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# IMPACT<sup>®</sup>

The University of Florida Institute of Food and Agricultural Sciences



 UNIVERSITY OF  
FLORIDA  
Institute of Food and Agricultural Sciences

**UF/IFAS: putting Florida  
FIRST in Agriculture**

# Perspective

By Michael V. Martin



**Mike Martin**

Vice President for Agriculture  
and Natural Resources

Florida FIRST (Focusing IFAS Resources on Solutions for Tomorrow) provides the framework for the University of Florida's Institute of Food and Agricultural Sciences (UF/IFAS) to invest resources in the state's future, thereby strengthening Florida's agricultural and natural resource industries.

Florida agriculture (including forestry and aquaculture) is a powerful but rapidly changing economic sector. With an annual economic impact of nearly \$54 billion, the agricultural and natural resource industries are challenged to maintain competitive market positions. Increased international trade, greater sensitivity to environmental stewardship, growing competition for water and land from urban and non-farm users, rising pressure from pests and diseases, and a shrinking supply of qualified labor are among the complex factors that are fundamentally reshaping agriculture across the state.

Although UF/IFAS programs have been impacted by significant legislative budget reductions, we must do all we can to maintain excellence in providing the agricultural and natural resource industries with public sector research and formal and informal education programs.

This issue of IMPACT provides some insight into how UF/IFAS is serving one of Florida's most powerful economic engines and promoting competitiveness in local, national and global markets. In partnership with Florida's agricultural leaders, UF/IFAS is putting Florida FIRST in agriculture by focusing resources on the most pressing challenges to the state's agricultural competitiveness.



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UF/IFAS is putting Florida FIRST in developing knowledge in agricultural, human and natural resources and the life sciences and making that knowledge accessible to sustain and enhance the quality of human life. Visit the Florida FIRST (Focusing IFAS Resources on Solutions for Tomorrow) Web page at: [floridafirst.ufl.edu](http://floridafirst.ufl.edu)

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### ON THE COVER:

*Kenneth Shuler, left, vegetable agent with UF's Palm Beach County Extension Service, and Madeline Mellinger, president of Glades Crop Care, Inc. in Jupiter, examine squash for silverleaf whiteflies and other pests at a farm in Martin County. For more than 28 years, Mellinger's firm has worked closely with UF's Institute of Food and Agricultural Sciences to solve pest problems in citrus, ornamentals, vegetables, sugarcane and turf. Turn to page 17 for more information on Glades Crop Care. Shuler also is a member of a special UF/IFAS team established to control the tomato yellow leaf curl virus described on page 10.*

*In June 2001, Mellinger served as co-chair of the second Florida FIRST (Focusing IFAS Resources on Solutions for Tomorrow) strategic planning conference in Orlando. Mellinger, who works with student interns from UF's College of Agricultural and Life Sciences, said the college's new Doctor of Plant Medicine program is the first of its kind in the nation. She also has served as a consultant to the U.S. Congress, the U. S. Environmental Protection Agency, the National Academy of Sciences and federal/state extension services. (Photo by Eric Zamora)*



# Florida's \$9 Billion Citrus Powerhouse

**Think of Florida agriculture and citrus immediately comes to mind as the state's most prominent crop. The industry's impressive growth and worldwide reputation for quality products are closely linked to University of Florida teaching, research and extension programs that span decades.**

*By Chuck Woods*

**F**rom the fresh fruit packing houses of early citrus pioneers to today's multibillion-dollar international market for processed juice and fruit, key scientific discoveries and technological achievements by UF's Institute of Food and Agricultural Sciences (UF/IFAS) have been crucial to the industry's development and success.

These achievements range from the development of frozen juice concentrate in the 1940s to major advances in crop improvement, grove management, fertilization, freeze protection, irrigation and pest control – to name just a few.

Decades of work at UF's Citrus Research and Education Center in Lake Alfred, coupled with citrus programs at UF research and education centers in Fort Pierce, Homestead and Immokalee, have helped build the industry into a \$9.13 billion powerhouse. Today, citrus generates more than 89,000 jobs in the state directly or indirectly through grove care, fertilizer sales and marketing.

The citrus industry's broad support for UF research and education programs is reflected in the following remarks from various industry leaders and officials:

Michael Stuart, president of the Florida Fruit and Vegetable Association in Orlando, said, "When it comes to finding solutions to many of the challenges facing Florida growers, IFAS is our 'go-to' organization. Their research and education programs are essential to the future viability of agriculture in this state."

Douglas Bournique, executive vice president of the Indian River Citrus League in Vero Beach, said UF's Indian River Research and Education Center in Fort Pierce has been invaluable to the league's 1,200 members. "The center's new *Indian River Citrus BMP Manual* is a prime example of how UF is helping our growers use proven best management practices on 250,000 acres of citrus," he said. "The manual is helping them lower production costs and reduce their environmental impact on the Indian River lagoon system."

Barney Greene, founder of Greene Groves and Ranch, Ltd. in Vero Beach, said UF research and education programs have "served us well in our business for over 50 years, showing us new ways to get the desired results."

Richard Kinney, executive vice president of Florida Citrus Packers in Lakeland, said the fresh citrus industry relies heavily on cutting-edge research to survive in today's extremely competitive environment. "IFAS helps provide the measure of difference, offering expertise to growers and shippers to increase yields, improve efficiencies and solve problems."

Lisa Rath, executive vice president of the Florida Citrus Processors Association in Winter Haven, said citrus processing research has been central to the development and expansion of Florida citrus products. "It is the foundation on which we have built this industry," she said. "UF's Citrus



*Lisa Rath, left, and Mickey Parish, professor of food microbiology, examine tubes of orange concentrate in a pathogen reduction study at the Citrus Research and Education Center in Lake Alfred. (Photo by Eric Zamora)*

Research and Education Center at Lake Alfred continues to be the quick-response team the industry turns to in times of crisis and immediate need. The industry is indebted to scientists at the center – such as Bob Braddock, Renee Goodrich, Mickey Parish and Russell Rouseff – for their dedication and commitment far beyond the requirements of their positions.”

Bernie Lester, vice president of Alico, Inc. in La Belle, said UF research and extension programs provide valuable assistance to the industry. “Basic and applied research on controlling the Mediterranean fruit fly, alerting growers about the possible spread of the brown citrus aphid and resulting tristeza problems, and using parasites to control leafminer pests are all good examples of how IFAS is helping the industry and consumers,” Lester said. “Other UF research deals with important problems such as nitrate leaching in the soil and genetic engineering to solve the citrus canker problem.”

Bill Barber, vice president and general manager of Lykes Citrus Management Division in Lake Placid, said the firm has groves in Highlands, Indian River and Polk counties. The information that IFAS provides to the citrus industry is

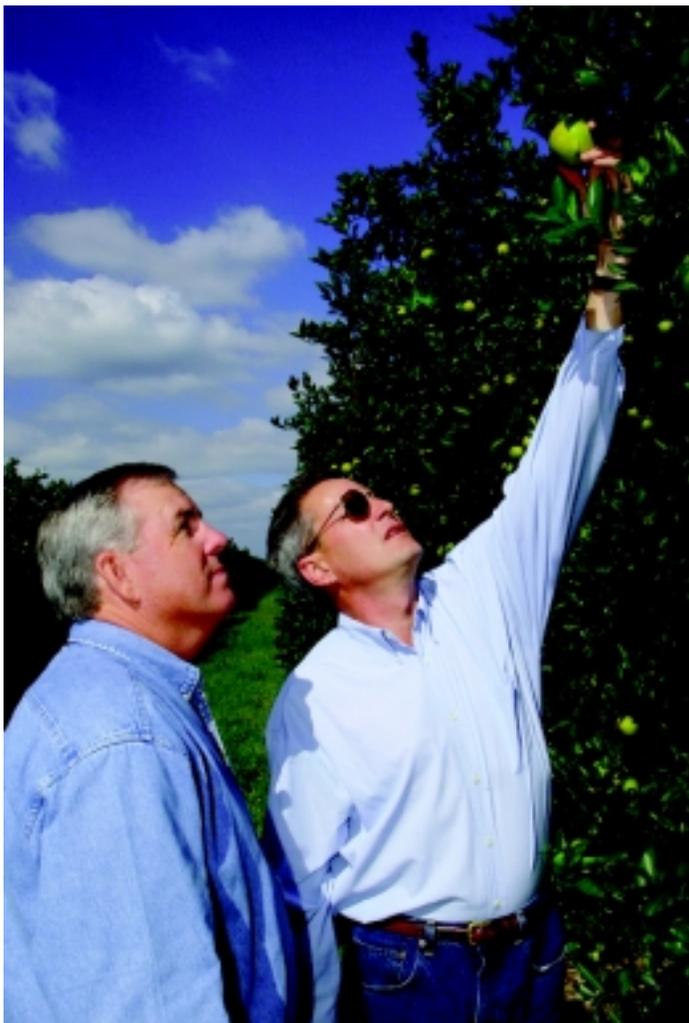
very valuable, he said. As the citrus business becomes more challenging, it is important to have the ability to deal with problems as they arise. Whether the needs are horticultural, environmental or economic in nature, IFAS is the first place producers call for help, he said.

“As we deal with disease problems such as citrus tristeza virus, we have called on IFAS to provide help with long-term decisions,” he said. “Questions such as which variety and rootstock to replant – as well as the economic aspects of deciding whether to remove diseased trees in solid blocks or individual trees within blocks – are answered with the help of IFAS.”

Barber said IFAS also provides critical information on things such as increasing fruit set using foliar sprays. In the current citrus market, a few boxes of extra fruit per acre can mean the difference between success and failure.

“When IFAS teams up with growers, this type of information is timely and needed for the industry to remain competitive,” he said.

Greg Carlton, vice president of Southern Gardens Citrus in Clewiston, said the U.S. Sugar Corporation subsidiary has relied heavily on IFAS expertise since the firm entered the



*Greg Carlton, left, and David Hall examine citrus for the presence of Asian citrus psylla, a new pest that is causing concern among growers. (Photo by Thomas Wright)*

If a new insect pest is known to be making its way toward Florida, IFAS researchers take the offensive, he said. They have made major contributions to understanding the quantitative relationship between pest infestation densities and economic losses – information that’s valuable from a business standpoint.

For example, when the citrus leafminer invaded Florida in the early 1990s, UF initiated a research project with Southern Gardens Citrus and began releasing a tiny parasite imported from Australia by Marjorie Hoy, professor in the Department of Entomology and Nematology in Gainesville. Hoy and the Florida Department of Agriculture and Consumer Services propagated thousands of the parasites and released them at many locations in Florida, including citrus groves in Hendry County.

“The parasite, *Ageniaspis citricola*, is now well-established and provides effective biological control of the leafminer,” Hall said. “In fact, we have made no direct expenditures on leafminer control for several years. We hope that Marjorie Hoy is successful in her efforts to find a similar solution for the Asian citrus psylla, a new pest that is causing substantial injury to young leaves this year.”

Hall said Hoy is tracking another pest, the pink hibiscus mealybug, that is moving through Central America and could threaten Florida’s citrus industry. She also is investigating exotic natural enemies that might be imported and released in Florida to control the pest.

citrus business in 1986. The company now produces 22,000 acres of citrus in Hendry County.

“Our company was one of those jumping into the business following the freezes of the 1980s, and IFAS educated literally hundreds of people in the art of citrus production on the flatwoods of South Florida,” Carlton said. “It’s interesting to look around the industry today and see the managers and leaders who started their careers by attending courses presented by IFAS research and extension faculty.

“At Southern Gardens, our production and research personnel have established relationships over the years with IFAS faculty – solving problems in entomology, plant pathology and many other areas. Today, citrus canker is a major problem, and IFAS is there with advice and leadership.”

When it comes to serious pest problems affecting citrus, David Hall, chief entomologist for Southern Gardens Citrus, said UF “has rescued us” many times.

“Instead of applying pesticides on a routine basis, our company prefers biological control as a management strategy for insect pests because it’s environmentally friendly, inexpensive and relatively permanent,” Hall said. “We appreciate and support IFAS activities in biological control, particularly on insect parasitoids. We always look to UF for new ideas, recommendations and strategies.”

*Marjorie Hoy examines a citrus tree attacked by an invasive insect called the Asian citrus psylla. Hoy, who also serves on a National Academy of Sciences Committee on Biological Threats to Agriculture, Plants and Animals, said U.S. agriculture may be vulnerable to bioterrorists who use destructive insects, bacteria and viruses to disrupt the food supply. (Photo by Thomas Wright)*



The citrus rust mite is another example of how UF is helping the citrus industry, Hall said. While the mite continues to be an important citrus pest, research by Clayton McCoy, professor of entomology at the Lake Alfred center, has helped the industry understand when and how to manage infestations of the mite.

Hall also commended McCoy and Jorge Pena, professor of entomology at the Tropical Research and Education Center in Homestead, for their integrated pest management (IPM) work on the Diaprepes citrus root weevil (*Diaprepes abbreviatus*). The destructive pest has invaded more than 100,000 acres of Florida citrus and causes more than \$70 million in damage annually.

McCoy has developed new genetically selected microbial agents to control the weevil. He said the biopesticides represent a major step forward in the development of environmentally compatible components for IPM systems in citrus.

“These biorational agents use microbes such as fungi and nematodes – instead of chemical pesticides – to kill damaging pests,” he said. “The larvae or grub stage of the weevil feeds on the roots of citrus trees, opening wounds that are frequently invaded by Phytophthora, a soilborne pathogen also capable of killing the tree outright.”

In his search for soil pathogens that kill the citrus root weevil grub, McCoy found three fungi that are highly virulent to weevils and stable in Florida soils. He also developed biopesticides that use nematodes to control root weevil grubs. Working with Larry Duncan, professor of nematology at the Lake Alfred center, McCoy field-tested two nematodes that appear to be effective against all stages of the root weevil grubs.

