

PLAN OF WORK

University of the Virgin Islands Agricultural Experiment Station

Federal Fiscal Years
2005-2006

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Introduction

The Agricultural Experiment Station (AES) at the University of the Virgin Islands (UVI) conducts agricultural research and works closely with the Cooperative Extension Service (CES) and the Virgin Islands farming community. UVI does not have a formal program in agricultural instruction.

This Plan of Work was developed with input from the entire AES research faculty and outlines planned research activities for federal fiscal years 2005 and 2006.

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I. Planned Programs

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GOAL I: An agricultural system that is highly competitive in the global economy

Program 1. Sustainable Fruit and Vegetable Production

Statement of Issue:

Production of horticultural crops in the Virgin Islands is constrained by several factors resulting in low efficiency and productivity. Poor crop management practices adopted by farmers are a major contributing factor to low productivity. Some of these practices include the use of old and low yielding crop cultivars, poor land preparation and planting methods, inefficient methods of fertilizer and water application, poor weed control method and lack of integrated pest management system.

Fruits and vegetables can be produced all year round, but without good management practice, crop performance is reduced resulting in lower potential yield and quality. There is high market demand for locally produced fruits and vegetables, but farmers often failed to meet this demand due to inefficient cropping system and management method. High quality produce demands a good market price, but can be achieved only if farmers use improved crop management practices.

Integrated crop management system is a potential tool for improving year-round production of fruits and vegetables in the Virgin Islands. Improved component technologies such as suitable cultivars, drip irrigation, balanced fertilizer application, and effective pest management strategy can be integrated in crop sequences for year-round production of high quality fruits and vegetables.

Development of integrated crop management system for fruits and vegetables is important if Virgin Islands farmers are to become highly competitive in the global economy. There is need for

designing drip irrigation system that is more efficient for fruits and vegetables. This system will also allow efficient fertilizer application resulting in improved and better quality yield.

This program focuses on the integration of selected crop management practices that will ensure year-round crop sequences and production of high quality produce by local farmers.

Performance Goals:

- Develop database for existing crop management practices by farmers
- Evaluate highly productive cultivars and cropping sequences
- Design efficient drip irrigation systems
- Promote use of improved cultivars and cropping sequences
- Increase adoption of efficient drip irrigation system

Output Indicators:

- Farmers' active participation
- Technology evaluation under farm environment
- Farmer adoption of improved management practices
- Production guides for good management practices
- Published reports and bulletins

Outcome Indicators:

- Improved cropping and management practices utilized by farmers
- Increased efficiency and productivity in fruit and vegetable farms
- Improved yield and quality of fruits and vegetables
- Better market price and increased income from fruits and vegetables

Key Program Components:

- On-station research on designing and developing efficient drip irrigation system
- On-farm evaluation of improved drip irrigation system and fertilizer application
- Data collection and analysis
- Economic evaluation and assessment of impact on farmers' income

Internal and External Linkages:

- Multi-State
- Strategic alliances
- W-128

Target Audiences:

- Fruit growers in the USVI and Caribbean region
- Small-scale vegetable farmers in the USVI and Caribbean region

Program Duration:

Intermediate term: 4-5 years

Allocated Resources:

Fiscal Year	2005	2006
Federal Hatch Funds (\$)	\$202,094	\$202,094
Local Matching Funds (\$)	\$101,295	\$101,295
FTE	3	3

Program 2. Forest Resource Conservation

Statement of Issue:

The forests and woodlands in the Virgin Islands are very limited due to land clearing for agriculture during colonial times and the present urban development. Rural forests and woodlands have been highly impacted by their proximity to agricultural production areas. Urban and suburban forests have also been affected by direct hits from three devastating hurricanes over the last fifteen years. The combined influence of these and other factors has resulted in the creation of highly fragmented urban forests with a multiplicity of owners and management objectives. A number of native tree species are very rare in the US Virgin Islands and little information is available on their propagation and potential use in agroforestry systems. To assure an adequate research base and the generation of high impact research products, available resources will be focused on the use of trees as environmental buffers, development of fast growing disease and insect resistant tree species, and protection and enhancement of the urban-suburban tropical forests of the Virgin Islands.

