

UNIVERSITY OF PUERTO RICO  
MAYAGÜEZ CAMPUS  
COLLEGE OF AGRICULTURAL SCIENCES  
AGRICULTURAL EXPERIMENT STATION

ANNUAL REPORT OF ACCOMPLISHMENTS AND RESULTS

*Planning Option:* This Annual Report of Accomplishments and Results is prepared for our Institution's individual functions, just as our 1999-2004 Five Year Plan of Work.

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Agricultural Experiment Station  
 University of Puerto Rico  
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# FY 2002-2003 ANNUAL REPORT OF ACCOMPLISHMENTS AND RESULTS

University of Puerto Rico  
Mayagüez Campus  
College of Agricultural Sciences  
Agricultural Experiment Station

## General Overview

The University of Puerto Rico's Agricultural Experiment Station (AES) conducts basic and applied research to promote an economically viable agricultural sector and to stimulate rural development in Puerto Rico and in the region. Research also promotes the conservation and enhancement of natural resources and the environment, supports established and newly developed industries that process agricultural raw materials, and provides technical assistance to farmers and private and public institutions. The Agricultural Experiment Station coordinates its academic activities with the teaching and extension Faculty of the College of Agricultural Sciences in an ongoing effort to implement the strategic plan that defines our programmatic goals. AES scientists also participate in several advisory boards of the Puerto Rico Department of Agriculture (PRDA), providing technical expertise for public policy decisions made by the PRDA. To advance regional goals, the AES participates in both multistate research and Special Grants from USDA-CSREES that target agriculture in the Caribbean Basin of the United States.

Five goals, consonant with both federal and local priorities, drive our research program:

1. To develop technology for achieving sustainable agricultural production systems that are socioeconomically viable and competitive.
2. To develop technology for processing traditional and new agricultural products and for achieving a safe food and fiber system.
3. To provide direct services and technical expertise to farmers, agro industries, and public agencies that lack specialized personnel or research facilities present at AES-UPR.
4. To develop agricultural technology compatible with the preservation and enchantment of our natural resources and environment.
5. To provide the socioeconomic research needed to formulate alternatives that can potentially improve economic opportunities and the quality of life in rural areas.

Research efforts at the Agricultural Experiment Station are concentrated on goals one and four of the national goals, whereas other goals are covered by the Agricultural Extension Service of the College of Agricultural Sciences. Our research program is still organized following commodity lines, but we now have ten commodities<sup>1</sup> instead of the original eleven. Since FY 2002 the sugarcane commodity group was eliminated, given the practical disappearance of sugar plantings in Puerto Rico and the retirement of researchers with expertise in that commodity.

Core funding for the Agricultural Experiment Station's research program is provided by

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<sup>1</sup> Current commodity groups are: dairy, coffee, plantains and bananas, vegetable crops, fruit crops, ornamentals, meat production, roots and tubers, basic grains and environment and natural resources.

various sources. State funds are primarily to cover salaries of academic and support personnel. USDA funding is crucial for directly financing the research program. Formula-funds include Hatch Regular, Hatch Regional, McIntire-Stennis and Animal Health. Special Grants such as the Tropical and Subtropical Agriculture Research (T-STAR) support targeted areas of research. Along with federal and state funding, there are extramural research grants and contracts such as those from the Natural Resources Conservation Service, Environmental Protection Agency, and USDA-ARS, Puerto Rico's Department of Agriculture, Puerto Rico's Department of Natural Resources and other agreements with US-Universities.

## **Executive Summary**

### ***Goal I. An agricultural system that is highly competitive in the global economy***

Overview: Agriculture is of strategic importance to Puerto Rico both in terms of its present and its potential contribution to the economy. Although it is the smallest of the primary economic sectors its broader economic impact is significant, given the high multiplier effect of its activities. Puerto Rico has a large food import bill, much of which could be competitively produced locally if appropriate technology and marketing strategies were devised, disseminated among farmers and processors, and emerging problems are researched to formulate viable solutions. Moreover, through its research and extension programs the island's land grant system could also make a significant contribution towards stabilizing and expanding our current agricultural exports. Approximately 50% of our federally funded research projects are ascribed to this goal. These projects are in line with the furtherance of agricultural production, the long-term critical issue targeted by this goal.

The dairy industry is the most important agricultural enterprise in Puerto Rico. Revenues from milk sales exceed \$190 million annually and contribute 27% to the gross national agricultural income. However, the industry is affected by a stagnant fresh milk market, high dependence on imported feeds, low levels of milk production, high involuntary culling rates and high costs of dairy replacements. Most of these problems are related to the feeding and management systems used in dairy farms. Research focusing on the development of feeding strategies to maximize the efficiency of local forage resources and imported concentrates for milk production and growth is one of the priorities of the dairy commodity sector, expected to have a positive economic impact at the farm level by reducing costs associated to concentrate purchases.

