

FY 2000 Annual Report of Accomplishments and Results
Agricultural Experiment Station, University of the Virgin Islands

Submitted by:

Dr. J.E. Rakocy, Director
Agricultural Experiment Station
University of the Virgin Islands
RR 2 Box 10,000
Kingshill, St Croix VI 00850

Phone: (340) 692-4031
FAX: (340) 692-4035
Email: jrakocy@uvi.edu

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

A. Overview:

The AES Animal Science Program presented a workshop on St Thomas and St Croix on evaluating bulls and rams for selection as herd sires. The procedures used to evaluate animals and the impact of using selection for specific traits were described to the farmers. Several farmers from each island attended the workshops. In addition, a seminar was also presented to the farmers on the topic of the importance for the local livestock germplasm. Information was provided on what is needed to develop off-island markets for the local livestock.

The AES Aquaculture Program held its second annual short course on Aquaponics and Tilapia Aquaculture. The course attracted 14 students from six states (Hawaii, Oregon, Michigan, Connecticut, New York and Florida) and four countries (Saudi Arabia, Haiti, St. Lucia and Barbados). The participants consisted of entrepreneurs, school teachers, an extension agent, a missionary and a researcher. The week long course consisted of a combination of lectures and field work. Students were taught the principles of tilapia production, hydroponic plant production and water quality management. The students were also shown how to prepare a business plan, analyze potential markets, design a system to meet a production target, and construct and operate a system.

The AES Biotechnology & Agroforestry program collaborated with a local, privately funded, botanical garden in promoting tropical fruits at a special event (Mango Melee). Over 1,500 people attended the function. AES staff members presented workshops on banana and papaya production and varieties.

The AES Forage Agronomy Program continued providing technical assistance and services to local producers. Technical information generated through forage research is communicated in a practical way so that producers can use the information on their farms. At this year's Agriculture and Food Fair, the Forage Agronomy Program distributed pamphlets describing pasture management practices in preparation for the dry season. Legumes and grasses suited for dry season feeding were on display. Ten livestock farmers viewed the displays and received a small amount of legume and grass seed for this year's planting. Farm visits were conducted in St. Thomas and St. John to assess the pasture situation. Farmers were encouraged to establish energy-protein banks (small areas of high quality grass and legumes) for a cut-carry feeding system. In St. Croix, 2 farmers will establish energy-protein banks on their farms for demonstration purposes.

The AES Fruit Crops Program lectured a group of high school students and encouraged them to enter the farming profession to replace the current aging generation of farmers. The need for more production of tropical fruits like mango, avocado, limes and grapefruit to reduce the island's heavy dependence on imports and diversify fruit crop production was emphasized. The importance of starting agricultural education in primary schools to attract more students to agricultural careers was also a point of emphasis.

In collaboration with the Cooperative Extension Service, the AES Vegetable Crops Program conducted a workshop on hot pepper production. Local growers, home gardeners, food processors, and research and extension staff attended the workshop. Data was presented on the different hot pepper varieties evaluated at the experiment station and at a farmers' field. A CES staff member presented a lecture on cultural practices for hot pepper production and two local food processors described their hot pepper sauce operation and business.

By conducting workshops and participating in local events AES staff members have provided information to a large portion of the local stakeholders. In addition this information was also available to individuals who are from outside the region, but were interested in the topics being presented. Feedback from farmers on how they have incorporated the technology into their existing operation is one way that AES staff is able to gauge the success of the workshops and seminars.

Funding for these programs were as follows:

Type	Federal	Local Match
Hatch	\$685,146	\$427,995
Regional	\$117,994	\$31,518
McIntire Stennis	\$51,579	\$887