Meanwhile, Pena has initiated a successful biological control program aimed at the eggs of Diaprepes. Since biocontrol of Diaprepes eggs already exists in Puerto Rico, Guadeloupe and other Caribbean areas, Pena’s first goal was to introduce biocontrol agents from the islands to determine if they would become established in Florida. Three egg parasitoids were introduced from the Caribbean region, placed under quarantine conditions and released in Florida. The parasitic wasps deposit their eggs into Diaprepes weevil eggs, thereby preventing the weevils from emerging.

Working with the Florida Department of Agriculture and Consumer Services and various industry organizations, Pena has released more than 363,000 wasps of the species *C. etiennei* since 1998, more than 160,000 *Q. haitiensis* since 1999 and more than 50,000 *A. vaquitarum* since 1999. Wasps were released throughout Florida citrus groves, ornamental plantings and undisturbed areas. Since their introduction, the wasps have begun to parasitize 35 to 100 percent of Diaprepes weevil eggs in various plantings.



*Catherine Mannion, left, assistant professor of entomology, and Jorge Pena record data on parasites of the Diaprepes citrus root weevil in a laboratory at the Tropical Research and Education Center in Homestead. (Photo by Thomas Wright)*





# Major Accomplishments

**Harold Browning, left, director of the Citrus Research and Education Center (CREC) in Lake Alfred, highlights some of the major accomplishments of UF/IFAS programs over the decades. During the past decade, much of this work has been enhanced by a special industry research fund that contributes more than \$1 million per year to UF/IFAS and USDA programs.**

## Frozen Juice Concentrate

In the 1940s, breakthrough work on frozen concentrate at CREC in conjunction with the Florida Citrus Commission (now the Florida Department of Citrus or FDOC) and the U.S. Department of Agriculture (USDA) spawned a whole industry and made orange juice available worldwide.

## Tree Nutrition

In the early 1900s, little was known about plant nutrition. IFAS scientists determined that citrus trees need several minor elements, including copper, zinc, manganese and iron. They also developed the first agricultural use of chelated iron as a fertilizer. These advances in plant nutrition led to more efficient fertilizer use and substantial increases in fruit production.

## Yellow Spot

Yellow spot, a widespread problem in the first half of the 20th century, caused citrus trees to lose leaves and eventually die. In the 1950s, IFAS researchers found it was due to a deficiency of the mineral molybdenum, and that it could be corrected by application of sodium molybdenum.

## Mechanical Hedging

Citrus tree pruning studies led to the first mechanical hedging machine, built at CREC in the 1950s. Now, mechanical hedging is a standard practice in Florida groves. Research on production practices has enabled growers to manage and maintain the high-density plantings common in Florida groves today.

## “Spreading Decline”

In the 1950s and 1960s, some growers lost up to 70 percent of their crops because of “spreading decline.” IFAS researchers discovered the cause of the malady was the burrowing nematode and developed a pest control program that many believe saved the industry.

## Greasy Spot

In the 1960s, IFAS scientists discovered that a fungus, *Mycosphaerella citri*, was the cause of a disease called greasy spot. Further work led to an understanding of the life cycle of the fungus and the development of control measures. The use of oil sprays for pest control was developed by IFAS scientists in the 1960s. Today, oil sprays are an important component of integrated pest management (IPM) programs for scales, aphids and other insects and diseases.

## Juice Processing

IFAS and FDOC scientists and engineers have worked with the citrus industry on improvements in juice processing technology, orange and grapefruit juice quality and flavor, food

safety, as well as studies on the nutritional benefits of citrus and citrus byproducts. For the past 50 years, researchers have presented updates at the Citrus Processor’s Day, an annual conference held at CREC.

## Alternaria Brown Spot

In 1973, Alternaria brown spot disease appeared on Dancy tangerines in Florida, causing substantial yield losses. IFAS scientists identified the cause of the disease as the fungus, *Alternaria citri*, and by 1976, recommendations for control of this disease were published.

## Irrigation

Studies initiated in the 1950s demonstrated that proper irrigation could increase yields. Research on water conservation led to the development of microsprinkler systems, considered to be the most economical and efficient systems today.

## Freeze Protection

Early methods to protect citrus trees and fruit from freezing weather used heaters or wind machines. In the 1980s, IFAS researchers demonstrated that microsprinkler irrigation was effective for freeze protection. Today, it’s the most common freeze protection system in Florida.

## Fresh Fruit Packing

IFAS and FDOC researchers continue to work closely with Florida’s fresh fruit industry, making advancements in fungicides and decay control, degreening, storage, handling, packaging and packinghouse technology. IFAS researchers produce the *Packinghouse Newsletter* and host the annual Packinghouse Day, a meeting where scientists and industry personnel share information about the latest developments in fresh fruit packing.

## Citrus Diseases

Research by IFAS has made substantial progress in controlling several diseases of importance in Florida and around the world. Demonstration of the graft transmission of citrus blight established the role of pathogens, and discovery of proteins in infected trees provided additional tools to study important tree-killing diseases. Progress on citrus tristeza virus has been noteworthy in terms of providing management strategies, as well as contributing to the study of virology. Proof that citrus variegated chlorosis, an exotic disease of citrus, was caused by *Xylella* bacteria also can be attributed to IFAS.

## Diaprepes Root Weevil

IFAS scientists are developing IPM programs to control the *Diaprepes* citrus root weevil.

### **New Varieties**

Researchers with IFAS are developing new and improved citrus varieties with traits such as disease resistance and superior flavor. Scientists at CREC have made breakthroughs in techniques to produce novel citrus hybrids and regenerate seedlings in tissue culture. These techniques hold promise for making further improvements in citrus varieties. Using conventional plant breeding methods and new molecular techniques, IFAS plant improvement scientists are addressing challenging citrus problems and working to keep the Florida citrus industry competitive in the future.

### **Environmentally Safe Production**

IFAS scientists work on ways to minimize the leaching of herbicides, fertilizers and other chemicals through the soil into groundwater and develop environmentally safe production practices.

### **Citrus Tristeza Virus**

In an effort to develop effective disease management strategies, scientists are working to understand the molecular genetics of the citrus tristeza virus, the cause of some of the worst diseases in citrus. Working with other laboratories, a team of scientists has decoded the sequence of the virus' genetic material and established a genetic system for studying the virus.

### **Precision Agriculture**

IFAS scientists are adapting satellite and computer technology to help growers manage citrus groves. Called precision agriculture, the approach involves the use of Global Positioning System (GPS) satellites, computers and other technologies to assist growers with the detection of disease and pest problems, soil deficiencies and other aspects of grove management. In addition, precision systems using computer data are being developed for best management practices (BMPs) in citrus.

### **Harvesting**

Since the late 1950s, the Florida citrus industry has been concerned about getting crops harvested at a reasonable cost. IFAS, FDOC and USDA engineers have designed, tested and evaluated many mechanical harvesting concepts to assist field workers. The work is helping alleviate harvesting problems related to labor availability and cost. Some mechanical harvesting systems being used today for processed oranges can lower harvesting costs by 20 to 40 percent.

### **Spray Technology**

Applying foliar pesticides effectively and economically has been a major concern for the Florida citrus industry. In the

1950s and 1960s, IFAS engineers and entomologists evaluated many airblast sprayers for manufacturers and the industry. Since the mid-1980s, IFAS scientists have developed field data relating pesticide coverage to sprayer type, nozzle arrangement, ground speed, volume rate and pest control. The information helps the industry improve spray coverage and reduces application costs and drift.

### **Grove Design and Tree Size Management**

After the severe 1962 freeze, growers began planting trees closer together to get earlier returns on their investment. For trees on more vigorous rootstocks, low yields often resulted from the closer spacings after the trees had reached containment size. After the mid-1970s, IFAS scientists conducted field experiments on tree row management strategies that showed the relative merits of hedgerows, cross-hedging and tree thinning. They also conducted long-range field experiments with tree densities ranging from 150 to 360 trees per acre. They found that higher densities resulted in greater yields per acre early on, but the rate of return after 10 years was very similar for all densities. They also demonstrated that good yields could be maintained on 12- to 14-foot trees budded on a moderately vigorous rootstock and headed out at 24 inches high.

### **Reclaimed Water**

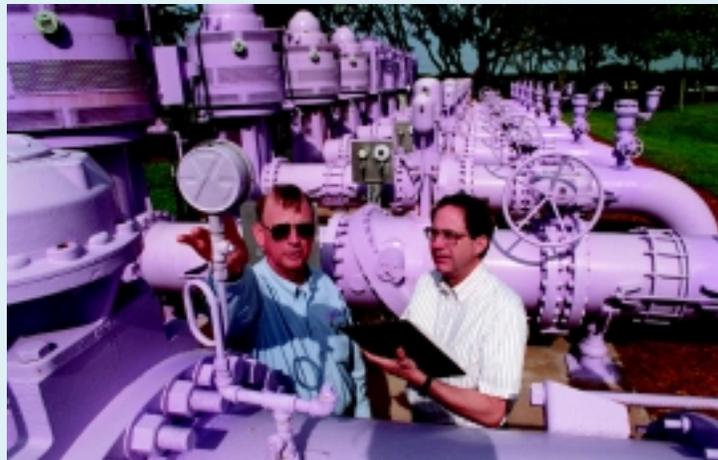
IFAS scientists are demonstrating how reclaimed water (highly treated wastewater) can be used for irrigation on both ridge and flatwoods citrus groves. IFAS research and extension faculty have been an integral part of the success of Water Conserv II, the largest reclaimed water agricultural irrigation project of its type in the world. Located west of Orlando, the Water Conserv II project currently irrigates more than 4,000 acres of citrus, the Orange County National Golf Center and several nurseries. IFAS research has shown that

reclaimed water can be safely and effectively used at very high application rates in citrus groves.

### **Food Safety**

Increased federal and state emphasis on food safety is resulting in significant changes in how juices are manufactured. Federally mandated HACCP (Hazard Analysis Critical Control Point) inspection programs are improving the safety and quality of juices, and IFAS is providing substantial national leadership to the HACCP program and industry safety. The effort is improving the understanding of spoilage and microbes in citrus products, and assisting in the development and implementation of practices to reduce food safety risks.

Harold Browning, hwbrowning@mail.ifas.ufl.edu



*Phil Cross, left, senior project manager at Water Conserv II, and Larry Parsons, professor of horticulture at the Citrus Research and Education Center, record data on reclaimed water at the distribution center west of Orlando in Orange County. (Photo by Eric Zamora)*



# Award-Winning Rapid Response Team

**Growers and industry officials say vigilance and rapid response by UF's Institute of Food and Agricultural Sciences to a destructive tomato virus are saving the state's \$400 million tomato crop from ruin.**

*By Chuck Woods*

**W**hen a new virus that could ruin the state's 50,000-acre tomato industry was discovered in 1997, a team of University of Florida research and extension faculty moved quickly to prevent the virus from becoming a major threat to Florida agriculture.

Tomato yellow leaf curl virus, or TYLCV, which prevents plants from producing marketable tomatoes, was first discovered in Charlotte, Collier, Miami-Dade and Sarasota counties, but it's now a statewide problem, said Jane Polston, associate professor of plant pathology at UF's Gulf Coast Research and Education Center (REC) in Bradenton.

"Spread rapidly and efficiently by whiteflies, the virus causes limited tomato production in other areas of the world wherever it becomes established," Polston said. "It also infects weeds and other crops such as green beans and ornamentals."

Key symptoms of the virus include severely stunted plants with deformed leaves showing yellow leaf margins. Leaves are reduced in size and may be cupped. Infected plants have a bushy appearance, but they lose vigor, drop flowers prematurely and have little or no fruit set.

*Joe Mobley, left, and Jane Polston check plants for the tomato yellow leaf curl virus. "I can't say enough good things about the UF team and how they have helped us deal with whiteflies and the viruses they spread," Mobley said. (Photo by Eric Zamora)*



First identified in Israel in 1959, the virus spread to Mediterranean and Caribbean countries. In 1992, it destroyed 90 percent of the tomato crop in the Dominican Republic. Polston said the virus probably entered the United States on infected plants, or it may have been carried by whiteflies from the Caribbean.

Polston, who discovered the virus on small tomato plants being sold to consumers at retail nursery stores, immediately recognized the potential impact of the virus on the state's tomato production and transplant industries and moved quickly to organize a rapid response to the threat.

Five days after the virus was discovered in Florida, the UF Extension Service notified all tomato growers in the state about the problem. To deal with various aspects of the problem, an 11-member team was established by UF's

Institute of Food and Agricultural Sciences to work closely with growers, as well as the Florida Department of Agriculture and Consumer Services and the U.S. Department of Agriculture. The UF team includes faculty in entomology, plant pathology and horticultural sciences.

“Members of the team quickly assessed the prevalence of the virus in tomato transplants sold in the retail trade and in commercial production fields and worked with state regulatory officials to stop the movement of the virus within and out of the state,” she said.

And they developed an ongoing research and extension education program to identify and control the whitefly vector, understand the epidemiology of the virus, minimize its spread and keep growers informed of the latest information on virus management. These actions were completed within two months of the first identification of the virus in Florida.

In addition to Polston, members of the team include: Phyllis Gilreath, Manatee County extension agent, Bradenton; Ernest Hiebert, professor, Department of Plant Pathology, Gainesville; Mary Lamberts, Miami-Dade County extension agent (vegetables), Homestead; Gene McAvoy, Hendry County extension agent, La Belle; Robert McGovern, associate professor of plant pathology, Gulf Coast REC, Bradenton; David Schuster, professor of entomology, Gulf Coast REC, Bradenton; John Scott, professor of horticulture, Gulf Coast REC, Bradenton; Kenneth Shuler, Palm Beach County extension agent (vegetables), West Palm Beach; Philip Stansly, professor of entomology, Southwest Florida REC, Immokalee; and Suzanne Stapleton, Suwannee County extension agent (marketing), Live Oak.

