

FLORIDA EXTENSION
INITIATIVE 1:
INCREASING THE SUSTAINABILITY, PROFITABILITY, AND
COMPETITIVENESS OF AGRICULTURAL AND HORTICULTURAL
ENTERPRISES

STATEWIDE EDUCATIONAL PROGRAMS IN SUSTAINABILITY OF PRODUCTION SYSTEMS AND
ALTERNATIVES

INTEGRATED PEST MANAGEMENT (IPM)

SITUATION

Increasing the sustainability, profitability and competitiveness of Florida agriculture and horticulture is becoming increasingly difficult as more invasive arthropod, plant pathogen, weed, nematode, and vertebrate pests invade the state (Oerke 2006, Dodds et al 2014). New and established species rapidly become resistant to pesticides and cannot be managed chemically (Tiwari et al 2011, Norsworthy et al. 2012). Unfortunately, protection of plants using an integrated pest management (IPM) approach also is particularly challenging in Florida because of the mild and variable climate, high number of farms, and diversity of crops. Pest management is more challenging when farms are close to urban areas, and people can be exposed to agricultural pesticides. The number of semi-urban small farms is increasing in Florida, now over 90% of all farms are classified as small, <\$250,000 annual sales (Gaul et al 2015). Many small farms in Florida are operated by limited resource farmers, often by women and minorities (USDA 2012, Tackie et al. 2009). Thus, significant pest problems are occurring more frequently and causing greater damage on all kinds of farms, and in communities and natural areas. This situation has created the following ten critical issues:

- Increasing threats and control costs for current and emerging invasive pests (Pimentel et al. 2005, Dodds et al. 2014)
- Too much reliance on pesticides and not enough alternatives (Chandler et al. 2011; Leo and Pintureau 2013; Fishel 2016)
- Increased pest resistance to pesticides (Tiwari et al. 2011, Norsworthy et al. 2012)
- Non-sustainable impacts of agriculture, including pest management (Godfray et al. 2010, Foley et al. 2011)
- Benefit/cost data on pest management options is lacking (Naranjo et al. 2015, Alvarez et al. 2016; Mhina et al. 2016)
- IPM plans with appropriate pest management practices are infrequently adopted (Schut et al. 2014, Klerkx et al. 2012)
- Over taxed pest diagnostics and management support (Miller et al. 2009, Palmateer et al. 2012)
- Funding for faculty with expertise in sustainable pest management has declined (Krell et al. 2016; McDowell 2004)
- IPM education and training programs and materials are inadequate (Tackie et al. 2009, Resel and Arnold 2010)
- Funding has decreased for innovative solutions to pest problems (Beddington 2010; Birch et al. 2011, Schut et al. 2014)

IPM is an ecosystem-based, socially acceptable, environmentally responsible, and economically viable approach to crop protection that focuses on long-term prevention of damage that can be caused by pests and diseases. A combination of techniques is employed such as biological control, habitat manipulation, modified cultural practices, and use of resistant varieties (USDA 2013). Support for long-term IPM research and Extension is becoming increasingly difficult to obtain as funding shifts to more immediate problems, such as the greening plague currently facing the Florida citrus industry. More resources should be invested in maintaining the infrastructure to plan for new pests and diseases, and respond intelligently. Resources are needed to develop pest management plans and rapidly detect pests before associated problems escalate. The investment in pest and disease prevention is minimal compared with emergency programs that are conducted in reaction to invasive pest outbreaks or disease epidemics, and is miniscule compared with the losses. For example, the current level of public and private investment in tickborne disease research and development in the U.S. is less than \$55 million and does not match the scale of the threat, which is estimated to exceed \$3 billion a year in medical costs and lost productivity (Anonymous 2016).