Crop protection studies remain an important component of research undertaken to maintain local agricultural competitiveness. Plantains, for example, rank first among crops of economic importance in the island. Yet, to maintain plantain's position in the local economy, and improve that of other crops such as coffee, studies on the identification and characterization of bacteria able to colonize healthy tissues and associated to diseases limiting these crops' development must be conducted. Effective control measures of bacterial pathogens can only be developed after this basic work of identification of bacterial diseases is performed, an objective of a federal funded project under this goal.

Plant breeding research is another pillar of the AES program to further agricultural production in the island. During the period covered by our current Plan of Work emphasis was given to crops of economic importance, such as calabaza or tropical pumpkin, and to basic grains important in the local population's diet and for the diversification of small scale farming systems, such as pigeon peas and beans. Bean research has continued this year with its focus on developing cultivars with resistance to the bean golden yellow mosaic virus (BGYMV). Most of the bean producers are small-scale farmers with modest incomes. Since the release of the 'Morales' variety the incidence of BGYMV in Puerto Rico has declined rapidly, and sales at the AES Isabela Substation remain strong. The line is currently being considered for release in Haiti. In addition, three McCaslan snap bean lines with resistance to BGYMV and rust were released in collaboration with the University of Florida and the USDA-ARS, and bean germplasm lines derived from interspecific crosses that have a novel source of resistance to BGYMV, have been recommended for release by the UPR Variety Release Committee.

Calabaza production ranks second among vegetables in terms of income generated. In recent years, research has focused on germplasm enhancement and cultivar development, screening for resistance to diseases and insects, as well as modification of growth habit by selecting for compact plant types. As a result semi bush types have been developed with superior fruit quality in color and texture, highly desirable traits to consumers, and more easily managed by growers than traditional vine types. Traditional long-vine varieties are also being developed with an emphasis on incorporating insect, disease, and virus resistance. These traits will benefit the grower by reducing costs of pest and disease control. In addition, evaluation of horticultural specialty crops germplasm with desirable characteristics for local and export markets will continue to be evaluated under a Hatch funded project, an activity which was considered a priority by farmers participating in our yearly commodity meetings in search of new competitive alternatives to penetrate these markets.

Hatch funds under this goal:	\$2,334,298	FTE: 25.9
Special Grant funds under this goal:	\$ 11,192	FTE: .45
Animal Health funds under this goal:	\$ 9,398	FTE: 1.1

***Goal II. A safe and secure food and fiber system***

Overview: When our current Plan of Work was originally prepared research efforts under this goal were concentrated in the areas of food safety (analysis of pesticide residues) and post-harvest storage and processing of crops. Most of these activities were carried out in the Food Technology Laboratory located in the AES facilities at Río Piedras. In recent years research activities have been limited by the retirement of the majority of food scientists associated to this laboratory, and by the transfer of remaining projects and facilities to the Mayagüez Campus, where the program's emphasis has shifted away from research to the formal training of students in food science. At the AES new activities are being developed

in the areas of emerging plant and animal protection issues, and food system research with an emphasis in alternative food production, alternative marketing, and food accessibility.

Under the activities of a Multi-state Hatch project, personal interviews were conducted with the organizers of the 5 principal Farmers Market that were operating in the island during FY 2002-2003 to assess their characteristics, possibilities and limitations. Results from this study have been used by local Department of Agriculture officials in their initial implementation of the WIC Farmers Market Nutrition Program, a new federal and state initiative in Puerto Rico which in FY 2003 injected \$1,300,000 to the local economy and improved local fresh food access for WIC's recipients.

Hatch funds under this goal:                      \$16,976                      FTE: .40

***Goal III. A healthy, well nourished population***

The current Plan of Work of the AES did not contemplate any research activities under this goal and no project have been developed in this area during this period. The Agricultural Extension Service conducts all the work performed in the CAS under this goal.

***Goal IV. Greater harmony between agriculture and the environment***

Overview: The principal objective of the Natural Resources and Environment commodity area--the program under which most the projects contributing to this goal are administered--has been since its inception to develop and support the scientific research carried out in the CAS on the interface of agriculture, natural resources and the environment. During this fiscal year work has continued to be focused on the following priorities: (1) Developing land use databases and technologies for the management of soil erosion, (2) Developing technologies for the management of organic residues, (3) Developing integrated management systems for different crops, and (4) Establishing pollution biological indexes. Emphasis has been given to water pollution control, integrated pest management, and sustainable agriculture. Close linkages have been maintained with personnel from the Natural Resources Conservation Service (NRCS), the Department of Agriculture, the Environmental Quality Board and the Department of Natural Resources, to guarantee that research results contributing to sound management practices are included within these agencies programs.