Glenn Dickman, owner of Artesian Farms in Ruskin, said the state’s tomato industry would have been devastated without UF’s prompt response to the problem.

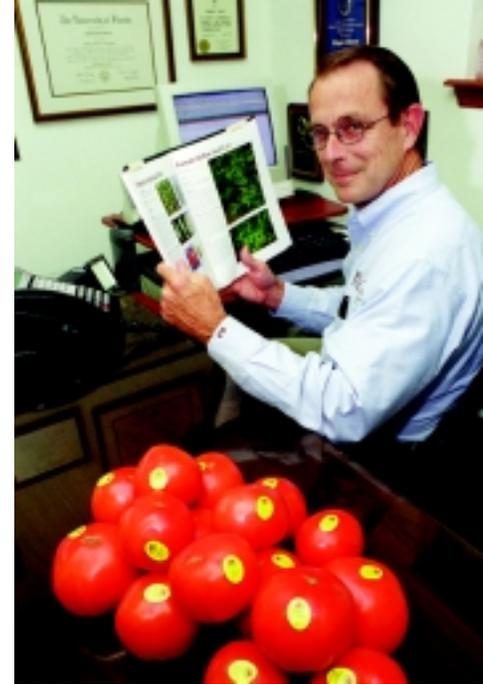
“Without UF’s quick and vigilant action, the virus had the potential to cause great losses in tomato production throughout Florida and make transplants produced in Florida unmarketable outside the state,” he said. “Without their help, the state’s transplant industry would have faced economic boycott from the other states that import Florida-grown vegetable and ornamental transplants.”

Dickman also said the absence of effective management strategies would have led tomato growers to apply excessive amounts of insecticides and herbicides in their efforts to reduce the virus in their fields.

“I can’t say enough good things about the UF team and how they have helped us deal with whiteflies and the viruses they spread,” said Joe Mobley, operations manager for Artesian Farms.

“Like many growers, we simply did not understand the disease and how it is spread by whiteflies, but the team – particularly David Schuster and Phil Stansly – has helped us minimize our losses by bringing the whitefly under control with pesticides,” Mobley said. “UF has been very helpful in our cultural practices, which include everything from selecting the right plastic mulch to cleaning up nearby fields

*Reggie Brown said rapid response to the TYLCV problem is another example of UF’s valuable research and extension programs. (Photo by Eric Zamora)*



that harbor whitefly populations and using so-called trap crops to control this pest,” he said.

Reggie Brown, manager of the Florida Tomato Committee in Orlando, said rapid identification and response to the TYLCV problem is another example of UF’s valuable research and extension programs.

“The quality of the extension agents working with the tomato industry is superb,” he said. “They are in the field interacting with the producers on a daily basis and provide that early warning system that is essential to combating new pests. A strong focus on solving ‘real problems in real time’ with good communication throughout the system gets results.”

Polston said other recent accomplishments of the team include the development of new tomato breeding lines by Scott and Schuster that are resistant to TYLCV as well as a less troublesome virus, tomato mottle virus.

In 1998, Polston and Hiebert initiated a research project to identify genes from the virus that could be inserted into the tomato and used to provide resistance to TYLCV. They have found at least one that makes the tomato plants immune to TYLCV.

“We are very pleased with the results, since this is the only known source of immunity to TYLCV,” said Hiebert. “Our goal now is to get this gene into commercial hybrids.”

In addition, four TYLCV-resistant cultivars that became available in 2000 from two seed companies were screened for horticultural performance and virus resistance at three Florida locations: Bradenton, Homestead and West Palm Beach. The tests were conducted by Gilreath, Polston, Shuler, McAvoy and Stansly.

The UF group received the IFAS Research and Extension Team Award at the Florida Associations of Extension Professionals conference in West Palm Beach Sept. 13, 2001.

Jane Polston, jep@mail.ifas.ufl.edu



*Craig Chandler rinses a batch of Sweet Charlie strawberries for visitors participating in a taste test. Sweet Charlie has been the most commercially successful variety developed at the Gulf Coast Research and Education Center in Dover. (Photo by Liz Zamora)*

# Strawberry Fields Forever

**New varieties and production methods developed by UF's Institute of Food and Agricultural Sciences have contributed to the success of Florida's \$167 million strawberry industry. With more than 6,000 acres in production, primarily in the West Central Florida area, the state is now the nation's primary source of winter strawberries.**

*By Paul Kimpel*

With names such as Sweet Charlie, Rosa Linda and Earlibrite, strawberry varieties developed by UF's Institute of Food and Agricultural Sciences have all the qualities Florida growers need in today's competitive markets.

But finding the right combination for success isn't easy. For example, Sweet Charlie, the most commercially successful variety developed by scientists at UF's Gulf Coast Research and Education Center (REC) in Dover, was seedling No. 4,925 out of a total of 10,000 evaluated during the 1985-86 season.

"That's a lot of seedlings to sort through," said Craig Chandler, associate professor of horticultural sciences and director of the center's strawberry breeding program. "Each year, we review thousands of strawberry offspring and select anywhere from 50 to 300 plants to propagate for the next season."

According to Chandler, the right qualities include a superior sugar-to-acid ratio, early flowering ability and strong disease resistance. After a potentially successful variety

is identified, a rigorous testing process is implemented. Commercial farmers grow the selected variety for several years under various conditions, and IFAS scientists continue testing it for as long as 10 years. If it becomes a "named variety" and UF obtains a patent, it then becomes available to all growers through licensed nurseries.

Due to Florida's weather, the state produces strawberries earlier than any other state in the nation, which is part of the reason IFAS develops varieties that bloom early, he said.

"We get the best prices for our crops that are harvested in November and December," Chandler said. "After that, California and other states start selling strawberries and prices drop."

In addition to developing new varieties and solving problems associated with strawberry pests and diseases, IFAS scientists do other things to help the strawberry industry.

Highlights of current research include the introduction of a biological control system for the two-spotted spider mite, development of a system to produce certified, disease-free strawberry transplants, and critical evaluations of the cooling efficiency of aftermarket packaging containers.

Ronnie Young, co-owner of BBI Produce, Inc. in Dover, said IFAS has helped his business in so many ways, he doesn't know how he could begin to calculate the value.

"Our company has earned a substantial amount of money thanks to the Sweet Charlie variety," Young said. "We also get a lot of help from IFAS on the use of fungicides, drip irrigation, insect control, growing techniques – you name it."

He hopes IFAS researchers can provide a viable alternative to methyl bromide, an effective soil fumigant being phased out by 2005 due to environmental concerns about its impact on the Earth's protective ozone layer. The chemical controls destructive nematodes, fungi and weeds.

In response to industry concerns about the loss of the material, UF researchers are seeking effective alternatives for methyl bromide. Jim Gilreath, associate professor of horticultural sciences at the Gulf Coast REC in Bradenton, and Joe Noling, professor of entomology and nematology at the Citrus REC in Lake Alfred, are testing alternatives. Noling said the best replacement available is a chemical "cocktail" that includes Telone®, chloropicrin and an herbicide such as Devrinol®.

"The combination is producing yields that are close to those seen with methyl bromide," Noling said. "However, unless certain restrictions to the buffer zone are resolved, it may not be a practical solution."

The buffer zone is the area around strawberry fields where chemical treatments cannot be used. In Florida, label restrictions on chemicals prohibit the application of Telone® within 300 feet of an occupied dwelling, and the labels have created a problem for growers.

But Noling said he hopes Florida will follow the lead of California, which has reduced its buffer zone requirements from 300 feet to 100 feet, allowing for chemicals such as Telone® to be used in agriculture.

In addition to chemical solutions, Noling and Gilreath are testing non-chemical and biocontrols for pests such as root-knot nematodes, but he said no effective alternatives have been found yet.

While the methyl bromide problem remains to be solved, Young said the industry is grateful to UF for convincing the U.S. Department of Agriculture to allow strawberry farmers to apply Captan® fungicide up to 24 times per growing season.

*Joe Noling, left, Ronnie Young and Jim Gilreath examine nutsedge weeds treated with Telone® C-35, a possible alternative to methyl bromide, which will be banned in 2005 due to environmental concerns.  
(Photo by Eric Zamora)*



He said IFAS demonstrated that Captan® did not leave an unreasonable level of residue when used eight times per crop. In Florida, plants typically produce three crops per season, which requires 24 applications per season.

In other work that has helped the industry, Dan Legard, associate professor of plant pathology at UF's Dover center, demonstrated the importance of proper timing for pesticide sprays during flowering and growth times.

Legard said he is developing and evaluating controls for Botrytis fruit rot, the single most devastating disease of strawberries. Controls being evaluated include cultural, genetic and chemical strategies.

Al Herndon, general manager of Ferris Farms in Floral City, said Legard and other UF researchers provide information on questions such as the proper timing of pesticide sprays. "For strawberry farmers, the secret to success is spraying only when you have to."

Herndon said he appreciates the objectivity of IFAS scientists when it comes to recommendations.

"Unlike some folks in the chemical industry, they don't have anything to gain by recommending a particular fungicide or number of applications," Herndon said. "If there is a problem, IFAS will tell you what it is and what to do about it. You get unbiased information, and that's valuable."

To support strawberry research at UF's Dover facility, Chip Hinton, executive director of the Florida Strawberry Growers Association in Plant City, helped obtain funding from the Florida Legislature.

Hinton said it's important that strawberry producers and other commodity groups in Florida support teaching, research and extension programs at land-grant universities such as UF.

Craig Chandler, ckc@gnv.ifas.ufl.edu  
Chip Hinton, chinton@tampabay.rr.com

A photograph of two men, Doyle Hicks and Lee Goode, standing in a greenhouse. They are surrounded by rows of green plants, likely Dieffenbachia 'Camille'. The man on the left is wearing a white polo shirt and the man on the right is wearing a blue polo shirt. The greenhouse structure is visible in the background.

Doyle Hicks, left, a grower at AgriStarts II in Apopka, and Lee Goode, owner of the firm, check *Dieffenbachia* 'Camille' in the greenhouse. "Our firm enjoys a very good relationship with UF's Institute of Food and Agricultural Sciences, and we participate in the annual Agricultural and Natural Resources Career Day at the College of Agricultural and Life Sciences in Gainesville," Goode said. "We have learned many things from UF research and extension faculty that can be immediately applied to our growing programs, especially in the areas of disease and pest control." Hicks completed his bachelor's degree in environmental horticulture at the UF college in 2000. (Photo by Eric Zamora)

# ***Award-Winning Crop Management Program***

**Now the fastest growing segment of Florida agriculture, the state's \$1.4 billion ornamental plant production industry is adopting new environmentally friendly crop management strategies developed by UF's Institute of Food and Agricultural Sciences.**

*Liz Felter, left, Lance Osborne and Doyle Hicks examine ferns for the presence of scale insects at AgriStarts II, a tissue culture production facility in Apopka. (Photo by Eric Zamora)*



*By Chuck Woods*

In the relentless pursuit of perfection, Florida's ornamental plant industry depends on pesticides to control pests and diseases, but a new University of Florida crop management program is reducing the use of chemicals without compromising the aesthetic quality of crops.

"Consumer demands for picture-perfect plants pushed the industry toward pesticide use in the 1990s," said Lance Osborne, professor of entomology at UF's Mid-Florida Research and Education Center (REC) in Apopka. "However, new economic, environmental and regulatory realities are driving the switch to biological control of pests as well as other environmentally friendly practices."

He said these realities include stronger regulation of water use, increased monitoring of groundwater quality, loss of effective chemicals for pest management, and greater concern about pesticide application procedures and worker protection standards. At the same time, producers must compete in markets that often support a low price structure for finished crops.

"Another major consideration was the 1996 Food Quality Protection Act, which established the goal of having 75 percent of all crop acreage in the United States under integrated pest management (IPM) by the year 2000," Osborne said.

He said mealybugs, mites and thrips are the most troublesome pests for industry, and the loss of widely used pesticides (Pentac<sup>®</sup>, Temik<sup>®</sup> and Vydate<sup>®</sup>) have left growers with major gaps in their chemical control programs.

"Loss of these chemicals forced the industry to use less-effective chemicals, thereby allowing pests to develop resistance to the available materials," he said. "We also have seen the elevation of minor pests such as aphids, scales and mealybugs to major pest status."

Moreover, once the Food Quality Protection Act is fully implemented, other effective organophosphate and carbamate pesticides may be removed from the market.

And, while the use of biological controls can be a viable alternative in certain situations, less than 10 percent of

producers surveyed in the mid-1990s used natural predators to control mites and other pests.

"All of these factors prompted UF's Institute of Food and Agricultural Sciences to launch an integrated crop management program in cooperation with the ornamental industry," said Osborne, who co-chairs a 13-member team working on the problem.

Liz Felter, Orange County extension agent who co-chairs the team with Osborne, said growers have reduced their use of pesticides up to 60 percent by monitoring or "scouting" crops for pests before applying chemicals on a routine basis. Growers have begun using biological controls in place of routine pesticide applications. Predator mites and beneficial nematodes and parasitic wasps now are being used throughout the ornamental industry to control aphids, fungus gnats, mealybugs, mites and thrips on crops.

George Butler III, vice president of Butler's Foliage, Inc. in Miami, said UF has been "very responsive and helpful" over the years in helping the industry deal with a variety of ornamental pests and other production problems.

