

2007 University of Puerto Rico Research Annual Report

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I. Report Overview

1. Executive Summary

The University of Puerto Rico Agricultural Experiment Station (AES) mission within the College of Agricultural Sciences (CAS) is to conduct scientific research that promotes an economically viable agricultural sector, the conservation and enhancement of natural resources and the environment, and a better quality of life in rural and urban areas. Our research also supports the industries that process agricultural raw materials and provides the technological base required for solving the problems affecting farmers, public and private institutions, and for rural development. The AES coordinates its academic activities with the teaching and extension faculty of the CAS, and incorporates into its research program faculty of these other two institutional branches. Although for this Plan of Work (POW) cycle, the AES and the Puerto Rico Agricultural Extension Service have opted to continue with separate submissions, all of our planned programs incorporate the collaboration of Extension faculty in the activities proposed to disseminate results, and many also extend this collaboration to other key aspects of the research process.

The AES has administrative offices and carries out research activities at two main centers: Río Piedras, in the northern San Juan metropolitan area, and Mayagüez, on the west coast of the island, where the CAS Campus is located. In addition, the AES has six substations comprising more than 2,000 acres of land distributed in the different geographical and ecological zones of Puerto Rico. This wide distribution allows for the evaluation of crop and animal production systems adapted to the conditions of different ecological zones. In addition, 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.

Until the present POW, research efforts in the AES were organized along traditional commodity lines. Commodity groups are still active and constitute an important link with our stakeholders, but they are no longer the basic unit structuring our research program. Adopting federal guidelines, we began in 2006 a transition towards defining and organizing research programs following the LOGIC model. During the initial three years of our POW, programs have been conceptualized around the situation and priorities of the area, but taking into account mostly the inputs and outputs from our Hatch and McIntire Stennis projects. This is the reason why some of the planned and actual outputs for 2007 appear to be low. By 2010 all of our projects should be already incorporated into our POW and contributing towards achieving the outcomes of the planned programs, including those of new programs created to accommodate all of our research lines.

Core funding for the Agricultural Experiment Station's research program is provided by various sources. State funds are primarily used to cover salaries of academic and support personnel. USDA funding is crucial for directly financing the research program and supplementing salaries of faculty and staff. Formula-funds include Hatch Regular, Hatch Regional, McIntire-Stennis and Animal Health, although during FY 2007 we had no active Animal Health project. Special Grants such as the Tropical and Subtropical Agriculture Research (T-STAR Caribbean) support targeted areas of research important for Puerto Rico, Florida and the Virgin Islands, although again, during 2007 these funds were temporarily suspended by Congress affecting somewhat the outcomes of the planned programs. Along with federal and state funding, there are extramural research grants and contracts such as those with the Natural Resources Conservation Service, Environmental Protection Agency, USDA-ARS, Puerto Rico's Department of Agriculture, Puerto Rico's Department of Natural Resources and other agreements with US-Universities. This fiscal year the Hatch allocation for Puerto Rico was \$5,190,430 of which \$4,233,469.00 were spent in the inputs of projects included in our 2007 Planned Programs. The difference between these two amounts will pass to FY2008 as Carryover Funds.

Planned Programs Overview

The Agricultural Economics, Marketing, Value Added and Community Development Program is the smallest of our research programs, although its contribution to the analysis of the conditions affecting agriculture and rural areas is increasingly recognized as vital to the search for alternatives for local commodities and communities. The total FTE/SY dedicated to this program in 2007 was 1.7. Following closely the stated needs of stakeholders in agency sponsored meetings, new studies were begun last year to explore consumers' preferences for roots and tubers and costs of production of poinsettias, one of our principal ornamental crops. Concerns over the performance of plantain producers' official marketing organizations also lead to the design of an opinion survey of agricultural extension agents dealing with this crop, to better assess problems and organizational alternatives. Results were presented in commodity meetings with producers and other stakeholders, and to government officials involved with the implementation of this program. Joint meetings between Department of Agriculture staff and AES researchers have continued, to implement some of the recommendations of these studies. In addition, publications and presentations were prepared documenting the emergence of farmers' markets and the globalization of food retailing in Puerto Rico, and analyzing

the components of the plantain commodity. The major limitation faced by this program at present is the lack of faculty members with the expertise needed to conduct research in this area, although the CAS administration has tried to recruit new personnel with expertise in agricultural economics and marketing.

