberry breeding program employs traditional cross-pollination techniques and field selection using a strategy called recurrent selection, where new seedlings are rapidly evaluated and the best are used as parents for the next generation. Growers are interested in varieties that are resistant to multiple diseases, provide early and consistent yield, and have plants with long stems to make harvesting easier. Marketers and wholesalers want uniformly shaped fruit of sufficient size with attractive color. Consumers also value these traits but especially prize flavor, a trait receiving increased attention in the breeding program because recent research is uncovering how certain volatile natural compounds affect the perception of flavor.

'Florida Radiance' was released in 2008 and replaced 'Strawberry Festival' as the leading strawberry cultivar in Florida by 2012. Known as 'Florida Fortuna' outside of the United States, it has expanded internationally as well. In 2017, it comprised approximately 55 percent of the Spanish strawberry industry. Sweet Sensation® brand 'Florida127', released in 2013, combines a sweet flavor and fruity aroma with excellent fruit size and shelf life. It accounted for 15 percent of the Florida industry in 2016 and is expected to grow to 25 percent in 2017.

Future UF/IFAS strawberry breeding program efforts will continue to enhance earliness, color, shape, size, yield, and flavor, as well as resistance to root and crown diseases.

2019 UPDATE

STRAWBERRY VARIETIES RELEASED SINCE 2006	
Release Date	**Cultivars**
04/28/08	Florida Radiance/Florida Fortuna (USPP20,363)
04/28/08	Florida Elyana (USPP21,317)
04/12/11	Winterstar™ 'FL 05-107' (USPP23,042)
05/19/13	Sweet Sensation® 'Florida127' (USPP25,574)
08/24/16	'Florida Beauty' (USPP30,385)
08/09/17	'Florida Brilliance' (USPPAF)

HIGH IMPACT RELEASES

'Sweet Charlie' (1992): This short-day cultivar was the first patented strawberry variety released by UF/IFAS. Its early yields and excellent flavor made it a very popular cultivar in Florida and in other strawberry-producing regions around the world.

'Strawberry Festival', USPP14,739 (2000): The attractive and firm fruit of this variety have been key characteristics that allow its fruit to be shipped longer distances with lower likelihood of rejection. It is also a sturdy plant that is easy to harvest. It enabled Florida strawberry growers to increase their acreage throughout the 2000s, and it has also been widely planted in other strawberry producing regions around the world.

'Florida Radiance', USPP20,363 (2008): This variety has been widely successful due to its early season yields. Prices during the early part of the Florida production window are typically higher than they are later in the season, which has made this variety the most popular variety currently grown in Florida. It has also performed well in other strawberry producing regions around the world (where it is called 'Florida Fortuna'). It is now the most popular variety grown in southern Spain.

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ORNAMENTALS

UF IFAS
UNIVERSITY of FLORIDA

INTRODUCTION

UF/IFAS has the largest university-based, ornamental plant breeding program in the nation. Recent emphasis has been on developing new varieties of caladium, gerbera, coleus, lantana, and ruellia. UF/IFAS ornamental plant breeders use an array of genetic approaches to improve plant performance, keep Florida's ornamental plant industry competitive, and enhance profitability in domestic and global markets. For example, the annual sales value of lantana produced in Florida is approximately $40 million, and the Florida caladium tuber-production industry supplies more than 95 percent of the world's caladium tubers.

FROM THE BEGINNING

The following highlights when each ornamental breeding program was begun and its purpose:

Caladium breeding program, 1976: To develop new cultivars with bright foliage colors, multiple leaves, good viability in container production, robust performance in the landscape, and quality tubers.

Gerbera breeding program, 2000: To combat powdery mildew and improve plant vigor, continuous flowering, and flower size and color.

Coleus breeding program, 2003: To produce colorful new annuals that thrive under Florida's environmental conditions. Breeders selected coleus for late flowering, plant form, easy propagation, improved vigor, and foliage in a variety of colors, shapes, and sizes.

Lantana breeding program, 2004: To produce non-invasive cultivars with reduced male and female fertility, improved growth habits, strong flowering potential, and plant performance for use in nursery production and in the landscape.

Ruellia breeding program, 2007: To develop new cultivars with different flower colors and with growth habits that have reduced fertility and reduced invasive potential by seed dispersal.

