PLAN OF WORK

University of the Virgin Islands
Agricultural Experiment Station

Federal Fiscal Years
2000-2004

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Introduction

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

This Plan of Work was developed with input from the entire AES research faculty and outlines planned research activities for federal fiscal years 2000-2004.

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I. Planned Programs

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GOAL 1: An agricultural system that is highly competitive in the global economy

Program 1. Sustainable Fruit and Vegetable Production

Statement of Issue:

Fruit and vegetable production in the U.S. Virgin Islands (USVI) is limited and constrained by biological, physical and socioeconomic factors. Major constraints are due to a short rainy season, high pH calcareous soils, high cost of labor, irrigation wa ter and other production inputs, and year-round incidence of pests and diseases. Adverse effects of major hurricanes and tropical storms also result in the general decline of the fruit and vegetable industry in the USVI. About 90 to 95 percent of fruits and

vegetables consumed in the USVI is imported from the mainland U.S. and neighboring islands of the Caribbean. Although local production is at low level, the production and marketing of fruits and vegetables provides primary or secondary income opportunities for many farmers and producers in the Virgin Islands. Also, many Virgin Islanders supplement their diets with fruits, vegetables and herbs grown in home gardens. To remain competitive in a rapidly changing global economy, farmers and food crop producers must adopt new and improved production technology, new cultivars/rootstocks that are more tolerant to abiotic and biotic stresses affecting plants, and utilize crop management systems that improve production efficiency and promote sustainability. Before new cultivars and improved production technology can be recommended, they must be thoroughly evaluated under Virgin Islands environmental conditions.

Performance Goals:

- Increase and sustain domestic production of fruits, vegetables, herbs and specialty crops through appropriate and improved technology.
- Improve the quality and increase the percentage of marketable products, reduce production costs and increase profitability through improved cultural techniques and use of high yielding tropical fruits, vegetables and specialty crops better adapted to soils and climate of the USVI.
- Improve overall efficiency and productivity while minimizing negative impacts to the environment through sustainable crop management practices.
- Reduce the huge amount of fruit and vegetable imports into the USVI.
- Increase self-sufficiency in the production of fresh produce and open opportunities for the export of specialty tropical fruits and vegetables.

Output Indicators:

- Better adapted fruit and vegetable cultivars for tropical environments.
- More improved production techniques that utilize resources more efficiently.
- Production practice options for reducing over-reliance on chemicals.
- More research information available to fruit and vegetable growers, homeowners, potential producers, scientific community, cooperative extension services, territorial agricultural agencies and the general public.

Outcome Indicators:

- Increased domestic production of fruits, vegetables and specialty crops.
- Higher efficiency, profitability and competitiveness.
- Greater adoption rate of high yielding fruit and vegetable cultivars, and improved production techniques.
- More rational/efficient use of agricultural chemicals by producers.
- Less imports of fruits and vegetables into the USVI.
- Increase self-sufficiency in local fresh produce.
- Greater exports of specialty tropical fruits and vegetable crops.

Key Program Components:

- Evaluate and select adapted and high yielding tropical fruits and vegetables for the USVI.
- Improve the production efficiency and increase the competitiveness of the Virgin Islands tropical fruit and vegetable industry through the increased use of adaptive cultivars tolerant to abiotic and biotic stresses.
- Improve production management systems for tropical fruits, major vegetables, herbs and specialty crops.
- Develop sustainable crop management practices that reduce the use of external inputs and agrochemicals while protecting and preserving environmental quality.

Internal and External Linkages:

- University of the Virgin Islands researchers and extension specialists
- St. Croix Farmers in Action
- St. Croix Black Farmers Association
- Virgin Islands Department of Agriculture and Economic Development
- Small Business Development Center, University of the Virgin Islands
- Water Resources Research Institute, University of the Virgin Islands
- Tropical Agriculture Research Station, USDA, Puerto Rico
- College of Agriculture, University of Puerto Rico
- Agricultural Experiment Station, University of Puerto Rico

- Cooperative Extension Service, University of Puerto Rico
- Institute of Food and Agricultural Sciences, University of Florida
- Caribbean Agricultural Research and Development Institute
- Inter-American Institute for Cooperation in Agriculture
- Asian Vegetable Research and Development Center
- Other institutions and agencies affiliated with CSREES multistate research committees S-9 and S-264.

