V(A). Planned Program (Summary)

Program # 13

1. Name of the Planned Program

Global Food Security and Hunger--Research

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
201	Plant Genome, Genetics, and Genetic Mechanisms	0%	0%	5%	
202	Plant Genetic Resources	0%	0%	5%	
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants	0%	0%	5%	
204	Plant Product Quality and Utility (Preharvest)	0%	0%	5%	
205	Plant Management Systems	0%	0%	5%	
212	Pathogens and Nematodes Affecting Plants	0%	0%	5%	
216	Integrated Pest Management Systems	0%	0%	5%	
302	Nutrient Utilization in Animals	0%	0%	5%	
306	Environmental Stress in Animals	0%	0%	5%	
307	Animal Management Systems	0%	0%	5%	
308	Improved Animal Products (Before Harvest)	0%	0%	5%	
311	Animal Diseases	0%	0%	5%	
312	External Parasites and Pests of Animals	0%	0%	5%	
313	Internal Parasites in Animals	0%	0%	5%	
402	Engineering Systems and Equipment	0%	0%	5%	
403	Waste Disposal, Recycling, and Reuse	0%	0%	5%	
404	Instrumentation and Control Systems	0%	0%	5%	
405	Drainage and Irrigation Systems and Facilities	0%	0%	5%	
501	New and Improved Food Processing Technologies	0%	0%	5%	
502	New and Improved Food Products	0%	0%	5%	
	Total	0%	0%	100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2013	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	40.0	0.0
Actual Paid Professional	0.0	0.0	20.4	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	905212	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	905212	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Conduct research experiments

2. Brief description of the target audience

Growers/ranchers
Producers/packers
Buyers
General Public
Government Officials
Scientists

3. How was eXtension used?

{No Data Entered}

V(E). Planned Program (Outputs)

1. Standard output measures

2013	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	0	0	0	0

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year:	2013
Actual:	48

Patents listed

1.Caladium Plant Named 'UF-172'
2.Caladium Plant Named 'UF-85-5'
3.Caladium Plant Named 'UF-18-49'
4.Caladium Plant Named 'UF 44-4'
5.Peach Tree Named 'GULFSNOW'
6.Caladium Plant Named 'UF 4424'
7.Caladium Plant Named 'UF 4412'
8.PUMMELO GRAPEFRUIT HYBRID TREE NAMED '914'
9.Gerbera Plant Named 'UFGE 7031'
10.Gerbera Plant Named 'UFGE 7080'
11.Coleus Plant Named UF12-62-2
12.Coleus Plant Named UF12-9-2
13.Coleus Plant Named UF12-87-9
14.Coleus Plant Named UF12-6-2
15.Coleus Plant Named UF11-74-5
16.Coleus Plant Named UF12-35-9
17.Coleus Plant Named 'Gator Glory'
18.Strawberry Plant Named 'Florida Sensation'
19.727 (UF10302) - Peanut
20.Buck, LA99017 - Oat
21.Materials and Methods for Producing Resistance to Two Distinct Strains of Tomato Yellow Leaf Curl Virus (CON)
22.Methods of Using Cellulase for Reducing the Viscosity of Feedstock
23.Gene Controlling Synthesis of an Important Tomato Flavor VolatilePCT
24.Gene Controlling Synthesis of an Important Tomato Flavor Volatile United States
25.Citrus Tristeza Virus Based Vectors for Foreign Gene/s Expression--Argentina
26.Citrus Tristeza Virus Based Vectors for Foreign Gene/s Expression--PCT
27.Citrus Tristeza Virus Based Vectors for Foreign Gene/s Expression?United States
28.Mobile Plant Material Removal System for Harvested Citrus Crops
29.Method of Making Biochar-MgO Nanocomposite and its Application to Sorb P and As
30.Methyl Salicylate-Based Attractants For Vectors Of Citrus Greening Disease
31.Method for Increasing the Speed and Resolution of Gas Permeation Instruments
32.Dual Action Lethal Ovitrap PCT
33.Dual Action Lethal Ovitrap?United States
34.Sweet Taste Created in The Brain PCT
35.Sweet Taste Created in The Brain?United States
36.Sweet Taste Created in The Brain
37.Single Nucleotide Polymorphisms That Predict Fertility of Dairy Cattle
38.Method for Artificial Selection
39.Manipulation of Color, Stature and Nutraceutical Content of Plant Products Using Narrow-Bandwidth Light (combined with 14497)
40.Manipulation of Color, Stature and Nutraceutical Content of Plant Products Using Narrow-Bandwidth Light
41.Identification of Biofilm Inhibitors to Increase the Efficiency of Copper Based Bactericides in Control Citrus Canker
42.Material and Methods to Increase Plant Growth and Yield
43.Method of Producing Graphene Coating/Film on Solid Surfaces
44.Method of Inhibition of Enzymatic Browning in Food Using a Sulfinic Acid Compound(CIP)
45.A Fluid Bait Matrix to be Injected into Active Infestation of Termites

