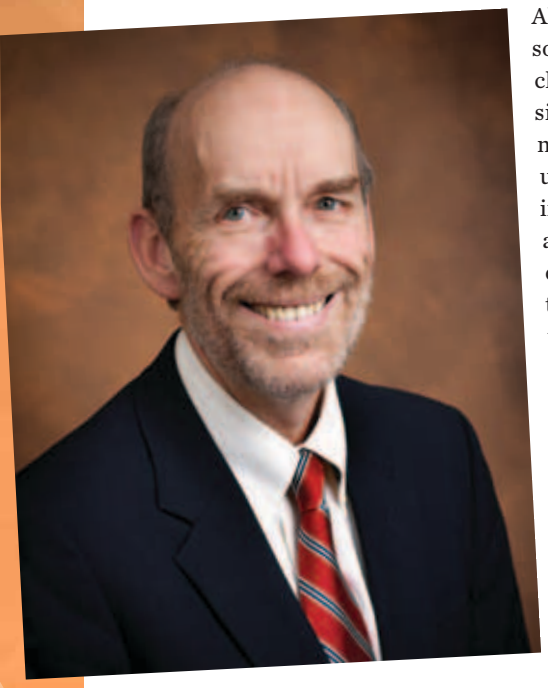
# IFAS RESEARCH UPDATE
# INTERDISCIPLINARY RESEARCH

**Institute of Food and Agricultural Sciences**
Florida Agricultural Experiment Station
2012


UF UNIVERSITY of FLORIDA

## When the Morrill Land-Grant Act was signed into law in 1862, establishing the framework for land-grant institutions like the University of Florida, many aspects of life differed greatly from today.



Although tremendous social and technological changes have occurred since that time, the core mission of land-grant universities — generating new knowledge to address critical societal needs and sharing that understanding with the public and the next generation of professionals and leaders — is more relevant than ever.

In line with our land-grant heritage, research at the UF Institute of Food and Agricultural Sciences (UF/IFAS) remains focused on food, agriculture, and natural resources. But the important questions in agriculture and natural resources facing today's society are increasingly intertwined and complex.

To address the challenges of the 21st century, our research programs must be built on strong disciplinary foundations, but at the same time they must be structured to integrate across disciplines. The complexity of the challenges we face today demands understanding that cuts across traditional disciplines. Indeed, as we look at the history of innovation, we see that the most significant breakthroughs generally occur when multiple perspectives are brought to the table.

Here we present a brief overview of a few integrated research projects being pursued by UF/IFAS scientists. Each of the projects highlighted brings together UF/IFAS scientists with different specializations and expertise to address key issues in agriculture and natural resources.

For example, a project aimed at improving the production and sustainability of sweet sorghum as an energy crop brings together a team including scientists from the departments of Agronomy, Microbiology and Cell Science, Agricultural and Biological Engineering, and Materials Science and Engineering. In another project, a team of researchers from the Mid-Florida Research and Education Center in Apopka and the departments of Agricultural and Biological Engineering, Soil and Water Science, and Agronomy are working to determine the minimum irrigation requirements for mixed landscapes while maintaining an aesthetically acceptable appearance.

In all, this report looks at seven program areas where UF/IFAS researchers are taking an integrated approach to the issues of sustainability, energy, climate change, water, food systems and human health, ecosystem health and services, and resource production.

I hope you enjoy learning about these efforts, and invite you to visit our web page (HTTP://RESEARCH.IFAS.UFL.EDU) for more information about our research programs.


**JOHN P. HAYES**
Interim Dean for Research, UF/IFAS
Director, Florida Agricultural Experiment Station


UF UNIVERSITY of FLORIDA
IFAS Research
*Florida Agricultural Experiment Station*

> "The complexity of the challenges we face today demands understanding that cuts across traditional disciplines."

# UF/IFAS Researchers Conducting World-Class Research at PSREU

**JUST A SHORT DRIVE** from Gainesville, the Plant Science Research and Education Unit (PSREU) in Citra is home to a staggering amount of research on everything from underground irrigation to the use of satellite technology to monitor agricultural production.

Nearly 150 UF/IFAS researchers have 680 experiments under way at the 1,100-acre site. Some are original studies, others replicate experiments conducted elsewhere in the state to determine if researchers get the same results under North Florida weather conditions.