Target Audiences:

- Small-scale fruit, vegetable, and herb growers in the USVI, Puerto Rico and surrounding Caribbean islands.

- Home gardeners, public schools, non-governmental organizations and the general public.

Program Duration:

1999-2004 or greater than five years

Allocated Resources:

Fiscal Year	1999 (base)	2000	2001	2002	2003	2004
Total Hatch and matching funds ($)	301,612	310,660	319,980	329,579	339,466	349,650
Scientist Years	2.5	2.5	2.6	2.6	2.7	2.7

Program 2. Improving Nursery and Ornamental Plants

Statement of Issue:

The ornamental industry has great horticultural potential for producing cut flowers for export from the U.S. Virgin Islands. A demographic shift from rural farms to urban living has changed the landscape in which most of the population lives and works. Plant systems and related services for the non-food sector of the green industry consist of production nurseries, landscape design, maintenance, installation firms, retail garden centers, greenhouse crops and retail. Basic and applied research is necessary to develop, select and maintain sustainable and environmentally -sound production and management practices. Research is needed to develop new technologies and strategies that increase profitability while minimizing the environmental impact from urban agriculture. The aesthetic, functional

and economic impact of ornamental plants and cut flowers in our working and living environment have a profound positive impact on the quality of life for all Virgin Islanders.

Performance Goals:

- Improve Virgin Islanders quality of life by developing sustainable ornamental plant systems.

Output Indicators:

- Selection of better root zone materials to reduce plant disease treatment.
- Improved plant production practices to reduce cost and increase profitability.
- Greater understanding of plant adaptability that leads to new plant materials and management techniques.
- Research reports to the scientific community, technical reports and workshops for active producers, interpreted information for potential producers, the general public, cooperative extension service and territorial agencies.

Outcome Indicators:

- Reduced dependence on fertilizers and pesticides through improved plant development.
- Qualitative improvements in the landscape through improved plant systems.
- Development of natural pesticides that reduce environmental risk.

Key Program Components:

- Nursery and Landscape: Conduct applied and basic research on ecological physiology of landscape plants, economically efficient and environmentally sustainable landscape plant production practices, and landscape plant establishment and maintenance.
- Greenhouse Crops: Develop production alternatives that reduce non-sustainable inputs (i.e., chemicals, energy, peat, etc.) used in the greenhouse industry; conduct research on alternative potting soil mixtures using waste products (i.e. coconut husk and wood chips), manipulation of the root zone environment, and the development of biological and cultural methods of controlling soil-borne fungal pathogens to reduce chemical fungicide usage.

Internal and External Linkages:

- Scientists in the horticulture program at the Agricultural Experiment Station
- Cooperative Extension Service
- Small Business Development Center, University of the Virgin Islands
- St. George Village Botanical Garden
- College of Agriculture, University of Puerto Rico

Target Audiences:

- Growers, consumers and managers in the ornamental plant industry in the Virgin Islands and the United States.

Program Duration:

1999-2004 or greater than five years

Allocated Resources:

Fiscal Year	1999 (base)	2000	2001	2002	2003	2004
Total Hatch and matching funds ($)	96,936	99,844	102,839	105,924	109,102	112,375
Scientist Years	0.5	0.5	0.6	0.6	0.7	0.7

Program 3. Forest Resource Conservation

Statement of Issue:

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

Performance Goals:

- Increase the use of native trees species in agricultural systems and the urban environment.

- Protect soil resources, increase crop yield, improve water quality, and enhance biological diversity.

- Meet the growing demand for native tree species by developing propagation systems to address the changing attitude of Virgin Islanders concerning the best use of these resources.