To assure that IPM action is rapid and appropriate, UF/IFAS established plant pest diagnostic clinics and networks, such as the Florida Plant Diagnostic Network (FPDN) and the Distance Diagnostic and Identification System (DDIS) that collaborate with the Southern

Plant Diagnostic Network (SPDN) and the Florida Department of Agriculture and Consumer Services (Palmateer et al. 2012). All capabilities of Florida's plant pest and disease diagnostic system will be fully operational when linked to First Detector Training designed to minimize grower plant protection costs and prevent the establishment of new invasive pests and diseases. This will be accomplished by increasing the speed, accuracy and effectiveness of local plant pest and disease scouting and identification, increasing high-risk sample submission, enhancing first detector and diagnostic capabilities, providing resources for appropriate sample submission, assuring rapid digital and actual specimen delivery, enhancing the Florida Pest Diagnostic System, and revitalizing the Florida Pest Alert listserv. Coupled with this diagnostic network is an extensive on-line library of Electronic Digital Information Source (EDIS) publications. Unfortunately, however, a multitude of EDIS publications for growers have been archived rather than updated.

More effective, safe and sustainable IPM tactics must be developed for Florida growers, along with the training required for the tactics to be widely adopted before pest and disease problems become too difficult and expensive to manage. This will require stable, long-term support for the Extension IPM infrastructure and associated research (Leppla et al. 2009). Research priorities can be set based on risk assessments for global pests. The IPM tactics will provide effective, socially acceptable and environmentally responsible pest management that will increase the profitability of agriculture and horticulture in the state. UF/IFAS has invested in a comprehensive IPM Program, IPM Florida, that provides statewide, interdisciplinary and inter-unit coordination and assistance in IPM to protect agriculture, communities and the environment. Additionally, several IPM faculty positions have been established at key locations throughout the state. Coordination and collaboration should be encouraged in advancing IPM among UF/IFAS faculty members and our clientele to provide expert consultation, education and training, and written Extension information to protect Florida's agricultural and horticultural enterprises.

PROGRAM OBJECTIVES

1. Increase development and adoption of IPM systems (issues 1-6). Develop IPM plans for entire sites, such as farms, nurseries, ranches, neighborhoods, and municipalities, that increase adoption of effective pest management strategies, i.e., more efficacious, cost-effective, safe, and sustainable methods for managing pests. Measurable advancements can be achieved by: 1) Rapidly detecting and managing invasive pest species, 2) decreasing the inappropriate use of pesticides and developing alternatives, 3) Eliminating pesticide resistance by rotating modes of action and establishing untreated areas, and 4) Reducing non-sustainable impacts of agriculture, e.g., protecting non-target organisms such as pollinators and reducing unnecessary pest management input, e.g., by establishing action thresholds, and 5) Developing a means of obtaining accurate economic assessments of IPM benefits. The benefits of IPM can be demonstrated and measured but they generally are site-specific, requiring resources for quantification that are not currently available. Although difficult and time-consuming, it is critical to deliver sustainable IPM systems to protect human health and the environment. This is a long-term, crop by crop effort that should be accelerated.
2. Enhance pest identification and disease diagnostic services (issue 7). Provide accurate and timely pest identification and disease diagnostic services to target audiences. Increased utilization, efficiency and accuracy of diagnostic and identification services will be indicated by increasing the number of samples submitted by or through state and county faculty and the number of samples processed. Given additional resources, these services can accelerate the detection of new insects, pathogens, weeds, nematodes, and other pests entering the state of Florida. This is necessary to minimize pest outbreaks and disease epidemics that can be extremely costly to Florida agriculture. It will increase the sustainability, profitability, and competitiveness of agricultural and horticultural enterprises by reducing unnecessary pesticide applications due to misdiagnosis, misidentification, or pesticide resistance. This increased knowledge of and access to pest diagnostic services among clientele groups can be achieved within a year after the resources become available.
3. Increase funding for Extension IPM faculty and training programs (issues 8-10). Provide additional funding for IPM faculty with expertise in sustainable pest management to increase Extension IPM programming, e.g., technical assistance to demonstrate innovative solutions to pest problems and deliver additional IPM education and training programs. Continue to improve pesticide applicator license training, testing and continuing education, so target audiences can safely, legally and appropriately handle and apply pesticides. This will increase awareness of the environmental impact of pests and pest management in Florida. A measurable increase will occur in the adoption of IPM practices by anyone who applies pesticides by expanding delivery of education and training at UF/IFAS research and education centers, multi-county Extension centers, and county

Extension offices. The system is in place to make immediate progress but additional resources are needed to develop new content for educational materials and deliver the training.