One important outcome of one of the projects contributing to this goal has been the negotiation of a collaborative agreement between the CAS, the NRCS and the local Department of Agriculture to promote the adoption of an ecological coffee processing technology, developed by the Colombian Coffee Research Center, and evaluated under a local Hatch funded project. Results showed that this technology reduces water consumption by more than 500% while maintaining a satisfactory bean processing efficiency. In another study, financed with Special Grants and State funds, a modified version of USDA P Index, a National tool utilized by NRCS to identify soils that constitute a threat to surrounding water bodies, was developed. This test has provided a much needed tool for the implementation of sound management guidelines for manure in Puerto Rico.

The soil erosion and soil quality research conducted under this goal also promise to positively impact the water resources of the island and to provide valuable information for the development of environmentally safe practices to prevent soil and fertilizer losses. Under McIntire-Stennis grants experiments are being conducted with the use of tree species as shade for coffee, evaluating if the accumulation of soil organic matter can enhance the adaptability of the crop to acid soil conditions. Also under these funds, databases on land use have been completed for the entire Rio Grande de Arecibo northern corridor, including satellite imagery and aerial photography for detail land use mapping of the area. This information is important for the development of data sets of soil erosion under prevailing land use practices and for the implementation of sound watershed management programs.

Finally, research geared towards establishing an Integrated Pest Management (IPM) system for the control of plantain pests is one of the objectives addressed by other projects under this goal. Plantain is the most economically important crop of Puerto Rico but its production is limited by the attack of the banana root borer and plant parasitic nematodes. The development of an IPM system using a combination of lured traps, cultural and phytosanitary practices and biological control agents could bring significant benefits to the plantain industry in Puerto Rico and other Caribbean countries.

Hatch funds under this goal:	\$1,428,130	FTE: 15.2
Special Grant funds under this goal:	\$ 81,107	FTE: 6.8
McIntire-Stennis funds under this goal:	\$ 94,964	FTE: 0.6

**Goal V. *Enhanced economic opportunity and quality of life for Americans***

Overview: High unemployment rates and chronic poverty are long term critical issues affecting Puerto Rico’s population, particularly in rural areas. Changes in the global economy since the mid-1970s, with the concomitant restructuring of major local economic sectors, have exacerbated these adverse conditions. Official statistics confirm that nutritional subsidies and welfare payments are highly important for the livelihood strategies of more than half of the island’s families. While the contribution of agriculture to the Gross Domestic Product is stagnant or declining, due to its high multiplier effect the continued viability of farming is critical for maintaining and improving the quality of life in the island, particularly in the central mountainous region where alternative employment opportunities do not abound.

Coffee production is vital for the economy of the central region of Puerto Rico. Studies conducted in the late 1990s showed that access to an adequate labor supply was the most important problem identified by farm operators. To explore the existing mismatch between coffee growers’ and agricultural laborers’ needs a survey was mailed to 600 coffee growers, and personal interviews were conducted to over 100 agricultural laborers participating in Work Investment Act training programs. While this study is still in progress, it is expected to provide concrete recommendations on how to improve labor conditions in the coffee

region and, consequently, the availability of laborers for coffee farms.

Research exploring the possible consequences of welfare reforms on unemployed women in rural areas is also being conducted under this goal. Thirty seven women participating in job readiness training programs sponsored by the Work Investment Act (WIA) were personally interviewed on their socioeconomic characteristics, previous labor history, perceived barriers to employment, and perceived contribution of their current training experience to their future job market prospects. Preliminary results suggest that constraints not necessarily related to their formal schooling are limiting their incorporation to the region's labor market. Results of this study will provide information on the special needs of sub-studied populations in rural areas, such as unemployed women trying to become more self-dependent.

Hatch funds under this goal:                     \$ 27,309                     FTE: .7

**Planned Programs:**

**Goal I. An agricultural system that is highly competitive in the global economy**

**I. Key Theme – Animal Production Efficiency**

A. (Under Hatch Funds). Typical feeding systems for dairy cows in Puerto Rico consist of grazing tropical perennial grasses one or two times a day (between milkings) and supplementing their diet in the milking parlor with concentrate feeds mixed locally from imported ingredients. This has led to the prevalence of inadequate fiber consumption as indicated by the low milk fat test and fat protein inversions that prevail in Puerto Rican dairy farms. In a trial with Bermudagrass hay at 30 and 60 days of regrowth fed to dairy cows in early lactation, it was concluded that hay of less than 60 days will not affect dry matter intake nor milk production of cows with a milk yield of 25 kg. In another trial, preliminary analysis indicates that reduced time to reach breeding weight and first lactation justifies the supplementation and the increased stocking rate (7.6 heads per ha).

