

**FY 2002 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 mentored two undergraduate students in the RISE program in collaboration with the division of Science and Math. The students conducted research projects on sheep and cattle physiology and presented the results at regional meetings and within UVI. Collaborations between UVI-AES and Mississippi State University and North Carolina State University were developed as part of a regional project. Outreach activities included fertility evaluations of Senepol bulls for producers as well as technical support for managing crossbreeding programs for local sheep producers. A research symposium on Senepol was hosted by AES and CES. There were 15 presentations over the 2-day conference. Approximately 60 people attended from places such as Brazil, Colombia, Panama, Paraguay and Venezuela, as well as several states in the US. The proceedings were posted on the web at [http://rps.uvi.edu/AES/Senepol/Main\\_Page.html](http://rps.uvi.edu/AES/Senepol/Main_Page.html).

The AES Aquaculture Program annual short course (Aquaponics and Tilapia Aquaculture) attracted 24 students from eight states, two territories and six countries, including Canada, Mexico, Antigua, Hungary, Lebanon and South Africa. The University of the Virgin Islands (UVI) formed a partnership with Rutgers University, funded by an EPA grant, to build and evaluate a replica of the UVI aquaponic system at the Burlington County EcoComplex. This system has produced excellent results with tomatoes in an environment-controlled greenhouse. A unique aspect of this project was the installation of four microturbines, which use methane from an adjacent landfill to generate electricity for the operation of the system, including supplemental lighting. The methane also heats the greenhouse during the cold season. Former short course students constructed UVI aquaponic systems in Alberta, Canada at the Crop Diversification Center South, and in Lebanon. The system in Canada is fully operational and producing tilapia and more than 20 types of vegetables, including tomatoes, lettuce, cucumbers, peppers, watermelon, cantaloupe and peas.

The AES Biotechnology & Agroforestry program provided technical assistance for the local Forest Legacy Program, Forest Stewardship Program the Nature Conservancy and schools on tree planting, care and establishment of rare native trees for planting in parks and public area on the island of St. Croix. Presentations on Genetically Modified Plants were conducted.

The Vegetable Crops Program continued to play a significant role in developing and promoting improved technologies for small-scale vegetable production in the Virgin Islands such as microirrigation and high yielding vegetable cultivars. On-farm experiments where farmers provided land, irrigation water and labor in maintaining the research and demonstration plots. Farmers and researchers jointly evaluated the contribution of drip irrigation, mulching and improved cultivars in increasing the yield and production of tomato, okra, and watermelon. A workshop on culinary herbs and hot pepper production designed for farmers was presented during World Food Day.

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	\$682,906	\$463,192
Regional	\$117,282	\$97,367
McIntire Stennis	\$51,359	\$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 a subset of the bulls tested over the past 3 years and the level of inbreeding was determined.
- b. Impact - Over 100 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. This was beneficial to the producer because they were able to offer a quality product with some level of guarantee regarding potential fertility of the bull. Because the inbreeding level of the bulls tested was below 5% it was recommended that no changes be made in the breeding programs.
- c. Source of Federal Funds - Hatch
- d. Scope of Impact - State Specific

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

- a. Holstein heifers were bred by artificial insemination and treated with supplemental hormones post-insemination in an effort to overcome the negative effects of heat stress on conception. Data was collected during two times of the year to evaluate seasonal effects. Due to the high temperature-humidity index during both seasons the heifers were under heat stress at all times. There was no positive effect of the supplemental treatment on conception rate. Darker heifers (>50% black hair coat) had higher rectal temperatures than lighter (< 50% black hair coat) heifers. A negative relationship between percentage of black hair coat and pregnancy rate in the heifers was also detected.
- b. Impact – Because of the continual heat stress throughout the year, there was no recommendation made to producers about using the supplemental hormone treatments to increase pregnancy rates. Although the data is preliminary, there is evidence suggesting that the selection of heifers with less black hair coat may be an inexpensive way to mitigate the negative effects of heat stress on reproduction and milk production in dairy cattle in tropical regions.
- c. Source of Federal Funds – Hatch Multistate Research
- d. Scope of Impact - Multi-State Research  
-With Mississippi and North Carolina