Short-term Objectives – Changes in knowledge

Objective 1: At least 60% of farm managers, smallholder farmers, pest management professionals, agricultural advisors, and others will know how to access information on new and emerging pests.

Objective 1: At least 60% of farm managers, smallholder farmers, pest management professionals, agricultural advisors, and others will know about alternative IPM tactics for crops and landscapes.

Objective 1: At least 45% of farm managers, smallholder farmers, pest management professionals, and agricultural advisors, and others will know how to avoid pest resistance to pesticides.

Objective 1: At least 35% of farm managers, smallholder farmers, pest management professionals, agricultural advisors, and others will know the benefit/cost for pest management options for crops and landscapes.

Objective 2: At least 10% of farm managers, smallholder farmers, pest management professionals, agricultural advisors, and others will increase their knowledge of correct pest identification and diagnosis.

Objective 2: At least 60% of farm managers, smallholder farmers, pest management professionals, agricultural advisors, and others will know how to access available diagnostic services.

Objective 3: At least 10% of farm managers, smallholder farmers, pest management professionals, agricultural advisors, licensed pest management professionals, and others will increase their knowledge of available IPM education and training resources, including EDIS, and Pesticide Information Office resources.

Objective 3: At least 10% of licensed pest management professionals will increase their knowledge of correct pesticide application methods, applicator licensing laws in Florida, and pesticide safety.

Intermediate Objectives – Change in behaviors and practices

Objective 1: At least 15% of farm managers, smallholder farmers, pest management professionals, agricultural advisors, and others will develop sustainable IPM plans for their farms.

Objective 1: At least 15% of farm managers, smallholder farmers, pest management professionals, agricultural advisors, and others will implement IPM strategies and techniques in cropping and landscape systems.

Objective 1: At least 10% of farm managers, smallholder farmers, pest management professionals, agricultural advisors, and others will decrease unnecessary pesticide applications.

Objective 2: At least 25% of farm managers, smallholder farmers, pest management professionals, agricultural advisors, and others will use identification and diagnostic (IDD) services.

Objective 2: At least 25% of farm managers, smallholder farmers, pest management professionals, agricultural advisors, and others will report a reduction in crop losses due to utilization of IDD services.

Objective 2: At least 10% of farm managers, smallholder farmers, pest management professionals, agricultural advisors, and others will increase in the detection of new pests and pathogens through IDD services.

Objective 3: There will be a 5% increase in the number of licensed pesticide applicators in the state of Florida.

Objective 3: At least 10% of farm managers, smallholder farmers, pest management professionals, agricultural advisors, and others will report an increase in adherence to pesticide labels and safety provisions.

Objective 3: At least a 10% increase will occur in the number of continuing education credits given through UF/IFAS Extension programs to farm managers, smallholder farmers, pest management professionals, agricultural advisors, and others.

Objective 3: At least 15% of farm managers, smallholder farmers, master gardeners, master naturalists, pest management professionals, and others will report an increase in the use of electronic and traditional educational resources, including EDIS.

Long term Objectives – Impacts

Objective 1: At least 50% of farm managers, smallholder farmers, pest management professionals, agricultural advisors, and others will experience reduced impacts of invasive pests.

Objective 1: At least 50% of farm managers, smallholder farmers, pest management professionals, agricultural advisors, and others will have decreased pest management inputs, including pesticides, and increased profits due to adoption of IPM plans.

Objective 1: At least 50% of farm managers, smallholder farmers, pest management professionals, agricultural advisors, and others will enjoy a decrease in the non-target effects of pesticides and improved human health.