B. Impact - Developing feeding strategies to maximize the efficiency of local forage resources and imported concentrates for milk production and growth can impact economically the local dairy industry. Estimated savings at the farm level in concentrate purchases, increased milk production and reduced cost of replacements can be well over \$10 million annually.

C. Source of Federal Funds: Hatch \$ 129,944                     FTE: 1.2

D. Scope of Impact: State Specific, PR



## II. Key Theme – Plant Health

A. (Under Hatch Funds). Plantains (*Musa spp.*) are an important food source in tropical and subtropical regions worldwide. In Puerto Rico, plantains rank second among crops of economic importance after coffee. In 2002, plantain production was 82,000 metric tons (8.20%), out of a total production of 999,631 metric tons for the Caribbean Basin. Plantain production in Central and South America and the Caribbean Basin is limited by bacterial diseases. In Puerto Rico, the production of the plantain “Hua Moa” is affected by a disease called bunch abortion or choke neck. The identification of bacteria and their role in relation to the choke neck disease was studied. Bacteria were isolated from pseudostems of “Hua Moa” in three locations in Puerto Rico, using common and semi-selective growth media. Under greenhouse conditions, the pathogenicity of four bacteria was tested on whole plants on five clones. A total of 167 strains were isolated from diseased plants from which *Burkholderia gladioli*, *Erwinia chrysanthemi* and *P. aeuriginosa* were determined pathogenic. *E. chrysanthemi* was virulent in all clones tested under greenhouse conditions.

B. Impact – The identification and basic characterization of bacteria able to colonize healthy tissues are important for the establishment of effective control measures of a bacterial pathogen.

C. Source of Federal Funds: Hatch Funds \$258,546

FTE: 2.5

D. Scope of Impact: State Specific, PR

## III. Key Theme - Plant Germplasm

A. (Under Hatch Funds). Tropical pumpkin or calabaza (*Cucurbita moschata*) occupy the second place among vegetables in terms of the amount of revenue generated. In recent years, research has focused on germplasm enhancement and cultivar development, screening for resistance to diseases and insects, as well as modification of growth habit by selecting for compact plant types. Research has also yielded varieties adapted for commercial production in Puerto Rico. Three cycles of selection were completed in PRShortvine, a population with semi-bush growth habit and superior fruit quality. Emphasis has been placed on selecting for appropriate fruit size and shape. A second population, PRLongvine SLR, has undergone two cycles of selection. This long vine population derives from lines selfed out of the OP cultivar Soler, and is resistant to whitefly-induced silverleaf resistance (Soler is susceptible). A field and molecular study of genetic compatibility between *C. moschata* and a sister species, *C. argyrosperma*, demonstrated a high degree of compatibility between these species, when the latter is used as the female parent, but incompatibility in the reciprocal cross, where *C. moschata* is used as the maternal parent.

B. Impact – Semi-bush types have been developed with fruit quality superior in color and texture to that of the most commonly grown variety in Puerto Rico. These traits are highly desirable to consumers. For the grower, semi bush tropical pumpkins can be more easily managed than traditional vine types. The ability of different species of tropical pumpkins to

be cross-pollinated was also studied. Compatibility will allow breeders to move traits of interest (such as better resistance) from one species to another. Undesirable genes from one species (including genetically engineered genes) are able to move to another species with relative ease, which can be useful when growing various tropical pumpkin species in the same area. Some varieties of these species also grow in temperate climates.

C. Source of Federal Funds: Hatch \$182,408 FTE: 1.7

D. Scope of Impact: MultiState: PR, FL.

#### IV. Key Theme – Plant Production Efficiency

A. (Under Hatch Funds and Special Grants). White-seeded bean breeding lines that combine heat tolerance and resistance to BGYMV and common bacterial blight were developed. Tropically adapted pinto bean lines were also developed, combining the Ur6 and Ur11 genes for resistance to rust and the bgm-1 gene for resistance to BGYM. The BGYMV and rust resistant cultivar Rosada Nativa is the first release of a tropically adapted pink bean. It is being considered for release in the Dominican Republic. Rosada Mocana, a striped kidney bean cultivar with resistance to BGYMV and heat tolerance, and three bean germplasm lines, derived from interspecific crosses with a novel source of resistance to BGYMV, were recommended for release by the UPR Variety Committee.

B. Impact – Green-shelled bean production in Puerto Rico has an annual value of approximately \$1,000,000 at the farm gate. Over 600 farms produce green-shelled beans and most bean producers are small-scale farmers with modest incomes. Since the release of the ‘Morales’ variety, a BGYMV resistant cultivar developed under this project, the incidence of this virus has declined rapidly in Puerto Rico and ‘Morales’ has become the most popular white-seeded cultivar for green-shelled bean production in the island. New breeding lines have been developed with resistance to BGYMV and rust and tolerance to heat. A total of 1,320 promising lines from mainland U.S. were advanced a generation in the dry bean winter nursery.