He said their goal is to move away from pesticides as much as possible, relying on natural biocontrols to achieve more effective pest control on their 48-acre foliage operation that produces interior plants such as aglaonema, spathiphyllum and palms.

"The best thing about integrated pest management and biocontrol is that we don't have those explosive pest outbreaks that can cause so much damage so quickly," Butler said. "By continuously scouting our crops, we can see how effective the natural predators are in keeping pests under control."

"In fact, biocontrol actually can be more effective than pesticides because the tiny predators get into the crevices on plants that chemicals may not reach. Another advantage of biocontrol is that we don't have to worry about the safety of workers when they re-enter a greenhouse," Butler said.

Wolfgang Engelmann, president and chief operating officer of Hermann Engelmann Greenhouses, Inc. in

Apopka, said his firm has worked with UF for more than 20 years to develop efficient pest management programs. UF helped train them to grow their own predatory mites, and the company recently hired a scout trained at the university.

“Our indoor foliage products, which include more than 200 varieties, enter the market pest-free thanks to a combination of tactics,” he said. “We grow our own predatory mites to manage two-spotted spider mites during specific phases of the production cycle. And, based on scouting reports, we integrate pesticides into our pest control program.

“With the loss of so many important pesticides, it has taken a significant amount of effort to maintain the level of quality we demand,” he said. “With the help of UF, we have an excellent pest control program that we’re proud of.”

Tony Costa, president Costa Nursery Farms in Goulds, said UF research and education programs are of “immeasurable value” to both growers and consumers. “UF’s contributions such as new varieties, more efficient production methods and biological pest controls help us remain productive in today’s competitive marketplace,” he said.

International shipments of ornamental plants into Florida are a source of exotic pests for the state and nation. Through its research and extension programs, the UF team is helping the Florida nursery industry respond to new or imminent biological threats.

Osborne also established PEST-UP, a Web site and listserv that acts as an early warning system about insect pests and diseases. He said the site fosters better communication for everyone concerned with emerging pest problems. Established in 2000, the Web site and listserv have proven their value. “As a result of one posting on the Web site about the detection of the banana mealybug on aglaonema, growers throughout the state were able to eradicate the pest before it was shipped,” Osborne said. “To date, the pest has not been detected again.”

Thanks to UF extension educational programs, growers are trained to recognize routine problems. In fact, growers now understand “normal” production problems so well that it’s easy for them to detect new or unusual problems, Osborne said.

“The PEST-UP Web site and listserv give producers time to react to problems before they become a significant economic threat. This approach coincides with the recommendations of the National Invasive Species Council, which advocates early detection and rapid response,” he said.

*Tony Costa, left, and George Butler III examine bean leaves used to raise predator mites at Costa Nursery Farms. (Photo by Eric Zamora)*

In addition to Felter and Osborne, other members of the integrated crop management extension team include: Tom Fasulo, assistant in the Department of Entomology and Nematology, Gainesville; Alan Hodges, coordinator of economic analysis, Department of Food and Resource Economics, Gainesville; Catharine Mannion, assistant professor of entomology, Tropical REC, Homestead; Frank Melton, Manatee County extension agent (ornamental horticulture), Bradenton; Bob McMillan, professor of plant pathology, Tropical REC, Homestead; Russ Mizell, professor of entomology, North Florida REC, Monticello; Tim Momol, assistant professor of plant pathology, North Florida REC, Quincy; Norm Nesheim, professor and pesticide information coordinator, Department of Food Science and Human Nutrition, Gainesville; Jeff Norcini, associate professor of environmental horticulture, Monticello; Jim Price, associate professor of entomology, Gulf Coast REC, Bradenton; and Bill Schall, Palm Beach County extension agent (horticulture), West Palm Beach.

The group received the IFAS Interdisciplinary Extension Team Award at the Florida Associations of Extension Professionals meeting in West Palm Beach in September 2001. The UF extension scouting workshops, which trained hundreds of scouts in Florida and Georgia, received the Search for Excellence Award in Horticulture from the National Association of County Agricultural Agents in 2000.

To help the ornamental industry stay abreast of changes in pest control strategies, the UF Extension Service has provided a statewide pest management update program for the past four years. New publications, *The Commercial Ornamental Scouting Manual* and *Commercial Foliage and Woody Ornamental Arthropod Pest Management*, are available from the extension service. Listservs on biological control and pest alert information also are maintained. Other entomology information can be found at the following Web site: [www.mrec.ifas.ufl.edu/lso/](http://www.mrec.ifas.ufl.edu/lso/).

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# Research & Education Partnership

Since 1972, scientists at Glades Crop Care, Inc. have worked closely with faculty at UF's Institute of Food and Agricultural Sciences to develop and promote a sustainable systems approach to crop health management.

Madeline Mellinger, president and founder of the independent consulting firm in Jupiter, Fla., said the sustainable systems approach includes integrated pest management (IPM), pest monitoring or "scouting" and pest control for citrus, ornamentals, sugarcane, vegetables and turf.

She said the firm was the first scouting/consulting firm in the nation serving fresh market producers, with about 60,000 acres under contract.

"We have a long history of working with research and extension faculty at UF, and we cannot begin to calculate the benefits of research performed by IFAS during this period," Mellinger said. "In many cases, we help implement research findings from UF, particularly in the areas of insect and disease management.

"Our firm provides a science-based service that is independent of any commercial product sales, and we rely on UF for accurate, reliable information to help solve various industry production problems."

She and her husband, Charles Mellinger, a plant pathologist who serves as the firm's technical director, offered four recent examples of how UF research and education programs are helping their company and producers around the state.

First, she said the tomato yellow leaf curl virus problem, described in the story on page 10, is a prime example of how UF research and extension faculty are helping producers.

Another example is Glades Crop Care's cooperative effort with UF to control the pepper weevil, the most destructive insect pest on peppers in South Florida. She said the firm is working with Dave Schuster, professor of entomology at the Gulf Coast Research and Education Center in Bradenton, who has released parasitic wasps to control the weevils in five South Florida locations. She said the biocontrol program, which relies on wasps to attack the larvae of pepper weevils, has resulted in a decrease of the pest.

The third example is the firm's work with UF to control bacterial leaf spot on tomatoes and peppers. She said Glades Crop Care is working with Jeffrey Jones, professor of plant pathology in Gainesville, who is using a bacteriophage, a virus that attacks the causal bacterium, to control the bacterial leaf spot diseases.

And, finally, she said they also rely heavily on diagnostic activity. "In most cases, we can identify routine disease problems in the fields, but there are some problems – such as



*Kenneth Shuler, left, vegetable agent with UF's Palm Beach County Extension Service, and Madeline Mellinger examine tomato plants for pests at a farm in Martin County. (Photo by Eric Zamora)*

late blight – that require expert identification and verification so we can determine if they will affect tomatoes or potatoes. That's where UF's Extension Plant Disease Clinic in Gainesville really makes a difference in our operation."

Diseased plant samples are forwarded to the clinic in UF's Department of Plant Pathology where they are analyzed by Richard Cullen, senior biological scientist, and Mark Gooch, biological scientist, said Carol Stiles, assistant professor and interim director of the clinic.

"We carry out a range of conventional and specialized tests, and we work with numerous specialists in IFAS to diagnose disease problems on different crops and make control recommendations," she said.

Stiles said the clinic staff helps train students in plant pathology and UF's new Doctor of Plant Medicine interdisciplinary program.

Mellinger said Glades Crop Care also diagnoses plant diseases in cooperation with other UF plant pathologists, including Bob McMillan, professor at the Tropical Research and Education Center in Homestead; Tim Momol, assistant professor at the North Florida Research and Education Center in Quincy; Pam Roberts, assistant professor at the Southwest Florida Research and Education Center in Immokalee; and Pete Weingartner, associate professor at the Hastings Research and Education Center. – *Chuck Woods*

Madeline Mellinger, [mmellinger@igc.org](mailto:mmellinger@igc.org)

# Fastest Growing & Second Largest

**Environmental horticulture – which includes landscape plants, flowers, foliage and turfgrass – is now the fastest growing segment of U.S. agriculture, and Florida is ranked as the second largest production state in the nation. The industry’s success in Florida can be attributed to many factors, including the statewide teaching, research and extension programs of UF’s Institute of Food and Agricultural Sciences.**

*By Chuck Woods*

**D**escribed as a small business industry with a big business economic impact, Florida’s nursery and landscape industry is now the nation’s second largest.

“The industry’s strong backbone is characterized by small family-run businesses that have a combined \$5.4 billion impact on the state’s economy,” said Ben Bolusky, executive vice president of the Florida Nurserymen and Growers Association in Orlando. “Perhaps more than any other segment of Florida agriculture, the wholesale, retail and landscape sectors enhance the environment and the aesthetic quality of life.”

While many factors have contributed to the segment’s rapid growth, Bolusky said FNGA cannot overemphasize the “genuine partnership” between UF’s Institute of Food

and Agricultural Sciences and the state’s nursery and landscape industry.

“It’s no accident that UF’s Department of Environmental Horticulture is recognized as one of the nation’s leading programs,” he said. “UF faculty in Gainesville and off-campus research and education centers have played an important role in propelling Florida into the nation’s second largest nursery crop production state.

“UF’s willingness to work and stand shoulder to shoulder with our industry – helping solve problems with cutting-edge technology and hands-on research – is a hallmark of the partnership we enjoy. It’s a true marriage,” Bolusky said. “Terril Nell, chair of UF’s environmental horticulture department, and his faculty and staff all deserve special recognition for their many contributions to the industry.”

As a prime example of the university’s effective research and education programs, Bolusky pointed to the first annual Great Southern Tree Conference sponsored by FNGA and UF.

The conference, held at the end of November 2001, was devoted entirely to tree selection, landscape, production, establishment, marketing and management issues in the southern United States. An outdoor demonstration area provided more than 300 participants with a hands-on opportunity to see new techniques and products.

“No other educational conference takes concepts from the classroom and implements them at a demonstration site,” Bolusky said. “Those attending the conference got an up-close look at the newest industry growing, planting and handling approaches.”

He said a new *BMP Guide for Producing Container-Grown Plants*, developed by Tom Yeager, professor in the department, provides details on best management practices to protect the environment. The guide is the official interim





*Ben Bolusky, left, and Terril Nell examine the quality of a magnolia blossom during the Great Southern Tree Conference at UF in November 2001. (Photo by Eric Zamora)*

BMP document for FNGA, the Florida Department of Environmental Protection and the Florida Department of Agriculture and Consumer Services. It's published by the Southern Nurserymen's Association in Marietta, Ga.

To demonstrate the use of BMPs in a commercial nursery, UF is working closely with Dick Holloway, owner of Holloway Tree Farm in Leesburg. His farm produces crepe myrtles, ligustrums, live oaks, magnolias and other types of trees in 30- to 100-gallon containers.

"UF faculty have been very helpful to us over many years, and one aspect of their current BMP program demonstrates the benefits of using an ebb flow or flood irrigation system in container plant production," Holloway said. "The system, which captures rainwater in basins for reuse, could boost plant growth by as much as 30 percent. Other advantages include reduced nutrient runoff, water use, fertilizer use and incidence of disease."

Dorota Haman, professor in UF's Department of Agricultural and Biological Engineering, is working on the demonstration project at Holloway Tree Farm. She said plants are placed on an impermeable surface in a basin that is periodically flooded for irrigation.

"Excess water is returned to a retention pond, and runoff water from rainfall also is collected in the pond for future irrigation needs," she said. "As a result, all dissolved nutrients are retained in the pond, eliminating groundwater pollution due to deep percolation and minimizing surface water pollution due to runoff."

Other UF faculty working on the demonstration project include Bob Stamps, professor at the Mid-Florida Research and Education Center in Apopka, Richard Beeson, associate professor at the center, and Yeager.

### **Award-Winning Series**

Another example of an effective educational program is the Florida/Georgia Green Industry Update Series. Presented by UF and the University of Georgia, the annual series informs nursery and landscape professionals on issues such as production management, best management practices and new strategies for insect and disease control.

"Since its inception in 1993, the updates have helped our employees expand their knowledge in many areas, including new plant materials and industry trends," said Don Covan, operations management for Simpson Nurseries in Monticello, Fla. "The update series is a perfect example of what can be accomplished when two universities pool their resources for the benefit of the green industries in Florida and Georgia."

The series, which draws hundreds of participants from the region, was organized by Gary Knox, professor of environmental horticulture at UF's North Florida Research and Education Center in Monticello, and Melvin Garber, professor at UGA's Rural Development Center in Tifton, Ga. They were co-recipients of the Commercial Horticulture Working Group's Distinguished Achievement Award from



*Bob Stamps, left, Dick Holloway and Dorota Haman check the operation of an ebb flow or flood irrigation system at Holloway Tree Farm in Leesburg. Holloway said the system, which captures rainwater in basins for reuse, could boost plant growth by as much as 30 percent. (Photo by Eric Zamora)*

the American Society for Horticultural Sciences at its recent national meeting in Sacramento, Calif.

### **Methyl Bromide Alternatives**

**T**he looming 2005 federal ban on the use of methyl bromide soil fumigant will have a widespread effect on agriculture across the nation, said Bryan Unruh, assistant professor at UF's West Florida Research and Education Center in Jay, who is searching for effective substitutes.

He said the Environmental Protection Agency ban is being imposed because the fumigant contributes to the destruction of the Earth's protective ozone layer, which absorbs harmful ultraviolet radiation and helps reduce global warming.

For more than 60 years, the soil fumigant has been used on tomatoes, peppers and strawberries to control diseases and nematodes. The fumigant also has been an essential tool for sod producers who must certify bermudagrass and other turf as being free of disease and cross-contamination from other types of grass.