Objective 2: At least 50% of farm managers, smallholder farmers, pest management professionals, agricultural advisors, and others will have a significant reduction in the number of invasive pests in crops and landscapes.

Objective 2: At least 50% of farm managers, smallholder farmers, pest management professionals, agricultural advisors, and others will rapidly detect and minimize the damage caused by invasive pest species.

Objective 3: At least 90% of pesticide applicators will obtain and continuously maintain their licenses, assuring that pesticides are used appropriately.

Objective 3: At least 50% of farm managers, smallholder farmers, pest management professionals, agricultural advisors, and other pesticide applicators will know and practice the principles of IPM in crops and landscapes.

Target Audiences

- Conventional and organic agriculture and horticulture producers; farm managers and workers; smallholder farmers; food processors, distributors and retailers; importers and exporters; and consumers.
- Educators, including UF\IFAS faculty, staff and students, and county faculty members and their programs (Master Gardeners, Master Naturalists, Florida Yards & Neighborhoods, 4-H, schools, etc.).
- Licensed pest management professionals, pest control operators (PCOs), agricultural advisors and scouts, and turfgrass and ornamental plant pest managers.
- Unlicensed agricultural workers and pesticide handlers, farm workers, green industry employees, and homeowners.
- Agrochemical industry distributors, sales professionals, technical support personnel, and research and development staff.
- Government employees in federal, state, county and municipal organizations (FFWCC, FDACS, USDA, EPA, mosquito and water management districts, etc.).
- Policy makers and special interests groups, including elected officials, activists and lobbyists.

EDUCATIONAL METHODS

The Extension community is helping to protect Florida’s agricultural, urban and natural environments through an extensive system of educational programming for stakeholders in all 67 counties. Supporting the Extension agents is a cadre of Extension specialists

educated and trained in IPM. Coupled with this is an extensive on-line library of Electronic Digital Information Source (EDIS) publications. The UF/IFAS Pesticide Safety Education Program (PSEP) provides training and information to applicators on safe, environmentally sound pesticide application practices, personal safety, and regulations. PSEP also assists applicators in meeting state and federal certification and licensing requirements to use pesticides.

In the UF College of Agriculture and Life Sciences, IPM topics are taught in many courses and several units, e.g., Entomology and Nematology, Agronomy, Plant Pathology, Horticulture, College of Natural Resources and Environment, etc. In the Entomology and Nematology Department, IPM principles are taught in at least IPM 3022, ALS 3153 (ALS 5156) Agricultural Ecology, ALS 4161 (ALS 6166) Exotic Species and Biosecurity Issues, ALS 4162 (ALS 6935) Consequences of Biological Invasions, ALS 4163 Plant Resource Protection, ENY 3225C Principles of Urban Pest Management, ENY 3228 (ENY 5226C) Urban Vertebrate Pest Management, ENY 5223C Biology and ID of Urban Pests, ENY 4221 Termite Biology and Control, ENY 4228 Pesticide Application, ENY 4660 Medical and Veterinary Entomology, ENY 4905 (ENY 5236) Insect Pest Vector Management, ENY 5245 Agricultural Acarology, ENY5332C Urban Vertebrate Pest Management, ENY 5405 Insect Vector Plant Pathology, IPM 3022 Fundamentals of Pest Management, PMA 4570C Field Techniques in IPM, etc. Most of the Doctor of Plant Medicine program is IPM-oriented, as well. A graduate-level seminar in IPM also has been offered. Curriculum from these courses has been delivered within county Extension programs and via distance education. IPM content is included in UF/IFAS programs, such as Florida Yards and Neighborhoods and master gardener training. IPM modules also are available from the IPM³ distance education program (U. Minnesota), Entomological Society of America (BCE, ACE), American Society of Agronomy (Certified Crop Advisor- CCA), Certified Professional Agronomist (CP-Ag), Certified Professional Plant Pathologist, National Alliance of Independent Crop Consultants (Crop Certification), and State CCAs.