Key Theme - Animal Production Efficiency

- a. Bull fertility tests were conducted on Senepol bulls located on three farms on St Croix. Bulls were tested as part of the data collection and also at the request of the producer at key times, such as prior to use in breeding or before a sale. A workshop was presented to farmers on both St Croix and St Thomas describing the test and how it can be used to select breeding animals. Hair sheep were bred to wool breeds of sheep to produce crossbred lambs. Growth and parasite data were collected in order to evaluate the ability of the crossbred lambs to survive in the tropical environment. A sheep production booklet was developed which provides information on the management and economic aspects of sheep production in the US Virgin Islands.
- b. Impact - Over 800 bull tests were conducted and the results were made available to the producer to use in their decision-making process when selecting replacement animals. Some animals that were tested prior to sale and failed were replaced with animals that had passed. This was beneficial to the producer because they were able to offer a quality product. Approximately 15 to 20 farmers attended the workshops. The crossbred lambs did not perform very well under conditions found in the tropics. There was a high mortality rate due to parasite burdens. Current methods of controlling internal parasites were not sufficient for use in the crossbred lambs. New methods are being investigated and this information will be made available to the producers through seminars and workshops. The sheep production booklet will be made available to people who are interested in sheep production in the region.
- b. Source of Federal Funds - Hatch
- c. Scope of Impact - State Specific

Key Theme - Aquaculture

- a. Greenwater tank culture systems are being developed for the commercial production of tilapia in the Virgin Islands where freshwater is limited. These systems conserve water and reuse wastewater discharges for the irrigation and fertilization of field crops. The use of greenwater systems is being evaluated for the growout of fish to marketable size and for the production of tilapia fingerlings that are needed for stocking growout tanks. The economics of producing tilapia fingerlings is a concern. Therefore research is being conducted to compare tilapia fingerling production in greenwater systems to that in clearwater recirculating systems which employ microscreen drum filters and rotating biological contactors for water treatment. Finally more efficient methods of managing broodstock and producing tilapia seed are being explored.
- b. Impact - Experiments showed that greenwater tank culture increases production of tilapia by 25-30 times over that of standard dug ponds, confirming that greenwater tank culture is a practical method for raising fish in water-limited areas. A commercial-sized growout tank (50,000 gallons) is being constructed at AES to evaluate construction techniques using a combination of local and imported materials. Two vegetables farmers (one on St. Croix and one in St. John) are waiting the results of the construction and the production evaluation before having similar tanks constructed on their farms. A series of production experiments has refined the technology of greenwater and clearwater for fingerling production and has made large amounts of fingerlings available for sale to the public. The importation of breeding net enclosures (hapas) from Thailand, at 10% of the U.S. cost, with better quality materials and more size availability, has greatly improved breeding efficiency and tilapia seed production. Our marketable fish are being sold to a HACCP-approved processing plant where fillets are being produced and sold in an effort to determine market size and price structure.
- c. Sources of Federal Funds - Hatch
- d. Scope of Impact - State Specific

Key Theme - Biotechnology

- a. Biotechnology has a strong future in agriculture and is being applied in the Virgin Islands to impart virus resistance in papaya. No virus resistance is present in the local varieties of papaya. The local papaya varieties are larger and not applicable to export but can be a major part of the local diet. Molecular techniques are using recombinant DNA technology to insert the coat protein gene for the local strain of papaya ringspot virus into the common Virgin Islands varieties.
- b. Impact - The first set of tissue culture derived punitive transgenic papaya were grown and evaluated under greenhouse conditions. Plants were hand inoculated twice with papaya ringspot virus isolated from locally grown infected plants. Controlled pollinations were made to obtain seeds from resistant plants to study the stability and level of resistance in the next generation.

- c. Source of Federal Funds - Hatch
- d. Scope of Impact - Territorial

Key Theme- Grazing

- a. In the seasonal dry areas of the U.S. Virgin Islands, low standards of grassland management (i.e., overgrazing) has led to pasture deterioration (extensive loss of guineagrass stands). Guineagrass is an excellent seed producer and its stands can regenerate from seed. An objective of this project was to determine the effects of closure dates from grazing (time when livestock should be removed from pastures to allow for an adequate seed crop) and N application rates effects on tillering and basal plant spread. Another objective assessed the influence of incorporating forage legume (i.e., glycine and desmanthus) in degraded guineagrass stands to increase forage distribution during the dry season.
- b. Impact - Discontinuing grazing of guineagrass pastures (at least 30 to 60 d before floral initiation) doubled seed yield. Increasing rates of N (30 to 120 lbs/acre) increased forage yield linearly, and also promoted aggressive tillering and spread. The incorporation of legumes provided additional green forage, particularly during the dry season. In the long-term, these legumes can also enhance sustainable land management by helping regenerate degraded pastures and also replenish the nitrogen supply of the system.
- b. Source of Federal Funds- Hatch
- c. Scope of Impact- State Specific