- Protect environmental quality while supporting economic development on a broader front.

Output Indicators:

- Improvement of surface water quality.

- Improvement in livability of the urban - suburban environment.

- Development of value-added wood-based products.

- Research reports to the scientific community, technical rep orts and workshops for active producers, interpreted information for potential growers, the general public, cooperative extension service and territorial agencies.

Outcome Indicators:

- Better placement and survival of native tree species in urban and community settings.

- Utilization of native tree species for wind breaks, living fences, and livestock shade and fodder.

- Reduction in stream water nitrogen and suspended solids concentrations.

- Broader application of wood products in the art and furniture industries.

Key Program Components:

- Expand the knowledge base on the establishment and management of field and streamside buffers, the efficiency of chemical and carbon capture in environmental buffers, and crop yield improvement.

- Improve stream water quality.

- Reduce soil erosion.

- Enhance ability to manage and improve urban and suburban forests.

Internal and External Linkages:

- Researchers from other programs at the Agricultural Experiment Station
- Researchers in allied departments in the Southern Region
- V.I. Department of Natural Resources
- U.S. Forest Service
- Agricultural Research Service, USDA
- St. Croix Farmers in Action
- St. Croix Black Farmers Association
- St. Croix Beautification Association

Target Audiences:

- Landowners, regulatory agencies, non-government organizations, home owners, conservation groups, natural resource management agencies

- Government leaders, community tree stewards and managers, commodity groups.

Program Duration:

1999-2004 or greater than five years

Allocated Resources:

Fiscal Year	1999 (base)	2000	2001	2002	2003	2004
Total McIntire Stennis and matching funds ($)	110,251	113,559	116,966	120,475	124,089	127,812
Scientist Years	1.0	1.0	1.1	1.1	1.2	1.2

Program 4. Plant Germplasm Conservation and Enhancement

Statement of Issue:

Germplasm is the key element of successful plant breeding programs. The conservation and use of a comprehensive collection of genetically-diverse cultivated plants and their relatives are the biological foundation for the long-term success of U.S. agricultural producers. Different selection and evaluation

methods are used to develop cultivars within and among different crop species, but elite germplasm is necessary in all instances to develop new superior cultivars. Evaluation, development and enhancement require long-term commitments (20 to 40 years) to produce superior germplasm sources. But today the goal for project completion involves a 5 to 10-year time horizon. To ensure future genetic advances, a long-term commitment is needed to increase genetic diversity of cultivated crops and to develop and enhance elite germplasm.

Performance Goals:

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

Output Indicators:

- Diverse sources of germplasm made available for cultivar development or for producer use.
- Genetically improved germplasm made available for cultivar development or for producer use.
- Information relative to effectiveness of breeding and selection methods.
- Research reports to the scientific community, technical reports and workshops for active producers, interpreted information for potential producers, the general public, cooperative extension services and territorial agencies.

Outcome Indicators:

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

Key Program Components:

- Papaya: Develop and enhance germplasm to broaden the genetic base for disease and pest

resistance through biotechnology.

- Passion Fruit: Identify plant characters appropriate for use as selection criteria and develop molecular genetic markers for improving quality and productivity in sustainable, integrated, cropping systems.

Internal and External Linkages:

- Scientists in the department.
- St. Croix Farmers in Action
- St. Croix Black Farmers Association
- University of Puerto Rico
- Cornell University

Target Audiences:

- Tropical fruit growers in the Virgin Islands and the United States.

Program Duration:

Five years

Allocated Resources:

Fiscal Year	1999 (base)	2000	2001	2002	2003	2004
Total Hatch and matching funds ($)	144,017	148,338	152,788	161,956	166,815	171,819
Scientist Years	1.0	1.0	1.1	1.1	1.2	1.2

Program 5. Improving Management of Pasture Resources in Warm Seasonally-Dry Tropics

Statement of Issue:

In the U.S. Virgin Islands (USVI), most of the soils are well-drained calcareous, with pH ranging from 7.8 to 8.3, low P, low to medium K and very high Ca concentrations. Calcareous soils present severe physical limitations to pasture establishment, subsequent growth and productivity. In addition, problems of dryland salinity, cyclic growth of pastures and low persistence of forages are also widespread. Lack of persistence of forages is usually ascribed to grazing management and other factors

such as soil fertility and soil pH. However, lack of adaptability may also be a significant factor in pasture decline. It has been exceedingly difficult to find suitable, adapted and improved forages for calcareous soils. There are numerous forage species that have not been tested for the warm seasonally-dry tropics.