IPM education and training includes: Pest Prevention and Detection (prevent pest outbreaks through habitat manipulation and other cultural practices; gain experience with pest habitats, e.g., crops or buildings; know the life cycles of the host plants, pests and beneficial organisms; understand the ecology and adaptability of the organisms), Pest Identification and Management (utilize scouting and other monitoring techniques; accurately identify key pest and beneficial organisms; apply damage, economic and other action thresholds; design systems of mitigation that minimize environmental impacts), General Knowledge and Professionalism (practice safe and appropriate use of pesticides and other IPM tactics, know current laws and regulations pertinent to pest management, be able to rapidly access pest management information, be involved in pest management and related organizations). Many of these topics can be gleaned from EDIS publications, the scientific literature, Extension fact sheets, handbooks, slide sets, videos, mobile apps, websites, email lists, blogs, other social media, and so forth.

Training is delivered to target audiences through in-house Extension programming, invited presentations at cooperator's educational conferences, scientific meetings (Florida Entomological Society, Florida State Horticultural Society, etc.), trade shows, workshops, and other functions. Most of these venues emphasize plant disease diagnostics, insect and weed identification, and nematode assays, and describe access to the UF/IFAS diagnostic laboratories where identifications and diagnoses are provided through email, telephone, and onsite consultation with state and county faculty, and Extension volunteers such as master gardeners. Pest management Extension programming utilizes diverse methods to deliver research-based content, training and services. Educational materials include video libraries, digital apps for pest identification and decision making, intensive IPM schools (e.g., Pest Management University), demonstrations, field days and plots, electronic publications (EDIS, including IPM guides), insect pest identifications, disease diagnoses, specialized tutorials, in-service trainings, pesticide applicator licensing and continuing education credits, IPM certifications, and "how to" workshops for pest identification and decision making (e.g., Suwannee Valley Agricultural Extension Center and Hastings Agricultural Extension Center).

RESULTS

Objective 1: At least 60% of farm managers, smallholder farmers, pest management professionals, agricultural advisors, and others will know how to access information on new and emerging pests.

- Outcome: Increased knowledge of available IPM education and training resources, including EDIS.
- Indicators:
 - Quantitative increase in knowledge recorded in program evaluations.
 - Participant success in accessing IPM education and training resources.
 - Quantitative measures of rapid detection and reduced spread and impact of invasive pests.

- Participant success stories detailing the rapid detection and control of invasive pests.

Objective 1: At least 60% of farm managers, smallholder farmers, pest management professionals, agricultural advisors, and others will know about alternative IPM tactics for crops and landscapes.

- Outcome: Increased knowledge of available IPM tactics and a decrease in crop and landscape losses.
- Indicators:
 - Quantitative increase in knowledge recorded in program evaluations.
 - Participant success in adopting IPM tactics and decreasing losses.
 - Quantitative increase in developing sustainable IPM systems as recorded in program evaluations.
 - Documented decrease in unnecessary pesticide applications.

Objective 1: At least 45% of farm managers, smallholder farmers, pest management professionals, and agricultural advisors, and others will know how to avoid pest resistance to pesticides.

- Outcome: Increased knowledge of how to avoid pest resistance to pesticides.
- Indicators:
 - Quantitative increase in knowledge recorded in program evaluations.
 - Participant success in avoid pest resistance to pesticides.

Objective 1: At least 35% of farm managers, smallholder farmers, pest management professionals, agricultural advisors, and others will know the benefit/cost of pest management options for crops and landscapes.

- Outcome: Increased knowledge of how to calculate benefit/cost of pest management options for crops and landscapes.
- Indicators:
 - Quantitative increase in knowledge recorded in program evaluations.
 - Participant success in calculating benefit/cost for pest management options.
 - Quantitative increase in profits due to the adoption of sustainable management tactics.
 - Participant success stories detailing the increase in profits due to the sustainable management of pests.

