FY 2004 Annual Report of Accomplishments and Results

Agricultural Experiment Station, University of the Virgin Islands

Submitted by:

Dr. R.W. Godfrey, Acting Director
Agricultural Experiment Station
University of the Virgin Islands
RR 1 Box 10,000
Kingshill, St Croix VI 00850

Phone: (340) 692-4042
FAX: (340) 692-4035
Email: rgodfre@uvi.edu

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 MBRS-RISE program in collaboration with the division of Science and Math during the summer session. The students conducted research projects on sheep behavior and physiology and presented their results at regional and national meetings and within UVI. One student in the National Student Exchange program also conducted a research project in the lab for class credit and presented her data at a regional conference. Collaboration between UVI-AES and Mississippi State University was continued as part of two regional projects (S-299 and S-1013). Outreach activities included fertility evaluations of Senepol bulls for producers as well as technical support for managing breeding programs for local sheep producers. A collaborative effort between the Animal Science Program, the VI Dept of Agriculture Veterinarian and VI farmers resulted in a group of sheep and goats being donated and transported to Heifer Project International in Haiti. This resulted in an influx of high quality genetics into the sheep and goat flocks of Haiti. A student from American University in Haiti spent two months in the VI learning about animal health and production from the VI Department of Agriculture Veterinarian and the UVI-AES Animal Science Program. As part of a germplasm exchange program, sheep from the UVI flock were sent to Virginia State and sheep from Virginia State flock will be sent to the UVI flock next year.

The AES Aquaculture Program annual short course (Aquaponics and Tilapia Aquaculture) attracted 33 students from three U.S. territories (Virgin Islands, Puerto Rico and American Samoa), 12 states (Alabama, Arizona, California, Florida, Georgia, Illinois, New York, Oregon, Pennsylvania, Texas, Washington and West Virginia) and five countries (Canada, Dominican Republic, Grand Cayman, St. Martin and South Africa). A student from the short course subsequently constructed a commercial facility in Illinois using the aquaponic technology developed at UVI. A presentation on aquaponics was given to a UVI science class with 14 students. An aquaponic workshop and a greenwater tank culture workshop were given at the American Samoa Community College. About 28 people attended each workshop. A workshop on aquaponics was given to the St. Croix farming community (18 people attended). A seminar on aquaponics was presented to approximately 20 people at Birbie Island in Queensland, Australia. A seminar on aquaponics and greenwater tank culture was presented to an audience of 150 people at the Thailand Department of Fisheries at Kasetsart University, Thailand's main agricultural university. The Aquaculture Program continues to work with Michigan State University and the Asian Institute of Technology (AIT) through a CSRP grant in Pond Dynamics/Aquaculture and is overseeing a research grant to study the impact of tilapia introductions on native fish species in Bangladesh. The Aquaculture Program supervised a summer research project on aquaculture waste utilization for an undergraduate student, who presented the results at a UVI science fair.

The AES Biotechnology & Agroforestry Program worked with CES and the VI Department of Agriculture to host the 9th Annual Caribbean and Community Forestry Conference in June and the 40th Annual Caribbean Food Crops Society Meeting in July. These meetings brought together researchers from across the Caribbean and from the U.S. mainland to discuss and present their research results. The AES Biotechnology & Agroforestry Program, in collaboration with the division of Science and Mathematics, mentored to two students in the MBRS-RISE program. The students conducted plant research projects on the tissue culture micropropagation of pineapple and cassava.

The AES Horticulture Program continued to participate in the regional project on microirrigation working together with other universities in developing microirrigation technologies for protection of natural resources and optimum production. The horticulture program also conducted workshops for local farmers in vegetable, herbs and fruit crop production during the World Food Day and the VI Agriculture and Food Fair.

