ANNUAL REPORT FOR ACCOMPLISHMENTS AND RESULTS

GUAM FY-2002

Location

University of Guam
College of Agriculture and Life Sciences
UOG Station
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Executive Summary

Guam, an unincorporated Territory of the United States, is located in the Western Pacific at 13 degrees north latitude and 144.4 degrees east longitude. It is the largest of 16 islands in the Mariana archipelago. It is approximately 3,600 miles west-southwest of the Hawaiian Islands and about 1,500 miles due east of Manila, Philippines. According to the 2000 census, Guam's population is 154,805. About forty percent of the population is under 20 years old. Twenty-three percent of the population lives in poverty. The ethnic background of the island includes: Chamorro (native islanders), Filipinos, Caucasians (including members of the U.S. Armed Forces and their dependents), other islanders (Micronesians and Palauans) and Asians (Koreans, Japanese and Chinese). The ethnic composition includes 37% Chamorro, 27% Filipino, 6.8% Caucasian and 29.9% other (i.e., Pacific Islanders other than Chamorros and Asians).

On June 22, 1972, the U.S. Congress through Public Law 92-318, designated the University of Guam as a member of the 1862 Land Grant institutions. In recognition of the University of Guam's land grant status, the Guam Legislature, through Public Law 13-47, assented to the federal provisions dealing with the research and extension functions of a land grant institution. In March 1974, the University of Guam Board of Regents created the College of Agriculture and Life Sciences (CALS) to facilitate the tripartite functions of the college: research, extension and teaching. The mission of CALS, in partnership with public and private sectors, is to improve economic, environmental, and social conditions for the people of Guam and the Western Pacific by providing creative and integrated research, education and extension programs in agriculture and life sciences.

The Agriculture Experiment Station (AES) conducts research for the development of the island's agriculture and related fields. The Guam Cooperative Extension (GCE) translates and delivers technical information and conducts informal education programs for farmers, homemakers, families, youth and the community. The primary mission of AES is to conduct applied, adaptive and basic research in agriculture and on issues pertaining to family well-being, youth development, human health/nutrition, consumer science, human resource development and the environment. The extension mission enables the multicultural community of Guam to make informed decisions through non-formal education programs based on research and identified local needs.

The Hatch and Smith-Lever formula funds and their respective Government of Guam matching funds are used to maintain operations of the University of Guam Agriculture Experiment Station and Guam Cooperative Extension. These funds principally support the salaries of permanent personnel of AES and GCE.

It is important that both AES and GCE implement programs to help Guam's people cope with the extraordinary social stresses they have suffered over the last seven years. Recent natural disasters have battered the community, and Asia's economic downturn and the events of September 11 have weakened the local economy. The President has declared Guam a federal disaster area three times since 2001 — after an October 2001 earthquake and after

two typhoons in 2002. Damage from the two typhoons forced businesses to close, left families homeless, and destroyed schools. Islanders suffered months without basic services such as water, electricity and phone service. Some schools shut down for weeks, while other schools closed permanently, adding to already overcrowded classrooms. According to the *Pacific Daily News*, Guam's unemployment rate has been in double-digits since 1999, when 15.2 percent of job seekers couldn't find jobs. Bankruptcy filings in 2001 posted a nearly 100-percent increase from 155 in 2000 to 287 as of Dec. 26, 2001. Also, last year, the port strike on the U.S. West Coast crippled importation of food and supplies to Guam.

Earlier measures to stimulate the economy have failed. Recently, the Governor of Guam and Guam Legislature passed controversial laws that shortened the work week from 40 to 32 hours, eliminated many holidays, laid off government workers and raised taxes. Many people who have lost their jobs are moving to the U.S. mainland or joining Guam's welfare rolls.

AES and GCE will continue to help the community through its outreach and extension efforts. AES and GCE also will continue their partnerships with resource agencies to build upon programs that have worked.

Planned Programs

National Goal 1: An agricultural system that is highly competitive in the global economy.

Executive Summary

Growers of fresh local produce face severe competition from the U.S. mainland. Local fruits and vegetables account for about 80 percent of the value of the agricultural industry on Guam. However, more than 90 percent of Guam's food supply is imported from U.S. West Coast wholesale markets. Imported produce has several advantages over locally grown produce. The supply of imported produce is reliable, the product is graded and consistent in maturity and quality, and importers can receive the produce directly when it arrives on island. Locally grown produce, however, offers benefits imported food does not. Local produce is often fresher than imported produce; there are no shipping costs; many of the local fruits and vegetables are cultivars or crops that are not commonly available on the U.S. mainland; and local produce does not generate extra packaging material that will be to the island's waste stream. Given the current situation on Guam, a three-pronged strategy to encourage local agriculture is under way. First, researchers continue to investigate new cultivars and crops for a variety of uses. Second, researchers are finding and implementing disease control in plants and bio-control against pests. Third, extension faculty focuses their efforts on stakeholder needs, which range from education on agricultural developments to finding out about financial assistance opportunities.

Highlight (1):
The University's germplasm evaluation program focuses on tropical fruit germplasm in four sites on Guam, and on distribution of superior genotypes to commercial and home garden users. The primary research accomplishments for this year were the identification of one new *Annona* species that has high potential for commercial and home garden production, and the identification of a tree species that has superior and resilience to typhoons. The primary extension accomplishment for the year was publication of eight newspaper articles. The articles served to draw attendees into educational programs and to increase knowledge of home fruit production. Additionally, five educational programs were held as a part of this program. A total of 343 participants participated in these educational programs, and 564 specimens of high-quality, tropical fruit genotypes were distributed.

Highlight (2):
Papaya Ringspot Virus (PRV) is the main production constraint of papaya in Hawaii, Guam, and the Western Pacific. No papaya available on Guam is resistant to the local strain of PRV. Transgenic resistance has been shown to work in Hawaii, but existing plants are resistant only to the Hawaii strain of the virus. Researchers are developing a transgenic papaya that is resistant to Guam's strain of PRV. Also, researchers will look at the variability of the virus with respect to its coat protein gene to determine if there is a potential new strain that could pose a threat to the entire region. By developing resistance in local papaya to PRV,

researchers hope to favor papaya production and increase yields for the local market. This resistance, however, can also be used in other islands of the region as well.

Highlight (3):
Guam's Cooperative Extension program produced a primer on growing eggplant, pepper and tomato crops. The 188-page color compendium covers a variety of topics from growth requirements and plant diseases to business opportunities and food recipes on these solanaceous crops. These vegetables are commonly grown on Guam, and are some of the world's most popular crops. Agricultural students, retail farmers, backyard gardeners and agricultural scientists will find the guide a valuable tool. It includes information on how to get started and how to develop budgets and receive financial assistance. It is the second in a series of publications designed to help growers understand the fundamental principles of production and protection practices for specific crops. The first was the Guam Cucurbit Guide.

The primer improves the efficiency of distribution of agriculture literature, and provides instructional materials germane to Guam. A daylong workshop was presented to farmers and personnel from Government of Guam agencies, in order to promote the publication.
Two hundred copies of the guide have been sold, and another 150 copies have been provided free to libraries and research personnel in the region and the Untied States.

Key issues addressed in Fiscal 2002 were:
Plant Germplasm
New Uses for Agricultural Products
Plant Production Efficiency
Plant Health, Nutrient Management
Agricultural Profitability
Plant Health
Biotechnology
New and Value Added Agricultural Products
Agricultural Competitiveness
Agricultural Profitability
Small Farm Viability
Invasive Species
Recycling
Animal Production Efficiency
Aquaculture
Home Lawn and Gardening

Key theme: Plant Germplasm

Germplasm Enhancement and Improvement of Local Supply of Planting Materials for Vegetable Production on Guam

a. Brief description of activity

The project continued to aim for improving the quality and quantity of planting materials available for vegetable production on Guam. The project initiated seed production of two local vegetables, okra (*Abelmoschus esculentus*) cultivar 'Charlie,' and field corn (*Zea mays*) 'Guam white field corn.' These seeds were packaged for distribution to local farmers and home gardeners.

The project also continued to collect various vegetable germplasm for deposit in the Vegetable Research Unit of the Agricultural Experimental Station. Crops included sweet potato (*Ipomoea batatas*), vegetable soybean (*Glycine max*) and tomato (*Lycopersicon esculenta*). The accessions of vegetable soybeans and sweet potato, and new cherry tomato accessions from AVRDC were evaluated during 2002. Tissue-cultured bananas were distributed to local community.

Research data on solanaceous crops generated from this Hatch project were summarized and presented in Tomato, Eggplants, Pepper Production Guide for Guam edited by Drs. Bob Schlub and Lee Yudin.

b. Impact/ accomplishment statement

Selections of plant accessions and commercial cultivars adapted to Guam are recommended to extension agents and to the community on Guam. Distribution of selected vegetable seeds can help improve local production of vegetables. Production of local vegetable seeds and disease-free planting materials using tissue culture is in progress to increase clean planting materials available to the local community.

c. Source of funding- Hatch Project
d. Scope of impact - state specific

Key theme: Plant germplasm

Tropical fruit tree collection and evaluation

a. Brief description of activity

The University's germplasm evaluation program focuses on tropical fruit germplasm located in four sites on Guam, and on distribution of superior genotypes to commercial and home garden users.

Primary research accomplishments for this year were the identification of one new *Annona* species that has high potential for commercial and home garden production, and the identification of a tree species that has superior resilience to typhoon damage. *Annona reticulata* was introduced to Guam many years ago, and is a favorite food item of Guam's native fruit bat. The seeds have been spread throughout northern Guam, and the species has naturalized. Fruit quality, however, is inferior and the fruit does not have wide appeal. We introduced several improved genotypes of this species several years ago, and 'San Pablo' has proven to excel in production and quality. We will be promoting the planting of this new genotype in the coming years.

Pleiogynium timoriense is a large tree that produces small purple fruit. We introduced this species to evaluate fruit production. The two major typhoons of 2002, however, allowed us to identify its superior resilience to typhoon damage. We will be promoting the

propagation and planting of this species in Guam's urban landscape because of these characteristics. We also produced one refereed publication on some of the biological limitations to growing a native tree species in the urban landscape.

The primary extension accomplishment for the year was publication of eight newspaper articles. The articles served to draw attendees into educational programs and increase knowledge of home fruit production. Additionally, five educational programs were held as a part of the tropical plant germplasm evaluation program. A total of 343 participants attended these educational programs, and 564 specimens of high-quality, tropical fruit genotypes were distributed.

b. Impact/ accomplishment statement

The new variety of *Annona reticulata* provides an alternative for household fruit production on Guam. Information on the care of backyard trees was provided to the public through the newspaper, and 343 people attended workshops and obtained high-quality fruit trees, with training on tree care and maintenance.

c. Source of funding - Hatch
d. Scope of impact - Integrated research and extension

Key theme: Plant Germplasm

Southern Multi-State Project S-009: Plant Genetic Resources Conservation and Utilization. 2001-2003

a. Brief description of activity

The project was initiated in January 2001 to collect local and international plant germplasm, and to propagate selected cultivars by seed and tissue culture. The project will improve plant acquisition and management systems for germplasm and plant propagation programs by advancing technology at the Guam AES Horticulture Laboratory.

Activities included: (1) collection of local and international plant germplasm for propagation of selected cultivars by seed production and in-vitro propagation, and for conservation of germlines and distribution, (2) evaluation of field performance of collected germplasm for tropical climate adaptation, pest resistance, and other desirable characteristics for consumers on Guam, and (3) improvement of plant acquisition and management systems for germplasm collection and plant propagation programs by advancing technology.

Crops tested in 2002 included sweet potato (*Ipomoea batatas* (L.) Lam.), vegetable soybean (*Glycine max* (L.) Merr.), and tomato (*Lycopersicon esculenta* Mill.). Two new sweet potato accessions were obtained from Saipan that have a fresh purple color.
Two sets of soybean accessions, one that originated from the AVRDC breeding program and one from a Japanese company, were evaluated in Guam cobbly clay soil. AVRDC lines were adapted to Guam's climate, while Japanese commercial cultivars matured too early, resulting in poor yields.
Open-pollinated cherry tomato accessions from AVRDC were evaluated twice for the local fresh market. Both experiments, however, were terminated before the harvest stage because of typhoon damage, the first trial, and an outbreak of bacterial leaf spot (*Xanthomonas*

campestirs pv. *vesicatoria*), the second trial. The result of data for plant tolerance to the disease in the second trial was summarized and presented to to Dr. P. Hanson, an AVRDC tomato breeder of AVRDC as a report.

b. Impact/ accomplishment statement

Plant propagation activities in this project contribute to the improvement of the local supply of planting materials. The indigenous germplasm collection maintains a variety of genetic materials from crops important to Guam.

c. Source of funding – Multi-state research funds
d. Scope of impact – Multi-state research - GU NM FM

Key theme: New Uses for Agricultural Products

Market study and cultivar selection of processed root crops in Guam

a. Brief description of activity

A sensory evaluation was conducted in September 2002 with collaboration of faculty member Dr. Jian Yang, Food Scientist. The result will be summarized and the report will be presented in Guam Vegetable News published by GCE. The research project focused on promoting post-harvest activities to increase marketability of traditional root crops on Guam. The field evaluation of sweet potato (*Ipomoea batatas*) was conducted during the dry season in 2002, and results are being analyzed.

A market study of sweet potato, taro (*Colocasia esculenta* and *Xanthosoma* sp.), and cassava (*Manihot esculenta*) was re-conducted using a revised survey form. The result is being summarized.

b. Impact/ accomplishment statement

The development of processed products made from traditional root crops will promote agriculture and agri-business on Guam and on other tropical islands in the region. The results of survey and field trials encourage creation of new forms of processed products. Faculty member Dr. J. Yang participated in the sensory evaluation of selected sweet potato accessions.

c. Source of funding - Special grants
d. Scope of impact - State specific

Key theme: Plant Production Efficiency

Response of vegetable crops to mycorrhizal inoculation in tropical limestone soils

a. Brief description of activity

The progress was made to establish a protocol for the multiplication method of *Glomus aggregatum* inocula in a laboratory. A study also was initiated to understand the influence of

Glomus aggregatum on the development of tropical vegetable crops grown in the calcareous soils on Guam. The degree of effectiveness of the VAM fungus on growth of important vegetable-crop seedlings in the tropics will be a part of a Masters of Science thesis study by Mr. Joseph Tuquero. A water-stress tolerance experiment on selected vegetable seedlings in response to VAM inoculation was conducted in October-November, 2002 and the results are being analyzed.