46.Antimicrobial Compounds to Combat Citrus HLB Bacterium, Candidatus Liberibacter Asiaticus or Other Species In This Genus
47.Mosquito control device using durable coated-embedded larvicide Bed Bug Control Method Using Heat and Volatile Insecticides
48.Antimicrobial Compounds Against Candidatus Liberibacter Asiacus by Inhibiting SecA

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2013	Extension	Research	Total
Actual	0	1298	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- {No Data Entered}

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Increase plant Production through the development of improved plant production BMPs
2	Improve Plant Protection through the development of new science and BMPs
3	Improve Animal Production through the development of BMPs
4	Improve animal protection through the development of new science and BMPs
5	Identify and increase quality and production of animals and plant systems through the development of new science in agricultural, natural resources and biological engineering
6	Reduce hunger and increase food productivity based on improved methods of processing, improving quality and delivery of animal and plant foods

Outcome #1

1. Outcome Measures

Increase plant Production through the development of improved plant production BMPs

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Florida has a large ornamental plants industry, with 2005 total sales by Florida nurseries, landscape service firms, and horticultural retailers totaling $15.2 billion, second in the nation after California. A number of leading ornamental plant propagation companies in and outside Florida actively collaborate with UF, through the Young Plant Research Center (http://hort.ifas.ufl.edu/yprc/), which is a university/industry consortium co-directed by Paul Fisher at UF. Many horticultural and agronomic crops are produced from plant cuttings, whereby a section of the plant is harvested from clonal stock plants, the cuttings are rooted in trays, and then the rooted cuttings are grown on in final containers for sale. Nurseries that produce cuttings for horticultural species are mainly located off-shore (for example, Canada, Costa Rica, Denmark, Guatemala, Israel, Kenya, Mexico). The cuttings are then transported by air, where the cuttings are rooted in a U.S. "rooting station" greenhouse. Problems in young plant production include high or low substrate-pH problems, nutritional disorders, waterborne pathogens, and inadequate management of the greenhouse climate, especially light and temperature. There is a need for research-based "Best Management Practices" to improve irrigation, fertilization, and crop management practices for plant propagation. Research in these areas will be conducted in a collaborative framework through university/industry research groups. Research and education on water quality and treatment, especially for recycled water, will also be focused with a goal to reduce runoff and water-related disease issues in the greenhouse and nursery industry.

What has been done
Research took place followed by presentations both national and international. Audiences targeted were greenhouse and nursery growers with emphasis on growers of young plants (vegetative and tissue culture cuttings, and seedling plugs).