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 was as follows:

Type	Federal	Local Match
Hatch	$677,999	$339,000
Regional	$116,183	$62,225
McIntire Stennis	$51,263	$0

Key Theme - Animal Production Efficiency

a. A study was conducted to evaluate a method of measuring body temperature of Holstein cows under conditions of heat stress. Three dark (> 50 % black hair) and three light (< 50% black hair) pregnant, non-lactating cows were evaluated for 7 days while grazing pasture. Vaginal and subcutaneous temperatures were recorded using wireless data loggers. A data logger was used to measure environmental temperature and relative humidity which were then used to calculate temperature-humidity index (THI). All data loggers were synchronized and programmed to record at 5-min intervals. Mean, minimum and maximum THI was 78.9, 73.4 and 88.8, respectively, indicating that the cows were under heat stress during the entire 7-day period. Vaginal temperature was not different between dark and light cows (38.7 vs. 38.8 C, respectively). Dark cows had higher white coat temperatures than light cows (38.1 vs. 37.9 C, respectively) but there was no difference in temperature under black hair between dark and light cows. Vaginal temperature decreased by 0.25 C at night in dark and light cows. During the day there was no difference in subcutaneous temperature between dark and light cows (38.4 C) regardless of hair coat color. At night the dark cows had a lower subcutaneous temperature than the light cows (37.5 vs. 37.6 C) regardless of hair coat color.

b. Impact – Coat color did not appear to have a strong influence on the response of dairy cows to elevated environmental temperatures as measured by either subcutaneous or vaginal temperatures. The methods used for measuring subcutaneous and vaginal temperatures are useful as indicators of body temperature in heat stressed dairy cattle and will be used by cooperators in the multistate project.

c. Source of Federal Funds – Hatch Multistate Research

d. Scope of Impact - Multi-State Research
   . With Mississippi

Key Theme - Animal Production Efficiency

a. Dorper sheep are being used in the US Virgin Islands for crossbreeding with the local hair sheep breeds. The objective of this study is to evaluate the production traits of crossbred ewes (St. Croix White X Dorper) in an extensive management and accelerated lambing system. The crossbred ewes (n = 14; 9.6 mo of age at first breeding) were compared to an established flock of Barbados Blackbelly (n = 22; 38.2 mo of age) and St. Croix White (n = 21; 50.8 mo of age) ewes managed on guinea grass pastures. Breeding occurred in October 2003 and June 2004 and lambs were born

in March 2004 and November 2004, respectively. Breeding within each breed was done using crossbred, Barbados Blackbelly and St. Croix White rams for 35 d. Ovulation rate was determined by laparoscopy on d 7 to 9 after mating. Milk production was evaluated at 14-d intervals starting on d 7 throughout the 63 d lactation. Lambs were weaned at 63 d of age in May 2004 and January 2005. Ovulation rate was lower in crossbred than in Barbados Blackbelly or St. Croix White ewes (1.1 vs. 1.6 vs. 1.9, respectively). Number of lambs born at the first lambing was higher for St. Croix White than for Barbados Blackbelly or crossbred ewes (2.1 vs. 1.7 vs. 1.2, respectively) but there was no difference at the second lambing (1.6). The crossbred ewes had fewer multiple births at the first lambing than Barbados Blackbelly or St. Croix White ewes (18.2 vs. 63.6 vs. 90.5 %, respectively) but not at the second lambing. Litter birth weight was lower for crossbred than for Barbados Blackbelly or St. Croix White ewes at the first lambing (3.4 vs. 4.9 vs. 6.2 kg, respectively) but not at the second lambing. There was no difference in litter weaning weight of the first lamb crop but in the second lamb crop it was greater in crossbred than in Barbados Blackbelly or St. Croix White ewes (20.9 vs. 14.8 vs. 16.3 kg, respectively). Milk production of the ewes was similar among breeds during both lactations.

. Impact – Dorper sheep can be successfully used in a crossbreeding program under tropical conditions. Ewe productivity is lower as yearlings but careful selection within the flock made it possible to increase the lambing rate of the crossbred lambs. Producers in the VI have already incorporated Dorper genetics into their flocks which has resulted in larger lambs and more revenue from sales. Long term production of the crossbred ewes will be evaluated.