C. Source of Federal Funds: Hatch (Multistate) \$165,934; Special Grants \$11,792 FTE: 2.05

D. Scope of Impact: Multistate PR, FL

#### V. Key Theme – Small Farm Viability

A. (Under Hatch Funds). Pigeon pea (*Cajanus cajan*) is one of the major legumes traditionally grown by small farmers in Puerto Rico and a popular item in the local diet, particularly during holiday celebrations. It is an excellent source of protein, resistant to droughts and low in fertilizer requirements. Pod damage caused by *Colletotrichum* is a serious problem along the northern coast of the Island. There is a need to control the disease that destroys practically 100% of the crop. Five and seven days after inoculation with *Colletotrichum* 1, no infected areas were present in pods of five pigeon pea lines. Lines

ICP-6915 x Cortada and (I-8-3-2 x ICP-7193)-3 showed 0.0 to 6.7% and 1.0 to 10% of pods infected after five and seven days of inoculation, respectively. These lines can be categorized as resistant. Evaluations of Colletotrichum 2 showed that any parental combination produce F1 resistant plants. Only four combinations showed an intermediate susceptibility to Colletotrichum 2. These results confirm the virulence of the Colletotrichum 2 isolate reported.

B. Impact – Work in progress will identify genetically-resistant material that will eventually contribute to stabilizing yield production at farm level, and maintain pigeon pea as a profitable alternative for the diversification of small farms. Use of these future-released lines will also reduce fungicide applications, thus diminishing environmental contaminants.

C. Source of Federal Funds: Hatch \$128,521 FTE: 1.3

D. Scope of Impact: State Specific, PR

***Goal II. A safe and secure food and fiber system***

**I. Key Theme – Food Accessibility and Affordability**

A. (Under Hatch Funds). The Puerto Rican food system, characterized by the increasing marginalization of agricultural production and dependence on food imports distributed through large supermarkets, is currently experiencing two somewhat related but contrasting trends. On the one hand, new types of farmers markets have emerged, reflecting growing activist and consumer interest in locally and sustainably grown products and providing farmers with new and hopefully more favorable markets. On the other, global trends in food retail consolidation continue to shake up the sector, as former locally owned supermarket chains have been acquired—in part or in whole—by giant players at a global level. Through the analysis of information on food retailing changes obtained from secondary sources and of interviews conducted with organizers of operating farmers’ markets, this project explored the characteristics, possibilities and limitations of these emerging community-based initiatives and the possible consequences for farmers and consumers of increased concentration in food retailing.

B. Impact - If duly institutionalized the farmers’ markets that have emerged in Puerto Rico in recent years hold great promise for both farmers and different classes of consumers. Yet, for the new initiatives to fulfill their potential contribution, public policies which support local production and stabilize the conditions that make it possible must be formulated. Information from this project has been used by the local Department of Agriculture in their initial implementation of the WIC Farmers Market Nutrition Program which in FY 2003 injected \$1,300,000 to the local economy and impacted 62,929 eligible recipients in 38 municipalities.

C. Source of Federal Funds: Hatch \$16,976 FTE: 0.4

D. Scope of Impact: Multistate PR, NY, CA, IA, MN, WI

***Goal III. A healthy, well nourished population***

The current Plan of Work of the AES did not contemplate any research activities under this goal and no project have been developed in this area during this period. The Agricultural Extension Service conducts all the work performed in the CAS under this goal.

***Goal IV. Greater harmony between agriculture and the environment***

I. Key Theme – Water Quality

A. (Under Hatch Funds). Coffee is one of the most important crops of Puerto Rico, both from an ecological and from a socioeconomic perspective. Coffee plantations, considered as secondary forests, are important for the preservation of local watersheds and indigenous species. Economically this crop is the principal source of income for many small farmers in the central mountainous region of the island, and through its processing and marketing, provides indirect incomes for many. Coffee processing requires, however, large amounts of water. Most of the 130 processors existing in the island are located near water sources. The management of resulting solid and liquid wastes is a critical problem for the industry. Under an AES Hatch project a new technology which reduces water consumption and processing wastes, developed by the Colombian Coffee Research Center, was evaluated. The parameters used to assess the machine's performance was percentage of well processed beans (unbroken and without adherences) and amount of water consumed. Results indicate that with a composition of 90% ripe beans (10% green), the machine can process well 87% of the beans; with 75% ripe beans the average result was 81%, and with 60% ripe, the average percentage of well processed beans was 68%. Results also showed that this new processing technology reduces water consumption by more than 500%.