Results

Impact: A direct measurement of the value to industry partners is that the FRA program has generated over $1M in industry funding (donations, industry grants and contracts) since 2007. Industry partners who have been directly involved in onsite trials represent more than 40 million square feet of floriculture production, including 7 of the largest 100 floriculture operations in the U.S. and 9 of the largest floriculture operations in Florida. Behavioral changes in the 30 grower partners with whom we have directly conducted trials, and which are supported by our applied research and education, include: Monitoring of light level, and improved efficiency in use of electrical light and shading based on research of crop responses to light quantity. Improved selection and rotation of pesticides, including parasitic nematodes (biological control) for fungus gnats (a major pest during plant propagation) based on onsite and controlled research on efficacy of pesticides. Increased diversity of liner sizes produced, and improved space use efficiency, based on trialing of crop timing, and modeling of financial returns. Matching of fertilizer type to water quality to minimize drift in substrate-pH based on research of pH. More efficient use of water and nutrients based on onsite and controlled research on leaching and fertilizer use in propagation. Improved ability to quantify costs, profitability, and crop losses by utilizing financial benchmarking and cost tracking tools developed by UF. On the growing media side, companies participating with FRA trials represent over 90% of production of peat-based substrates for floriculture in the U.S. and Canada market. We have provided "Consumer Reports" type quality control testing for these companies, in the process establishing industry standards and quality control procedures for propagation substrates that are used by these companies.

4. Associated Knowledge Areas

KA Code	Knowledge Area
201	Plant Genome, Genetics, and Genetic Mechanisms
202	Plant Genetic Resources
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems

Outcome #2

1. Outcome Measures

Improve Plant Protection through the development of new science and BMPs

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Insecticide resistance, losses of registrations, effects on the environment, and safety issues have presented a need for alternatives to insecticides in the management of insect pests of vegetables. The purpose of this project is to address problems in the management of insect pests in vegetable crops, principally cole crops such as head cabbage and collards. Emphasis is placed on the use of insecticides and alternatives to insecticides in the management of diamondback moth, cabbage looper, aphids, whiteflies, and dipterous leafminers. The results of this work will contribute to the continued development and conservation of important chemical and biological tools used in the management of pests important to Florida and the rest of the world such as: diamondback moth, a pest of cabbage and related crops; and Liriomyza trifolii and two-spotted spider mite, two pests of ornamentals and vegetables. This work will also contribute to a reduction in the use of insecticides and an increase in the sustainability of production of cabbage and other vegetable crops.

What has been done

Experiments were conducted in the laboratory, greenhouse, and field to evaluate new insecticide chemistries and formulations for efficacy at controlling various insects such as diamondback moth, dipterous leafminer, and whitefly. Studies were continued on the biology of the Florida fern caterpillar. Results from these activities were presented at various conferences. Field experiments were conducted in cooperation with the Plant Medicine Program at UF to provide students with training and experience in conducting field studies. Mentored students and taught a capstone course and a field experimentation course for Plant Medicine Program.

Results

elected insecticidal treatments were evaluated for the control of silverleaf whitefly in acorn squash. Scorpion (dinotefuran) 35SL at 3 fl oz/acre (three applications) and 5 fl oz/acre (two applications), and AzaDirect (azadirachtin) at 16 fl oz/acre (four applications) were compared to the standard, Admire Pro (imidacloprid), at 1.3 fl/oz per acre (four applications), and an untreated check (water only). The whitefly infestation was extremely heavy. Plants in all treatments suffered heavy damage and insignificant amounts of fruit were produced regardless of treatment. One sampling of all treatments was conducted on the same date. Based on the application schedule, the low rate of Scorpion was sampled one week after the last of three weekly sprays, the high rate of Scorpion was sampled two weeks after the last of two weekly sprays, and Admire Pro and AzaDirect were sampled 2 days after the last of four weekly sprays. The two applications of Scorpion at the high rate significantly reduced whitefly numbers compared to all other treatments. There were no significant differences among the other treatments. There was no visible evidence of phytotoxicity. Selected insecticidal treatments were evaluated for the control of cabbage webworm (CW) and cabbage looper (CL) in collards. GWN-10137 at 6.8 fl oz/acre, 13.7 fl oz/acre, and 27.4 fl oz/acre were compared to the standard, Coragen (rynaxypyr) at 5.0 fl oz/acre, and an untreated check (water plus wetting agent). Coragen was very effective at controlling the CW. GWN-10137 was not as effective as Coragen, but did show a rate response with numbers decreasing with increasing rate for CW. Coragen was also very effective at controlling CL, where GWN-10137 was not. The number of CL tended to increase with increasing rate of GWN-10137. It is suggested that this could have been due to increased control of CW with increasing rates of GWN-10137 allowing more foliage at the higher rates, which in turn, allowed higher numbers of CL which was not effectively controlled by GWN-10137. There was no visible evidence of phytotoxicity.