Livestock production is highly dependent on forages to meet the nutritional requirements of grazing livestock. However, levels of animal production and performance achieved by ruminants in USVI forage-based systems show wide variation, because of seasonal fluctuation of dry matter production and nutritive value. Further assessment is needed for the incorporation of forage legumes into naturalized grass pastures to increase seasonal forage availability, improve nutritive value and enhance animal productivity.

Invasion of improved pastures by less desirable components (i.e., forbs and spiny shrubs) is a common symptom of pasture degradation. The extent of this problem varies considerably between pasture type, soil type, fertility, drought and degree of disturbance due to grazing practices. Pasture degradation is the result of inappropriate grazing strategies, poor weed control, reduction in fertilizer usage and possibly drought. Adverse changes occur in pastures, such as loss of plants, weed ingress, lack of production stability and reduction of seed reserves. Research is needed to determine the impact of grazing management and no-till oversowing on pasture rehabilitation in the USVI.

***Performance goals**:*

- Promote superior tropical grasses and legume germplasm, based on characterization of their genetic diversity, yield and adaptation, in the warm seasonally-dry tropics (WSDT).

- Enhance forage production and grazing management techniques that make livestock and crop production more efficient and contribute to environmental protection in the WSDT.

- Improve degraded pastures by generating grazing systems and knowledge aimed at better management and utilization of natural resources.

***Output indicators**:*

- Characterization of tropical forage grasses and legumes for their yield, nutritional value, adaptation and persistence to the climatic and edaphic conditions of the WSDT.

- Development of guidelines for more productive and efficient combinations of grasses and legumes and their contribution to animal productivity.

- Increased knowledge on integrated pasture, livestock and soil management practices that are productive, sustainable and environmentally friendly.

- Development of decision-support guidelines for the farming community and researchers and in-service training that increases the capacity of livestock farmers and extension agents to better understand participatory research on integrated livestock production systems and their components.

***Outcome indicators**:*

- New forages that increase the quality of stock and the productivity of livestock farming sy stems in the WSDT.
- Adequate recommendations that maintain stability of the pasture system, increase soil fertility and preserve natural resources.
- Wider adoption of environmentally sound pasture and grazing management practices.
- Greater economic returns.

***Key Program Components**:*

The forage agronomy program through a series of projects will conduct basic and applied grass and legume-based pasture research with emphasis on screening new forages for adaptation to changing climatic conditions, identifying stable grass-legume combinations with potential for improved animal performance, and assessing management practices aimed at the rehabilitation of degraded pastures to enhance the stability and sustainability of existing grazing l ands in the USVI.

Specific objectives of these projects will be to:

- Assess recently developed tropical grasses and legumes for adaptation, production potential and nutritive value in the WSDT.
- Quantify the production efficiency, nutritive value, persistence and botanical composition of pasture grass-legume combinations when rotationally stocked with growing lambs in the dry and wet seasons.
- Compare pasture grass-legume combination effects on daily gains, diet botanical composition and diet selectivity of lambs when rotationally stocked in the dry and wet seasons.
- Determine the effects of selective herbicides on broadleaf and shrub control, grazing and no-grazing effects on grass basal spread, seed yield and seedling recruitment.

- Evaluate the effects of seedbed management (tilled and no-till+herbicide) and tropical grasses over-seeded with legumes on seedling emergence, survival, forage dry matter and seed yield.

