

**FY 2001 Annual Report of Accomplishments and Results**  
**Agricultural Experiment Station, University of the Virgin Islands**

Submitted by:

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

### **A. Overview:**

The AES Animal Science Program presented a seminar on St Thomas to the senior students in the Science and Math Division. The seminar highlighted the use of assisted reproductive technologies used in livestock such as estrous synchronization, artificial insemination and embryo transfer. A booklet on sheep production and economics was produced and distributed to local farmers and land grant institutions in the U.S.

The AES Aquaculture Program held its third annual short course on Aquaponics and Tilapia Aquaculture. The weeklong course consisted of a combination of lectures and fieldwork. 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 provided technical assistance for the local Rotary Clubs, Botanical Gardens and schools on seed collection, germination and establishment of rare native trees for planting in parks and public area on the island of St. Croix. Workshops on passion fruit care and production were conducted on the islands.

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. Two bulletins were produced that highlighted pasture development and maintenance under the conditions found in the U.S. Virgin Islands.

The Fruit Crops program provided technical assistance and planting materials to several farmers and backyard growers. Almost 1000 suckers of banana and plantains particularly of the new disease resistant tetraploid FHIA types were distributed. In addition assistance was provided to a farmer's cooperative in acquiring tissue-cultured banana and plantain plants from a mainland lab for their farm development program. The Minor fruit project continued to generate widespread interest in the introduction and cultivation of several species that are particularly tolerant to local high pH soil types. A new TSTAR project was approved to fund an integrated control approach for Dodder – a highly invasive epiphytic parasite of several fruit crops in the VI.

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:

<b>Type</b>	<b>Federal</b>	<b>Local Match</b>
Hatch	\$684,031	\$339,130
Regional	\$117,454	\$56,450
McIntire Stennis	\$51,422	\$0

### **Key Theme - Animal Production Efficiency**

- a. Breeding soundness evaluations were conducted on Senepol bulls located on two 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. Using information obtained from the cattle owner, pedigrees were determined for all bulls tested over the past 2 years and the level of inbreeding in one herd was determined.

- b. Impact - Over 500 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 the evaluation were replaced with animals of similar genetic quality that had passed the test. This was allowed the producer because to offer a quality product with a guarantee regarding potential fertility of the bull. Because the inbreeding level of the bulls tested was below 5% in the herd evaluated it was recommended that no changes be made in the breeding program for the herd.
- c. Source of Federal Funds – Hatch
- d. Scope of Impact -State Specific

### **Key Theme – Aquaculture**

- a. Greenwater tank culture systems continue to be 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 tilapia to marketable size and for the production of fingerlings that are needed for stocking growout tanks. New terminology has emerged which describes these systems as heterotrophic or bacterial systems, which depend on heterotrophic bacteria for water treatment rather than autotrophic phytoplankton. Although UVI’s system contains high phytoplankton concentrations, heterotrophic bacteria maintain water quality. In the future, greenwater tank culture will be referred to as a bacterial-based system for tilapia tank culture.
- b. Impact – Three experiments were conducted to determine the best stocking rate and management practice for tilapia fingerling production in bacterial-based systems. A stocking rate of 500 sex-reversed fingerlings per cubic meter of water was determined to be the best rate to produce 50-gram fingerlings in 12 weeks. In the last 6 weeks, when feeding rates are exceedingly high, small weekly partial water exchanges (20-25%) improved water quality and growth by reducing organic matter and nitrate levels. This will be the recommended management procedure to farmers. Fingerlings from these experiments are being sold to the public and to a prison tilapia-farming project. Construction is almost complete on a 50,000-gallon rearing tank, which will be the basis of commercial system for tank culture of tilapia in the Virgin Islands. A unique construction technique has been developed to decrease construction costs by 30% over that of standard concrete tanks. Upon completion, the tank will be tested to verify tilapia production results obtained in experimental-sized tanks. Several farmers in the Virgin Islands and other Caribbean islands await the trial results as interest in the commercial application of this production technique runs high. A summary of the fingerling research was presented at a national aquaculture conference (World Aquaculture Society), and a chapter (An Integrated Fish and Field Crop System for Arid Areas) has been published in a book titled “Ecological Aquaculture.”
- c. Source of Federal Funds – Hatch
- d. Scope of Impact – State Specific

### **Key Theme – Innovative Farming Techniques**

- a. A food production system known as aquaponics is being developed. Aquaponics is the combined culture of fish and hydroponic plants in a recirculating system. A commercial-scale system has been established outdoors in the tropics. It consists of four fish rearing tanks, a set of tanks for removing

solid waste and six hydroponic tanks, which use a raft technique. The fish grow rapidly on a formulated diet high in protein. Solid waste is removed from the system, aerated in lined ponds and disposed of through land application. Dissolved metabolic waste products and nutrients are pumped through the hydroponic beds where they are treated and removed by the plants, thereby purifying the water which is returned to the fish rearing tanks. Water for the system is obtained through rainwater harvesting using a geo-synthetic membrane. Both fish and plants are raised intensively with minimal usage of water and land. Studies are being conducted on design criteria, best management practices, and production capacity.