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems
216	Integrated Pest Management Systems

Outcome #3

1. Outcome Measures

Improve Animal Production through the development of BMPs

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Animal agriculture is one of the fundamental cornerstones that has helped shape the development of United States. Over the last 100 years animal agriculture has changed dramatically. The implementation of new technologies and production techniques has enhanced the efficiency of production. An increase in production efficiency has enabled producers to produce more meat, milk, and eggs with fewer animals, while maintaining a high quality, safe food product at a low cost to the consumer. In order for production animal agriculture to continue to deliver a safe and low cost product to the consumer, abatement of animal stressors are fundamental animal husbandry components essential for optimizing animal health and productivity. Stressors relative to animal production include environmental, management and immunological factors that have been reported to decrease animal production (growth, reproduction, efficiency, etc.) and overall animal well-being. Environmental and management stressors erode efficiency and cost livestock production enterprises billions of dollars annually in lost potential profitability. For example, in the absence of heat abatement measures, total losses across all animal classes averaged 2.4 billion annually (St-Pierre et al., 2003). In addition to climatic stressors, thoroughly understanding the impact of how stress affects the immune system and susceptibility of livestock to disease is extremely important because the majority of emerging animal diseases have proven to be zoonotic diseases, and therefore threaten public health. Likewise, it is important to understand the impact of different levels of stress and the interaction of multiple stressors on animal health and production efficiency. Finally, identification of the modes of adaptation to acute and chronic stress conditions, as well as recovery, will allow for improved future prediction of the impact of a changing environment on animal performance and well-being. The objectives outlined in the current proposal address both critical aspects of responses of

livestock to environmental and management stressors, and examine viable management interventions and alternatives to mitigate the detrimental effects of these challenges. This collaborative group of scientists and engineers spans a broad range of disciplinary training, and the group proposes cross-station experiments that run the gamut from very basic cellular/molecular questions to very applied investigative aims. Thus, outcomes of this multi-state project can reasonably be expected to broadly impact production practices, animal comfort and wellbeing, and improve profitability across diverse livestock commodity sectors.

What has been done
Examine the role of trace mineral nutrition in pre-post weaned calves. This will be a multistate collaboration.

Results
Impact: What was accomplished under these goals? Our objectives were to evaluate the effects of repeated freezing and thawing cycles, and different storage temperatures on concentrations of haptoglobin and ceruloplasmin using colorimetric procedures within biochemical assays. Briefly, haptoglobin concentrations were assessed via the measurement of haptoglobin/hemoglobin complexing by estimating differences in peroxidase activity, and ceruloplasmin concentrations, via estimation of oxidase activity. Blood samples were collected from 12 Brangus-crossbred steers on d 3 after vaccination against Mannheimia haemolytica (One Shot, Pfizer Inc. New York, NY). Blood samples were allocated to 1 of 5 handling protocols: (1) plasma samples were frozen, and thawed only on the day of analysis; (2) 24-h; blood samples were stored at 8oC for 24 h, and plasma was harvested, frozen, and thawed on the day of analysis; (3) 1-time; 1 wk prior to analysis, plasma samples were thawed for 1 h and re-frozen; (4) 2-time; 1 and 2 wk prior to analysis, plasma samples were thawed for 1 h and re-frozen; (5) 3-time; 1, 2, and 3 wk prior to analysis, plasma samples were thawed for 1 h and re-frozen. Each handling scenario was assessed at 1 and 7 mo of storage and at freezing temperatures of -20 and -80oC. Concentrations of both proteins analyzed at 7 mo after blood sampling were greater ($P = 0.01$) than results from analysis conducted 30 d after blood sampling, irrespective of thawing and refreezing protocol. Samples subjected to 24-h storage in the refrigerator, prior to centrifugation and plasma harvest, had greater ($P < 0.05$) haptoglobin concentrations compared to 1, 2, and 3-time handling protocols. For ceruloplasmin, a storage temperature effect was detected with plasma concentrations stored at -80oC being greater ($P = 0.05$) than -20oC. In conclusion, plasma collection protocol, storage time, and storage temperature appear to impact the results of biochemical assays aimed at the quantification of bovine haptoglobin and ceruloplasmin.
Keywords: acute-phase proteins, beef cattle, stability