B. Impact – Adoption of the new coffee processing machinery evaluated can significantly reduce the consumption of water by coffee processors, while maintaining a satisfactory bean processing efficiency. This equipment consumed only 0.15 gallons of water to process one pound of clean coffee, while the processing equipments commonly used in Puerto Rico needs from one to four gallons of water to process this same amount of coffee. A collaborative agreement between the CAS, the NRCS and the local Department of Agriculture is being negotiated to promote the adoption of this technology which has been labeled "Ecological Coffee Processing Technology".

C. Source of Federal Funds: Hatch \$41,896.40

FTE: .7

D. Scope of Impact: State Specific PR

## II. Key Theme – Agricultural Waste Management

A. (Under Special Grants and State funds). Animal farm operations, particularly poultry production, constitute the biggest threat to water pollution by nutrients. The development of sound management guidelines for manure management requires a systemic approach for the identification of potentially polluting fields within a particular farm. A modified version of USDA P Index, a National tool utilized by NRCS to identify soils that constitute a threat to surrounding water bodies, was developed. Our version, the Caribbean P Index, was specifically developed to take into consideration soil topography and mineralogy, as well as farm management practices and size characteristics, unique to the tropics. Results indicate that transport factors are as crucial as source factors, in terms of the off-field transport of nutrients from agricultural lands. Total annual losses from agricultural fields are largely influenced by runoff. It is, therefore, critical to prevent fertilizer applications (inorganic or organic) close to a significant rainfall event.

B. Impact – Animal production in Puerto Rico generates close to 55% (approx. \$450,000,000) of the total agricultural gross income. However, to become sustainable producers must comply with stricter environmental laws being implemented by environmental regulatory agencies. The critical environmental soil test P levels for different soils has provided a much needed tool for the implementation of sound management guidelines for manure in the Island. In addition, the systematic evaluation of the impact of rainfall duration and intensity on the extent of nutrient losses through runoff will enable the agricultural sector to adopt practices that significantly reduce its negative impact on the environment.

C. Source of Federal Funds: Special Grants \$48,815

FTE: 3.6

D. Scope of Impact: State specific (PR)

## III. Key Theme – Soil Erosion

A. (Under McIntire-Stennis Funds). Soil erosion research in Puerto Rico is almost nonexistent at least as an organized program. An anthropogenic effect added to intense climatology and steep slopes makes our environment a very different research plot. The lack of experimental work has forced researchers to use common sense when it comes to estimating soil losses and the resulting siltation rates from local watersheds. To develop sound watershed management programs, minimum data sets of soil erosion under the prevailing land use practices in the Island must be developed. Competition between agricultural and non-agricultural practices will continue to increase in the coming years, threatening not only agricultural and forest resources, but important water resources throughout the Island. In this study, the databases for the entire Rio Grande de Arecibo (RGA) have been completed, including satellite imagery and aerial photography for detailed land use mapping of the area. The geographic information systems (GIS) of the RGA watershed is 95% completed. Land use coverage of the watershed was obtained from

several sources, including satellite imagery, aerial photography and interviews and site visits with agricultural extension agents of neighboring towns.

B. Impact – This project will positively impact water resources in the northern corridor of Puerto Rico from Arecibo to the metropolitan San Juan area. The RGA watershed supplies potable water to over 1.5 million people in the service area. Findings from this project will provide much required physical information of land use management and planning for the continuous production of water and the reduction of soil erosion and siltation of lakes and reservoirs.

C. Source of Federal Funds: McIntire-Stennis \$25,126

FTE: .50

D. Scope of Impact: State Specific (PR)

#### IV. Key Theme-Soil Quality

A. (Under McIntire Stennis Funds Pr-MS-00013). The use of tree species as shade for coffee may enhance the adaptability of the crop to acid soil conditions through the accumulation of soil organic matter. A field experiment was established on Alonso clay (Oxic Dytrudepts) to evaluate effect the of *Pithecellobium carbonarium* on the accumulation and quality of soil organic matter, soil pH, exchangeable Al<sup>3+</sup>, available P, exchangeable basic cations and micronutrients. This tree species is a legume with good potential as a shading species for coffee plants, due to its fast growing habits, low density canopy and its capacity to fix oxygen. The treatments included a low density shade plot, a high density shade plot and a full sunlight plot. At 0-20 cm and 20-40 cm depths, the pHs were 4.59 and 4.66 for the high shade density plots, 4.64 and 4.60 for the low shade density plots and 4.72 and 4.35 for the full sunlight plots, respectively. The full sunlight plot showed the lowest available P content (2.0 mg/kg) and the lowest organic matter content (1.03 percent) at the 20- to 40-cm depth. A laboratory experiment is in progress to evaluate the effect of tree litter on the chemical properties of Alonso clay.