- b. Impacts – This year the commercial-scale unit was operated continuously and annual tilapia production was determined to be approximately 12,000 lbs., which was greater than expected for a rearing tank volume of 8,200 gallons. The commercial system was modified slightly during operation and six replicated experimental systems were substantially renovated. Simultaneous production trials of 13 types of vegetables in the commercial-scale system failed due to logistical problems. Production capacity of these vegetables will be tested individually. A trial with 2,000 basil plants is underway. Our annual 1-week short course attracted 16 students from several states, England, Columbia, Martinique and Canada. A Japanese film studio sent a team to make a documentary of our aquaponic system. The film will be shown on Japanese television program called “Spaceship Earth,” which has an estimated audience of 5 million people. A presentation on this year’s research results was given at the annual meeting of the World Aquaculture Society, U.S. Chapter. The plenary speaker at the upcoming annual meeting of the international World Aquaculture Society in Beijing, China has requested a set of our aquaponic slides. He plans to use these slides to illustrate the modern extension of traditional Chinese aquaculture, the world’s oldest form of aquaculture, which was practiced in harmony with the environment. A chapter on aquaponics was written for a textbook on recirculating systems.
- c. Source of Federal Funds – Hatch
- d. Scope of Impact – Territorial, National and International

### **Key theme- Ornamental/Green Agriculture**

- a. The ornamental program at AES continued to develop an appropriate system for cut flower production with the major emphasis on identifying a suitable growing medium for the cultivation of shade-grown Large Pink Anthurium. Secondly, efforts continued to identify the optimum vase-water source for cut flowers. A third objective was to simulate shipping conditions in a greenhouse cooler to try and identify suitable temperatures and shipping times for cut blooms.
- b. Impact - Coconut husks medium generated the best Anthurium blooms in terms of flower size and quality. This medium also appeared to produce the highest number of side shoots so giving the highest number of flowers and plantlets for replanting. This may be related to the relatively high natural cytokinin content of coconut. Coconut husks are readily available as a byproduct of harvested nuts from mature trees. Instead of being discarded as done previously they are now collected and utilized as a planting medium for Anthuriums and several other potted plants. This will not only boost the local production of Anthuriums but eventually help to reduce the imports of costly media products. In a second year trial on vase water source the local potable water again resulted in the longest keeping vase life of cut Anthurium flowers. With Ginger lily, the chlorine of potable water source appeared to decrease vase life and caused necrosis of leaves. Filtered potable water or cistern water was best source for vase-life of Ginger lily. This distinction in water source use has aided local

florists in prolonging the shelf life of Anthuriums and Ginger lily and made them more aware of the deleterious effects of chlorinated water on many other other cut flower and foliage species.

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

### **Key Theme- Plant Production Efficiency**

- a. The Fruit Program continued to select cultivars best adapted to local V.I conditions with major crops researched being banana, plantain and avocado. The minor fruit project progressed in its investigation of 40 less traditional fruit species in an effort to expand and diversify germplasm material available to local growers.
- b. Impact - The tetraploid hybrid banana FHIA03 and plantain FHIA21 continued to give superior yields. The former produced bunches in excess of 90lbs and the latter over 50lbs and 65 plantain fingers per bunch. Since these tested cultivars are readily available from tissue culture labs in Florida local farmers are increasingly including these hybrids in their orchards. This evidenced by the many roadside and farmers' markets that are selling fruits of these new cultivars. A semi-dwarf plantain – UVI2 – originally selected from plants at UVIAES has been successfully micropropagated by a Florida lab for commercial production.. Several island farms including the recently initiated Integrated Production Model farm at UVIAES have acquired UVI2 plantain plants for their production programs. Of the minor fruits, the Wax Jambu, Black Sapote and Egg Fruit continued to perform well. Their excellent growth and yields on a high pH soil was demonstrated in a poster/live display and enthusiastically received by farmers and researchers at the 2001 regional Caribbean Food Crops meeting in Port-of-Spain, Trinidad. In addition another minor fruit the Star Apple, *Chrysophyllum cainito*, fruited for the first time after 5 years growth. The plum-like appearance of the purple variety and its prolific nature (over 300 fruits/tree) has had a highly favorable impact on local farmers. The Star Apple's attractive appearance, good taste and relatively long shelf life (>25 days) could make this relatively unknown minor species a good potential for both the local and export markets.
- c. Source of Federal Funds - Hatch
- d. Scope of Impact - State Specific