### **Key Theme – Aquaculture**

- a. An experiment was conducted in bacterial-based tanks to determine if water quality can be improved and production increased by increasing the carbon:nitrogen ratio to 16:1 (the standard C:N ratio is 9:1). Researchers have reported that a higher carbon to nitrogen ratio will enhance the growth of heterotrophic bacteria and improve water quality. Molasses is often recommended as a source of additional carbon. Therefore a growout experiment was conducted in bacterial-based tanks to assess water quality and production with the addition of molasses. Results showed that molasses turned the water dark brown, depressed phytoplankton growth, reduced oxygen

concentrations and decreased tilapia production significantly. Construction of a unique, commercial-scale (1/20 acre) bacterial-based tank was completed. The bottom of the circular tank slopes 3% to a 1-m<sup>3</sup> central cone (45% slope). A vertical-lift pump, tilted sideways, creates a circular rotation in the tank, which moves settleable solids to the cone. Solids collect in the cone and are removed daily by opening a drain line. The tank is aerated with three additional vertical-lift pumps. Tilapia production after the first 25-week trial was 6,343 lbs. The harvest density was 29 times greater than a conventional pond. Such high production in this small tank represents a significant reduction in land and water usage. The 21,700 gallons of sludge removed from the tank represents a valuable resource for field crop production. Water quality was excellent throughout the trial due to the good mixing characteristics of the circulation pump, which increased contact between bacterial floc and waste metabolites and enhanced nitrification.

- b. **Impact** –The results of the experiment evaluating the addition of molasses to the water will be presented at a national meeting and published in a journal to discourage researchers from promoting this practice. The findings from the commercial-scale tank represent a major breakthrough in the management of these systems and indicate that it would be feasible to scale-up this tank many times. Future research will be directed at developing a simple adjoining denitrification unit to remove nitrate ions.
- c. Source of Federal Funds – Hatch
- d. Scope of Impact – Territorial, Regional

### **Key Theme – Biotechnology**

- a. Papayas in the Virgin Islands and the Caribbean are plagued with the papaya ring spot virus. This virus can be devastating to papaya, causing mottled yellowing leaves, water-soaked lesions on the stem and ring spots over the fruit. Transgenic papayas have been developed in the Virgin Islands with virus resistance. Inbreeding of papaya lines is being used to stabilize the virus resistance. Plant selection also includes early bearing sweet fruit with a firm flesh, characteristics sought in the market place. .
- b. Impact – Tours of the transgenic papaya field plots by local farmers and back yard gardeners has produced favorable responses. The tour groups could easily distinguish the healthy transgenic papaya plants from the virus-infected plants. They were encouraged by the technology and could see first hand that the transgenic plants grow normally as a papaya. All growers were eager to try the transgenic lines when the seeds are approved for release. By providing tours of the transgenic field plots to the local residence, they became educated on what genetically modified plants are and their impact in their lives.
- c. Source of Federal Funds – Hatch
- d. Scope of Impact – State Specific

### **Key Theme- Grazing**

- a. The effect of lablab (*Lablab purpureus*) on average daily gains (ADG) of weaned lambs was investigated. Treatments were unrestricted grazing of guineagrass (*Panicum maximum*) supplemented with lablab (SL; 0.5% animal liveweight on a dry matter basis), unrestricted grazing of both guineagrass and lablab (GL), and unrestricted grazing of guineagrass which served as a control. We found significant differences (P<.05) among treatments for ADG. There

was a four-fold increase in ADG for GL (72.8 g/d) compared to the control (18.5 g/d). Average daily gains of lambs on GL were also much higher than SL (36.4 g/d). There were also herbage mass difference among treatments ( $P < 0.05$ ). The herbage mass on offer for GL (3.64 Mg/ha) was two-fold higher than SL (1.9 Mg/ha) and control (1.3 Mg/ha). This study suggests that weight gains of lamb can be increased with summer grazing and /or supplementation with lablab.