Key Theme - Innovative Farming Techniques

- a. A system known as aquaponics is being developed. Aquaponics is the combined culture of fish and hydroponic plants in a recirculating system. In the aquaponic system being developed in the Virgin Islands, tilapia are being cultured intensively in circular tanks. Water continuously circulates between the fish rearing tanks and hydroponic tanks, which use rafts as a substrate. Solid waste from the fish effluent is removed by settling tanks and filters before it enters the hydroponic tanks. This solid waste is disposed of through land application. The fish supply 10 of the 13 required plant nutrients in adequate amounts, leaving only calcium, potassium and iron to be supplemented. The hydroponic plants in turn filter the effluent, which cycles back continuously through the fish tanks, allowing the production of large quantities of fish and plants with minimal water usage. Water for these systems is obtained through rainwater harvesting. Studies are being conducted on design criteria, best management practices of fish, plants and water quality and the production capacity.
- b. Impacts - Based on data from six replicated experimental systems, a commercial-scale aquaponic system has been established and upgraded several times. The current system is

designed to produce 11,000 lbs. of tilapia annually and large amounts of vegetables on 0.1 acre of land. Currently production capacity of 13 types of vegetables are being measured. A one -week short course on aquaponics was offered twice and attracted 35 students during the last 2 years. The students came from many states and foreign countries. At the annually meeting of the World Aquaculture Society, we gave three aquaponic presentations, each of which attracted an audience exceeding 100 people. We are also constantly asked for information on aquaponics via the Internet and several systems have been established in the U.S. and overseas using the our design. A revised edition of an aquaponic fact sheet is being prepared for national distribution.

- c. Source of Federal Funds - Hatch
- d. Scope of Impact - National

Key Theme -Ornamental/Green Agriculture

- a. The ornamental program at AES has focused on the development of a suitable system for production of cut flowers for both the local and export markets. A major objective of the Cut Flower Production project is to identify a suitable media for growing Anthuriums under 53% shade house conditions and microirrigation. Major constraints have been the yearly occurrence of Atlantic storms over the Virgin Islands that have continually destroyed shade and green house facilities used for this study. A second objective is to characterize the best vase-water source for cut Anthurium blooms. This is critical for a local florist whether cut flowers are used from a local grower or as is the norm from a foreign source.
 - b. Impact -Preliminary results have so far indicated that coconut husks or shells left after nut extraction and imported pine bark chips are producing better Anthurium blooms than either shredded Mahogany stems or pure peat moss. The later media have also decomposed faster resulting in lowered bed levels. At an AES stakeholder's field day in May 2000, the visual impact of the superior media was highlighted. As a result many nurseries and growers have been incorporating these media for growing Anthuriums. Although pine bark is imported from the mainland, most is used for landscaping purposes. It is therefore readily available in the V.I for Anthurium growers. Resin in pine bark apparently has reduced the incidence of bacterial blight of plants growing in this medium. Among the 3 sources of water used in the Anthurium vase life study -potable water, bottled water and collected rain/cistern water - potable water has produced the longest vase life of over 20 days. Potable water in the V.I is less expensive than bottled water but costs more than cistern water. Chlorine used in potable water was probably the major factor in prolonging vase life since bacterial blockage of conducting tissue of cut flower stems is a major limitation in vase life.
- a. Source of Federal Funds -Hatch
 - b. Scope of Impact -State Specific

