

Integrated Pest Management Strategic Plan for Guam (September 1, 2013 to August 31, 2016)

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Cooperative Extension Services

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This strategic plan is the result of a FY2012 Extension Integrated Pest Management grant titled:
“Extension Integrated Pest Management Coordination Program Development for Guam”

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Cover Picture: Participants listen during presentations at an IPM strategic planning session.

Part 1: Summary of Events and Methods

1.0 Introduction

In FY2012 Guam was awarded an EIPM-Coordination Development Grant. The EIPM-Coordination Development Grant Coordinator conducted three IPM strategic planning sessions to provide stakeholders an opportunity to identify institutional strengths and weaknesses at the University of Guam and to develop IPM program goals that could be used to position it for future IPM competitive funding. Stakeholders engaged in the strategic planning sessions involved individuals who deal with any aspect of IPM from government agencies, commercial agriculture production and residential gardening. The primary goals were to provide stakeholders an opportunity to identify institutional strengths and weaknesses at the University of Guam and to develop IPM program goals that could be used to position it for future IPM competitive funding.

Stakeholder topics were limited to agriculture production, residential gardens, and public policy. Goals of the EIPM-Coordination Development Grant were to strengthen multi-directional flow of EIPM information for local and federal agencies in Guam through stakeholder involvement in strategic planning; to position the Guam EIPM program for future competitive funding sources by involvement of commercial agriculture producers in strategic planning; and to position Guam EIPM program for future competitive funding sources by involvement of residential gardeners in strategic planning.

2.0 Strategic Planning Session 1: Strengthening Multi-Directional Flow of IPM Information

On November 7, 2012, a strategic planning session focused on strengthening multi-directional flow of IPM information with UOG-EIPM and local and federal agencies was held. Thirty stakeholders representing nine agencies and public groups were present. Groups represented included UOG-CES, Western Pacific Tropical Research Center (WPTRC), Guam Department of Agriculture (DOAg), Department of Land Management (DLM), USDA Animal and Plant Health Inspection Service (APHIS), Guam Department of Parks and Recreation (GDPR), Northern Marianas College Cooperative Research, Extension and Education Service (NMC-CREES), Landscape Management Systems (LMS), and Leo Palace Resort, as shown in Table 1. Objectives of this workshop for local and federal agencies were to:

1. Inform agencies of existing IPM practices and its current level of interaction between UOG-CES and themselves.
2. Identify the strengths and weaknesses of communication of UOG-EIPM information between the University of Guam CES and other agencies.
3. Identify how to improve communication between stakeholders.
4. Assess the needs of UOG-EIPM
5. Engage stakeholders in strategic planning for the UOG-EIPM program.

Presentations on Integrated Pest Management National Roadmap, strategic planning, NIFA logic Model, and the existing IPM practices and interaction between UOG-CES and other agencies were provided.

Table 1: Participation at the workshop on Strengthening Multi-directional Flow of IPM Information

Agency	Count	Percentage
UOG	12	40%

AGENCIES	13	43%
LANDSCAPE/GOLF COURSE	3	10%
OFF-ISLAND AGENCIES	2	7%

Attendees were composed of stakeholders from the following agencies the Guam Cooperative Extension Service, Western Pacific Tropical Research Center (WPTRC), Guam Department of Agriculture (DOAg), Department of Land Management (DLM), USDA Animal and Plant Health Inspection Service (APHIS), Guam Department of Parks and Recreation (GDPR), Northern Marianas College Cooperative Research, Extension and Education Service (NMC-CREES), Landscape Management Systems (LMS), and Leo Palace Resort.

Attendance from this workshop can be found in Appendix B.

2.1 Evaluation Results

At the conclusion of the strategic planning session participants completed an evaluation questionnaire to measure various aspects of the workshop (Appendix C). Over 77% of respondents rated objectives, expectations, speakers, moderators, venue, catering, organization, pace, and relevance as a 4 or greater (where 1=strongly disagree and 5=strongly agree). Frequently cited comments included:

Workshop improvements needed:

- Better air conditioner
- Invite other agencies
- Be specific on group project goals
- Increase and update content
- More time for workshop
- Provide better information before workshop
- Clarify objectives
- Improve instructional methods

Least valuable aspect of the workshop:

- The need to establish action plan
- The workshop will be better with more days

Most valuable aspect of the workshop:

- Acknowledgement of the need to communicate
- Very informative
- Active participation
- Discussion between participants

2.2 Focus Group Summary

Subjects identified by breakout groups included production agriculture, natural resources and recreational environments, residential and public areas, and public policy. Additionally, participants interacted to identify the strengths and weaknesses of the current UOG-EIPM program and methods to enhance communication between themselves and UOG-CES. Following breakout groups, an appointed group member conducted presentations summarizing their group's discussions through the

use of paper easels. Table 2 summarizes the information on the paper easels and notes taken during presentations.

Table 2: Workshop A Focus Group Summary

PRODUCTION AGRICULTURE	
Approach	NIFA Logic Model
Situation	1) Sweet Potato Co-Op <ul style="list-style-type: none"> - Decrease import of sweet potato to Guam - Destruction due to sweet potato weevil - Competition from imports - Cost of production 2) Inputs <ul style="list-style-type: none"> - From UOG faculty - Infrastructure - Funding - From farmers
Activities	1) UOG faculty <ul style="list-style-type: none"> - Develop research methods to control sweet potato weevil - Educate farmers - Local promotion for Guam sweet potato - Pool resources to decrease costs
Outputs	<ul style="list-style-type: none"> • New methods and publications for control of sweet potato weevil • Increase public awareness of Guam sweet potato • Increase farmer's capabilities by decreasing spending • Increase farmer's skills in production of sweet potato
	\$20,000 should be used for education and regular newspaper inserts
NATURAL RESOURCES AND RECREATIONAL ENVIRONMENTS	
Approach	Multi-directional flow questions
Question 1	What are the <i>weaknesses</i> in the lines of communication between the Cooperative Extension and the agencies involved with IPM? <ul style="list-style-type: none"> - Needs more public outreach - Lack of collaboration between agencies (needs a MOA or MOU)
Question 2	What are the <i>strengths</i> in the lines of communication between the Cooperative Extension and the agencies involved with IPM <ul style="list-style-type: none"> - IPM is an establish program - Many people with expertise to provide input
Question 3	What can we do to improve collaboration and communication between individuals, organizations, and government agencies? <ul style="list-style-type: none"> - Start educational task force with these agencies <ul style="list-style-type: none"> - DOAg, DPHSS, Env. Health Div, DOE, Archdiocese, DCQ, GAA, PAG, DPR, Media, Invasive Species Council - Mapping of areas impacted by pests <ul style="list-style-type: none"> - Impacts to natural environment - Cost
Output	How can IPM assist in Natural Resources and Recreational Environments <ul style="list-style-type: none"> - Keep invasive species out of these areas through monitoring and regular

	<ul style="list-style-type: none"> site visits - Implement native species in restoration areas - Create more programs to promote native species (trees) - Encourage volunteers and partners for joint efforts - More public outreach - Prevent wild fires as they kills native species and promote invasive, non-native species take-over. - IPM can minimize effects of pests through <ul style="list-style-type: none"> - Outreach: schools and presentations - Workshops - Media - IPM can reduce environment degradation by <ul style="list-style-type: none"> - Planting native species - Eradicate introduce and invasive species - Education - Control - Site visits and monitoring
RESIDENTIAL AND PUBLIC AREAS	
Approach	Multi-directional flow questions
Question 1	<p>What are the <i>weaknesses</i> in the lines of communication between the Cooperative Extension and the agencies involved with IPM?</p> <ul style="list-style-type: none"> - Identifying which department/agency to go to with issues or concerns for assistance - Lack of involvement/presence - Understaffed - No priority
Question 2	<p>What are the <i>strengths</i> in the lines of communication between the Cooperative Extension and the agencies involved with IPM</p> <ul style="list-style-type: none"> - Commitment
Question 3	<p>What can we do to improve collaboration and communication between individuals, organizations, and government agencies?</p> <ul style="list-style-type: none"> - Improve collaboration and communication - Pass out pamphlets to homes if stakeholders cannot attend meetings - Create fact sheets - More workshops - Communicate more through word of mouth – emails - Promote washing vegetables
	\$20,000 should be used for educational workshops at local communities, creation of fact sheets and a weekly newsletter
PUBLIC POLICY	
Approach	Multi-directional flow questions
Question 1	<p>What are the <i>weaknesses</i> in the lines of communication between the Cooperative Extension and the agencies involved with IPM?</p> <ul style="list-style-type: none"> - Needs more public outreach - Lack of collaboration between agencies (needs a MOA or MOU) - No integration with regulatory agencies, technical advice, and policy

	makers for community
Question 2	<p>What are the <i>strengths</i> in the lines of communication between the Cooperative Extension and the agencies involved with IPM</p> <ul style="list-style-type: none"> - IPM is an establish program - Some public outreach - Sharing
Question 3	<p>What can we do to improve collaboration and communication between individuals, organizations, and government agencies?</p> <ul style="list-style-type: none"> - Acquire more funding to improve lack of enforcement - Update laws and enforce existing laws - Create MOU/MOA (Memorandum of Understanding/Agreement) between agencies - Find money to establish framework for IPM - Establish QRF (quick reaction force): seek funding from participating agencies - Revise current policies to have more legal enforcement - Educate school administrators on the value of teaching IPM principles - Possibly staff by Dept. of Agriculture
	\$20,000 should be used to establish the framework and education

2.3 Survey Results

Surveys were given to at the beginning and end of the strategic planning session to assess knowledge gained of Integrated Pest Management, IPM strategies, benefits, and control methods, IPM National Roadmap, hazards, core strategies, and tactics (Appendix D). Results found 45% of participants to have an increase in knowledge.