Performance Goals:

- Develop protocol for the propagation of rare native trees through seed germination and cuttings. Increase the use of native trees species in agroforestry systems and the urban environment.
- Protect soil resources, increase crop yield, improve water quality and enhance biological diversity.
- Meet the growing demand for native tree species by developing propagation systems to address the changing attitude of Virgin Islanders concerning the best use of these resources.
- Protect environmental quality while supporting economic development on a broader front.

Output Indicators:

- Improvement of surface water quality.
- Improvement in livability of the urban-suburban environment.
- Development of value-added wood-based products.
- Research reports to the scientific community, technical reports, fact sheets and workshops for active producers, interpreted information for potential growers, the general public, cooperative extension service and territorial agencies.

Outcome Indicators:

- Increased use of native trees in landscaping and urban plantings.
- Better placement and survival of native tree species in urban and community settings.
- Utilization of native tree species for windbreaks, living fences, and livestock shade and fodder.
- Reduction in stream water nitrogen and suspended solids concentrations.
- Broader application of wood products in the art and furniture industries.

Key Program Components:

- Expand the knowledge base on the propagation, establishment and management of field and streamside buffers, the efficiency of chemical and carbon capture in environmental buffers and crop yield improvement.
- Improve stream water quality.
- Reduce soil erosion.
- Enhance ability to manage and improve urban and suburban forests.

Internal and External Linkages:

- Researchers from other programs at the Agricultural Experiment Station
- Researchers in allied departments in the Southern Region
- V.I. Department of Natural Resources
- U.S. Forest Service
- Agricultural Research Service, USDA
- The Nature Conservancy
- St. Croix Farmers in Action
- St. George Village Botanical Gardens

Target Audiences:

- Landowners, regulatory agencies, non-government organizations, homeowners, conservation groups and natural resource management agencies.
- Government leaders, community tree stewards and managers.

Program Duration:

Intermediate term: 2005 - 2009 or greater than five years

Allocated Resources:

Fiscal Year	2005	2006
Federal Hatch Funds (\$)	\$51,293	\$51,293
Local Matching Funds (\$)		
FTE	1	1

Program 3. Plant Germplasm Conservation and Enhancement

Statement of Issue:

The use and maintenance of diverse germplasm are the key elements of successful plant breeding programs. The conservation and use of a comprehensive collection of genetically varied cultivated plants and their relatives are the biological foundation for the long-term success of U.S. agricultural producers. Different selection and evaluation methods are used to develop cultivars within and among different tropical crop species, but elite germplasm is necessary in all instances to develop new superior cultivars. Evaluation, development and enhancement require long-term commitments (20 to 40 years) to produce superior germplasm sources. Today the goal for project completion involves a 5 to 10-year time horizon. To ensure future genetic advances, a long-term commitment is needed to increase genetic diversity of cultivated crops and to develop and enhance elite germplasm. Though over seven species of orchids existed on St Croix 100 years ago, only

two species remain. Tissue culture systems will be evaluated to germinate seed and maintain the genetic diversity of the remaining populations of the rare native species.

Performance Goals:

- Increase the genetic diversity available for basic and applied tropical plant science research.
- Increase the germplasm base of U.S. tropical crop species to reduce the chances of devastating crop losses due to either biotic or abiotic stresses.
- Improve germplasm to ensure systematic genetic advances of newly developed cultivars.
- Enhance specific plant and seed traits through applied biotechnology.
- Maintain the genetic diversity of the rare native trees.

Output Indicators:

- Diverse sources of germplasm are made available for cultivar development or for producer use.
- Genetically improved germplasm made available for cultivar development or for producer use.
- Information relative to effectiveness of breeding and selection methods.
- Information relative to the most efficient cultural practices to take full advantage of the improved germplasm.

Research reports to the scientific community, technical reports and workshops for active producers, interpreted information for potential producers, the general public, cooperative extension services and territorial agencies.

Outcome Indicators:

- Incorporation of valuable traits from germplasm collections into new cultivars and other commercial products.
- Genetic gains for yield and quality of new cultivars.
- Expanded the potential uses and markets for specialty types.