Two other experiments will be conducted in 2003. First, the selected vegetable seedlings grown in a commercial media will be inoculated before transplanting to the field and effects of the VAM fungus on plant growth and development will be evaluated. The second study will focus on an interaction of the VAM fungus with inorganic fertilizer amended with poultry manure in calcareous soil. Supplies and materials currently are being prepared for these two experiments.

b. Impact/ accomplishment statement

Expected effects of VAM inoculation include improved seedling growth and development, an increase in plant water-stress tolerance, and reduction in the need for use of chemical fertilizer. The study will demonstrate possible benefits of VAM fungus on the various crops in a calcareous tropical soil. Findings of the proposed study will lead to applied research on development of farm management systems using VAM fungus for sustainable agriculture in the tropics. A graduate student, Mr. Joseph Tuquero of the Environmental Science Program, has started work on a part of the research problem for his thesis.

c. Source of funding - Special grants
d. Scope of impact - State specific

Key theme: Plant health/plant production efficiency

Papaya production practices

a. Brief description of activity

The primary focus of this program is to determine the influence of nursery practices on papaya growth during the juvenile period and early fruit production. The papaya industry on Guam is geared toward speed of production following planting. Early and heavy fruit production are essential components to success, as papaya plants are highly susceptible to typhoon damage. A typhoon means total loss in any papaya planting.

A typhoon destroyed field research plots in July 2002. These have been replanted, and we are determining the interaction of nursery practices with the use of wood chips as mulch for orchard floor management. We published one refereed publication and one extension publication, and held one educational program with 101 people in attendance. We distributed 200 papaya plants to the attendees.

b. Impact/ accomplishment statement

Acceleration of initial fruit set will allow greater productivity from each plant before fruit set is halted by infection with Papaya Ringspot Virus. The distribution of high-quality seedlings with training on care to 101 people will increase home and commercial papaya

production on Guam.

c. Source of funding - Hatch
d. Scope of impact - Integrated research and extension

Key theme: Plant Health

Invasive weeds as hosts of agricultural pests on Guam

a. Brief description of activity

The project was initiated this year with the goal of publishing a "weed book" for Guam. A research assistant was hired, and her literature review work resulted in a list of more than 60 plant species as weeds on Guam. At a Golf Course Superintendent monthly meeting on November 12, 2002, Dr. Robert Schlub, Lauren Gutierrez and Dr. Greg Wiecko presented the prospects for this research project and for the creation of the weed book. We asked the group for any suggestions on publication of the weed book that might assist their organizations.

b. Impact/ accomplishment statement

A guide to the weeds of Guam would allow farmers, gardeners and turf managers to better plan their weed control efforts.

c. Source of funding - Special grants
d. Scope of impact - State specific

Key theme: Nutrient Management

Evaluation and implementation of nitrogen fixing species in hedgerow intercropping in the Mariana Islands

a. Brief description of activity

Pamphlets with plant propagation procedures for six nitrogen fixing plants are being produced. The plants include *Gliricidia sepium*, *Desmodium rensonii*, *Leucaena leucocephala* cv. K636, *Calliandra calothyrsus*, *Sesbania sesban* cv. Nubica, and *Cajanus cajan*. College of Agriculture and Life Sciences faculty at the University of Guam and personnel of USDA Natural Resources Conservation Services, Pacific Basin, are reviewing the publications.

Plant specimens of eight nitrogen fixing trees are being maintained for observation at three Agricultural Experiment farms, Yigo, Barrigada, and Ija. The plants include *Gliricidia sepium*, *Desmodium rensonii*, *Leucaena leucocephala* cv. K636, *Calliandra calothyrsus*, *Sesbania sesban* cv. Nubica, *Cajanus cajan*, *Acacia angustissuma*, and *Flemingia macrophylla*. Workshops at the planting sites will demonstrate use of nitrogen fixing trees as hedgerows.

Biomass studies showed that *L. leucocephala* cv. K636 had highest yield in alkaline soils at two locations, while *F. macrophylla* and *G. sepium* produced greater biomass in acidic soil than the other leguminous trees. Results will be published in press in the proceedings of Sustainable Agriculture in the Pacific and Asian Regions.

Monthly observation of seed production was summarized. Generally, seed production of NFTs reflected the soil's fertility and plant adaptability to a particular soil type. *Desmodium rensonii* and *Flemingia macrophylla* produced numerous seeds regardless of season at all three locales. In contrast, *Leucaena leucocephala* and *Sesbania sesban* produced more seeds in the alkaline soils of Barrigada and Yigo than in the acid soils of Ija. *Acacia angustissima* and *Cajanus cajan* had good seed production in Barrigada, while there were no or very few seeds produced in Yigo and Ija. At all locations *Calliandra calothyrsus* produced very few seeds and only one flower and pod of *Gliricidia sepium* was observed at Barrigada.

The most troublesome pests on leguminous hedgerow plants were arthropods such as mealybugs (*Ferrisia virgata*?), Chinese rose beetle (*Adoretus sinicus*), and longhorn beetle (*Prosplus branchii*). No serious foliar, stem or floral diseases were observed on any NFTs at any location. The root-knot nematode (*Meloidogyne* spp) affected none of the NFTs in Yigo, although the soil at the Yigo Experiment Station is known to be infested by the pathogen.

A 10-min video production on plant management of NFTs is being produced. A script was drafted, and a commercial video producer, Mr. Joe Cunningham, was contracted. The production will be completed in January 2003. Copies of the video will be distributed to middle and high schools and organizations where agricultural/environmental science is studied.

b. Impact/ accomplishment statement

We will generate two kinds of products from this project. First, data from the comparison study of nitrogen fixing trees at different soil regimes have revealed each species' adaptability to various soil regimes. The result was summarized and disseminated in an oral presentation at an international conference, and as a written report in the proceedings. A fact sheet was distributed to the local community.

Second, an educational pamphlet and video were created for distribution to secondary schools and through the Guam Cooperative Extension Service to show the various benefits of NFTs in our agricultural practices.

c. Source of funding - SARE
d. Scope of impact - State specific

Key theme: Plant health/ plant production efficiency

Photosynthetic recovery rates of Ifit

a. Brief description of activity

This project is designed to determine the limitations on photosynthetic rates at the canopy level, and how the rate of foliar development and specific physiological characteristics help optimize yields during times of environmental limitations.

b. Impacts/accomplishments.

We studied post-defoliation leaf expansion and photosynthetic functioning in *Intsia bijuga* plants. The species is Guam's official territorial tree, and it is highly susceptible to defoliation during typhoons. Defoliation is the essential reason the species recovered rapidly from typhoon damage: It allows wind forces to pass through the canopy without them being transferred to the stems and trunk. The rebuilding of leaves is rapid following defoliation, and photosynthetic capacity reaches mature levels in about three weeks after leaf expansion begins. Rapid development of photosynthetic capacity explains the general ability of this species to tolerate typhoon damage.

b. Impact/ accomplishment statement

This project increases understanding of how native ecosystem respond to periodic tropical storm systems.

c. Source of funding – Multi-state Hatch
d. Scope of impact - State specific

Key theme: Agricultural Profitability

A Model integrated small farm for the U.S. Caribbean and Pacific Islands

a. Brief description of activity

The project was initiated to create a model farm to illustrate successful sustainable agriculture with Guam's limited resources. The project to establish the foundation of the farm operation is in its second year. We conducted a consumer survey on production of lei flowers on the farm and on other possible branches of the farming enterprise. Specific objectives then were set to produce profitable local fruit and vegetable crops, to produce ornamental plants used in local mwarmwar and lei making, and to raise goats to illustrate rotational grazing techniques. It is hoped the demonstration farm will be a site of education in tropical island agriculture.

During the second year of the project, rooted cuttings of karamansi (X *Citrofortunella mitis*) and barbado cherry (*Malpighia punicifolia*) and seedlings of star fruits (*Averrhoa carambola*) were planted in the orchard. Ti (*Cordyline terminalis*) and plumeria (*Plumeria* spp.) were are also planted for production of lei flowers and forage. In the rotational operation for vegetable and goat production, stargrass (*Cynodon nlemfuensis* var. *nlemfuensis*) and pangola grass (*Digitaria eriantha*) were planted in mother beds to increase the number of both plants. Some materials for fencing goat in the farm were purchased. Water catchment and compost bins are planned for the site. A draft of main farm structures is being finalized. Windbreaks (*Casuarina equisetifolia* and *Leucaena leucocephala* K636) and hedge plants (*Hibiscus* spp.) were planted or replaced as needed.

b. Impact/ accomplishment statement

A potential integration of crop and animal production on a small-scale farm of four acres will be demonstrated to the community. Record keeping in all operations will create a reference of expenses, including the cost of labor; farming supplies and materials; the farm

structure design; planning a layout of crop and animal production sites; the production of fruits, vegetables, ornamentals, and animals; the propagation of fruit, vegetable and ornamental crops; windbreaks; hedgerow plants from a plant nursery; and planting windbreaks and hedgerow plants at the farm.

c. Source of funding - IFAFS
d. Scope of impact – Multi-state integrated research and extension - VI PR GU

Key theme: Plant health

Study of Coconut Tinangaja disease and possible modes of transmission

a. Brief description of activity

Cocos nucifera L, the coconut palm, is a very important tree species in the Western Pacific region. Coconut Tinangaja is the most significant disease occurring throughout Guam and possibly in other Mariana Islands. The disease poses a threat to all other coconut growing areas in the world. We obtained an instrumentation grant for research and teaching, and purchased an ultraviolet spectrophotometer and a Kodak chemiluminescent/fluorescent imaging system. With these instruments, we are better able to see and capture the results of nucleic acid electrophoresis, hybridization and extraction. We are now able to quantitatively work with DNA and RNA, making our inoculation studies more efficient. We have found different DNA/RNA ratios in coconut tissues from Tinangaja-infected and healthy tissues. We have incorporated most molecular techniques used in this project into one graduate course in environmental microbiology, and some of these techniques into an undergraduate course in plant pathology. We have prepared a method for inoculating coconut seedlings with nucleic extracts from CTiVd-infected trees. Although the study was twice devastated by typhoons within a six-month, we are again gearing up to continue our research on Tinangaja. We had hoped to already have some results on pollen and insect transmission studies, but those will have to wait for next year. We only have a preliminary study of insects collected from diseased and healthy trees, and the results are questionable, so the work must be repeated.
We have published an extension paper on Tinangaja disease, its symptoms and control.

b. Impact/ accomplishment statement

The development and application of control measures will help reduce Tinangaja incidence in Guam's coconut populations, and help reduce the likelihood the disease will spread to other regions in the Western Pacific.

c. Source of funding - Special grants
d. Scope of impact – Multi-state research - GU NM FM

Key theme: Biotechnology

Development of molecular biology capability for the teaching lab at CALS, UOG

a. Brief description of activity

The College of Agriculture & Life Sciences at the University of Guam needed to upgrade its teaching capability to remain competitive. Its graduates need to be trained in the most important and up-to-date techniques being used for research and production in the field of agriculture. We set out to acquire new instrumentation to give us the capability of teaching molecular biology techniques in the various lab sessions of our agricultural science courses. Our researchers will also benefit from having access to upgraded molecular biology instrumentation to help them remain competitive in obtaining research grants.

We received a grant to do the above. A list of instruments was included in the grant proposal, and those instruments have been purchased. Most of the instruments are already in place and being used in our research and also in teaching. During the past two semesters, we used micro-centrifuges, gel electrophoresis equipment, a gel documentation system and an ultraviolet spectrophotometer in two different classes. We also have had several students, high school and college, working on special projects, even through the summer.

b. Impact/ accomplishment statement

New instrumentation has enhanced the ability of our graduates and researchers to compete with their peers from other institutions. We have already trained some students in molecular techniques. Three different researchers have approached the principal investigator for help with molecular techniques, and have asked for access to our equipment in new grant proposals they are preparing. The points we made last year continue to apply: 1. Our graduates will be prepared to seek jobs anywhere in the nation, and will be trained in molecular biology techniques, making them more competitive. 2. As our graduates take jobs in local and regional organizations, our area will benefit from their up-to-date scientific preparation. For instance, molecular biology techniques will come into more use within our scientific community, and the public will benefit from more sensitive detection systems for pathogens and pests. 3. Our researchers will find new opportunities to put molecular biology to work for them, making them more competitive in obtaining research grants, a further benefit to our region.

c. Source of funding - Department of Defense
d. Scope of impact - State specific

Key theme: Plant health

Research on diseases of traditional Pacific Island crop plants

a. Brief description of activity

Coconut, banana and taro are important traditional crops in Pacific islands. The most important diseases of these crops on Guam are Coconut Tinangaja, Banana Bunchy Top, Black Leaf Streak and Panama Wilt, and Taro Leaf Blight (TLB), respectively. The aim of this project is to facilitate ways to develop control measures for these important diseases. We are working on methods to develop the most sensitive technique possible for the detection of Tinangaja Viroid (CTiVd) so we can detect it at the earliest possible infection stage and investigate ways of reducing the spread of CTiVd from infected to healthy coconut trees. A

state-of-the-art technique has been developed and fine-tuned for early detection of CtiVd. An extension publication on Coconut Tinangaja was prepared and circulated among interested parties. We are searching for ways to reduce the negative impact of banana diseases on local production by reducing the likelihood of the spread of important pathogens such as BBTV, BLS and PW. We successfully applied for a grant to search for resistance to PW in bananas for Guam and Kosrae, and are starting on that work this year. We are looking for ways of managing TLB and other important taro diseases. This is currently being addressed via a second T-STAR grant to study the possible existence of disease and insect resistance in taro germplasm. Work is ongoing.

b. Impact/accomplishment statement

Control of any of the diseases of coconut, taro or banana will have significant economic impact in the Western Pacific region.

c. Source of funding - Hatch
d. Scope of impact – Multi-state research - AS FM GU HI NM.