4. Associated Knowledge Areas

KA Code	Knowledge Area
302	Nutrient Utilization in Animals
306	Environmental Stress in Animals
307	Animal Management Systems
308	Improved Animal Products (Before Harvest)

Outcome #4

1. Outcome Measures

Improve animal protection through the development of new science and BMPs

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The NC-1042 committee maintains that a systems paradigm will remain the most useful approach to help dairy managers make the best decisions. The revised project will develop decision support systems that address nutrition, management, environmental impacts, and economics of 1) calves and heifers; and 2) lactating and dry cows; and furthermore integrates these decision support systems using a 3) whole farm systems approach. Whole dairy farm management research remains needed to enhance understanding and application of farm records, and reduce undesirable impacts on the environment. In dairy farms of the future, a system to integrate data from production, financial and management databases into routine decisions will be necessary to optimize efficiency and economic sustainability. Since the start of this project, several member states and developed and assessed financial databases. These databases provide the framework for further expansion and development of financial benchmarks. As energy costs continue to increase, their impact on management decisions for profitability and sustainability become more dominant in the rank of inputs. The creation of a database for total farm energy budgets and usage is needed to accurately evaluate alternatives. Niche markets or alternative management schemes (organic, on farm processing, electricity generation, grazing, and climate (Carbon) trading) have been proposed for sustainability of dairy enterprises. These enterprises need base line data and financial benchmarks also. Dairy producers need to make daily decisions about whether and when to treat, inseminate, cull, dry-off, raise, or purchase dairy cows. They need to simultaneously consider a cows future biological performance, milk and cow prices, and herd constraints such nutrient balance or availability of labor to make the best decisions day after day. These future estimates are subject to seasonality and price and production risks. Directly associated with these complex tasks are questions about the economic value of proposed changes in management, such as reproductive management. Dairy producers and allied industries have indicated that they need support in making these complex planning decisions to improve their efficiency of production, profitability, and for the dairy industry to remain economically and environmentally sustainable. The computer programs developed in this project

will enable evaluation of financial implications of the direct and indirect effects of various management options, and assist dairy producers with making effective decisions. Finally, dairy farms need to make sure they do not cause undesirable impacts on the environment.

What has been done
We studied the effect of optimal genomic testing in dairy cattle with simulation models. Linear regression equations were developed. The eequations were built into the linear program previously developed. This linear program is state-of-the art and publications are planned for 2013. A simpler herd calculator was greatly extended to do on-th-fly calculations of herd evaluations, such as overcrowding, the use of sexed semen, and genomic testing. The model was used to support the value of new information technology and genomic testing. An existing model, DairyVIP, is being converted for on-line use with the help of IFAS-IT and should be ready in Spring 2013. We evaluated the agreement between Afilab and DHI testday components. We started building a model for evaluation of embryo transfer economics.

Results
Impact: Results from the herd budget calculator showed that the Herd Navigator could be of value to dairy producers in Canada. The calculator also showed that 120% stocking density was optimal for dairy herds for typical assumptions, but this stocking density leads to reduced welfare. The Afilab - DHI comparison showed "average" agreement which fluctuates greately from month to month and cow to cow.

4. Associated Knowledge Areas

KA Code	Knowledge Area
302	Nutrient Utilization in Animals
308	Improved Animal Products (Before Harvest)

Outcome #5

1. Outcome Measures

Identify and increase quality and production of animals and plant systems through the development of new science in agricultural, natural resources and biological engineering