B. Impact – A better understanding of the nutrient dynamics and organic matter accumulation in coffee plantations under shade will provide valuable information for appropriate management of the crop in order to develop environmentally safe practices to prevent soil and fertilizer losses. The microenvironment of coffee plantations under shade may provide for a more efficient use of water and nutrients by the crop. The role of organic matter to provide nutrients and ameliorate aluminum toxicity can be an attractive alternative for farmers who want to extend the longevity of their coffee plantations, increase yields and reduce costs.

C. Source of Federal Funds: McIntire-Stennis \$ 34,064

FTE: .10

D. Scope of Impact: State Specific (PR)

## V. Key Theme – Integrated Pest Management

A. (Under Hatch funds and Special Grants). Plantains are an important food source in tropical and subtropical regions worldwide. In Puerto Rico, plantains rank first among crops of economic importance. During 2002-03, the farm gate value of the crop was \$45,900,000. The banana root borer, *Cosmopolites sordidus*, and plant parasitic nematodes are the most damaging of the species that attack plantains and bananas worldwide. Both pests are considered the major limiting factors of plantain production in the Caribbean. The goal of this project is to develop an IPM system using a combination of lured traps, cultural and phytosanitary practices, and biological control agents for plantain pest control. In a plantain study, insect populations were sampled at Isabela and Corozal. Treatments were: rotation of velvetbean with plantain, poultry litter, nematicide and absolute control. Poultry litter treatment increased plant height and diameter at 4 months. *R. similis* was predominant nematode in the absolute control treatment. In another study at Isabela being analyzed, the most effective trap system is the commercial trap plus Cosmolure.

B. Impact – Information generated from this project is most useful in order to determine the viability of IPM for the commercial production of plantain in the Caribbean Basin. The development of an IPM system using a combination of lured traps, cultural and phytosanitary practices and biological control agents will result in enormous benefit to the plantain industry in Puerto Rico and the Caribbean Basin.

C. Source of Federal Funds: Hatch \$49,319.5; Special Grants \$32,292 FTE: .95

D. Scope of Impact: Multistate PR, VI

### **Goal V. *Enhanced economic opportunity and quality of life for Americans***

#### I. Key Theme – Jobs/Employment

A. (Under Hatch Funds). Welfare reform was implemented in the United States with the underlying premise of promoting self-dependence among the nation's TANF (Temporary Assistance to Needy Families Program) recipients. In Puerto Rico, as in many southern states, TANF participation had already undergone significant declines prior to the beginning of welfare reform laws. By 2000 only 3.2% of the population was participating in the TANF while 44.6% was below the poverty level and reached by the Nutritional Assistance Program, which in effect is considered the largest welfare program in the island. This study was designed to explore the job market prospects and challenges faced by women from poor households in their process of incorporation to local labor markets. Thirty seven women participating in job readiness training programs sponsored by the Work Investment Act (WIA) were personally interviewed on their socioeconomic characteristics, previous labor history, perceived barriers to employment, and perceived contribution of their current training experience to their future job market prospects. Preliminary results suggest that constraints not necessarily related to their school level—years of school completed ranged from 0 to 1 college graduate, with a median of 9<sup>th</sup> grade—are limiting their incorporation to

the region's labor market. For the interviewees who had not completed high school, and were in a High School Equivalency preparation program, lack of transportation in the rural areas where they lived was an additional major obstacle to employment. Those with a high school diploma or higher education—attending training programs on agricultural skills and sustainable practices--perceived, however, that there were simply not enough jobs in their locality to accommodate them.

B. Impact – Results of this study will provide information to those with decision making power in public policy about the possible consequences of welfare reforms and the special needs of sub-studied populations in rural areas, such as unemployed women trying to become more self-dependent.

C. Source of Federal Funds: Multi-State Hatch \$ 5,433 FTE: .2

D. Scope of Impact: State Specific, PR

### **STAKEHOLDER INPUT PROCESS**

The AES recently began an internal and external evaluation process of current priorities to identify other critical issues that should be targeted by our research program, and to incorporate stakeholders input on these issues and on the setting of research priorities. Two types of meetings held during last year in different locations of Puerto Rico were instrumental for achieving these goals.

First, we have continued to celebrate an annual meeting with all the researchers, extension faculty, farmers and other public interested in the work performed under each commodity area. In these meetings the progress of currently active projects is discussed, preliminary results are shared and further input is sought for updating the commodity's research needs and priorities. The meeting is usually celebrated in the Research Center or Substation closest to where the main nucleus of the commodity producers are located, and coordinated with the Agricultural Extension Service commodity specialist and agricultural agents of the region. Both the commodity leader and the extension personnel identify and invite interested stakeholders from producers associations, individual farmers, faculty and students, government officials and community organizations with an interest in the commodity's work. The input received in these meetings from all the stakeholders present is summarized, evaluated and presented in a concluding meeting of commodity leaders and research administrators, where final decisions are taken.

