# A COMPILATION OF FACTSHEETS OF SUSTAINABLE AGRICULTURE AND RESEARCH EDUCATION (S A R E) PROJECTS IN THE AMERICAN PACIFIC (2000-2005)

Western Region Sustainable Agriculture Research and Education


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# A Boost for Banana Production

## Situation

Banana, the leading fruit crop in the Pacific islands, is a well-adapted subsistence crop in Micronesia typically grown in back yards for family consumption. Bananas are grown for commercial production In Guam and Korsae. While Palau has no consolidated area for banana production, its maritime climate is ideal, rainfall is fairly uniform throughout the year and the area is outside the Pacific typhoon zone.


**Research and Education Grant**

**Project Number**: SW05-053

**Project Title**: Research and Demonstration on Banana Production Technologies in Micronesia



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**Producer Cooperators**:
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Elechui, Aimeliik



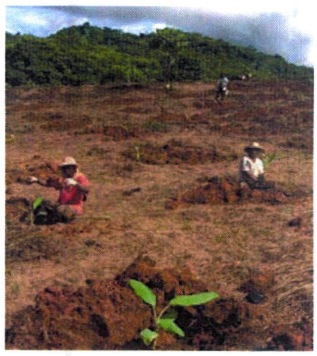
**SARE Grant**: $83,992


Badeldaob Island in Palau, the second largest island in Micronesia, is near Guam, making it ideal for producing bananas not only for local consumption by Palau residents and tourists, but also for export to Guam and its larger population and tourist industry.

Plants materials ready for the banana trials.

## Objectives

1. Establish research and demonstration areas on producer farms to showcase traditional and appropriate technologies for small-scale banana production
2. Assist and guide the farmers in appropriate cultural management practices, post-harvest



Workers plant seedlings, grown in the greenhouse, below.

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technology and marketing strategy to ensure successful banana production

3. Set up an experiment on producer farms to determine nutrient requirements
4. Produce a handbook on small-scale banana production in Palau
5. Train farmers and extension agents on best management practices for banana production

## Actions

Research and demonstration areas were established on farms of cooperators in Ngaremlengui, Airai and Melekeok states in Palau. Soil samples from the farms were submitted to a laboratory for analysis, and each demonstration farm was divided into four sections to demonstrate the effects of nutrients on the growth of "lacatan" banana:

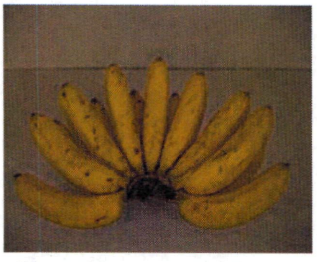
- no manure and fertilizer (control)
- manure and fertilizer at planting
- manure and fertilizer every two months
- manure every two months

Tissue-cultured "lacatan" planting materials, all timed to grow at the same pace, were laid out at a distance of 4 meters by 4 meters with 24-28 plants per treatment.

## Results

Early results of the project show:

- Soils, based on test results, are very low in phosphorus and potassium.
- Lacatan bananas fertilized with manure and fertilizer at planting and every two months were significantly taller than those without fertilizer (control) and those with manure applied every two months.



Ripened bananas ready to eat.

Bananas are planted four meters apart in the field trials.

Work to be completed:

- Produce a banana production brochure
- Train producers and extension agents in banana production techniques

## Potential Benefits

Although the banana production project has yet to be completed, it has the potential to produce these benefits:

The farmers' active participation in the demonstration project will give them hands-on experience and increase awareness, understanding and skills in appropriate cultural management practices.

The appropriate production technologies will be documented in a handbook detailing cultural practices, pest and disease control and cost and return analysis. The handbook will be distributed to farmers, extension agents, traditional leaders, government officials and interested individuals in Micronesia and elsewhere.

More farmers will be encouraged to produce bananas, with about 20 new acres of banana production expected.

A healthy hand of bananas ripens.

With a projected yield of 13,114 pounds per acre, and at a current price of 70 cents a pound, gross income of $9,179.80 per acre could be possible. If new production of 20 acres materializes, the potential gross income for farmers would be $183,596.

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# Building Aquaculture Capacity

## Situation

The aquaculture industries of Guam, American Samoa and the Commonwealth of the Northern Mariana Islands (CNMI) are expanding, each with more than 50,000 pounds of production a year. All three areas import most of their seedstock from Hawaii and Asia, but such imports can create problems, like shrimp white spot disease introduced from imports to Guam, which shut down Guam's largest shrimp farm.

Thailand faced a similar situation a decade earlier and has since developed cultural strategies that may be instructive to aquaculture industries on Pacific islands, which have environment conditions parallel for those in Thailand for such species as marine shrimp, freshwater prawns, tilapia and catfish.

Female tilapia with eggs in her mouth.

## Objectives

1. Train producers and agricultural professionals in Guam, American Samoa and CNMI in sustainable commercial aquaculture techniques used in Thailand
2. Produce a training manual of grow-out methods used in Asia
3. Produce a video and DVD of commercial aquacul-

Above, fresh harvested shrimp from a Thai cooperative market. Below, bamboo racks are used to hold the hapa nets.

**Professional Development Program Grant**

**Project Number:** EW05-017

**Project Title:** Capacity Building and Training in Commercial Aquaculture for Guam, Commonwealth of the Northern Mariana Islands and American Samoa

**Project Coordinator:**

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SARE **Grant:** $90,000

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Above, workers use nets to harvest catfish in one of the aquaculture ponds. Below are the results of their efforts.

ture technology used in Thailand

4. Conduct two workshops in Guam, two in American Samoa and three in CNMI to disseminate sustainable aquaculture information to ag professionals, employees of government agencies, producers and others

## Actions

Working teams of ag professionals and producers from each participating island and a photographer – 12 participants in all – completed a two-week study tour in Thailand, with training conducted in Bangkok by the Asian Institute of Technology. Material and information were gathered to produce a training manual and video, and still photographs of major activities and facilities on the study tour were recorded to produce a video and DVD and for use in training.

These activities are now being addressed:

- Complete the training manual
- Complete the video and DVD
- Conduct training on each of the three participating islands

## Results

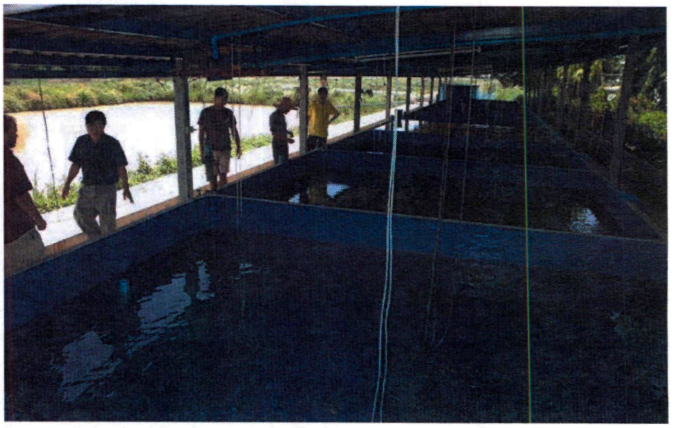
Even though the project has yet to be completed, several impacts have already been realized:

- Farmer participants are engaging family and friends in discussions about their experiences in Thailand.
- An article was submitted to and published in "Regional Notes," a newsletter of the Center for Tropical and Subtropical Aquaculture.
- Two farmers purchased enhanced tilapia fry from commercial tilapia hatcheries in Thailand to improve their production.
- The public hatchery in Guam purchased, from the Asian Institute of Technology, 6,000 enhanced tilapia broodstock for its tilapia hatchery.
- While in Thailand, based on what they were able to see and experience, eight farmers and ag professionals purchased equipment for their farms or work activities.

## Potential Benefits

Using train-the-trainer techniques, the study tour participants will extend what they've learned and experienced to other agricultural professionals and producers on their respective islands, fostering sustainable, biosecure aquaculture industries. This, in turn, will allow aquaculture producers and policymakers to make informed decisions.

*Photos by John Williams, David Crisostomo, John Brown, Michael Ogo, Joseph Fuamoto and Bob Barber.*



Tour participants inspect fry tanks during their tour in Thailand.

# Container Vans for Livestock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## Situation

The typhoons that strike Guam and Micronesia as often as two or three times a year, with winds between 50 and 130 miles per hour, can easily blow away structures made of light materials. Buildings for poultry producers are particularly susceptible, which has discouraged many producers from constructing permanent facilities.

Converted container vans could provide the structural soundness that producers need to maintain their chicken flocks.

The chickens in the vans grew at a uniform rate.

## Objectives

- Study and demonstrate container vans as alternative poultry housing structures
- Demonstrate the impact of such housing on the Pacific region poultry industry
- Encourage producers to revive the poultry industry
- Increase producer awareness about animal welfare
- Produce educational materials about the project in different dialects in the region

## Actions

In the first year of the project, a 20-foot container van was used to house and raise, from brooding to layer, 50 Brown Nicks (a cross between Rhode Island and White Leghorn) chickens. Dried hay and dried banana leaves were used as litter and bedding material, and 5-gallon plastic pails were used as feeders and waterers. Another batch of Brown Nicks was raised from brooding to layer in typical open pens. Performance of the two batches was re-

Feeding time in the container.


**Research and Education Grant**

**Project Number:** SW02-048

**Project Title:** Alternative Housing Structure for Livestock and Poultry in Micronesia



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**SARE Grant:** $26,857

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The chickens in the trials began laying eggs at 22 weeks of age.

corded and compared at the end of a six-month production cycle.

In years two and three of the study, two 40-foot container vans were added, each housing 100 chickens from brooding to laying for a 20-month production cycle. Production records were maintained and analyzed on feed conversion, growth rate, disease incidence, bird behavior and mortality rate.