TODAY AND TOMORROW

The ornamental plant industry benefited greatly when UF/IFAS ornamental plant breeders developed varieties with decreased fertility in species that are popular but often invasive. Controlled hybridization between tetraploids and diploids, progeny ploidy analysis, and multiple rounds of screening led to the release of two new lantana varieties and four ruellia varieties.

Many of the plants in the ornamental plant breeding program are introduced from other parts of the world with traits that are still poorly understood. UF/IFAS ornamental plant breeders plan to expand their germplasm collection to better understand important horticultural traits using somaclonal variation, artificial mutagenesis, somatic hybridization, and molecular markers to complement the technical approaches used for developing new varieties.

The future of the UF/IFAS ornamental plant breeding program lies with expanded production of its varieties outside of the U.S.

Plant breeders are working with Florida Foundation Seed Producers, Inc. and licensees to expand commercial production of these cultivars in Canada, Europe, and Asia.

2019 UPDATE

ORNAMENTAL VARIETIES RELEASED SINCE 2014

Release Date	Cultivars
Caladium	
07/17/15	'Sizzle' (USPP26,591), 'Passionista' (USPP26,592)
03/09/16	'Cosmic Delight' (USPP27,154), 'Hearts Desire' (USPP27,155), 'Fiesta' (USPP26,833)
11/08/16	'Icicle' (USPP29,249)
Coleus	
01/30/14	Marquee™ Blonde Bombshell (USPP27,076), FlameThrower™ Chili Pepper (USPP27,078), FlameThrower™ Habanero (USPP27,077), Coleosaurus™ 'UF10-45-12' (USPP27,126), Lime Time™ 'UF12-30-6' (USPP27,140)
08/01/14	FlameThrower™ Chipotle (USPP27,288), Campfire 'UF12-22-1' (USPP27,269)
01/30/14	Mainstreet™ Abbey Road, Mainstreet™ Broadway, Mainstreet™ Fifth Avenue
01/07/15	FlameThrower™ Spiced Curry (USPP27,499), Marquee™ Special Effects (USPP27,500), Velveteen® 'UF13-6-11'
10/27/15	Apple Brandy® 'UF12-70-7'
04/22/16	Inferno (USPP28,591), Ruby Slipper (USPP28,566), French Quarter (USPP28,517)
10/10/17	Mainstreet™ Chartres Street 'UF16-27-1' (USPPAF), Mainstreet Ruby Road 'UF16-64-1' (USPPAF), Mainstreet Ocean Drive 'UF16-5-6' (USPPAF), Mainstreet La Rambla 'UF16-72-8' (USPPAF), Stained Glassworks™ Royalty 'UF16-88-9' (USPPAF), Sedona Sunset® 'UF16-1-20' (USPPAF), Stained Glassworks™ Crown Jewel 'UF16-45-18', Cherry Brandy® 'UF16-14-3', Torchlight® 'UF16-14-5', Flame Thrower™ Salsa Verde 'UF14-24-1' (USPPAF)
09/20/2018	Rediculous™ 'UF16-90-3', FlameThrower™ Salsa Roja 'UF15-97-9' (USPPAF), Pinkplosion 'UF15-20-6' (USPPAF) FlameThrower™ Serrano 'UF15-6-28' (USPPAF)
04/17/19	Stained Glassworks™ Eruption 'UF17-128-7', Wicked Witch™ 'UF17-128-7, Mainstreet™ Beale Street 'UF17-64-1', Wicked Hot™ 'UF17-52-2', Mainstreet™ Alligator Alley 'UF17-50-5' Stained Glassworks™ Cooper 'UF17-43-3', Heartbreaker™ 'UF16-91-25', Borderlime™ 'UF16-31-15'
Ruellia	
04/22/16	Mayan™ Compact Purple (USPP28,449)
01/31/18	Aztec™ Purple 'R13-5-3' (USPPAF), Aztec™ White/Pink 'R15-24-17' (USPPAF), Aztec™ Pink 'R16-1-1' (USPPAF)
Lantana	
11/18/16	Bloomify™ Red 'UF-1013A-2A' (USPP29,292), Bloomify™ Rose 'UF-1011-2' (USPP29,267)

HIGH IMPACT RELEASES

Florida Sweetheart (1993): First caladium released and patented by the University of Florida and still popular.

Red Ruffles, USPP13,136 (2000): Strap-leafed caladium well-suited for mass planting.