Internal and External Linkages:

- Institute of Food and Agricultural Sciences (University of Florida)
- USDA/NRC, Virgin Islands
- Tropical Agriculture Research Station, Puerto Rico
- University of Puerto Rico, College of Agriculture
- Center for Tropical Agriculture (CIAT)
- Caribbean Agriculture Research Institute (CARDI)

Target Audiences:

- USVI livestock producers; Cooperative Extension Service and the scientific community in general.

Program duration:

Five years

Allocated Resources:

Fiscal Year	1999 (base)	2000	2001	2002	2003	2004
Total Hatch and matching funds ($)	164,142	169,066	174,137	179,361	184,741	190,283
Scientist Years	1.0	1.0	1.1	1.1	1.2	1.2

Program 6: Improving Reproductive and Productive Traits of Livestock in a Tropical Environment

Statement of Issue:

The beef cattle industry on St. Croix is based on the use of Senepol cattle. Senepol is a breed of tropically adapted *Bos taurus* cattle that was developed on the island of St. Croix in the early 1900s and has been selected for their ability to maintain growth and reproductive rates even under the harsh

conditions found in the tropics.

The main market for the Senepol breeders is the export of germplasm, either as live animals or more recently, frozen embryos. Currently there is no system established to collect, preserve and transport frozen semen off the island. Instead the farmers must sell bulls and ship them off the island to the buyers. The Senepol ranchers on St. Croix have developed both a domestic and an international market for the cattle. Live animals have been sent to the United States and Central and South America and embryos have been shipped to Australia.

Because the Senepol cattle on St. Croix are marketed as breeding stock, fertility of bulls and cows is an important trait to the producers. Bull fertility can be estimated by testicular measurements and semen quality, but the true measure of fertility is obtained when a bull is allowed to breed females. The identification and optimum use of genetically superior bulls is necessary for continued improvement in beef cattle production.

Sheep production in the Caribbean is limited to the production of animals for meat with no measurable demand for wool producing animals. Since resources are limited in many areas of the tropics, the use of sheep for meat production is partly based on economics. Sheep can be raised on smaller plots of land, require less feed than cattle, produce multiple offspring and have a shorter inter-birth interval.

Sheep in the tropics wean smaller lambs than sheep in more temperate areas, and this is due to nutritional and environmental influences. By crossbreeding hair sheep it may be possible to increase the rate of gain and size lambs produced. Increases in the rate of gain would mean that lambs could be slaughtered at a younger age and would require less resource input by the farmer. The offspring would benefit from hybrid vigor and have the potential to increase the quantity and quality of meat produced by local sheep producers. The use of artificial insemination (AI) to produce crossbred lambs needs to be explored. The costs associated with shipping and maintenance of rams of several breeds at a time are prohibitive.

Performance Goals:

- Develop data base on indicators of bull fertility in Senepol cattle.

Promote use of testing bulls at young ages prior to sale or use on breeding herds.

- Evaluate growth and carcass traits of St. Croix white hair and crossbred sheep under tropical conditions.

- Increase use of crossbreeding in hair sheep flocks for marketing animals for meat.

Output Indicators:

- Number of producer participants.
- Market acceptance of product.
- Consultations with producers on data summaries.
- Manuscripts and producer oriented reports.

Outcome Indicators:

- Use of bull selection procedure by producers.
- Measurable increases in fertility of bulls used or marketed.
- Increase in price obtained for lamb carcasses at market.
- Decrease in resource costs to producers.

Key Program Components:

- On farm testing of bulls.
- Consultation with herd owners on test results.
- Acquisition of different breeds of sheep (hair and wool) for crossbreeding.
- Carcass data collection and economic impact analysis on farm budget.