## Results

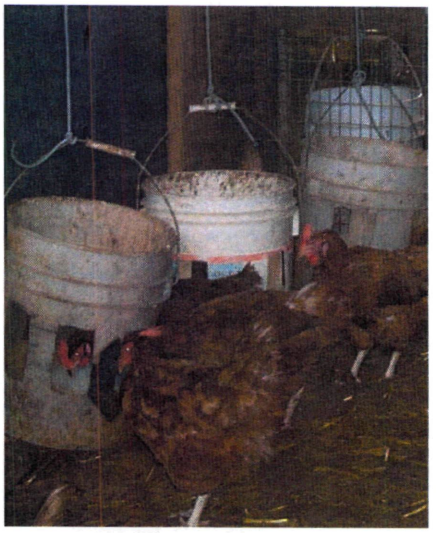
The performance of the chicks, from brooding to pullet stage inside the containers was rated as satisfactory:

- Morbidity and mortality rates were within standard performance for poultry houses in the Pacific
- The growth rate of the chicks was uniform
- There was no incidence of disease or behavioral problems

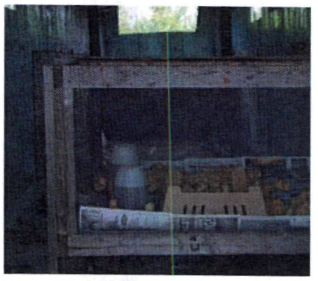
The satisfactory performance carried through to the laying stage:

- The birds began laying at 22 weeks
- Peak production occurred at eight weeks after the onset of laying
- The birds exhibited no behavioral problems

Although no super typhoon struck Guam during the grant period, the results proved that chickens could be raised inside container vans with satisfactory results. It's important that the vans be properly secured to the ground. And temperatures can be lowered inside the vans by cutting back the sides to increase air movement and circulation.



Plastic pails serve as feeders and waterers.



Chicks were placed directly into the container vans

## Potential Benefits

The project opened more alternatives for housing in typhoon-prone areas, including condemned school or tour buses. It also showed how plastic containers can be converted to cheaper yet practical means of feeding and watering poultry and that dried banana leaves can be used as bedding for floors and nests, demonstrating how local resources can be used for raising poultry instead of buying expensive imported products.

# Crab Ranching in the Marianas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## Situation

The coconut crab, a cultural icon among indigenous people of Rota and a food delicacy increasingly in demand, was once plentiful in the wild. But populations have dwindled as the crabs were hunted for their cash value.

Wild crabs subsist mainly on figs and coconuts, but will eat almost anything organic.

Ranches on Rota, in the Northern Mariana Islands, have been growing captive populations of coconut crap for several decades. However, few of these part-time producers have applied scientific techniques of animal husbandry to increase yields. The penned crabs typically suffer nutrient deficiency and unsanitary conditions.

Increased demand in the tourist industry, where coconut crab may fetch $50 a plate, has far exceeded the annual production of farm-raised livestock. Because of declining farm-raised stocks, most of the consumption comes from the hunted wild crabs, which is rapidly shrinking their populations.

## Objectives

- Increase the captive coconut crab populations found on ranches of indigenous people on the island of Rota
- Monitor the behavior of captive crabs to assess which recycled foods they prefer and their preferred habitat
- Develop protocols for rearing coconut crabs in captivity
- Disseminate information, in a brochure and on a webpage, to small farmers in the Northern Marianas, Guam and other parts of Micronesia

## Actions

Project coordinator Henry Atalig, whose father has been growing coconut crabs on his small rural ranch for decades, used separate funding to build a concrete and cinder block coconut crab rearing facility. It measures 25 feet square and 5 feet high and is designed to mimic the crabs' natural environment. It is equipped with two

The rearing facility measures 25 feet square by 5 feet high.


**Farmer/Rancher Grant**

**Project Number**: FW06-010

**Project Title**: Coconut Crab Production Using Recycled Food Sources

**Project Coordinator**:
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**SARE Grant**: $10,000

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ponds, one fresh and one salt.

The CNMI Department of Land and Natural Resources permitted Atalig to obtain wild coconut crabs, noting that his project had merit and would benefit many CNMI residents, especially current crab ranchers.

Atalig captured 104 crabs, tagging 20 for identification and weighing and measuring each for monitoring.

In addition to coconuts, the crabs are being fed a variety of locally available foods, including banana, tapioca, sugar cane, noni fruit, guava and breadfruit.

Work to be completed:

- Atalig will monitor the crabs, recording growth, reproduction, diets and other elements crucial to their well-being
- A brochure will be printed to provide information on appropriate production practices for crab ranchers
- A webpage will be produced and hosted on the Northern Marianas College website

## Results

Results from the project should be available in 2008.

## Potential Benefits

As with the sea turtle, the coconut crab is being hunted into being a rare creature.

Atalig's facility includes sources of fresh and salt water.

Growing these crabs using local ingredients like coconuts and other recycled foods should increase the availability of crab, potentially increasing the income not only of farmers but of businesses in Rota's tourism industry.

Producing the crabs on farms will promote good stewardship of natural resources in the Northern Mariana Islands by relieving pressure on hunted populations of wild coconut crabs. It will also enhance the well-being and satisfaction of island residents as the coconut crab is one of the icons of the indigenous people.

The coconut crab, the largest terrestrial arthropod in the world, can reach 9 pounds with a body 16 inches across and claws with a 30-inch span.

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# Crop Shelters in the Storm

## Situation

The rainy period on Guam runs from July through December, limiting production of water-sensitive crops, including cucurbits (cucumbers, watermelon and cantaloupe), solanaceous crops (hot pepper, tomato and eggplant) and legumes (beans).

## Objectives

Develop a way for Guam farmers to grow and market crops sensitive to heavy rain and moisture during the rainy season using a greenhouse water barrier.

## Actions

Four participants agreed to build and test greenhouses using materials available locally from hardware stores and other vendors.

- One built a greenhouse from a canopy supply house, making for easy setup with prefabricated fasteners.
- Three built greenhouses from industrial metals, like rebar and steel piping, to withstand storms.
- All used tarps, 20 feet by 100 feet, supplied by the Guam Department of Agriculture.

Ernie Wusstig's water barrier structure at Island View Farm.

Storms blew tarps off all four structures, but the frames withstood the high winds. All the crops planted before the storm were lost in the storm. But they had grown 7-12 inches taller than plantings of similar ages and varieties in open fields.

Cooperators Ernie Wusstig and Rick Guerrero were able to obtain additional tarps, and delayed planting until the storm cycle passed, Guerrero in August, Wusstig in September.

Grower cooperator Rick Guerrero.


**Producer + Professional Grant**

**Project Number**: FW04-302
**Project Title**: Greenhouse Water Barrier
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**SARE Grant**: $10,871

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## Results

With the greenhouse framework surviving, the two producers who obtained new tarps grew out their crops and tapped into the market at a time when short supply and high demand increased market price. Guerrero has been able to supply the market with out-of-season cherry tomatoes, and Wusstig is able to supply tomatoes.

David Wusstig, Ernie's grandson, checks crops at Island View Farm.

## Potential Benefits

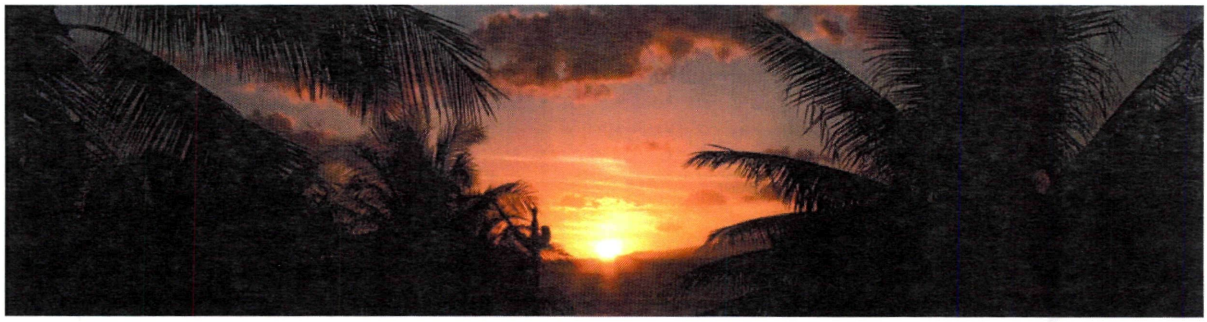
Despite weather setbacks, the project showed that greenhouse water barriers can help improve crop production:

- The growing season can be extended, opening market opportunities during the rainy season.
- Covered tomatoes grown during the rainy season can fetch as much as $2-3 a pound, compared with 50 cents during the dry season.
- Crops grow and reach maturity more rapidly under the protective canopy.
- Water damage is reduced, improving crop quality.

Greenhouse frames tested used industrial materials like rebar and steel piping.

- The system reduces pest populations, reducing pesticide and labor costs. Wusstig saved $100 in pesticide costs and $500 in labor costs for applications, weeding and fertilization. Guerrero saved $100 in pesticide costs and $200 in labor costs.
- The protective cover reduced wind damage, resulting in higher production of fruits and flowers.

More than 65 people visited a demonstration of the system at the Guam Department of Agriculture, and two producers made plans to test it growing peppers, cabbages, melons and cucumbers.



# Cultivating a Cultural Symbol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## Situation

Guam relies heavily on a single source of revenue – tourism – and communities need to develop markets to tap into this source of revenue.

- Hotel lobbies, restaurants, banks, offices and conference rooms on Guam display beautiful floral arrangements
- Flower leis are given at a variety of special occasions and celebrations – graduations, anniversaries, weddings and arrival and departure of friends of family – as symbols of love, friendship, best wishes and welcome.
- Few of the flowers used in leis and floral arrangements are grown on Guam; most are imported from Hawaii and Asia.

The Okada family wanted to see if they could grow tropical flowers on their farm, then add value in the form of leis and flower arrangements. In turn, they wanted to share their results with others.

## Objectives

Provide economic opportunities for tropical flower producers and encourage women, in particular, to enter into the cut flower and lei making market, a market currently untapped by local producers.

Okada models the finished products from her classes.

## Actions

In this multi-faceted project, coordinator Antoinette Okada engaged in several activities:

The next generation learns lei-making.