Key theme: Plant health

Development of PRV resistance for the West Pacific and assay of PRV variability

a. Brief description of activity

Papaya Ringspot Virus (PRV) is the main production constraint of papaya in Hawaii, Guam, and the Western Pacific. No papaya available on Guam is resistant to the local strain of PRV. Transgenic resistance has been shown to work in Hawaii, but existing plants are resistant only to the Hawaii strain of the virus. Researchers are developing a transgenic papaya that is resistant to Guam's strain of PRV. Also, researchers will look at the variability of the virus with respect to its coat protein gene to determine if there is a potential new strain that could pose a threat to the entire region. In 2002, our field plots were totally devastated twice within a six-month period. We have started from scratch for a third time. We shall attempt to self-pollinate some local papaya plants to produce homozygous seed for transgenic conversion. The seeds have been planted, and we currently are waiting for them to germinate. We have learned the technique for identifying the Gus gene, and therefore are able to detect transgenic plants. We received approval from our institutional biosafety committee to work with transgenic plants as described in our proposal. The University of Hawaii has applied for permission to import papaya seed and leaf samples from Guam to do the above work.

b. Impact/ accomplishment statement

By developing resistance in local papaya to PRV, researchers hope to favor papaya production and increase yields for the local market. This resistance, however, can also be used in other islands of the region as well. Researchers will look at the variability of the virus with respect to its coat protein gene to determine if there is a potential new strain that could pose a threat to the entire region.

c. Source of funding - Special grants
d. Scope of impact – Multi-state research - AS FM GU HI AS

Key theme: New and value added agricultural products

Commercial production of tropical mushrooms grown organically

a. Brief description of activity

Organic waste products can be used to generate more food for the local community. We previously have developed techniques for tropical mushroom production *with Pleurotus ostreatus sajor-caju* and *Volvariella volvacea*. This technique is good enough for the amateur, but we need to fine-tune it for commercial production, in which volume and profitability are critical issues. Though two severe supertyphoons delayed the project, some accomplishments can be mentioned. We purchased a container, shelves, air conditioner, etc. and were set up to start our trials. We are maintaining the fungus cultures so we can proceed with testing as soon as possible. We were able to help researchers on the neighboring islands of Palau with information on growing tropical mushrooms and with a shipment of cultures and spawn. Palau researchers were successful in doing a brief economic feasibility study and will send us their results.

b. Impact/ accomplishment statement

We still hope to develop a large-scale production system that is profitable. If we succeed, the region will benefit from having mushrooms locally produced. This would benefit those involved in growing the mushrooms, any intermediaries marketing the produce, and consumers enjoying fresh, delicious and exotic tropical mushrooms.

c. Source of funding – SARE
d. Scope of impact – State specific

Key Theme: Plant Health

In vitro breeding to develop Fusarium wilt-resistant bananas (Musa sp.)

a. Brief description of activity

The banana is an important staple food in the Western Pacific. Panama wilt is a limiting factor in its production. This is particularly true today in Kosrae, where production is worth $100,000 annually. The disease is also important on Guam, where banana production reaches annual values of $121,000. Cultivar Saba is the most popular in Kosrae, and among the most important on Guam as well. This cultivar has already been established in tissue culture, and methods for micro-propagation have been developed. We propose to develop wilt-resistant bananas by means of an in vitro method called “cell line selection” because banana is a seedless crop. Authorization for spending the first year's funding of this project was obtained on January 23, 2003. We are already developing a memorandum of understanding between UOG and COM to govern the activities described in this joint

venture.

b. Impact/ accomplishment statement

Many farmers have expressed concern about Panama wilt of bananas, both on Guam and Kosrae. It is only right to try to address this problem by seeking to develop resistant plants from popular cultivars.

c. Source of funding - Special grants
d. Scope of impact – Multi-state research - GU NM FM

Key theme: Plant Production

a. Brief description of activity

This project seeks to improve crop production and water-use efficiency by using switching tensiometers as part of micro-irrigation management practice, and to increase grower use of switching tensiometers through instruction publications and workshops. Field experiments have shown that switching tensiometers when they are properly maintained and set to the proper soil matric potential for a particular crop perform better than timers in both crop yield and water-use efficiency in micro-irrigation systems. Four publications for dissemination by extension services have been produced in this area. Workshops for local farmers will be scheduled in the near future.

b. Impact/ accomplishment statement

Farmers on Guam use water from the public distribution mains for irrigation. Any savings of water through micro-irrigation techniques will cut the cost for the farmers and save on the public subsidies used for the distribution system.

c. Source of funding - Hatch multi-state - W-128
d. Scope of impact - State specific

Key theme: Agricultural Competitiveness

Career opportunities for Pacific Islanders in general food and agricultural sciences through a $100,000 Multicultural Higher Education Program.

a. Brief description of activity

The project will achieve National Goal I through research and education, and empower the agricultural community with knowledge that will improve competition in domestic production, processing and marketing. The project will support seven scholars at the University of Guam in the completion of their undergraduate studies in the discipline of general food and agricultural sciences.

b. Impact/ accomplishment statement

This multicultural education program will enhance the recruitment of students in the discipline of food and agricultural sciences, promote undergraduate research in the

development of tropical foods and agricultural crops, and prepare students for careers in agricultural food production and food-processing enterprises on Guam and in the Western Pacific islands.

c. Source of funding - Higher Education grants
d. Scope of impact - State specific

Key theme: Agricultural Profitability

Thirty-five new heliconia cultivars are available for Guam nurseries.

a. Brief description of activity

Heliconias are significant plants to the landscaping industry and as cut flowers on Guam. Due to quarantine restrictions, new cultivars have not been readily available to Guam nurseries. This project collected and is evaluating 35 heliconia cultivars for use on Guam. Vegetative propagation is increasing the quantity of these heliconia cultivars. New cultivars will be made available to nurseries for commercial sales. Trial gardens were planted at four sites for people to observe habits and floral characteristics.

b. Impact/ accomplishment statement

An increase in the variety of cultivars available will enhance the tropical environment on Guam. Improving landscape and interior-scape aesthetics will boost tourism, Guam's most important industry.

c. Source of funding - Special grants
d. Scope of impact - State specific

Key theme: Animal Production Efficiency

Use of local feed stuffs for swine

a. Brief description of activity

While no study has been conducted on the actual cost of swine production in the region, the cost is known to be high because imported commercial swine feeds are expensive. Feeds come from the U.S. mainland. Freight, taxes and other charges triple U.S. ration prices for the region's pig farmers to $15.95 for a 75-pound swine and $15.00 for a 50-pound sow. Pig prices have increased so much that they are beyond the reach of the region's communities. At times, when supply is very low, a 300-pound to 400-pound sow can cost between $2,000 to $3,000 in Pohnpei.

The Western Pacific region has an abundance of local feed stuffs, such as breadfruit, bananas, copra and fish byproducts. During harvest season, these feed stuffs are readily available for swine feeding. The primary reason these feed stuffs are not used is the lack of information on the nutritional content of these individual feed stuffs and no demonstrative study of these products for swine rations. A feeding trial is being conducted at the Ohwa Christian School on Pohnpei and another feeding trial at the Mangilao Hog Farm on Guam.

b. Impact/ accomplishment statement

This proposal aims to develop a feeding program using these feed stuffs to reduce feed costs by 50 % for growing and finishing hogs and breeding stocks. These local feed stuffs will undergo basic processing methods such as drying, cooking and grinding as needed. Feeding trials will be conducted at the Mangilao Hog Farm and Ohwa Christian School in Pohnpei. Growth rate, litter size, weight and body conditions will be used as parameters to evaluate the rations from these feed stuffs. The project started in August 2002. Initial results are still being gathered and compiled

c. Source of funding - SARE
d. Scope of impact – Multi-state integrated research and extension - FM GU NM

Key theme: Agricultural Competitiveness

Eggplant, tomato and pepper guide for Guam

a. Brief description of activity

A publication on how to grow eggplant, pepper, and tomato was produced in order to provide instructional materials germane to Guam agriculture. A daylong workshop to promote the publication was presented to farmers and personnel from Government of Guam agencies.

b. Impact/ accomplishment statement

Two hundred copies of the guide have been sold and another 150 have been provided free to libraries and research personnel in the region and the United States.

c. Source of funding - SARE and Smith-Lever 3d - IPM
d. Scope of impact - State specific

Key theme: Agriculture Competitiveness

Increasing knowledge of plant diagnostic techniques

a. Brief description of activity

To improve the viability of Guam's agriculture, renewed efforts were made to increase the proficiency of farmers and agriculture students in identifying plant diseases. Teaching of plant diagnostic techniques is provided directly to clients through contact in the office and in the field, and indirectly through fact sheets. Students will receive in-depth training through a new course being offered by the Department of Tropical Agriculture and Environmental Sciences at the College of Agriculture and Life Sciences in the University of Guam.

b. Impact/ accomplishment statement

Nine students are enrolled in AG 425 Plant Diagnostics. One of the students' assignments is to collect and identify specimens of plant abnormalities. These specimens will constitute the start of a collection of diagnostic material that can be used for extension or university

instruction.

c. Source of funding - Smith Lever
d. Scope of impact - State specific

Key theme: Agricultural Profitability

Promoting agriculture education in the Western Pacific

a. Brief description of activity

This program/project addresses the issue of how to promote and sustain economic self-sufficiency and self-reliance by enhancing the instructional capabilities of the University of Guam, Palau Community College (PCC) and College of Micronesia, FSM. Through the development of distance education instructional design, technology delivery and adaptation of traditional courses, the program extends and increases outreach to regionally based vocational agriculture teachers. This project will provide new access to its target population in education, giving non-traditional, adult learners an opportunity to attain a baccalaureate degree.

Challenge Grant activities began on September 1, 2001, and continued into 2002. Site visit assessments for the distance education capabilities and classroom design were completed with the development of an assessment report and a list for specifications for a model science lab. This was circulated to the faculty and administrators of the University of Guam College of Agriculture and Life Sciences and the College of Education at the University of Guam, Palau Community College, College of Micronesia-Federated States of Micronesia, and Florida A & M University, a collaborating partner. A comprehensive strategy and implementation plan resulted. Informal training in instructional use of experiment plots and in the instructional design of distance courses was conducted throughout the year during the site visit assessments and during the annual coordinator visit to the regional institutions. From August 5 through August 9, a regional workshop was conducted on Guam, co-sponsored with Japan's Sasakawa Peace Foundation. Participants were representatives and individuals from all the regional stakeholders, including K-12 agriculture teachers, administrators, policy makers, and faculty from UOG, PCC, COM-FSM, regional departments of education, NGOs and service providers. Work sessions focused on policy, support and technology delivery issues and the development of a regional strategic distance education plan. Training was conducted on the use of the technology platform PROA, which is being developed by CALS/UOG as one type of distance education delivery for the agriculture curriculum: Web based, on-line courses, via the Internet. A brochure was developed and disseminated for the workshop. Before the workshop, a consumer family science course, CFS 351, was used as a pilot project and adapted into a sample model with the design of the technology platform PROA. As a result of the workshop, a plan for adaptation of the agriculture curriculum for the baccalaureate was created with the establishment of an academic team with members from CALS, PCC and COM-FSM. Members of the team from CALS are now preparing a pilot project agriculture course adaptation with CALS' course, Ag101, Introduction to the Agricultural Sciences. From the initiation of this pilot, the adaptations of the other courses have now begun. An

organizational process for enrollment and registration of the agriculture teachers is being developed for DE courses.

b. Impact/ accomplishment statement

By raising the level of qualification of 150 agriculture teachers in grades K-12 throughout the region, it is the goal of the project to influence not only on the quality of instruction but on the practice of the field of agriculture within the general population. Better-educated students become farmers or move into other professional careers in agriculture as more highly qualified workforce members. Assessment of the impact of the project will not be determined until 2004.

c. Source of funding - Higher education Challenge Grant.
d. Scope of impact – Multi-state extension - GU FM NM

Key theme: Aquaculture

Growth concepts for tropical aquaculture

a. Brief description of activity

The aquaculture industry on Guam currently supplies only a local market. No aquaculture products are exported. High production costs and limited output limit the possibilities of export. Other areas of aquaculture have not been looked at for their viability. Ornamental aquaculture and recreational fishing in aquaculture ponds may have potential to offer economic opportunities to the community. Large commercial and small-scale producers have been presented with the fee-fishing concept. Most have been intrigued with the possibilities, but were reluctant to change existing practices. One commercial farmer had however started to implement a fee-fishing operation on a portion of the farm. The operation has been suspended due to damage from recent typhoons. It is expected that he will resume development of that aspect in the near future.

b. Impact/ accomplishment statement

Discussions on ornamental aquaculture have not received much interest from existing producers. The primary resistance was to exporting and the high labor requirements. Lack of information for Guam was another reason for the resistance. The Guam Aquaculture Growers Association (GAGA) organized as a group and filed their needed paperwork. Except for one board member, all GAGA officers are active producers.

c. Source of funding - Smith-Lever
d. Scope of impact - State specific

Key theme: Small Farm Viability

Financial management assistance for local farmers

a. Brief description of activity

The Guam Agricultural Development Fund (ADF) program allows a qualifying farmer access to a low 4% interest rate financing with a maximum term of 12 years. The program continues to be a popular funding source for farm production and farm equipment acquisition. CES reviews the loan application for the ADF, which allows farmers the opportunity to consider their proposed farm plan and strategies before committing resources and time. Over a four-year period, the sum total of ADF applications reviewed by CES totaled over $3.5 million.

b. Impact/ accomplishment statement

As a result, ADF funded four projects totaling $114,500.00. A farm technical brochure was published and is issued to clients making program inquiries.

c. Source of funding - Smith-Lever
d. Scope of impact - State specific

Key theme: Invasive Species

Invasive insects of Micronesia

a. Brief description of activity

Invasive arthropod pests pose a continuous and serious threat to agricultural, urban and natural ecosystems on Guam and in Micronesia at large. The majority of insect and mite pests on Guam are alien species accidentally introduced from Asia, from adjacent islands or from the U.S. mainland. These arthropod pests infest crops, vector plant and animal diseases, lead to quarantine of plant produce, destroy houses and wood structures, and threaten the island's biodiversity. Similarly, introduced arthropod pests comprise the majority of serious crop pests in the other islands of Micronesia. With increased air and ship travel between the islands of Micronesia, and with increasing demand for products from Asia, the U.S. mainland and from other continents and island ecosystems comes an increasing threat for the introduction and establishment of additional pests. Approximately one new arthropod pest is introduced annually into Guam. Records from other islands within Micronesia are less comprehensive. Although previous workers have sought to catalogue the insects of Guam and other Micronesia islands, there have been no comprehensive insect surveys in Micronesia for many years. As a result, pest records do not accurately reflect the fauna, nor describe the animal/plant arthropod relationship existing within Micronesia.