Key Program Components:

- Papaya: Develop and enhance germplasm to broaden the genetic base for disease and pest resistance through biotechnology. Improve the yield and fruit quality in developing early bearing cultivars.
- Passiflora: Identify plant characters appropriate for use as selection criteria and develop molecular genetic markers for identification of species and improving the fruit quality and productivity in sustainable, integrated, cropping systems.
- Cassava: Develop and evaluate germplasm with modified characteristics to improve the production and quality of the starch.
- Orchids: Develop tissue culture protocols for the seed germination of the remaining two native species.

Internal and External Linkages:

- Department of Science and Math, UVI
- Researchers from other programs at the Agricultural Experiment Station
- Researchers in allied departments in the Southern Region
- V.I. Department of Agriculture
- Agricultural Research Service, USDA

- St. Croix Farmers in Action
- St. George Village Botanical Gardens

Target Audiences:

- Landowners, farmers, home owners, conservation groups, tropical crop growers,
- Government leaders, community tree stewards and managers.

Program Duration:

Intermediate term: 2005 - 2009 or greater than five years

Allocated Resources:

Fiscal Year	2005	2006
Federal Hatch Funds (\$)	\$153,678	\$153,678
Local Matching Funds (\$)	\$79,111	\$79,111
FTE	2	2

Program 4. Evaluation, management, and economic potential of preserving high quality leguminous hay in the Virgin Islands

Statement of Issue:

Tropical regions of the world are highly dependent upon forages to meet the nutritional demands of livestock. Forage production in tropical environments show high levels of fluctuation in yield, quality, and overall plant performance throughout the year. During seasonal periods of low forage productivity, alternative feed resources are needed for ruminant livestock. In many areas of the world this problem is addressed by feeding grain-based concentrates, hay, or silage. In the tropics, grain-based concentrate feeding is not a viable option because base ingredients required are not locally produced and shipping costs are prohibitive. Therefore, producers must find alternative feeds. Locally produced high quality hay may be a viable option. This can be achieved by cutting hay when forage biomass is in surplus to the nutritive needs of the livestock operation, or by managing independent hay fields.

Performance Goals:

- Develop data base on legume hay production parameters
- Promote use of proper pasture management techniques necessary for high quality legume hay production
- Evaluate hay/improved pasture for legume hay production longevity
- Discern the economic viability of locally produced leguminous hay

Output Indicators:

- Producer participants
- Market acceptance of product
- Consultations with producers and the Department of Agriculture on data summaries
- Manuscripts and producer oriented reports

Outcome Indicators:

- Incorporation of leguminous hay production parameters into local agriculture
- Measurable increases in availability of locally produced, high quality hay
- Increase in hay quality with a decrease in cost
- Decrease in resource costs to livestock producers

Key Program Components:

- On farm legume hay production
- Consultation with the Department of Agriculture and local agriculture producers
- Acquisition of proper hay making equipment
- Legume hay production data collection and economic impact analysis on farm budget

Internal and External Linkages:

- Strategic alliances with the Virgin Island Department of Agriculture
- Local livestock producers

Target Audiences:

- Agriculture producers and land owners to participate in alternative agriculture
- Livestock producers in USVI and Caribbean region

Program Duration:

Intermediate term: 4-5 years

Fiscal Year	2005	2006
Federal Hatch Funds (\$)	\$134,751	\$134,751
Local Matching Funds (\$)	\$67,317	\$67,317
FTE	2	2

Program 5: Evaluation of reproductive and productive traits of livestock in a tropical environment.

Statement of Issue:

Hair sheep are common throughout the Caribbean but crossbreeding with other, non-indigenous breeds is becoming more common as a method to enhance production traits. Not all breeds of sheep can tolerate the environmental conditions, parasite burdens or extensive production system found throughout the Caribbean. Using breeds that will enhance production traits such as lamb growth rate and efficiency and be able to survive under the local conditions can have a positive impact of sheep production in the tropics. Evaluation of these breeds and the crosses needs to be done before recommendations can be made for their widespread use in the limited sheep population.

In the USVI, ambient temperature and relative humidity frequently exceed the critical temperature-humidity index (THI) necessary for heat stress during almost the entire year. Reduced reproductive performance is a common result of this. Evaluating methods to monitor heat stress as

well as ways to mitigate the negative effects of heat stress on reproductive function are crucial to the dairy industry in the region.