In an effort to eliminate legal skirmishes, many state sod and seed certification agencies now require fumigation and inspection of sod fields before growers receive the "certified" label.

"The impact of the ban on agriculture, particularly the turfgrass industry, stands to be huge," said Wiley McCall, owner of Emerald Island Turf in Punta Gorda, Fla. "In the absence of a viable, cost-effective substitute for methyl bromide, state sod certification programs essentially will be null and void, leaving turfgrass managers in quandary."

McCall, who is working with UF to develop a broad range of integrated pest management strategies on turf, said Unruh is the only turfgrass scientist in the world who is

*Bryan Unruh, left, and Wiley McCall examine seashore paspalum, a new species of turfgrass that is highly salt tolerant and well suited to Florida's coastal environment. (Photo by Thomas Wright)*



*Ole Nissen examines gerbera daisies at his 70-acre cut-flower farm in Martin County. (Photo by Eric Zamora)*

conducting extensive evaluations on methyl bromide alternatives. He said Unruh also played a key role in convincing federal policy-makers that the original 2001 ban on methyl bromide would not allow researchers enough time to develop alternatives.

### Flower Power

When it comes to improving the quality and longevity of flowers, both domestic and imported, UF is one of two land-grant universities in the nation with active research and education programs for these high-value crops. The University of California, Davis, is the only other land-grant university working on post-harvest problems in the flower industry.

In Florida, one of the state's largest producers attributes their continued success in today's competitive marketplace to UF research and education programs, particularly those at the Gulf Coast Research and Education Center in Bradenton.

Ole Nissen, president of Sunshine State Carnations, Inc. in Hobe Sound, said UF faculty at Bradenton and Gainesville have helped solve a number of problems that threatened production at his 70-acre cut-flower farm in Martin County. Nissen, who also serves on the research and education center's advisory committee, produces delphinium, gerbera daisies, larkspur, lilies, lisianthus and snapdragons at Hobe Sound and Palm City.

"Time after time, UF has been very helpful in our business," Nissen said. "For example, when a destructive crown and stem rot caused by the fungus *Fusarium avenaceum* became a serious problem on cut-flower and pot-flower lisianthus production, researchers at UF's Bradenton center moved quickly to solve the problem."

He said Florida cut-flower producers experienced losses in the 30- to 70-percent range during the 1995-99 growing seasons. However, UF researchers solved the problem by 1999.

"As a result, outbreaks of fusarium crown and stem rot have been sporadic and generally of minor importance since then," Nissen said.

Bob McGovern, associate professor of plant pathology, and Brent Harbaugh, professor of environmental horticulture at the center, found that outbreaks of the disease



were linked to infected transplants, and they worked closely with production facilities in California to remedy the problem. Their research was supported by FNGA, American Floral Endowment and the Fred C. Gloeckner Foundation.

"Our research indicated the fungus had poor survivability in Florida soils and did not appear to be seed-borne, but it did persist for a number of months on plastic and styrofoam transplant trays, and it appeared to be transmitted by fungus gnats," McGovern said. "We developed an integrated strategy for transplant growers to manage crown and stem rot, which includes routine use of effective fungicides, sanitation and fungus gnat control."

Growers also rely on UF for the latest information and technology in postharvest handling of cut flowers.

Larry Howkins and Jim Teper, partners who own Continental Farms in Miami, import 60 to 70 different types of flowers from Colombia, Costa Rica, Ecuador, Mexico and Peru. Howkins said UF continues to provide the industry with valuable postharvest expertise, including information on preservative solutions, temperature and humidity issues, pest and disease identification as well as packing design.

"We are committed to delivering the highest quality flowers possible to our customers for the benefit of the consumer," Howkins said. "Over the years, when we have had difficult postharvest problems, UF has been an excellent source of accurate and independent technical information that has helped us prolong the shelf life and enhance the presentation of our flowers."

"We are extremely grateful to everyone in UF's environmental horticulture program for the help they have extended to us," Howkins said. "They are a terrific asset not only to us but to all levels of the floral community."

Terril Nell, [tnell@mail.ifas.ufl.edu](mailto:tnell@mail.ifas.ufl.edu)

# A + in Agronomy

**Row crops and forages cover almost a third of Florida's total land area, generating about \$1.5 billion in farm income. Industry producers give high marks to UF's Institute of Food and Agricultural Sciences for research and education programs that have made this important segment of Florida agriculture economically viable in today's competitive markets.**

*By Tom Nordlie*

**B**ecause of the wide range of crops and growing conditions throughout the state, agronomic producers may face more challenges than any other segment of Florida agriculture.

This segment includes everything from sugarcane in South Florida to corn, cotton, hay, peanuts, small grains, soybeans and tobacco in North Florida, as well as range and pasturelands throughout the state. Row crops generated about \$960 million in 2000 while forages, the backbone of the state's \$1.38 billion livestock industry, contributed another \$500 million.

"Florida farmers and ranchers face unique challenges, which means we must deliver unique solutions," said Jerry Bennett, chair of UF's Department of Agronomy in Gainesville. "Industry leaders say their success – particularly now during difficult economic conditions – is built on the

statewide teaching, research and extension programs of UF's Institute of Food and Agricultural Sciences."

## **Sugarcane Selection**

**I**n 2000, Florida produced 445,000 acres of sugarcane, with an estimated value of about \$750 million. To provide the industry with improved cultivars, UF is an integral part of the U.S. Department of Agriculture's breeding program in Canal Point near Lake Okeechobee.

"This program has a worldwide impact," said Rob Gilbert, assistant professor of agronomy at UF's Everglades Research and Education Center (REC) in Belle Glade. "We develop cultivars specifically for Florida, Louisiana and Texas, and provide free germplasm to developing nations to improve their economies."

Half the program effort focuses on Florida, said Jimmy Miller, USDA research leader at Canal Point. In 2000,

*Modesto Ulloa, left, Jimmy Miller and Rob Gilbert examine a sugarcane stalk at UF's Everglades Research and Education Center in Belle Glade. (Photo by Milt Putnam)*



*Dan Gorbet, right, and Jeff Crawford check the new C-99R peanut cultivar at UF's North Florida Research and Education Center in Marianna. (Photo by Eric Zamora)*



cultivars developed at the facility occupied 75 percent of Florida sugarcane acreage, accounting for \$562.5 million in farm income.

Field testing in the Everglades Agricultural Area is vital to Florida's sugar industry, said Modesto Ulloa, director of farm operations for Florida Crystals in Palm Beach County.

"Our area has unique environmental conditions, so it's critical that new varieties be developed for those conditions," he said. "We've had more disease pressure in the last two decades than in the previous recorded history of sugarcane production, but the Canal Point program has risen to the challenge."

### **Peanut Progress**

**I**n 2000, Florida produced almost 214 million pounds of peanuts on 86,000 acres, accounting for \$53.6 million. Dan Gorbet, professor of agronomy and head of UF's peanut breeding program, said the publicly funded effort is especially important to producers and consumers. From 1970 to 1994, UF peanut cultivars meant \$2.7 billion to growers alone.

"Our Florunner cultivar was the most successful peanut in U.S. history," said Gorbet at UF's North Florida REC in Marianna. "Released in 1969 by Al Norden, it covered as much as 98 percent of Southeastern peanut acreage in the 1970s and 80s."

Southern Runner, released in 1986, was the first U.S. peanut cultivar resistant to tomato spotted wilt virus (TSWV), and the new C-99R cultivar offers the best TSWV resistance yet, Gorbet said. To provide human health benefits and greater shelf life, Gorbet developed the SunOleic 95R and 97R cultivars in the mid-90s, the first peanuts with the health benefits of high-oleic oil chemistry, for which UF has three utility patents.

Jeff Crawford, executive director of the Florida Peanut Producers Association in Marianna, said the UF program remains crucial to peanut farmers throughout the Southeast.

"For 10 years TSWV has devastated our industry, and the C-99R will help Florida growers get back in the game," he said. "We're also very excited about Dan Gorbet's efforts to combine TSWV resistance with high-oleic oil chemistry."

### **Management Methods**

**T**o help peanut farmers battle weeds, UF and other universities developed HERB-Peanut, an interactive computer decision program that recommends weed control measures, said Barry Brecke, professor and associate director of UF's West Florida REC in Jay.

He said Joyce Tredaway Ducar, assistant professor of agronomy in Gainesville, is training extension agents to use HERB-Peanut. "By applying the right herbicide, producers

save money, boost yields and protect the environment," Brecke said.

Brecke said the program could save peanut farmers up to \$20 per acre by reducing herbicide inputs and improving weed control.

Another "win-win" management practice is conservation tillage, using crop residue to enrich soil and prevent erosion. Florida farmers practice conservation tillage on 164,000 acres, including 75 percent of the state's 130,000 acres of cotton, said David Wright, professor of agronomy at UF's North Florida REC in Quincy. Conservation tillage can save cotton farmers up to \$70 per acre.

Mark Peacock, a cotton farmer in Altha with about 2,600 acres in production, said conservation tillage saves valuable time. "I can prepare my fields in winter when there's less to do, and the crop residue holds moisture in the soil," he said. "When we're ready to plant in April, I don't have to wait for rain. Conservation tillage also reduces tractor use, which saves money in equipment costs."

Conservation tillage is often coupled with multiple cropping, the practice of using fields more than once a year, said Raymond Gallaher, professor of agronomy in Gainesville.



*Carrol Chambliss, left, and Lee Albritton discuss fall planting of Cherokee red clover at Albritton's farm in Alachua. (Photo by Thomas Wright)*

“Multiple cropping is especially important to the cattle industry,” he said. “By growing different forages at different times of the year, we have reduced feed costs dramatically.”

### **Forage Frontiers**

Florida's 1.8 million beef and dairy cattle and calves rely on economical forage, said Findlay Pate, professor and director of UF's Range Cattle REC in Ona. In 2000, Florida milk accounted for \$384 million, and Florida beef, \$371 million.

Warm-weather forages such as star, paspalum and bermudagrass are grown on more than 50 percent of commercial cattle ranches and nearly 100 percent of dairy farms in Central and South Florida. Paul Mislevy and Rob Kalmbacher, professors at the Ona center, have released several varieties.

Mislevy developed a system to establish these grasses from cuttings rather than seed, reducing establishment time from 11 months to 60 days or less. To encourage faster rooting, he modified a sprigging machine that pushes one end of the cutting into the soil. Both the system and the machine are now used worldwide.

“The Florida dairy industry owes a lot to Paul Mislevy,” said Jerry Dakin, president of Jerry Dakin Dairy in Parrish. “I've doubled my forage yield by using his grasses and management programs.”

Mislevy and Kalmbacher often conduct their research at local ranches. “Every ranch has unique growing conditions and management practices,” Kalmbacher said. “So we test our ideas in real-world situations, with cooperation from producers.”

Deseret Cattle and Citrus, Florida's largest cattle ranch, has participated in UF/IFAS research for decades, said Ferren Squires, general manager of the

300,000-acre operation in Brevard, Orange and Osceola counties.

“Forage is our base of production, so we're always looking for better ways to do things,” Squires said. “Deseret has been involved in so many projects it's impossible to single one out as being most important. Let's just say UF research has played a big role in our success. And if we have a question or problem, the experts at Ona are always ready to help.”

One problem Ona researchers are addressing is mole cricket damage to bahiagrass, the state's most important cattle forage. With damage totaling \$55 million annually, Martin Adjei, assistant professor of agronomy, is perfecting application methods for a parasitic nematode that kills the cricket.

Perhaps the biggest challenge facing UF agronomists is closing the winter “forage gap” when warm-weather forages become dormant and producers must use hay or feed, said Carrol Chambliss, associate professor of agronomy in Gainesville.

“We're getting there,” said Chambliss, who helps educate cattle producers through UF's Extension Forage and Pasture Management School. “Cool-season grasses and legumes are a great help, especially in North Florida.”

*Rob Kalmbacher, left, and Ferren Squires inspect Floralta limpograss for insect damage at Deseret Cattle and Citrus in Deer Park. Covering 300,000 acres in Brevard, Orange and Osceola counties, Deseret is Florida's largest cattle ranch and has participated in UF forage research for decades. (Photo by Milt Putnam)*



Each winter, Florida cattle producers cultivate 300,000 acres of annual ryegrass, much of it bred by Gordon Prine, professor of agronomy in Gainesville.

Prine's biggest success is the Surrey cultivar, said Tom Stadskev, manager of Florida Foundation Seed Producers in Greenwood, which handles production and distribution of seed for UF forage and row crop cultivars. "Surrey was released in 1989 and remains extremely popular in the U.S. Southeast, Europe and Australia," he said. "Worldwide, producers use more than one million pounds of Surrey seed each year."

Red clover, a legume forage popular from Tennessee to Wisconsin, was once considered unsuitable for Florida's climate. In 1992, Ken Quesenberry, professor of agronomy in Gainesville, changed attitudes with the Cherokee cultivar, now grown on more than 20,000 acres in the U.S. Southeast. Quesenberry said each year Cherokee provides forage worth \$4.6 million as hay, and adds \$570,000 in nitrogen to Florida's soil.

Since 1995, Alachua County beekeeper and rancher Lee Albritton has grazed 45 to 60 head of cattle on Cherokee in late spring. "I wanted a grazing system that didn't require supplemental feed, and Cherokee works great for the dry period in April and May," he said. "Even though I'm a small producer, Ken Quesenberry and Carrol Chambliss are always available to assist me or offer advice."

### Small Grains Success

By introducing wheat, oats and rye to Florida, Ron Barnett, professor and head of UF's small-grains breeding program, has provided important new winter forages. Barnett, based at the North Florida REC in Quincy, said oats are the state's dominant small-grains forage, and UF's Chapman and Horizon 314 cultivars are the most widely grown varieties. North Florida farmers also use rye to graze or "background" South Florida calves during winter months, and UF's Wrens 96 variety has done well in those programs.

