2010 University of the Virgin Islands Research Annual Report of Accomplishments and Results

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I. Report Overview

1. Executive Summary

The work conducted by AES scientists is production oriented. The small size of AES and limited physical and fiscal resources limit our ability to expand into new research areas. One way of addressing this issue is developing collaborations with other departments and institutions. AES has continued to collaborate with the other insular land grant institutions as a member of the CariPac consortium to obtain funds for student support and just this year distance education. The Resident Instruction funds at UVI are used to support students who conduct research projects in AES labs and present their results at local, regional and national conferences. The Distance Education funds will be used to enhance and strengthen the infrastructure. The Horticulture faculty position was advertised and several interviews were conducted. A suitable candidate has been identified and we are in the process of getting them to UVI. Because of scheduling conflicts is hoped that the person will be on site by June 2011.

The Animal Science Faculty continued collaboration with CES colleagues at the University of Hawaii to conduct livestock production workshops in Guam and the Northern Marianas Islands as part of a USDA NIFA grant from the Disadvantaged Farmer/Rancher Program. Using information generated at UVI, training and workshops are being developed to provide assistance to livestock producers in the Pacific Islands. A new grant was submitted through the Office of Outreach and Assistance to expand the work to Palau and Pohnpei in the Pacific.

Three undergraduate students were mentored in the Animal Science Program research lab. All of the students were enrolled in Pre-Vet programs at their stateside institutions, but two of the students were from the VI. All three students were supported by funds from the Insular Grants Program for Resident Instruction. The students conducted work that was part of an ongoing TSTAR project and two Multistate research projects (S-1045 and W-1173). Two students submitted abstracts that will be presented at the Feb 2011 Southern Section meeting of the American Society of Animal Science. One student will present her results at the Annual Biomedical Research Conference for Minority Students conference on Nov 2011.

Work continues on a USDA-NIFA TSTAR project to evaulate the genetic com[ponent of heat tolerance in Senepol cattle in collaboration with U of Florida. Cattle have been genotyped for the presence of the Slick Hair gene and crossbred calves produced to evalaute the impcat of the gene on coat characteristics and body temeparture.

The Research Analyst managing the sheep research facility has been filled and the new person started in June 2010. This will help the program to advance by allowing daya to day chores to be done by the assistant instead of by the faculty.

The Forage GAronomy program had a collaborative SARE grant with Texas AgriLife Research (Texas A&M University System) evaluated the use of small ruminants as a biological control agent for corral vine (Antigonon leptopus), an invasive ornamental prevalent on most Caribbean islands). Results indicate that coral vine can be controlled by small ruminant grazing if livestock are conditioned to the plant and are grazed in high density for short rotational periods.

Forage Agronomy collaborated on a USDA-NIFA-SARE grant the University of Puerto Rico, Mayaguez . This research will examine the efficacy of condensed tannin rich tropical legumes on internal parasitism in small ruminants. In initial trials consumption of calliandra was limited due to either limited exposure of the lambs to calliandra or poor palatability of the calliandra. Lambs in the control group exhibited severe internal parasite infections due to extremely high rainfall and the experiment was terminated. The calliandra hedgerows were coppiced and allowing to re-grow so the trials can resume in the spring of 2011.

The collaborative USDA-CSREES-T-STAR grant between Forage Agronomy and the University of Florida and USDA, ARS, Cattle Tick Fever Research Laboratoryin Edinburg, TX resulted in numerous live tick collections that resulted in 5 successful shipments of live ticks collected from 5 different cattle herds on St. Croix. Ticks will be evaluated for pesticide (acaricide) resistance status of the southern cattle tick, Boophilus microplus, a highly capable vector of bovine babesiosis. The Agronomy Program cooperated the Head of Veterinary Services for the V.I. Department of Agriculture in collecting B. microplus from local cattle herds. The emergent larvae, through live bioassay protocols are currently being evaluated for organophosphate, fipronil and ivermectin genetic resistance.

Stuart Weiss, Acting Agronomy Program Leader continues to pursue a Doctor of Philosophy degree in Horticultural Science with an emphasis in agroecology and organic crop production at the University of Florida Horticulture Department. Mr. Weiss is in the process of compiling dissertation data into publication format for journal submission.

The Biotechnology and Agroforestry program made a strong effort to work with farmers and conducted research trials on four independent farmer's plots. This outreach and collaboration with farmers assists them in seeing and working with new technologies and varieties being evaluated. These stakeholders then apply the technology to their situation and communicate positively of the work being conducted by UVI-AES Biotechnology & Agroforestry program. AES benefits by conducting plant evaluations under varying soil and locations. Though off campus plots require more time and effort the rewards are mutual.

Biotechnology & Agroforetry was successful in obtaining grants from the USGS-WRRI, USDA-TSTAR, two from the USDA-SCBG and two from private sources. Through these grant proposals collaboration exists with UVI-CES, the VI Department of Agriculture, local farmers, USDA, University of Florida-IFAS, Ventria Biosciences and Pan American Seeds. These collaborations provide expertise in areas that UVI doesn't have.

Sixteen years of payaya research and breeding has resulted in one line selected by a private seed company to license and distribute. The payaya line is a compact tree with early bearing fruit within three feet of the ground. The fruits are large, over two pound, red and sweet. This selection produces only fruit bearing trees and is void of nofruiting male trees.

UVI undergraduates conducted independent research in teh Biotechnology & Agroforestry program. Five students conducted research projects involving ELISA tests for viruses in sweet potato and papaya, seed germination in vitro and in situ of Hibiscus sabdariffa and papaya and sweet potato tissue culture. Students were able to take the results of their research and present it at local and national symposia which have won them awards. Results were presented at national and international conferences which provided for the development of collaboration between institutions.

The vacancy in Agroforestry funded through McIntireStennis was filled in late summer to reinvigorate the portion of the Biotechnology & Agroforestry program. The focus is on studying the rare native trees in the USDA to develop phenology of the trees and germination protocols. This information can be used by

local nurseries to grow trees native to this climate and reduce the import of nonnative trees.

The Horticulture Research Faculty position remained vacant for the third year but was managed by the Biotechnology & Agroforestry program. Beets were a focus throughout the year because the multi-use of the plant for the greens and tuberous roots as well as tolerance to high pH calcareous soils. Cucumbers and honeydew melons were evaluated for production potential and tolerance to local diseases. A suitabel candidate has been identified and will start in July 2011.