2.4 Group Recommendations for Strategic Planning

Strengths of the current UOG-EIPM program identified by stakeholders included the large number of experts who are committed and highly trained, and the sharing and collaboration between agencies, although it can be further enhanced. Weaknesses in communication consist of the lack of public outreach and collaboration between agencies, the lack of an EIPM function directory for department/agency the community contacts, and the understaffing in all agencies.

Specific recommendations by stakeholders for the EIPM Coordination Program proposal included the need for more public outreach and collaboration, and improved communication. To improve communications between agencies, it was suggested that an educational task force be established. One possible function of the task force would be to map areas of pests and their impacts on the island environment.

2.5 Pictures



Figure 1: A group picture of some of those who attended the strategic planning session 1.



Figure 2: Dr. Schlub presents on UOG-EIPM and the National Roadmap during the strategic planning session 1.



Figure 3: Belmina Soliva summarizes the discussion for Natural Resources and Recreational Environments focus group at strategic planning session 1.

3.0 Strategic Planning Session 2: IPM and the Commercial Agriculture Producers

A second strategic planning session involving 28 commercial agriculture producers occurred on December 19, 2012. The goal of this workshop was to involve commercial agriculture producers in strategic planning to identify institutional strengths, and to develop IPM program goals that address pest control needs and concerns of Guam farmers. Objectives of this workshop for local commercial producers were to:

1. Identify the needs and concerns of local commercial producers.
2. Engage stakeholders in strategic planning for the UOG-EIPM program.

Presentations were given on IPM and the IPM National Roadmap; existing IPM practices of UOG-CES; pest issues with locally grown tomato, bean, and cucurbit crops; and current pesticide regulations. Presentations were followed by a focus group breakout session.

3.1 Farmer's Survey Form

Each participant completed a farm survey requesting information on crops grown, farm location, cultural practices, pests, and pesticide use. Tables 3 - 9 show the results of the information gathered: Crops commonly grown (Table 3), Farm location (Table 4), Crop Rotation (Table 5), Mulch Use (Table 6), Pest Scouting (Table 7), and Common Pests (Table 8).

Table 3: Crops commonly grown

Rank	Crop	Rank	Crop
1	Cucumber	10	Avocado
2	Eggplant	11	Okra
3	Pepper	12	Papaya
4	Banana	13	Watermelon
5	Bittermelon	14	Cacao
6	Taro	15	Bitternut
7	Coconut	16	Citrus
8	Tomato	17	Mango
9	Beans		

Table 4: Farm location

Farm Location	(%)
Northern Guam	67
Southern Guam	33

Table 5: Crop Rotation

Crop Rotation	(%)
Yes	71
No	24
Not specified	6

Table 6: Mulch Use

Mulch Used	(%)
Yes	59
No	29
Not specified	12

Table 7: Pest Scouting

Scout for Pest	(%)
Yes	100
No	0
Not specified	0

Table 8: Common Pests

Common Pest Problem		(%)
Fungus	<i>Fusarium</i> , target leaf spot, black sigatoga, rust ring	32
Disease	Bunchy top, banana wilt, bacterial wilt, anthracnose, wilt	18
Insect	Aphid, hornworm, leaf roller, flea hopper, Japanese beetle, looper, army worm, lady bug, thrips, leaf miner, ants, white fly	35
Other	Chicken, pig, stem-rot, root knot nematodes	15

Table 9: Pesticide Use

Pesticide Used	(%)
Insecticide	42
Fungicide	11
None	11
Other	5
Not specified	32

Attendance from this workshop can be found in Appendix B.

3.2 Evaluation Results

Participants were given a workshop evaluation form to fill-out upon completion of the workshop (Appendix C). Eighty percent (80%) or more of evaluation respondents rated information, speaker quality, moderator assistance, organization, catering, venue facilities, and overall benefit from the workshop as a 4 or greater (where 1=strongly disagree and 5=strongly agree). Additionally, 94% or more of attendees found the breakout session beneficial to them. The most commonly cited comments included:

Areas of the workshop participants said they would like to see more improvement on included:

- Increase the content covered
- Allot more time for the workshop
- Update the content covered
- Improve organization

Some General Comments:

- Informative and enriching.
- Glad I'm here.
- Workshop helped farmers learn more and get input and output on maintaining their crops.
- Learned from other farmers input about different problems.
- It was very helpful.
- I learned something.
- Help established a network system of farmers.
- Overall training was excellent.
- Please continue to provide these types of training.
- Overall good job.
- More time for interaction from participants.

3.3 Focus Group Summary

At the conclusion of presentations, stakeholders were divided into focus groups. Group discussions were divided according to chemical & biological control and record keeping, site selection and soil preparation, and monitoring, thresholds, forecasting, and pest trapping. Table 10 summarizes easel board annotations and group presentations by group members following focus groups discussions.

Table 10: Workshop B Focus Group Summary

CHEMICAL & BIOLOGICAL CONTROL, AND RECORD KEEPING	
Issues and Concerns	<p>CHEMICAL</p> <ul style="list-style-type: none"> ● Core training: training of pesticide usages. When available and how often ● Organic pesticides don't need certification ● Use and abuse of pesticides ● Issues: <ul style="list-style-type: none"> - Chemical Core testing (\$40) - Wrong chemical use - Wrong application: must always read the labels ● Inputs: <ul style="list-style-type: none"> - Provide training more often: core and private pesticide workshop - Read the label and warning signs to ensure the proper equipment and supplies. ● Ways to resolve <ul style="list-style-type: none"> - Have more training periods - RFP from GEPA to solicit facilitation of training - Private: \$50 for exam, and \$15 for card - Know your target insect - Education - Make sure chemicals are properly used - Enforcement must be practiced by EPA, DOAg, UOG, as well as the user ● Penalties <ul style="list-style-type: none"> - Farmers can be shut down, penalized, and fined

	<p>BIOLOGICAL</p> <ul style="list-style-type: none"> • Knowing your life cycle and target is crucial to prevent resistance against pesticides • Other than chemicals, resistant varieties may be used, also biological control methods • Issues <ul style="list-style-type: none"> - Problems: dispersing it difficult, accessibility, coverage, and high expenses - Pest control at border needs to be increased • Inputs <ul style="list-style-type: none"> - Increase research and investigation of biological control measures and production - Identify insect, pest challenges, and host plants - Need to have responsible agencies, proper identification and treatment • Resolve <ul style="list-style-type: none"> - Introduction of biological control agents needs to be managed and controlled - Field sanitation is important - Education of people - Private and commercial business interest as out source - Biosecurity, plant protection and quarantine: needs to be strengthened at the border - Must keep good record keeping • Outcomes <ul style="list-style-type: none"> - Better screening <p>RECORD KEEPING</p> <ul style="list-style-type: none"> • Records must be kept of inputs, outcome, and practices there are no excuses. • Issues <ul style="list-style-type: none"> - Poor/No record keeping • Inputs <ul style="list-style-type: none"> - Know your costs and revenue: when to apply pesticides to keep costs down - IPM: cost of production • Resolve <ul style="list-style-type: none"> - Keep good records - Know or adopt new models and spreadsheets (like those provided by the University) - Need to project and forecast, which also affects market value of crops • Outcomes <ul style="list-style-type: none"> - Keep better records
SITE SELECTION AND SOIL PREPARATION	
Issues and Concerns	<ul style="list-style-type: none"> • Determining soil type is a problem. <ul style="list-style-type: none"> - Testing results take too long – needs faster results

	<ul style="list-style-type: none"> - Need advice on what crops grow best in different soils, location, and topography • Need more expert advice on how to deal with <ul style="list-style-type: none"> - Soil testing (faster results) - Soil type - Crop selection - Erosion and managing erosion - Assistance with EPA, USDA, and UOG • Windbreaks: best tree as windbreaks (i.e. acacia, ylang-ylang, good fruit tree to serve as both windbreak and source of resource) • Securing perimeter to protect from animals: using a battery operated electric fence. Can the University provide guidance on where to purchase and set-up • Restrictions and regulations put a lot of constraints on farmers • If existing vegetation is removed, farmers would like to know what can be planted in place of that plant • Clearing virgin land is difficult and expensive <ul style="list-style-type: none"> - What do you do with trees that are cut down: equipment to chip trees that are cut is not available, possibly can be provided by the government - Need more equipment for: <ul style="list-style-type: none"> - Spraying pesticides for large trees and handling land clearing • Water supply: costly (even for areas of low pressure)
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MONITORING, THRESHOLDS, FORECASTING, AND PEST TRAPPING