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Assuring the production and quality of US agricultural commodities, processed foods and beverages is vital to the country's security and market competitiveness. Fresh and processed foods need to be safe as well as nutritious and good tasting. Maximizing sensory attributes and nutritional value while retaining fresh-like quality and ensuring safety are requirements for all food processors eager to conquer diverse emerging markets. The goals of this project are (I) to carry out exploratory research on stabilization and activation of citrus and other food enzymes and (II) to develop new and improved methods for plant and food pathogen detection, quality assurance of food and beverage products. Pectic enzymes are used for viscosity reduction and yield increase in the fruit juice industry. Lipases are used in the production of natural flavors. Stabilization and reuse of enzymes has the potential to decrease production costs and increase productivity. The effects of high hydrostatic pressure (HHP) on enzyme activity will be characterized by applying HHP to pectic enzymes and lipases at different temperatrues. Faster and more accurate and automated quality methods are required in the food industry. This research will focus on developing novel sensors, biosensors or rapid assays to replace the current assays for pectinesterase and oil content in juice. Physical, biochemical and electrochemical strategies will be used. We also expect to develop biosensors for indirect rapid detection of food pathogens. Citrus Huanglongbing (HLB)is one of the most threatening citrus diseases in the world and it is gravely affecting Florida's industry. Rapid in-field diagnosis of the disease can help reducing its spread. Knowing the changes in metabolites present in infected trees can help understanding the mechanisms of infection. In this research we will focus on identifying biomarkers for rapid detection of citrus HLB. Based on these biomarkers, we expect to develop portable sensors or biosensors for rapid, in-field diagnosis of HLB. Outcomes. a) Improved understanding of the effects of HHP on enzyme catalysis and structure. b) Incorporation of research findings into two graduate courses taught by Dr. Reyes De Corcuera: Citrus Processing Technology and Food Kinetics. c) Quality assurance laboratories are expected to save time and improve product quality by implementing a faster PME activity method for fruit juices. d) A faster and more sensitive method to determine oil in juice is expected to reduce processing costs to citrus juice and oil processors by reducing assay time and providing feed-back process control and more accurate quality control. e) In-field determination of titratable acidity that citrus growers can readily and inexpensively adopt at harvesting and increase crop value. f) Rapid methods for Salmonella and E. coli O157:H7 detection in foods reduce assay time and minimize the likelyhood that contaminated or under processed foods reach the consumer, thus, minimizes foodborne disease outbreaks. g)In-field diagnosis of HLB is expected to help citrus growers mitigate the spread of this disease

What has been done

Goal (I) to carry out exploratory research on stabilization and activation of citrus and other food enzymes. Final report of stabilization of pectinases was submitted separately for project FLA-LAL-004928 and presented as a poster at the 2012 annual meeting of the Institute of Food Technologists in Las Vegas, Nevada. Goal (II) to develop new and improved methods for plant and food pathogen detection, quality assurance of food and beverage products. In collaboration with Dr. Geoffrey Puzon from CSIRO, Perth, Australia an in-line sensor for detection of biofilm formation in water distribution systems and liquid food contact surfaces was developed. The results were presented at Biosensors 2012, Cancun, Mexico, May 2012. Rheological characterization of citrus pulp by capillary viscometry at selected processing conditions using a modified concentric tube pasteurizer were presented at the 2012 Citrus Engineering conference in Lake Alfred, Florida. Thermal properties and heat transfer characteristics of citrus pulp were presented at the 2012 annual meeting of the Institute of Food Technologists in Las Vegas, Nevada. A summary of both, rheological and thermal properties was presented at the 2012 International Citrus and Beverage Conference in Clearwater, Florida. Research on the effects of

in-field thermal treatment of citrus trees was initiated.

Results
First draft a book chapter on fruit and vegetable juice processing was submitted to publisher. Three M.S. students, a visiting scientist from Italy and a laboratory technician were mentored and conducted most this research.

