

V(A). Planned Program (Summary)

Program # 2

1. Name of the Planned Program

Climate Change - Integrated Management of New and Emerging Pest and Diseases

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
211	Insects, Mites, and Other Arthropods Affecting Plants			19%	
212	Diseases and Nematodes Affecting Plants			27%	
215	Biological Control of Pests Affecting Plants			20%	
216	Integrated Pest Management Systems			34%	
	Total			100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2014	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	2.7	0.0
Actual Paid	0.0	0.0	1.5	0.0
Actual Volunteer	0.0	0.0	0.7	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	969193	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	715661	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

The Integrated Management of New and Emerging Pest and Diseases at PRAEXS support the enhancement of natural enemies, biocontrol and mitigation of new pest introductions. The Center for Invasive Species and Quarantine in Puerto Rico evaluated horticultural oil and imidacloprid and they were shown to be compatible with the release of natural enemies to control *H. pugnans*, offering a selectivity effect to a wasp *L. hypogaeococci* and a coccinellid predator, *S. flavifrons*. A series of alternative practices were disseminated to banana and plantain growers and extension educators for nematode control. Stakeholders acquired knowledge of effective management of nematodes such as a short rotation scheme with velvetbean and organic matter application, which will decrease the use of commercial nematicides. Results will contribute to increasing the cost-benefit ratio of nematode control and decreasing the risks for human health and the environment associated with the use of chemical nematicides.

Small growers were the target audience for the coffee berry borer integrated control recommendations that include keeping the CBB population below the economic threshold levels by adopting integrated management strategies such as anticipating and continuously monitoring pest outbreaks, maintaining optimum shade, pruning of coffee bushes, harvesting and processing the berries and using biological control with *Beauveria bassiana*. These results were disseminated to agronomists and farmers in professional and community meetings.

Few studies in Puerto Rico have determined the presence of phytoplasma from important crops. Using end point PCR with universal and specific primers, phytoplasmas were identified in periwinkle, pigeon pea, citrus, coffee and tabebuia. Insect genera of *Empoasca kraemeri*, *Melornemis antillarum* and *Colpoptera maculifrons* were positive for PPWB phytoplasma based on results from conventional PCR and DNA sequence analysis. These findings indicate that these insects fed upon the aforementioned plant species, and may act as potential phytoplasma vectors in the field.

Approximately, 200 stakeholders from a total of 466 that visited the Plant Disease and Insect Clinic received recommendations about the management of new and emergent diseases in 16 different agricultural crops. Emphasis was on reducing the use of insecticides in horticultural crops affected by viral diseases and the profitability and environmental impact of the practices. The citrus orchards of Adjuntas and the "Citrus Germplasm Bank of Isabela" substations were evaluated for graft-transmissible diseases. Observations of the parent material, phytosanitary status and vigor were carried out and citrus samples were collected, tested and found free of symptoms of graft-transmissible pathogens based on the initial visual inspection that included gummosis, citrus blight, citrus canker, citrus greening, decline, leprosis and evidence of unacceptable bud mutation. Laboratory analyses were carried out for Citrus Greening (CG), Citrus Tristeza Virus (CTV) and Citrus Variegated Chlorosis. Parent trees that were positive for CG and CTV were eliminated and healthy trees were covered with insect-proof screen. This program will distribute clean citrus material to growers.

2. Brief description of the target audience

- Extension specialists and agents

- Producers and commodity groups
- Researchers in the Vegetable Industry
- Academic programs faculty and students
- Federal and State Agricultural Agencies (PRDA, USDA/APHIS, USDA/ARS, USDA/NRCS).
- American Phytopathological Society (APS), Agronomy Society of America, Horticultural Society, Puerto Rican Agricultural Sciences Society, Entomological Society of America.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2014	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	348	466	250	250

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

Patent Applications Submitted

Year: 2014

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2014	Extension	Research	Total
Actual	0	10	10

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of 'Pest Management Strategic Plans' (PMSPs) developed

Year

Actual

2014 4

Output #2

Output Measure

- Number of peer-reviewed articles in major scientific journals resulting from program activities.

Year	Actual
2014	6

Output #3

Output Measure

- Peer reviewed articles in local Scientific Journals resulting from program activities.

Year	Actual
2014	4

Output #4

Output Measure

- Abstracts or oral presentations in professional scientific society meetings resulting from program activities.