Florida Moonlight, USPP14,565 (2002): Fancy-leafed caladium produced extensively for the bulb trade.

Royal Glissade® 'UF03-8-10' (2006): Coleus with excellent vigor and jagged, red-and-moss-green leaves.

Electric Lime® 'UF04-33-5' (2006): Coleus with lemon-lime leaves, grown in shade or full sun without fading.

Redhead 'UF06-4-6', USPP21,585 (2008): Most popular red-leafed coleus due to its deep-colored red leaves.

Royal Flush™ 'UF-18-49', USPP24,431 (2010): Fancy-leafed caladium well-suited for sun and shade and awarded one of the 'Best of the Best' at the Ohio State University Annual Cultivar Trial in 2013.

Tapestry™ 'UF-172', USPP24,432 (2010): Fancy-leafed caladium intended for use in large containers and awarded one of the 'Best of the Best' at the Ohio State University Annual Cultivar Trial in 2013.

Wasabi 'UF-08-4-3', USPP23,585 (2011): Coleus widely used in landscape due to bright leaves that don't fade.

Mayan™ Purple, Mayan™ White (2012): Non-invasive ruellia that do not set seed, are season-long, prolific bloomers, and were top performers in the Louisiana State AgCenter's 2014 trials.

Campfire 'UF12-22-1' (2015): Copper-colored coleus, exceptional branching and growth habit, and one of the top 20 new plants at the 2016 RHS Chelsea Flower Show.

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GRAPE

UF IFAS UNIVERSITY of FLORIDA

INTRODUCTION

Florida is the nation's second-largest consumer of grape products. The industry has been expanding due to increased appreciation of wines made from the native muscadine grape, known scientifically as *Vitis rotundifolia*. Although grocery chains are increasingly distributing these sweet wines, they fill only a narrow niche in a large market. The UF/IFAS grape-breeding program has helped Florida expand its presence in the wine market with bunch grape hybrids of the *Vitis vinifera* species.

FROM THE BEGINNING

Florida had a large grape industry in the 1920s but plantings of *V. vinifera* and existing hybrids failed due to a disease initially known as vine degeneration, later renamed Pierce's disease (PD). This bacterial disease killed *V. vinifera* grapes and hybrids but was relatively harmless to muscadines. At the time, muscadines were not popular for winemaking or the fresh-fruit market. Continued interest in viticulture by Florida farmers led to the formal establishment of a UF/IFAS grape-breeding program that same decade. The program was led initially by Loren Stover and later by John Mortensen, both of whom spent their careers breeding grapes at the UF/IFAS Central Florida Research and Education Center.

The 'Blanc du Bois' grape was developed in 1968 when Mortensen crossed PD-resistant, native Florida grapes with susceptible *V. vinifera* selections, resulting in a wine grape resistant to PD, a significant development. When Mortensen retired in 1990, the formal breeding program ended, but UF/IFAS grape research continued.

In 1984, researchers began applying emerging biotechnological methods to grape improvement. Three muscadine cultivars were released; 'Eudora' (2006), 'Delicious' (2007), and 'Southern Jewel' (2007), all of which were developed via conventional breeding. Researchers are currently preparing a disease-resistant *V. vinifera* hybrid for release.

TODAY AND TOMORROW

The primary challenge for Florida grape production continues to be Pierce's disease (PD) and various fungal diseases. The main strategy to combat these diseases is interspecies gene transfer.

The bacterium responsible for PD, *Xylella fastidiosa*, thrives in hot, humid climates and has proven resistant to all control strategies except genetic improvement. With interspecies gene transfer, researchers insert genes from one grape variety into another to boost desirable traits, resulting in a modified plant that contains only grape genes. Such plants are more acceptable to consumers than plants produced via cross-species gene transfers, and may be more amenable for federal agency approval.

One recent study showed that it was possible to significantly enhance the fungal disease resistance of 'Thompson Seedless' grapes by inserting a gene from the 'Chardonnay' grape. Other studies have aimed to enhance the resistance to PD in *V. vinifera* grapes and their hybrids. Another project focuses on development of seedless, muscadine cultivars resistant to fruit rot.