4. Associated Knowledge Areas

KA Code	Knowledge Area
402	Engineering Systems and Equipment
404	Instrumentation and Control Systems
501	New and Improved Food Processing Technologies
502	New and Improved Food Products

Outcome #6

1. Outcome Measures

Reduce hunger and increase food productivity based on improved methods of processing, improving quality and delivery of animal and plant foods

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Efficient energy and water usage systems are crucial in a contemporary society with high demand, and limited water and energy resources. A sustainable alternative is the integration of an aquaculture production with land-based production systems. Culture of ornamental fish in Florida is limited primarily by lack of brood stocks and rearing different developmental life stages, principally due to lack of appropriate diets. Sturgeons: have traditionally been among the world's most valuable fisheries commodities, both for their meat and eggs. They are also an important sport and commercial fishery in many areas of the US. Sturgeons, however, have been over-fished worldwide and many populations have become threatened or endangered of extinction. The aquaculture and restoration efforts for sturgeon ultimately will depend on the production of large numbers of larval fish that can be used to augment populations in the wild or to develop

domestic brood stock for commercial aquaculture production. Studies will focus on integration of aquaculture to land-based agricultural systems. An example is a a polyculture approach to nutrient reduction in agricultural wastewater. The model will include plankton to incorporate elemental nutrients, baitfish to consume zooplankton, and mussels to consume phytoplankton. Studies will enhance culture technology for mass propagation for selected ornamental fish species. Studies will also focus on the natural history of sturgeons for their protection in the wild and develop techniques for their husbandry and management in captive conditions.

Efficient energy and water usage systems are crucial in a contemporary society with high demand, and limited water and energy resources. A sustainable alternative is the integration of an aquaculture production with land-based production systems. Culture of ornamental fish in Florida is limited primarily by lack of brood stocks and rearing different developmental life stages, principally due to lack of appropriate diets. Sturgeons: have traditionally been among the world's most valuable fisheries commodities, both for their meat and eggs. They are also an important sport and commercial fishery in many areas of the US. Sturgeons, however, have been over-fished worldwide and many populations have become threatened or endangered of extinction. The aquaculture and restoration efforts for sturgeon ultimately will depend on the production of large numbers of larval fish that can be used to augment populations in the wild or to develop domestic brood stock for commercial aquaculture production. Studies will focus on integration of aquaculture to land-based agricultural systems. An example is a a polyculture approach to nutrient reduction in agricultural wastewater. The model will include plankton to incorporate elemental nutrients, baitfish to consume zooplankton, and mussels to consume phytoplankton. Studies will enhance culture technology for mass propagation for selected ornamental fish species. Studies will also focus on the natural history of sturgeons for their protection in the wild and develop techniques for their husbandry and management in captive conditions.

What has been done

Research conducted in my laboratory has been responsible for much of the development of sturgeon aquaculture techniques now utilized worldwide for commercial and conservation purposes. Our laboratory is recognized by the industry among the best ones in the world for the aquaculture of sturgeon. Between 1990 and 2000 we secured approximately three million dollars for other faculty in our department and our laboratory to work on sturgeon. Sturgeon aquaculture is now a reality worldwide and in Florida we have developed and established domestic brood stocks of the principal commercial species of sturgeon in the world for making caviar: the beluga, osetra, and sevruga sturgeons. This is one major accomplishment, a first in America but also one of a few locations in the world. This development will provide immense economic opportunities for further development of the food-fish aquaculture industry in Florida and nationwide. We expect as sturgeon aquaculture develops worlwide funding opportunities to our programs in the near future will resume again. The impact that our sturgeon aquaculture program initiated in 1990, together with only a few other worldwide, has had in world sturgeon production is best summarized in the following graph from the world FAO fisheries statistics (FAO statistics, 2008). Sturgeon aquaculture (blue in graph) now accounts for more than 90% of the world supply in sturgeon; wild fisheries stocks (red in graph) have collapsed. Research in our laboratory has also focused in

assisting ornamental fish farmers develop brood stocks of important species in the trade like the neon and cardinal tetras. These two species provide revenues to the Florida ornamental fish industry of over million dollars a year. Also I have introduced farmers to technologies to raise ornamental fish indoors utilizing efficient water recirculating systems. A major emphasis of our laboratory is to improve feeding efficiency of their stocks to minimize their costs of production. We have also extended our work with ornamental fishes to the field. We are collaborating with faculty at the Universidad de los Llanos in Colombia.

