

V(A). Planned Program (Summary)

Program # 2

1. Name of the Planned Program

Small Island Agricultural Systems

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
102	Soil, Plant, Water, Nutrient Relationships	15%		15%	
112	Watershed Protection and Management	10%		10%	
136	Conservation of Biological Diversity	15%		15%	
202	Plant Genetic Resources	10%		10%	
204	Plant Product Quality and Utility (Preharvest)	5%		5%	
205	Plant Management Systems	10%		10%	
212	Pathogens and Nematodes Affecting Plants	5%		5%	
216	Integrated Pest Management Systems	15%		15%	
315	Animal Welfare/Well-Being and Protection	5%		5%	
601	Economics of Agricultural Production and Farm Management	10%		10%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of professional FTE/SYs expended this Program

Year: 2010	Extension		Research	
	1862	1890	1862	1890
Plan	19.0	0.0	7.0	0.0
Actual	18.0	0.0	8.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
435920	0	371613	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
64679	0	70079	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

PCC: Conservation and maintenance of the taro, cassava and sweet potato germplasm at the research station continued to be a major activity as a repository of root crops germplasm collection in Palau. Field and sensory evaluation of taro hybrids obtained from the SPC revealed that they were well adapted to the environment and were very acceptable to Palauan taste. Planting materials of these new taro hybrids were distributed to farmers. Biocontrol agents for control of cassava spider mite and taro leafhopper were released on cassava and taro plantings to assist farmers in controlling these pests. Training on maintenance of rainwater catchments were conducted to students and teachers. Community groups and students visited the Dry Litter waste demonstration. Assessment of and workshop on piggery waste management was conducted. Revised dry litter design was distributed to five farmers. A televised infomercial was shown in a local television program to increase awareness on alternative ways of operating a piggery without harming the environment.

Biocontrol agents for predatory mite for cassava spider mite and mirid bug for taro leafhopper were released on cassava and taro plantings to assist farmers in controlling these pests. Also, Entomologists from Northern Marianas College came to Palau to collect psyllid insects to control Mimosa in the Saipan, Rota and Tinian.

Water outreach presentations were conducted to high school students and teachers on how to maintain their rainwater catchments. Different community groups and schools visited the animal waste dry litter system and a piggery waste management assessment was conducted to piggery farmers. An animal waste management workshop was conducted in collaboration with University of Hawaii. Revised dry litter design was distributed to five farmers and a televised infomercial was shown in a local television program as awareness on alternative ways of operating a piggery without harming the environment.

CMI: Lime trees and mountain apples were propagated thru air layering and distributed and demonstrations on growing sweet potato using used tires were conducted. In collaboration with the government and NGOs and in celebration of World Water Day, a video entitled "The Challenges of Water in the Republic of the Marshall Islands" was produced.

COM-FSM: Activities vary between home and school gardening. Small scale commercialization has emerged with new farms in all islands. A research project on salt tolerant root crops started in response to climate change and agroforestry programs continued to promote biodiversity and food security. Livestock farmers benefited from local feed and medicinal plants as pharmaceuticals. A public demonstration on

water catchment's first-flush divergent to remove contaminants from catchment collecting rain water was conducted. The concept behind the first -flush is to divert the first downpour, in effect removing contaminants including bird droppings, dust, or foreign particles before the storage tank. The divergent mechanism is by gravity with the use of "V trap" to prevent overflow of contaminated water into the catchments. Kosrae continued seedling distribution and farm visits for on-site recommendations. During visits, technical assistance and support were provided to farmers on appropriate farming techniques and practices. Transfer of tissue-cultured plantlets from growth room to greenhouse for acclimatization, from greenhouse to nursery for maintenance and distribution continued. More than 7,000 taro and 6,500 sweet potato seedlings were produced, and total 10 banana, 4,600 taro and 1,472 sweet potato plants were distributed and more than 8,701 eggplant, green onion, Chinese cabbage, cucumber and tomato seedlings were produced, and 6,050 seedlings were distributed.

2. Brief description of the target audience

PCC: The agriculture program caters to several groups including the farmers, students from the kindergarten, elementary, high schools to college level, parents, teachers, government officials and the private individuals.

COM-FSM: Scientists, extension staff, agricultural professionals, agriculture students, federal, state and national agencies, conference publications, and scientific journals are target audiences for research activities. Farmers, producers and exporters of the state, extension colleagues, and other members of the community who are involved in the agriculture sector are target audiences for extension activities.