2019 UPDATE

GRAPE VARIETIES RELEASED SINCE 2006	
Release Date	**Cultivars**
Muscadine	
04/13/06	‘Eudora’
10/25/07	‘Delicious', ‘Southern Jewel’
Bunch	
06/01/15	‘BN5-4’ (USPP27,451)

HIGH IMPACT RELEASES

'Blanc DuBois' (1987): This hybrid grape variety was released due to its resistance to Pierce's disease, a bacterial malady that is devastating to *Vitis vinifera* species in Florida. This variety has been widely planted in southern U.S. states such as Florida, Texas, Louisiana, South Carolina, and Tennessee to produce white wine.

'Southern Home' (1992): This interspecific hybrid grape has been a popular ornamental and dooryard variety due to its disease resistance and unique leaf shape, resembling that of a maple leaf.

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TROPICAL FOLIAGE

UF IFAS UNIVERSITY of FLORIDA

INTRODUCTION

Florida leads the nation in production of tropical foliage plants, accounting for more than 55 percent of national wholesale value every year since the 1960s. The UF/IFAS foliage-breeding program, housed at the UF/IFAS Mid-Florida Research and Education Center in Apopka, Fla., is the only organized foliage-breeding effort in the world. Plant breeders working on tropical foliage are developing innovative methods to create new plant forms that increase the potential for new cultivar development.

The UF/IFAS foliage-breeding program is a comprehensive program that develops cultivars with new foliage colors, shapes and leaf orientations; increased plant vigor; full appearance; tolerance to low-light levels; increased flower production and flower counts; earlier flower development; and increased disease resistance.

FROM THE BEGINNING

The UF/IFAS foliage plant breeding program was established in 1976 with the goal of creating new ornamental tropical foliage plants. Initial breeding research was divided into four stages, all of which still apply to ongoing research today:

Stage 1: Flowering. The primary barrier to breeding tropical foliage is the inability to achieve simultaneous flowering in many species. UF/IFAS plant breeders used tools such as gibberellic acid to stimulate flowering, allowing breeders to produce flowers on demand year-round. Growers applied this technique to *Spathiphyllum*, making this foliage plant one of the world's most valuable flowering crops.

Stage 2: Seed production. *Anthurium* and *Spathiphyllum* plants have showy spathes that add to their ornamental value. Their bisexual flowers do not require any special aid for seed set. However, to obtain seed from *Aglaonema* and *Dieffenbachia* plants, 100 percent relative humidity is required for pollen germination. UF/IFAS plant breeders developed an effective technique for wrapping newly pollinated spadices with moistened paper towels and placing them in plastic bags for 24 hours to set seeds.

Stage 3: Variegation. The leaf variegation trait is controlled by a single dominant gene, with multiple alleles determining variegation patterns within *Dieffenbachia* and *Aglaonema* plants. Multiple genes control branching from the lower stems in both individuals, and different patterns can be combined in hybrids through direct crosses and selecting for favorable traits in the offspring. After favorable traits are selected, hybrids are propagated by tissue-culture techniques for rapid population production. These large populations are evaluated for stable characteristics before being released to the nursery industry.

Stage 4: Hybrid testing. Hybrids are grown and tested under simulated commercial and consumer conditions before release to ensure that UF/IFAS plant breeders produce quality plants that will have a positive economic impact.

TODAY AND TOMORROW

Researchers in the UF/IFAS foliage plant-breeding program have been applying growth regulators to selected plants – including Pothos (*Epipremnum*), *Philodendron*, and ZZ (*Zamioculcas*) – to induce flowering on demand, obtain seeds, and select hybrids of new foliage types. New tissue culture techniques allow researchers to evaluate new varieties without having to grow plants to full size, which can reduce research time by two or more years.

2019 UPDATE

TROPICAL FOLIAGE VARIETIES RELEASED SINCE 2006	
Release Date	**Cultivars**
Aglaonema	
06/04/08	Mondo Bay 'UF-742-3' (USPP20,463)
11/13/08	Key Lime 'UF-257-12' (USPP19,712) Leprechaun 'UF-SB-2' (USPP19,714)
01/05/10	Scenic Bay 'UF-808-4' (USPP22,825)
Pothos	
11/12/08	Green Genie 'UFM10' (USPP20,930)
11/12/08	Pearls and Jade® 'UFM12' (USPP21,217)
Philodendron	
11/12/08	Frilly Philly 'UF-M-1' (USPP20,961)

HIGH IMPACT RELEASES

Sparkles (1993): This *Dieffenbachia* cultivar has been grown and sold extensively due to its high performance in greenhouse production, its brightly colored foliage, and its freely branching, compact growth habit.