We have begun to survey the extensive literature on invasive insect species from Micronesia, especially pest catalogues assembled by entomologists from the different island groups in the region. We have also established a rough timetable and collaborative work assignments with the Secretariat of the Pacific Commission, who will provide additional funding for training exercises in the Federated States of Micronesia and the Republic of Palau. Surveys of arthropod pests have begun on Guam, and will shortly be started in the Commonwealth of the Northern Marianas Islands (CNMI) of Saipan, Tinian, and Rota, in the various islands of the Republic of Palau (RP), in Yap, Pohnpei, Chuuk, and Kosrae states of the Federated States of Micronesia (FSM) and in the Republic of the Marshall Islands (RMI). We have identified qualified technical personnel, and employment offers have been tendered.

b. Impact/ accomplishment statement

We have trained PPQ personnel from all regions of Micronesia on the importance of invasive species, and how to recognize them during their inspections. The trainees in their daily work assignments are using these techniques.

c. Source of funding - Special grants

d. Scope of impact – Multi-state integrated research and extension - FM GU NM

National Goal 2: A safe and secure food system.

Executive Summary

Food safety issues continue to play an important role in extension training. Data from the Guam Department of Public Health showed there were 599 outbreaks and 1,658 cases of food-borne illness on Guam from 1983 to 2001 due to incorrect food preparation and handling. Food safety was especially critical in 2002. Last year, two typhoons severely damaged the island's infrastructure. Residents were left without telephone, electrical, sewer and water services. With no power for refrigeration or ability to make ice, people were exposed to spoiled foods, and food preparation was difficult with little or no potable water.

Highlight (1):
After each typhoon, food safety articles were published in Guam's only daily paper, which was the island's main source of news during the typhoon recovery period. The articles provided food safety knowledge to promote proper food handling practices. The articles also educated people about how to handle and prepare food during times of power outages and water safety problems.

Highlight (2):
A total of 130 people participated in a series of five, 20-hour long, combined food safety and Hazard Analysis Critical Control Point (HACCP) workshops conducted by Guam Extension Service. Ninety-two participants adopted safe food handling HACCP practices, good personal hygiene, proper hand washing requirements, proper storage and the use of the time/temperature principle. All participants have increased their knowledge of food safety and HACCP principles.

Key theme: Disease prevention and food safety

Food safety educational activities

a. Brief description of activity

Costly health problems on Guam are caused by food-borne illness. There is need for food safety education throughout the Island. The people of Guam experience frequent power outages. Power shortages can leave refrigerated foods contaminated and spoiled. Another cause of food-borne illness is the lack of good personal health and sanitation practices. The water supply system on island is unsatisfactory, unsafe and undesirable. Education in safe food-handling HACCP practices is necessary for the consumers. Food preparers need to know how to prepare wholesome food and to prevent costly medical care caused by food-borne illnesses. A total of 130 people participated in a series of five, 20-hour long, combined food safety and HACCP workshops conducted by the College's Guam Extension Service.

Three food safety articles were published in the Pacific Daily News as a public educational service, providing food safety knowledge to promote proper food handling practices at home.

b. Impact/ accomplishment statement

Ninety-two percent of participants adopted safe food handling HACCP practices, good personal hygiene, proper hand washing required for food preparation, proper practices for checking incoming food, proper storage of food, and use of the time/temperature principle. All participants have knowledge about food safety and HACCP principles and have reduced questionable health risk behavior.

c. Source of funding - Smith-Lever

d. Scope of impact - State specific

National Goal 3: A healthy, well-nourished population

Executive Summary

Chronic diseases such as diabetes, cardiovascular disease and cancer have been primary causes of death for people on Guam for over 30 years. According to recent data from the Guam Department of Public Health and Social Services — Vital Statistics Office, six out of the ten leading causes of death on Guam are preventable by healthful lifestyle habits, especially in diet and exercise.

Infant mortality and low birth weight rates on Guam are increasing. Smoking and inadequate prenatal care are both known to contribute to these negative birth outcomes. Furthermore, adolescent pregnancy rates are also increasing. Many of these adolescents and adult women do not have insurance coverage, and therefore do not have prenatal care. Guam's recent welfare reform has made access to health care difficult. Guam's performance plan addresses the following areas of concern: (a) the need to increase objective data regarding nutrient intake in the region, (b) the need to improve nutritional education materials and methodologies for pregnant and lactating women, teens, adults and children at risk of chronic and communicable disease, and (c) the need to train more professionals in the fields of human nutrition and consumer family sciences.

Highlight:

The Guam Expanded Food and Nutrition Education Program reached 47 families and 508 elementary school-aged children. They completed five lessons of the non-formal, life skills, nutrition education program on improvement of dietary habits, food safety practices, and food resource management skills. An additional 2,137 elementary school-aged children were exposed to a lesson of the EFNEP curriculum that included the Food Guide Pyramid and the importance of a '5-a-day' diet. A total of 2,645 public school children participated.

Out of the 15 men and 32 women participants in the Adult Guam EFNEP program, 72 percent showed improvement in at least one of the nutrition practices such as planning meals, making healthy food choices, reading nutrition labels, or feeding children breakfast. Twenty-two percent reported using the 'Nutrition Facts' on food labels, and 28 percent reported their children ate breakfast more often. Forty-seven percent of participants showed improvement in one or more of the food safety practices, such as thawing and storing foods properly.

Eighty-seven percent of the 508 children completed the '5-a-day' lesson. The EFNEP curriculum was effective in increasing youth knowledge in human nutrition.

Key issues addressed in Fiscal 2002 were:
Human Nutrition
Human Health
Food Resource Management

Key theme: Human nutrition

Expanded Food and Nutrition Education Program (EFNEP)

a. Brief description of activity

EFNEP is a federally funded program conducted through the U.S. Department of Agriculture. EFNEP has been on Guam for more than 20 years and has been helping local families and children learn how to eat healthier meals and snacks, stretch food dollars and reduce the risk of food-borne illness. The goal of this extension program is to teach children and families how to choose healthful foods, how to stretch food dollars, and to reduce the risk of food-borne illnesses.

Other methods used to reach consumers by the Guam Cooperative Extension agent included: 1) mailing about 150 copies of diabetes and food and nutrition newsletters; 2) setting up display booths of food and nutrition information at conferences and malls; 3) demonstrating four healthy food meal plans at elderly centers and supermarkets; and 4) setting up supermarket/market field trips for school children.

The Guam Cooperative Extension Services collaborated with EFNEP, WIC, Team Nutrition Group, Public Health and Social Services, Senior Citizen/SPIMA, Catholic Social Services, Guam Diabetes Association, Pacific Island Cancer Network, and AARP. The collaborators provided pertinent information in order to motivate individuals, families and the community at large to improve their nutritional status.

b. Impact/ accomplishment statement

A total of 175 participants (124 adults and 51 youths) completed the food and nutrition workshops. The adult respondents indicated that:

- 70% increased nutrition knowledge and food preparation skills;
- 50% improved in planning meals and using grocery list;
- 48% used the Food Pyramid Guide to plan healthful meals;
- 38% read label;
- 55% budgeted for food;
- 41% ate low fat foods;
- 36% reduced salt intake;
- 25% removed skins and fats from meats;
- 61% chose more nutritious foods;
- 60% increased fruits and vegetables by 2/3 requirements;
- 70% ate the fruits and vegetables minimum daily requirement;
- 37% consumed one or more dairy product.

The 51 youth respondents indicated that:

- 61% gained knowledge and skills;
- 79% ate breakfast;
- 41% improved eating varieties of foods;
- 61% ate healthful meals and snacks;
- 35% ate 2 or 3 fruits and vegetables;
- 90% read labels before shopping.

Short-term extension teaching on food and nutrition was conducted to enable 175 individuals and families to acquire knowledge and necessary skills for healthy lifestyles. The main objective for the non-formal education program was to promote better health through good dietary habits, reducing the risk factors of chronic diseases. Participants were encouraged to increase consumption of vegetables, fruits and milk products, and to eat less meat, fat, salt and sugar-rich foods. The workshops focused on eating varieties of well-balanced nutrient-dense meals, planning healthful diets, and using the Food Guide Pyramid model.

c. Source of funding - Smith-Lever 3d EFNEP
d. Scope of impact - State specific

Key theme: Human nutrition

EFNEP and nutritional life skills education through after-school and 4-H programming

a. Brief description of activity
The Guam EFNEP program reached 47 adult volunteers and 508 elementary school-aged children, who completed five lessons of the non-formal, life skills, nutrition education program to improve dietary habits, food safety practices, and food resource management skills. An additional, 2,137 elementary school-aged children were exposed to one lesson of the EFNEP curriculum, which reviewed the Food Guide Pyramid and the importance of '5-a-day'. A total of 2,645 children were reached through the public school system.

b. Impact/ accomplishment statement
Out of the 15 men and 32 women participants in the Adult Guam EFNEP program, 72 percent showed improvement in at least one of the nutrition practices, such as planning meals, making healthy food choices, reading nutrition labels, or feeding children breakfast. Twenty-two percent reported using the 'Nutrition Facts' on food labels, and 28 percent reported their children ate breakfast more often. Forty-seven percent of participants showed improvement in one or more of the food safety practices such as thawing and storing foods properly.
Impact of youth program: Eighty-seven percent of the 508 children completing the 5-lesson EFNEP curriculum increased their knowledge of the essentials of human nutrition.

c. Source of funding - Smith-Lever 3d - EFNEP
d. Scope of impact - State specific

Key theme: Human health

Diabetes education

a. Brief description of activity
The Guam Diabetes Association: The Guam Diabetes Association and Family Consumer

Sciences met monthly to address the members' diabetes concerns, and the needs and concerns of the community in Guam. Whenever possible, professional guest speakers were invited to the meetings. The emphasis of these meetings was on diabetic education and awareness. Therefore, the 15 to 35 participants who attended the meetings learned more about diabetic issues.

The participants at the monthly meetings learned more about diabetes prevention and control, which starts with education. Those who are at risk of diabetes, or who have diabetes, received information on how to help prevent, control, and manage the disease. Preventing, controlling, and managing diabetes requires education, a healthful diet, daily regular exercise, self-monitoring of blood sugar, regular visits to the doctor, and faithfully taking required medication, practices voiced by the participants.

The Guam Cooperative Extension Service conducted 12 two-hour diabetic awareness workshops. Specialists were invited to address diabetics' concerns and to offer educational advice to a group of 30 diabetics as a part of the workshops. Diabetes newsletters were mailed out to 225 diabetics each quarter. Also, a form of exercise encouragement was initiated. A Fun-Run-Walk was conducted during Diabetes Month. More than 900 participants enjoyed this form of exercise. Participants were allowed to make healthy food choices after enjoying the 5-mile Fun-Run-Walk.

Guam Extension professionals collaborated with other community leaders, businesses, and government health professionals. Collaborators sponsored a three-day diabetic conference. About 500 health professionals and diabetics from the general public participated. Diabetic specialists from off-island as well as on-island professionals presented a wealth of knowledge to the participants. Two Guam Extension professionals were involved in the planning, registration, presentation and panel discussion. EFNEP and the Guam Diabetes Association were among the ten table displays.

b. Impact/ accomplishment statement

Healthier lifestyle changes were rated first in the evaluation (95%). More knowledge about diabetes care came out second (93%). Skills in meal preparation, which incorporate all essential nutrients to maintain healthier lifestyles by eating recommended balanced meals and exercising daily, were rated third (88%). The non-diabetic observers became more aware of the importance of good nutrition, daily exercise, and regular visits to health providers.

Twenty-five diabetics who participated in the monthly workshops responded that:

- 60% increased exercise to one hour daily.
- 81% followed diabetic food exchange balanced diets.
- 91% supported diabetic support group monthly activity meetings.
- 95% were involved in an annual 5-K fun run-walk event. About 900 people attended.
- 67% increased nutrition knowledge.
- 70% improved diet behavior.
- 72% applied healthy lifestyle changes through better knowledge of nutrition, diet, and exercise.

About half (112) of the readership of the Diabetes Newsletter remarked that the diabetes newsletters mailed out quarterly have helped them. The results show:

- 94% expressed gratitude for gaining knowledge.
- 48% gained cooking skills by following the recipes given each quarter.

- 54% became more informed about diabetes issues.
- 60% used newsletters.
- 11% called in for further clarification of technical terms.

c. Source of funding - Smith-Lever
d. Scope of impact -State specific

National Goal 4: Greater harmony between agriculture and the environment.

Executive Summary

The College of Agriculture and Life Sciences is on target with national goal four. Among several issues that the College addressed in Fiscal 2002 were water quality and quantity, and biocontrol. The College continues to work toward solutions that will help protect the island's most precious resources, Guam's sole-source aquifer and the people who depend on this resource not only for their physical health but economic livelihood. Eighty percent of Guam's drinking water resource sits under Guam's industrial, urban and agricultural districts.

The College conducted several projects to help farmers raise disease-resistant crops. Guam's year-round tropical conditions make the island a natural haven for agricultural pests. Unlike weather in temperate areas with cold periods that naturally "check" pest populations, Guam's weather only makes for prolific pest growth and recurrence of insects of diseases. During the past year, AES and CES faculty continued to develop a multi-faceted plant protection and urban entomology program, as well as a plant pathology research program for Guam and the region. In developing an integrated pest management awareness program for Guam and the region, much work has been centered on reducing chemical pesticide usage.

Highlight (1):

Potable water has become an extremely valuable and limiting resource worldwide. Numerous national and regional governments continually tighten their laws and regulations that restrict its waste. A continuous, unrestricted supply of irrigation water is costly and, in the future, will become illegal. The current simultaneous practices of using municipal water for irrigation and dumping wastewater (effluent) into the ocean are both environmentally unacceptable and wasteful. Recycled wastewater is a potentially valuable resource that could free up potable water supplies for future human consumption. Research began with a survey assessing the chemical composition of wastewater effluent discharged from sewage treatment plants that could be used for irrigation of turf and landscapes. After basic compositions of effluents originating from different sources were identified, a study to assess the long-term effects on major soil characteristics and turfgrass quality was conducted. Long-term effects (two years) of wastewater effluents on soil parameters such as salinity, structure, permeability, saturated conductivity, and on the turfgrass quality, were evaluated. Research information given to the local government (Guam Environmental Protection Agency) may be used in future decision-making processes. Research assessed the level of essential and toxic nutrients in water discharged from sewer treatment plants, and determined the effect of irrigation with effluent on soil properties as well as on turfgrass quality.