<p>Issues and Concerns</p>	<ul style="list-style-type: none"> • Monitoring <ul style="list-style-type: none"> - Need workshop for more information <ul style="list-style-type: none"> - Monitoring will be different per crop - Establish local thresholds and crops - Chart pests of each crop - Create an ID kit and packet for each: include information, magnifying glass, pictures of each crop, etc. - Use sticky traps to monitor insects and potential thresholds - Beneficial pests • Thresholds <ul style="list-style-type: none"> - Determine/establish the crops thresholds depending on what you're dealing with: i.e. ornamentals (no pest), - Need more research - Local threshold - Need resistance varieties • Forecasting <ul style="list-style-type: none"> - Keep data on the market - Know what you're planting to reduce flooding of market - Season planting: rainy/dry/wind - Seasonality and environmental conditions: what insects and crops will be present during that time of the year - Who will do the forecasting
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- **Pest trapping**
 - Local research needs to be done on crops that can be grown here: problem is it is expensive
 - Need research on economic feasibility
 - Is the existing information from other universities beneficial to us. We need good data for Guam.
 - Use of chemical trap cropping done many years ago (i.e. melon fly): needs a recent
 - Repellent crops (i.e. garlic)

3.4 Survey Results

Participants were asked to complete surveys at the start and end of the strategic planning sessions to measure knowledge gained of Integrated Pest Management, IPM strategies, benefits, and control methods, IPM National Roadmap, hazards, core strategies, and tactics (Appendix D). The results of the surveys demonstrated 100% of participants to have gain in knowledge of the defined topics.

3.5 Group Recommendations for Strategic Planning

Through the strategic planning session recommendations by stakeholders included to increase the current level of public outreach and training sessions, and improve cooperation between agencies. It was also noted that improvements were needed in plant protection, quarantine, and screening. It was recommended that more experts be hired to provide better assistance to farmers on soil testing, crop selection, and erosion control.

3.6 Pictures



Figure 4: A group picture of some of those who attended strategic planning session 2.



Figure 5: Commercial Agriculture Producers listen during presentations at strategic planning session 2.

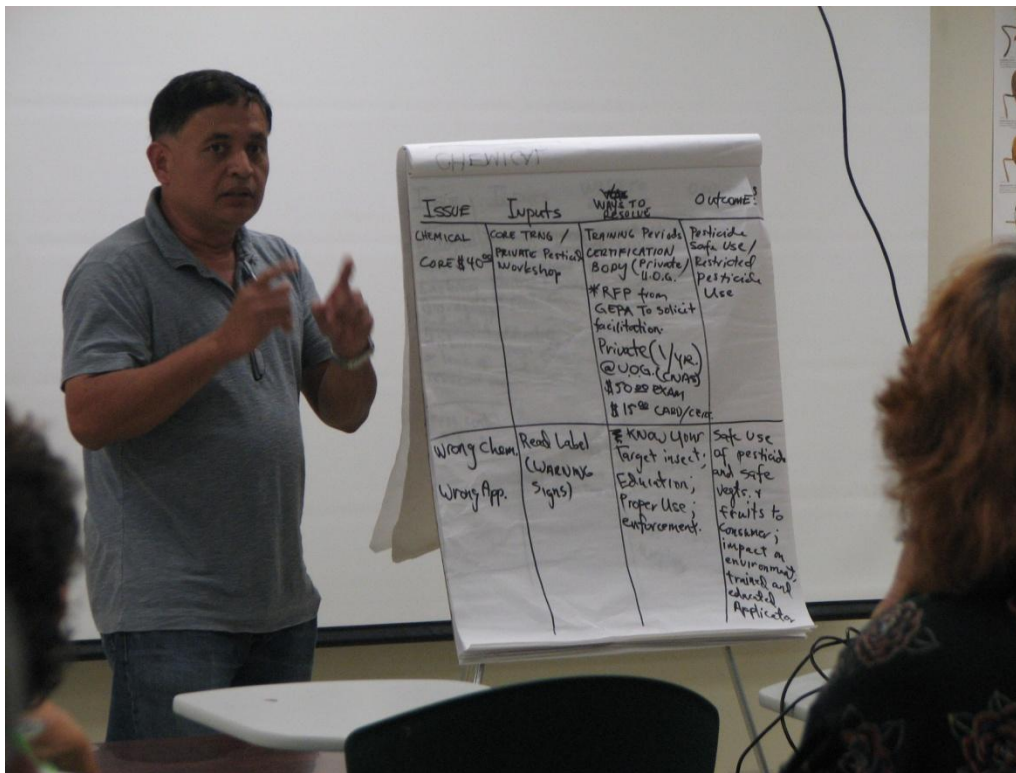


Figure 6: John Borja summarizes the discussion for the Chemical & Biological Control and Record keeping focus group at the strategic planning session 2.

4.0 Strategic Planning Session 3: IPM and Residential Gardeners

On March 2, 2013 a third and final workshop was held involving 69 residential gardeners. The goal of this workshop was to position Guam Extension Integrated Pest Management Program (EIPM) for future competitive funding sources by involvement of residential gardeners in strategic planning.

Objectives of this workshop for local commercial producers were to:

1. Identify the needs and concerns of residential gardeners.
2. Engage stakeholders in strategic planning for the UOG-EIPM program.

Presentations were given on IPM and the IPM National Roadmap; IPM practices; current pesticide regulations; and general IPM information. Presentations were followed by a focus group breakout session. Participants interacted to identify the strengths and weaknesses of the current UOG-EIPM program, to identify methods to enhance communication between themselves, UOG-CES, and EIPM, and to articulate their concerns and needs regarding pest management, cultural practices, crop selection and varieties, and chemical and pesticide application.

4.1 Evaluation Results

Participants were given a workshop evaluation form to fill-out upon the completion of the workshop (Appendix C). Eighty percent (87%) or more of evaluation respondents rated information, speaker quality, moderator assistance, organization, venue facilities, and overall benefit from the workshop as a 4 or greater (where 1=strongly disagree and 5=strongly agree). Additionally, 92% of attendees found the breakout session beneficial to them. Participants were asked to evaluate the usefulness and value of the Eggplant, Pepper, and Tomato Production Guide for Guam, which was passed out during the workshop. 100% of the participants considered the guide useful and would like them to be updated and made available.

Areas of the workshop participants said needed most improvements included:

- Clarify workshop objectives
- Allot more time for the workshop
- Increase the content covered
- Update the content covered
- Improve instructional methods

Some General Comments included:

- Very useful information.
- I would like to have hands-on activities or demonstrations.
- It helps me improve my gardening.
- Provide more handouts to complement the oral presentations.
- Workshop was very well organized and provided very useful information and insights to home gardeners that are just starting out on vegetable production for household consumption.

4.2 Focus Group Summary

Participants interacted to identify the strengths and weaknesses of the current UOG-EIPM program, to identify methods to enhance communication between themselves, UOG-CES, and EIPM, and to articulate their concerns and needs regarding pest management, cultural practices, crop selection and varieties, and chemical and pesticide application. Table 11 summarizes easel board annotations and group presentations by group members following focus groups discussions.

Table 11: Workshop C Focus Group Summary

PEST MANAGEMENT	
Issues and Concerns	<ul style="list-style-type: none"> • There is a need to steer small gardeners away from making poor choices: crop selection, cultures practices, and pest control. For example, each of Guam's soil has their positives and negatives for a particular crop. Some soils are shallow, some are basic, some are acidic, some are well drained, etc. Some sites are prone to wind. The grower needs to be informed of this before they plant. Some soils are more productive and can tolerate a higher plant density then others. The grower needs to be informed of problems to be aware during season. For example, when should a grower anticipate a particular insect problem or disease appearing? What practices make pest problems worse. How do you control the big pests like pigs, chickens, deer, and thieves. Such as wire, electric fences, motion detectors, etc. • There is a need to develop IPM information solely for the residential gardener. The current crop production guides are good but contain too much information for the homeowner. How do you control the big pests like pigs, chickens, deer, and thieves. Such as wire, electric fences, motion detectors, etc. • There is a need for demonstrations and crop selection trials designed just for the back yard gardener. Such as container / window box gardening, square foot gardens, raised beds, and roof top gardening. Demonstrations should be tied into workshops and need not take place at UOG. Back yard gardeners need information on easy of production. For example hot peppers are much easy to produce then bell pepper. Cherry tomatoes are easier to produce than large tomatoes. Cucumber need lots of water, hot peppers don't. Design and promote information for various age groups. What kinds of things can kids? What kinds of things can seniors or some someone with a handicap do? • Back yard gardeners want simple, quick answers designed for their needs. The kind of stuff you find in fact sheets. How do you identify a particular pest (insect, disease or weed). How to control a pest (insect, disease or weed) in your back yard garden. Possible titles: How do you control aphids on tomato; What are aphids and what do they look like. • There is a need for a guide on growing and harvesting plants from the wild, a how to make a raised bed. There is a need for information on how to care for ones yard and ornamental plants as well. What pests and diseases spread from crops to ornaments? Composting is good, but how do I compost without promoting the buildup of rhino beetle populations? What can I do about caterpillars on my flame tree? • Make use of the Internet. Perhaps a fact book page or blog should be established as a means to disseminate IPM information. • Homeowners also what to know about the "big picture" such as global warming, invasive species, development of pesticide resistance, and GMO crops (Genetically Modified Crops).
CULTURAL PRACTICES	