Key Theme - Plant Germplasm

- a. The University of the Virgin Islands continues to be active in germplasm conservation and evaluation of fruits and rare native plants. Five new papaya varieties were obtained, planted and grown under local conditions. These papaya were evaluated for tolerance to the local strain of papaya ringspot virus, early fruiting and fruit quality. Only two have shown promise for further evaluation and incorporation into the on-going papaya breeding program. Seeds, collected from fifteen rare but native tree species, were used in seed germination experiments. No information is presently available on seed propagation and plant establishment of these rare tropical tree species in the Virgin Islands. Information is also being collected on the phenology of these uncommon native trees to understand the growth, flowering and seed production cycles. The hurricane in November 1999 provided an opportunity to evaluate the effects of the storm on the trees and their rate of recovery.
- b. Impact - Workshops on papaya production were conducted for farmers and backyard growers on all three islands of the Virgin Islands. The information provided included plant establishment, sex determination, fertilization, pest control, and plant varietal characteristics and fruit quality. Seeds of inbred and new developed hybrids were made available to the public. The Agricultural Experiment Station continues to be the source of papaya seeds for varieties grown in the Virgin Islands. The Caribbean Urban Forestry Conference was held on the island of St. Croix and jointly organized with the Agricultural Experiment Station. This forum was open to the public to see and hear the presentations from the Caribbean region. Preliminary results from seed germination studies were presented. The rare native tree species had specific seed treatments to optimize seed germination. The seed treatments most effective for germination included hot water soak, acid scarification or direct seeding.
- c. Source of Federal Funds - Hatch and McIntire Stennis
- d. Scope of Impact - State Specific

Key Theme- Plant Germplasm

- a. The main objective of the forage germplasm evaluation program is to characterize new forage grass and legume genotypes for higher dry matter yield, better nutritional quality and their adaptation to the harsh soil (mildly-to high alkaline) and climatic conditions of the U.S. Virgin Islands. New introductions of guineagrass (i.e., cv. Tanzania), *Brachiaria* spp., *Setaria* and the legumes perennial peanut, tropical alfalfa, lablab, and cowpea were evaluated.
- b. Impact- Guineagrass varieties (Tanzanai and Mombasa) exhibited good stand germination and establishment. *Brachiaria brizantha* was found to adapt to the mildly alkaline soils and was more productive in periods of high rainfall. Its aggressive growth habit shows potential for rehabilitation of pastures using minimum tillage. Twenty-five cowpea accessions were assessed and six accessions were found to be productive. These six are being re-evaluated for seed increase. Lablab was found to be an aggressive cover crop. In on-farm studies, guineagrass and lablab were inter-cropped successfully. The advantage of this system is that the legume provides an earlier forage crop, while the planted grass takes over. The direct

beneficiaries of this research are ruminant farmers in the U.S. Virgin Islands, whose livelihoods depend on livestock farming. These new forage germplasm will enable farmers to increase the productivity of their pasture system. Although perennial peanut and alfalfa can be grown on the mildly alkaline soils, irrigation will be needed for productive yields.

- c. Source of Federal Funds- Hatch
- d. Scope of Impact- State specific

Key Theme - Plant Production Efficiency

- c. Three high yielding tomato cultivars were identified from on-farm evaluation using sustainable (organic) crop management systems. The top three cultivars produced over 40 tons/ha of high quality fresh tomatoes. Three promising West Indian hot peppers produced high yields and performed better than the local (common) cultivar grown by farmers. These cultivars are introduced to local growers for production of fresh hot peppers as well as for processing into hot pepper sauce. The use of organic (grass straw) and synthetic (black on white plastic) mulches increased tomato yields and improved fruit size under drip irrigation. The combination of mulch and drip irrigation increased water use efficiency in tomato production.
- d. Impact - Results of tomato cultivar evaluation study under sustainable (organic) crop management system show that tomato can be produced in Virgin Islands without chemical pesticides and synthetic fertilizers. This would save tomato growers in production cost at the same time protect the environment. Results of germplasm evaluation trials identified promising hot pepper cultivars for growers in the Virgin Islands. By planting these cultivars, growers will benefit from increased yields (20-30%) and economic returns. Drip irrigation and mulching improved marketable yield and fruit quality of tomato. Mulching also increased water use efficiency which resulted in 33 to 46% increase in economic returns, a significant economic benefit to local growers. More than 30 participants attended a seminar on promising hot pepper cultivars presented by the Vegetable Crops Program. A diverse group consisting of local growers, researchers, extension specialists and homeowners listened and participated in the discussion covering topics on plant characteristics, yield, cultural practices including plant spacing, fertilization, irrigation, pest and disease management for hot peppers. Discussion on processing and marketing was stimulated by the participation of local cottage industry entrepreneurs who displayed a wide range of hot pepper products.
- c. Source of Federal Funds - Hatch
- d. Scope of Impact - State Specific

Key Theme -Plant Production Efficiency

- a. The major objective of the Fruit program at AES is to identify cultivars that are sustainable

with good economic yields under V.I conditions. Among the major crops being evaluated are banana, plantain and avocado. A minor fruit project is also investigating the performance of 40 less traditional fruit species of both native and foreign origin. This will serve to expand and diversify the germplasm collection of tropical fruit crops available to the fruit growers of the V.I.