A great many of these studies are interdisciplinary in nature, such as Diane Rowland's agronomy work, which involves agronomists and irrigation scientists from Texas Tech and Texas A&M universities, the United States Department of Agriculture and Florida Cooperative Extension. The researchers are trying to determine whether castor bean can become a viable commercial crop for biofuel in Florida. UF agronomist Kevin Kenworthy's turf-breeding work is another example; he's collaborated with nematologist Billy Crow and plant pathologist Phil Harmon to create turfgrass that is both nematode- and disease-resistant.

The PSREU facility, which began with just one shed and a single-wide mobile home office, now includes 27 buildings, including a new conference facility where IFAS faculty will host academic classes, field days and seminars.

PSREU Director Danny Colvin said he believes the facility is one of the best of its kind in the country.

"Basically, if it's got anything to do with a plant — cotton, soybeans, new varieties of flowers, every variety of turf that can be grown in Florida, a three-hole golf course — we are studying it," Colvin said.

The facility helps UF send students into agriculture-related careers with hands-on growing experience, which gives them an edge in the job market, he said.

Colvin said that while there is a tremendous amount of research ongoing, the Citra unit has room for additional research. The number of field workshops held at the site — currently 10 to 15 per year — will almost certainly increase with the recent construction of the conference facility.

IFAS officials also expect to begin holding several academic classes at PSREU each week.

## UF/IFAS Computer Model Aids Fishery Management Policies

Sustainability is a cornerstone of sound fisheries management policies. In Florida, they must provide enough fish for recreational and commercial anglers today while ensuring that fish communities thrive for future generations.

A UF/IFAS interdisciplinary research team has developed a computer-generated modeling tool that examines the many interactions of species in the Gulf of Mexico alongside the economic impacts to commercial and recreational fishing in Florida, which generates $17 billion annually. The model uses data from the Gulf fishing area to generate complex scenarios of how different policies may affect Florida's economy and fish communities, ranging from species with a high dollar value, such as grouper, to sea turtles and birds, which may have no market value but are integral to the ecosystem's health.

The Florida Sea Grant-funded project combines the expertise of researchers representing the departments of Food and Resource Economics, Wildlife Ecology and Conservation, and the School of Forest Resources and Conservation.

Throughout the project, the UF/IFAS team has cooperated with the Florida Fish and Wildlife Conservation Commission. The aim is to show anglers, businesspeople and policymakers how the model can help them explore economic and ecological trade-offs of future management actions.

**RESEARCH TEAM:** Micheal Allen, William Lindberg, Carl Walters, School of Forest Resources and Conservation; Sherry Larkin, Department of Food and Resource Economics; William Pine, Department of Wildlife Ecology and Conservation; Behzad Mahmoudi, Florida Fish and Wildlife Conservation Commission

## Discovering New Possibilities for Sweet Sorghum

UF/IFAS researchers are discovering ways to use sweet sorghum and the waste generated from its processing to help meet societal needs using profitable, environmentally friendly approaches.

Researchers from the departments of Agronomy, Microbiology and Cell Science, Materials Science and Engineering, and Agricultural and Biological Engineering are working to develop improved sweet sorghum cultivars that don't require as much water as traditional varieties for production in Florida. Such production is anticipated to create more jobs in rural communities, sustainable production of plastics and biofuels, and medical advances.

Sugars collected from sweet sorghum's juice and stems can be fermented into the biofuel ethanol. Researchers are discovering ways in which carbon dioxide captured during the fermentation process can be turned into succinic acid, which can replace petroleum in the production of various biodegradable plastics, thus helping to reduce America's reliance on foreign oil.

The research team is also finding ways to use lignin, another waste component resulting from processing sorghum, to generate heat for the fermentation — creating a more energy efficient pathway for the process. Researchers are also looking into an important medical use for lignin: as nanotubes for drug delivery in humans. Flexible plant-based nanotubes are likely more compatible with the body than traditional nanotubes. They can follow the shape of arteries and veins and can be easily modified, offering opportunities for targeted drug delivery.

**RESEARCH TEAM:** Wilfred Vermerris, John Erickson, Department of Agronomy; Lonnie Ingram, Jim Preston, and K.T. Shanmugam, Department of Microbiology and Cell Science; Amelia Dempere, Department of Materials Science and Engineering; Zhaohui Tong, Department of Agricultural and Biological Engineering and Bradley Krohn, Highlands EnviroFuels

## With a $20 Million Federal Grant, PINEMAP Aims to Help Trees Beat the Heat

Florida is known for its oranges, but also grows 5 million acres of planted pine, used for lumber, paper, pulp, bioenergy, and environmental services. To sustain these forests and help mitigate global climate change, a UF-led consortium has obtained a five-year, $20 million USDA grant to develop new management techniques.