<p>Issues and Concerns</p>	<ul style="list-style-type: none"> • More consultants to conduct plant diagnostics, soil testing, and field/site visits • What to plant – intercropping, crop rotation, • More outreach about new research, plants, cultural practices, invasive species awareness • Update soil maps and plant guides which are made more available • Reduce competition through better farmers co-op and networking • Better media publicity regarding workshops • Community equipment for use by the community • Research on human manure as N source for composting: participants would like to know information on human manure that is used for composting. • Encourage recycling & trash separation to reduce disease and expand Guam waste control. • Pesticide application made more aware to farmers on their usage, effectiveness, restrictions, and regulations. • Crop selection: gardeners want to know what type of tomato or cucumbers best grows on Guam. Seed saving, genetic modified plants (better understanding and public awareness), protect farmers
<p>CROP SELECTION & VARIETIES</p>	
<p>Issues and Concerns</p>	<ul style="list-style-type: none"> • There is a need for more media coverage to create better awareness of new varieties available, upcoming workshops, events, and field days, current studies, new pests, diseases, and etc. • There is a need for farmers to be provided with better quality of varieties. Residential gardeners want to be provided with more varieties of crops that are resistant to current diseases, pests, etc. There is a need to have a higher quality of crops. • Gardeners want to know more about new vegetables and varieties that can grow on Guam. • Aside from the current, commonly grown crops on Guam there is a desire to grow new crops that are not yet grown here but are able to do well under Guam’s conditions. • Homeowners want to see more hands on field days and demonstrations with UOG-CES and DOAg. Participants would like to see more community outreach through farm visits, field days, and demonstrations where they can get better hands-on experience on how to properly maintain and care for their crops. Although workshops are beneficial, hands-on instruction will be more beneficial and effective. For example, have field days on proper pesticide application, planting practices, composting, etc. • There is a need for more classes and workshops to educate homeowners, farmers, and gardeners. The more classes that are available • There is a need for better networking between farmers and agencies. This networking can encourage a support system for growers, which could lead to crop and trade secrets sharing. • Design workshops that are conducted by farmers/growers but organized through agencies like UOG-CES or DOAg. These workshops

	will be coordinated by the agencies in cooperation with local farmers and gardeners. The workshops can provide farmers to teach what they know and have learned through experience to both novice and veteran farmers.
CHEMICAL CONTROL AND PESTICIDE APPLICATION	
Issues and Concerns	<ul style="list-style-type: none"> • There is a problem with too many untrained pesticide users both farmers and residential gardeners. More training on proper pesticide use needs to be provided to reduce misuse. • There is a need for better front line control of imported pesticides at customs and ports of entry/exit. There are many pesticides that are being brought in, which are improperly used and/or unregistered. • There is a need for more courses to be offered to pesticide users at a lower fee. The current Pesticide Applicator Training (PAT) is not offered frequently.

4.3 Survey Results

Participants were asked to complete surveys at the start and end of the strategic planning sessions to measure knowledge gained of Integrated Pest Management, IPM strategies, benefits, and control methods, IPM National Roadmap, hazards, core strategies, and tactics (Appendix D). Survey results showed 90% of participant's to have an increase in knowledge.

4.4 Group Recommendations for Strategic Planning

Recommendations by stakeholders included increasing the current number of crop trials, IPM publications specifically for residential gardeners, and consultants, educational workshops. The update of agriculture guides was also recommended.

Recommendations specifically identified the need to increase training and outreach programs for stakeholders. Activities identified are public training, workshops, and outreach programs, and more frequent yet inexpensive pesticide training. Training will incorporate the adoption of IPM practices, such as pest management, pesticide/chemical application training, soil testing, and crop selection by private citizens within the community.

4.5 Pictures



Figure 7: A group picture of some of those who attended the workshop strategic planning session 3.



Figure 8: Dr. Schlub lectures on EIPM-CS to residential gardeners during strategic planning session 3.



Figure 9: Participants listen during presentations at the strategic planning session 3.

5.0 Project Summary

Through three strategic planning sessions and the involvement of 127 stakeholders, the strengths and weaknesses of the current UOG-EIPM program were identified. Identified strengths included the large number of experts who are committed and highly trained and the sharing and collaboration between agencies, although it could be further enhanced. Weaknesses in communication consist of the lack of public outreach and collaboration between agencies, the lack of an EIPM agricultural directory of agency services and community contacts, and the understaffing in all agencies. Specific recommendations by stakeholders for the EIPM-Coordination Program proposal were the inclusion of more public outreach and training sessions, as well as improving communication and cooperation between agencies to improve plant protection, quarantine, and screening services. Other needs identified by stakeholders were the need to increase crop/variety trials on Guam and the hiring of more experts to provide better assistance to commercial and residential growers. Stakeholders additionally recommended updating extension guides and manuals.

Pre-tests were given to the participants prior to instruction and post-tests were given after instruction for all strategic planning sessions. Change in knowledge was measured in the following areas: IPM strategies, benefits, and control methods, IPM National Roadmap, hazards, core strategies, and tactics. Results of the three strategic planning sessions found 45% (Session I), 100% (Session II), and 90% (Session III) of participants to have an increase in knowledge of IPM practices. Stakeholders from the strategic planning sessions identified several areas that will enhance and support the adoption of IPM practices in commercial and residential agricultural practices. These areas were ranked by importance and then categorized by IPM emphasis areas of Communities or Specialty Crops. Stakeholders also ranked issues for IPM Support in Pest Diagnostics.

Areas identified to increase training for the community and consumers include supplemental public training, workshops, and outreach programs, the need for more experts and consultants, and for more frequent, but inexpensive pesticide training classes. Training will incorporate the adoption of IPM practices like pest management, pesticide/chemical application training, soil testing, and crop selection. A key point emphasized during the strategic planning sessions for IPM implementation for specialty crops was the importance of crop variety research and variety trials. Stakeholders expressed the need for studies on new crops, varieties, pest resistance, crop rotation, and intercropping. Fundamental to the development of appropriate pest management practices, is the engagement of stakeholders. Stakeholders formulated a list of top priorities for IPM support for pest diagnoses, which included increased site visits and the development of guides and information to identify pests, diseases, and best management practices. Furthermore, stakeholders conveyed the significance of updating agricultural guides and manuals, which will be made readily available to the community.

APPENDIX A: Workshop Agendas

Strengthening Multi-directional Flow of IPM Information

November 7, 2012

Agenda

Purpose: To identify institutional strengths and to develop IPM program goals that can be used by the University of Guam's Extension Integrated Pest Management (EIPM) Coordination program to develop a five year strategic plan.

Objective:

Develop a plan for Strengthening Multi-directional Flow of IPM information.

Target audience: Local and Federal Agencies.

Time	Topic / activity	Presenter
8:00-8:30	Registration and pre-survey form to assess their use of IPM and their knowledge of strategic planning	Sheeka Tareyama
8:30-8:35	Welcoming Remarks	Victor Artero
8:35-8:45	Mission of Guam Cooperative Extension	Victor Artero
8:45-9:15	Integrated Pest Management National Roadmap for IPM	Dr. Robert Schlub
9:15-10:15	- Existing IPM practices and interaction between UOG-EIPM and other agencies	Dr. Robert Schlub Phoebe Wall
10:15-10:30	Break	
10:30-11:45	- Existing IPM practices and interaction between UOG-EIPM and other agencies - Rhino beetle on Guam	Jesse Bamba Dr. Aubrey Moore
11:45-12:00	Formation of focus group: distribution of IPM topics and questions for discussion	Sheeka Tareyama
12:00-1:00	Lunch	
1:00-2:00	Focus group discussion	Moderators
2:00-3:00	- Presentation of focus groups - Focus group evaluation	Sheeka Tareyama
3:00-3:15	- Workshop evaluation - Post-survey	Sheeka Tareyama
3:15-4:00	Workshop wrap up	Dr. Robert Schlub



EIPM and the Commercial Agriculture Producers

December 19, 2012

Agenda

Purpose: To identify institutional strengths and to develop IPM program goals that can be used by the University of Guam's Extension Integrated Pest Management (UOG-EIPM) Coordination program to develop a five year strategic plan.