. Source of Federal Funds – Hatch

. Scope of Impact – State Specific

Key Theme - Animal Production Efficiency

. The objective of this study is to analyze the relationship between temperament score (1 = calm, no movement to 5 = highly agitated) and exit velocity (in m/s) in Senepol cattle. Exit velocity was measured using electric timers located just past the exit of the chute. Heifers (n = 65) and bulls (n = 23) on two farms were used. Heifers ranged in age from 1.5 to 18.4 mo and 83 to 295 kg and bulls were 2.3 to 9 mo of age and 74 to 295 kg. Temperament score was not different between bulls and heifers (1.4 vs 1.9). Exit velocity was higher in heifers than it was in bulls (2.1 vs 1.6 m/sec). In heifers and bulls there was no difference in exit velocity based on temperament score. The distribution of temperament score was different between bulls and heifers. All of the bulls had TS of 3 or less while heifers had temperament scores in each category of 1 through 5. There was no difference between farm in temperament score (1.8 and 2.2) but there was a difference in exit velocity (2.4 and 0.4).

. Impact – It is too early in the study to determine if there is any impact of the results on livestock production in the USVI.

. Source of Federal Funds – Hatch Multistate Research

. Scope of Impact – Multi-State Research
    . With Mississippi

Key Theme – Aquaculture

a. A third production trial was conducted with a unique, 1/20-acre tank (200 m^3) that treats the culture water through continuous aeration, mixing, daily solids removal and nitrification (ammonia and nitrite removal) in the water column. This technology is referred to as greenwater tank culture or a mixed suspended growth process. A ¾-hp, vertical-lift pump, tilted sideways, creates a circular rotation in the tank, which keeps organic particles (biofloc) in suspension. Nitrifying bacteria, attached to the biofloc, provides excellent water treatment. The tank is aerated with three additional vertical-lift pumps. Five thousand tilapia fingerlings (25/m^3) have been stocked. To prevent the19% mortality that occurred in the previous trial due to predation by herons, orchard netting has been installed around the perimeter. Two feet of netting has been erected vertically at the edge of the tank to remove heron perching sites. In the previous trial, the daily feed intake leveled off in the middle of the trial and declined slightly near the end in response to total suspended solids (TSS) levels increasing continuously through the trial and reaching an exceedingly high level of 1,960 mg/liter. Water movement was too rapid for solids to settle out, but water mixing was essential for good nitrification. A 500-gallon, cylindro-conical clarifier with a 60% slope and a 50-minute retention time was installed outside the tank and operated for the last 3 weeks of the previous trial. During that period, 792 lbs of solids (dry weight) were removed, and TSS levels decreased to 600 mg/liter. Several other water quality parameters improved, and the fish feeding response increased dramatically. In the current trial the external clarifier has been operated continuously from the start of the trial. TSS levels are currently at 260 mg/L midway through the trial. Water quality has been excellent, and the daily feed input continues to increase and is currently at its previous high. The concentration of nitrate-nitrogen, the end product nitrification, increased steadily throughout the previous trial to 707 mg/liter, a level that may reduce fish growth. The process of denitrification removes nitrate under anaerobic conditions. Two denitrification channels (100 ft x 4 ft x 2 ft deep) have been constructed next to fish rearing tank. Two side-streams of culture water are being circulated through the channels at retention times of 1 and 2 days. Nitrate-nitrogen concentrations are decreasing by approximately 20 mg/L in the 1-day retention channel and 40 mg/L in the 2-day retention channel. Nitrate-nitrogen levels in the production tank are currently at 165mg/L. The harvest in anticipated to be 7,500 lbs, an increase of 25% over the proceeding trial. This harvest would be 30 times greater than standard pond production.

b. Impact – Greenwater tank culture has the potential of replacing standard pond production in areas with limited water supplies because it requires only 3-4% of the water used in pond culture, and, unlike pond culture, it recovers solids and nutrients, which can be reused for field crop production. Greenwater tank culture is at a very early stage of adoption. One tank has been constructed and is in operation on the neighboring island of Antigua. Another greenwater tank was constructed in St. John at a vegetable farm. Nearly 500 hundred people were informed of this technology during the year through seminars, workshops and conference presentations. Researchers from Auburn University and Louisiana State University have expressed interest developing a multi-state research project on greenwater tank culture.