The project, called PINEMAP, is part of a federal effort to improve major U.S. cropping systems to sequester more carbon, a component of the greenhouse gas carbon dioxide and a vital part of plant cells. The project will also help growers cope with the effects of climate change — rising temperatures, decreased rainfall and increased disease and pest pressures.

The project involves faculty from UF's School of Forest Resources and Conservation, Soil and Water Science, and Agricultural and Biological Engineering departments, along with other southeastern land-grant universities, industry research cooperatives and government agencies. Collaborators include geneticists, entomologists, economists, climatologists and soil scientists, among others. PINEMAP will involve students in the work, preparing the next generation of forest scientists and educators.

PINEMAP will focus on growers' needs, because its ultimate success hinges on growers adopting its recommendations.

Researchers and extension specialists will seek input and feedback from large and small landowners and will provide workshops, webinars and other programs.

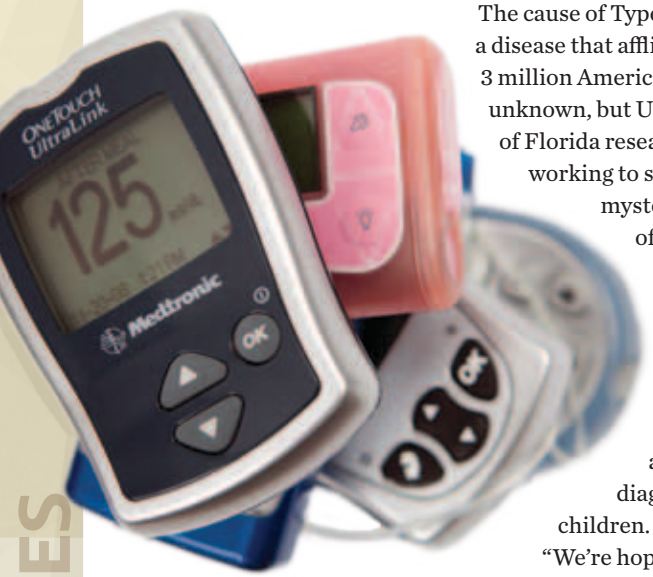
**RESEARCH TEAM:** Damian Adams, Doug Carter, Wendell Cropper, John Davis, Eric Jokela, Tim Martin, Martha Monroe, Gary Peter, School of Forest Resources and Conservation; Sabine Grunwald, Department of Soil and Water Science; Jim Jones, Department of Agricultural and Biological Engineering

## IFAS Research Keeps Lawns — and Consumers' Wallets — Green Year-Round

To help Floridians conserve money and water, UF/IFAS scientists from the departments of Agricultural and Biological Engineering, Agronomy, Environmental Horticulture, and Soil and Water Science are searching for just the right amount of irrigation needed to keep mixed-use landscapes aesthetically pleasing year-round. Most current recommendations are based on the needs of young turfgrass, which requires regular watering — this can lead to over-irrigation, water waste and environmental issues when applied indiscriminately in mixed-use landscapes. Different plants have different water requirements, and in established landscapes, plants need less frequent irrigation as they mature. The experiment examines tree, shrub, and turfgrass quality and growth extending long past the establishment period. Using weather station data and lysimeters — large concrete planters that measure root system water and fertilizer absorption — scientists are determining the amount of water needed for various landscapes based on percentage of grass, trees and shrubs. The experiment has shown that older plants thrive with less frequent irrigation. Mature St. Augustinegrass stayed lush through summer with irrigation only every 10 days. Another promising finding is that the expansive root systems of woody ornamentals may reduce leachate and nutrient loss from the landscape as these plants grow.

**RESEARCH TEAM:** Richard Beeson Jr., Mid-Florida Research and Education Center; Michael Dukes, Department of Agricultural and Biological Engineering; Amy Shober, Gulf Coast Research and Education Center; Thomas Sinclair, Department of Agronomy and Grady Miller, North Carolina State University

# UF Researchers Study Development and Prevention of Type 1 Diabetes




The cause of Type 1 diabetes — a disease that afflicts some 3 million Americans — is unknown, but University of Florida researchers are working to solve the mystery in hopes of someday preventing new cases. Type 1 diabetes affects all ages and is often diagnosed in children.