Objective 2: At least 10% of farm managers, smallholder farmers, pest management professionals, agricultural advisors, and others will increase their knowledge of correct pest identification and diagnosis

- Outcome: Increased knowledge of how to correctly identify pests and diagnose pest problems.
- Indicators:
 - Quantitative increase in knowledge recorded in program evaluations.
 - Participant success in correctly identifying pests and diagnosing pest problems.
 - Quantitative decrease in pest management inputs due to misidentification and misdiagnosis.
 - Participant success stories detailing the decrease in pest management inputs due to misidentification and misdiagnosis.

Objective 2: At least 60% of farm managers, smallholder farmers, pest management professionals, agricultural advisors, and others will know how to access available diagnostic services.

- Outcome: Increased use of identification and diagnostic (IDD) services.
- Indicators:
 - Quantitative increase in accessing available diagnostic services.
 - Quantitative increase in the detection of new pests and pathogens through IDD services.
 - Participant success in reducing crop losses through utilization of IDD services.

Objective 3: At least 10% of farm managers, smallholder farmers, pest management professionals, agricultural advisors, licensed pest management professionals, and others will increase their knowledge of available IPM education and training resources, including EDIS, and Pesticide Information Office resources.

- Outcome: Increased knowledge of how to access available IPM education and training resources.
- Indicators:
 - Quantitative increase in number of times education and training resources are accessed.
 - Participant success in accessing IPM education and training resources.

Objective 3: At least 95% of licensed pest management professionals will increase their knowledge of correct pesticide application methods, applicator licensing laws in Florida, and pesticide safety.

- **Outcome:** Increased knowledge of pesticide application methods, applicator licensing laws in Florida, and pesticide safety.
- **Indicators:**
 - Quantitative increase in knowledge recorded in program evaluations and license examinations.
 - Participant success rate in passing license examinations.
 - Quantitative increase in adherence to pesticide labels and safety provisions as recorded in program evaluations.
 - Quantitative increase in the number of continuing education credits given through UF/IFAS Extension programs.
 - Detailed success stories about decreased non-target effects of pesticides as recorded in program evaluations.

NEEDS

- Improve pest management guides (EDIS) to make them more comprehensive and useful to Extension faculty and clientele, including searchable tables for updating pesticide availability lists.
- Improve the "Solutions for Your Life" website pest management content and links (<http://solutionsforyourlife.ufl.edu/>).
- Increase communication and collaboration among interdependent UF/IFAS pest management programs.
- Create a formal coordinating mechanism for new and established IPM faculty.
- Have more flexibility to rapidly mobilize state and county Extension faculty to address emerging pests.
- Provide assistance in preparing interdisciplinary IPM grant proposals.
- Place greater emphasis on focused IPM projects with measurable objectives and deliverables.
- Increase incentives and support for new, innovative IPM projects in addition to ongoing work.
- Provide a mechanism to coordinate current UF/IFAS resources (personnel and programs) to solve specific pest problems, including up-to-date and searchable databases of pests, resources, and experts.
- Develop and disseminate resources for pest identification and management decision making.
- Develop and implement methods for evaluating effectiveness and cost of pest management practices.
- Provide funding and staffing for the UF/IFAS Statewide IPM Program to implement training, education and Extension programs.

SUPER ISSUES

- Expand the UF/IFAS Statewide IPM Program (IPM Florida) to adequately address the critical needs above and others.
- Significantly increase the awareness, knowledge, and adoption of IPM options for protecting food systems, human health and the environment.
- Increase the capability for IPM to enhance resource sustainability and conservation in Florida communities.

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Logic Model: Initiative 1 Priority Work Group 1.4 Integrated Pest Management