And UF hasn't forgotten grain production. In cooperation with the University of Georgia, UF has released six wheat varieties since 1993, including the new AGS 2000 variety, of which 250,000 bushels of seed were sold in 2001, Barnett said. "It's good for milling, has excellent disease resistance and has dominated yield trials from Arkansas to the Carolinas."

One of the wheat varieties that gave rise to AGS 2000 was Florida 302, grown on up to 3 million acres per year in the U.S. Southeast in the late 1980s and early 90s. Glen Barber, co-owner of B & B Seeds in Marianna, credits Florida 302 with launching his business.

"Florida 302 paid for everything we have," said Barber, who raises 300 to 600 acres of wheat. "Since then, we've probably averaged 15 percent greater yield by using Ron Barnett's cultivars and following his management advice. Without IFAS, we wouldn't be in business."

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## UF/IFAS Stakeholders are Putting Florida FIRST Through Private Gifts

Agriculture and natural resources are not only the most stable components of Florida's economy, they are the state's most basic industries. Agriculture's strength and \$54 billion contribution to the Florida economy are second only to tourism, which experienced a downturn following the tragic events in New York and Washington, D.C., Sept. 11, 2001.

Helping ensure the continuing strength and stability of Florida agriculture and natural resources are the statewide teaching, research and extension programs of the University of Florida's Institute of Food and Agricultural Sciences.

The value of these programs is reflected in the industry's generous support of IFAS in UF's recently concluded capital campaign – *It's Performance That Counts*.

Melda Bassett, above photo, assistant vice president for IFAS/SHARE Development (Special Help for Agricultural Research and Education), worked closely with the University of Florida Foundation, Inc. to develop a strategy for fulfilling the UF/IFAS capital campaign goal of \$54,125,000. The five-year campaign closed Dec. 31, 2000 with a total of \$64,358, 283 – 119 percent of its goal.

Mike Martin, UF vice president for agriculture and natural resources, said Bassett played an important role in the highly successful campaign.

"Melda's leadership and commitment were critical to helping UF/IFAS develop and maintain support for the highest possible level of research and education programs for the benefit of all stakeholders throughout the state and nation," he said. "The results of the campaign will make an extraordinary difference for many years into the future.

"The gifts and pledges of all of our donors will make possible new programs, scholarships and facilities for putting Florida FIRST: Focusing IFAS Resources on Solutions for Tomorrow. As we look to the future, we cannot be content with our present achievements. Through SHARE, UF/IFAS stakeholders can continue to play an ongoing role in helping Florida's food, agricultural and natural resource systems remain globally competitive, environmentally friendly and responsive to changing consumer needs and preferences," Martin said. – *Chuck Woods (Photo by Tara Piasio)*

Melda Bassett, [mlba@mail.ifas.ufl.edu](mailto:mlba@mail.ifas.ufl.edu)

# Living Large:

## Florida's Livestock Industry Tops \$1.3 Billion

Florida livestock production generates more than \$1.3 billion in farm income annually. In 2000, the dairy industry contributed \$384 million to the total; beef cattle added \$371 million and poultry produced \$336 million. UF's Institute of Food and Agricultural Sciences is providing the livestock industry with new technologies to remain competitive in national markets at a time of rapid economic change.

By Tom Nordlie

**B**uilding on a successful animal science program that has revolutionized Florida's livestock industries, UF's Institute of Food and Agricultural Sciences recently surveyed producers to find out "where we go from here."

"Producers indicated – overwhelmingly – that our research and education programs have been largely responsible for the remarkable gains the industry has made during the past 50 years, and they also told us what our future research priorities should be," said Glen Hembry, chair of UF's Department of Animal Sciences.

The survey was part of UF's Florida FIRST (Focusing IFAS Resources on Solutions for Tomorrow) strategic planning effort.

Hembry pointed out that the UF/IFAS commitment to superior livestock production extends beyond his department. Many faculty in UF's College of Veterinary Medicine have IFAS

appointments and work closely with animal sciences faculty on a variety of teaching, research and extension programs.

Eleanor Green, chair of the college's Department of Large Animal Clinical Sciences, said proper animal health care is crucial to the success of any livestock operation.

"Much of UF's veterinary program is geared toward improving the production of commodities," Green said. "We have a positive impact largely because of cooperative efforts by the College of Veterinary Medicine and the Department of Animal Sciences, along with other UF units and industry producers."

### Dairy Cattle

**I**n 2000, Florida's 240 dairies produced 2.46 billion pounds of milk from 157,000 cows. To simplify waste management, many dairies have concrete flooring, which may result in cattle lameness. Lameness and other foot disorders cost producers \$15 million to \$20 million annually, said Jan Shearer, professor of veterinary medicine.

"In the early 1990s, lameness reached crisis proportions in

*Tim Olsen, left, and Chad Chase, Jr. check a slick-haired Holstein calf at USDA's agricultural research station in Brooksville. Research shows that cattle with slick hair are heat tolerant. The gene for slick hair comes from Senepol cattle and may help Holstein dairy cattle be more productive in hot climates. (Photo by Milt Putnam)*



*Jan Shearer, right, discusses proper cattle hoof care with John Gilliland, upper left, and Anderson Virgilio Dos Santos, a Brazilian student, at McArthur Farms in Okeechobee. Shearer helped develop the Master Hoof Care Technician Program, which helps prevent lameness and other cattle foot disorders. (Photo by Thomas Wright)*



Florida,” he said. “As a result, we initiated the nation’s first Master Hoof Care Technician Program to help dairy farm employees detect and treat hoof problems in the earliest stages.”

The four-day training program is followed by independent study and a hands-on final exam. Taught in English and Spanish, the program has trained 300 participants from 38 states and 14 foreign countries, Shearer said.

By using employees to treat hoof problems, dairies can keep production schedules running smoothly, said John Gilliland, dairy operations manager at McArthur Farms in Okeechobee, which operates four farms at a total of 8,000 cows.

“Professional hoof trimmers usually come around every six months, and with so many cows to manage, we had to stop everything else until the trimming was done,” Gilliland said. “By having a full-time employee at each farm trained in hoof care, we can handle trimming on an as-needed basis without breaking from our normal schedule.”

Florida’s dairy cattle are virtually all Holsteins, a Dutch breed unaccustomed to hot, humid weather, said David Bray, animal sciences extension agent. Proper cooling practices can increase Holstein milk production by 20 percent in summer months.

“Ten years ago, Florida milk production was about 13,000 pounds per cow per year,” Bray said. “Today it’s about 18,000 pounds, and cooling methods developed at UF have helped.”

Options include cooling ponds, sprinklers, misters, fans and air conditioning, he said. To help producers cope with water restrictions, Bray and Ray Bucklin, professor in UF’s Department of Agricultural and Biological Engineering, designed sprinkler systems that reduced water use from 130 gallons per cow per day to 30 gallons.

When Alliance Dairies in Trenton needed cooling for its new free-stall barns, Bray helped managing partner Ron St. John develop a sprinkler system and appropriate management methods.

“We wanted a simple, efficient system and that’s what we got,” St. John said. “David Bray helped us choose the type of sprinkler heads we needed, and determine where to put them and how to use them. From May to October, we

average six to eight pounds more milk per cow per day than we did previously.”

When it comes to withstanding heat, some cattle have a built-in advantage, said Tim Olson, associate professor of animal sciences. He’s studying a gene that causes breeds such as the Senepol to have a lower body temperature, resulting in greater heat tolerance.

“It’s called the ‘slick-hair gene,’ because it’s associated with a sleek, short-haired coat,” Olson said. “We’d like to bring this gene to Holsteins, to improve summer milk production and pregnancy rates in Florida dairy cattle.”

Olson, along with U.S. Department of Agriculture researchers Chad Chase, Jr., Sam Coleman and Rick Brenneman in Brooksville, has been cross-breeding Senepol and Holstein cattle in an effort to develop more heat tolerant dairy animals.

Chase said USDA scientists are also examining the genome or genetic map of the Senepol, trying to locate the genetic “neighborhood” where the slick-hair gene is found.

“Once we do that, we’ll be able to use a simple DNA test on crossbred cattle to determine the gene’s presence,” he said. “This could have dramatic benefit for dairy farmers in warm regions of the world, enabling them to achieve the best possible production without cow cooling.”

Heat stress not only reduces milk production, it often causes embryo loss when dairy cattle are bred during summer months, said Pete Hansen, professor of animal sciences. The USDA recently awarded UF and eight other institutions a \$1.5 million grant to develop methods to improve fertility in lactating dairy cows exposed to heat stress.

One of those methods is embryo transfer, which can protect fertilized eggs during the first week of development and



*Findlay Pate, left, Mike Adams and John Arthington discuss beef cattle management practices at UF's Range Cattle Research and Education Center in Ona. (Photo by Milt Putnam)*

improve calf production. Hansen is using in vitro fertilization (IVF), where eggs are removed from a cow's ovaries, fertilized in a laboratory, then implanted in other cows for gestation and birth. The method is inexpensive – costing \$30 or less per embryo – and can be tailored to Florida conditions.

“We’re one of the first institutions investigating summertime IVF,” he said. “And Florida needs the technology. Currently, our dairy cows have only a 5- to 10-percent successful pregnancy rate in hot weather.”

Don Bennink, owner of North Florida Holsteins in Bell, said embryo transfer has helped him produce calves with greater reliability.

“It’s definitely improved the quality of our herd,” he said. “UF is a leader in this field, and one of the reasons is that the animal sciences department and veterinary college work closely on reproductive biology research. Our dairy is fortunate to participate in UF research and work with people such as Pete Hansen, Bill Thatcher and veterinary professors Maarten Drost and Lou Archbald.”

Thatcher, a graduate research professor of animal sciences, is best known for his research with artificial insemination (AI) in dairy cattle. The process is labor-intensive and complex, but expenses can be reduced by inseminating large numbers of cows in a single session, a practice known as timed AI.

“The tough part is getting the cows to come into heat simultaneously, but we’ve solved that problem,” he said.

Using hormone treatments, a producer can pause each cow’s fertility cycle temporarily, then cause her to ovulate when needed. By “synchronizing” entire herds this way, producers can complete AI procedures on hundreds of cows in a day.

Okeechobee-based dairyman Woody Larson has worked with Thatcher for 15 years on various aspects of reproductive physiology, and says that timed AI has helped Larson Dairy breed heifer groups and cows being re-bred after calving.

“Reproduction is one of the biggest hurdles for both dairy and beef producers,” Larson said. “Timed AI isn’t the total answer, but it makes breeding faster and easier to schedule, because you don’t have to spend time trying to figure out which cows are in heat. Also, some high-production dairy cows don’t show outward signs of heat at all, and with timed AI that’s not a problem.”

Mary Beth Hall, assistant professor of animal sciences, is causing producers to rethink traditional notions about dairy cattle feed. Since the 1800s, feed producers had considered many carbohydrates to be interchangeable, but Hall’s work demonstrated that for dairy cattle, four of these “interchangeable” carbohydrates – organic acids, sugars, starch and soluble fiber – can have very different effects on production and health.

Hall’s current work focuses on two areas – using human food byproducts in cattle feed, and using proper carbohydrate balance to prevent cattle health problems such as rumen acidosis, caused by excessive starch consumption.

“By using the right balance of carbohydrates in cattle feed, producers not only maximize production and general cattle health, but also minimize feed costs and waste,” she said. “By using food byproducts such as citrus pulp as feed, dairy cattle are part of the solution to society’s environmental problems.”

A former extension agent, Hall has assisted individual dairy farms with feed analysis and management, said James Frazel, dairyman with Eljim Dairy in Grandin. Frazel’s veterinarian consults regularly with Hall and follows her recommendations.

“The old thinking was that the more grain you fed cows the more milk you’d get, but now we know that’s not necessarily true,” Frazel said. “With the right balance of forages and carbohydrates, you should expect a minimum of 15 to 20 percent increase in milk production, and you’ll keep your herd healthier in the long run.”

## Beef Cattle

Chuck and round cuts comprise two-thirds of a beef carcass, but traditionally they're not in high demand, said Dwain Johnson, professor of animal sciences. So UF has teamed up with the Florida Beef Council (FBC), National Cattleman's Beef Association (NCBA) and the University of Nebraska to develop innovative strategies to enhance sales of these cuts.

Johnson helped develop a "muscle profile" of the chuck and round in young cattle, which resulted in a handbook and CD-ROM to help producers understand the characteristics and possible uses of the muscles. "This way everyone can speak a common language and develop value-added products for retailers and the hospitality industry," Johnson said.

To add value by increasing tenderness and flavor, Roger West, professor of animal sciences, is comparing methods of introducing tenderizing solutions to chuck and round cuts. At the same time, Sally Williams, associate professor of animal sciences, has developed a method of fabricating small muscles into larger, uniform steaks.

"This is a very promising area, and it takes teamwork," Williams said. "As UF scientists develop the technology, organizations like FBC and NCBA promote it to industry."

Polly Golden, executive director of the FBC in Kissimmee, said improving the sales performance of underutilized beef cuts is crucial, not just to Florida cattlemen but to the entire nation.

"We've sponsored seminars where we demonstrate new products to chefs and salespeople, and we've gotten tremendous response," she said.

For years, UF experts have educated Florida cattlemen about the relationship between cow body condition and reproductive performance, said Findlay Pate, professor of animal sciences and director of UF's

Range Cattle Research and Education Center in Ona. Young heifers often need feed supplements to improve their body condition prior to breeding, and UF research shows that molasses is just the ticket.