Data show that cattle with excitable temperament ratings produce a higher incidence of borderline low quality carcasses than cattle with calm temperament ratings. Studies to determine the amount of stress on farm animals during routine handling often have shown variable results and are difficult to interpret as related to animal welfare. The increase in the use of non-traditional breeds of cattle, such as Senepol, in tropical areas has led to interest in the relationship between temperament and production traits.

Performance Goals:

- Evaluate production traits of hair and crossbred ewes under tropical conditions.
- Increase use of crossbreeding in hair sheep flocks to increase meat production.
- Devalue methods to measure the level of heat stress in dairy cows.
- Enhance the ability of dairy cows to reproduce under conditions of heat stress.
- Evaluate hormonal therapies to mitigate the impact of heat stress on reproduction in dairy cows.
- Evaluate the relationship between temperament and production traits of Senepol cattle.

Output Indicators:

- Number of producer participants.
- Market acceptance of product.
- Producer adoption of new management practices.
- Methodologies used by collaborators on multistate projects.
- Manuscripts and producer oriented reports.

Outcome Indicators:

- Increase in price obtained for lamb carcasses at market.
- Decrease in resource costs to sheep producers.
- No decrease in ewe productivity with crossbreds.
- Enhanced reproductive performance of heat stressed dairy cows.
- Enhanced beef production traits by selection for mild temperament.

Key Program Components:

- Measures of ewe productivity such as lambing and weaning rates, fertility and longevity in the flock.
- Evaluation of dairy cow reproduction in response to hormonal treatments.
- Development of ways to measure physiological parameters of dairy cows under conditions of heat stress.
- Measurement of chute temperament score and chute exit velocity and their relationship to production traits.

Internal and External Linkages:

- Department of Science and Math, UVI
- Cooperative Extension Service, UVI
- Researchers participating in NCR-190, S-299 and S-1013
- Livestock producers on St. Croix

Target Audiences:

- Dairy, sheep and Senepol farmers in USVI, Caribbean region and Southern US

Program Duration:

Intermediate term: 4-5 years

Allocated Resources:

Fiscal Year	2005	2006
Federal Hatch Funds (\$)	\$173,745	\$173,745
Local Matching Funds (\$)	\$88,584	\$88,584
FTE	2.5	2.5

Program 6. Integrated Aquacultural Production Systems

Statement of Issue:

Nearly 80% of the fish and more than 95% of the fresh farm crops consumed in the Virgin Islands are imported. The economy is in crisis and the government is being forced to make deep budget cuts. There is a legislative initiative to increase the economic contribution from the agricultural and fishing sectors. Aquaculture is being called on to play important economic role in pending legislation. Research is needed to develop aquacultural production systems that are technically and economically feasible in an environment with limited freshwater resources. Practical production systems will require the use of high fish densities, water treatment and recirculation. Integrating plant crop production with aquaculture will reuse aquaculture effluent, recycle nutrients and organic matter, improve soil structure, reduce the use of synthetic fertilizers and increase profitability.

Performance Goals:

- Develop practical aquaculture production systems that recover solid and nutrient waste, incorporate plant crop production, conserve water and earn profits.
- Provide technical knowledge and management training to producers.

Output Indicators:

- New aquaculture technologies for water-limited areas.
- Commercial-scale demonstration systems that integrate intensive aquaculture with plant crop production.
- Better understanding of the productive capacity of integrated aquacultural/plant crop systems.
- Better understanding of water treatment and nutrient cycling in integrated production systems.
- Research reports to the scientific community, farmer’s bulletins, fact sheets, short courses, workshops, seminars, conference presentations, advice and guidance to students, the general public, entry levels aquaculturists, regulators and legislators.

Outcome Indicators:

- Adoption of the technology developed by these projects.

- Increase in the local production of fish and fresh plant crops.
- A positive economic impact through the establishment of commercial operations, increased employment and import substitution.

Key Program Components:

- Develop design criteria and evaluate the interactions of fish, plants and water quality that govern the operation of integrated systems.
- Determine the output of fish and a wide range of plant crops from integrated systems and develop enterprise budgets.
- Assess the impact of aquaculture effluent on soil fertility and field crop production and evaluate application methods.
- Establish commercial-scale units demonstrating new integrated production system technologies.
- Evaluate new species and polyculture in the integrated systems that have been developed.
- Market products of integrated production systems to determine price structure for product forms and assess demand.
- Develop an educational program and instructional materials for regional and national producers and potential producers.