**Farmer/Rancher Grant**

**Project Number**: FW04-104
**Project Title**: Lei Making and Marketing — A New Approach to Marketing
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**SARE Grant**: $6,750

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- She conducted a phone survey to gauge the retail value of the flowers in floral arrangements
- She surveyed local hotels to assess their interest in purchasing local flowers
- She advertised and conducted two lei making workshops
- She installed a collapsible greenhouse on her farm to propagate plants used for leis and floral decorations

## Results

From the Hotel Survey, she found that:

- 10% of Guam hotels were surveyed to obtain information on the potential for leis and cut flowers
- All 11 hotels surveyed responded that they purchase flowers from on-island flower shops
- The most commonly ordered flowers are orchids, heliconias, bird of paradise and anthuriums

The Workshop Survey showed that:

- Of the 24 people who attended her workshops, 22 attended to develop or further their lei-making skills as a hobby or recreational activity
- Six of the 24 were interested in making leis for money
- Five will continue to make leis for their personal celebration
- A step-by-step lei making brochure was printed and distributed and is available for future workshops

Okada in the finished greenhouse with her thriving plants.

Workshop participants craft ti leaf leis.

## Potential Benefits

The Okada family expected to save around $900 on the purchase of plant material from off-island vendors. They also reduced the risk of introducing off-island pathogens and diseases.

While others could realize similar benefits, Okada cited three barriers for those entering the cut-flower industry:

- Lack of lei-making skills
- Lack of capital for purchasing seedlings
- Lack of capital for building a greenhouse

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# Demonstrating a Fish Pond

## Situation

The people of Yap and other Pacific islands can benefit from aquaculture. A created test and demonstration pond can provide first-hand knowledge and examples of raising fish in ponds.

## Objectives

Using a constructed fishpond, provide practical and technical factors, including constraints, involved in raising fish in brackish water.

## Actions

A small pond, 75 by 125 feet, was created with a dike across the mouth of a cove-like area. Mud and debris were excavated from the pond and a gate installed for draining the pond and for water exchange during tide changes.

Mullet and rabbitfish were caught and stocked, 600 juveniles in all, the mullet 1-2 inches long, the rabbitfish 2-3 inches. The ponds were not fertilized nor were any supplements fed to the fish.

## Results

Several events, including Typhoon Sudal and an invasion of tilapia that attacked the mullet, altered the scope of the project. Even so, several positive outcomes evolved.

Many of the students visiting the farm volunteered to harvest the fish.

- The harvested tilapia proved popular at the market, selling for $1.75 a pound, compared with $1 a pound for other species


**Producer + Professional Grant**

**Project Number:** FW04-311

**Project Title:** Lamer Fishpond Pilot Test and Demonstration



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**SARE Grant:** $6,1572

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- Water and soil quality of the demonstration pond are similar to water and soil in surrounding areas, meaning water exchange in the pond is adequate for fish growth
- Algal growth was observed, but it was limited because of poor soil fertility and the tilapia invasion. Algae, as feed for the fish, could be enhanced with natural fertilizer (it is recommended that pig manure be tested)
- Costs, high at first, should drop as fish crops are harvested
- Labor for such projects is readily available
- Interest in the project is very high

More than 300 people visited the pond.

- 50% were students ages 6 to 16
- 25% were members of various communities
- 15% were government officials
- 5% were interested Filipinos and tourists
- 5% were interested farmers and fishers

Volunteer assistants cast the net for tilapia and rabbitfish.

## Potential Benefits

The pilot project provided a clear picture of how this resource can be utilized and methods for increasing the populations of much demanded fish products.

- Potential aquaculture farmers now have guidelines for planning and developing a fishpond.
- Such farmers are aware that the market for tilapia may prove more profitable than other species, especially among the Filipino community.
- Future farmers will have information about how to deal with natural disasters, marketing and fishpond modification and improvement.

The dam, with flow gate for water exchange.

Tilapia from the pond sold well at the market.

# Improving Livestock Forage


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## Situation

Rising populations on the islands of the Western Pacific require increasing supplies of animal protein. Rather than enduring the expense of importing animal meat and feeds, the islands might be better served by striving for self-sufficiency.

Island goat producers currently graze their animals on poor, undeveloped pastures, supplementing with imported alfalfa hay or grains. This inefficiency doubles the time it should take to produce a goat. Producers without pasture lands gather feed daily in a "cut and carry" system that requires driving 5 to 10 miles a day, increasing production costs and reducing efficiency.

Likewise, cattle producers are often discouraged by the low productivity of herds raised on poor quality pasture with little access to water, resulting in overgrazing, invasive weeds, soil erosion and water contamination.

Correcting these inefficiencies, and improving island self-sufficiency, will require research into the sustainable production of animal feeds and improved management systems for animal production.

This pasture is a mix of signal grass and Guinea grass.

## Objectives

1. Conduct forage evaluation and demonstration trials that incorporate adaptable forage grass and legume species into a pasture improvement management plan for ruminant and poultry producers

Cattle graze on mix of Guinea grass and mimosa.


**Research and Education Grant**

**Project Number**: SW06-042
**Project Title**: Sustainable Forage and Livestock System for the Island of Tinian


**Principal Investigator**:
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**SARE Grant**: $10,000

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2. Raise the level of technical knowledge and management skills for beef producers and provide agricultural professionals with information on pasture and cattle management
3. Develop a goat industry as an additional source of income for small farmers and provide options for improved goat production
4. Develop awareness of using legumes to enhance soil fertility and encourage manure disposal on pastures
5. Explore methods for improving pasture and extending the grazing season in ways that are economical and efficient

Turkeys forage inside one of two pens designed for the project. Below, bare grass patches show the path of the other portable chicken pen.

## Actions

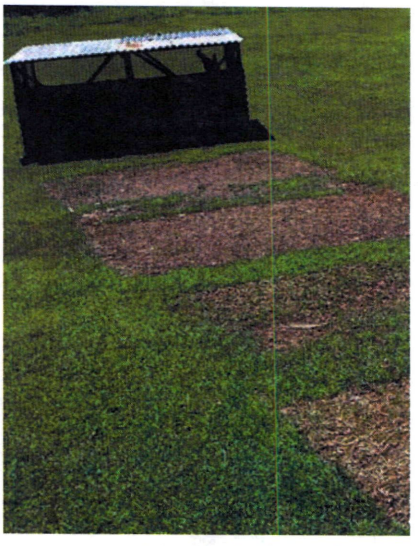
A pasture improvement plan and rotational grazing system were established on the 35-hectare Tinian ranch of Sam Palacio. The land was subdivided into eight paddocks for 35 cattle and planted with several combinations of these grasses and legumes:

- Local grasses: Guinea grass and signal grass
- Introduced grasses: buffel grass, whittet kikuyu and Guinea grass
- Legumes: leucaena, mimosa and sunn hemp

Based on advice from the Natural Resources Conservation Service, Palacio rotated his cattle every seven days, providing an eight-week rest period for the pasture in each paddock.

A qualitative evaluation of the system will be based on cattle performance, rancher observations and the palatability of the grasses.

In addition to the rotation trials, the project team set up two types of portable chicken pens to demonstrate pastured poultry, featuring turkeys and chickens grazing grass and perennial peanuts. The portable pens, each built with different materials based on needs and purposes, were moved every week.



## Results

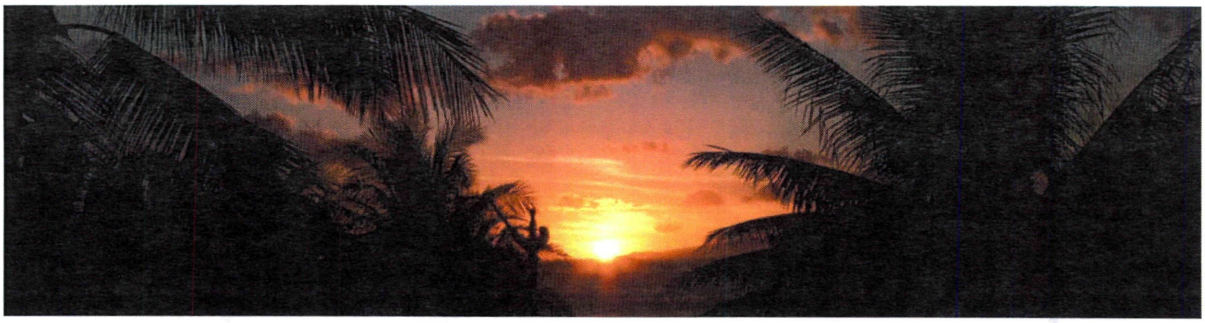
Project results will evolve in 2008, and field days and workshops will extend knowledge gained to producers and ag professionals.

## Potential Benefits

Producers should become more knowledgeable about sustainable grazing systems and management practices, which will result in:

- Increased productivity
- Reduced input requirements
- Increased profitability
- Improved management of the island's natural resources

Pacific island livestock farmers will decrease their feed costs, save time on farm operations and improve general farm sustainability.



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# Island Guide for Tomatoes Etc.

## Situation

Fresh eggplant, pepper and tomato (solanaceous crops) are becoming more popular among Pacific island consumers. They are easy to grow and their seeds can be collected and used the next year. But growers in the Pacific region often struggle to find production information that applies in the tropics.

## Objectives

1. Establish a working group of people from the private and public sectors interested in educating people about solanaceous crops
2. Publish a guide on producing eggplants, peppers and tomatoes in the tropics
3. Disseminate information on these crops over the Internet, in classrooms and in newspapers

## Actions

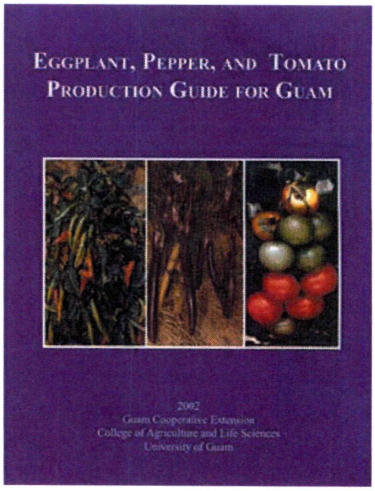
Robert Schlub, the principal investigator, solicited expertise on producing solanaceous crops from several experts located in Guam, Hawaii, the Northern Mariana Islands, the Federated States of Micronesia and American Samoa. In addition, growers on Guam were surveyed about diseases, pests and current farming practices.