Highlight (2):

Taro, *Colocasia esculenta* (L.), is a culturally important and profitable crop grown on Guam and throughout the tropical Pacific that is beset by insect pests and diseases that restrict its production in the Pacific, and impede expansion of its use elsewhere in the U.S. Research was conducted to identify sources of resistance in regional taro cultivars to the aphid *A. gossypii* and taro leaf blight, *Phytophthora colocasiae* (TLB). In conjunction with this activity, an insect/disease-resistant taro germplasm collection is being assembled on Guam for use in on-island field trials, and for eventual distribution to interested parties throughout the Pacific region. Aphid- and TLB-resistant taro lines identified in this project will be made available to breeders and growers to hasten the development of commercially suitable taro varieties for U.S. and Pacific region growers.Research was conducted to identify sources of resistance in regional taro cultivars to the aphid *A. gossypii* and taro leaf blight, *Phytophthora colocasiae* (TLB). In conjunction with this activity, an insect/disease resistant taro germplasm collection is being assembled on Guam for use in on-island field trials and for eventual distribution to interested parties throughout the Pacific region. Aphid and TLB resistant taro lines identified in this project will be made available to breeders and growers to hasten the development of commercially suitable taro varieties for US and Pacific region growers.

Key issues addressed in Fiscal 2002 were:
Integrated approaches and programs
Sustainable agriculture
Integrated pest management
Water Quality
Weather Stations
Pesticide Application/IPM
Agricultural Waste Management

Key theme: Integrated pest management

Integrated pest management of important Guam crops

a. Brief description of activity

Cucurbits are among the most important cash crops grown on Guam and in the Commonwealth of the Northern Mariana Islands (CNMI). Of the cucurbits, cucumbers and watermelons predominate and are produced in sufficient quantities to fill most of the local demand. A number of serious insect pests infest cucurbit crops on Guam and in the Mariana Island archipelago. A truly integrated cucurbit pest management system must address the effect that controlling each pest might have on populations of other pests.

Comprehensive aphid and ant surveys on Guam have been conducted on Guam and in the CNMI and Palau. Follow-up aphid surveys are now conducted once every three months to see if establishment has occurred at sites on Guam where aphidiid parasitoids have been released. Surveys on other islands continue as opportunity arises to visit them, and in collaboration with PPQ and agriculturists. Surveys of whiteflies and their associated natural enemies on Guam were conducted monthly until midsummer and then stopped. No Encarsia

parasites have yet been located in any sampling area, contrasting with surveys conducted in years past on Guam where Encarsia sp was abundant. We have just finished a multi-year study of the effectiveness of floating row covers on watermelon, showing that they can be used economically to reduce cucumber beetle damage and minimize pesticide use.

b. Impact/ accomplishment statement

Farmers are considering use of crop covers, and technical people are using our keys to aphids and natural enemies.

c. Source of funding - Hatch
d. Scope of impact - State specific

Key theme: Biological control

Biological control in pest management systems in plants

a. Brief description of activity

The purpose of this project is ultimately to reduce the amounts of insecticides used against aphids on Guam and in Micronesia by introducing parasitoids that prey specifically on aphids. In a classical biocontrol program for beans, melons, and taro, the project integrates aphid biological control with crop management tactics used against other insect pests on the target. The project further identifies aphids and associated natural enemies in Micronesia by continuing comprehensive aphid and natural enemy surveys currently ongoing throughout the island. The project educates Guam's agricultural community on distinguishing aphids and associated natural enemies on crops, and recognizes the necessity of biorational pest management strategies.

A preliminary survey of aphids, their host plants, and associated natural enemies was conducted in January in Yap State of the Federated States of Micronesia. The primary aphid species collected was *Aphis gossypii*. No aphidiid or aphelinid natural enemies were observed.

Comprehensive surveys of aphids and associated natural enemies on Guam, emphasizing hymenopteran parasitoids, have been scaled back to quarterly examinations of parasitoid release sites.

Colonies of *L. testaceipes* collected on Guam were reared in a newly established insectary on the UOG campus. Reared *L. testaceipes* were then released on *A. gossypii* and *T. citricida* at agricultural sites where they had not previously been observed on farms in northern and southern Guam.

Follow-up surveys were conducted on the island of Babeldaub in the Republic of Palau where about 1000 *L. testaceipe*s were released in 2001 on *A. gossypii* and *A. craccivora*.

Studies on ant-aphid-parasitoid associations begun in 2001 continue on Guam and in the CNMI and Palau. A collaborative network of ant/aphid/aphidiid taxonomists has been established to work on aphid-associated questions of the Western Pacific Basin.

b. Impact/ accomplishment statement

Local and regional technical people, the scientific community and some farmers are using our keys to aphids and parasitoids. Various programs around Micronesia are considering biorational strategies at pest control.

c. Source of funding - Hatch multi-state W-185
d. Scope of impact – Multi-state research - FM GU NM

Key theme: Sustainable agriculture

Insect- and disease-resistant taro

a. Brief description of activity

Taro, *Colocasia esculenta* (L.), is a culturally important and profitable crop grown on Guam and throughout the tropical Pacific that is beset by insect pests and diseases that restrict its production in the Pacific, and impede expansion of its use elsewhere in the U.S. The purpose of the research is to identify sources of resistance in regional taro cultivars to the aphid *A. gossypii* and taro leaf blight, *Phytophthora colocasiae* (TLB). Aphid- and TLB-resistant taro lines identified in this project will be made available to breeders and growers to hasten the development of commercially suitable taro varieties for the U.S. and Pacific region.

Fifty nine varieties of taro, *Colocasia esculenta* (L.), obtained from the Western Pacific and Hawaii were screened for aphid resistance on Guam by evaluating the extent of naturally occurring infestation by *Aphis gossypii* Glover, by assessing survivorship and reproduction of *A. gossypii* caged on the leaves, and by assessing preference using leaf disks in laboratory choice trials. Significant differences were observed among taro varieties in the number of aphids naturally infesting plants in the field. Similarly, significant differences in reproductive rates and longevity of aphids were observed between taro varieties. Aphids also showed preferences for certain varieties of taro. During the current year, taro varieties collected from the Western Pacific and obtained from the University of Hawaii have been planted in screening nurseries at two sites on Guam. Eight other varieties suspected of being aphid-resistant have been obtained from workers at the University of Hawaii, and are being propagated in tissue culture on Guam before planting in field-screening nurseries. Sufficient numbers of aphid and planthopper clip cages have been constructed for use in field-screening trials once plants are sufficiently mature to begin insect screenings. Refinements in constructing aphid life tables and estimating aphid reproductive capabilities are being investigated.

b. Impact/ accomplishment statement

Resistant varieties identified in this study may be used as parents in crossing blocks designed to combine *A. gossypii* resistance with other desirable agronomic traits such as disease resistance and yield, and as a foundation for generating markers for molecular marker-assisted selection.

c. Source of funding - Special grants
d. Scope of impact – Multi-state research

Key theme: Biocontrol

Genetics of *Aphis gossypii*

a. Brief description of activity

Aphis gossypii Glover is an extremely cosmopolitan and polyphagous pest of crops and ornamental plants in the tropical Pacific Basin and worldwide. While confined primarily to glasshouses in cooler climates, *A. gossypii* in the tropics and subtropics is a major pest of cotton and cucurbits, where its high reproductive rate allows it to rapidly build up high populations and kill otherwise healthy plants by direct feeding or through the transmission of over 50 virus species. Despite an abundance of past work on *A. gossypii*, the pest's taxonomic status is still poorly understood. The lack of certainty in identifying *A. gossypii* renders interpretation of biological information, including host plant-herbivore-natural enemy relationships, questionable. Lack of understanding about the specific identity of *A. gossypii* populations lessens the chance for successful natural enemy introductions against them in classical biological control programs. Similar taxonomic confusion may also exist among the aphid's aphidiid parasitoid complex, further reducing the chances of successfully establishing an introduced parasitoid on a specific target host while avoiding unanticipated and undesirable nontarget activity.

We have begun collections of *A. gossypii* and other aphids to ecological relationships throughout Micronesia. Collections of *A. gossypii* have been sent to Agriculture and Agri-Food Canada to develop primers for DNA analysis using RAPD-PCR. Arrangements are currently being made for the visit of Dr. R. Foottit to Guam to assist in collecting *A. gossypii* and in evaluating our procedures for genetic, ecological and morphometric analysis. Supplies for collecting *A. gossypii* from around Micronesia have been obtained.

b. Impact/ accomplishment statement

Determining the taxonomic status of *Aphis gossypii* Glover will help researchers identify its natural enemies for biocontrol applications.

c. Source of funding - Special grants

d. Scope of impact - potentially U.S. wide

Key theme: Biocontrol

Effects of indigenous and exotic ants on Guam's native trees

a. Brief description of activity

A number of forest trees and ferns indigenous to Guam and the Mariana Islands are considered threatened or endangered. Suspect in the decline in recruitment has been the rise in the number and species of alien, invasive ants that have been introduced over the years into Guam, and that now have established extensive populations throughout its forests. While most ants are opportunistic foragers, some ant species feed on plant exudates or leaf and stem material, on arthropods infesting trees, and on seeds. A number of ant species have

become widespread, often associated with human activity. While most of these ants are most commonly encountered in urban environments, many are also found in disturbed areas and on oceanic islands where they are able to exploit vacant ecological niches. Invasive ants frequently have drastic disruptive effect on the native ant populations and upon the general ecology of the habitat they invade. Invasive ants may exclude competing native species from food resources and may raid their nests. Indigenous aboveground foraging ants are often the most severely affected, and established ant-plant interactions may be disrupted.

We have begun extensive collecting on Guam to identify indigenous and exotic ants infesting Guam's forest areas. Visiting scientists from the western U.S. have visited Guam to assist in making these collections. A graduate student has received training in ant taxonomy in the U.S. from these scientists, and is now identifying subsequent samples collected on Guam. A computer database of the collected ants with associated ecological and GIS information has been created.

b. Impact/ accomplishment statement
Identifying invasive ants will help researchers understand their association with other agricultural pests.

c. Source of funding - McIntire-Stennis
d. Scope of impact: Local and regional; pending

Key theme: Biocontrol

Biological control of papaya mealybug

a. Brief description of activity

Papaya mealybug was introduced to Guam in 2002. It affected papaya, plumeria, hibiscus and other plants. Papaya farmers abandoned their fields, as they were unable to control the mealybug.

In cooperation with APHIS, USDA, three parasitoids were introduced to Guam. One workshop was conducted for the farmers and the public.

b. Impact/ accomplishment statement

The parasitoids have become established on Guam and have suppressed the papaya mealybug population. Farmers have started planting papaya again. Parasitoids here also have reduced the risk of this new pest being introduced to neighboring islands in Micronesia and Hawaii.

c. Source of funding - USDA, APHIS
d. Scope of impact - State specific

Key theme: Natural resources management

Guam cycads

a. Brief description of activity

This project is designed to determine the impact of manipulating environmental resources on growth and secondary metabolite production in Guam's native cycad, *Cycas micronesica.* This natural resource is Guam's only native gymnosperm, and its use in the urban landscape is severely limited.

Three field studies were completely destroyed in December 2002 by Typhoon Pongsona. We are initiating these studies again, and duplicating them in controlled conditions in anticipation of another typhoon before the project's termination date. We published two refereed publications during the past year.

b. Impact/ accomplishment statement

This research could lead to increased use of indigenous plants by the landscape industry and greater compatibility between landscapes and the local environment.

c. Source of funding - Special grants
d. Scope of impact - State specific

Key theme: Recycling

Extrusion of restaurant waste for swine feed

a. Brief description of activity

The objective of this study was to explore ways of reducing feed cost and dependency on imported feed by examining the feasibility of using restaurant and hotel food waste as animal feed using dry-extrusion feed-processing technology. Food waste is a major source of potential feed on Guam and in the CNMI because of the islands' tourist-based economies. There is also a critical need in the region to reduce the burden on limited landfill capacity.

Several trials were conducted to determine the optimum combination of food waste and other complementary dry ingredients to arrive at an acceptable, stable product that meets the nutrient requirements of growing/finishing swine at the lowest possible cost. Feeding trials showed that the processed feed was comparable to commercial feed in terms of nutrient value. We have determined that, unless some other means of moisture reduction such as use of mechanical press, centrifuging or drying is used, we can only incorporate about 20% food waste with 80% dry feed ingredients to have a post-processing stable product with no more than 12% moisture. Considering the added cost of electricity, transportation, machine maintenance and labor involved in manually separating papers, plastics and foils from the food waste, the 20% usage does not economically justify using the present procedure for large scale feed processing.

b. Impact/ accomplishment statement

The negative results of this project will prevent further use of resources in investigating this subject.

c. Source of funding - SARE
d. Scope of impact - State specific

Key theme: Biocontrol

Biological control of Siam Weed, *Chromolaena odorata*

a. Brief description of activity

Siam weed is an exotic invasive weed of Central and South American origin. It has become a serious problem in Guam, Micronesia, and humid tropical parts of Asia and Africa. It suppresses native vegetation and invades pastures, vacant lands, orchards and disturbed forests. It is also a serious fire hazard.

We initiated a biological control program in Guam. Based on its success, we conducted five international workshops with several countries participating. Workshops were conducted in Bangkok, Bogor, Abidjan, Bangalore and Durban. Fourteen circulars, five proceedings of the workshops and several research papers were published.

b. Impact/ accomplishment statement

Introduction of natural enemies in Guam, Rota, Tinian, Saipan, Pohnpei, Kosrae, Indonesia and Ghana has resulted in the clearing of several thousands of hectares of this weed. It resulted in saving several thousands of dollars spent in mechanical clearing of the land, and in reduction in forest and roadside fires and increased use of the land for pastures, orchards and other activities.

c. Source of funding - Special grants

d. Scope of impact – Multi-state research - FM GU NM

Key theme: Biocontrol

Biological control of red coconut scale

a. Brief description of activity

Coconut is one of the important crops on Guam. Red coconut scale was introduced accidentally to Guam in the 1970s. It attacks coconut fronds and the nuts. In severe infestations, the whole tree appears red. It reduces vigor of the trees and yield of nuts.

A parasitoid of red coconut scale was brought in from Ulithi Island in Yap State of the Federated States of Micronesia in 1987. This parasitoid has become established on Guam and it markedly reduced the red coconut scale population. However, reintroduction was necessary in late 2001 and was done. A survey was conducted to determine the extent of establishment and the results of the reintroduction were published.

b. Impact/ accomplishment statement

Red coconut scale is no longer a problem in Guam. The parasitoid introduction has saved people from spending thousands of dollars on insecticides. Also, it averted the possible environmental pollution caused by spraying insecticides. It increased the production of nuts and the aesthetic value of trees.

c. Source of funding - Special grants

d. Scope of impact - State specific

Key theme: Water Quality

Efficiency of drip irrigation alternatives in watermelon crops

a. Brief description of activity

Field experiments were conducted to evaluate drip system design parameters, drip spacing and the number of drip lines per row for watermelon crops. These are important parameters for the very shallow soils (15 to 30 centimeters deep) of northern Guam situated over the sole-source fresh water lens that supplies potable water. One, two, three, and four drip lines per row with 200-centimeter spacing were tested for yield and leachate. Based on in-situ soil moisture irrigation scheduling at 20 centibars, no differences in yield were observed and there was no leachate under any of the treatments. However, data indicated that the frequency of irrigation was inversely related to the number of drip lines per row.