During 2007, the AES allocated 13.1 Scientist years (SY) to address the Integrated Management of New and Emerging Pests (IMNEP) program's goals. We have continued with active participation within the Southern Pest Detection Network (SPDN). Diagnostic docents attended two specialized training symposia, and offered 5 participant training seminars for peers, government and industry. Major efforts are underway in the characterization of bacterial, viral, and fungal diseases, and insect pests in cucurbits, ornamentals, coffee, palms, citrus, and other crops. Also a Pest Strategic Management Plan (PSMP) for fresh tomato and pepper production is in progress. The AES has as a goal to establish PSMPs for major commodities to assist with defining priorities for the program.

For some time now, AES new pesticide registration activities have been diminishing due to changes in federal legislation. Four projects (watermelon, plantain, citrus, tomato and avocado) address testing of "reduced risk" pesticides. Innovative integrated pest management projects, such as management of new watermelon and avocado diseases, economic threshold development for key tomato pests, and natural enemy mass-rearing for coffee, continue to provide producers with cutting-edge pest management solutions. Other important projects now focus on new and potentially devastating problems like the recent introduction of the coffee berry borer, cucurbit vine decline, and on black sigatoka management.

Currently, one disappointing aspect of the IMNEP program has been our inability to gauge progress in technology adoption outcomes. Our frustration has been not to be able to simultaneously seek new research directions to attain results based on cutting edge science, while at the same time gauging stakeholder satisfaction and approval. One aspect of this failure is given in the nature of agriculture in Puerto Rico, where we deal with many crops some grown in thousands of acres; others just in a handful of acres. We need to improve the connection between research and extension and develop transfer mechanisms tailored to the conditions of different types of farmers. In essence, it is conceivable that IMNEP-based research is in fact being adopted, and better pest management is occurring thanks to our research, but we are still trying to find a reliable mechanism to ascertain this fact.

The Milk and Meat Production Systems program has as its principal objective to support commercial livestock production in Puerto Rico. The local livestock industries, led by dairy farming and broiler raising, and with smaller contributions from production of beef cattle, swine, sheep and goats, horses, rabbits, fighting cocks and layer hens, constitute the most important segment of the island's agricultural economy. During 2007 the AES allocated 11.7 FTE/SY and half of our Hatch funds to this program. Livestock production in Puerto Rico competes against animal products imported from lands where production costs are lower. This requires, among other things, sound scientific resources to solve technical problems in animal breeding, feeding, rearing, milking, housing, health care, comfort and welfare, all in harmony with environmental protection; and to translate scientific knowledge into recommended management practices (RMP). Research and extension activities were conducted with the aim of developing, testing, and implementing on private farms, new or modified RMP, e.g., use of novel or improved feed resources and more efficient feeding practices; non-drug-dependent control of internal parasites; techniques for alleviating thermal stress in lactating cows and for producing more tender beef; and establishment, irrigation, fertilization and management of swards under grazing and forages for hay or silage.

Progress was also made in obtaining stakeholders' opinions regarding the problems they face and the topics for scientific research most pertinent in this regard. Certain RMP are being widely adopted by producers, e.g., the elimination of wasteful use of concentrate feeds on non-responsive lactating dairy cows and the feeding of transition cows diets designed to prevent milk fever and other metabolic disorders at calving. Also, the establishment of a breeding season in beef cattle herds as opposed to yearlong breeding. The adoption of other RMP will require much additional effort, because these offer no immediate benefit in the short term to justify the cost and effort of their implementation, but in the long term would be profitable, e.g., the large scale production of tropical legume forages and their optimal use in well-balanced diets for ruminant livestock.

Research supported by formula funds under our Natural Resources and Environment program is centered on reducing barriers to the adoption of microirrigation technologies, decreasing the presence of pest related chemicals in our water resources through improvements in the methodology for extraction and analysis of pesticides and toxins in water, and on forestry studies of fire dynamics in dry forests and of the advantages/disadvantages of growing coffee under partial shade and in full sunlight. In 2007 the AES allocated 3.3 FTE/SY to formula funded projects in this program. More than fifteen papers were presented in seminars, workshops and conferences to disseminate the findings of these projects. Work continues on developing ways to provide this information to non traditional stakeholders. Externally funded projects whose efforts are related to this program will be gradually incorporated into our future POWs and reported in annual reports.

Results from microirrigation studies with root crops under the arid conditions of southern Puerto Rico indicate that marketable yield and quality of tanager and yam can be improved by increasing the level and frequency of irrigation by using the

method of evapotranspiration (ET) replenishment. Moreover, the visual incidence of root rot in tanager decreased when the level and the frequency of irrigation were increased. These findings confirm the potential for commercial production of tanager and yam in the arid zone with the implementation of management practices that prevent stress conditions during growth. A formal workshop for farmers on microirrigation research activities and results was conducted in collaboration with the Extension Service.