### **Key Theme – Biotechnology**

- a. The papaya ringspot virus continues to plague farmers and backyard gardeners of papaya. The development of transgenic virus resistant papaya has been fruitful. The local population has preferences for both the red and yellow varieties. Transgenic lines have been selected that bear medium to large fruit (2-6 lb) and fruit production starting within three feet from the ground. Four transgenic lines have been selected to be included in field trials.
- b. Impact - The second generation of transgenic papayas for papaya ringspot virus resistance were grown and evaluated for stable virus resistance. All plants were hand inoculated twice with the papaya ringspot virus and resistant lines, having good fruit quality and production, were hand pollinated to obtain seeds for future generations. The year was free of hurricanes, which allowed for data to be collected for 1.5 years on production and resistance to this viral disease. Local farmers and off-island guests that have toured the transgenic papaya plot have seen the potential and have

expressed an interest in the plants. They have encouraged the continued research on these plants so that seeds will one day be released for public use.

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

### **Key Theme – Plant Germplasm**

- a. Germplasm conservation and evaluation are a major focus at the University of the Virgin Islands with emphasis on fruits and rare native plant species. In the area of fruit germplasm, three new papaya varieties and eight passion fruit varieties were planted and grown. The calcareous soils and semiarid environment of the island provides a strong selection pressure for any new variety being evaluated. The calcareous soils and semiarid environment has limited production of many tropical fruits. Trellis systems of either one or three wires are being studied for passion fruit production as well as wind tolerance during hurricanes. Due to the lack of information on the growing of most of the rare native tree species, six species were selected for determining phenology of the tree and seed germination. All species were listed on the Virgin Islands endangered species list and one, *Buxus vahlii* is part of the federal endangered species list. The phenology of these trees will provide information when during the year it flowers and set fruit as well as when the fruits and seeds mature. Collected tree seeds were subjected to basic treatments to determine their influence on seed germination.
- b. Impact - Workshops on passion fruit production were conducted on the islands of St Croix and St. Thomas to provide information to farmers and backyard gardeners on the growing and production potential of passion fruit. Topics covered in the workshop included variety selection and production, trellis systems, plant establishment and care and uses for the fruit. Interest generated by the passion fruit workshops has resulted in requests for seeds and cutting of passion fruit varieties. Such material was made available to farmers and backyard growers to allow them to establish their own passion fruit vineyards. Presentations have been made at local schools, rotary and the botanical gardens to provide the information to the public. Also, the Caribbean Urban Forestry Conference had the results of this study presented at their forum. Because of the interest and demand for native species, seedlings of rare native trees, which have resulted from seed germination experiments, have been provided to the local botanical gardens and rotary for planting in parks and public location throughout the island
- c. Source of Federal Funds – Hatch and McIntire Stennis
- d. Scope of Impact -State Specific

### **Key Theme- Grazing**

- a. Studies were conducted to assess management (i.e., N rates, minimum tillage, and spot -spraying with herbicide) and grazing effects on stand regeneration of guineagrass. In pastures with 50% cover or more of guineagrass, pastures were fertilized with N (0, 56, 112 lbs/acre) and mob-grazed with cattle at 12-wk intervals. In severely degraded pastures, field were minimum tilled (MT) or MT-sprayed with glyphosate and re-seeded with improved guineagrass ( cv. Tanzania or Mombassa) and grazed lightly after flowering and seed shedding. In completely degraded pastures, fields were sprayed with glyphosate prior to ploughing and discing vs. un-sprayed and re-seeded with Tanzania or Mombassa and grazed 6-mo after.