Dissemination of information was planned via a farmer's workshop at the field site just before harvest. The planned workshop had to be cancelled because Typhoon Chata'an cleared the field.

One high school student received summer apprenticeship training during the summer of 2002 while the field experiments were in progress. Another group of high school students in various summer programs with the college visited the experimental field and learned about the irrigation system, irrigation controllers, tensiometers, watermelon crop, and the weather station.

b. Impact/ accomplishment statement

Drip irrigation systems will help conserve water, save money and increase crop yield.

c. Source of funding - Special grants

d. Scope of impact - State specific

Key theme: Weather and climate

Guam agricultural weather stations

a. Brief description of activity

Weather stations provide important climatic information to the agricultural community. The Guam Agricultural Climatic Data System (GACDS) has been created to assist scientists, students, golf course managers, farmers and gardeners.

Climatic data from two weather stations (northern and southern Guam) are collected on a daily basis. Rain, temperature, relative humidity, wind speed, wind direction, total solar radiation, photosynthetic radiation, pan evaporation, and estimated turf grass evapotranspiration are measured via sensors and a datalogger. Modems allow data to be collected at a central location. GACDS is to be initiated in four phases:

Phase 1: Install GACDS on an in-house shareware network.

Phase 2: Disseminate GACDS information through yearly technical bulletins

Phase 3: Create a GACDS web site for use by the local community
Phase 4: Add an additional estimated evapotranspiration measurement from a system similar to CIMIS.

The first two phases have been implemented. Phase three has been started, and will require seminars and workshops to instruct the community about accessing and using the information. Phase four is still being researched.

b. Impact/ accomplishment statement
The public will have access to real-time data to help with their agricultural activities.

c. Source of funding - Hatch
d. Scope of impact - State specific

Key theme: Pesticide Application/IPM

Effects of ocean water on weed control in recreational turf of the Pacific Islands

a. Brief description of activity

Alternative methods of weed control have received considerable attention in the past decade. Concerns that the golf course industry on Guam could pollute the aquifer resulted in strict regulatory actions. On Guam all weeds are perennial and cannot be eliminated by natural factors such as frost. Mimosa vine, alyceclover, crabgrass, goosegrass and yellow nutsedge require herbicides to be controlled. Visual observations of weeds affected by ocean water spray suggest that salt stress could control salt susceptible weeds in salt tolerant turfgrasses. Limited research evaluating weed responses to salt stress had been conducted. According to numerous studies, seashore paspalum grass exhibits exceptional salt tolerance, Bermuda grass is listed as tolerant, St.Augustine grass tolerance varies widely with cultivars and centipede grass expresses little tolerance. The objective of this research was to evaluate the sensitivity of five common weeds and the tolerance of four common turfgrasses to salinity stress induced by ocean water.

Several experiments were conducted at the University of Guam Experiment Station. Crabgrass, goosegrass, mimosa vine, alyceclover, yellow nutsedge, as well as Bermuda grass, seashore paspalum, St.Augustine grass, and centipede grass were salt stressed by ocean water and dilutions of ocean water mixed with fresh water. Ample differences were observed among tested plants regarding their sensitivity to different levels of salt stress. At high concentrations of salt, mimosa vine and alycelover and crabgrass showed complete necrosis within 5-7 days. Goosegrass injury reached 90% and lasted only 10 to15 days, then all injured plants recovered. Yellow nutsedge showed very little response to the salt stress.

Among tested turfgrasses, a seashore paspalum showed superb salt resistance, and injury was only minor in Bermuda grass. St.Augustine grass showed severe injury when treated with ocean water and centipede grass showed complete necrosis. Research has proven that short-term soil saturation with salt water could be used as an alternative to herbicides. Results suggest that this method can be used to control crabgrass, goosegrass, mimosa vine, and alyceclover in seashore paspalum and Bermuda grass turf.

b. Impact/ accomplishment statement

This research has significant impact on weed control in the West Pacific region, as well as in coastal areas of numerous tropical countries of South Asia and South East Asia, where environmental issues are of increasing concern.

c. Source of funding - Special grants
d. Scope of impact – Multi-state research - NM GU HI

Key theme: Agricultural Waste Management

Application of effluent water on recreational turf in the American Pacific

a. Brief description of activity

Potable water has become an extremely valuable and limiting resource worldwide. Numerous national and regional governments continually tighten their laws and regulations that restrict water waste. The total potable water demand on Guam is approaching current estimates of a long-term sustainable yield. Currently, a smaller portion of aquifer potable water is being used for drinking purposes, and a larger part is being used for irrigation, which usually does not require potability.

A continuous unrestricted supply of irrigation water is costly, and in the future will become unlawful. The current simultaneous practices of using municipal water for irrigation and dumping wastewater (effluent) into the ocean are both environmentally unacceptable and wasteful. Recycled wastewater is a potentially valuable resource that could free up potable water supplies for future human consumption.

Research began with a survey assessing the chemical composition of sewage treatment plant wastewater effluent that could be used for irrigation of turf and landscapes. After identifying the basic compositions of effluents originating from different sources, a study to assess the long-term effects on major soil characteristics and turfgrass quality was conducted. Long-term effects (two years) of wastewater effluent on soil parameters such as salinity, structure, permeability, saturated conductivity, and on turfgrass quality were evaluated. Data indicated elevated levels of phosphorus and nitrates when compared to effluent collected in southwestern and southeastern mainland United States. No heavy metals were found. Soil and plant analysis currently is being conducted, and will be presented as a Master of Science Thesis in June 2003.

b. Impact/ accomplishment statement

Research provided information to the local environmental protection agency that may be used for policy decisions. Research assessed the level of essential and toxic nutrients in water discharged from sewer treatment plants, and determined the effect of irrigation with effluent on soil properties as well as on turfgrass quality.

c. Source of funding - Special grants
d. Scope of impact - State specific

Key theme: Soil quality

Using composted organic waste for the enhancement of productivity and to improve the quality of eroded soils in southern Guam

a. Brief description of activity

Soil organic matter is probably the most important soil quality indicator. On the other hand, soil erosion and runoff are both detrimental to soil nutrients and organic matter content of the soil. Residue management and compost mulching both can have a significant impact on increasing soil organic matter and enhancing the soil quality of degraded soil, and can prevent erosion.

Twelve field plots (25 feet by 18 feet) were set up at the Inarajan agricutural experiment station for this project. Plots were planted with sunnhemp seeds to provide a nitrogen source and soil cover before corn planting in June of 2002. Control plots, however, were left fallow and without cover at all times. Following sunnhemp, compost materials were applied to increase the organic matter content and to enhance the soil quality of these eroded soils. Corn was planted following the application of composted organic waste.

Typhoon Chata`an in July of 2002 washed away and destroyed all the newly established crops (corn) for this project. All irrigation settings and plot markings were scattered and disassembled. However, soon after the damage assessment processes were completed, we proceeded with the project using sunnhemp as green manure and compost organic waste as soil amendment in separate treatments to evaluate the effect of green manure and compost material on organic matter buildup in these soils. Corn was established on plots receiving compost, and water was provided using drip irrigation. Preliminary results from this experiment indicated that the organic matter content of the soils receiving composted organic waste was the highest among the treatments.

b. Impact/ accomplishment statement

Soil quality has degraded to an alarming stage in most regions of the Guam. A humid tropical climate causes rapid decomposition, thus depleting the organic content of in soil. Additional biomass from sunnhemp residue as green manure and/or compost is often needed to maintain or increase organic matter levels in soil. Compost is more than a fertilizer and more than a soil conditioner. Using compost can help build good soil texture, structure and qualities that enable soil to retain nutrients, moisture and air for the support of healthy crop growth. Compost also helps control erosion that otherwise would wash topsoil into waterways.

c. Source of funding - Hatch
d. Scope of impact - State specific

Key theme: Soil erosion

Conservation tillage and residue management: an integrated ecological approach for soil restoration and conservation in the badlands of Guam

a. Brief description of activity

Badlands on the island of Guam are actively eroding areas of very deep, well-drained saprolite derived from tuff and tuff breccia. These badlands are exposed to overland flow, wind and rain causing severe erosion as the result of rapid runoff from the pitted, sloping sites devoid of vegetation. The intensity of badland erosion and its effects on the environment are at a threatening stage. The challenge facing soil and agricultural scientists is to develop strategies in order to control erosion in the area and also introduce new conservation techniques for crop production within a framework of increasing environmental and financial constraints. Similar challenges are facing the island of Hawaii, and therefore this research project is being conducted in Hawaii at the University of Hawaii by our collaborators as part of this grant.

Twelve field plots (28 feet by 33 feet) were set up at the Ija agricultural experiment station for this project. Plots were planted with sunnhemp seeds to provide a nitrogen source and soil cover before corn planting in November of 2002. Control plots however were left fallow and without cover at all times. Following sunnhemp, corn was to be planted as the evaluating crop.

Typhoon Pongsona in December of 2002 washed away and destroyed all the newly established crops (corn) for this project. However, soon after damage assessment processes were completed, we proceeded with the project using sunnhemp as green manure to provide an initial nitrogen supply for the evaluating crop. Presently sunnhemp is being observed and corn planting is planned for late March.

b. Impact/ accomplishment statement

An integrated approach is designed to evaluate the effect of conservation tillage, leguminous cropping for organic matter buildup, and residue management for soil re-habilitation and restoration of the badlands in southern Guam. In our companion study, we will use compost not only to protect the surface of the eroded soils, but also as organic amendments for enhancement and maintenance of soil productivity. Green manure and its effect on the enhancement of eroded soils will be evaluated in our companion study. We anticipate that the results of these two studies will be a good database for modeling the erosion processes of the badlands and similar soils in the region.

c. Source of funding - Special Grants
d. Scope of impact – Multi-state research - GU NM HI

Key theme: Sustainable Agriculture

a. Brief description of activity

Environmental concerns continue to be expressed in all areas of agriculture. The impact of aquaculture effluent has been overlooked by past government administrations. Efforts have been made to influence the way aquaculture producers have dealt with effluent. Larger commercial farms have the greatest impact, but are also the most resistant to altering operations. Stakeholder input has resulted in a prioritization of environmental issues for funding. A proposal to study the impact of aquaculture effluent has been submitted as a regional effort with the Commonwealth of the Northern Mariana Islands.

Another area of sustainability, local hatchery production of tilapia stocks, has been addressed with the funding of a project to identify the best strain of tilapia available through growth trials. Selected strains will then be evaluated for reproductive capacity. The start of the project has been delayed due Guam's last two typhoons. The project will begin in early March 2003.

b. Impact/ accomplishment statement

The impact of these efforts has yet to be realized. Producers are aware of the effort to study the impacts and are in general agreement that the environment must be protected for the future existence of aquaculture.

c. Source of funding - Smith-Lever
d. Scope of impact - State specific

Key theme: Sustainable agriculture

Decreasing dependence on man-made fertilizers for crop production in tropical limestone soils

a. Brief description of activity

A farm trial was initiated to determine if sweet corn production could be improved through the replacement of man-made fertilizers with enriched chicken manure, and through the incorporation of a green manure crop. The objectives are to provide producers with a cost-effective means of improving the health of their farms' soil and to provide agricultural researchers with information regarding the benefits of adding organic matter to Guam's shallow, limestone soils.

Due to Guam's two major typhoons in 2002, the trail was delayed. Fields were planted in sunnhemp in the fall and disked under in January of 2003.

b. Impact/ accomplishment statement

Identifying an efficient method of using natural fertilizers could be more economical and does improve soil conditions.

c. Source of funding - SARE
d. Scope of impact - State specific

Key theme: Pesticide Application

Guam farm pesticide and fertilizer use survey

a. Brief description of activity

The Guam Cooperative Extension Service (GCES) in cooperation with the Department of Agriculture (DOA) surveyed 323 farmers in 2001-2002 focusing on local pesticide and fertilizer use. The data gathered revealed a heavy reliance on three agricultural pesticides and the over application of certain fertilizers.

b. Impact/ accomplishment statement

Impact: The Guam Pesticide Safety Education Program (PSEP) and Guam Farm Safety Program (FSP) re-evaluated and changed its training to include greater focus on general use pesticides and fertilizers. The production of Extension Fact Sheets*: Using Herbicides for Weed Control*, *Farm and Garden Pesticide Use*, and *Storing Pesticides and Fertilizers* are products of the survey.

c. Source of funding - Smith-Lever 3d
d. Scope of impact - State specific

Key theme: Integrated Pest Management

a. Brief description of activity

To improve the viability of cucurbit crop production on Guam in light of potential reductions in the availability of insecticides in the near future, experiments were initiated to evaluate the efficacy and economic feasibility of using floating row covers to control pumpkin beetles in watermelon. Floating row covers are currently being evaluated at Guam's northern experiment station as an alternative to insecticides for the control of pumpkin beetle, *Aulacophora similes,* on watermelon. Preliminary results indicate that row covers should be added as part of our IPM recommendations to cucurbit growers.

As a means to reduce the spread of viruses through vegetative propagation of banana, the College began a tissue culture program. Agriculture students prepared the plantlets and extension personnel handled the sales responsibilities. The students used the money for various club activities. It is hoped that farmers and the public will start to realize the importance of growing disease-free plants, and will create a demand that will aid the agriculture business sector of Guam.

b. Impact/ accomplishment statement

The added cost associated with the row cover and labor are offset by savings on insecticide application. This is true, however, only when beetle populations are moderate to heavy. A major drawback is the development of weeds under the row cover. This issue probably will have to be resolved before the method is widely accepted. The use of plastic mulch under the row cover is one possible solution.