Internal & External Linkages:

- Institutions and agencies affiliated with CSREES multistate research committee NCR - 190
- St. Thomas Livestock Association
- Cooperative Extension Service
- Senepol Cattle Breeders Association

Target Audiences:

- Cattle owners in USVI and Caribbean region
- Sheep producers in USVI and Caribbean region

Program Duration:

Intermediate term: 4-5 years

Allocated Resources:

Fiscal Year	1999 (base)	2000	2001	2002	2003	2004
Total Hatch and matching funds ($)	196,930	202,838	208,923	215,190	221,646	228,295
Scientist Years	2.0	2.0	2.1	2.1	2.2	2.2

Program 7. Integrated Aquacultural Production Systems

Statement of Issue:

About 80% of the fish and most of the fresh farm crops consumed in the Virgin Islands are imported. The economy is in crisis and plans for economic recovery call for greater agricultural output. Aquaculture has been targeted as promising new industry. Research is needed to develop aquacultural production systems that are technically and economically feasible in an environment with limited freshwater resources. Practical production systems will require the use of high fish densities, water treatment and recirculation. Integrating plant crop production with aquaculture will reuse aquaculture effluent, recycle nutrients, reduce the use of synthetic fertilizers and increase profitability.

Performance Goals:

- Develop aquaculture production systems that incorporate plant crop production, conserve water and earn profits.
- Provide technical knowledge and management skill training to producers.

Output indicators:

- New aquaculture technologies for water-limited areas.
- Commercial-scale demonstration systems that integrate intensive aquaculture with plant crop

production.

- Better understanding of the productive capacity of integrated aquacultural/plant crop sys tems.

- Better understanding of water treatment and nutrient cycling in integrated production systems.
- Research reports to the scientific community, technical reports, short courses and workshops for active producers, interpreted information for potential producers, the general public and schools, and cooperative services to territorial agencies.

Outcome indicators:

- Adoption of the technology developed by this project.

- Increase in the local production of fish and fresh plant crops.

- A positive economic impact through the establishment of commercial operations, increased employment and import substitution.

Key Program Components:

- Establish design criteria and evaluate the interactions of fish, plants and water quality that govern the operation of integrated production systems.

- Determine the output of fish and a wide range of plant crops from integrated systems and develop enterprise budgets.

- Assess the impact of aquaculture effluent on soil fertility and field crop production and evaluate application methods.

- Establish commercial-scale units demonstrating new integrated production system technologies.

- Determine the most cost-effective method of producing fingerlings for growout systems.

- Market products of integrated production systems to determine price structure for product forms and assess demand.

- Develop an educational program for regional and national producers and potential producers.

Internal and External Linkages:

- American Tilapia Association
- Aquacultural Engineering Society

- Aquaponics Technology Center
- Caribbean Aquaculture Association
- Cooperative Extension Service
- Intercontinental Growers Association
- Mississippi-Alabama Sea Grant Consortium
- Small Business Development Center
- USDA Southern Regional Aquaculture Society
- University of the Virgin Islands researchers in the agronomy and horticulture programs
- USDA agencies
- Virgin Islands Department of Agriculture
- World Aquaculture Society

Target Audiences:

Investors, commercial producers, backyard producers, and aquacultural supply companies in the U.S. Caribbean and Pacific islands and the United States.

***Program Duration*:**

Greater than five years

***Allocated Resources*:**

Fiscal Year	1999 (base)	2000	2001	2002	2003	2004
Total Hatch and matching funds ($)	257,942	265,680	273,650	281,860	290,316	299,025
Scientist Years	2.5	2.5	2.6	2.6	2.7	2.7

II. Stakeholder Input Process

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

Due to the small geographic area of the Virgin Islands, AES scientists work in close contact with local farmers, which fosters considerable communication and responsivene ss to farmers' needs. For example, AES faculty members are currently conducting research on 19 local farms out of a total of 202 registered farms.

III. Program Review Process - Scientific Peer Review

A scientific peer review process is followed. Scientists submit three copies of their proposals to the director. The director sends these proposals to three professional staff members who are qualified to judge the relevance and scientific soundness of the proposal. A positive consensus must be r eached before the project is approved by the director for submission to CSREES for final approval.

IV. Multistate Research Activities

Exempt

V. Integrated Research and Extension Activities

Exempt

Submitted by James Rakocy, Director, July 21, 1999