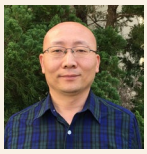
Red Hot (1995): This popular *Anthurium* has been sold widely as a potted plant due to its bright red spathes and highly prolific, compact flowering and growth habit.

Golden Bay (1999): Widely sold *Aglaonema* cultivar with uniquely patterned, attractive silvery-gold foliage. It has been used extensively in interiorscape designs.

Emerald Bay, US PP12,867 (2001): This *Aglaonema* cultivar has been widely sold due to its attractive and unique variegated foliage. It has been a preferred cultivar for interiorscape uses.

Pearl and Jade® 'UF-M-12' (2008): This popular Pothos cultivar has uniquely colored foliage consisting of unusual splotches of greens and whites distributed unevenly across the leaf, not typical of standard varieties. It has been sold widely as a hanging-basket display.

FACULTY RESEARCH CONTACT:



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SWEET CORN

UF IFAS UNIVERSITY of FLORIDA

INTRODUCTION

Fresh-market sweet corn is grown on approximately 230,000 acres in the U.S. with a farm-gate value ranging from $750 million to $850 million. In Florida alone, 35,000 to 40,000 acres are grown each year with a farm-gate value of $150 million to $170 million. Most fresh-market sweet corn is shipped in the spring (March through May) with limited amounts shipped during fall and winter (October to March).

FROM THE BEGINNING

In 1956, Emil Wolf, a sweet corn breeder at the University of Florida, initiated a breeding program with Shrunken-2 (sh2), a gene that produces a dried, mature seed with a highly wrinkled phenotype due to the high sugar content of the kernel, when compared to sugar enhancer (se) or sugary-1 (su1) genes. This high-sugar sweet corn suffered from poor germination until 1975 when Wolf released inbreds Florida 32 and Florida 56. When crossed, they produced a hybrid that was named Florida Staysweet, also known as Summer Sweet 7800. This hybrid caused the Florida fresh-market industry to convert from su/se to sh2 varieties because the higher sugar levels at harvest made the end product taste sweeter, which consumers prefer.

After Wolf's retirement, plant breeder Brian Scully incorporated diverse germplasm from numerous sources to improve disease resistance and plant type. Scully released two hybrids (Snow Storm and Florida XP-7); two inbreds (UFISH 8008 and UFISH 8029); Zap Chico 'sh2' and '2451F' that had improved resistance to an ear-feeding insect; and su1, bt1, and sh2 forms of the NE-EDR population that had improved foliar disease resistance.

TODAY AND TOMORROW

Today, the UF/IFAS sweet corn program is breeding new sweet corn inbreds that have improved plant and ear quality, increased sugar levels, and a more creamy, corn taste using a combination of su/se and sh2 genes. The first inbred from this work was released in 2012 and is currently being used in a breeding program that has already created two cooperative, industry hybrids (Yellowstone and Everglades). These are now available commercially and should provide stable yields under environmental conditions typical of South Florida.

In development are sweet-corn lines with improved eating quality, disease resistance, and natural insect resistance. These lines will be able to resist foliar- and ear-feeding insects such as fall armyworm and silk fly.

2019 UPDATE

SWEET CORN RELEASED SINCE 2006	
Release Date	**Cultivars**
07/24/12	'UFi 9EC' (US PVP 201400486) - inbred 'UFi 2ED' - inbred

HIGH IMPACT RELEASE

'Florida Staysweet' (1977): This hybrid was revolutionary to the sweet corn industry and allowed the industry to move to the Shrunken-2 gene. This gene provided increased sugar content and enhanced eating quality, allowing this hybrid to take over the industry in the 1970s. The inbred lines produced from this hybrid have been widely used by other sweet corn breeders, and many sweet corn hybrids grown today can be traced back to these inbred lines.

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FOREST SPECIES

UF IFAS
UNIVERSITY of FLORIDA

INTRODUCTION

As the human population grows, the demand for wood and the hundreds of products made from it increases, making forest species, such as pine and eucalyptus, valuable commercial crops.