With this information and assistance, a 188-page softcover guide, "Eggplant, Pepper, and Tomato Production Guide for Guam," was published. It contains 17 chapters and five appendices and features 42 color plates, 54 figures, 47 tables and 16 recipes. The chapters and appendices are:

A tomato crop on Guam.

<u>Part 1. Getting Started</u>

Chapter 1 Getting Started
Chapter 2 Growth and Development
Chapter 3 Production
Chapter 4 Irrigation, Fertigation and Drainage
Chapter 5 Harvest and Postharvest Handling
Chapter 6 Container Gardening and Horticultural Therapy





**Research and Education Grant**

**Project Number:** SW99-047

**Project Title:** Strengthening Through Education the Sustainability of Solanaceous Crop Production in the Western Pacific Region



**Project Coordinator:**
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**SARE Grant:** $16,000

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Chapter 7 Nutrition and Recipes

Part 2. The Economics of Farming

Chapter 8 Developing Budgets

Chapter 9 Economic Assessment

Chapter 10 Financial Assistance to Guam's Farmers

Part 3. Plant Problems and Solutions

Chapter 11 Trouble Shooting Problems

Chapter 12 Plant Diseases

Chapter 13 Animal Pests

Chapter 14 Insects and Mites

Chapter 15 Weeds

Chapter 16 Regulations Regarding the Importation of Propagative Plant Material

Chapter 17 Pesticide Safety

Part 4. Appendices

Appendix 1 Eggplant, Pepper and Tomato Production Survey

Appendix 2 Guam Variety Evaluation Trials

Appendix 3 Guam Farmer Survey

Appendix 4 Seed Company Information

Appendix 5 Helpful Resources

Selected References

Color Plates

Glossary


Extension agents Jesse Bamba, right front, and Pheobe Wall, center, talk with local farmers at a workshop on a Guam farm.

## Results

- 2,000 copies of the guide were published, a number of which were distributed free to Integrated Pesticide Management coordinators and college libraries in the Pacific
- A poster highlighting the guide was presented in August 2002 at the annual meeting of the American Phytopathological Society
- In September 2002, the guide was presented to growers and government agencies, and a consortium was formed to promote the production of eggplant, peppers and tomatoes on Guam
- Guides were distributed in October 2002 to the steering committee of the American Pacific Pest Management Information Network

Solid-set tomato plants on a Guam farm.

## Potential Benefits

The publication should increase the level of knowledge about solanaceous crops among farmers, extension agents, students and homeowners. Tables listing all of the known insects and plant diseases of eggplant, pepper and tomato in the Pacific will help with diagnostics. If the publication contributes even a 2% gain in production of these plants, it could increase sales by $100,000.

# Marshall Island Sustainability

## Situation

The tropical atoll agriculture found in the Marshall Islands presents farmers with challenges seldom encountered in other environments:

- Winds and salt spray damage crops near the shore
- Inadequate rainfall some years limits growth
- Low fertility of alkaline soils inhibits plant growth

The Marshallese people are familiar with the traditional crops like coconuts, breadfruits and pandanus, but they have little understanding of the new crops that this project is trying to introduce, especially the leafy vegetables.

Village members listen to a presentation on sustainable practices.

## Objectives

1. Educate and train extension agents, government agricultural staff, agricultural professionals and members of nonprofit and farm organizations in on-farm implementation of sustainable management systems through training workshops and field days
2. Hold one-day brainstorming audio-visual conferences on "Sustainable Atoll Agriculture: Needs, Management Strategies and Future Potential," followed by a four-day training workshop at eight sites throughout the Republic of the Marshall Islands
3. Develop, publish and distribute sustainable farming guides, handouts and brochures in English and local languages
4. Develop and distribute a video, in English and local languages, on sustainable compost preparation and use

Bed preparation is a community effort.

**Professional Development Program Grant**

**Project Number:** EW05-004

**Project Title:** Training on On-Farm Implementation of Sustainable Management Systems for Tropical Atoll Agriculture in the Marshall Islands

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SARE **Grant:** $37,362

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## Actions

A change in the project coordinator in May 2006 resulted in a revised plan of work under the direction of Dr. Nacanieli Tuivavalagi.

The project team has trained individuals on six Marshall Island atolls: Ailuk, Arno, Ebon, Mejit, Mili and Ujae. Two other atolls, Malaolep and Kili, will also be visited.

In addition, five staff members of the land grant program attended a short course on Adobe Photoshop through collaboration with the Development of Sustainable Agriculture in the Pacific Project of the Secretariat of the Pacific Community.

Activities to be completed:

- Develop topics and content for guides, brochures and handouts
- Produce videos demonstrating sustainable agriculture techniques

## Results

The project team has demonstrated several sustainable practices, including how to make a vegetable garden, nursery production, transplanting, fencing and composting. In addition, residents have learned about trench gardening, whereby trenches (drains) are dug and filled with organic debris. The crops (bananas etc.) are planted on the side of, or inside, the trench.

Above, seeds are planted directly into prepared seedbeds or, below, on pallets for transplanting into beds when the seedlings mature.

Basic tools (rakes, shovels, hoes, picks, watering cans and machetes) are left with group leaders so they can expand the plots.

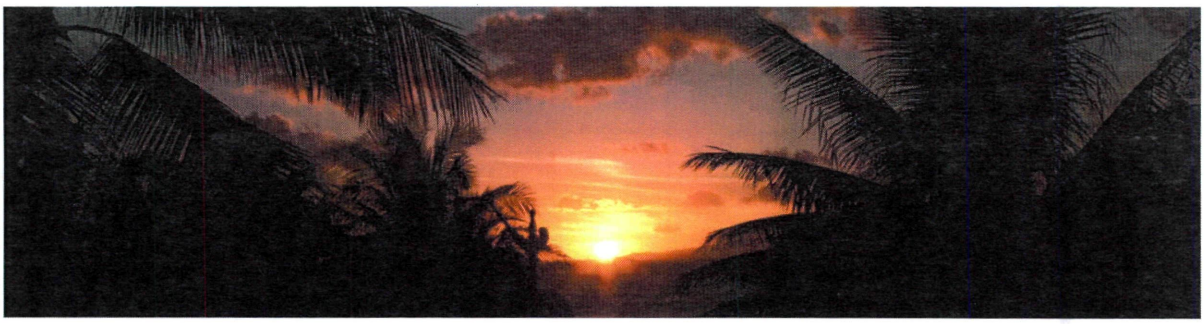
The groups are revisited at harvest time to show crop harvesting techniques. In addition, a food and nutrition officer demonstrates food preparation and discusses the importance of a healthful diet.

Seedlings emerge in a raised-bed garden.

## Potential Benefits

This train-the-trainer project has the potential to help the Marshall Island atolls improve food self-sufficiency by improving soil fertility through compost application and training locals in sustainable food production. This could expand options to grow crops like corn, pokchoy, cabbage, radish, cucumbers, tomatoes and other new crops, especially leafy vegetables. This could:

- Improve residents' nutrition
- Lead to long-term availability of local fresh food at affordable prices
- Serve as a model for the Micronesia region
- Ensure food security
- Generate farm income



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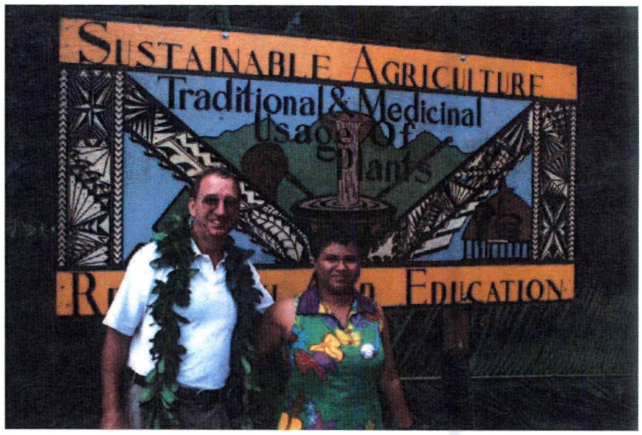
# Medicinal Plants for Samoa

## Situation

A number of plants native to Samoa have long been used for medicinal and other purposes. To assure that the plants – and knowledge of their traditional uses – are not lost in an age of increased use of modern medicines, this Professional Development Program grants seeks to educate interested individuals about the plants and collect specimens for a variety of uses.




Jim Currie and Totoa Currie, both involved in the project, during the opening ceremonies for the Medicinal Garden in July 1999.

## Objectives

1. Conduct a workshop on the botany of native Samoan plants traditionally used for medicines and other purposes, focusing on the cultural, biological and economic importance of these plants.
2. Establish a herbarium at the American Samoa Community College Land Grants Program with permanent specimens for use in identifying plants with medicinal and other traditional uses.
3. Establish a collection of living specimens of native plants, used for medicinal and other purposes, as a botanical garden at the college Agricultural Experiment Station.
4. Prepare a plant key that includes descriptions, slides and prints of the plants.

Staff members at the Medicinal Gardens inspect the aromatic fern.