- b. Impact - Three newly introduced minor tropical fruits have had highly successful field performance trials. These are Wax Jambu, *Syzygium samarangense* from Malaysia, Black Sapote *Diospyros dignya* and Egg Fruit, *Pouteria campechiana* both from Central America. These fruits and their potential production have been demonstrated at field days, workshops and seminars. Local farmers have shown considerable interest and begun to introduce them into their fruit orchards. Two newly introduced tetraploid hybrid bananas -FmA 02 and FmA 03 and a plantain FmA 21 -all from Honduras have produced yields in excess of traditional cultivars while maintaining good resistance to soil diseases and nematodes. These cultivars have also been demonstrated at workshops, field days and seminars and have had great impact on local farmer throughout the V.I. This interest is clearly indicated by the great demand for planting material of these crops from the field collections at AES.
- e. Source of Federal Funds -Hatch
- d. Scope of Impact -State Specific

Key Theme- Rangeland/Pasture Management

- a. The U.S. Virgin Islands is characterized for seasonally wet and dry periods. During the dry season (March to August) guineagrass yield can be insufficient to meet livestock needs, and during the wet season forage is in excess of animal needs. The objective of this project was to assess grazing management practices that would influence forage distribution and utilization year-round. Continuous and rotational stocking methods (28 d rest period) effects on live-weight gains of small ruminants were compared during the wet and dry season.
- b. Impact- Grazing methods did not have an effect on average daily gains of St. Croix White hair sheep, but forage yields were affected. Sheep on continuous stocking needed supplementation mid-way through the grazing season to gain weight. Under rotational stocking, forage distribution was maintained above 2000 lb/acre and supplementation was not needed. Data suggest that under continuous stocking, a lower stocking rate or a put and take system (removal of animals at some point during the grazing period) will be needed to maintain yield and persistence of the pasture system. Although, selectivity is favored under the continuous system, better utilization of the pasture resource has been observed under rotational stocking. During the rainy season a faster rotation (weekly) was needed to better utilize the pastures. The use of a low-cost portable solar electric net fencing for division of pastures, particularly during the dry season is being promoted for small ruminants.
- c. Source of Federal Funds- Hatch
- d. Scope of Impact- State Specific

B. Stakeholder Input Process

Listening sessions were held on St Croix and St Thomas to collect input from stakeholders on St Croix and St Thomas/St John, respectively. Staff of the Agricultural Experiment Station, the Cooperative Extension Service, the local Department of Agriculture and residents of the 3 islands previously mentioned attended these meetings. In addition, the AES Advisory Council met to discuss issues of concern to the agriculture community and.

The AES scientists continued to work in close contact with farmers as part of several research projects. This provided continuous input and feedback from the community regarding the work being done by AES.

C. Program Review Process

There has been no change made to the process as described in the initial Plan of Work submitted.

D. Evaluation of the Success of Multi and Joint activities

AES has two ongoing multi-state research projects: 1) Plant Genetic Resource Conservation and Utilization (S-009), and 2) Microirrigation of Horticultural Crops in Humid Regions (S-264). A third multi-state research project was developed during this time period: Enhancing Production and Reproductive Performance of Heat-Stressed Dairy Cattle (S-299). In addition, AES has continued to work closely with the University of Puerto Rico and the University of Florida in the Tropical and Subtropical Agricultural Research Program (T-STAR).

A half-day meeting was held between AES professional staff and the CES personnel involved in agriculture to discuss agricultural concerns and search for areas of collaboration. A transcript of the discussions was made and circulated among the participants. The directors of AES and CES met twice during the year to discuss their unit's activities. AES and CES worked together on World Food Day activities and the Virgin Islands Annual Agriculture and Food Fair, a 3-day event attended by nearly 25,000 people. AES and CES created educational displays in the same exhibition area and had staff members present throughout the fair. CES personnel attended AES seminars, and AES personnel participated in relevant CES workshops. In areas where CES did not have expertise, AES initiated workshops and short courses for the farming community. On some projects AES and CES scientists are serving as co-principal investigators.