The AES Aquaculture Program conducted its 12th International Aquaponics and Tilapia Course during June 13-19. This year's course was attended by 96 students from 23 U.S. states (Alabama, Arizona, California, Colorado, Connecticut, Florida, Georgia, Iowa, Kansas, Kansas, Kentucky, Louisiana, Maryland, Michigan, North Carolina, New Jersey, New York, Oregon, Pennsylvania, Rhode Island, South Carolina, Tennessee, Texas, Virginia), St. Croix, St. Thomas, Puerto Rico and 19 other countries (Antigua, Argentina, Bahamas, Botswana, BVI, Canada, Colombia, England, France, Ghana, Jamaica, Mexico, Netherlands Antilles, Peru, Saipan, Singapore, St. Lucia, Trinidad and Tobago, United Arab Emirates). Over 11 years the Aquaculture Program has trained 510 students from 42 US states and territories and 53 other countries.

This year marked the 10th year that the Aquaculture Program Leader (Dr. James Rakocy) has written a Question and Answer Column for Aquaponics Journal, a quarterly trade publication with 2,500 subscribers. The advice given is very detailed and has helped the questioners and other interested readers improve their aquaponic systems. Aquaponics Journal is preparing a book containing the 9-years of questions and answers. As a result of increased demand for small-scale aquaponic systems, the consulting arm of Aquaponics Journal fabricates and sells aquaponic systems based on the UVI design.

Dr. Rakocy was invited to speak by the University of Hawaii. He gave a presentation at the Hawaiian Aquaculture and Aquaponics Association annual meeting. He then co-taught a 4-day International Aquaponics course. Hawaii has 18 businesses using aquaponic systems following the UVI design. A participant from the 2007 course has been actively teaching the technology. Dr. Rakocy also gave aquaponic and biolfoc presentations at the annual World Aquaculture Society meeting in San Diego, CA. Research Specialist R. Charlie Shultz gave a presentation at the Eight International Conference on Recirculating Aquaculture in Roanoke, VA.

The Aquaculture Program conducted biofloc system research in which waste slurry water was filtered through a Geotube and the filtrate returned to the rearing tank. This recovers the water resource and provides a saving for a farmer. It also eliminates the need to discharge waste into public water or sewer systems. A biofloc production trial was completed in a 18,500-gallon tank. Tilapia fry were stocked in this tank and fed by a fixed feeding table with bi-weekly adjustments. Labor cost savings can be achieved by a farmer using a fixed feeding table vs. ad libitum feeding but feed conversion ratios may be higher and offset the advantage.

Aquaponic system research evaluated a swirl separator for the removal of solid waste. A swirl separator has a smaller footprint and simple installation compared to the cylindro-conical clarifiers to which they were compared. They were as efficient as the clarifiers and there were no differences in production of either tilapia or water spinach. Three vegetables were evaluated in the commercial aquaponic system over a period of 12 weeks. Sorrel (Hibiscus sabdariffa), cucumber (Cucumis sativus), and chives (Allium schoenoprasum) were cultured testing different culture practices for each. Sorrel can be picked in one full harvest as weekly harvests do not stimulate additional flowering to produce more sepals. Cucumber can be grown densely without pruning to product the greatest number of fruits. Disease and insect damage were not observed at a higher rate than for less densely planted plants or for pruned plants. Chives should be harvested after five weeks as the biomass can double during the final week of production.

The Aquaculture Program is providing technical assistance to the Virgin Islands Bureau of Corrections, which constructed two, 50,000-gallon tilapia production systems based the biofloc technology developed at UVI. These tanks were stocked with 5,000 tilapia fingerlings each. Inmates were trained in feeding and pH management and monitored the growth of the fish.

Total Actual Amount of professional FTEs/SYs for this State

Year: 2010	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	18.0	0.0
Actual	0.0	0.0	17.0	0.0

II. Merit Review Process

1. The Merit Review Process that was Employed for this year

- Combined External and Internal University External Non-University Panel

2. Brief Explanation

There has been no change made to the process as described in the initial Plan of Work submitted. 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 and merit 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. Scientists are required to publish their results but sometimes the project is completed before the PI has time to publish the results in a peer reviewed journal, so there is a lag between the project and publications. Because of the small staff size and amount of non-research related work each faculty and staff member end up doing, finding time for writing is difficult for some faculty but we are looking at methods to remedy this, such as collaborating with other institutions to train graduate students and put more emphasis on outputs such as publication in the Faculty Annual Evaluation process.

III. Stakeholder Input

1. Actions taken to seek stakeholder input that encouraged their participation

- Use of media to announce public meetings and listening sessions
- Targeted invitation to traditional stakeholder groups
- Targeted invitation to non-traditional stakeholder groups
- Targeted invitation to traditional stakeholder individuals
- Targeted invitation to non-traditional stakeholder individuals
- Targeted invitation to selected individuals from general public

Brief explanation.

The AES Advisory Council meets 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. The Advisory Council is composed of individuals involved in several aspects of agriculture (horticulture, livestock, and farmer's co-ops) from both St. Croix and St. Thomas. When needed, new members are recruited by the AES Director based on suggestions of the research faculty and existing members of the council. Research faculty present information on current projects and members of the Advisory Council express their concerns and opinions about what they see as the needs of the agriculture community. Issues are prioritized within discipline based on the input of the Advisory Council members in their role as representatives of the agriculture community.

The council was told that the Cooperative Extension Service has offered short courses in both plant and animal production to local farmers, with the assistance of AES faculty. Other specific issues within a field of study brought up by the Advisory Council were discussed with the appropriate research faculty. Research faculty use the feedback from the council when developing future grants and research projects. Priority is given to those ideas that are researchable within the capabilities of the research programs at AES and funding sources. Because of the small staff size and limited scope of our programs not all areas can be addressed. In cases where the topic is outside of the AES faculty area of expertise efforts are made to get information for the stakeholders from other sources and put the stakeholders in contact with other people, either within UVI or outside, who can provide assistance. The small community and high level of contact with farmers help to provide 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. The demographics of the USVI are such that all of our stakeholders would qualify as under-served or under-represented populations based on factors such as race, gender, economic status and farm size. Workshops and seminars on various topics (horticulture, animal science, aquaculture and agronomy) were conducted and feedback was received from individuals, cooperatives and agribusinesses. Question and answer sessions at each event are used to allow the community to bring up issues that they feel are important to the agriculture community and this allows the AES scientists to get input on their research as well. 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) in conjunction with the appropriate CES personnel.