The demand for banana seedlings was greater than our ability to provide them. It is hoped that farmers and the general public will continue their interest in growing bananas and the use of disease-free planting materials. If the demand for tissue-cultured plants is great enough, perhaps this will stimulate a new business venture on Guam. To date, over 300 plantlets have been sold.

c. Source of funding Smith Lever 3d - IPM
d. Scope of impact - State specific

National Goal 5: Enhanced economic opportunity and quality of life for Americans

Executive Summary

Members of Guam's community are at risk. The economic conditions have caused financial and emotional stress on individuals and families. The July 2002 typhoon, a the lack of water due to the island's decaying water system and the December 2002 supertyphoon have caused some schools to lose about a month or more of instructional classroom days. Within the school year, one quarter is 45 days. The dismal economy has affected parents as well. They may have been laid off or forced to take on two jobs. The fabric of Guam's family system is breaking down because of multiple stresses. The high incidence of confirmed suicide, youth runaways, juvenile delinquency and family violence suggest a strong indication that youth lack adequate social skills, have low self-esteem and are limited in accessing resources to enhance a decent lifestyle. Yet, the faculty of the College of Agriculture and Life Sciences continue to play a vital role in maintaining certain community needs.

Highlight (1):

The damaging impact of a typhoon affects individuals and businesses. These typhoons can also cause much emotional stress for individuals, families and businesses that have lost most or all of their belongings to the storm. Through the Federal Emergency Management Agency Immediate Service Grant, a collaborative partnership was formed between Guam Mental Health & Substance Abuse and the Guam Cooperative Extension at the University of Guam.

The federal grant funded a Crisis Counseling Program. The government of Guam and University of Guam partnership combined the expertise of treatment providers and professional extension educators to recruit train and deliver crisis-counseling services through individuals in the local community. In Typhoon Paka (1997) and Typhoon Chata'an (2002), this partnership trained over 50 people in the crisis-counseling model, reaching over 100,000 individuals through individual, school, special population (disaster response workers, teachers, elderly, physically challenged) and media outreach activities. Coping skill brochures were translated into four regional languages to assist the various ethnic groups of Chamorro, Filipino, Palauan, Chuukese, and Pohnepeian.

The Crisis Counseling Program prevented the escalation of severe mental health problems needs for formal mental health services. Through this program, individuals acquired effective coping skills to manage the stress brought upon them by natural disasters.

The grant helped individuals access formal mental health services, making it possible for the Guam Mental Health agency to concentrate on its existing caseload, and not requiring additional overtime costs and services beyond the initiation of the Crisis Counseling Program.

The grant also funded the creation of educational brochures and Teaching Aids Guidebook, which are made available for disaster victims to assist them in taking responsibility for their post-recovery issues without the need for formal mental health treatment.

Highlight (2):

The Guam Cooperative Extension Service continues to successfully involve youth in its 4-H and Youth Development Programs. During the summer of 2002, the College offered nine programs that involved over 300 youth that learned and practiced life skills. College faculty,

university community members and families were involved in successfully coordinating the following programs:

- Nutritional (Cooking) Workshop
- Basketball Camp
- Baseball Camp
- Carpentry
- Computer Classes
- Plant Propagation and Grafting (Family Workshop)
- Fisheries
- Entomology
- Youth Leadership Development

Key issues addressed in Fiscal 2002 were:
Community Development
Youth Development/4-H

Key theme: Impact of change to rural communities

Guam responds to emotional recovery of disaster victims

a. Brief description of activity

In the past year, Guam was devastated by two typhoons that left thousands homeless and without safe drinking water or electricity for months. The damaging impact of a typhoon affects individuals and businesses. These typhoons can also cause much emotional stress for individuals, families and businesses that have lost most or all of their belongings to the storm. Through a Federal Emergency Management Agency Immediate Service Grant, a collaborative partnership was formed between Guam Mental Health & Substance Abuse and the Guam Cooperative Extension at the University of Guam.

The federal grant funded a Crisis Counseling Program. The government of Guam and University of Guam partnership combined the expertise of treatment providers and professional extension educators to recruit, train and deliver crisis-counseling services through individuals in the local community. The grant also funded the creation of a Teaching Aids Guidebook and educational brochures that were made available to disaster victims. The coping skill brochures were translated into four regional languages to assist the various ethnic groups on Guam.

b. Impact/ accomplishment statement

In Typhoon Paka (1997) and Typhoon Chata'an (2002), this partnership trained over 50 people in the crisis-counseling model, and reached over 100,000 individuals through individual, school, special population (disaster response workers, teachers, elderly, physically challenged) and media outreach activities.

Through this program, individuals acquired effective coping skills to manage the stress brought upon them by natural disasters. The Crisis Counseling Program allowed individuals access to mental health services and helped prevent an escalation of demand for services from the formal mental health service sector. This made it possible for the Guam Mental

Health & Substance Abuse Department to concentrate on those in need of acute care and on its existing caseload.

Key theme: Community development

PEOPLE (Portable Extension Office for Program Literature Exchange) version 3

a. Brief description of activity

PEOPLE is a collection of agricultural information relevant to the sub-tropics and tropics. It is accessed through a graphic web browser interface and is indexed to be searched in Acrobat. The topics do not have to be correctly spelled and can be searched phonetically.

The database was duplicated on CD and installed on the University of Guam web site. A link was also established from the ADAP web site in Hawaii.

b. Impact/ accomplishment statement

PEOPLE makes agricultural information available to agriculture professionals and their clients in the islands of the Pacific and Caribbean in order to enhance the sustainability of the region's agricultural industries. PEOPLE makes the information available to homeowners and gardeners. The information is also useful as a resource for students.

c. Source of funding - SARE and ADAP
d. Scope of impact – Multi-state extension - GU NM HI FM AS VI PR

Key theme: Community Development

a. Brief description of activity

A major activity was the organization and nurturing of an aquaculture industry organization. Through many meetings and informal discussions with producers and others involved in the aquaculture industry, an organization to represent the aquaculture industry was fostered.

b. Impact/ accomplishment statement

The Guam Aquaculture Grower's Association (GA'GA) has been active in providing visibility to aquaculture with its presence alongside the Guam Cooperative Extension and the local Department of Agriculture at featured community events, such as the Pacific Hotel and Restaurant Exposition (PHARE), the University of Guam Charter Day celebration and The Micronesian Island Fair. This has provided the opportunity to increase public awareness and provide an avenue for the producers to make market connections with hotel and restaurant operations, and increase demand for their products through taste-testing events.

c. Source of funding - Smith-Lever
d. Scope of impact - State specific

Key theme: Youth development/ 4-H

Elementary school children learn life skills in entrepreneurship

a. Brief description of activity

In response to the islands' rapid economic changes in terms of growth and job marketability, an entrepreneurship program was implemented at Guam elementary schools based on the Kauffman Center of Entrepreneurial Leadership Model.

4-H & Youth Development conducted a seven-day training program titled "Mini-Society for Elementary School" for children ages 8-12. Over 100 elementary school students participated in the educational learning activities.

b. Impact/ accomplishment statement

Ninety-five percent of the participants gained and learned basic concepts of business economy, entrepreneurship and important decision-making. Starting a business allowed participants to apply knowledge and practical skills in computations, salesmanship, and promotions of products and communications. All the participants were able to start a business and/or form a company to run a business. In creating their own society, they were able to demonstrate concepts in finance, accounting, and leadership.

c. Source of funding- Smith-Lever and Drug Free School and Community Grant
d. Scope of impact. - State specific

Key theme: Character/ ethics education

Fishing 4 Life

a. Brief description of activity

Resource management and environmental concerns have become focal issues in the islands. Using the life skills experimental model, participants learned about conservation, oceanography, marine science and water quality. Four girls and 25 boys between the ages of 10 and 14 participated in the three-week daily Fishing 4 Life program that started July 15, and finished August 3, 2002.

Ten mentors who implemented all the life skills activities provided program delivery. The life skills activities included: learning to learn, concern for others, teamwork, social skills, communication, decision making, problem solving, cooperation, planning, organizing, leadership, healthy lifestyle choices, personal safety and keeping records.

Twenty-eight adults voluntarily spent an average of four hours each on the project. Two young adults who were previous participants of the program spent 120 hours on the project. A total of 232 hours was spent voluntarily on the program.

b. Impact/ accomplishment statement

At the conclusion of the program, almost all of the participants were able to apply knowledge and demonstrate skills. Participants learned basic skills in snorkeling, gained an understanding of water quality and conservation, gained understanding that drugs and fishing do not mix, learned Guam's applied and understood fishing laws and regulations, learned and practiced skills in marketing, learned fishing safety, learned food handling and food safety,

learned to make their own lures in lure-tying session, practiced and learned traditional fishing techniques such as spearfishing and net throwing, learned and applied basic CPR lessons, demonstrated rod and reel fishing with accuracy, participated in a night diving/fishing session, learned about fishes and the water environment, and were able to identify fish species and name them.
Twelve participants learned boat safety and regulations, and were able to go fishing on a boat for trolling, bottom fishing and spear fishing. Eighty-nine percent of the participants indicated that they have increased their ability to practice all of the above.

c. Source of funding - Smith-Lever and a Drug Free School and Community Grant
d. Scope of impact - State specific

Key theme: Youth Development/ 4-H

Alternative lifestyles

a. Brief description of activity

A survey titled "Guam Youth Risk Behavior Surveys: 2001" reports that drug and alcohol use were common among Guam youth in both middle schools and high schools, an alarming fact for everyone on Guam, especially youth program providers. Asked the question: "Have ever drunk alcohol?" 57.1 percent of eighth-graders said they have; 39.4 percent of eighth-graders surveyed said they have drunk alcohol at twelve years or younger.

The Department of Youth Affairs, the Dededo Mayor's Office and 4-H Clubs have collaborated to inform and provide youth with literature on the danger of drug and alcohol abuse. Clubs have been formed to provide alternative workshops on self-esteem, nutrition and arts and crafts to show youth that there are alternatives to drug and alcohol abuse.

For most of FY 2002, the 4-H Unit, Department of Youth Affairs, and the Dededo Vice Mayor's office established a booth every Wednesday night at the Chamorro Village. The booths showed films, passed out pamphlets and provided a button-making machine that allowed youth the opportunity to express their uniqueness.

b. Impact/ accomplishment statement

There have been several observations made by government officials. The youth that are reached by these programs are more open, are more aware of the danger of drug and alcohol abuses, and, more importantly, are aware of alternatives for a better lifestyle. Youth that have been involved in such programs are visiting the Resource Centers more frequently and have shown more interest in joining village sports programs.

c. Source of funding - Smith-Lever
d. Scope of impact - State specific

Key theme: Aging

Effective partnerships for a sustainable community

a. Brief description of activity

The elderly population on Guam has increased greatly. More care for them is required. The Guam Cooperative Extension Service has accepted the challenge to help promote the quality of life with dignity for the elderly by working to strengthen elderly support and care programs on Guam. It has done so by encouraging its agents to serve a members of the advisory boards of the Guam Diabetes Association, Catholic Social Services, AARP, and the Guam Pacific Islander Cancer Control Network, a research program funded by the University of California, Irvine, to study cancer issues specific to Chamorros, American Samoans, and Tongans. GCES has helped organize an advisory board on elderly services. Board members initiated a learning program to increase their abilities to serve elderly customers. Quarterly meetings were held throughout the fiscal year in which each chairperson for case management reported activities.

GCES agents have worked with public and private social service professionals to demonstrate the best practices in dealing with dysfunctional customer situations. These institution members, the board members, the advisory body and other constituents have demonstrated their ability to effectively manage the institution to prevent unnecessary waste. The existing collaboration is designed to promote and strengthen institutional programming initiatives.

b. Impact/ accomplishment statement

GCES has increased member involvement in elderly-care organizations through projects and public service, and improved outreach delivery service to needy elderly in senior citizens center, and to those who are homebound. GCES has helped the elderly develop important life skills through increased collaboration and partnerships of private and public organizations. GCES has broadened learning experiences and relationships among organization members. GCES has been instrumental in the approval of local PICCN research. Seven hundred elderly members and thirty-five senior citizens on Guam received better service through strengthening of three community organizations.

A Guam Diabetes Association (GDA) grant was awarded to four of the members of the advisory board and their advisor to conduct two three-day grant-writing workshops conducted by the UOG College of Business.

c. Source of funding - Smith-Lever
d. Scope of impact - State specific

Key theme: Community Development

Grant-writing workshop

a. Brief description of activity

The Pacific Diabetes Today Resource Center sponsored Train-the-Trainers workshops, Phase I and Phase II, together with the UOG Cooperative Extension Services, Guam Diabetes Association and Department of Public Health Social Services. Fifty guests, 20 male and 30 female, attended the Phase I workshop. Contacts for the Phase I workshop was 40 male and 60 female.

A two-and-a-half day Phase II workshop was held on July 31, August 1 and August 2, 2002. A total of 30 participants daily attended the Phase II workshop. Contacts for Phase II sessions, by ethnicity, were 55 male and 58 female.

b. Impact/ accomplishment statement

Attendees became more skillful in grant writing. Grant awards were given to the participating Guam Diabetes Association grant writers to help conduct the FY 2002-2003 diabetic conference held in November 2002.

While workshops explored and practiced grant writing, participants also increased their knowledge about diabetic issues and good health care. They planned to adopt and practice positive life-style changes in order to limit non-communicable disease, and to prevent further health risk. They planned to change their behaviors, equipped with the necessary knowledge, attitude and skills to maintain healthier life-styles.

c. Source of funding - Smith-Lever and Guam Diabetes Association
d. Scope of impact - State specific

Key theme: Youth development/4-H

Extension's signature workshop

a. Brief description of activity

Charter Day is the University of Guam's annual showcase event. Last year, more than 3,000 local school children visited the campus to take part in a variety of open-house tours and festivities. The university community and the island community came together to celebrate the University Charter.