c. Source of Federal Funds – Hatch

d. Scope of Impact – State specific

Key Theme – Biotechnology

a. Tissue culture is being used to germinate the local orchid species which have become very uncommon in the wild. Multiple in vitro media are being evaluated to determine the best

environment for the germination and in vitro growth. The two remaining species grow in two diverse environments. One is terrestrial while the second is epiphytic. Each species has its specific tissue culture media constituents for seed germination and in vitro growth. Techniques are being developed for application of in-home orchid tissue culture.

. Impact – The local population has become aware of the need to conserve this native orchid. Through the local orchid society, enthusiasts are attempting to use the developed technique for orchid seed germination at home. One devotee plans to offer his orchids in auction on the internet.

. Source of Federal Funds – Hatch

. Scope of Impact – State Specific

Key Theme – Plant Germplasm

. Papaya is an important tropical crop in the Virgin Islands and throughout the tropical regions of the world. Over 65 varieties of papaya have been evaluated for production potential in the semi-arid tropical environment of the U.S. Virgin Islands. Breeding and selection continues toward the development of early bearing lines that initiate production within three feet of the ground as apposed to five to six feet for many commercial varieties. The populations of the Caribbean have a preference for papaya of the two pound or larger size whereas the commercial varieties produce fruit one half to one pound in size. Seeds of selected, early bearing lines are made available to farmers and backyard growers.

The U.S. Virgin Islands has populations of rare native trees that can be found on the local endangered species list as well as one found on the federal endangered species list, *Buxus vahlii*. A hillside plot was established to evaluate growth under no maintenance on calcareous soils. Eleven species of rare native trees was established three years ago. The results have revealed those trees which actively grow and attain heights of over ten feet within ten years. The focus is now on the native palms, the royal palm (*Roystonea borinquena*), Puerto Rican hat palm (*Sabal causiarium*) and the thatch palm (*Coccothrinax argentea*).

a. Impact – Farmers have returned year after year to purchase seed that produces quality fruit for them in our local environment. The acreage of papaya has increased and over four hundred papaya seed packets were distributed to farmers and backyard growers. Requests for seeds has also occurred from neighboring islands in the Caribbean that have tried the selected papaya lines and found them superior to what was available on their island.

Native trees are being grown and planted along roadsides and into landscapes. Local nurseries have started growing the rare native species that have landscape potential and have been shown to tolerate the semiarid environment with little care and maintenance. The public perception of the rare native trees has grown with their willingness to buy and plant these trees in their landscapes instead of using exotic species.

a. Source of Federal Funds – Hatch and McIntire Stennis

a. Scope of Impact – State Specific

Key Theme - Plant Germplasm

a. A two-year study assessing the physiological components and response of three mature guinea grass (*Panicum maximum*) cultivars (cv. Local, Tanzania, and Mombassa) by season (wet and dry) and nitrogen fertilization is currently in its first year. As grass stands mature their ability to produce optimum levels of nutrient rich biomass decreases. This project is assessing the nutrient depletion cycle of mature guinea grass stands. Three different levels of fertilization are being compared; chemical inorganic nitrogen, rum distillery effluent, and an organic sheep manure tea. Fertilization rates are being made to a balanced nitrogen level. Physiological components measured are: plant height, dry matter (DM) herbage, and nutritive value [crude protein (CP) and in vitro organic matter disappearance (IVOMD)]. Grass cultivars are harvested at six-week intervals during both the dry and wet season. This study is currently ongoing, but preliminary results indicate that both cultivars introduced (cv. Tanzania and Mombassa) exhibit increased DM production, have a lower stem to leaf ratio, have greater crown area, and show increase tillering at mature ages as a result of nitrogen fertilization and do not show a significant difference as a result of fertilization method. It is recommended that guinea grass cultivars Tanzania and Mombassa be incorporated into local and regional pasture management practices and used as stand-over forage in dry heavy clay conditions and can maintain acceptable nutrient and biomass levels into advanced maturity through alternative fertilization methods.