2(A). A brief statement of the process that was used by the recipient institution to identify individuals and groups stakeholders and to collect input from them

1. Method to identify individuals and groups

- Use Advisory Committees

Brief explanation.

AES is available to any individual or group who approaches AES with a question or a proposed research idea. Some of these ideas come through the Advisory Council, whose members are on other community groups or co-ops and bring them forward at the meetings. In some cases AES faculty have to mention that we are here for research and we direct people with questions or concerns about outreach activities to the appropriate Cooperative Extension Service staff.

2(B). A brief statement of the process that was used by the recipient institution to identify individuals and groups who are stakeholders and to collect input from them

1. Methods for collecting Stakeholder Input

- Meeting with traditional Stakeholder groups
- Meeting with traditional Stakeholder individuals
- Meeting with the general public (open meeting advertised to all)
- Other (Clients contact AES with specific requests)

Brief explanation.

Stakeholder input is collected by the pertinent program, depending on the source and area of interest. In many cases stakeholders come to AES faculty and staff with questions or concerns and we can provide an answer in short order. In other cases we are able to get them the information after doing a bit of searching. We are also able to direct them to outside resources such as the VI Department of Agriculture or other federal agencies or NGOs that may have the information they are seeking.

3. A statement of how the input will be considered

- To Identify Emerging Issues
- Redirect Research Programs

Brief explanation.

Input is used when developing future research projects. In some cases an idea is not really researchable but we make an effort to provide some feedback to the stakeholder on these topics. In other cases where there is a researchable idea brought to us we can incorporate it into current projects or into new projects. Sometimes the lag time between getting an idea and being able to implement the research project to come up with an answer is frustrating to the stakeholders, but when the information is finally generated they are glad to have it.

Brief Explanation of what you learned from your Stakeholders

There is still some confusion about the roles of AES and CES in the eyes of the stakeholders, both internal and external. The local community as well as the central administration of the University are still not clear on the separate functions of AES and CES as part of the land grant system. In many cases stakeholders approach AES about outreach activities and we have to direct them to the CES offices. In addition, there is still pressure from the central administration for AES faculty and staff to conduct outreach activities in spite of there being no joint appointments between AES and CES that would allow us to do these activities.

We also learned that our stakeholders have very specific ideas of what they would like to see AES doing. They provide valuable input on crop varieties that they would like to see evaluated for local production as well as issues relating to minimizing water usage for crop production.

IV. Expenditure Summary

1. Total Actual Formula dollars Allocated (prepopulated from C-REEMS)			
Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	951922	0

2. Totaled Actual dollars from Planned Programs Inputs				
	Extension		Research	
	Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
Actual Formula	0	0	709442	0
Actual Matching	0	0	384828	0
Actual All Other	0	0	0	0
Total Actual Expended	0	0	1094270	0

3. Amount of Above Actual Formula Dollars Expended which comes from Carryover funds from previous				
Carryover	0	0	0	0

V. Planned Program Table of Content

V(A). Planned Program (Summary)

Program # 1

1. Name of the Planned Program

Aquaculture - Aquaponic Systems

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
205	Plant Management Systems			30%	
307	Animal Management Systems			35%	
403	Waste Disposal, Recycling, and Reuse			35%	
	Total			100%	

V(C). Planned Program (Inputs)

1. Actual amount of professional FTE/SYs expended this Program

Year: 2010	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	2.0	0.0
Actual	0.0	0.0	2.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	119458	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	60255	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

- Conduct research project
- Provide training

- Present data at conferences
- Publish results in scientific journals

2. Brief description of the target audience

The audience for this research consists of local farmers as well as national and international farmers, entrepreneurs, researchers and development workers.

V(E). Planned Program (Outputs)

1. Standard output measures

2010	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	92	0	0	0

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year: 2010

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2010	Extension	Research	Total
Actual	0	0	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Abstracts presented at conferences

Year	Actual
2010	3

Output #2

Output Measure

- Journal articles

Year	Actual
2010	0

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of new farmers anywhere adopting aquaponic technology

Outcome #1

1. Outcome Measures

Number of new farmers anywhere adopting aquaponic technology

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	2	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Interest in aquaponics is expanding rapidly and the scope is global as indicated by the number of people who took the UVI aquaponics course (92). A former student has been offering aquaponic courses in Hawaii which has led to the development 14 aquaponic farming operations there. A student from Pennsylvania offered an aquaponic training course and will be marketing systems.

What has been done
Production of two vegetable crops was evaluated in the aquaponic system. Sorrel (Hibiscus sabdariffa) and chives (Allium schoenoprasum) were grown and marketable product weighed to determined production per square meter. Two harvest strategies were employed for sorrel: weekly for 5 weeks vs. one complete harvest. This was to determine if harvesting mature sepals would stimulate more flowering and higher yield. Chives were grown for either 4 or 5 week periods and the biomass measured for each.

An experiment was conducted to evaluate a swirl separator verses a cylindro-conical settling clarifier for the removal of solid waste from an aquaponic system. The objective was to see if there is a solids removal device that works better and uses less space (i.e., a smaller footprint)than the clarifier. Three replicated aquaponic systems were set up with settling clarifiers and three were set up with swirl separators. Water spinach (Ipomoea aquatica) was grown in the system during the trial. The systems were evaluated over a 10-week production period.

Results
Sorrel yielded 2.8 kg/m2 for multiple harvest plants and 2.6 kg/m2 for single harvest plants. The difference is not appreciable compared to the labor required and a recommendation for one single harvest can be made. Chives harvested at 4-week intervals weighed 24 g/bunch vs. 47 g/bunch for plants grown for 5 weeks. This size difference would translate into a different sales price and

higher overall revenues for the farm even with fewer annual harvests each year.

After these two devices were operated for 10 weeks in replicated aquaponic systems, there was no difference between treatments for water quality, fish production or the production of water spinach. Spinach production per unit area was 23 kg/m2 over the duration of the experiment. The swirl separator was simple to operate. Flow rate through the clarifier was low and the device needs to be tested on the Commercial Aquaponic System to test the upper limits of its capabilities.