- b. Impact– Assessment of a fast growing summer legume (i.e., lablab) as animal feed is limited. Base information was developed for management of this legume for supplementation and grazing. Lablab will be used as an under-story cover crop in tree-crop-small ruminant production system.
- 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 continues to be developed. Aquaponics is the combined culture of fish and hydroponic plants in a recirculating system. An outdoor commercial-scale system has been established. It consists of four fish rearing tanks, a set of tanks for removing solid waste and six hydroponic tanks, which use the raft technique. Fish grow rapidly on a formulated diet. Solid waste is removed from the system daily, 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 land and water. A trial was conducted with tilapia and basil, comparing batch and staggered production systems. Batch culture depleted nutrients by the fourth crop, leading to the appearance of nutrient deficiency symptoms. Staggered production moderated the uptake of nutrients and no deficiency diseases appeared. With the staggered method, annual production of basil was estimated to be 11,000 lbs.
- b. Impacts -The total annual value of basil and tilapia from the system, which occupies 1/8 acre of land, was projected to be \$134,245. The production of basil would be profitable if the market could absorb such a large amount.
- c. Source of Federal Funds – Hatch
- d. Scope of Impact – Territorial, National, 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 suitable growing media for the cultivation of shade-grown Large Pink Anthurium. Secondly, efforts continued to identify the optimum vase-water source for cut flowers.
- b. Impact - Coconut husks medium and shredded pine bark generated the best Anthurium blooms in terms of flower size and quality. The former produced the highest number of side shoots so producing the highest number of flowers and plantlets for replanting purposes. 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. Although pine bark must be imported from off-island sources it provides a growing medium that is well aerated, weed-free and very tolerant to pathogenic organisms particularly bacterial blight which is a major constraint in many Anthurium growing areas of the world. A lot of pine bark is traditionally imported as a mulch for other crops and used extensively in the local landscaping industry. Pine bark is therefore readily available for growing Anthuriums. Although the fresh cut flower industry is being largely replaced by cheaper and easily imported artificial flowers there is still a valuable and profitable niche market for locally grown Anthuriums and Ginger lilies.

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

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

- a. New varieties of watermelon were evaluated for yield and quality with farmer's collaboration. The top three high yielding varieties were 'Sugar Baby', 'Jade Star' and 'Yellow Doll'. Based on the results, the farmer decided to plant a larger plot next year using these varieties. On another on-farm variety trial, four varieties of okra were evaluated for yield. Varieties 'North-South' and 'Clemson Spineless' were the best in terms of number of fruits and total yield. Farmers would plant the variety 'North-South' since this is a newer variety than 'Clemson Spineless', a common variety. Heat tolerant tomato varieties 'Heatwave' and 'Sunmaster' consistently produced high yields during summer planting. Farmers are now able to grow these varieties during summer when production is low because high incidence of pests and diseases. Puerto Rican sweet pepper is a popular vegetable crop in Virgin Islands where there is a significant Hispanic community. There are no research studies conducted on the water requirement of this crop and we conducted the first trial to evaluate the response of Puerto Rican sweet pepper to levels of drip irrigation. Results indicated that the crop responded to increasing levels of irrigation water applied via drip system. Yield increased at irrigation level equivalent to -20 kPa soil moisture tension. This indicates that irrigation water is very important in producing high yields of Puerto Rican sweet pepper.
- b. Impact - When grown by farmers, high yielding cultivars of watermelon, okra and heat tolerant tomato will boost overall vegetable production in the Virgin Islands thereby increasing self-sufficiency in fresh vegetables and improving income of farmers. Use of drip irrigation and higher application rates would also increase production of Puerto Rican sweet pepper.
- c. Source of Federal Funds - Hatch
- d. Scope of Impact - State specific

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

- a. The Fruit Program continued to identify 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 among the established Musa germplasm at AES. These proven cultivars are still readily available from tissue culture labs in Florida local farmers continue to include these hybrids in their orchards. This is evidenced by the many roadside and farmers' markets that are selling fruits of these new cultivars and the variety of local restaurants that include the new hybrids in their menus. A total of 1000 kgs of green banana and plantain from AES plots were sold last year valued at \$1000 in funds for AES revenue generating activity. Saba a triploid cooking banana has also become popular with local residents in the preparation of many native dishes. A semi-dwarf plantain – UVI2 – originally selected from plants at UVIAES continues to be successfully micropropagated by a Florida lab for commercial production. Several VI farms including the 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 live display and enthusiastically received by locals and visitors to the 2003 VI Agric. Food fair. Another relatively unknown tropical fruit the Star Apple or Caimito, *Chrysophyllum cainito*, fruited for the second year. A white-fruit variety added to the already popular and prolific nature (over 300 fruits/tree) of the purple variety. It has also had a highly favorable impact on local farmers. With its ongoing good growth and yield characteristics, attractive fruit variety and appearance, appealing taste and relatively long shelf life (>25 days), the Caimito, white and purple has excellent potential for both the local and export markets.
- c. Source of Federal Funds - Hatch
- d. Scope of Impact - State Specific