"We're hoping we can prevent children from getting sick," said Eric Triplett, the IFAS microbiologist leading an interdisciplinary team including researchers from the departments of Microbiology and Cell Science, Statistics, and UF's College of Medicine.

The research team has shown that digestive tract bacteria could be linked to developing Type 1 diabetes. For example, they found healthy children have more bacterial diversity in their digestive tracts than children who later develop the disease.

Coupling DNA sequencing with powerful computer analysis, they've begun learning the functions of the bacteria they've identified. Their data suggests that those who develop Type 1 diabetes lack bacteria that produce substances known to maintain healthy digestive tracts. Knowing the bacterial environment associated with the disease could allow for early identification and treatment.

The researchers have also introduced beneficial bacteria to mice that helped prevent them from developing Type 1 diabetes, and hope to soon attempt this promising experimental treatment in humans.

**RESEARCH TEAM:** Eric Triplett, Joseph Larkin, Claudio Gonzalez, Graciela Lorca, Bryan Kolaczkowski, Department of Microbiology and Cell Science; Mark Atkinson, Desmond Schatz, Josef Neu, UF College of Medicine; George Casella, Department of Statistics

# Farming with Sod-Based Rotation Raises Yields, Reduces Environmental Impacts

UF/IFAS researchers are uncovering profitable approaches to farming that helps maintain ecosystem health while providing high food and fiber yields.

Known as sod-based rotation, the system takes cattle-grazed, perennial grass pastureland and rotates it with row crops such as cotton and peanuts.

The perennial grasses planted on row crop land are key. For crops following grasses, UF researchers have found there is better yield, drought resistance, reduced fertilizer application and runoff and fewer nematodes. Rotating in legumes, such as peanuts, adds nitrogen.

On a 40-acre field of cotton using this system, revenue increased approximately $200-$300 per acre, and nitrogen application was reduced by 140 pounds per acre.

"There were not necessarily a lot of data to verify the system worked until now, even though it was used for many years," said David Wright, one of the research team members and an agronomy professor at UF's North Florida Research and Education Center.

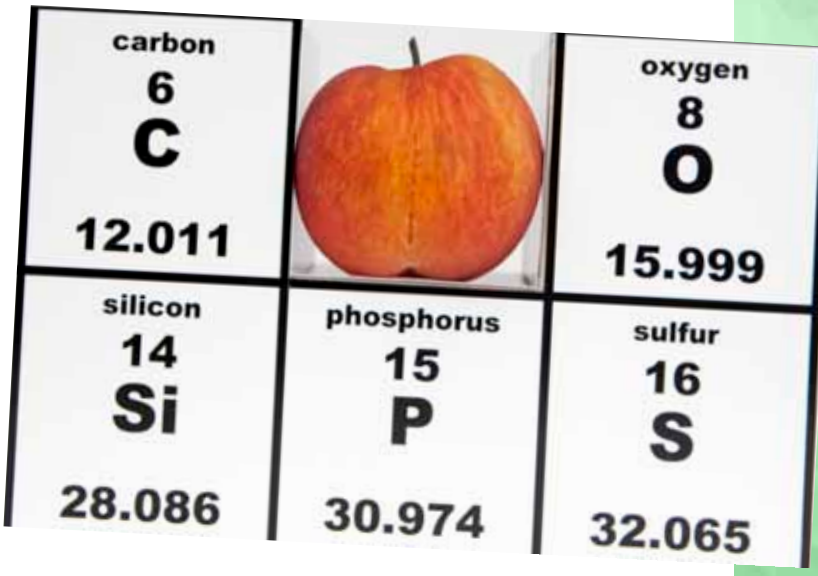
Besides Wright, professors in the departments of Sociology, Plant Pathology and Animal Sciences are part of the interdisciplinary team analyzing the system.