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems
307	Animal Management Systems
403	Waste Disposal, Recycling, and Reuse

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes

Brief Explanation

V(I). Planned Program (Evaluation Studies and Data Collection)

Evaluation Results

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 2

1. Name of the Planned Program

Aquaculture - Biofloc Systems

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
307	Animal Management Systems			60%	
403	Waste Disposal, Recycling, and Reuse			40%	
	Total			100%	

V(C). Planned Program (Inputs)

1. Actual amount of professional FTE/SYs expended this Program

Year: 2010	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	1.5	0.0
Actual	0.0	0.0	1.5	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	160048	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	0	145247	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

- Conduct research
- Conduct training

- Present data at conferences
- Publish results in scientific journals

2. Brief description of the target audience

The audience for this research consists of local farmers as well as national and international farmers, entrepreneurs, researchers and development workers.

V(E). Planned Program (Outputs)

1. Standard output measures

2010	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	92	0	0	0

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year: 2010
Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2010	Extension	Research	Total
Actual	0	0	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Abstracts presented at conferences

Year	Actual
2010	2

Output #2

Output Measure

- Journal articles

Year	Actual
2010	0

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of new farmers anywhere adopting biofloc technology

Outcome #1

1. Outcome Measures

Number of new farmers anywhere adopting biofloc technology

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	2	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Farmers in the Virgin Islands and elsewhere in the world want to raise tilapia using new intensive biofloc technology that reduces land and water use by 97% and recovers solid and nutrient wastes. The demand for fish is increasing while world fisheries are on the decline. Biofloc technology can play an important role for producing tilapia in tropical regions. The feasibility of this technology has been clearly demonstrated and farmers are interested in adopting it. However, capital costs are a concern for island farmers who have limited resources.

What has been done
A production trial was conducted in a 70 m3 tank known as a quick tank. An aerator, blower, water pump and external clarifier were installed. The 9.1-m (30 ft) diameter tank was stocked with 1,799 Red tilapia fingerlings, (6.8 grams/fish). The initial size was small to replicate conditions a farmer might encounter if they were purchasing tilapia fry from a supplier. A feed table with a prescribed amount of feed per day was used as a feeding regime. The table assumed a daily amount consumed based on the biomass of the fish population and an assumed feed conversion ratio. The table was adjusted biweekly. A fixed feed table will save time and reduce labor costs but does not account for fish response to water quality and can contribute to over and/or under feeding. The fish were fed for 7.5 months and harvested.

A production trial was conducted in a 200 m3 tank. The tank was stocked with 5,000 Nile tilapia fingerlings. The sludge water discharged from this system was filtered through a Geotube and the filtered water was returned to the fish rearing tank, thereby reducing the amount of waste water discharged into the environment. The fish were grown for nearly 6 months before a power outage caused an oxygen depletion and loss of most of the fish.

Results

After a 7-month grow-out period in the quick tank the red tilapia had reached an average size of 435 g/fish. Production of 9.8 kg/m3 was achieved. Red tilapia are more sensitive to poor water quality and there were frequent periods when they did not feed on the amount of food administered. Further refinement of feed requirements for fish at various sizes is needed so that over feeding does not occur and contribute to poor water quality.

Results were very promising for the production trial in the 200 m3 tank despite the loss of fish at the end of the experiment. The sludge removed, 26.9 m3 was filtered in the Geotube and 26.1 m3 of water was returned to the culture tank. This filtrate water was high in ammonia and nitrite but was assimilated into the system by the nitrifying bacteria and caused not appreciable deterioration of water quality in the rearing tank. The death of the fish due to power failure highlights the need for redundant emergency systems for power and aeration.

4. Associated Knowledge Areas

KA Code	Knowledge Area
307	Animal Management Systems
403	Waste Disposal, Recycling, and Reuse

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes

Brief Explanation

St. Croix received over 80 inches of rain in 2010 which contributes to dilution of measured water quality parameters in the biofloc system.

V(I). Planned Program (Evaluation Studies and Data Collection)

Evaluation Results

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 3

1. Name of the Planned Program

Irrigation

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
102	Soil, Plant, Water, Nutrient Relationships			15%	
111	Conservation and Efficient Use of Water			25%	
132	Weather and Climate			15%	
205	Plant Management Systems			20%	
405	Drainage and Irrigation Systems and Facilities			25%	
	Total			100%	

V(C). Planned Program (Inputs)

1. Actual amount of professional FTE/SYs expended this Program

Year: 2010	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	2.0	0.0
Actual	0.0	0.0	2.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	26152	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	12987	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

- Conduct research projects
- Present data at conferences
- Publish results in scientific journals

2. Brief description of the target audience

The target audiences are the local crop farmers and back yard growers. These producers normally have less then two acres under production. The Virgin Islands has only three producers with total production acreage over two acres.

V(E). Planned Program (Outputs)

1. Standard output measures

2010	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	0	0	0	0

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year: 2010

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2010	Extension	Research	Total
Actual	0	0	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Abstract presented at conference

Year	Actual
2010	0

Output #2

Output Measure

- Research publications

Year	Actual
2010	0

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of farmers adopting irrigation strategies based on soil moisture

Outcome #1

1. Outcome Measures

Number of farmers adopting irrigation strategies based on soil moisture

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	2	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Water is a rare commodity on a semiarid island and the Virgin Islands stakeholders are concerned to use this precious resource as efficiently as possible. Fertigation and chemigation are new technologies for utilizing a drip irrigation system to apply fertilizer and pesticides.

What has been done
Cucumbers and honeydew style melons were grown in a variety trial that incorporated fertigation and chemigation. All fertilizer was applied through the drip irrigation system during the production of the crop. Chemigation was used when the pesticide needed could be applied through the irrigation stream.

Results
Using fertigation was an efficient method of applying low fertilizer dosage over the life of the crop. This resulted in better plant growth and production during the crop life over a single application of granular fertilizer at planting. Also the fertigation allowed for changing the fertilizer formulation over time to more efficiently meet the needs of the growing plants. Chemigation was useful, effective and safer to apply then the regular spray application. However, this technology is limited in pesticides available to use and timing of application.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
132	Weather and Climate
205	Plant Management Systems

405 Drainage and Irrigation Systems and Facilities

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes

Brief Explanation

V(I). Planned Program (Evaluation Studies and Data Collection)

Evaluation Results

Stakeholders came to see and ask questions regarding the fertigation and chemigation system. The initial investment is higher but the management of water and fertilizer is more efficient.