### **Key Theme – Plant Germplasm**

- a. Tropical fruits and rare native plant species is the focus of the plant germplasm conservation and evaluation at the University of the Virgin Islands. New papaya varieties are grown and evaluated for their tolerance to the caliche soils and semiarid environment. Papayas have been repeatedly planted in the same plot that provides for selection to soil born pathogens. Plants that survive this selection pressure have tolerance to these papaya diseases. *Passiflora quadrangularis*, barbadine, has been added to the passion fruit evaluation trials. The barbadine produces fruits of over a kilogram and both the rind and pulp have culinary uses. Tissue culture seed germination has been employed to establish a rare native orchid, *Psychilis macconnelliae*. The goal is to produce plants that can be reintroduced in their native environment. A grove of native forest trees was established as part of a genetic bank for native germplasm at UVI. Fifteen genera, consisting of over 160 trees, were planted in a minimal maintenance area. Data was collected monthly on establishment, growth rates, insect pests and phenology. In addition to a genetic bank, the planting also serves as a popular demonstration plot. Results from this tree establishment research were presented at the regional Caribbean forestry conference.
- b. Impact – Papaya production has increased on the island of St. Croix from the farmers adopting the use of varieties selected by the University of the Virgin Islands. Fruits from these farms can be seen in the farmers market and roadside vendor stands. Seeds of papaya varieties are made available to farmers. Visitors toured the native tree germplasm plot, including US Forest Service staff from Puerto Rico, the staff of VI Department of Agriculture, The Nature Conservancy, St Croix Environmental Association, Department of Fish and Wildlife, Parks Service and local farmers and land owners. All were able to see how the rare native trees grew and survived the semiarid climate. The visiting guests were able to determine which native trees would grow best in their urban forest, farm or yard.

- c. Source of Federal Funds – Hatch and McIntire Stennis
- e. Scope of Impact - State Specific

**Key Theme- Plant Germplasm**

- a. A two-year study assessed the effect of season (wet and dry) and cutting intervals (6 and 12 wks) on (HM) and nutritive value [crude protein (CP) and in vitro organic matter disappearance (IVOMD)] of grass entries [*B. decumbens* (Signalgrass) and *B. brizantha* cv. Marandu]. Dry season HM of grass entries was low (1.0 Mg/ha), but wet season was much higher (3.0 Mg/ha). Herbage mass at 12-wk harvest was twice that of 6-wk. Crude protein averaged 10% in the dry and 14 % in the wet season. Results of this study show that these grass entries are low HM producers during the dry season but are productive in the wet season. Crude protein was higher when harvested during the wet season. It is recommended that these grass entries be used as stand-over forage in dry heavy clay conditions.
- b. Impact- An improvement in nutritional quality was noted for the *Brachiaria* cv. when compared to guineagrass, but additional information is needed on persistence. Seed material of cv. Marandu was released for planting (8 acres) to three farmers on St. Croix.
- c. Source of Federal Funds- Hatch
- d. Scope of Impact- State specific

**Key Theme - Plant Production Efficiency**

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



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

- a. Invasive shrubby weeds are invading pastures (i.e., Manjack and Acacias) due to over-stocking and low soil fertility. Chemical weed control (wicking a 50:50 concentration) of the herbicides Triclopyr and Glyphosate were assessed. Eight-wk regrowth of plants were wet thoroughly and visual measurement taken. The method of herbicide application was effective on the Acacia, but not on the Manjack. Repeated application will be needed to suppress the spread of Manjack.
- b. Impact-These preliminary results identified safe herbicides for use on pastures. Glyphosate is the safest herbicide available without a residual soil effect. Triclopyr is also a safe herbicide and approved for use on pastures. These two herbicides provide an alternative to Spike on those with higher concentration of Picloram (e.g., Tordon) and are available for stakeholder use.
- 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 agriculture 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.