CMI: Audience include community members such as, leaders, farmers, men, women, youth, school principals and teachers, elementary, high school and college aged students.

V(E). Planned Program (Outputs)

1. Standard output measures

2010	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Plan	600	3000	300	600
Actual	5600	9200	3664	7700

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

Patent Applications Submitted

Year: 2010
 Plan: 0
 Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2010	Extension	Research	Total
Plan	0	0	
Actual	0	0	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Expected Professional Journal Publications.

Year	Target	Actual
2010	3	1

Output #2

Output Measure

- Expected Gray Literatures

Year	Target	Actual
2010	3	7

Output #3

Output Measure

- Expected publications for lay use.

Year	Target	Actual
2010	3	18

Output #4

Output Measure

- Conference presentations

Year	Target	Actual
2010	3	15

Output #5

Output Measure

- Conference publications

Year	Target	Actual
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2010 3 4

Output #6

Output Measure

- Number of publications for lay use.

Year	Target	Actual
2010	6	6

Output #7

Output Measure

- Number of conference paper publication/presentations.

Year	Target	Actual
2010	3	3

Output #8

Output Measure

- Number of demonstration farms established.

Year	Target	Actual
2010	12	79

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of persons with increased knowledge on appropriate production technologies.
2	Number of program participants adopting recommended practices.
3	Number of established farms and farm related businesses by individuals and cooperatives.

Outcome #1

1. Outcome Measures

Number of persons with increased knowledge on appropriate production technologies.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	2400	5000

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

PCC: People are unaware of pollution caused by piggeries to water resources. Best management practices and IPM techniques are essential to increase productivity.

CMI: Most farmers using commercial fertilizers are unaware of the detrimental impacts on the environment. Due to lack of knowledge and information on proper water treatment, people are bound to experience health issues.

COM-FSM: Many farmers have limited technical knowledge and skills about appropriate agricultural practices, animal waste management, and composting.

What has been done

PCC: Demonstrations on rainwater catchment and dry litter system were conducted in schools and communities. Planting materials, publications and biocontrol agents were distributed to farmers.

CMI: Demonstrations on making compost were conducted in schools and communities. Water quality awareness activities were also performed.

COM-FSM: Pilot projects on appropriate animal management were implemented. Training and demonstration Research and Extension have organized hands-on trainings to increase the participants' knowledge and farm visits for on-site recommendations on composting and appropriate farming techniques were conducted.

Results

PCC: Students, teachers, farmers and the community gained knowledge and awareness on maintenance of rainwater catchments and animal waste management. Farmers now understand the importance of germplasm conservation, use of biocontrol agents, and best management practices to ensure successful crop production and improve productivity.

CMI: Farmers gained knowledge in making their own compost using copra cakes. Participants are aware of the first-flush diversion catchment system.

COM-FSM: Participants gained knowledge about animal waste management, composting and appropriate farming techniques. Participants are aware of the first-flush diversion catchment system. The extension activities have improved knowledge, created awareness and developed skills of 143 participants in sustainable agriculture systems and innovative farming techniques and practices.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
112	Watershed Protection and Management
136	Conservation of Biological Diversity
202	Plant Genetic Resources
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems
212	Pathogens and Nematodes Affecting Plants
216	Integrated Pest Management Systems
315	Animal Welfare/Well-Being and Protection
601	Economics of Agricultural Production and Farm Management

Outcome #2

1. Outcome Measures

Number of program participants adopting recommended practices.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	1200	250

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

PCC: Water contaminants and improper animal waste disposal are harmful to health and the environment. Planting materials and pests and diseases greatly affect farm productivity.

CMI: Seventy-five percent of household water catchments are contaminated by pathogens and E. coli. Saline groundwater on farms affects plant growth.

COM-FSM: Inappropriate livestock management practices and limited knowledge in manure utilization contribute to pollution of the environment. Targeted number of farmers and home-gardener communities will adopt appropriate farming techniques and practices.

What has been done

PCC: Workshops and demonstrations on cleaning of water catchment and proper animal waste disposal were conducted. Farmers were provided with planting materials and biocontrol agents.

CMI: Demonstration on the first-flush and presentation of dry litter waste management were conducted. Brochures were developed, translated, and distributed. Proposed sites for groundwater wells were tested.

COM-FSM: Interagency-conducted training and workshops. Pilot demonstration projects sites were identified. Ten banana, 4,600 taro, 1,472 sweet potato plants and 6,050 seedlings of eggplant, green onion, Chinese cabbage, cucumber and tomato were distributed to interested farmers.