Key Items of Evaluation

Two stakeholders purchased an injector system to incorporate into their drip irrigation system in order to utilize fertigation and chemigation.

V(A). Planned Program (Summary)

Program # 4

1. Name of the Planned Program

Horticulture

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
102	Soil, Plant, Water, Nutrient Relationships			25%	
133	Pollution Prevention and Mitigation			15%	
202	Plant Genetic Resources			20%	
205	Plant Management Systems			30%	
216	Integrated Pest Management Systems			10%	
	Total			100%	

V(C). Planned Program (Inputs)

1. Actual amount of professional FTE/SYs expended this Program

Year: 2010	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	2.0	0.0
Actual	0.0	0.0	2.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	24627	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	21500	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

- Conduct research
- Present data at conferences
- Publish results in scientific journals

2. Brief description of the target audience

The target audiences are the local crop farmers and back yard growers. These producers normally have less then two acres under production. The Virgin Islands has only three producers with total production acreage over two acres.

V(E). Planned Program (Outputs)

1. Standard output measures

2010	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	0	0	0	0

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year: 2010

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2010	Extension	Research	Total
Actual	0	0	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Research publications

Year	Actual
2010	0

Output #2

Output Measure

- Abstracts presented at conferences

Year	Actual
2010	0

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of farmers using selected cultivars
2	Number of farmers adopting sustainable production systems

Outcome #1

1. Outcome Measures

Number of farmers using selected cultivars

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	10	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Beets and cabbage are vegetable crops in high demand but seldom grown resulting in high priced imports. Varieties needed to be evaluated to recommend those most appropriate for the Virgin Islands. Beets are a multi-use plant that has usable leaves as greens and tuberous roots. Cabbages have early, mid and late season types and no type is recommended for the Virgin Islands to assist farmers in which is the most productive to grow.

What has been done
Variety trials were conducted throughout the year with 16 varieties of beets. Beside the standard solid red beet, novel varieties were evaluated which included, yellow, white, red/white striped and elongated roots as well as green, red/green and solid red tops. Single row was compared with double row planting. Direct seed and transplants were evaluated. A variety trial utilizing 15 cabbage varieties, five for each early, midseason and late, were grown in a replicated trial

Results
All beets did well in the high pH calcareous soils throughout the year. Aphids were only a problem during early spring. The double row beet system was more efficient than the single row. The novelty of the nonsolid red beets had a higher marketable value though the production cost were similar. Consumer preference was for the solid red or the red/green beet tops which were used in salad or steamed. Beets could be grown year round if irrigation is available during the dry season. Cabbage can be a productive crop if it is closely monitored to control diamond back moth. A regular integrated pest control results in well formed heads. The early cabbage types didn?t form adequate heads that were solid. The midseason varieties out preformed the other two types.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
133	Pollution Prevention and Mitigation
202	Plant Genetic Resources
205	Plant Management Systems
216	Integrated Pest Management Systems

Outcome #2

1. Outcome Measures

Number of farmers adopting sustainable production systems

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	5	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Stakeholders are looking for low cost sustainable production because fertilizer and pesticide costs are high on these imported commodities

What has been done
Nothing this year with the vacancy in the Horticulture faculty position

Results
None

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
133	Pollution Prevention and Mitigation
205	Plant Management Systems

216 Integrated Pest Management Systems

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes

Brief Explanation

V(I). Planned Program (Evaluation Studies and Data Collection)

Evaluation Results

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 5

1. Name of the Planned Program

Plant Germplasm Conservation and Enhancement

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
202	Plant Genetic Resources			70%	
205	Plant Management Systems			30%	
	Total			100%	

V(C). Planned Program (Inputs)

1. Actual amount of professional FTE/SYs expended this Program

Year: 2010	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	1.5	0.0
Actual	0.0	0.0	1.5	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	118073	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	0	39358	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

- Conduct research project
- Sell papaya seeds to local framers
- Present data at conferences
- Develop fact sheets for local growers

- Publish results in scientific journals

2. Brief description of the target audience

The target audiences are the local crop farmers and back yard growers. These producers normally have less then two acres under production. The Virgin Islands has only three producers with total production acreage over two acres.

V(E). Planned Program (Outputs)

1. Standard output measures

2010	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	0	0	0	0

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year: 2010
Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2010	Extension	Research	Total
Actual	0	1	1

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of publications

Year	Actual
2010	1

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of local farmers growing selected plant varieties

Outcome #1

1. Outcome Measures

Number of local farmers growing selected plant varieties

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	1	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The local stakeholders have limited resources and access to new varieties of tropical plants and in some cases varieties are not commercially available as the case for sorrel and papaya seeds. Sorrel is a culturally important crop that is normally seasonal and in high demand. New varieties exist that are darker in color and day neutral but stakeholders don?t have access to them or know which is best for the Virgin Islands. Pineapple is a popular plant but varieties and plant availability are lacking.

What has been done
Thirty four sorrel lines have been obtained from the USDA Germplasm Repository and locally use in comparative production trials to assess quality and yield. Trials occurred both at AES facility as well as on-farm. The soils at AES are calcareous and have a higher pH, above 8.0, than most stakeholders fields. Planting date, as well as plant spacing were evaluated. Date was collected on height, branching, branch angles, date to flowering, calyx length, diameter and weight. Micropropagated pineapples from 16 varieties obtained from the USDA Germplasm Repository were established in pot and a fertilizer trial set to determine rate of growth to the flowering stage.

Results
The sorrel selected had a great amount of variability between lines. From one local farmer source, three distinct types were found, red, white and bronze. Two lines were dwarf plants that has potential for potted production for limited area stakeholders. One line had fruit 1.5 times the normal fruit length, however the color was not a deep red. Three lines appeared to be day neutral. Six lines were less day sensitive but not as photoperiodic as traditional lines that only flower in December. These six less photoperiod sensitive lines had sorrel production by Thanksgiving while the day neutral lines had sorrel production by late October. A late planting of sorrel in December resulted in even flowering on all sorrel lines and resulted in production in February. Because the later planted sorrel induces flowers early, is was found that a plant

spacing of either 8 or 16 inches was more efficient than the standard 24 inch spacing use in August planting.
Pineapple responded to foliar fertilizer application better that soil applied fertilizer. High nitrogen balanced fertilizer resulted in the most robust growth over the eight month trial.