**RESEARCH TEAM:** David Wright, Jim Marois, Cliff Lamb, Nicolas DiLorenzo, North Florida Research and Education Center

# RESOURCE PRODUCTION

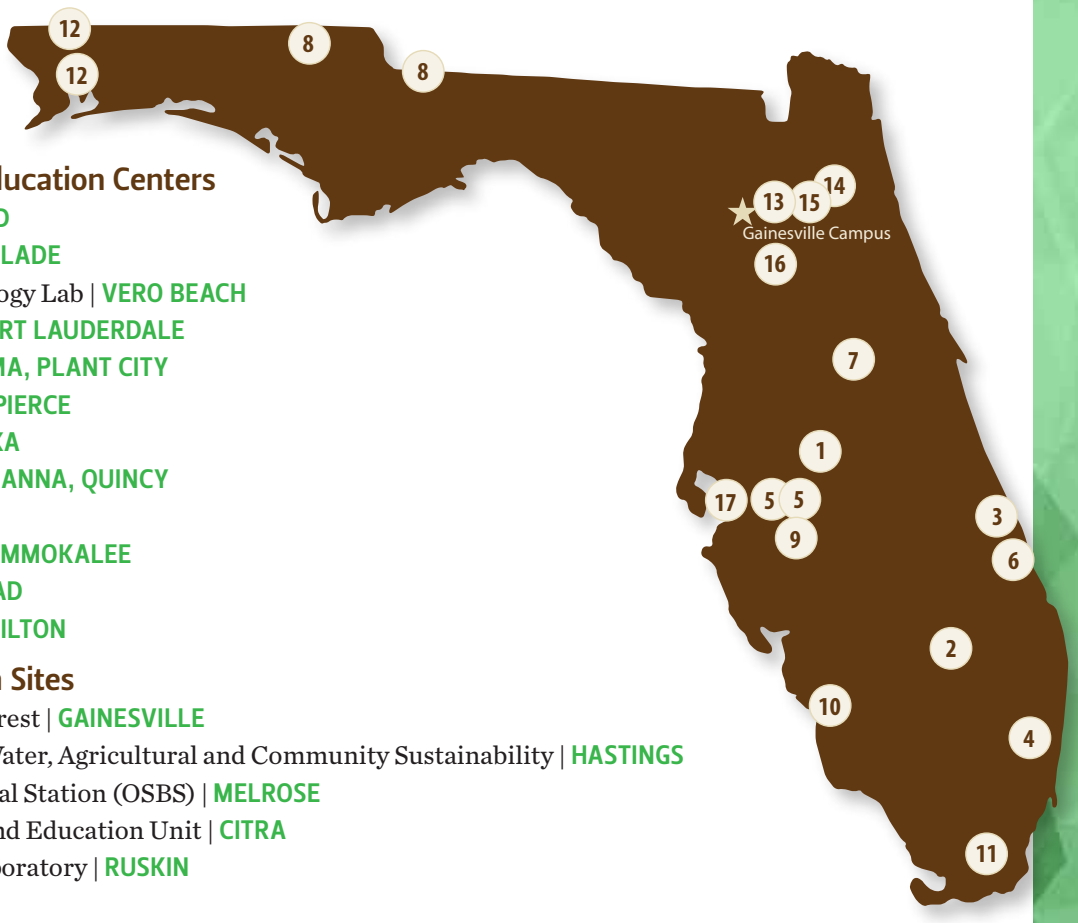
## Creating Best Possible Fruit Key to Florida's Success in Global Peach Industry

UF/IFAS researchers are helping Florida peach growers carve a new niche in the fresh fruit market — and giving Floridians an estimated $5 million annual crop of quality fruit grown closer to home. Florida's warmer climate has led to an earlier peach crop, giving growers an edge in national and global markets, and bringing better prices than later-harvested crops. Researchers with UF's Horticultural Sciences and Soil and Water Science departments, the Florida Department of Agriculture and Consumer Services, and Mississippi State University are working together to examine nitrogen fertilization, irrigation, fertigation, disease control, leaching and frost protection and other factors, hoping to create better-tasting eating and canning fruit that has a longer shelf life and is grown on healthier, longer-living trees. Experimental nitrogen applications range from zero to 240 pounds per acre, and the results will be instrumental as the process is fine-tuned to minimize under- and over-fertilization. UF has bred such peach varieties as UFSun, TropicBeauty and UF1. Their newest and most ambitious variety, UFBest, promises a first full crop in 2014 with larger, sweeter, more durable fruit that could secure Florida's spot in the global peach market.