Objective:

To focus on the practices that prevent, avoid, or mitigate pest attack. Identify institutional strengths and develop IPM program goals that address the pest control needs and concerns of Guam's farmers.

Audience: Commercial Agricultural Producers/Farmers.

<i>Time</i>	<i>Topic / activity</i>	<i>Presenter</i>
8:00-9:00	Set-up	Sheeka Tareyama
9:00-9:30	Registration and pre-survey form to assess their use of IPM and their knowledge of strategic planning	Sheeka Tareyama
9:30-9:35	Welcoming Remarks	Sheeka Tareyama
9:35-9:45	Mission of Guam Cooperative Extension	Dr. Robert Schlub
9:45-10:00	Integrated Pest Management National Roadmap for IPM	Dr. Robert Schlub
10:00-10:15	Break & Group Picture	
10:15-11:00 (10 min ea.)	<ul style="list-style-type: none"> - Introduction of speakers - Existing IPM practices of UOG-CES - Tomato, bean, and cucurbit issues - Current pesticide regulations 	<ul style="list-style-type: none"> - Dr. Robert Schlub - Phoebe Wall - Jesse Bamba - Guam EPA
11:00-11:10	Break	
11:10-12:00	Formation of focus groups 1) Chemical & biological control, and record keeping 2) Cultural control and planting 3) Site selection and soil preparation 4) Monitoring, threshold, pest trapping, and forecasting	Sheeka Tareyama
12:00-1:00	Lunch and Discussions	
1:00-1:30	Focus group presentations	Moderators
1:30-2:00	<ul style="list-style-type: none"> - Workshop evaluation - Post-survey 	Sheeka Tareyama
2:00-4:00	Follow up: Summary and assessment	Sheeka Tareyama



EIPM and Residential Gardeners

March 2, 2013

Agenda

Purpose: To identify institutional strengths and to develop IPM program goals that can be used by the University of Guam's Extension Integrated Pest Management (EIPM) Coordination program to develop a five year strategic plan.

Objective:

To focus on the practices that prevent, avoid, or mitigate pest attack. Identify institutional strengths and develop IPM program goals that address the pest control needs and concerns of Guam's residential growers.

Audience: Residential growers

<i>Time</i>	<i>Topic / activity</i>	<i>Presenter</i>
8:00-9:00	Set-up and pre-registration	Sheeka Tareyama
9:00-9:30	Registration and pre-survey form to assess their use of IPM and their knowledge of strategic planning	Sheeka Tareyama
9:30-9:35	Welcoming Remarks	Sheeka Tareyama
9:35-9:45	Mission of Guam Cooperative Extension	Dr. Robert Schlub
9:45-10:00	Integrated Pest Management National Roadmap for IPM	Dr. Robert Schlub
10:00-10:15	Break & Group Picture	
10:15-11:00	<ul style="list-style-type: none"> - Introduction of speakers - What is IPM - Existing IPM practices of UOG-CES 	<ul style="list-style-type: none"> - Dr. Robert Schlub - Phoebe Wall - Sheeka Tareyama
11:00-11:10	Break	
11:10-12:00	Formation of focus groups 5) Chemical control & Pesticide application 6) Cultural practices 7) Pest management 8) Crop selection & varieties	Sheeka Tareyama
12:00-1:00	Discussions and Lunch	
1:00-1:30	Focus group presentations and discussion	Moderators
1:30-2:00	<ul style="list-style-type: none"> - Workshop evaluation - Post-survey - Plant distribution 	Sheeka Tareyama
2:00-4:00	Follow up: Summary and assessment	<ul style="list-style-type: none"> - Dr. Robert Schlub - Sheeka Tareyama

APPENDIX C: Workshop Evaluation Forms



EIPM Workshop Evaluation
University of Guam Cooperative Extension Service
November 7, 2012

Participant name: _____
Email (if not previously provided): _____
Job title: _____
Years in present position? <1 1-3 3-5 >5

INSTRUCTIONS

CIRCLE YOUR RESPONSE TO EACH ITEM

1=Strongly disagree 2=Disagree 3=Neither agree nor disagree
4=Agree 5=Strongly agree N/A=Not applicable

-
- 1.) I was well informed about the objectives of this workshop.
1 2 3 4 5 N/A
 - 2.) This workshop lived up to my expectations.
1 2 3 4 5 N/A
 - 3.) The content is relevant to my job or responsibilities.
1 2 3 4 5 N/A
 - 4.) The activities in this workshop gave me influence the future direction of Extension IPM activities.
1 2 3 4 5 N/A
 - 5.) The pace of this workshop was appropriate.
1 2 3 4 5 N/A
 - 6.) The speakers were well prepared.
1 2 3 4 5 N/A
 - 7.) The moderators were helpful.
1 2 3 4 5 N/A
 - 8.) The objectives of the workshop were met.
1 2 3 4 5 N/A
 - 9.) The facility adequate for the workshop.

1 2 3 4 5 N/A

10.) The lunch and refreshments provided at the workshop was sufficient.

1 2 3 4 5 N/A

11.) How would you improve this workshop? (Check all that apply.)

- Provide better information before the workshop.
- Clarify the workshop objectives.
- Reduce the content covered in the workshop.
- Increase the content covered in the workshop.
- Update the content covered in the workshop.
- Improve the instructional methods.
- Make workshop activities more stimulating.
- Improve workshop organization.
- Make the workshop more difficult.
- Slow down the pace of the workshop.
- Speed up the pace of the workshop.
- Allot more time for the workshop.
- Shorten the time for the workshop.

12.) What other improvements would you recommend in this workshop?

13.) What is least valuable thing about this workshop?

14.) What is most valuable thing about this workshop?

15.) Would you like for us to email you the final report for this meeting?

Yes or No

EIPM Workshop Evaluation
 University of Guam Cooperative Extension Service
 December 19, 2012



IPM and the Commercial Agriculture Producer Workshop

To assist with planning for future events please rate the following items by scoring in the box on each line (5=excellent through 1=poor)

GENERAL	RATING				
	5 (excellent)	4	3	2	1 (poor)
Information provided					
Quality of speakers					
Moderator assistance					
Overall organization					
Catering (food)					
Venue facilities					
Overall benefit from attending the workshop					

16.) Did you find the break out session useful? Please comment.

- Yes No

Comments: _____

17.) How could we improve this workshop? (Check all that apply.)

- | | |
|--|---|
| <p><input type="checkbox"/> Clarify the workshop objectives.</p> <p><input type="checkbox"/> Reduce the content covered in the workshop.</p> <p><input type="checkbox"/> Increase the content covered in the workshop.</p> <p><input type="checkbox"/> Update the content covered in the workshop.</p> <p><input type="checkbox"/> Improve the instructional methods.</p> <p><input type="checkbox"/> Improve workshop organization.</p> | <p><input type="checkbox"/> Make the workshop more difficult.</p> <p><input type="checkbox"/> Slow down the pace of the workshop.</p> <p><input type="checkbox"/> Speed up the pace of the workshop.</p> <p><input type="checkbox"/> Allot more time for the workshop.</p> <p><input type="checkbox"/> Shorten the time for the workshop.</p> <p><input type="checkbox"/> Provide better information before the workshop.</p> |
|--|---|

18.) General comments:

EIPM Workshop Evaluation
 University of Guam Cooperative Extension Service
 March 2, 2013



IPM and Residential Gardeners

To assist with planning for future events please rate the following items by scoring in the box on each line (*5=excellent through 1=poor*)

GENERAL	RATING				
	5 (excellent)	4	3	2	1 (poor)
Information provided					
Quality of speakers					
Moderator assistance					
Overall organization					
Catering (food)					
Venue facilities					
Overall benefit from attending the workshop					

19.) Did you find the focus group session useful? Please comment. Yes No

Comments: _____

20.) How could we improve this workshop? (Check all that apply.)

- | | |
|--|--|
| <input type="checkbox"/> Clarify the workshop objectives. | <input type="checkbox"/> Make the workshop more difficult. |
| <input type="checkbox"/> Reduce the content covered in the workshop. | <input type="checkbox"/> Slow down the pace of the workshop. |
| <input type="checkbox"/> Increase the content covered in the workshop. | <input type="checkbox"/> Speed up the pace of the workshop. |
| <input type="checkbox"/> Update the content covered in the workshop. | <input type="checkbox"/> Allot more time for the workshop. |
| <input type="checkbox"/> Improve the instructional methods. | <input type="checkbox"/> Shorten the time for the workshop |
| <input type="checkbox"/> Improve workshop organization. | <input type="checkbox"/> Provide better information before the workshop. |

21.) Did you find the guide passed out during the workshop useful? Yes No

22.) Should the guide continue to be updated and made more available? Yes

No

23.) General comments:

APPENDIX D: Workshop Survey Questionnaire Forms



Strengthening Multi-directional Flow of IPM Information
University of Guam Cooperative Extension Service
November 7, 2013

ID _____

Survey Questionnaire

- 1.) What does IPM stand for?