4. Associated Knowledge Areas

KA Code	Knowledge Area
202	Plant Genetic Resources
205	Plant Management Systems

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes

Brief Explanation

Excessive rain and flooding delayed the early fall sorrel planting past the normal traditional time by stakeholders.

V(I). Planned Program (Evaluation Studies and Data Collection)

Evaluation Results

Stakeholders were skeptical of the December sorrel planting when grown on farmer's plots. However, when production came in out of the normal holiday season, the demand for the sorrel was high for fresh fruit and was easily marketed.

Key Items of Evaluation

Marketability of out of season sorrel.

V(A). Planned Program (Summary)

Program # 6

1. Name of the Planned Program

Plant Biotechnology

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
201	Plant Genome, Genetics, and Genetic Mechanisms			40%	
204	Plant Product Quality and Utility (Preharvest)			30%	
206	Basic Plant Biology			30%	
	Total			100%	

V(C). Planned Program (Inputs)

1. Actual amount of professional FTE/SYs expended this Program

Year: 2010	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	1.5	0.0
Actual	0.0	0.0	1.5	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	23462	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	26274	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

- Conduct research project
- Develop genetically enhanced plants

- Develop efficient micro-propagation systems
- Present data at conferences
- Develop fact sheets for the local population
- Publish results in scientific journals

2. Brief description of the target audience

The target audiences are the local crop farmers and back yard growers. These producers normally have less then two acres under production. The Virgin Islands has only three producers with total production acreage over two acres.

V(E). Planned Program (Outputs)

1. Standard output measures

2010	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	0	0	0	0

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year: 2010

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2010	Extension	Research	Total
Actual	0	1	1

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of publications

Year	Actual
2010	1

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of local farmers growing micro-propagated sweet potato, cassava and hybrid papaya

Outcome #1

1. Outcome Measures

Number of local farmers growing micro-propagated sweet potato, cassava and hybrid papaya

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	2	3

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Stakeholders have noticed production of sweet potatoes was declining with time and sorrel was seasonal. Early bearing papayas lacked red color which is a preference throughout the Caribbean.

What has been done
Sweet potatoes were collected from local farmer in 18 locations throughout the island of St Croix and screened for five common sweet potato viruses with ELISA. Micropropagated 28 virus-free sweet potato lines obtained from the USDA Germplasm Repository, since only one to three microcuttings were received. Micropropagation was necessary to increase plants to 150 for field trials. Studied systems for long term storage of in vitro virus free sweet stock through sucrose concentration modification. Screened papaya plants for three viruses using ELISA. Papayas samples were collected from four local stakeholders and the AES papaya germplasm collection. Made crosses between papaya to incorporate red color into Caribbean lines.

Results
ELISA tests indicated that sweet potatoes from the local growers were infected with 2 to 5 common sweet potato viruses. Sweet potatoes lines varied between lines for micropropagation efficiency and growth in vitro. Reducing the sucrose level from 30 g/L to 1 or 3 g/L controlled the rate of sweet potato growth in vitro but also kept them alive. Sweet potatoes were able to survive for one year without subculture on the reduced sucrose medium. After one year, explants from these long term stored in vitro sweet potato plants grew normally when put back onto 30 g/L sucrose containing tissue culture medium. Hybrid papayas have been developed with disease tolerance, good size and a red flesh color.

4. Associated Knowledge Areas

KA Code	Knowledge Area
201	Plant Genome, Genetics, and Genetic Mechanisms
204	Plant Product Quality and Utility (Preharvest)
206	Basic Plant Biology

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Other (Federal certification of transgenics)

Brief Explanation

Hurricanes and extended rains that caused flooding resulted in the papaya plot to be excessively wet and resulted in the plants becoming infected with phytophthora which destroyed the plants. Papaya is sensitive to waterlogged soils.

V(I). Planned Program (Evaluation Studies and Data Collection)

Evaluation Results

Stakeholders were surprised to discover that their sweet potatoes vines, which they have had for years were so infected with virus. They are eager to obtain the virus free material when it becomes available. The stakeholders have come to AES to buy papaya seeds in the small quantities that they need to grow in their small plots. Stakeholder have been satisfied with the papaya variety selections and are returning each year for fresh seed.

Key Items of Evaluation

Key evaluation items were rate of growth, height to first flower and first fruit, fruit set and quality for papaya. Plants were selected for tolerance to viruses.

V(A). Planned Program (Summary)

Program # 7

1. Name of the Planned Program

Agronomy - Mixed Cover-Crop Livestock Systems

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
101	Appraisal of Soil Resources			10%	
204	Plant Product Quality and Utility (Preharvest)			30%	
205	Plant Management Systems			30%	
302	Nutrient Utilization in Animals			10%	
307	Animal Management Systems			20%	
	Total			100%	

V(C). Planned Program (Inputs)

1. Actual amount of professional FTE/SYs expended this Program

Year: 2010	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	2.0	0.0
Actual	0.0	0.0	2.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	109138	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	36379	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

- Conduct research project
- Present data at conferences
- Publish results in scientific journals
- Conduct local and regional seminars

2. Brief description of the target audience

The target audience consists of local and regional farmers.

V(E). Planned Program (Outputs)

1. Standard output measures

2010	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	0	0	0	0

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year: 2010
Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2010	Extension	Research	Total
Actual	0	1	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Abstracts presented at conferences

Year **Actual**

2010	2

Output #2

Output Measure

- Articles published in scientific journals

Year	Actual
2010	0

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Outcomes will be measured by the number of local farmers that utilize cover crop technologies in mixed crop-livestock production systems and the number of farmers who use the tested cover crops for soil improvement and as livestock forage.

Outcome #1

1. Outcome Measures

Outcomes will be measured by the number of local farmers that utilize cover crop technologies in mixed crop-livestock production systems and the number of farmers who use the tested cover crops for soil improvement and as livestock forage.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	2	5

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Small farm holders operating under limited external input farming conditions depend on the production of a diversity of farm products to be sold and consumed on the farm and in the extended family community. This includes agronomic, horticultural, and livestock products that are produced in mixed crop-livestock systems. Cover crops can provide a crucial link between organic farming and livestock production. When planted during fallow periods between main crops, cover crops can improve soil physical, chemical, and biological properties and consequently lead to improved soil health and yield of principal crops. Livestock incorporation can provide valuable additional revenue to small holder farmers and can serve as a primary source of organic fertilizer through added manure production. This will result in closed system nutrient cycling where the farm is recycling nutrients from cover crop to livestock to cash crop. Therefore, cover crops may be able to serve to build and improve soils for cash crop production, as well as provide forage in the form of principle grazing, stored hay, cut and carry forage, or green chop for livestock production.