Results

PCC: People are now cleaning water tanks or boiling drinking water. Regulating agencies are promoting the use of dry litter waste management which is now adopted by three piggeries. Food production has been enhanced by the improved yield of farmers using disease-free and high-yielding planting materials and use of biocontrol agents to control pests.

CMI: Four farmers have installed first-flush divergent systems. Ten farmers have volunteered their pigpens for demonstration of the dry-litter system.

COM-FSM: Ten livestock waste management projects have been established and animal manure has been utilized to improve crop production and the environment. Eighty-four youths and adults have started establishing their farms. Ultimately the projects have developed positive attitudes, zeal for learning techniques and farming aspects, and have changed the behavior of the participants.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
112	Watershed Protection and Management
136	Conservation of Biological Diversity
202	Plant Genetic Resources
204	Plant Product Quality and Utility (Preharvest)
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216	Integrated Pest Management Systems
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601	Economics of Agricultural Production and Farm Management

Outcome #3

1. Outcome Measures

Number of established farms and farm related businesses by individuals and cooperatives.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	18	75

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

PCC: Clean drinking water and proper animal waste disposal are essential for health and environment. Quality planting materials, and IPM techniques should be adopted to improve productivity.

CMI: Outbreak of waterborne illnesses continues to be a problem. Through collaborative efforts, effective programs will be organized to address the health issues.

COM-FSM: Clean drinking water and proper animal waste disposal are essential for health and environment. Quality planting materials, and IPM techniques should be adopted to improve productivity.

What has been done

PCC: Education programs to clean water tanks and demonstration on dry litter waste management were conducted. Crops were produced using quality planting materials and biocontrol agents.

CMI: Water Quality awareness trainings were conducted with schools and communities. The water quality staff collaborated with partner agencies in addressing these issues by offering awareness programs, testing water sources for bacterial contaminants, and demonstrating the First Flush Device concept in schools and communities.

COM-FSM: Extension staff had established gardens in the communities and schools and provided training on maintaining them. Students have been recruited into the college programs in agriculture. Agro-forestry and sustainable agriculture programs have been promoted in all communities and basic skills and knowledge on agriculture were provided as well as seedlings and planting materials in order for adults and students to start their own gardens.

Results

PCC: Collaborative efforts on conservation and protection of natural resources have improved water quality and the environment. Quality planting materials, biocontrol agents and fertilization resulted in high productivity of root crops. Visitors are interested to adopt the practices showcased at the research station.

CMI: The use of hand sanitizers is used by young kids and adults in all events. Individuals are conscientiously aware that they need to use hand sanitizers at all times. Local businesses have indicated that it is one of the first items that was sold out, especially during the outbreaks of waterborne and other health illnesses. Individuals and schools administrators have install the First Flush Device.

COM-FSM: Demonstrations on home gardening were provided at ECE schools for both children and staffs as a way of supplementing the school menu. Total of fifty-seven gardens were established in Kosrae and 39 in Pohnpei. On farmer in Yap reached sales of \$2000 per month by the end of the year. Farmers in Chuuk planted leguminous trees as hedgerows to provide mulch and compost materials to improve soils. The President of the FSM included the statement of "Go Local" in his State of the Nation address. Vegetable products were used in the kitchen to improve family meals.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
112	Watershed Protection and Management
136	Conservation of Biological Diversity
202	Plant Genetic Resources
204	Plant Product Quality and Utility (Preharvest)
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V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

PCC: Financial constraint would affect the outcome for farmers who can not afford the dry litter system and the supplies to operate it as well as rainwater catchments and their maintenance. There is a need to hire a crop protection specialist to assess and develop effective techniques to control new pests that may seriously affect crop production.

CMI: The arrival of the chemical reagents to test for bacteria took over 6 months, which hindered the testing component of the awareness activities. The Regional water quality project fund was reduced which made it difficult to do all proposed activities.