Second, several commodity leaders and directors of integrated academic departments have organized thematic workshops, seminars, or field days in which research results on particular topics have been shared and alternative views on the subject--including further research and extension needs, or public policy determinations--have been discussed. The feedback received in these activities was incorporated into the revised statement of issues prepared under each goal for the FY 2004-2006 Plan of Work (POW) update.



## **PROGRAM REVIEW PROCESS**

There have been no significant changes in our Program Review Processes since our Five-Year POW was submitted. This annual report includes the same description previously presented, with minor revisions.

Every AES proposal or request for extension, formula funded or otherwise, goes through a thorough merit review process following the *Administrative Manual for the Hatch (Experiment Station) Act as Amended* (see section C.3, page 7, Projects Supported with Regional Research Funds). The review committee is made up of AES Assistant Dean for Research, the concerned Department Chair<sup>2</sup> and the concerned commodity Leader or Leaders, or, in the case of these last two, their representatives. Each individual evaluates and rates the various proposals before they are submitted to the proper authority for approval. If any of the members of the review committee are collaborating in the proposal being submitted, they do not participate in the evaluation process, but send the proposal to a qualified scientist, in some instances to external reviewers.

More specifically, the scientific peer review process of proposals according to the source of funding is the following:

a) Matching Commonwealth Research Funds:

Proposals are submitted to the Assistant Dean for Research with the pre-approval of the respective Department Head and Commodity Leader. The Assistant Dean for Research discusses and evaluates the proposals in a meeting with the 10 commodity leaders. Once the proposal goes through this process and is accepted, the project is included in the AES research program.

b) Formula Hatch Research Funds:

Proposals are submitted to the Assistant Dean for Research with the preliminary endorsement of the respective Department Head and Commodity Leader. The Assistant Dean for Research sends the proposal again to the corresponding department head, commodity leader and external reviewers—if needed—for their written comments on the scientific merit of the proposed research and compliance with the AES strategic plan. Proposals and their reviewers' input are discussed, evaluated, and a final decision is reached in a subsequent meeting of the Assistant Dean for Research with the ten commodity leaders and seven departments' heads. These proposals are then sent to the USDA-CSREES Office of the Administrator, where the respective specialist reviews them. Once the proposals are approved in Washington, the new or revised projects are included in the AES research program.

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<sup>2</sup> The College of Agricultural Sciences is made up of seven Integrated Departments: Animal Industry, Horticulture, Crop Protection, Agronomy and Soils, Agricultural Economics and Rural Sociology, Agricultural Engineering and Agricultural Education.

c) Special Grant Research Funds:

Pre-proposals are submitted to the Assistant Dean for Research with the pre-approval of the respective Department Head and Commodity Leader. The Assistant Dean for Research sends the pre-proposal to a scientific review committee composed by members of the scientific staff within and outside the College of Agriculture. These scientific review members make written comments and decide on the scientific merit of the proposed research and if it complies with the AES strategic plan. Eight scientists compose this committee. Once the pre-proposal is accepted, the principal investigator is notified and asked to write up a full proposal. The Assistant Dean for Research sends the proposal again to the scientific review committee. They review the full proposal and again make written comments. These proposals are then sent to the program manager. The program manager send them out for external review using a mailing list similar to the one managed by the NRI program. A panel of 4 to 5 reviewers rank each proposal and make written comment on the scientific merit, scientific preparation of the principal investigator, and the potential success and impact of the research. This information is then gathered, distributed, and discussed among the technical committee members of the special grant fund at an annual spring meeting in Washington. This committee is composed of representatives of the universities of Florida, Puerto Rico, and the US Virgin Islands (Dean and Director, Associate Dean and/or Assistant Dean for Research), CSREES staff, and USDA-ARS representative. This group and the Program Manager decide which proposals will be accepted for funding and included in each of the participating universities research program.

**Evaluation of the Success of Multi and Joint Activities:**

The Agricultural Experiment Station of the University of Puerto Rico actively participates in Multi-State Research. There were six projects within Multi-State Research last fiscal year. Research covers disciplines such as plant breeding, pesticide detection and assessment, and rural sociology. While the impact of some of these studies appears to be state specific, when results from the participant states are put together, conclusions about the impact of a particular program and nationwide variations can be reached. This has been the case with multistate projects in the area of rural sociology, for example. The exchange of information and disciplinary discussions taking place in these projects annual meetings have contributed to the improvement of our research program.