What has been done

A St. Croix White Hair Sheep feeding trial was conducted from January 2010 to April 2010 to examine the feed value of Sorghum sudan (var. mega mill) and crotalaria juncea hay. Sunn hemp (SH; Crotalaria juncea L.) has historically been cultivated as a multi-purpose fiber crop that has received increased interest as a cover crop and green manure in both temperate and tropical climates. Sunn hemp may serve as a useful livestock forage when harvested as hay from mixed crop-livestock systems. A pen trial measured growth traits of post-weaning St. Croix White hair (n = 36) lambs fed a mixed ration containing a concentrate diet (16% crude protein) fed at 2% body weight and either SH or sorghum-sudan hay (SS; Sorghum bicolor x S. sudanense cv. Mega

Green) fed ad-libitum for 84 days. Forage was evaluated for nutritional quality and digestibility. Both SH and SS were cultivated on St. Croix, USVI prior to the feeding trial as part of the mixed cover crop-livestock systems experiment.

Two experiments were initiated and established in August and September, 2009. Sorghum sudan (var. mega mill), crotalaria juncea, lablab purpureus (cv. Rio Verde), and mixtures of both sorghum sudan/lablab and sorghum sudan/crotalaria were planted at two different farming locations on St. Croix, US Virgin Islands. Comparisons were made between crops and weedy fallows for vegetative, root, and total biomass production based upon three different harvest dates. Plant tissue samples were collected for plant tissue nutrient analysis and soil samples were collected to determine any soil nutrient shifts as a result of main treatment effects. In August, 2010 this experiment was repeated at 1 location and the experimental design was because sorghum sudan/crotalaria bicultures were not as productive as monocultures under low-external-input conditions. Therefore, these treatments were excluded from the experiment and Sorghum sudan (var. mega mill), crotalaria juncea (cv. IAC-1), lablab purpureus (cv. Rio Verde), and a weedy fallow were evaluated in 5 x 10 m plots to determine vegetative and root/stubble biomass yields, root to shoot ratios, and the respective plant tissue nutrient partitioning levels. Only 1 harvest out of 3 proposed harvests was successful due to extreme herbivory from feral cattle.

Sorghum sudan (var. mega mill) and crotalaria juncea were cultivated on a large scale in single field monocultures to be harvested and stored as hay to be evaluated for feed and livestock production value in a subsequent small ruminant trial that took place initially in the spring of 2010 and which is scheduled to be repeated in Spring 2011.

Results

The field plots that were established on St. Croix, U.S. Virgin Islands in August 2009 in a split plot design to evaluate the effect of three cropping systems and two harvest dates on harvested forage and non-harvested root/stubble plant tissue nitrogen (N) and CC biomass. Systems tested were: 1) high crop complexity with 1 legume (HIGH-L) and 1 grass (HIGH-G) CC biculture, 2) intermediate crop complexity with 1 legume (MED-L) or 1 grass (MED-G) CC monoculture, and a control of 3) low crop complexity (LOW) of native grass monoculture. The legume CC was sunn hemp (Crotalaria juncea L.) [SH], the grass CC was sorghum-sudangrass (Sorghum bicolor x S. sudanense L. cv Mega Green) [SS], and the control plots were volunteer native guinea grass (Panicum maximum Jacq.) [GG] CC. Harvest 1 was conducted 60 days after planting (DAP) and harvest 2 took place 105 DAP, both harvests represented a CC with forage removal. Statistical analysis was performed by system complexity and harvest using PROC MIXED (SAS). The SS (Med-G) monoculture harvested biomass yield was 4,787 and 4,698 kg ha-1 at harvest 1 and 2, respectively, which was greater than all other CC forage biomass at harvest 1, but was similar to GG forage biomass with 4,565 kg ha-1 at harvest 2 (P ≤ 0.05). Root/stubble biomass for SS (Med-G) produced 1,296 kg ha-1 in harvest 1; however, harvest 2 GG produced the greatest root/stubble biomass at 3,448 kg ha-1 (P ≤ 0.05). Sunn hemp (Med-L) had the numerically highest vegetative N level (3.9 % N DM basis), but had the lowest root/stubble N (1 % N DM basis). Guinea grass had the highest root/stubble N percent at all harvests with a range of 2.1 to 2.8 % N DM basis. Lab lab (cv. Rio Grande) failed to establish for plantings and will not be a lab lab cultivar recommended to local farmers for either a cover crop or a forage crop. Overall, N concentrations declined for forage biomass and root/stubble from harvest 1 to harvest 2 (P ≤ 0.05). Neither soil organic matter nor NO3-N showed any major shifts over the 4-mo crop cycle and averaged 2.5 % and 27 ppm, respectively. Vegetative biomass removal from traditional CC may provide valuable livestock forage, and simultaneously provide soil cover and contribute to soil fertility through root/stubble N contribution.

In the small ruminant crotalaria juncia (sunn hemp; SH) hay feeding pen trial the SH hay had an average of 116 g/kg crude protein, 556 g/kg acid detergent fiber, 713 g/kg neutral detergent fiber, and 557 g/kg in vitro dry matter digestibility. The SS hay had an average of 83 g/kg crude protein, 468 g/kg acid detergent fiber, 669 g/kg neutral detergent fiber, and 605 g/kg in vitro dry matter digestibility. Lambs receiving SH hay did not exhibit increased growth performance over lambs receiving the SS hay. Sunn hemp hay resulted in an average daily gain (ADG) of 80 g compared to SS hay with an ADG of 75 g. However, as previous research indicates, castrated male lambs had greater ADG than female lambs with 89 g compared to 70 g, respectively ($P<0.05$). This study indicates that St. Croix White Hair Lambs will consume SH hay and attain growth performance similar to that of the conventional forage SS. Sunn hemp hay is a tropical legume that can grow without the need for nitrogen fertilizer and has plant tissue quality characteristics that make it a viable option as an alternative livestock forage resource.