- b. ImpactB Increasing N rates enhanced forage yield two-fold. As a result other grazing studies (on-station and at farmer co-operators) were initiated. Three small ruminant farmers introduced cvs. Mombassa and Tanzania in their pastures both to be used for grazing and seed production. Two cattle farmers introduced Tanzania in degraded pastures using herbicide and minimum till which resulted in excellent establishment as first grazing was possible 6-months after planting.
- c. Source of Federal Funds- Hatch
- d. Scope of Impact- State Specific

### **Key Theme- Plant Germplasm**

- a. New grass and legume germplasm were evaluated for adaptation to mildly alkaline soils and drought tolerance. Cynodon spp. [two african star-grasses (Florona and Florico) and Tifton-85] were assessed for yield and nutritive value during wet and dry periods when clipped at 6-wk intervals. A two-year study on adaptation of cvs. Florigraze and Arbrook and four new plant introductions (PI) of rhizoma perennial peanut was terminated.
- b. Impact- An improvement in nutritional quality was noted for cv. Tifton-85. This grass was displayed at Agriculture fairs and livestock farmers pasture walks and will be released for farmers use as a special purpose pastures in 2002. The perennial peanut PI-2352 out-yielded commercial cultivars. The thick growing mat and shade tolerance of this legume was ideal for use on tree crop plantations. One farmer established a nursery area for extended propagation on his fruit trees. Propagation material was supplied to a forage research program in the Dominican Republic for further evaluation. Further evaluation of this PI is on-going and performance documented to assist release of a new cultivar.
- c. Source of Federal Funds- Hatch
- d. Scope of Impact- State specific

### **Key Theme- Rangeland/Pasture Management**

- a. Seasonally wet and dry periods, compounded by long drought periods (March to August) affects both forage yield and nutritive value of local guineagrass. Guineagrass stands inter-mixed with *Leucaena leucocephala* (approximately 25% of planted area) were divided using solar-powered electric netting and stocked continuously with growing lambs (10 lambs/acre) in the wet (September to December, 2000) and dry season (March to July 2001). Forage yield, legume contribution and live-weight gains of St. Croix White hair lambs were assessed in each season.
- b. Impact- These preliminary results suggests that different grazing management practices for guineagrass during the seasonally wet and dry periods are needed. Data support the use of a put and take system (i.e., increase of ruminants during periods of lush grass growth) to enhance guineagrass utilization. This was stressed to livestock producers on the U.S. Virgin Islands on farm visits and workshops.
- c. Source of Federal Funds- Hatch
- d. Scope of Impact- State specific

## **Key Theme - Plant Production Efficiency**

- a. New and improved vegetable cultivars were evaluated for yield and quality. Three eggplant cultivars produced yields of more than 25 tons/ha under sustainable (organic) crop management systems. West Indian hot peppers and eggplant were produced at lower irrigation rates while the use of organic (straw) mulch was as effective as synthetic (plastic) mulch in increasing yields. Straw mulch was superior to plastic mulch and the control (bare soil) in terms of water use efficiency of eggplants. On-farm research identified optimum in-row planting densities for hot pepper cultivars. Some cultivars produced higher yields at closer spacing, others performed better at wider spacing. A new agroforestry project was initiated to look at the potential of integrating medicinal trees into production of high value horticultural crops including hot peppers and culinary herbs. During the year the Vegetable Crops Program conducted five (5) on-farm trials with the collaboration of local farmers. These trials involved snap beans, culinary herbs, hot peppers and yam.
- b. Impact – Cultivars of eggplant were introduced to local farmers for high productivity and efficiency using local resources. The use of drip irrigation and mulch reduced water requirement of hot peppers and increased water use efficiency. Farmer adoption of drip irrigation at lower rates combined with organic mulch cut production costs by as much as 30 to 50% through increased water use efficiency. The impact of the research station projects is being realized in local farms. Farmers are slowly adopting some of the improved practices developed for vegetable production at the experiment station.
- c. Source of Federal Funds- Hatch
- d. Scope of Impact- State specific

## **B. Stakeholder Input Process**

The AES Advisory Council met to discuss issues of concern to the agriculture community and AES scientists continued to work in close contact with farmers as part of several research projects. These actions provided continuous input and feedback from the community regarding the work being done by AES as well as providing a means for identifying the concerns of the agricultural community. Workshops and seminars on various topics are conducted and input is received from individuals, cooperatives and agribusinesses. Because of the small size of the ag community in the USVI, anyone who contacts AES regarding information on agriculture is considered a stakeholder. In most cases, input from stakeholders is directed at a specific program and the program leader is charged with deciding how to consider the input and what action to take. The response may be just a simple matter of providing information to the stakeholder in the form of verbal communication or technical bulletins. In other instances it may involve a visit to the farm to provide technical assistance with a crop (plant or livestock).

## **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 three 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), and 3) 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).

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.