"It's a low-cost source of carbohydrates, and we can mix in protein and other additives heifers need," he said. Pate and assistant professor of animal sciences John Arthington in Ona, along with professor of animal sciences Bill Kunkle in Gainesville, are comparing the benefits of several protein additives, including urea, feather meal and cottonseed meal.

Mike Adams, president of Adams Ranch in Fort Pierce, said molasses supplementation helped his operation improve conception rates in younger heifers.

"We breed many of our heifers as yearlings, and it's tough to re-breed them the second year due to inadequate body condition," he said. "Using molasses fortified with natural protein, we've improved conception rates probably 5 to 10 percent. We're also impressed with the earliness of the calf crop."

Kunkle said an amino acid called methionine may hold the key to further gains. "Cattle don't produce methionine naturally, and it seems to be one of the most common factors limiting cattle performance," he said. "We improved cattle weight gain by about a quarter-pound per day using a few cents' worth of methionine, and we're working to make the system even more profitable."

Efficient cattle breeding involves more than good nutrition, so UF's Beef Cattle Reproductive Management School offers ranchers an intensive short course covering all facets of cattle breeding, said Bob Sand, associate professor of animal sciences.



*Dwain Johnson, left, Polly Golden and Sally Williams check steaks cooking at UF's meat sciences laboratory in Gainesville. UF has teamed up with the Florida Beef Council and other agencies to develop new methods of marketing beef chuck and round nationwide. (Photo by Milt Putnam)*

Now in its 19th year, the course is offered annually at several locations, he said. Participants range from new cattlemen to seasoned experts looking for a refresher course. UF faculty conduct the teaching sessions, while Sand and local extension agents handle the logistics.

“This past summer, calves sold for about \$500 each,” he said. “Increasing calf production by a few percentage points can make a big difference on your bottom line.”

The school provides producers with other opportunities to save money as well, said Mike Milicevic, general manager for cattle operations with Lykes Brothers Ranch in Brighton. After completing the program, employees can check cows for pregnancy, saving \$1.50 to \$2 per head in veterinary fees.

“We can work 500 to 800 cows per day, so it adds up,” said Milicevic, who works with the fourth largest cow-calf population in the nation. “Sometimes we send our employees to the school just to gain a better understanding of the business, even if they don’t need the specific skills taught there.”

AI allows greater efficiency in beef cattle breeding, but is used on less than 1 percent of Florida’s beef cows, compared to 40 to 60 percent of the state’s dairy cows, said Mike Fields, professor of animal sciences.

“The problem is labor costs,” Fields said. “Florida beef operations tend to be large, and they don’t lend themselves to extensive handling of cattle, which is necessary for conventional AI.”

Building on dairy cattle research conducted by Bill Thatcher, Fields and colleague Joel Yelich, assistant professor of animal sciences, are working with an implant device that can be used to pause a cow’s fertility cycle temporarily, making timed AI practical and affordable.

The implant, licensed to Pharmacia Animal Health Company and awaiting final approval by the U.S. Food and Drug Administration, could be available to producers by early 2002, Yelich said.

“Our research shows that beef cow pregnancy rates with timed AI are 55 percent when a specific hormone is administered at the insertion of the implant, compared to 35 or 40 percent with just the implant and timed AI,” Yelich said. “If a rancher breeds 100 cows using the improved timed AI implant protocol, he could get at least 15 more calves, each worth \$500 to \$600. That’s an extra \$7,500 to \$9,000.”

Brucellosis, a contagious bacterial disease that causes pregnant cows to miscarry, was once a serious problem in the United States, threatening to cost the nation \$800 million annually in lost meat and milk, said Ed Richey, professor of veterinary medicine.

“In the early 1980s, Florida’s brucellosis infection rate was high, and many herds were quarantined as a result,” Richey said. “Opinions varied about how serious the disease was, but we needed to deal with the problem in a unified way.”

In 1986, UF and eight other organizations formed the Florida Brucellosis Information Committee (FBIC) to educate Florida beef producers on the need for vaccination and removal of infected animals. Richey was selected as FBIC chair and continued in that role until March 1992, when the federal restrictions were lifted and FBIC disbanded.

Richey fashioned the technical data and recommendations into a program producers could apply, said C. Dix Harrell, area epidemiology officer with USDA’s Animal and Plant Health Inspection Service in Gainesville.

“Florida was one of the hardest-hit states, and several UF faculty made outstanding contributions to the eradication effort,” Harrell said. “Paul Nicoletti, professor of veterinary medicine, modified the use of an existing vaccine to make it much easier to protect adult cattle on large ranches throughout the Southeast.”

Florida is now classified as brucellosis-free, said Jim Handley, executive vice president of the Florida Cattlemen’s Association in Kissimmee.

“It took the better part of 60 or 70 years to beat this thing,” Handley said. “The fact that we did it shows what determination and cooperation can do.”



## Poultry

In 1978, Bob Harms, graduate research professor of animal sciences, began leading a UF research effort to determine minimum nutrition requirements for commercial layers. By focusing on several key amino acids, the

*Chuck Smith, left, and Gary Butcher examine a laying hen at UF's poultry research unit in Gainesville. (Photo by Milt Putnam)*

team developed recommendations that were eventually adopted by 90 percent of U.S. egg producers and 75 percent of producers worldwide.

“We’ve saved producers about 50 cents per hen per year,” Harms said. “In Florida alone we have about 11 million layers, so that’s roughly \$5.5 million saved per year. And we’re not finished yet.”

Harms said he recently determined the exact amounts of the amino acids methionine, lysine and tryptophan required to produce one gram of egg. Using this data, producers can feed the minimum amounts needed to meet their goals, saving money and reducing poultry waste. Harms is now developing similar data for other amino acids.

Egg producers are eager to receive the results of Harms’ latest research, said Jack Hazen, chairman of the board of Hillandale Farms in Lake City.

“This work is very beneficial to us in trying to produce eggs for the least cost,” Hazen said. “Feed is 65 percent of the cost of egg production, so if you can save a little on each hen it helps a lot.”

In response to environmental concerns about water quality at Florida poultry farms, Bobby Damron, professor of animal sciences, established a voluntary testing program for producers. Evaluating on-site well water for broiler, layer and broiler breeder facilities, Damron tested for water hardness, bacterial growth, nitrate nitrogen, phosphorus and other chemicals.

“We gave producers an honest evaluation with no strings attached,” Damron said. “Most of the results were very favorable, and we offered advice to those who had specific problems.”

Florida produces some of the safest eggs in the nation, thanks to UF’s statewide monitoring effort for Salmonella enteritidis, a bacterial disease that strikes improperly handled foods, said Gary Butcher, professor of veterinary medicine. Participating producers collect samples of organic material from structures such as hen houses and egg collection belts and forward them to UF for laboratory analysis.

“We have almost 100 percent participation, and all the producers involved have been certified as Salmonella enteritidis-free,” Butcher said. “Most other states have significant levels of infection, so our eggs should be considered a premium product.”

Initiated in 1998, the monitoring is part of the nationwide “Five Star” egg quality assurance program sponsored by United Egg Producers, Butcher said. Many grocery chains will buy eggs only from producers following the program.

UF’s salmonella monitoring effort is fully funded by the Florida Poultry Federation in Tampa and was started as a proactive step to help the industry police itself, said Chuck Smith, executive vice president of the federation.

“This work is a great example of how industry can cooperate with state institutions to accomplish good things,” Smith said. “Everybody wins, especially consumers.”

Glen Hembry, [hembry@animal.ufl.edu](mailto:hembry@animal.ufl.edu)



*Dennis Gray, left, and Jeanne Burgess select award-winning wines at Lakeridge Winery and Vineyards. (Photo by Eric Zamora)*

## Grape Expectations!

From award-winning wines to plants that resist disease, research and education programs at UF’s Institute of Food and Agricultural Sciences are helping the state’s grape industry reach its full potential.

In fact, the growth and development of the state’s \$5 million viticulture industry would not have been possible without UF, said Jeanne Burgess, vice president of winemaking operations at Seavin, Inc. The firm owns Lakeridge Winery and Vineyards in Clermont and San Sebastian Winery in St. Augustine.

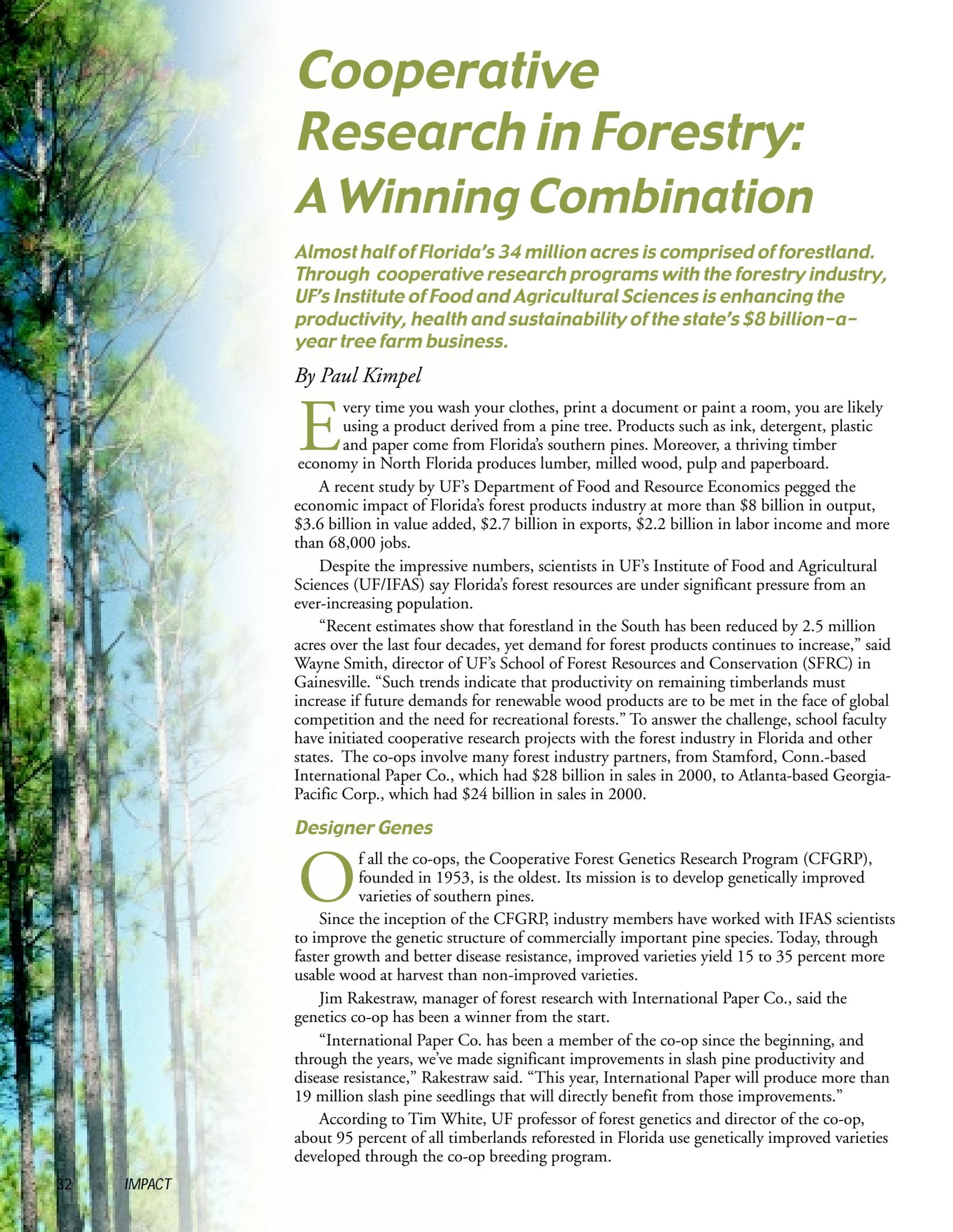
“For more than 70 years, UF grape and wine research and extension programs have given us the tools to achieve success and promote opportunities for commercial viticulture in Florida,” she said. “Research programs have solved major production problems; extension workshops have provided practical hands-on experience, and conferences have provided direction for the grape industry.”

In 1997, experts at the Indy International Wine Competition in Indianapolis picked Blanc du Bois, developed by a UF breeder, as one of the 40 best of 2,147 wines from 19 countries.

Meanwhile, UF research may help control a disease that causes millions in losses and prevents the cultivation of popular grape varieties in the Southeast. In May, the U.S. Patent and Trademark Office issued a patent for the use of a group of genes in grapevines expected to make the plants resistant to Pierce’s disease, for which there currently is no effective control. The patent was issued jointly to UF and the U.S. Department of Agriculture, which helped develop the technology in 1996 to transfer one of the genes into plants. Since then, the research has continued at UF’s Mid-Florida Research and Education Center in Apopka.

“We believe these genes could protect grape plants against a number of diseases, but our target is Pierce’s disease,” said Dennis Gray, professor of developmental biology at the UF center in Apopka. “We had promising results early on in the project, and we’re optimistic tests will confirm heightened resistance in the plants.” – *Chuck Woods*

Jeanne Burgess, [winejb@aol.com](mailto:winejb@aol.com)



# Cooperative Research in Forestry: A Winning Combination

***Almost half of Florida's 34 million acres is comprised of forestland. Through cooperative research programs with the forestry industry, UF's Institute of Food and Agricultural Sciences is enhancing the productivity, health and sustainability of the state's \$8 billion-a-year tree farm business.***

*By Paul Kimpel*

Every time you wash your clothes, print a document or paint a room, you are likely using a product derived from a pine tree. Products such as ink, detergent, plastic and paper come from Florida's southern pines. Moreover, a thriving timber economy in North Florida produces lumber, milled wood, pulp and paperboard.