### Professional Development Program Grant

**Project Number**: EW97-018

**Project Title**: Constructing a Herbarium, Collection and Key to Medicinal Plants and Other Traditional Plants of Samoa

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**Major Participant**:

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**SARE Grant**: $15,510

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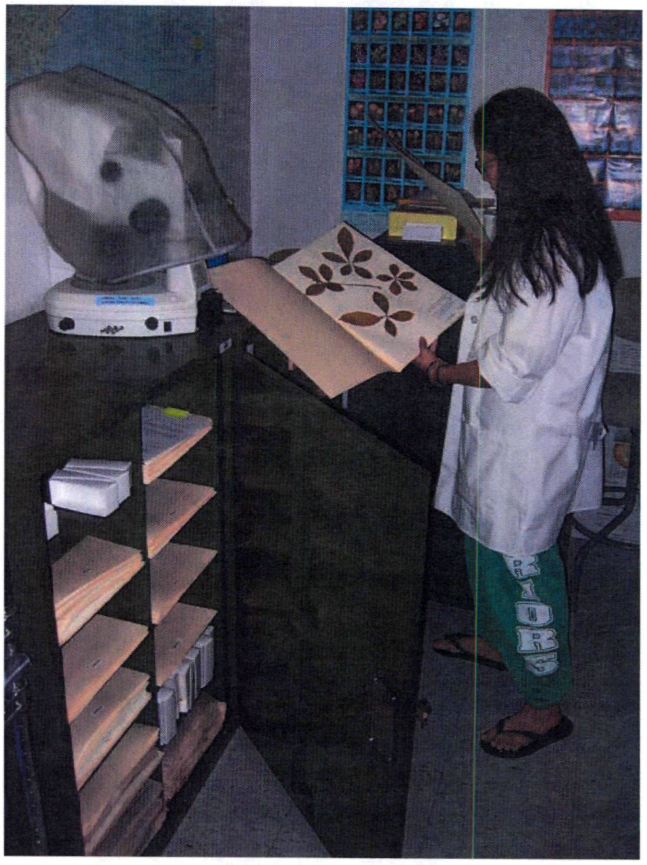
5. Prepare a booklet for local use that features the key, descriptions and photographs of the plants.

### Actions

The project coordinators held an eight-day botanical workshop Dec. 2-11, 1997, under the direction of Arthur Whistler, a noted ethnobotanist with the University of Hawaii and an expert in the flora of Polynesia. Whistler, who has broad experience in Samoa, taught 19 participants who attended the full workshop and a handful of others who attended selected sessions.

Two of the participants, from the American Samoa Department of Education, subsequently conducted mini-workshops for teachers in elementary and secondary schools, with the goal of making environmental education more pertinent and interesting to schoolchildren of American Samoa.



The herbarium collection is available to professionals.

### Results

The project resulted in the establishment of a herbarium and botanical garden and the preparation of a guide to Samoan medicinal and traditional plants, a botanical taxonomic key and a guide to the most commonly used medicinal plants of Samoa.

The Medicinal Garden draws schoolchildren and traditional healers alike.

Vargo reports (email Aug. 2, 2007) that the Medicinal Garden continues to be a draw during campus tours by schoolchildren and traditional healers. The healers are allowed to harvest small amounts of needed materials as long as they also contribute to the garden's collection by bringing in plants and explaining their uses.

Because some plants are not well adapted to the conditions at the garden site, the collection will never be all-inclusive. However, at any given time, about 50 species can be found in the garden, each signed by Samoan and botanical names.

The herbarium collection is available to professionals, who may examine mounted specimens in the climate-controlled room housing the collection.

### Potential Benefits

The garden provides a valuable resource on the use of plants for traditional medicine and a source of such plants for island traditional healers, and the herbarium provides a resource for professionals to study of plants found in Samoa's rain forest.

# Nitrogen-Fixing Hedgerows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## Situation

Intercropping with hedgerows, one of the recommended farming systems in the Pacific, can enhance productivity of limited farmlands by providing:

Biomass from nitrogen-fixing trees is weighed.

- Nutrient cycling from deeper soil layers
- Green manuring and mulching benefits
- Weed suppression and barriers from pests and diseases
- Erosion control
- Biologically fixed nitrogen in farming systems
- Animal feeds and lumber

After the USDA Natural Resources Conservation Service introduced selected species of hedgerow plants to the Marianas, several farmers expressed an interest in planting hedgerows on their farms. However, lack of site-specific information on hedgerow management and species adaptability to local soils hindered adoption.

## Objectives

1. Develop protocols for seed propagation of leguminous plants as hedgerows and develop a guidebook
2. Examine biomass production of the plants grown in different soils on Guam
3. Examine seed production in different soils
4. Examine the plants' susceptibility to arthropod, nematode and disease problems
5. Produce videos, fact sheets and technical reports on plant production and present results at workshops and conferences

Workers assess the canopy of *Gliricidia sepium*

## Actions

Seeds of eight nitrogen-fixing leguminous plants were obtained locally or from a seed company in Hawaii, and three-month-old seedlings were planted in a randomized complete block design with three replications at three experiment stations on Guam:

- Yigo Farm, northern Guam, soil type Guam cobbly clay loam, 6.4 to 7.5 pH
- Barrigada Farm, central Guam, soil type Pulantat clay, 6.0 to 7.5 pH
- Ija Farm, southern Guam,


**Research and Education Grant**

**Project Number:** SW99-048

**Project Title:** Evaluation and Implementation of Nitrogen-Fixing Species in Hedgerow Intercropping In the Marianas



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**SARE Grant:** $132,100

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soil type Akina silty clay, 4.5 to 6.2 pH

Biomass, flowering, seed production and occurrence of arthropods, diseases and nematodes were examined for each of these species:

1. *Leucaena leucocephala* cv. K636
2. *Sesbania sesban* cv. Nubica
3. *Gliricidia sepium*
4. *Desmodium rensonii*
5. *Cajanus cajan*
6. *Acacia angustissima*
7. *Flemingia macrophylla*
8. *Calliandra calothyrsus*

## Results

### Propagation

A brochure describing the propagation methods for each species was produced.

### Biomass Production

*L. leucocephala* cv.K636 produced the greatest biomass in the trial, with 26.1 tons per hectare at Barrigada, followed by *S. sesban* cv. Nubica at 19.9 tons per hectare, also at Barrigada. Except for *F. macrophylla* and *C. calothyrsus*, all of the nitrogen-fixing trees produced greater than 11 tons of biomass per hectare at Barrigada.

These nitrogen-fixing trees, being grown inside a fenced area, are to be used as goat feed.

Biomass production not only varied by location and soil type, it also varied by season, with a general decline in vegetative growth from November to February.

### Seed Production

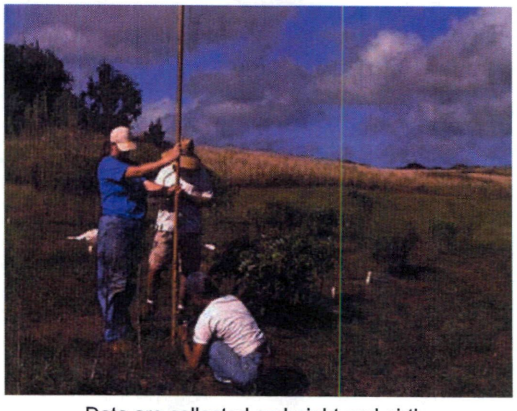
*D. rensonii* and *F. macrophylla* produced numerous seeds regardless of season. *L. leucocephala* and *S. sesban* produced more seeds in the alkaline soils of Barrigada and Yigo than in the acid soils of Ija.

### Plant Pests

The main troublesome insect pests were mealybugs, Chinese rose beetle and longhorn beetle. No serious foliage, stem or floral diseases were observed.

## Potential Benefits

The project provided information on selecting nitrogen-fixing trees suitable to different soil types on Guam. The results were disseminated via a technical publication, eight pamphlets and a 15-minute video to local high schools and offices of the Guam Cooperative Extension and USDA-NRCS in Guam and the Commonwealth of the Northern Mariana Islands.



Data are collected on height and girth.

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# Organic Produce from Dry Litter

## Situation

As population pressures increase in American Samoa, fertile land is being consumed by houses and the associated development. Meanwhile, the diets of most people in the territory are lacking in fresh fruits and vegetables, and those that are consumed must be shipped in from as much as 5,000 miles away.

Ivona Ballard used her Western SARE grant to test a way to grow fresh market vegetables on her valley floor landholding on the island of Tutuila, which has steep mountains and fertile valleys.

The dry litter system employs a portable piggery and uses bedding materials from a variety of sources, including leaves and coconut husks.

## Objectives

Demonstrate the sustainable, intensive farming of fresh organic market produce using pig waste composted under a dry litter waste management system.

## Actions

The project was established with portable pigpens producing mulch and compost in a dry litter system to create raised beds on which to plant vegetables. The project included these steps:

- One pig was raised in a 10-foot by 12-foot portable piggery that was

The portable piggery is a 10- by 12-foot wire-enclosed structure.


**Farmer/Rancher Grant**

**Project Number:** FW02-040

**Project Title:** Increasing Sustainable Production in High Polynesian Islands

**Project Coordinator:**
Ivona Ballard
Nu'uuli, American Samoa

**Technical Advisor:**
Laura Laumatia
American Samoa Community College

**SARE Grant:** $15,510

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moved after six months.

- The bed was allowed to dry for two to three months.
- Vegetables, including eggplant, red lettuce, cucumbers, beans and sweet basil, were then planted in 2-foot by 50-foot beds, raised 3 feet to protect against flooding.
- No other plant nutrition was applied to the soil.
- Crops were harvested and sold to restaurants and at roadside markets.

## Results

For the past four years, Ballard has successfully grown a variety of vegetables using no chemical fertilizers or pesticides. The compost created using the manure from the portable piggery and the dry litter system has been sufficient to provide the nutritional requirements for the sustainable production of vegetable crops.

Ballard now has a 60-foot by 60-foot plot developed from the project on which she continues to produce vegetables. The 3-foot-high beds have proved high enough to preclude flooding.

The Natural Resources Conservation Service takes growers to view Ballard's dry litter system at least six times a year, and the College of Natural Resources at American Samoa Community College brings agricultural students each year as part of their coursework.

Several small piggery owners, with two or three pigs, have adopted the system to grow various crops, including vegetables and taro, a Samoan staple.