PINE

Southern pine, planted on more than 32 million acres in the southeastern U.S., ranks in the top four crops in the United States in terms of farm-gate value. Southern pine has long been an economic mainstay in Florida, and its germplasm, which is the store of genetic material for this essential crop, is the fastest growing germplasm resource in the U.S. and southern hemisphere.

The UF/IFAS southern pine breeding program was initiated in the 1950s to breed fast-growing trees with straight stems and strong disease resistance, enabling Florida growers to produce large quantities of high-quality wood faster. The breeding program was the first to use modern statistical methods to analyze the genetic control of traits and rank for selection. UF/IFAS pine breeders have shortened the southern pine breeding cycle to make it more efficient, and they are now pioneering the use of molecular methods to accelerate breeding.

The UF/IFAS Cooperative Forest Genetics Research Program (CFGRP) developed a highly advanced crop of slash pine that is grown widely in North Florida and southern Georgia. The genetic material for nearly all of Florida's 4 million acres of planted pine came from CFGRP selections.

EUCALYPTUS

Eucalyptus was established in the U.S. in the late 1960s as a potential source of hardwood pulpwood in South Florida, and cultural practices for raising seedlings and establishing commercial plantations were developed. However, after severe freezes from 1983 to 1989, many research participants dropped out, but the University of Florida continued its research.

The severe freezes encouraged the development of fast-growing, freeze-resilient clones. Based on performance across a wide range of conditions, UF released five cultivars ('G1', 'G2', 'G3', 'G4', and 'G5') that grow well under many environmental circumstances. A fifth-generation *Eucalyptus grandis* seedling seed orchard has also been established.

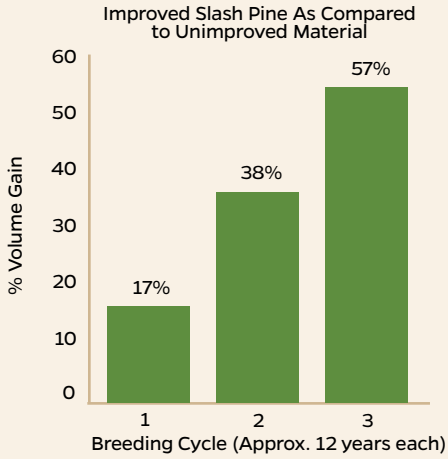
Current eucalyptus plantations in Florida exceed 18,000 acres, primarily made up of *E. grandis*. Most of these are harvested in eight years or less for mulchwood, which is sold throughout the eastern U.S.

Eucalyptus plantation acreage and markets are likely to expand greatly as wood pellet plants, biomass-fueled utilities, and other such energy projects develop.

2019 UPDATE

SOUTHERN PINE

Almost all southern pine seedlings planted in Florida come from the CFGRP, with benefits estimated at $500 million more than if growers had planted unimproved material. The graph below shows slash pine volume gain at harvest, as compared to unimproved pine, for each breeding cycle.



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EUCALYPTUS VARIETIES RELEASED SINCE 2006

Release Date	Cultivars
02/05/09	‘G1’ (USPP21,582)
02/05/09	‘G2’ (USPP21,571)
02/05/09	‘G3’ (USPP21,569
02/05/09	‘G4’ (USPP21,570)
01/10/12	'G5' (USPP24,441)

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SUGARCANE AND BIOENERGY GRASSES

UF IFAS UNIVERSITY of FLORIDA

INTRODUCTION

Sugarcane has been vital to Florida since 1572, when it was first grown by the Spanish founders of St. Augustine. Today, the state produces about 400,000 acres annually with an estimated farm-gate value of $750 million. This crop has become increasingly important in recent years for its bioenergy production potential.

High-biomass grasses such as energy cane, napier grass, and sorghum promise to become primary feedstock for Florida's emerging biofuels industry. Energy cane produces biomass with elevated fiber and reduced sucrose content. Napier grass is a major livestock feed because of its excellent forage quality and tolerance of multiple annual harvests. These two grasses are the most productive perennial biomass grasses on marginal land in the coastal southeastern U.S. and are considered dedicated feedstocks for production of lignocellulosic biofuel. Sweet sorghums and high-biomass sorghums are annual bioenergy crops with exceptional drought tolerance.

FROM THE BEGINNING

Florida's sugarcane-breeding program began in the 1960s at Canal Point under an agreement between the USDA, the University of Florida, and the Florida Sugar Cane League. The main purpose of the program was to develop high-yielding and disease-resistant sugarcane cultivars for sucrose production. More than 90 percent of Florida's sugarcane acreage is planted with cultivars from this program.