A two-year study assessing the physiological components and production parameters of *B. brizantha* cv. Marandu and the recently released *B. brizantha* cv. Mulato by wet and dry season effect and nitrogen fertilization is currently in its first year. As grass stands mature their ability to produce optimum levels of nutrient rich biomass decreases. This project is assessing the nutrient depletion cycle of mature *B. brizantha* cv. Marandu and cv. Mulato stands. Three different levels of fertilization are being compared; chemical inorganic nitrogen, rum distillery effluent, and an organic sheep manure tea. Fertilization rates are being made to a balanced nitrogen level. Physiological components measured are: plant height, sward width, stem/leaf ratio, number of inflorescence, crown area, number of tillers, dry matter (DM) herbage, and nutritive value [crude protein (CP) and in vitro organic matter disappearance (IVOMD)]. Initial results of this study indicate that *B. brizantha* cv. Mulato is suitable forage for dry heavy clay conditions with increased forage quality.

b. Impact- An improvement in physiological forage traits was noted for guinea grass cvs. Tanzania and Mombassa as a result of nitrogen fertilization on mature stands. Bracharia cv. Mulato exhibits physiological and growth production traits suitable for introduction into local livestock production as a viable forage feed source with increased nutritional components over existing forage grasses and can continue to provide nutrient rich biomass into later years of maturity. Seed material of Bracharia cv. Mulato and guinea grass cvs. Tanzania and Mombassa have been made available to local farmers. Local farmers are being advised on alternative fertilization methods and the benefits therein.

c. Source of Federal Funds- Hatch

d. Scope of Impact- State specific

Key Theme - Plant Production Efficiency

a. Water requirement of table and cooking bananas in the Virgin Islands is high due to high temperatures and seasonal wind velocity. These climatic conditions result in high evapotranspiration rates. Limited water resource is a major constraint to crop production. Micro-sprinkler irrigation is an efficient method and technique in conserving water resource in the

Virgin Islands. Using minimum and optimum micro-sprinkler irrigation rates (regimes) reduced total water use of cooking bananas by as much as 50 percent compared to conventional method of irrigation. Plant growth, however, was the same with different micro-sprinkler irrigation regimes (every day, every other day, and every three days). Micro-sprinkler irrigation cut irrigation water cost and increased economic returns.

b. Impact - Small-scale banana production in the Virgin Islands is expanding due to increasing local demands. Efficient water use through micro-sprinkler irrigation will further extend the area into production. Local farmers started using micro-sprinklers in their banana plantation for efficient water use and reduced cost.

. Source of Federal Funds – Hatch Multistate Research

. Scope of Impact – State Specific

Key Theme - Plant Production Efficiency

a. Culinary herbs are high value crops in the Virgin Islands. In smallholder farming systems herbs and medicinal plants are integrated into home gardens where fruit and medicinal trees are component crops. Evaluation of popular culinary herbs grown under hedgerow intercropping system showed that marketable yields of most species were not significantly reduced during early establishment of hedgerows. Competition for soil moisture and light was not critical at this stage. Best and high yielding herbs were lemongrass, basil and blue verbena. Virgin Islands herb growers grow these herbs both under monoculture and mixed cropping systems.

b. Impact - Culinary herb production provides extra income to vegetable growers in the Virgin Islands. Increasing demands in local markets encouraged farmers to intensify production through intercropping with other high value horticultural crops such as fruit trees.

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 were conducted and input was 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 four ongoing multi-state research projects: 1) Plant Genetic Resource Conservation and Utilization (S-009), 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 has continued to work closely with the University of Puerto Rico and the University of Florida in the Tropical and Subtropical Agricultural Research Program (TSTAR). The Agronomy Program is a cooperator on a planning grant and a research grant through the SARE program in cooperation with Texas and Georgia.

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 50,000 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. In a collaborative effort AES and CES conducted a production short course for farmers to attend and become trained in the small ruminant livestock production and management. Participants applied what they had learned to enhance their sheep and goat farming operations.