| Situation | Priorities | Inputs (what we invest) | Outputs Activities (what we do) | Outputs Participation (who we reach) | Outcomes Short term | Outcomes Medium term | Outcomes Long term |
|---|--|---|--|--|--|--|--|
| <p>Plant diseases and insect pests cause billions of dollars of damage to agricultural and horticultural crops each year.</p> <p>Pesticides and biologicals are effective and readily available to mitigate effects of some of these plant problems, but represent investment and have inherent risks.</p> <p>Stakeholders need research based IPM guidance, education, and services to maximize sustainability and profitability</p> | <p>Provide disease and pest diagnostic and identification services</p> <p>Pesticide applicator training and education</p> <p>Support and demonstrate ongoing IPM systems</p> <p>Training and education in the use of biologicals</p> | <p>Plant disease diagnostic clinics, Insect and weed ID labs, and nematode assay lab support services.</p> <p>Applied IPM research efforts to generate management data.</p> <p>State and county faculty effort to develop and deliver IPM trainings, services, and educational resources in partnership with state and commodity clientele base.</p> <p>Statewide IPM program</p> | <p>Develop and deliver research-informed IPM information to stakeholders</p> <p>Provide diagnostic and ID reports with IPM principles</p> <p>Provide pesticide applicator certification</p> <p>Conduct training and education regarding biologicals</p> <p>Survey clientele for change in knowledge, behavior, and economic impact of IPM services and resources</p> | <p>Agriculture and horticulture producers</p> <p>Educators, pest management professionals, agricultural workers, agrichemical professionals, federal and state government organizations, policy makers, households</p> | <p>Increased access to information on invasive pests</p> <p>Increased knowledge of IPM tactics</p> <p>Reduced pesticide resistance</p> <p>Knowledge of cos/benefit of IPM</p> <p>Increased ability to ID and diagnose pests</p> <p>Increase in IPM education and training</p> <p>Increase motivation to use diagnostic and ID services</p> <p>Provide pesticide applicator training and licenses</p> <p>Provide training in effective use of biologicals</p> | <p>Decrease unnecessary pesticide applications</p> <p>Decrease crop losses</p> <p>Increase detection of invasive pests and diseases</p> <p>Increase sample numbers of diagnostic and ID service labs</p> <p>Increase adoption and utilization of IPM principles and practices by clientele</p> <p>Increase compliance with pesticide applicator regulations</p> <p>Decrease environmental impact through IPM practices</p> | <p>Reduce environmental impact of invasive pests and diseases</p> <p>Decrease pest management inputs and costs</p> <p>Increase the sustainability of ag and hort enterprises</p> <p>Increase the profitability of ag and hort enterprises</p> <p>Increase knowledge and practice of IPM principles</p> |

Assumptions: Florida will remain a sentinel state with many existing plant pest and disease problems as well as imminent threats from

exotic insects and pathogens. New applied research will continue to inform and refine management recommendations to increase efficacy and sustainability while decreasing associated costs and environmental impacts. The University of Florida will continue to invest in and subsidize diagnostic and identification service laboratories.

External Factors: Continued competitive research dollars to support applied IPM projects. Changes in state and federal rules, laws, and regulations, and their enforcement, that govern allowable pesticides and application methods for IPM.

Evaluation: Outcomes, particularly short term, will continue to be reported in individual faculty's annual reports. UF-wide usage statistics for diagnostic and ID service laboratories, as well as pesticide applicator trainings, should be compiled and tracked to monitor for increased use and awareness of IPM resources by clientele directly involved with pest management decisions. These reports should supplement medium-term impact assessments of individual faculty programs. Long-term impacts should be elucidated from follow-up clientele surveys and substantiated with state-wide economic and environmental data.

Team Members: Initiative 1 Priority Work Group 1.4 Integrated Pest Management

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|--------------------|---------------------|
| Vanessa Campoverde | Michelle Samuel-Foo |
| Monica Elliott | Bill Schall |
| Martha Glenn | Brent Sellers |
| Kelly Greer | Phil Stansly |
| Erin Harlow | Blake Thaxton |
| Phil Harmon | Bryan Unruh |
| Bob Hochmuth | Bonnie Wells |
| Adrian Hunsberger | Oscar Liburd |
| Phil Koehler | Calvin Otero |
| Norm Leppla | Pasco Avery |
| Catharine Mannion | Amanda Hodges |
| Henry Mayer | Faith Oi |
| Christian Miller | Adam Dale |
| Anita Neal | Joyce Merritt |
| Juanita Popenoe | Ethan Carter |