Breeding bioenergy grasses began at UF/IFAS in the early 1980s with the creation of the napier grass-breeding program by Stanley Schank. The increased interest in renewable energy from low-input crops stimulated the formation of the energy cane cultivar development program at the UF/IFAS Everglades Research and Education Center through the collaborative efforts of Robert Gilbert (UF/IFAS) and Jack Comstock (USDA, Canal Point) in 2006. The bioenergy sorghum-breeding program, founded the following year, benefitted from Daniel Gorbet's grain sorghum-breeding program at the UF/IFAS North Florida Research and Education Center which included germplasm with excellent disease resistance.

TODAY AND TOMORROW

The primary focus of the current **UF/IFAS sugarcane-breeding program** is to improve biomass and sucrose content in new cultivars with greater resistance against major diseases, such as brown rust and orange rust, with strategies focused on developing molecular techniques to improve screening of clones against these diseases.

The **UF/IFAS energy cane-breeding program** is focused on developing high-biomass and disease-resistant cultivars for lignocellulosic ethanol production on marginal or sandy soils. Some top priorities of the program include improving genetic diversity and resistance against biotic and abiotic stresses.

The **UF/IFAS sorghum-breeding program** is focused on developing cultivars adapted to low-input agriculture in the southeastern U.S., including sweet sorghums with enhanced bioprocessing characteristics. Genetic marker-assisted selection is helping breed for disease resistance.

The **UF/IFAS napier grass-breeding program** is implementing conventional and marker-assisted breeding strategies for improved biomass production. Genetically distant napier grass genotypes were identified with molecular markers and used as parents for diallel crosses. Progenies with hybrid vigor were selected and field-tested in different locations throughout Florida, showing significant yield increases compared to earlier cultivars.

While Florida currently contributes 50 percent of the nation's cane sugar and 25 percent of all U.S.-produced sugar, bioenergy grasses recently bred by UF/IFAS breeding programs will begin to be commercially grown in Florida when dedicated biofuel conversion facilities for these feedstocks are completed.

2019 UPDATE

SUGARCANE AND BIOENERGY GRASSES RELEASED SINCE 2006

Release Date	Cultivars
Sugarcane	
11/19/07	'CP 00-1446', 'CP 00-2180', 'CP 00-1101'
10/21/08	'CP 01-1372', 'CPCL 97-2730'
11/09/09	'CPCL 99-4455'
02/18/11	'CP 03-1912', 'CPCL 00-4111'
08/19/11	'CPCL 95-2287', 'CPCL 02-0926', 'CPCL 02-1295', 'CP 04-1566', 'CP 04-1844', 'CP 04-1935'
09/07/12	'CPCL 05-1791', 'CPCL 05-1526', 'CPCL 02-6848', 'CPCL 05-1102', 'CPCL 05-1201'
Sweet Sorghum	
04/15/14	Gusher, Caramelo, Fortuna, Sweet Florida, Candycane
07/21/15	12 Inbred Breeding Lines
Energy cane	
10/07/13	UFCP 74-1010, UFCP 78-1013, UFCP 82-1655, UFCP 84-1047, UFCP 87-0053