Year	Actual
2014	12

Output #5

Output Measure

- Poster presentations in professional scientific society meetings resulting from program activities

Year	Actual
2014	10

Output #6

Output Measure

- Number of joint Research-Extension activities that include pest diagnostics and identification, use of reduced impact pesticides, or research on pesticide impact assessment on non-target beneficial organisms.

Year	Actual
2014	3

Output #7

Output Measure

- Number of program-sponsored scientific events, like symposia, topic conferences, and open houses

Year	Actual
2014	4

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of stakeholders with increased knowledge on emerging pests and aware of non-target pesticide effects (Short Term)
2	Number of persons who adopted reduced risk pesticides and practices
3	Number of farmers reporting decreased losses due to key and emerging pests
4	Number of stakeholders knowledgeable of climate changes issues and their importance in agricultural production.

Outcome #1

1. Outcome Measures

Number of stakeholders with increased knowledge on emerging pests and aware of non-target pesticide effects (Short Term)

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	250

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

New key pests, weeds and diseases are introduced each year into the island. Constantly evolving production systems pose new challenges to IPM as pest complexes change and adapt. There's a generalized lack of management knowledge among producers and even among extension agents and Department of Agriculture personnel. This lack of knowledge causes the use of unsuitable pesticides, the application of higher doses than needed and death of beneficial and non-target organisms. We need to address these environmental concerns and reinforce the use of newer, more environmentally sound crop management methods.

What has been done

Approximately 150 stakeholders that visited the Plant Disease Clinic received recommendations about the new and emergent diseases and their management in 16 different agricultural crops. Emphasis was given to reducing the use of insecticides in horticultural crops affected by viruses in hydroponics. In a CG workshop, 47 growers and extension specialists received information in the nutritional program for the management of citrus greening and psyllid control tactics.

Results

Farmers are increasingly aware of alternative pest and disease management methods. Coffee growers, for example, learned the following control strategies against the coffee berry borer (CBB): keeping the CBB below the economic threshold, continuously monitoring the CBB, maintaining the optimum shade, pruning the coffee bushes, using the biocontrol *Beauveria bassiana*, and the timely harvesting and processing of the coffee berries.

4. Associated Knowledge Areas

KA Code	Knowledge Area
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Diseases and Nematodes Affecting Plants
215	Biological Control of Pests Affecting Plants
216	Integrated Pest Management Systems

Outcome #2

1. Outcome Measures

Number of persons who adopted reduced risk pesticides and practices

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	18

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Diseases and Nematodes Affecting Plants
215	Biological Control of Pests Affecting Plants
216	Integrated Pest Management Systems

Outcome #3

1. Outcome Measures

Number of farmers reporting decreased losses due to key and emerging pests

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Growers increasingly visit plant disease and insect detection facilities in Juana Diaz in search of diagnostics and recommendations for diseased crops.

What has been done

The Plant Disease and Insect Clinic in Juana Diaz engages growers who visit the clinic in the process of disease detection and identification. This is essential for growers and general public acquisition of knowledge and to promote ownership of the disease and pest detection process. Disease and Pest detection has been fast and accurate and improvement in the methods used for pathogen identification is reflected in the number of new diseases identified, and in the number of publications submitted and published.

Results

The largest producer of tomatoes and several hydroponic producers of lettuce, tomatoes and peppers in Puerto Rico have adopted the recommendations issued for Tomato Chlorotic Spot Virus (TCSV) prevention. By scouting the thrips vector and producing seedlings in insect-proof facilities plus the eradication of symptomatic plants, losses were decreased in the hydroponic facilities and less incidence of TCSV was reported in field tomatoes.

4. Associated Knowledge Areas

KA Code	Knowledge Area
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211	Insects, Mites, and Other Arthropods Affecting Plants
212	Diseases and Nematodes Affecting Plants
215	Biological Control of Pests Affecting Plants
216	Integrated Pest Management Systems

Outcome #4

1. Outcome Measures

Number of stakeholders knowledgeable of climate changes issues and their importance in agricultural production.

Not Reporting on this Outcome Measure

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Other (Reduction of AES personnel)

Brief Explanation

While the continued stagnation of the Puerto Rican economy affects everyone it is increasingly difficult to keep pace with the rapid entry of new diseases in the island with a reduced faculty roster due to retirement and very few new hirings at the university. Personnel limitations are perhaps the biggest obstacle we have for making more progress toward meeting our goals.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

{No Data Entered}

Key Items of Evaluation

{No Data Entered}