For CALS, Charter Day traditionally allows us to present a mix of activities in support of the University and its Land Grant Programs. The following presentation summarizes the many activities carried out during the year:

- CALS debut of the sweet potato and sweet sour sop smoothie drink;
- Mini-farmer's market showcase where farmer's provided local produce, promoting the variety of fresh produce;
- The CALS Fiesta Sampler featuring local food and processed goods. The food was made from local fruits by the faculty and staff. Over 3,500 individual servings represented the different menu items served;
- Extension's signature salt-water conditioned tilapia. This popular product is provided through a collaborative project with the Guam Fishermen's Association;
- Promotion of our Consumer Family Sciences (Resident Instruction) program through student participation. Students from the different classes helped in the processing and demonstration of the various activities;
- Displays and exhibits of all the different programs and current research;
- 4-H and youth development Fisheries Program. A highlight this year, the 4-H Summer Fisheries program was the youth's most popular event. The inclusion of a mini-boat show accentuated the importance of safety, courtesy of the Coast Guard Reserves. Water testing by the Guam Environmental Protection Agency promoted environmental stewardship. The

program also included the debut of Guam's Seafaring Society membership. A seafaring presentation displayed exhibits, pictures promoting the culture and traditions of a seafaring past;

- Inter-generation programs. Our partners from the American Association of Retired Persons participated in showcasing their services, membership and programs. Their presence was a show of support for our university;
- A weaving demonstration. This cultural demonstration, promoting local resources and skill building, was one of the most well attended events;
- Plants/flowers/produce presentations. Guam Department of Agriculture and the Guam Nurserymen's Association showed their plants, flowers and local produce and animals to round out Charter Day activities.

b. Impact/ accomplishment statement

Each year, the popularity of our program continues to grow. Charter Day activities allow CALS to highlight its many contributions to the community. They also allow CALS to build new mutually beneficial relationships with dignitaries, industry partners, students and stakeholders.

c. Source of funding - Local
d. Scope of impact - State specific

Key theme: Community development

Elder law conference

a. Brief description of activity

Through our continuing collaborative partnership with the Guam Legal Services and the Guam Chapter of American Association of Retired Persons (AARP), GCES co-sponsored the Governor's 2001 Elder Law Conference. The forum provided an opportunity for participants and service providers to become intimately aware of training programs, services and key issues and problems related to elders. This forum allowed lawyers to receive continuing education (CE) credits for attending. Topics covered laws of intestacy, incapacity planning and overview of the Office of the Public Guardian.

b. Impact/ accomplishment statement

Two hundred seventy participants representing both government and non-governmental agencies attended the three-day training sessions. GCES provided technical support for the conference by videotaping the series. The videotape serves as a valuable reference for topics important to our elderly population and government organizations that serve them. Requests for tapes continue. GCES participation also resulted in a legislative resolution recognizing the extension’s efforts. Our local clientele now includes both local and national chapters of AARP collaborating with us to recognize the needs of our elderly population.

c. Source of funding - Smith-Lever
d. Scope of impact - State specific

Key theme: Youth Development/ 4-H

Sports and Leadership Enhancement Program — summer and vacation activities

a. Brief description of activity

The goals of this program are to provide year-round 4-H sports training for stakeholders interested in enhancing youth sports development, and to address the issue of access to sports facilities for organized sports programs. The program encompasses youth clinics, specialized training, professional affiliations, inter-agency collaboration and informal educational opportunities consistent with the development of local youth and adult sports. While sports organizations provided expertise in sports, the 4-H Youth Development Unit of the College of Agriculture and Life Sciences (GCES) specialized in the enhancement of training and application.

The following workshops and clinics conducted addressed areas in team leadership, nutrition, public relations, marketing, youth finance, sports medicine, life-skills development training, mentorship training, and a host of other possible informal/formal educational experiences for youth.

A sports-leadership baseball workshop was available to all island youth, coaches, and parents to enhance participants' fundamental baseball skills. The fifteen coaches, umpires and parents who participated in our program received 27 hours of instruction in leadership, sports medicine, conditioning, public relations and time and stress management. They also participated in a youth clinic at Paseo Stadium.

4-H Basketball Camp, in existence for the past three years, is designed to diversify the range of sports clinics available to our youth. More than 150 youth have participated. 4-H Baseball Camp was held in June of 2002. Thirty-four youth participated in a weeklong workshop learning life skills and the basic fundamentals of baseball.

b. Impact/ accomplishment statement

Sports activities and summer camps allow children to develop life skills and physical fitness habits that will serve them through life.

c. Source of funding – self-sustaining

d. Scope of impact - State specific

Key theme: Character/ethics education

Youth horticulture

a. Brief description of activity

The 4-H Horticulture Program was developed to establish youth horticulture projects on our island. Community- and school-based programs were developed to serve as model sites with 4-H core clinics available year round. The goal of this program was to provide stakeholders with horticulture training and to develop sustainable sites and indigenous plant life on our island. This includes establishing an active collaboration with village mayors, the Department of Education, Department of Agriculture, ANR (CALS), and parents.

The Nursery Project Workshop (Building for the Future) provides a unique approach to education, providing hands-on experience for the 4-H Science and Beautification Club at one of Guam's middle schools. Co-facilitator Extension Associate Joe Tuquero helped teach thirty students from 4-H F.B.L.G. Middle School Science and Beautification club how to properly manage a school nursery throughout the school year.

The Indigenous Plant Workshop (field-trip-nature walk) is a year-round workshop offered to all interested youth groups, students and educators. Fifty students from Southern High School and F.B.L.G Middle School participated in daylong events at the Ritidian Point Wildlife Refuge. The goal of the workshop is for students to learn all about Guam plant life and the need to protect our environment from over-development.

b. Impact/ accomplishment statement

The two workshops allowed a total of 80 students to learn about their culture, the plants of Guam and environmental ethics.

c. Source of funding - Smith-Lever
d. Scope of impact - State specific

Key theme: Youth development/4-H

Guam 4-H clubs and leadership

a. Brief description of activity

The 4-H club program on Guam consists of a coordination group and five active clubs. The youth and adult leaders coordination program is designed to increase stakeholder participation and awareness of 4-H Programs. Fifteen youth and adult leaders meet monthly, or when schedules permit, to discuss club activities and participate in working sessions. The sessions enhance development of local programs, and make local program development compatible with national standards. The sessions provide participants the opportunity to access other CALS units for technical assistance in developing their prospective projects. The meetings also help coordinate the activities of the five active 4-H clubs on-island:

The 4-H Chamorro Culture Enhancement Club has 50 youth participants whose focus is the understanding of our islands' cultures and customs. The goal of the club is to promote social interaction between Chamorro and the people of neighboring islands. Club members and adult advisors are all from different ethnic backgrounds, and share their customs and the traditions of their countries. Club activities include campouts, horticulture, dancing, singing, and Chamorro traditional arts-and-crafts projects.

The 4-H F.B.L.G. Middle School Science and Beautification Club was created four years ago, and is one of the first clubs to be involved in all our 4-H programs and projects. The primary goal of this club is to provide life-skill education to its members through various projects that are implemented at the school level. For the past two years, 70 youth members have been involved in granting workshops, and have been awarded two grants for their school beautification project. Youth members participate in a year-round school beautification project that encompasses over 50 acres of school grounds.

The 4-H Yigo Rangers was created to build citizenship, character and mental and

physical fitness through outdoor programs and activities. Twenty-one youth members from the ages of 12 to 18 years participate in campouts, hikes and community-orientated programs to enhance their life-skill abilities.

The 4-H Yigo Council also was created four years ago, and serves as the first-ever community-based club on our island. Club activities included village youth programs, sports, graffiti wipeouts, recruitment, mentorship training, computer training, horticulture, campouts and participation in national conferences.

The Astumbo Elementary School Beautification Club, with 25 youth members and three adult advisors, is involved in various horticulture projects throughout the year. Members' goals and objectives are to educate themselves as well as other students through hands on horticulture activities. The club also educates members about all components of 4-H, and collaborates with the village mayor's office and other island schools to expand school beautification programs.

b. Impact/ accomplishment statement

4-H clubs and activities have a tremendous long-term impact on the student participants and the adult partners. Students learn life skills and ethical values. Students become aware of their ethnic background and traditions, and understand the vast ethnic diversity of youth in our community.

c. Source of funding - Smith-Lever
d. Scope of impact - State specific

B. Stakeholder Input Process

Actions taken to seek stakeholder input

Three major efforts were undertaken this year to seek stakeholder input. First, all faculty within the College of Agriculture and Life Sciences were required to solicit the services of three members in the community to serve as their advisers. The Office of the Dean will be inviting community advisors of each faculty member to a stakeholders meeting, which is planned for early April 2003. Second, open town meetings were conducted in September of 2002 to gain a perspective of the current state of agriculture on Guam. Ninety-seven people representing various agricultural interests attended and gave valuable input. Third, we have an ongoing effort to seek stakeholder input as a part of our daily interactions with the community at workshops, in daily client consultations and during meetings of the formal organizations in which our professionals participate. Also, we are still working through the input received from last year's island-wide congress that we held with our stakeholders, and the review of the Resident Instruction program.

Processes used to identify stakeholders

Guam is a small place. For the most part, our professionals know the primary stakeholders in their particular disciplines. This is why we asked each to name a three member advisory committee. However, this does present a potential problem of inbreeding of relationships. The three open town meetings for farmers were widely advertised, and were open to the public for the stakeholders to identify themselves. The Guam Cooperative Extension Service participated in both the mental-health delivery programs and the farm disaster relief programs after Typhoon Chata'an and Supertyphoon Pongsona. Both of these efforts resulted in the identification of additional stakeholders on-island.

Results of consideration of received stakeholder input

The primary criticism GCES received at the town meetings and elsewhere was that on-farm agricultural extension services decreased over time as our agriculture extension agents faced increasing university faculty obligations. We are searching for funding for a cooperative agricultural statistics collection program with the local department of agriculture and the FSA. This will put a GCES employee on a majority of the large farms once a month. A Guam Farmer Resource Guide was also developed, with over 300 copies distributed to help mitigate the decrease in services. GCES conducted a two-day seminar for the Department of Agriculture's Agriculture Development Services (ADS) Division and the director's office. Through the capacity-building workshop, ADS underwent program planning and self-assessment, resulting in new division plans of work. GCES and ADS will attempt to undertake new joint programming during upcoming year.

As a result of the FY 2001 three-day retreat with faculty, students and community business stakeholders, the resident instruction programs have significantly revised the B.S. in Agricultural Sciences degree and B.A. in Consumer and Family Sciences degree. The

agriculture degree has become the B.S. in Tropical Agriculture and Environmental Sciences, with a capstone project and an internship course added to a revision of the existing course and requirements. The CFS degree eliminated its multiple-track alternatives and added capstone projects and internship offerings along with a revision of its courses.

Finally, community stakeholders, in general, say they wish to see the university do more to help the community deal with the problems associated with the decline in local economic conditions caused by changes in the Japanese and Korean economies, and by A-76 military services outsourcing. We are seeking ways to strengthen our relationships with the Small Business Development Center, Guam Economic Development Authority and other community development groups. New faculty were hired or transferred into the Economic and Community Sciences program of the GCES. It will take some time for the new emphasis to take effect in modifying the overall mix of GCES programs.

C. Program Review Process

Significant changes in the program review processes

There have been no significant changes in Guam's program review processes since our 5-year plan of work.

D. Evaluation of the Success of Multi and Joint Activities

The University of Guam participated in five multi-state research projects in FY 2002. They were NC-174 - management of eroded soils for enhancement of productivity and environmental quality, W-185 - biological control in pest management systems of plants, W-128 - microirrigation management practices to sustain water quality and agricultural productivity, NC-142 - regulation of photosynthetic processes, and S-009 - plant Germplasm. In addition, we participated in four multi-state coordinating committees. They were WCC-011 - turfgrass research, WCC-067 - western coordinating committee for sustainable agriculture, WCC-205 - integrated water quality research and extension program for the western United States and WCC-206 - Pacific Basin tropical agriculture.

The AREERA guidance asks that the following four questions be answered in evaluation of the University of Guam's participation in Multi and Joint Activities.

Did the planned programs address critical issues of strategic importance?

Yes and no. Most did, but we are not happy with our participation in NC-142, regulation of photosynthetic processes, due to our perception that it lacks focus on our strategic needs. We plan to withdraw from this research project in FY 2003. The others are addressing the long-term needs of our clientele on Guam and in the region.

Did the planned programs address the needs of under-served populations?

Yes, our planned programs focus on tropical agriculture, and our farmers are under-

served by the U.S. agricultural research and extension system. If "under-served populations" means people on Guam who are under-served based on economic, social and ethnic criteria, the answer is again, yes. All populations on Guam are ethnic minorities and most of our farmers are Asian/Pacific Islanders. How well we are meeting their needs is a different question, but we definitely are trying to address them.

Did the planned programs describe the expected outcomes and impacts?

Where? This question in the guidance is incomplete. The multi-state programs generally do a good job of describing their expected outcomes and impacts in their initial proposals to the regional directors associations and in their progress reports as a whole. In their local Plans of Work and AREERA reports, however, individual scientists and extension agents on Guam vary considerably in their success in meeting this goal. Some have a good understanding of what are outcomes and impacts, and do a good job of reporting, and some fail miserably. We will continue to work with our faculty to improve their understanding and performance in this area. Any educational help that could be provided by CSREES in terms of training or materials would be appreciated.

Did the planned programs result in improved program effectiveness and/or efficiency?

Our membership in multi-state projects and committees is important because it allows our researchers and extension agents to interact with their counterparts from within the region and around the country. Because Guam is isolated, and we have no more than one or two faculty in each discipline, annual and ongoing interactions improve our programs' effectiveness and efficiency.

On an individual project basis, we are happy with the effectiveness and efficiency of all of our projects but one. We are working with the PI of the project to improve the outcome and impact of the project. If there are no improvements in the local management and results of this project, our participation in it will be terminated at the end of this fiscal year.

Thus, we may terminate participation in two of our five multi-state projects this year: one because it is not aligned with our strategic needs, and the second because it has not been an effective or efficient use of the college's resources.

Appendix A. Allocation of Local, Hatch and Smith-Lever 3c Funds within the College of Agriculture and Life Sciences

	Prof FTE	ParaProf FTE	Staff FTE	Admin FTE	Federal Funds	State Funds	Total Funds
Goal 1							
research	4.14	1.00	7.50	1.50	411,354	410,953	822,308
extension	4.58	0.00	1.00	0.50	241,804	242,474	484,279
Goal 2							
research	0.25	0.00	0.00	0.10	12,606	12,594	25,200
extension	0.30	0.00	0.25	0.10	19,941	19,996	39,936
Goal 3							
research	0.00	0.00	0.00	0.00	0	0	0
extension	2.42	0.00	0.50	0.30	112,924	113,236	226,160
Goal 4							
research	2.42	1.00	5.50	1.50	275,303	275,034	550,337
extension	1.28	0.00	0.75	0.50	89,552	89,800	179,352
Goal 5							
research	0.00	0.00	0.00	0.00	0.0	0	0
extension	6.72	0.00	1.00	1.00	344,185	345,139	689,324
Programatic Subtotal	22.11	2.00	16.50	5.50	1,507,668	1,509,227	3,016,895
University and community service	1.57		2.00	0.50		233,861	233,861
Fall teaching	1.28		0.25	0.50		162,525	162,525
Spring teaching	1.04		0.25	0.50		132,674	132,674
Research	6.81	2	13.0	3.1	699,263	698,581	1,397,844
Extension	15.3	0	3.5	2.4	808,405	810,645	1,619,050
Teaching and service	3.36		2.5	1.5	0	529,060	529,060
Total	26.00	2.00	19.00	7.00	1,507,668	2,038,287	3,545,955