- 2.) What is IPM?

- 3.) UOG provides IPM activities with what government agencies? (*circle all that apply*)
 - a. USDA
 - b. UOG-WPTRC
 - c. EPA
 - d. Guam Dept. of Agriculture
 - e. NRCS
- 4.) The goal of the Cooperative Extension Service (CES) is to provide the best advice for dealing with current and new immerging pests and diseases.
 - a. True
 - b. False
- 5.) Give 5 examples of pesticides.
 - a. _____
 - b. _____
 - c. _____
 - d. _____
 - e. _____

- 6.) Which of the following is NOT a major principle of integrated pest management? (*circle one*)
- Exclusion
 - Sanitation
 - Repairs
 - Perimeter spraying
 - Modification
- 7.) What are the core strategies in IPM? (*circle all that apply*)
- Prevention
 - Avoidance
 - Monitoring
 - Suppression
 - All of the above
- 8.) Identify 3 agencies that incorporate IPM practices.
- _____
 - _____
 - _____
- 9.) What does PAMS stand for?
- _____
- 10.) List 2 reasons why IPM should be implemented.
- _____
 - _____
- 11.) Who can use IPM? (*circle all that apply*)
- Farmers
 - Buildings and grounds maintenance personnel
 - Professional pest control operators
 - Home owners
- 12.) The three basic steps of IPM are inspection, identification, and treatment.
- True
 - False



IPM and the Commercial Agriculture Producer
University of Guam Cooperative Extension Service
December 19, 2012

ID _____

Survey Questionnaire

- 1.) What does IPM stand for?

- 2.) Who can use IPM? (*circle all that apply*)
 - a. Farmers
 - b. Maintenance personnel
 - c. Professional pest control operators
 - d. Home owners
 - e. All of the above
- 3.) Information on many of these potential hazards for specific pesticides can be found on which of the following: (*circle all that apply*)
 - a. Pesticide labels
 - b. Material Safety Data Sheets (MSDS)
 - c. Resources such as www.pesticideinfo.org
 - d. All of the above
- 4.) The core strategies of IPM are Prevention, Avoidance, Monitoring, and Suppression (PAMS).
 True False
- 5.) What are the control methods IPM uses? (*circle all that apply*)
 - a. Cultural
 - b. Biological
 - c. Mechanical and Physical
 - d. Chemical
 - e. Legal
 - f. All of the above
- 6.) What are the benefits of IPM?
 - a. Improve cost benefits when adopting IPM practices
 - b. Reduce potential human health pests and the use of control strategies
 - c. Minimize adverse environmental effects from pest and their control
 - d. All of the above
- 7.) How does IPM reduce hazards?
 - a. Minimizes pesticide use
 - b. Minimizes hazardous pesticides
 - c. Provides special protective measures
 - d. All of the above

8.) Are all pesticides are bad?

- Yes No

9.) What are example of IPM practices (*circle all that apply*)

- a. Tilling
- b. Crop rotation
- c. Resistance varieties
- d. Pesticides
- e. All of the above

10.) What does PAMS stand for?

11.) The more tactics used to control a pest, the less likely the pest will not develop a chemical resistance?

- True False

12.) The IPM roadmap focus areas are: 1) production agriculture, 2) natural resources and recreational environments, and 3) residential and public areas.

- True False



EIPM and Residential Gardeners
University of Guam Cooperative Extension Service
March 2, 2013

ID _____

Survey Questionnaire

1.) What does IPM stand for?

2.) Who can use IPM? (*circle all that apply*)

- f. Farmers
- g. Maintenance personnel
- h. Professional pest control operators
- i. Home owners
- j. All of the above

3.) Information on many of these potential hazards for specific pesticides can be found on which of the following: (*circle all that apply*)

- a. Pesticide labels
- b. Material Safety Data Sheets (MSDS)
- c. Resources such as www.pesticideinfo.org
- d. All of the above

4.) The core strategies of IPM are Prevention, Avoidance, Monitoring, and Suppression (PAMS).

- True False

5.) What are the control methods IPM uses? (*circle all that apply*)

- a. Cultural
- b. Biological
- c. Mechanical and Physical
- d. Chemical
- e. Legal
- f. All of the above

6.) What are the benefits of IPM?

- a. Improve cost benefits when adopting IPM practices
- b. Reduce potential human health pests and the use of control strategies
- c. Minimize adverse environmental effects from pest and their control
- d. All of the above

- 7.) How does IPM reduce hazards?
- a. Reducing pesticide use
 - b. Using least hazardous pesticides
 - c. Take special protective measures
 - d. All of the above

- 8.) Are all pesticides are bad?
- Yes No

- 9.) Types of control methods
- a. Tilling
 - b. Crop rotation
 - c. Resistance varieties
 - d. Pesticides
 - e. All of the above

- 10.) What does PAMS stand for?
-

- 11.) The more tactics used to control a pest, the less likely the pest will not develop a chemical resistance?
- True False

- 12.) The IPM roadmap focus areas are: 1) production agriculture, 2) natural resources and recreational environments, and 3) residential and public areas.
- True False

APPENDIX E: Farmers Information Form



IPM and the Commercial Agriculture Producer
EIPM Workshop
University of Guam Cooperative Extension Service
December 19, 2012

Information Sheet

Name: _____ Farm location: _____
Contact number: _____ Email: _____

- 1.) What size is your farm? _____ acres
- 2.) What are the most common crops that you grow in ranking 1st, 2nd, and 3rd?
1st: _____ 2nd: _____ 3rd: _____

- 3.) Other crops grown (*please check all*)
 - Banana Eggplant Tomato Watermelon
 - Hot Pepper Corn Beans Papaya
 - Citrus Cucumber Bell pepper Pumpkin
 - Yam (Dågu) Sweet potato Okra Green onion
 - Taro Bittermelon Pak-choi Ginger
 - Honey dew Melon Other: _____
- 4.) Do you practice crop rotation?
 Yes No
- 5.) Do you use any type of mulch?
 Yes No
- 6.) Do you scout your field for pests?
 Yes No
- 7.) What are your common pests/insect problems?
 - Fungus Disease
 - Insects (types: _____) Other:
 - _____
- 8.) What types of pesticides do you use?
 - Insecticides Fungicides

Common pest problems	What do you use for it	When do you apply	How effective is it (5= very effective 1= not effective)
Insects (type: _____)			5 4 3 2 1
Insects (type: _____)			5 4 3 2 1
Insects (type: _____)			5 4 3 2 1
Fungus			5 4 3 2 1
Fungus			5 4 3 2 1
Virus			5 4 3 2 1
Virus			5 4 3 2 1

Part 2: Results and Discussion

The EIPM-Coordination Development Grant Coordinator conducted three IPM strategic planning sessions in FY2012 with the support of an EIPM-Coordination Development Grant. Stakeholders engaged in the strategic planning sessions were individuals involved with commercial agriculture production, residential gardening, or governmental agencies. The primary goals were to provide stakeholders an opportunity to identify institutional strengths and weaknesses at the University of Guam and to develop IPM program goals that could be used to position it for future IPM competitive funding. Stakeholder topics were limited to agriculture production, residential gardens, and public policy. Goals of the EIPM-Coordination Development Grant were to strengthen multi-directional flow of EIPM information for local and federal agencies in Guam through stakeholder involvement in strategic planning; to position the Guam EIPM program for future competitive funding sources by involvement of commercial agriculture producers in strategic planning; and to position Guam EIPM program for future competitive funding sources by involvement of residential gardeners in strategic planning. Presentations on Integrated Pest Management National Roadmap, strategic planning, NIFA logic Model, and the existing EIPM practices and interaction between UOG-CES and other agencies were provided. Group breakout sessions followed the presentations, where participants interacted to identify the strengths and weaknesses of the current UOG-EIPM program and methods to enhance communication between themselves and UOG-CES.

The first strategic planning session, which occurred on November 7, 2012, consisted of 30 stakeholders from nine agencies and public interest groups. Groups represented included UOG-CES, Western Pacific Tropical Research Center (WPTRC), Guam Department of Agriculture (DOAg), Department of Land Management (DLM), USDA Animal and Plant Health Inspection Service (APHIS), Guam Department of Parks and Recreation (GDPR), Northern Marianas College Cooperative Research, Extension and Education Service (NMC-CREES), Landscape Management Systems (LMS), and Leo Palace Resort. Subjects identified by breakout groups included production agriculture, natural resources and recreational environments, residential and public areas, and public policy. Strengths of the current UOG-EIPM program as identified by stakeholders included the large number of experts who are committed and highly trained, and the sharing and collaboration between agencies, although it could be further enhanced. Weaknesses in communication consist of the lack of public outreach and collaboration between agencies, the lack of an EIPM agricultural directory for department/agency services, poor community engagement, and understaffing in all agencies.