COM-FSM: Limited supplies and funding to carry on planned activities was one of the major constraints. Additionally, transportation, extreme bad weather, scheduling of field trip boats to the outer islands with no advance notice of ship scheduling. Drought, heavy rains and low government budget for agriculture hampered the delivery of efficient services especially to far-flung villages outside the lagoons due to unavailability/lack of travel money. Likewise, local populace looked down in farming as a dirty and low-paying job. Wildfire during hot days caused crop losses in affected areas. The weather has contributed to the effect of the outcome, especially with cucurbits and is a strong limiting factor in the production of tomatoes. Duplication of efforts through the Department of Resources and Economic Affairs and local and international NGOs in programs which are similar to the backyard garden program create misunderstandings with farmers. The tidal surges of December emphasize the need for Food Security initiatives, management for atoll food systems as sea levels rise and salt tolerant crops and/or rapid generating crops for post-disaster relief. Other factors affecting production are the number of working age Micronesians who are emigrating each year. Local statistics indicate close to 2800 emigrants per year.

V(I). Planned Program (Evaluation Studies and Data Collection)

1. Evaluation Studies Planned

- Retrospective (post program)
- Before-After (before and after program)
- During (during program)
- Time series (multiple points before and after program)
- Case Study
- Comparisons between program participants (individuals, group, organizations) and non-participants

Evaluation Results

PCC: Participants gained knowledge and valued their health, water resources and environment. The root crops germplasm collection has been a reliable source of planting materials of high yielding varieties of root crops, which are essential to increased productivity. Biocontrol agents have effectively controlled pests of taro and cassava.

CMI: Addressing water quality issues was challenging, so more funding for water quality programs will allow the Extension Agent to target the populated islands and atolls. It will also allow follow up visits to monitor program impact. The agriculture staff learned the significance of agriculture and especially on the practical skills that farmers must possess.

COM-FSM: Experiments are showing positive results and farmers increased interest in developing agricultural farms. The extension activities have increased knowledge on sustainable agriculture systems. Ultimately the projects have developed positive attitudes, zeal for learning techniques and farming aspects, and have changed behavior of participants. More than 19,500 elite seedlings of different varieties of staple food crops were produced through micropropagation and nursery management. Total 10,031 seedlings of different varieties of banana, taro, sweet potato and vegetables were distributed to 213 interested farmers. New varieties of banana are bearing fruits and farmers are very happy to harvest excellent bunches of banana.

Families that participated in the program produced their own vegetables and continue to maintain their gardens. And municipalities that participated in the program displayed more vegetables during their perspective agriculture fairs this year. Farmers in Yap are producing enough noni to require external markets. More yellow varieties of bananas and other crops are available in markets. More farmers are treating animal diseases using local medicines and are requesting less service from Extension staff. Farmers are accepting agro-forestry techniques for soil improvement.

High efficiency protocols and nursery techniques have been developed for mass-multiplication of different varieties of banana, taro and sweet potato. Initial grafting experiments on citrus are showing positive results. Ultimately the projects have developed positive attitudes, zeal for learning techniques and farming aspects, and have changed the behavior of the participants.

Key Items of Evaluation

PCC: Water education campaign and dry litter waste management workshops and demonstrations have been successful in providing continuous education and awareness to farmers, youths, community groups, government and private organizations. The tissue

culture technique has been successful in providing a continuous supply of taro and banana planting materials to farmer clients. Biocontrol agents have been successful in controlling pests of root crops and invasive weeds in Palau.

CMI: One hundred eighty farmers have acquired the basic skills in farming. The agriculture staff plans on working with farmers from other populated atolls, but in order to do so, funding should be increased. Additional funding to cover all thirty islands is necessary for more programs in schools and in the communities.

COM-FSM: Increased germplasm types, increased seedling production, increased number of farmers, increased number of agricultural farms, presented results of research and extension project during scientific conferences and meetings, published publications related with the projects, developed high efficiency protocols for rapid multiplication of banana, sweet potato and taro; extension activities resulted in improved knowledge, created awareness and developed skills of the participants in sustainable agriculture systems; positive results of the evaluation: Use of local plants and farm residues as fertilizers and pesticides; conserving local plants for food, medicinal and other uses; revival of traditional farming through Agroforestry approach

There is an increase in the number of students with interest in farming for profit and increase number of commercial farms, research is effective in small programs if targeted efficiently such as developing high efficiency protocols for rapid multiplication of different varieties of banana, sweet potato and taro, and in vivo and in vitro grafting experiments in lime showed positive results and sour orange rootstock accepted Mexican lime and Mexican lime thorn-less budwood. There is a definite need to develop strategic plans in food security and in responses to climatic change including identifying or developing salt tolerant root crops and skills in sustainable agriculture systems. Stakeholders are in need of marketing guidance and processing techniques to add value and lengthen shelf-life of local foods.