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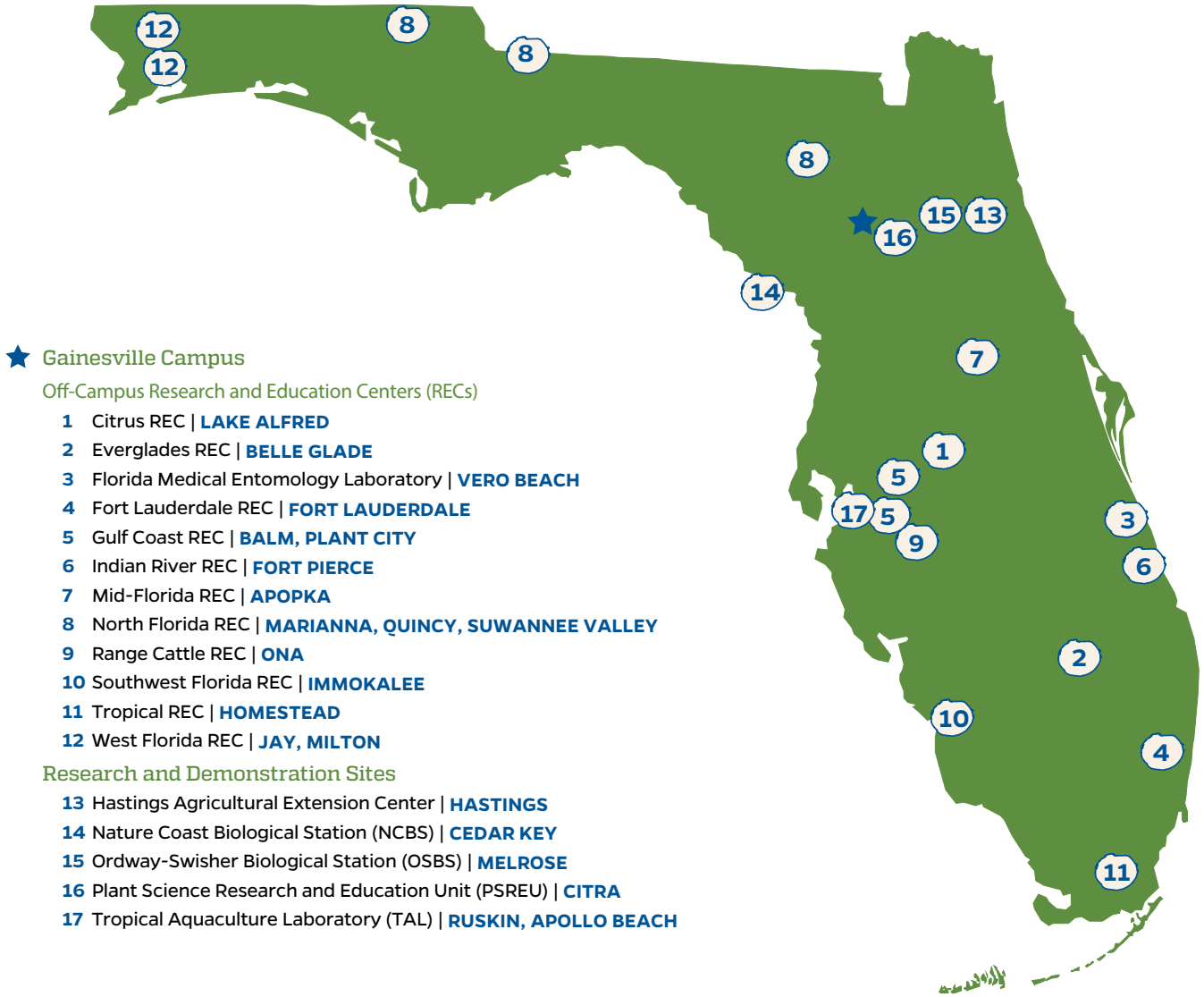
UF IFAS
UNIVERSITY of FLORIDA

Unit Map



★ Gainesville Campus

Off-Campus Research and Education Centers (RECs)

1 Citrus REC | **LAKE ALFRED**
2 Everglades REC | **BELLE GLADE**
3 Florida Medical Entomology Laboratory | **VERO BEACH**
4 Fort Lauderdale REC | **FORT LAUDERDALE**
5 Gulf Coast REC | **BALM, PLANT CITY**
6 Indian River REC | **FORT PIERCE**
7 Mid-Florida REC | **APOPKA**
8 North Florida REC | **MARIANNA, QUINCY, SUWANNEE VALLEY**
9 Range Cattle REC | **ONA**
10 Southwest Florida REC | **IMMOKALEE**
11 Tropical REC | **HOMESTEAD**
12 West Florida REC | **JAY, MILTON**

Research and Demonstration Sites

13 Hastings Agricultural Extension Center | **HASTINGS**
14 Nature Coast Biological Station (NCBS) | **CEDAR KEY**
15 Ordway-Swisher Biological Station (OSBS) | **MELROSE**
16 Plant Science Research and Education Unit (PSREU) | **CITRA**
17 Tropical Aquaculture Laboratory (TAL) | **RUSKIN, APOLLO BEACH**

ADDITIONAL RESOURCES

To learn about licensed cultivars released from the UF/IFAS plant breeding programs and their availability, please visit www.ffsp.net.