A recent study by UF's Department of Food and Resource Economics pegged the economic impact of Florida's forest products industry at more than \$8 billion in output, \$3.6 billion in value added, \$2.7 billion in exports, \$2.2 billion in labor income and more than 68,000 jobs.

Despite the impressive numbers, scientists in UF's Institute of Food and Agricultural Sciences (UF/IFAS) say Florida's forest resources are under significant pressure from an ever-increasing population.

"Recent estimates show that forestland in the South has been reduced by 2.5 million acres over the last four decades, yet demand for forest products continues to increase," said Wayne Smith, director of UF's School of Forest Resources and Conservation (SFRC) in Gainesville. "Such trends indicate that productivity on remaining timberlands must increase if future demands for renewable wood products are to be met in the face of global competition and the need for recreational forests." To answer the challenge, school faculty have initiated cooperative research projects with the forest industry in Florida and other states. The co-ops involve many forest industry partners, from Stamford, Conn.-based International Paper Co., which had \$28 billion in sales in 2000, to Atlanta-based Georgia-Pacific Corp., which had \$24 billion in sales in 2000.

## ***Designer Genes***

Of all the co-ops, the Cooperative Forest Genetics Research Program (CFGRP), founded in 1953, is the oldest. Its mission is to develop genetically improved varieties of southern pines.

Since the inception of the CFGRP, industry members have worked with IFAS scientists to improve the genetic structure of commercially important pine species. Today, through faster growth and better disease resistance, improved varieties yield 15 to 35 percent more usable wood at harvest than non-improved varieties.

Jim Rakestraw, manager of forest research with International Paper Co., said the genetics co-op has been a winner from the start.

"International Paper Co. has been a member of the co-op since the beginning, and through the years, we've made significant improvements in slash pine productivity and disease resistance," Rakestraw said. "This year, International Paper will produce more than 19 million slash pine seedlings that will directly benefit from those improvements."

According to Tim White, UF professor of forest genetics and director of the co-op, about 95 percent of all timberlands reforested in Florida use genetically improved varieties developed through the co-op breeding program.

Over the past 20 years, the co-op has conducted more than 1,000 field trials involving 1.5 million trees, White said. From those experiments, UF and industry scientists selected the best genotypes to produce the current, improved varieties.

Robert Schmidt, professor of forest pathology, has focused on determining which tree families are most resistant to fusiform rust, a significant disease of southern pines. In many areas of Florida, fusiform rust is the major factor that limits pine tree production. In the southern United States, 2.5 million acres of loblolly and slash pine plantations have more than 50 percent of trees infected with the fungus.

Industry experts said management practices derived from Schmidt's research have lowered rust-related losses.

"Schmidt's work with the genetic co-op has helped us determine the most rust-resistant tree families to deploy in the high-hazard areas," said Early McCall, genetic resource manager for Jacksonville, Fla.-based Rayonier, Inc., a global supplier of timber. "We have gone from a 60-percent rust infection rate in the past to a 25-percent rate today." McCall said Rayonier manages about 2 million acres of forestland in the Southeast.

### Quantum Leap

Building upon the work of the genetics co-op, the Defense Genes In Forest Trees cooperative (DGIFT), which was formed in 1997, is making a quantum leap in methods used to identify trees with the best traits.

John Davis, UF associate professor of forest biotechnology and director of the gene discovery co-op, said their goal is to discover the genes that control the biology of important traits in trees, such as disease resistance and growth rates.

"We understand precious little about the genes that control complex traits in trees," Davis said. "But through modern genomes, we are beginning to get a better handle on what the important genes are and how they function."

Davis said trees have novel characteristics such as large physical size, relative lack of domestication, perennial growth and long generation intervals.

So far, the co-op has discovered hundreds of genes for use in research, and the goal is to create practical applications for those genes in the forest industry.

"UF's biotech co-op is the only program doing research at this level," said Les Pearson, section leader for biotechnology at Charleston, S.C.-based Westvaco Corp., a

paper products manufacturer. "The fundamental research being done by the co-op will help us understand the mechanisms of disease resistance in forest trees."

### Good Nutrition

Much of Florida's soil is sandy, infertile and incapable of supplying sufficient nutrients to sustain rapid tree growth. By using fertilizer, tree producers can increase yields and sustain high levels of productivity.

Research conducted by Eric Jokela, UF professor of silviculture, and Nicholas Comerford, professor in UF's Department of Soil and Water Science, has focused on the nutritional aspects of forest yield and soil fertility. Their studies have played a critical role in providing land managers with cost-efficient methods for forest soil management and fertilization.

At Plum Creek Timber Co. in Seattle, Wa., Marshall Jacobson, manager of silviculture technology, said IFAS scientists have helped the company improve its yields beyond expectations. The firm formerly was The Timber Co., an affiliate of Georgia-Pacific.

"Research done by IFAS co-ops has been instrumental in allowing us to expand our business by growing more wood per acre," Jacobson said. "Our increased understanding of forest soils, tree nutrition and genetics allows us to routinely double production in managed areas of our forest land."

He said IFAS has helped increase their understanding of forest soils and tree nutrition. "In some cases, phosphorus supplementation has turned barren, unviable land into commercially productive land," he said.

As of 1997, more than 4.7 million acres of loblolly pine and 2.1 million acres of slash pine had been fertilized in the South, mostly by the forest industry. According to Jokela, a single, mid-rotation application of fertilizer would be expected to produce about four cords per acre more wood than a non-fertilized plantation at the end of a 25-year

*Eric Jokela, right, and Marshall Jacobson measure the growth rate of pine trees at UF's Austin Cary Memorial Forest near Gainesville. (Photo by Thomas Wright)*



rotation. The estimated annual value of this treatment to Florida is \$8.5 million.

Although much IFAS forestry research is performed with large co-op members, small, family-owned operations also benefit.

John deBrauwere, a forestry consultant with F&W Forestry, Inc. in Marianna, said landowners who operate plots ranging from 40 acres to 4,000 acres benefit from IFAS research. F&W Forestry is headquartered in Albany, Ga.

“There’s a ‘trickle down effect’ when IFAS scientists make improvements in soil science and fertilization,” deBrauwere said. “In the Southeast, fertilizer is a key element to growth, and some of our small clients would not have productive land without UF’s technology.”

Currently, Jokela and Comerford are developing a new model, called Soil Supply and Nutrient Demand (SSAND), that will assist forest landowners in making site-specific fertilizer recommendations. The model works by matching plant nutrient demands with soil supply characteristics.

### Keeping Tabs

Forest managers in Florida have no easy task keeping track of 16.5 million acres of forestland. Problematic issues such as controlled burns, disease detection and mammoth tree inventories can cause headaches for governmental and private landowners.

But forest managers today have a big advantage: They have UF Professor Loukas Arvanitis, whose expertise in biometrics applies mathematics and statistical analyses to solve problems in various scientific disciplines, including agriculture.

Arvanitis provides precise and cost-effective data that is shared via the Internet by managers and policy makers. UF uses the latest technologies including: Global Positioning System (GPS), Geographic Information System (GIS), remote sensing and mobile computing.

In a recent project funded by the Suwannee River Water Management District, Arvanitis developed a multi-resource inventory system to provide data on more than 140,000 acres owned by the district.

Robert Heeke, land resources manager for the district, said the system enables him to get a grip on the whole picture.

“We now have a way to measure interrelated resources,” Heeke said. “We can determine with greater accuracy if an activity we’re planning in one area will negatively impact another area we’re trying to protect.”

### Merging Disciplines

Formed in 1996, UF’s Forest Biology Research Cooperative (FBRC) is taking a 21st century approach to forest science. The team’s goal is to combine the disciplines of tree physiology, soil fertility, fertilization, plant genetics and pathology to produce fast-growing, disease-resistant loblolly and slash pines.

Smith said FBRC was formed because single-discipline studies are often ineffective at dealing with the dynamics of pine forests. To address this problem, Tim Martin, assistant professor of tree physiology, was added to the team.

“Due to advances in technology and genetics, the team approach will be the model for the future,” Smith said. “With everyone working together, answers to why some trees thrive and others don’t will come at a faster pace.”

Industry people have already noticed benefits from the team approach.

“The FBRC is adding considerable depth to our understanding of how genetic improvement affects the physiological response of pine trees to forest management practices,” said International Paper’s Rakestraw.

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*Loukas Arvanitis, right, and Robert Heeke use the Global Positioning System (GPS) to identify the exact locations of trees, trails and other landscape features along the river. (Photo by Eric Zamora)*

# Higher Net Gains

Alligators, aquatic plants, catfish, clams, crawfish, eels, sturgeon, tilapia and tropical fish are all part of Florida aquaculture, one of the fastest growing segments of agriculture in the state. Research and education programs at UF's Institute of Food and Agricultural Sciences are helping producers meet consumer demands for high-quality products in global markets.

In 1995, when tropical fish breeder Marty Tanner was losing money on his neon tetras, he turned to UF's Tropical Aquaculture Laboratory in Ruskin for help.

Tanner said research at the lab improved the productivity and health of neon tetras, which has led to increased profitability for fish breeders.

"Now we're turning a profit, selling between 50,000 and 100,000 neon tetras a month," said Tanner, who owns Aquatica Tropicals in Plant City. "Instead of 11 cents per fish, we are getting 30 cents per fish, thanks largely to research programs at the Ruskin lab."

By studying the natural spawning environment of the fish, UF researchers were able to determine optimal breeding conditions, Tanner said. Water conditions, temperature, feeding habits and other issues must be precise for successful and sustained breeding of healthy fish.

Frank Chapman, associate professor in UF's Department of Fisheries and Aquatic Sciences in Gainesville, said the challenge is to breed fish of better quality than those imported from Asia and South America. Florida produces 95 percent of domestically raised tropical fish, but imported fish have about 65 percent of the U.S. market.

Ornamental fish for the home aquarium are Florida's most valuable aquaculture commodity, accounting for 50 percent of all aquaculture sales. According to UF's Department of Food and Resource Economics, there were 178 aquaculture producers in the state in 1999, with sales totaling \$43 million.

Craig Watson, coordinator of research programs at Ruskin, said scientists at the laboratory are working on other projects to exploit tropical fish, other types of tetras and clown loaches.

"To gain a larger market share, breeders need new species to offer," Watson said. "The challenge is to take exotic, imported species and find ways to breed them domestically."

"For example, if we can figure out how to produce clown loaches repetitively and in mass numbers, Florida fish farmers could sell them to pet shops worldwide," Watson said.

Aquatica's Tanner said he would like to have domestic clown loaches to sell. "The clown loach would be an excellent new species for the industry," he said. "I'm sure IFAS will find a way to do it."

Watson said UF recently expanded its role in the industry with the renovation and expansion of the Ruskin laboratory. The facility provides industry support, including research, demonstration, disease diagnostics and extension services.

*Marty Tanner, left, and Frank Chapman check neon tetras being readied for shipment from Aquatica Tropicals in Plant City. (Photo by Eric Zamora)*

## Cultured Clams

Cultured clams are another bright spot in aquaculture, bringing jobs and substantial incomes to previously out-of-work Florida fishermen.

Leslie Sturmer, an aquaculture agent with UF's Extension Service in Levy County, said the industry went from zero cultured clam production in Cedar Key in 1991, to about 50 million clams in 1997, to 100 million clams in 1999.

Sales of clams produced by Florida growers in 1999 totaled \$15.9 million, up from \$12.7 million in 1997. The 351 active growers sold 134 million clams statewide and averaged 11.4 cents per mature clam sold, she said.

As the industry expanded, IFAS provided support to clam farmers by creating Sturmer's extension position in 1995 in Cedar Key. Sturmer said she has assisted in identifying viable lease areas, helped educate people and placed program graduates into business on two-acre leases in the Gulf of Mexico.

One of those graduates is Ed Ellison, who said Sturmer taught him how to raise clams. He also said he learned a lot about the effects of water quality on marine life.

"It's amazing how sensitive clam seed is, and how important it is to get the clams past the initial stages when so many die," Ellison said. "That's what UF and Leslie Sturmer do for us here in Horseshoe Beach with the land-based clam nursery."

Sturmer said Cedar Key now has about 60 land-based nurseries that are helping to minimize seed shortages farmers had in the past. She said successful clam farming requires three steps: seed production, nursery and growout. More than 450 individuals are commercially culturing hard clams.

In addition to educating potential and existing clam farmers, Sturmer was also instrumental in helping clam farmers obtain the same kind of crop insurance as traditional farmers. — Paul Kimpel

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## Sky-High Tech

*Pete Weingartner, left, associate professor of plant pathology and interim director of UF's Hastings Research and Education Center, Austin Tilton, Putnam County extension director in East Palatka, and Bill Cotton, executive director of the North Florida Growers Exchange in Hastings, adjust equipment on a solar-powered Florida Automated Weather Network (FAWN) monitoring station in St. Johns County. The station measures temperature, rainfall and other conditions and sends data to computers at UF in Gainesville. When the National Weather Service discontinued forecasts for agriculture in 1997, UF's Institute of Food and Agricultural Sciences started FAWN. Various grower organizations, spearheaded by the Florida Fruit and Vegetable Association in Orlando, formed a weather task force and helped obtain funding for the network.*

*Pat Cockrell, director of agricultural policy with the Florida Farm Bureau in Gainesville and chair of the task force, said, "FAWN is a major step forward in developing accurate and reliable weather data, and the network is a valuable asset in farming operations across the state." By the end of 2002, the statewide network will include 32 monitoring stations, providing "real time" weather data 24 hours daily via telephone (352) 846-3100 or (305) 246-7040 and the FAWN Web site: <http://fawn.ifas.ufl.edu> (Photo by Thomas Wright)*