4. Associated Knowledge Areas

KA Code	Knowledge Area
101	Appraisal of Soil Resources
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems
302	Nutrient Utilization in Animals
307	Animal Management Systems

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes

Brief Explanation

V(I). Planned Program (Evaluation Studies and Data Collection)

Evaluation Results

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 8

1. Name of the Planned Program

Animal Science - Beef Cattle

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
301	Reproductive Performance of Animals			10%	
305	Animal Physiological Processes			10%	
306	Environmental Stress in Animals			60%	
307	Animal Management Systems			20%	
	Total			100%	

V(C). Planned Program (Inputs)

1. Actual amount of professional FTE/SYs expended this Program

Year: 2010	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	2.5	0.0
Actual	0.0	0.0	2.5	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	64300	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	21433	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

•Conduct research •Publish results •Present data at conferences •Collaborate with other members of multistate project

2. Brief description of the target audience

Beef producers in the tropics, greater Caribbean, Central and South America and the southern US.

V(E). Planned Program (Outputs)

1. Standard output measures

2010	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	0	0	0	0

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year: 2010

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2010	Extension	Research	Total
Actual	0	1	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Abstracts

Year	Actual
2010	1

Output #2

Output Measure

- Journal articles

Year	Actual

2010	0

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of cattle producers in teh VI using managed breeding program
2	Number of cattle producers in the VI incorporating temperament into their selection criteria

Outcome #1

1. Outcome Measures

Number of cattle producers in teh VI using managed breeding program

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	1	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Livestock production in the USVI is impacted by seasonal rainfall and forage availability. Comparing cow and calf production traits and cow reproduction at different times of the year will result in data that can be used to make recommendations to local producers about herd management.

What has been done
Cow productivity was monitored for three years and compared between a Spring calving and Fall calving herd. After weaning calves grazed forage pastures with no supplemental feed. Records collected an analyzed included pregnancy rate, cow body weight and condition score at breeding, calving and weaning and calf weights at birth, weaning and yearling.

Results
Cows that calved in the Fall were larger (frame score), heavier and had higher body condition scores than Spring calving cows. The calves born during the Fall had higher birth weights, lower weaning weights and higher yearling weights than Spring born calves. Fall born calves had higher temperament scores at weaning but not as yearlings compared to Spring born calves. Growth differences of cows and calves may be due to seasonal forage availability, rainy season or sire effect. More data needs to be collected to separate out these confounding factors.

4. Associated Knowledge Areas

KA Code	Knowledge Area
301	Reproductive Performance of Animals
305	Animal Physiological Processes
306	Environmental Stress in Animals

307 Animal Management Systems

Outcome #2

1. Outcome Measures

Number of cattle producers in the VI incorporating temperament into their selection criteria

Not Reporting on this Outcome Measure

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes

Brief Explanation

We had a hurricane thsi year but it did not imapct this program.

V(I). Planned Program (Evaluation Studies and Data Collection)

Evaluation Results

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 9

1. Name of the Planned Program

Animal Science - Small Ruminants

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
301	Reproductive Performance of Animals			40%	
303	Genetic Improvement of Animals			10%	
307	Animal Management Systems			50%	
	Total			100%	

V(C). Planned Program (Inputs)

1. Actual amount of professional FTE/SYs expended this Program

Year: 2010	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	2.0	0.0
Actual	0.0	0.0	2.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	64184	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	21395	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

•Conduct Research Experiments •Publish results •Present data at conferences

2. Brief description of the target audience

The target audience is hair sheep producers in the tropics and the southern US.

V(E). Planned Program (Outputs)

1. Standard output measures

2010	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	0	0	0	0

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year: 2010

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2010	Extension	Research	Total
Actual	0	1	1

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Abstracts presented at conferences

Year	Actual
2010	1

Output #2

Output Measure

- Journal articles

Year	Actual

2010	1

Output #3

Output Measure

- Presentation that was published in a Conference Proceeding

Year	Actual
2010	1

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of local farmers weaning sheep at 90 days of age

Outcome #1

1. Outcome Measures

Number of local farmers weaning sheep at 90 days of age

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	10	7

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Local sheep producers want to increase the size and efficiency of lambs produced without increasing costs.

What has been done
St. Croix White ewes and lambs, and Dorper x St Croix White ewes and lambs were used. Lambs were weaned at 63 or 120 d of age based on breed, sex and litter size. After weaning lambs were fed concentrate ration and grazed guinea grass. Ewes grazed guinea grass at all times. Weights were analyzed using breed and weaning age as main effects. Pregnancy was determined after a 35-d breeding season using transrectal ultrasonography.

Results
Ewe weight at breeding prior to the first lambing was the same as at the subsequent breeding (41.9 vs. 41.6 kg, respectively). At the start of the subsequent breeding 100% of LATE and 0% of CTRL ewes were nursing lambs. There was no difference in days to first heat in the breeding season between LATE and CTRL ewes (16.2 vs. 14.0 d, respectively). Lambing rate after the subsequent breeding was not different between LATE and CTRL ewes (72.4 vs. 75.9 %, respectively). At weaning LATE lambs were heavier than CTRL lambs (20.5 vs. 11.9 kg, respectively) and DRPX were heavier than STX lambs (18.7 vs. 13.7 kg, respectively). At 63 d LATE and CTRL DRPX lambs were heavier than LATE and CTRL STX lambs (15.4 and 13.7 kg vs. 11.5 and 10.2 kg, respectively). At 120 d LATE DRPX were heavier than CTRL DRPX lambs (23.6 vs. 20.2 kg, respectively) and LATE STX were heavier than CTRL STX (17.3 vs. 15.1 kg, respectively). Weaning lambs at 120 d of age in an accelerated lambing system resulted in heavier lambs at weaning with no negative impact on ewe productivity. Late weaning led to a decrease in the amount of time that lambs received high cost, imported feed resulting in a savings of $10-13 per lamb.

4. Associated Knowledge Areas

KA Code	Knowledge Area
301	Reproductive Performance of Animals
303	Genetic Improvement of Animals
307	Animal Management Systems

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes

Brief Explanation

Even though we had a hurricane this year it did not significantly impact the data collection and the study.

V(I). Planned Program (Evaluation Studies and Data Collection)

Evaluation Results

{No Data Entered}

Key Items of Evaluation

{No Data Entered}