Specific recommendations by stakeholders for the EIPM-Coordination Program proposal included the need for more public outreach and collaboration, and improved communication. To improve communications between agencies, it was suggested that an educational task force be established. Possible functions of the task force will be to map areas of pests and their impacts on

the island environment, and to develop a directory of IPM and agricultural services that will benefit the community.

The second strategic planning session involving 28 commercial agriculture producers occurred on December 19, 2012. Agriculture commodities represented included cucumber, eggplant, pepper, banana, bittermelon, and taro. Goals for this planning session were to involve commercial agriculture producers in strategic planning to identify institutional strengths, and to develop IPM program goals that address pest control needs and concerns of Guam farmers. Presentations on EIPM and the IPM National Roadmap, existing EIPM practices of UOG-CES, pest issues with locally grown tomato, bean, and cucurbit crops, and current pesticide regulations were conducted. Following presentations, a focus group breakout session took place where local agriculture producers were able to express their concerns and needs regarding chemical and biological control, record keeping, site selection and soil preparation, monitoring, thresholds, forecasting, and pest trapping.

Recommendations included the EIPM-Coordination Program proposal to increase the current level of public outreach and training sessions, and improve cooperation between agencies. It was also noted that improvements were needed in plant protection, quarantine, and screening services. It was recommended that more experts be hired to provide better assistance to farmers on soil testing, crop selection, and erosion control. It was recommended that diagnostics services be supported to insure a quick turn around on identifications of pests, weeds, and plant diseases.

The third strategic planning session occurred on March 2, 2013, which included 69 residential gardeners from all villages throughout Guam. The goal of this workshop was to position Guam EIPM for future competitive funding sources by involvement of residential gardeners in strategic planning. Presentations on IPM practices, the IPM National Roadmap, strategic planning, and NIFA logic Model were provided. A group breakout session followed the presentations, where participants interacted to identify the strengths and weaknesses of the current UOG-EIPM program, to identify methods to enhance communication between themselves, UOG-CES, and EIPM, and to articulate their concerns and needs regarding pest management, cultural practices, crop selection and varieties, and chemical and pesticide application. Subjects identified by breakout groups included pest management, crop selection and varieties, cultural practices, and chemical control, and pesticide application.

Stakeholders from the strategic planning sessions identified several areas that will enhance and support the adoption of IPM practices in commercial and residential agricultural practices. These areas were categorized based on levels of importance and were then placed into priority lists. The priority lists were aligned with the IPM primary emphasis areas of Communities and Specialty Crops. Stakeholders also recommended supporting the IPM secondary emphasis area of Pest Diagnostic Facilities. Recommendations for the EIPM-Coordination Program proposal by stakeholders included increasing the current number of crop trials, IPM publications specifically

for residential gardeners, and educational workshops. The updating of agriculture guides was also recommended.

Recommendations specifically identified the need to increase training and outreach programs for stakeholders. Activities identified are public training, workshops, and outreach programs, and more frequent yet inexpensive pesticide training. Training will incorporate the adoption of IPM practices, such as pest management, pesticide/chemical application training, soil testing, and crop selection by private citizens within the community. Through improved collaboration and communication between stakeholders, the development and delivery of up-to-date research and information can be made more available to the community. Expert advice is a fundamental aspect for commercial and residential gardeners, as it will encourage effective decision making regarding crop selection, soil analysis, integrated pest management, and chemical application.

A key point emphasized during the strategic planning sessions for IPM Implementation for Specialty Crops was the importance of crop variety research and variety trials. Stakeholders described the lack of research specific to Guam. They expressed the need for studies on new crops, varieties, pest resistance, crop rotation, and intercropping. The identification and management of pests and diseases on specialty crops was also identified as a priority.

Fundamental to the development of an appropriate pest management program, engaged stakeholders must prioritize IPM and pest diagnostic needs. This includes increased site visits and the development of guides and information to identify pests, diseases, and best management practices. Furthermore, stakeholders conveyed the importance of updating agricultural guides and manuals, which will be made readily available to the community.

Of the various stakeholder recommendations, the following activities and objectives were identified and developed for this EIPM-Coordination grant:

- Support of pest diagnosis with timely diagnostics.
- Create a directory of IPM and agriculture related services.
- Updating of vegetable production guides, which will be made available online and at workshops via electronic and hard copies.
- Increase the knowledge of pest identifiers and first responders, island vegetable producers, and residential gardeners by conducting workshops on:
 - Current and future IPM practices
 - Pest and disease identification and procedures
 - Horticultural practices

Part 3: IPM Strategic Plan for Guam Sep.1, 2013 to Aug. 31, 2016

1. A Continuing activities for all 3 years

As a result of strategic planning sessions in 2012 and 2013, the need for timely and accurate pest and disease diagnoses were identified.

One of the first steps in implementing many IPM practices and strategies is the proper identification of plant disease and plant pests. A graduate student, under the direction of the PI, will be the point-of-contact for diagnostic services of the Guam Plant Health and IPM Center EIPM-CS. The graduate student will complete the diagnosis and respond to the client after validation of the diagnosis by the program PI.

Graduate student under the direction of the PI will setup and supervise an IPM interactive display for teachers, students, farmers, homeowners and the general public as part of the University of Guam's Charter Day activities.

On an ongoing basis, a graduate student under the direction of the PI will collect stakeholder input for assessing Extension IPM program delivery and for future program direction. It is recognized that any person who seeks the advice of the Extension Plant Health and IPM Center or share in its commitment are potential stakeholders and therefore, a valuable source of information. Stakeholder engagement will be carried out through relatively informal means such as one-on-one conversations and through more formal mechanisms of workshop stakeholder evaluations.

1. B Workshops

As the result of strategic planning sessions, the need for three workshops were identified:

1. During the first year the grant will sponsor a farmer-hosted workshop on current and future IPM practices for vegetable producers.
2. During the second year, the program will conduct a pest and disease identification and first responder workshop for commercial vegetable producers, agriculture students, plant quarantine identifiers, agriculture professionals, and others.
3. During in the third year, the program will conduct a workshop on relevant IPM and horticultural practices for Guam's residential gardeners.

A graduate student under the direction of the PI will identify workshop presenters and participants from among island agriculture specialist and the general public as well as attendees and presenters of the strategic planning sessions held in 2012. The workshops will be half a day (4 hours) in duration and consist of 30-50 participants.

The graduate student under the direction of the PI will develop survey questions for attendees to assess knowledge gained, strengths and weaknesses of the workshop, and suggestions for EIPM

program direction in the future. The PI will conduct and be the lead presenter for the pest and disease identification workshop and the workshop for residential gardeners. Under the PI's direction, a graduate student will identify presenters and content for the workshop hosted by commercial vegetable producers. A graduate student under the direction of the PI will perform the following tasks associated with the meeting: purchase materials including markers, folders, notebook pads, pens and pencils that will be used during the workshops, personally contact workshop presenters among local specialist and commercial vegetable producers, and collect and tabulate survey findings.

General outlines of the three proposed workshops agendas are shown below.

IPM for Stakeholder Meetings for Guam

Year 1: Farmer-Hosted

Agenda (general outline)

Purpose: To increase knowledge of IPM practices for island vegetable producers.

Objectives:

- Sponsor a farmer-hosted workshop on current and future IPM practices for vegetable producers.
- Establishment of partnerships among producers based on experience and knowledge.

Time	Topic / activity	Presenter
8:00-8:30	Sign in and Stakeholder Questionnaire	Graduate student
8:30-8:35	Welcoming remarks	Dr. Schlub
8:35-9:00	Overview of IPM practices	Dr. Schlub
9:00-10:30	IPM and agriculture practices <ul style="list-style-type: none"> - Pesticide Safety - Plant Problems and Solutions - Diseases - Animal Pests, weeds, and insects - Scouting - Thresholds 	Local commercial producers identified from previous strategic planning sessions
10:30-10:45	Break	
10:45-11:30	Agriculture production practices <ul style="list-style-type: none"> - Current cultural practices - Modern/Future cultural practices 	Local commercial producers identified from previous strategic

		planning sessions
11:30-12:00	Workshop Evaluation Assessment of knowledge gained Suggestions/Comments for future EIPM programming	Graduate student
12:00	Conclusions	Graduate student

IPM for Stakeholder Meetings for Guam

Year 2: Pest Identifiers and First Responders

Agenda (general outline)

Purpose: To increase knowledge of IPM practices of pest identifiers and first responders.

Objectives:

- Pest and Disease Identification for pest identifiers and first responders, including commercial vegetable producers, agriculture students, plant quarantine identifiers and agriculture professionals
- Train first responders on the procedures for handling potentially new pests or diseases for Guam.