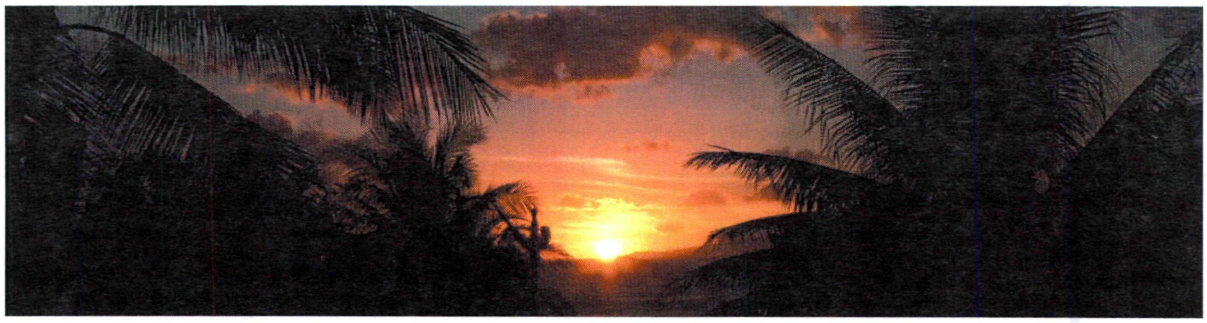
After the piggery had been moved several times, the remaining composted material created a fine bed for vegetable production.

Larger piggery owners have been less inclined to adopt the system, however, because of the challenge of combining greater quantities of pig waste with organic matter to apply to their fields. Also, renovating traditional pigpens into dry litter systems can be costly.

## Potential Benefits

Ballard's family has benefited by being able to eat fresh vegetables through the duration of the project.

Equally important has been the demonstration of alternative waste management practices for American Samoa's swine industry, from which several people in recent years have contracted leptospirosis, a bacterial disease associated with wild and domestic animals.



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# Pacific Agroforestry Profiles


## Summary

Agroforestry is a vital aspect of sustainable agriculture in the tropics, and producers increasingly seek tree species for use in crop diversification, windbreaks, coastal protection, shade, soil improvement, water conservation, livestock fodder, woodlots and other applications. This project produced a series of 10- to 32-page fact sheets for 83 of the most important agroforestry species in the region. Each fact sheet provides information on products, uses, interplanting applications, environmental requirements, propagation methods and cultivation techniques.



Craig Elevitch, Permanent Agriculture Resources. — Ron Daines Photo


**Professional Development Program Grant**

**Project Number:** EW02-001

Project Title: Species Profiles for Pacific Island Agroforestry



Project Coordinator:

Craig Elevitch

Permanent Agriculture Resources

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## Objectives

1. To strengthen NRCS and CES agent understanding of and proficiency in Pacific island tree species and their products and uses;
2. To meet the defined needs of NRCS, extension, and other agricultural professionals by creating concise, practical, user-friendly species profiles (8- to 16-page fact sheets) for 50 outstanding Pacific island agroforestry species;
3. To produce selected tables of the 50 species sorted by associated crops, agroforestry uses/products (i.e., windbreak, timber, fruit) and five climatic zones;
4. To distribute a searchable CD with live Internet links and a reproducible, bound and printed set of the species profiles and selection tables to 50 NRCS, CES and other agricultural organizations in the American-affiliated Pacific islands;
5. To publish the species

Noni is an example of a native tree with a long tradition of Pacific island use that has proved to have high export value. Kona, Hawa'i. © Craig Elevitch

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Cultural values of Pacific island trees are often as important as material values. Cultural festivalat Pu'uhonua o Honaunau with coconut and noni trees growing in background. Kona, Hawai'i . © Craig Elevitch

profiles on the Internet (www.agroforestry.net) for viewing in HTML (using a web browser) and downloading in PDF format (for reading with the free Acrobat Reader) for at least a three-year period;

6. To assess the effectiveness and benefits of above objectives by conducting a follow-up survey of recipients three months after distribution of the completed species profiles.

## Publications & outreach

A total of 47 species profiles covering 83 species (849 pages in sum) were published to the project website, http://www.traditionaltree.org. CDs containing the species profiles were distributed to 140 NRCS, Cooperative Extension, state forestry and numerous other offices throughout the Pacific islands.

**Species profiles published to website:**

*Acacia koa* (and *A. koaia*)
*Aleurites moluccana*
*Alphitonia zizyphoides*
*Artocarpus altilis*
*Artocarpus camansi*
*Artocarpus mariannensis*
*Barringtonia procera*
*Broussonetia papyrifera*
*Bruguiera gymnorrhiza*
*Calophyllum inophyllum*
*Cananga odorata*
*Canarium indicum* (and *C. harveyi*)
*Casuarina equisetifolia* (and *C. cunninghamiana*)
*Citrus* species
*Cocos nucifera*
*Cordia subcordata*
*Endospermum medullosum*
*Erythrina variegata*
*Fagraea berteroana*
*Flueggea flexuosa*
*Gliricidia sepium*
*Inocarpus fagifer*
*Intsia bijuga*
*Mangifera indica*
*Metroxylon* species
*Metrosideros polymorpha*
*Morinda citrifolia*
*Musa species*
*Pometia pinnata*
*Pterocarpus indicus*
*Rhizophora mangle* (and *R. samoensis*, *R. racemosa*, *R. x harrisonii*)
*Rhizophora apiculata* (and *R. mucronata*, *R. stylosa*, *R. x annamalai*, *R. x lamarckii*)
*Samanea saman*
*Santalum yasi* (and *S. austrocaledonicum*)
*Santalum ellipticum* (and *S. freycinetianum*, *S. haleakalae*, *S. paniculatum*)
*Syzygium malaccense*
*Terminalia catappa*
*Terminalia richii*
*Thespesia populnea*
*Tournefortia argentea*

## Dissemination

From January 2005 to August 2007, more than one million hits on species profiles were posted to the project website. During August 2007 there were 52,000 web hits on species profiles, indicating the current rate of dissemination. The species profiles will be available for download for at least three years from January 2006 (date of project completion) at www.traditionaltree.org.

Each species profile included detailed information on plant propagation. Gliricidia seedlings grown by the Department of Forestry, Guam. © Craig Elevitch.

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# PORTABLE OFFICE FOR "PEOPLE"

## Situation

Compared with their U.S. Mainland counterparts, land grant institutions in the Pacific are small and isolated from low-cost communications options. Their small size means fewer extension subject matter specialists are available to meet the information needs of their clients. Yet these clients have information needs as diverse as those on the Mainland.

At the same time, advances in computer and Internet technology have opened low-cost avenues of disseminating information digitally to even the remotest locations.

## Objectives

1. Identify, obtain and disseminate, in digital format, literature related to tropical sustainable agriculture practices and issues developed through extension programs in the Pacific, Caribbean and U.S. Mainland
2. Increase institutional capabilities to publish and disseminate information relevant to the Pacific
3. Develop staff skills at nine Pacific sites on the use of equipment, software and information resources to enable a print-on-demand literature exchange program
4. Determine the impact of the literature exchange and distribution program on the development of tropical sustainable agriculture in the region


**Professional Development Program Grant**

**Project Number**: EW98-011

**Project Title**: Portable Extension Office for Program Literature Exchange (PEOPLE)

**Project Coordinator**:
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**SARE Grant**: $45,954


AG FAXTS — Plant of Guam 99-2

**Bikkia tetrandra**

Family: Rubiaceae
Scientific Name: *Bikkia tetrandra*
Chamorro Name: Gaasali
English Name: Torchwood

Gaasali (*Bikkia tetrandra*) is a shrub that is endemic to the Mariana Islands. It is a member of the Coffee Family (Rubiaceae). Bikkia has long tubular flowers that are pure white and square in shape. The leaves are attractive, glossy green with lighter colored mid-veins. The stems contain flammable compounds which allows stems to be used as candles when cut into short sections. Branches grouped together can be used as torches. This characteristic has lead to the common name torchwood.

Gaasali is a ragged plant commonly found growing on limestone cliff faces usually near the ocean. Carefully examine cliff areas to observe various aged plants.

Gaasali growing on a limestone cliff.

Gaasali seedlings germinated on crushed limestone.

Germinating seedlings are no larger than the head of a pin. It is amazing to see the stems emerging out of cracks or depressions in the limestone. Many consider gaasali one of the most attractive Guam flowers. This handsome plant would make a good addition to the landscape as an informal hedge. Torchwood is one of the few flowering plants that is adapted to growing in pure limestone. Gaasali could also be grown as a flowering potted plant or outplanted in flower beds. Flowers and fruits can be found through much of the year. This native species has been suggested as the official flower of Guam.

**Propagating Gaasali**

Gaasali is easily propagated from seed. The fruits are fibrous, woody, two-celled capsules which are green as they develop and turn brown when ripe. The dried fruits split open releasing many small, dark seeds. When collecting seed, select mature capsules that have not split open. To germinate seeds, fill a container, such as a six inch pot, with crushed limestone. Spread a thin layer of moist, soilless potting mix or peat moss over the top of the crushed limestone. Sprinkle the seeds on top of the potting mix. Keep the container in a shaded area. Lightly mist with water every few days to prevent drying. The seeds should germinate in about four weeks. The germinating seedlings are tiny, with small opposite round leaves. The young plants are succulent with light green leaves. Small seedlings can be easily mistaken for axillary plant (Piloo spp.) which is a common weed in nurseries. As the seedlings grow, they can be exposed to brighter light. When three inches tall, the seedlings can be transplanted to individual pots. Crushed limestone can be used as a growing medium.

Prepared by James McConnell and Frank J. Cruz

FOG 99-2, March, 1999

## Actions

Needs assessments, conducted among agricultural professionals on Guam and extension agents across the Pacific, concluded that a digital extension library that brings together all of the publications from the Pacific Islands and U.S. Mainland relevant in a tropical environment would help agents deliver more effective extension programs.