Results

Impact: A new area of research in our laboratory is studying the feasibility of practicing aquaculture of marine species in land-based facilities and possibly in freshwater. Traditionally marine fish have greater consumer acceptance and commanded a higher price. Aquaculture in coastal areas in the United States, however, has met with many obstacles so this has hindered industry development. One marine species we have identified with great potential for aquaculture in inland waters is the goliath grouper. Our investigations indicate that the species can tolerate waters of low salinity and adapt very well to culture conditions. In the US the species is protected so we have conducted our preliminary studies in Colombia. We are still in the process of experimentation and data gathering that should result in several peer-reviewed publications. The first culture of goliath grouper, especially in freshwater is a major breakthrough and certainly will attract the attention of the aquaculture industry. In 2009 we also initiated an investigation on methods for the control of invasive species. The technique involves the production in the laboratory of an all-male population of the invasive species. The laboratory produced YY or super males can then be released into the wild and their offspring will be all males, hence, theoretically driving the invasive species to extinction; as less and less females will be available to reproduce with. During 2010 we successfully completed the first and most tedious step of the procedure involving the reversion of sex in an experimental population of ornamental cichlids that are considered a nuisance in the Everglades National Park in south Florida. We are now entering the second phase of the procedure that involves breeding the sex-reversed individuals and conducting progeny testing to identify the YY-males in the population. Our results are encouraging and we have already secured over $100,000 in funding from the USGS to continue with this investigation and there is great possibility of further funding. With successful completion of this study we will also be in a stronger position to seek funding from other agencies for a major expansion of this work and application to other animals; one species we have already selected is the marine lionfish. The technique of producing 'same-sex' populations is also a valuable tool in aquaculture practices, especially in tilapia. Tilapia has become a seafood of choice for consumers and is cultured extensively worldwide. We are receiving numerous requests for assistance and to resume our previous research activities with this species.

4. Associated Knowledge Areas

KA Code	Knowledge Area
502	New and Improved Food Products

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges
- Populations changes (immigration, new cultural groupings, etc.)

Brief Explanation

Florida is still being heavily impacted by the economic situation. Public higher education in Florida has lost more than 50% of state funding and research has been impacted by other losses caused indirectly by the economic down turn including a reduction of funding opportunities available at the national level. In some cases faculty who leave or retire are not being replaced because of economic issues. Changes in state, county and federal appropriations can also affect the outcomes related to the Florida research land-grant mission. Because of limited resources in Florida and continuing devolution research projects can always be affected by changing public and governmental priorities policies, regulations and laws.
Natural and national disasters can also affect research field studies and multistate research. Natural disasters such as tropical storms and hurricanes are common annual occurrences in this state and often cause severe damage to plants and the environment in which active research is taking place.. Severe weather conditions such as droughts frequently led to large-scale fires which can also impact studies. In 2013 we were heavily impacted by severe storms and fires. We also had other weather extremes such as floods leading to large scale damage especially along the coastal regions and the panhandle of the state. All of these can have a direct and indirect impact on research.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

UF/IFAS research has privided research in areas that improve global food security and reduced hunger. They have also increased agricultural profitability for farmer, producers

and all others in agriculture from field to fork. In Florida increasing plant productivity and animal reproduction and finding better ways to improve food security have become priorities in the area of research.

Key Items of Evaluation

Plant productivity has become increasingly critical for the resolution of world food and energy shortages. Plant growth and development traits critical to crop production are governed by the coordinate action of genetic information distributed among the nuclear, plastid and mitochondrial compartments of the cell. While molecular-genetic studies have revealed the importance of plant mitochondrial function to plant reproduction, the molecular-genetic regulation of plant mitochondrial processes is poorly understood. The overarching goal of this research project is to address these deficiencies through fundamental research, so that new strategies to genetically modify and improve crops can be developed. We will identify mitochondrial genes and processes that condition mitochondrial dysfunction and mitochondria-signaled cell death pathways culminating in pollen sterility. Through molecular investigations of pollen sterility and fertility restoration in the CMS-S system of maize, we will identify nuclear genes that govern expression of the mitochondrial genetic system and we will learn the specific roles that these nuclear genes perform in the mitochondria. In the longer term, this information is expected to lead to new strategies for the manipulation of mitochondrial function for enhanced crop plant performance and for the control of pollen development in crop plant species.