Time	Topic / activity	Presenter
8:00-8:30	Sign in and Stakeholder Questionnaire	Graduate student
8:30-8:35	Welcome and pre-survey	CES Assoc. Director
8:35-8:45	Mission of Guam Cooperative Extension	CES Assoc. Director
8:45-9:15	Overview of IPM practices	Dr. Schlub
9:15-10:15	IPM Practices, Pest and Disease - Identification and Procedures - Pests	Dr. Schlub Dr. Moore Dr. McConnell Local pest experts
10:15-10:30	Break	
10:30-11:30	IPM Practices, Pest and Disease	Dr. Schlub

	<ul style="list-style-type: none"> - Diseases - Weeds - Scouting - Thresholds Reporting protocol and Standard operating procedure	Dr. Moore Dr. McConnell Local pest experts UOG Extension agents
11:30-12:00	Workshop Evaluation Assessment of knowledge gained Suggestions/Comments for future EIPM programming	Graduate student
12:00	Conclusions	Graduate student

IPM for Stakeholder Meetings for Guam

Year 3: Residential gardeners

Agenda (general outline)

Purpose: To increase knowledge of residential gardeners of relevant IPM and horticultural practices.

Objectives:

- Enhance understanding and demonstrate IPM practices involving horticultural production for residential gardeners.

Time	Topic / activity	Presenter
8:00-8:30	Sign in and Stakeholder Questionnaire	Graduate student
8:30-8:35	Welcome and pre-survey	CES Assoc. Director
8:35-8:45	Mission of Guam Cooperative Extension	CES Assoc. Director
8:45-9:15	Overview of IPM practices	Dr. Schlub
9:15-10:15	IPM Practices <ul style="list-style-type: none"> - Cultural practices - Chemical and biological control - Soil preparation and planting - Monitoring - Pest Trapping - Scouting 	Dr. Schlub UOG Extension agents

	- Thresholds	
10:15-10:30	Break	
10:30-11:30	Horticulture and Production Practices - Chemical application - Crop varieties	Dr. Schlub UOG Extension agents
11:30-12:00	Workshop Evaluation Assessment of knowledge gained Suggestions/Comments for future EIPM programming	Graduate student
12:00	Conclusions	Graduate student

1. C Production of documents

As the result of strategic planning sessions, the need for new and updated IPM related documents were determined. Those identified are the development of a Guam Directory of Agricultural Services and revisions to the 2002 *Eggplant, Pepper, and Tomato Production Guide for Guam* and the 1998 *Guam Cucurbit Guide* (Schlub & Yudin, 2002; and Yudin & Schlub, 1998).

During the first year of the proposed grant, a graduate student under the direction of the PI will form a task force of five individuals each from a different government agency to develop a searchable Guam Directory of Agricultural Services provided by various government agencies. Task force members will be chosen from among attendees of the strategic planning session for government agencies held in 2012. Groups represented will include the University of Guam Cooperative Extension Service (UOG-CES), Western Pacific Tropical Research Center (WPTRC), Guam Department of Agriculture (DOAg), Department of Land Management (DLM), USDA Animal and Plant Health Inspection Service (APHIS), Guam Department of Parks and Recreation (GDPR), and Guam Environmental Protection Agency (GEPA), and USDA Natural Resources Conservation Services (NRCS).

The Guam Directory of Agricultural Services will provide stakeholders and service providers with access to accurate and up-to-date information about agriculture and IPM related services provided by local and federal government agencies on Guam. The Directory establishes linkages between agencies names and IPM and agriculture related services. A rough example of what a possible index may look like is shown below.

Services	Agencies	Point of contact	Number	email
Pesticides	GEP, UOG-CES,	Betwin Alokoa Jessie Bamba	475-1654 735-2091	Betwin.alokoa@epa.guam.gov jpbamba@uguam.uog.edu

	Dept of Ag	Agriculture Division	734-3942	
Pesticide applicator license	GEP	Karl Olson	475-1658	Karl.olson@eap.guam.gov
Pesticides for use on vegetables	UOG-CES DEPT-AG NRCS	Jessie Bamba Agriculture Division Main office	735-2091 734-3942 735-2111	jpbamba@uguam.uog.edu www.pia.nrcs.usda.gov
Pesticide enforcement	GEP	Betwin Alokoa	475-1654	Betwin.alokoa@epa.guam.gov
Plant diseases Identification and IPM	IPM Center Dept of Ag	Roger Brown Biosecurity Division	734-2094 475-1427	rwbrown@uguam,uog.edu
Weed identification	UOG UOG	Jim McConnell Herbarium	735-2129 735-2791	mccannel@uguam.uog.edu

During the second and third year of the proposed grant, a graduate student under the direction of the PI will review Guam’s two vegetable guides. Sections will be updated and expanded where deemed necessary. The 2002 *Eggplant, pepper, and tomato production guide for Guam* will be reviewed and updated during the second year of the proposed grant. The 1998 *Guam Cucurbit Guide* will be revised during the third year. When possible, the graduate student will work with the original chapter authors for their input. Upon completion, the guides will be placed on the University of Guam/Cooperative Extension Service website.

2. Outputs and expected deliverables

- Respond to clientele requests for pest and disease identification and report new findings for Guam to local and federal agencies. The Plant Health and IPM Center will conduct yearly interactive displays for University of Guam Charter Day. Hundreds of school children and adults regularly attend Charter Day.
- Produce a directory for services provided by Guam agencies (Guam Directory of Agricultural Services.)
- Promote and support a farmer-hosted workshop on current and future IPM practices for vegetable producers.
- Conduct a pest and disease identification and first responder workshop for commercial vegetable producers, agriculture students, plant quarantine identifiers, and agriculture professionals.

- Revise and publish the 1998 *Guam Cucurbit Guide*.
- Revise and publish the 2002 *Eggplant, Pepper, and Tomato Production Guide for Guam*.
- Conduct a workshop on relevant IPM and horticultural practices for Guam's residential gardeners.
- An IPM interactive display for teachers, students, farmers, homeowners and the general public will be set up as part of the University of Guam's Charter Day activities.

3. Expected outcomes and the National Road Map for IPM

Enhance Pest Diagnostics responsiveness: Clients/stakeholders challenged by pest identification issues will gain in knowledge from interaction with diagnosticians. Our nation's natural resources and ecosystems are under constant pressures from encroaching invasive species. Invasive species, which diminish habitat quality and the diversity of wildlife, can be reduced through early detection.

Improve client's ability to identify IPM service providers: The development of a Guam Directory of Agricultural Services for the general public and government agencies will expand existing and developing new collaborative relationships with public and private sector cooperators. This will ultimately enhance the multi-directional flow of pest management information between the public and private sector cooperators.

Increase knowledge of IPM practices among island vegetable producers: Address in this workshop is an important priority of the National IPM Roadmap, which is the development and implementation of economical and effective IPM systems for crops and commodities consumed by humans.

Increase knowledge of pest identifiers and first responders: Pest identifiers and first responder workshop: Increasing the number of pest identifiers and first responders reduces the impact of invasive species to our nation's natural resources and ecosystems through early detection.

Enhance current online IPM and vegetable production information to clientele: Through revisions of Guam's production guides, practitioners are afforded the opportunity to acquire new skills to implement targeted IPM strategies using new technologies, including reduced risk pesticides, cultural practices, and biocontrols.

Increase knowledge of residential gardeners of relevant IPM and horticultural practices: Through the education of residential gardeners the proposed EIPM program will address a point raised by

the National IPM Roadmap, “The greatest general population exposure to pests and the tactics used to control them occurs where people live, work, and play.”

4. How results or products will be used:

Surveys of engaged stakeholders will be used to set extension IPM program direction in the future. The results and products of this proposal will be distributed to stakeholders through workshops, one-on-one contact and via University of Guam website. Copies of the Guam Directory of Agricultural Services will be given to workshop attendee and others that need a means of quickly identifying IPM and agriculture related services provided by government agencies. Additionally, this directory will target duplication in services provided. Revised vegetable production guides will be placed on the Guam Cooperative Extension Service website for use by agricultural professionals, agriculture students, farmers, and gardeners. Results of pest diagnostics inquiries will be shared with clients. In addition, those in the Western region will be informed of new identifications.

5. Means by which results will be assessed or evaluated for impact:

Attendees of the workshop for commercial vegetable producers will show enhanced responsiveness to critical, priority pest management challenges. Attendees will realize an improvement in the flow of information to themselves with the use of the Guam Directory of Agricultural Services. Pre-and post-tests of workshop participants will show increased knowledge of Guam’s pests, diseases, and IPM practices. Over the course of routine farm visits by extension agents, there will be evidences that growers are adopting new sustainable IPM practices. Among attendees of the residential gardener workshop, field agents will see the adoption of workshop IPM, cultural, and pesticide safety practices through one-on-one conversations.



For additional information, please contact an agricultural extension agent at the Guam Cooperative Extension, College of Natural and Applied Sciences, University of Guam, you may call 734-2080 or write to the Guam Cooperative Extension, College of Natural Applied Sciences, University of Guam, UOG Station, Mangilao, Guam 96932.

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