Based on this information, the project team:

- Located regional, national and international publications and organized them digitally onto a CD
- Disseminated the CD to participating islands and to hundreds of individuals and institutions
- Supplied participating institutions with equipment that allows them to print the digitized publications on demand
- Developed a website that mirrors the CD – www.uog.edu/cals/people

## Results

- Initially, 33 digitized publications, most related to dealing with insect and

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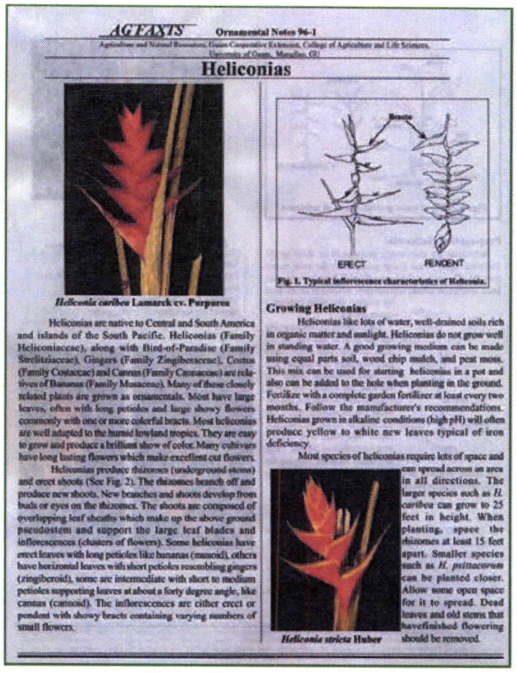

AGFAXTS Ornamental Notes 96-1

Heliconias

*Heliconia caribea* Lamarck cv. Purpurea

ERECT PENDENT

Fig. 1. Typical inflorescence characteristics of Heliconia.

Growing Heliconias

*Heliconia stricta* Huber

University of Guam FR2000-12

Betel-Nut Palm Care

Guam Cooperative Extension — Fruit Production Publication

Victor T. Artero
Extension Economist

Vincent M. Santos
Extension Horticulturist

disease pests, were added to the CD and website.

- The project distributed 28 three-ring binders containing hard copies of all publications on the PEOPLE CD and website to each participating Pacific island extension office.
- Recognizing the relevance and importance of the PEOPLE project, the Agricultural Development in the American Pacific Program (ADAP) added funding and helped identify relevant publications to include on the CD and website.

## Potential Benefits

The PEOPLE project has given participating offices a 100-fold increase in the number of extension publications available for client and program use. In addition:

ADAP

Bacterial Wilt (Ralstonia solanacearum) (syn. Burkholderia, Pseudomonas solanacearum)

- Many of the publications have been updated electronically, notably on new guidelines for chemical use
- The publications have been used as sources of information to benefit agricultural sustainability
- Several agricultural telecommunications and distance education programs have used the publications as source texts

In short, the CD and website have become powerful tools enabling isolated island professionals to address a wide variety of topics.

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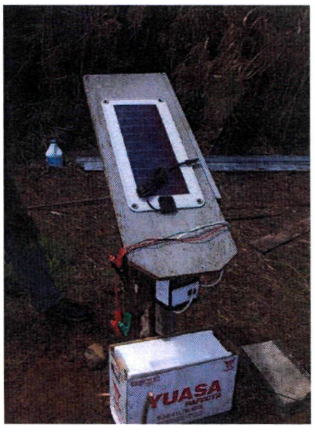
# Rat Patrol with Electric Fence

## Situation

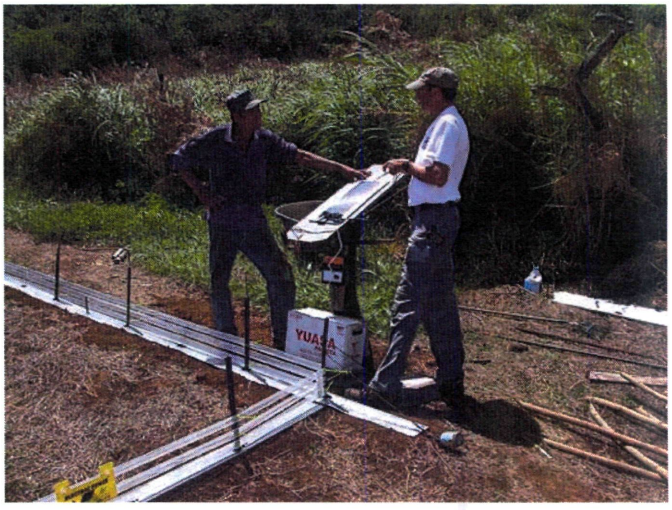
In the Commonwealth of the Northern Mariana Islands, three species of urban rats damage nearly every crop grown in the country. High-value crops like melons, sweet corn and pineapples are particularly vulnerable to rats. Lino Mendiola of Rota found that local rats had developed a taste for his expanding pineapple crops.

Standard rodent poisons are available at most agricultural retail outlets, but farmers find them expensive and ineffective as residential rats continue to enter farming areas. What's more, coconut crab, a land-based scavenger and historically and culturally important food species, eats poisoned rats and dies.

In addition to damage from rats, crops grown on exposed hillsides, including Mendiola's, suffer from wind and salt spray.




The fence is charge with a flexible solar panel.




Lino Mendiola and Scott Crocket with the electric rat control fence.

## Objectives

- Establish a method for using an electric fence to control the rats that cause damage to pineapples
- Plant a double row of trees as a windbreak, da'ok (Callophyllum inophyllum) and Gliricidia sepium. (Powerful Typhoon Chaba in August 2004 interrupted the windbreak project.)

## Actions

Mendiola built an electric rat-protection fence using materials readily available for purchase on the Internet. Scott Crockett, district conservationist with the Natural Resources Conservation Service, designed the fence:

- The electrified tape was 1.5-inch nylon/wire typically used for horse fences
- Aluminum building studs were bent flat along the ground under the tape
- The studs were staked

**Farmer/Rancher Grant**


**Project Number:** FW03-017
**Project Title:** Rat Control in Pineapples on Rota


**Project Coordinator:**
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**Technical Advisor:**
Scott Crockett
Soil Conservationist
Natural Resources Conservation Service, Rota, MP


**SARE Grant:** $5,569

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with 24-inch rebar posts; PVC pipe was slipped over the posts as insulation

- Zip ties held the tape to the posts
- The electrified tape was spaced at about half an inch – close enough to keep a rat from crawling through, but far enough to prevent sparks from jumping the gap
- The fence, 14-inches tall when finished, was electrified with a small cattle fence energizer powered by a car battery and charged by a flexible solar panel

After the fence was up and running, poison bait was placed inside the fence to kill any remaining rats.

Aluminum building studs were bent flat along the ground under the electric tape to prevent weeds from growing up.

## Results

The flattened metal studs created a contact pad and prevented weeds from growing up and touching the fence. Rats, which could jump the fence, won't jump where they cannot see, so they try to climb over. As soon as they touch the fence, they receive a 7,000-volt jolt. If that doesn't kill them, they won't try again. Clever rats could dig under the fence, but the poison bait inside gets them.

The project was a tremendous success. Mendiola went from never harvesting a ripe pineapple before the fence was built to zero rat damage after the fence. The entire set up cost under $500, not counting labor, which Mendiola did mostly himself.

The finished electric fence, 14 inches high, cost less than $5,000.

## Potential Benefits

The technology is cheap, simple and effective and will work for any rat-prone crop, such as corn, melons, sweet potato and pineapple. The fence is light weight and can be rolled up in anticipation of a typhoon.

Agricultural suppliers are now retailing the appropriate materials as a result of the successful model provided by this grant

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# Renewing Poor Quality Soils

## Situation

A large portion of land in the northern and central portion of Guam is limestone with just barely 6-12 inches of topsoil, which has been left uncultivated and unproductive.

Laila Pierson, coordinator of this Western SARE Farmer/Rancher grant, learned as a young farmer in Ethiopia a method for growing bananas for a good harvest that can convert land of poor soil quality to more productive status.

The land-conversion technique involves digging beds up to 4 feet deep, 6 feet wide and 50 feet long, then filling the beds up to 2 feet deep with organic materials from around the farm, including trees, leaves, manure and soils. This is done just before the rainy season for the pit settle down and to store the moisture.

Pierson plants a variety of cooking bananas 6 feet apart.

## Objectives

- Test in poor Guam soils a method used for centuries in Ethiopia – digging pits and filling them with organic debris – that can improve soils for growing crops like banana, taro and sweet potato
- Analyze the compost materials in the pit for nutrient content
- Conduct tissue analysis on banana, taro and sweet potato

- Demonstrate through field days how farmers in Guam and other Pacific islands can convert land of poor quality to more


**Farmer/Rancher Grant**

**Project Number:** FW06-026

**Project Title:** Multi-Crops on Plant Beds on Guam



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**SARE Grant:** $5,915

productive status

- Craft and distribute publications showing the design and results to local farmers and farmers in the region

## Actions

Four beds have been created and planted with bananas, taro and cassava. The plant beds are 4 feet deep, 6 feet wide and 50 feet long. A tarp was placed underneath before the pits were filled with organic material (the plants that were uprooted when the area was being prepared) along with sludge and selected soil.

Sweet potato were planted in between the plant beds when the taro and cassava plants reached a certain height.

Additional plant beds were prepared, and field days were organized and held when the plants were nearing production.

## Results

Results from the project will be reported in early 2008.

Plants thrive in Pierson's revitalized cropping beds..

## Potential Benefits

Harvest coming from taro, sweet potato and bananas would bring more food and income to farms on the island. Greater supply of these local foods should lower the market price, enabling their purchase by local people.

Pierson evaluates the plants in her improved beds.

An increase in the availability of these three staple foods can help to overcome the shift in the diet of Pacific islanders to rice and fatty foods, which has increased the incidence of diabetes, obesity and heart disease.

Positive results from this Western SARE grant may ignite new ideas in approaching how tracts of low-fertility, shallow soils can be put to the full benefit for the lessee or owner of these limestone-based farmlands.

This would encourage agricultural producers to look back at century-old practices that have sustained thousands of people, showing that old and proven management practices can be merged with new ideas.