**RESEARCH TEAM:** Mercy Olmstead, Jose Chaparro, Lincoln Zotarelli, Jeff Brecht, Department of Horticultural Sciences; Tom Obreza, Department of Soil and Water Science; researchers from Mississippi State University

## IFAS Research Facilities




### Off-Campus Research and Education Centers

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

### Research and Demonstration Sites

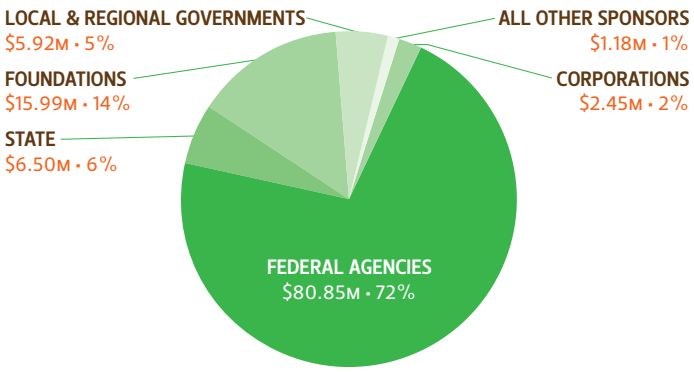
13 Austin Cary Memorial Forest | **GAINESVILLE**
14 Florida Partnership for Water, Agricultural and Community Sustainability | **HASTINGS**
15 Ordway-Swisher Biological Station (OSBS) | **MELROSE**
16 Plant Science Research and Education Unit | **CITRA**
17 Tropical Aquaculture Laboratory | **RUSKIN**

# IFAS Sponsored Research Funding, FY 10-11

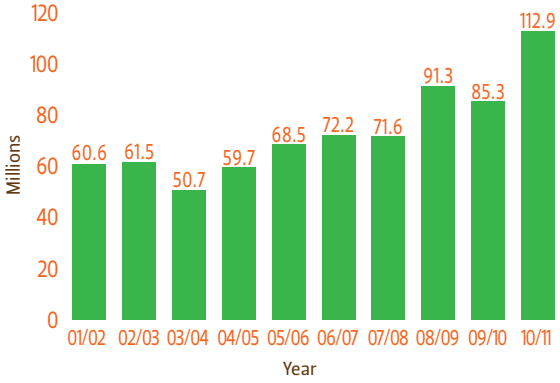
**1,034 AWARDS RECEIVED, TOTALING**

**$112.89M**

## BY SPONSORS



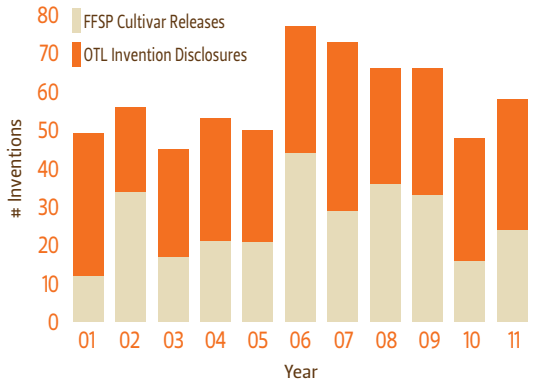

## BY FISCAL YEAR



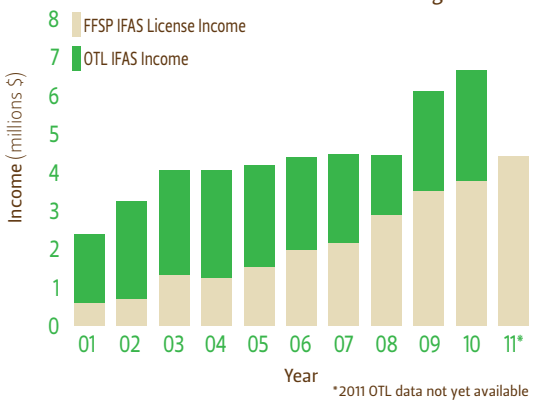

# IFAS Patents and Licenses

## Florida Foundation Seed Producers (FFSP) and Office of Technology Licensing (OTL)

### IFAS Inventions

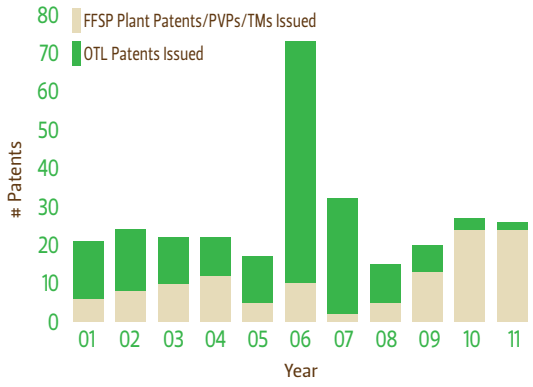



### License Revenues - IFAS Technologies




*2011 OTL data not yet available

### IFAS U. S. Patents Issued




### License Agreements - IFAS Technologies