Internal and External Linkages:

- American Tilapia Association
- Aquaculture Engineering Society
- World Aquaculture Society
- Agriculture Research Service
- CSREES
- T-STAR Program
- SARE Program
- CRSR Program - Pond Dynamics/Aquaculture
- Southern Regional Aquaculture Center
- Tropical and Subtropical Aquaculture Center
- American Samoa Community College
- University of Guam
- University of Puerto Rico
- Rutgers University EcoComplex
- University of Michigan
- Virginia State University
- Crop Diversification Center South, Alberta, Canada
- Asian Institute of Technology
- FAO
- UVI Cooperative Extension Service
- UVI Small Business Development Center
- UVI Water Resources Research Institute
- Virgin Islands Department of Agriculture

Target Audiences:

Investors, commercial producers, backyard producers, researchers, educators

Program Duration:

Intermediate term: 4-5 years

Allocated Resources:

Fiscal Year	2005	2006
Federal Hatch Funds (\$)	\$129,398	\$129,398
Local Matching Funds (\$)	\$64,644	\$64,644
FTE	3.5	3.5

II. Stakeholder Input Process

The Agricultural Experiment Station’s Advisory Council meets two times annually. The Council consists of farmers that represent a cross-section of the Virgin Islands farming community, including the President of the St. Thomas Livestock Association and the President of St. Croix Farmers in Action. All AES Program Leaders sit in on the meetings as well as a representative from the Cooperative Extension Service. The farmers are given the opportunity to raise their concerns. AES scientists try to incorporate researchable issues into their research programs. Non-researchable concerns are referred to CES or appropriate federal or state agencies for action.

Due to the small geographic area of the Virgin Islands, AES scientists work in close contact with the local farming community, which fosters considerable communication and responsiveness to farmers' needs. For example, AES faculty members are currently conducting research on eight local farms out of a total of 247 registered farms.

AES programs hold field days that are advertised in the local newspapers. Virgin Islands farmers and interested citizens tour current projects and have an opportunity to comment on the work that is being performed. Selected farmers are invited to AES seminars when the topic is relevant to their operations. The AES staff work with members from Farmers in Action, a group of about 25 farmers in St. Croix, to organize special events such as Virgin Islands Agricultural Forums.

In the event that the needs of some of the smallest, underserved farmers are not being heard, all AES staff will host a publicly-announced listening session in St. Croix and in St. Thomas, which will also be accessible to St. John farmers. These sessions will be held early in the evening. On the day of the sessions, an AES staff will tour a cross-section of each island's farms and talk to farmers firsthand. CES personnel organize these tours.

III. Program Review Process -Scientific Peer Review

A scientific peer review process is followed. Scientists submit three copies of their proposals to the Director, who attaches evaluation forms and sends them to three people who are qualified to judge the proposal. At least one of the reviewers is selected from CES. The reviewers are asked to rate the proposals on a scale of 1 to 5, 5 being the highest score, as to relevance of the proposed project to the agricultural sector (justification). The evaluated proposals are then returned to the Director who gives the reviews to the scientist for any needed revisions. The revised proposal is then returned to the Director who verifies the improvements in writing and gives final approval.

IV. Multistate Research Activities

AES is participating in four multistate research projects: 1) Plant Genetic Resource Conservation and Utilization (S-O09); 2) Microirrigation of Horticultural Crops in Humid Regions (S-264); 3) Enhancing Production and Reproductive Performance of Heat-Stressed Dairy Cattle (S-299); and 4) Genetic (Co) Variance of Parasite Resistance, Temperament, and Production Traits of Traditional and Non-*Bos indicus* Tropically Adapted Breeds (S-1013). In addition, AES works closely with the University of Puerto Rico and the University of Florida in the Tropical and Subtropical Agricultural Research Program (T-STAR).

V. Integrated Research and Extension Activities

There is a close working relationship between AES and CES personnel, some of whom share the same building. AES and CES work 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 create educational displays in the same exhibition area and man the displays throughout the fair. CES personnel attend AES seminars, and AES personnel participate in relevant CES workshops. In areas where CES does not have expertise, AES initiates workshops and short courses for the farming community. CES staff members review AES proposals for formula funding.

Certified by:

James Rakocy, Director

Date