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# STORING BREADFRUIT FOR PIG FEED


**Western SARE Program**

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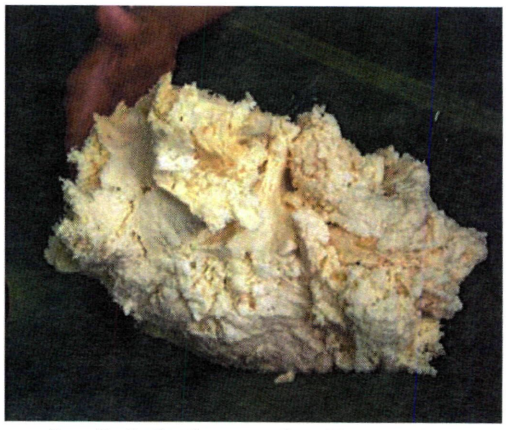
A perfect breadfruit.

## Situation

Swine production is the primary livestock industry of the Federated States of Micronesia. Pigs are a major part of traditional and cultural practices. However, the cost of producing pigs in Micronesia is extremely high, owing mainly to the expense of importing commercial feeds.

Breadfruit, meanwhile, is one of the most common indigenous trees in the tropical islands. Its football-size fruit has long been a traditional starch crop throughout Oceania. Breadfruit is relatively high (40-50%) in dry matter and produces twice as much energy as bananas. Although not rich in protein, breadfruit is a fair source of minerals and vitamins. Scavenging domestic pigs routinely eat over-ripe breadfruit that has fallen to the ground, which suggests that breadfruit can be an acceptable energy source for swine.



Breadfruit after three months of fermentation.

## Objectives

- Develop a feeding regime using fermented breadfruit to reduce feed cost by at least 25% for growing-finishing pigs and breeding stocks
- Develop a feed formula using fermented breadfruit
- Develop sustainable practices for preparing fermented breadfruit for swine feed
- Conduct workshop/ trainings in the Federated States of Micronesia based on the results of feeding trials and preparation methods
- Determine the actual cost of production in the Federated States of Micronesia

## Actions

The project team will take these approaches:

- Randomly select experimental and control growers from the College of Micronesia-Kosrae State Agriculture station and two private farms in Chuuk and Pohnpei


**Professional + Producer Grant**

**Project Number:** FW06-307

**Project Title:** Replacing Imported Energy Feeds by Storage of Excessive Bread-Fruits as Out-of-Season Pig Feed



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**SARE Grant:** $16,712

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- Conduct feeding trials at each farm until the growing-finishing groups reach a market weight of 150 pounds
- Analyze an experimental formulated ration of fermented breadfruit for crude protein, energy, phosphorus, calcium and fat
- Compare the growth rate, feed conversion and body condition of pigs fed the experimental ration with those fed the control ration, which constitutes the current diet of imported commercial feed, at both Pohnpei and Chuuk
- Compare the price of each ration type at both Pohnpei and Chuuk

As of fall 2007, these activities had been conducted:

- 700 pounds of breadfruit had been stored for feeding, with storage at project sites in Pohnpei and Chuuk
- Identification tags, scales and equipment had been ordered
- A 50% feed supplement had been identified and ordered

## Results

Results of the first year's activities will be available in early 2008.

## Potential Benefits

The project will shed more light and information on how to be more effective in utilizing excess breadfruit during the full season, which will help producers save on the cost of expensive imported feeds.

Above, damaged breadfruit unfit for humans but great for pig feed. Below, cut breadfruit showing damage from disease.

All island cultures have a history of preserving breadfruit for human consumption during off seasons and for food security. These islands normally experience an overabundance of breadfruit during the main seasons, but they lose a large portion of the late-season fruit to diseases and fruit fly infestations. Instead of risking crop loss, storing the breadfruit out of season and preserving it in the traditional pit fermentation system will allow producers to use it as pig feed.

Breadfruit mash in storage bags.

# Windbreaks with Added Value


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## Situation

Most of the land on the Commonwealth of the Northern Mariana Islands is broken into small, privately owned parcels. This, coupled with frequent and devastating typhoons, makes it difficult for landowners to produce an income. Planting a windbreak could protect crops, but the space required for the windbreak would take scarce land out of production.

A solution could be a windbreak that offers both protection from tropical storms and an agricultural commodity that produces an income.

## Objectives

Establish a dense multi-row windbreak/shelter belt that will protect fragile crops from prevailing and seasonal winds and, at the same time, produce a marketable crop.

Salt spray can damage crops.

Technical advisor Scott Crockett of NRCS and Ephram Taimanao.

## Actions

Two types of trees were planted with seedlings acquired from a local nursery.

- Da'ok (*Calophyllum inophyllum*), a native typhoon-resistant tree that produces an oil-rich nut used in aromatherapy, was planted as the primary row
- Various citrus trees, the fruit from which could be sold at local restaurants and grocery stores, were planted on the inside rows, staggered to create a closed wall of leaves at maturity

The planting scheme was adapted to fit local conditions:

- Trees were planted in three or four rows, depending on topography
- The low-fertility soils were supplemented with a 16-16-16 fertilizer
- Da'ok performs well on shallow soils, as found at field edges, so they were planted as the primary row

### Farmer/Rancher Grant

**Project Number:** FW01-091

**Project Title:** Luta Windbreak/Agroforestry

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**SARE Grant:** $7,485

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- Soil depth increases further into the field, so fruit trees were planted there between rows of existing banana plants
- As fruit trees matured among the sheltering banana plants, the bananas were to be phased out, leaving only healthy citrus

The project suffered two major weather-related setbacks:

- Typhoon Chata'an on July 7, 2002, toppled both windbreak trees and banana plants and caused salt damage to both
- On Sept. 8, 2002, Super Typhoon Pongsona devastated seedlings that had survived Chata'an

## Results

The disastrous typhoons allowed the project team to assess which varieties survived better than others and might be good candidates for future plantings.

Da'ok, in the foreground, were planted after the typhoons. At right, NRCS conservationist Crockett checks a fruit three that survived the typhoons.

Meanwhile, the results of the project will take several years to assess. Because of optimism over the potential benefits of commercially productive windbreaks, the project was continued beyond the original SARE funding date to provide for replanting and evaluation.

## Potential Benefits

If the windbreaks of commercially valuable trees are successfully established, they can offer a variety of benefits:

- The windbreaks can virtually eliminate damage from prevailing winds to fragile crops like bananas, papayas, taro and okra.
- Wind-borne diseases and moisture loss to evaporation and evapotranspiration can be greatly reduced
- The trees will improve the aesthetics of the

# 12 Fruits for Island Promotion

## Situation

Small producers of coffee and macadamia nuts in the Kona region of Hawaii have struggled with high costs and limited land and labor. Producing locally adapted tropical fruits, and creating marketing linkages between the farms and high-end restaurants within marketing distance, could add profitable crop alternatives.

Figs, one of the 12 fruit species selected, have proved popular among island chefs.

## Objectives

1. Identify 12 species of exotic tropical fruits with high potential for year-round market acceptance
2. Develop and demonstrate a prototype polyculture tropical fruit production system based on sustainable production technologies
3. Develop direct and wholesale markets for both fresh fruit and processed products
4. Help the Kona Pacific Farmers Cooperative expand into new activities, including the long-term marketing of the fruits developed from this project

## Actions

The project team conducted these activities:

- Gathered information on 100 fruits already grown in the region
- Based on surveys of 54 island chefs, selected 12 trees for demonstration

1. Loquat – three varieties
2. Mysore berry
3. Poha (Cape gooseberry)
4. Pomegranate – four varieties
5. Cherimoya – two varieties
6. Tamarillo (tree tomato)
7. Rangpur "Kona" lime
8. Tropical apricot
9. Grumichama
10. Surinam cherry – two varieties
11. Kumquat – two varieties
12. Figs – two varieties

- Developed a 1-acre demonstration site on land

Rangpur "Kona lime has also proved popular.

**Research and Education Grant**

**Project Number**: SW03-055

**Project Title**: Development of A Sustainable Polyculture and Marketing System for Exotic Tropical Fruits

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**SARE Grant**: $156,800

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adjacent to coffee and macadamia nut processing facilities of Kona Pacific Farmers Cooperative

- Planted trees (both purchased and donated) and developed sustainable and organic production protocols
- Created an agritourism attraction with educational kiosks, displays, pathways, signage and landscaping
- Created demand for fruits by providing information to chefs and other potential buyers and alerting them to fruit availability

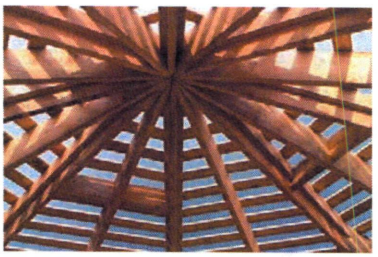
## Results

The production and marketing information gathered from the project has been provided to producers through workshops, publications and the 12 Trees website, www.hawaiifruit.net/12trees.html, which receives more than 2,500 visits a month.

Faculty and students in the UH West Hawaii Culinary Arts Program in Kona developed recipes using the 12 fruits (fresh and processed) and tested them with consumers. Graduates carry this knowledge into the local restaurant industry.

Above, jackfruit, another fruit gaining acclaim, and below, figs from UC Davis, which are part of a new Hawaii Western SARE Farmer/Rancher grant.

The flower of the grumichama, also known as Brazilian cherry.



Visitor kiosk under construction.

Brown turkey figs, gaining popularity among chefs, generated $3,263 in sales from the project. Demand now exceeds supply from 20 farms that have started producing figs.

The project has been featured locally and nationally on television and in magazines and newspapers.

## Potential Benefits

- Project results have been discussed widely and put into practice by local farmers
- Kona growers who increased production based on seasonal diversification cite benefits like reduced need for external labor during the coffee-picking season
- Growers are profiting from figs, tropical apricot and Kona rangpur limes, and many report easier sales of fruit not sold in years before the project
- Cost-of-production figures have helped growers dealing with chefs and grocers
- Demand for project fruit has been high, presenting a challenge for supply, which also includes fruit from trees not part of the initial planting – including rollinia, jackfruit and jaboticaba
- Results have been put in place in south India and are under study in Japan