Studies in agroforestry systems showed that the recuperation of coffee plantations after rejuvenation pruning varies if the plantation is cultivated in full sunlight or under partial shade. Our results indicate that it is important to maintain partial cultivated shade in coffee plantations to attain optimum yield, plantation quality and longevity. In dry forests, calorimeter data suggest that fires in grass-dominated areas are patchy in both extent and intensity, despite appearing to be relatively uniform in cover. After a fire, stems and branches of saplings in closed canopy areas tend to survive and releaf even if leaf loss is total. These and other results are informing forest managers about the role of wildfire and tree response. Researchers are currently developing ways to provide this information to public users of the forest through a series of interpretive activities and signage.

The Plant Genetic Resources, Breeding and Production Systems Program is an essential component of the AES research program receiving about a third of our Hatch funds and engaging 12.7 FTE/SY in its projects. During the past year work has continued on the research and release of improved cultivars of crops of economic importance and on the distribution of germplasm to scientists and the public. A white bean line that combines resistance to Bean Golden Yellow Mosaic Virus and common bacterial blight was released as the cultivar 'Verano'. This heat tolerant bean cultivar also has resistance to Bean Common Mosaic Virus. In addition, fifteen pigeon pea germplasm lines from ICRISAT were found to have resistance to the pigeon pea pod borer (*Melanagromyza obtusa*). Resistant lines with the most desirable agronomic and horticultural traits were used as parents in the pigeon pea breeding program. Research on the use of mulches and other organic and transitional crop management systems was also initiated to address the need to develop efficient sustainable/organic production systems for horticultural crops. More than thirty presentations were delivered at scientific meetings by program researchers, and thirteen articles were published in refereed journals. Also, six graduate students collaborating in program's projects presented their theses to the graduate school.

During the past year, seed of bean, squash, pigeon pea, corn, eggplant, sweet potato and tanager varieties were sold at the Isabela Substation. In some cases, the AES is the only reliable source of seed. Some farmers who visited the Isabela Substation to purchase seed also purchased technology packages or met with researchers to obtain advice concerning production problems. More than 700 technological packages of the different crops were distributed during the year. Nevertheless, we are aware that a significant increase in the cost of fertilizer has resulted in decreased use of this input for some crops. Future research activities dealing with soil nutrient management will have to address the need to use fertilizer more efficiently and to promote natural processes such as biological nitrogen fixation.

Total Actual Amount of professional FTEs/SYs for this State

Year:2007	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	44.2	0.0
Actual	0.0	0.0	42.5	0.0

II. Merit Review Process

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

- Internal University Panel
- Combined External and Internal University Panel
- Expert Peer Review

2. Brief Explanation

There has been no significant change in our Program Review Process since last year update was submitted. In 2005, however, we changed the way in which our Hatch-funded research proposals are initially granted. In response to internal and external evaluations requesting that a portion of Hatch funds be allocated to projects on the basis of an annual call for proposals with the year's revised priorities, part of our formula-funded research is now competitively granted on the basis of said proposals. More specifically, the scientific peer review process of Hatch proposals is the following:

An annual call for proposals which includes the year's revised research priorities is prepared and distributed by the AES Research Office. Proposals are submitted to the Assistant Dean for Research with the preliminary endorsement of the respective Department Head. The Assistant Dean for Research sends the proposal again to the corresponding department head, to a local peer reviewer and to an external reviewer 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 and evaluated by the CAS Associate and Assistant Deans for Research, and a final decision is taken by the administration. Project directors of the selected proposals are given the opportunity to incorporate reviewers' suggestions and make adjustments as appropriate. These proposals are then sent to the USDA-CSREES Office of the Administrator, where the respective national program leaders review them. Once the proposals are approved in Washington, the new or revised projects are included in the AES research program. Beginning in 2008, all McIntire-Stennis funds are distributed competitively following this same approach.

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

Brief Explanation

Two types of meetings are held in Puerto Rico to identify critical issues that should be addressed by AES research programs. First, the AES continues to celebrate an annual meeting with researchers, extension faculty, farmers and other members of the public interested in the work performed by the different programs and commodity groups. In these meetings the progress of active research projects is discussed, preliminary results are shared and further input is sought from participants to update research needs and priorities. The meeting is usually celebrated in the Research Center or Substation closest to the principal area of production, 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 members of producers associations, individual farmers, faculty and students, government officials, and community organizations with an interest in the commodity's work and related research programs. This year the calendar was also published in the island's monthly agricultural newspaper. The input received in these meetings from all the stakeholders present is summarized, evaluated and presented in a meeting of commodity group leaders, program coordinators and research administrators, where final decisions are made concerning research priorities. The list of priorities assembled through this process guides the year's call for proposals for new Hatch and Special projects.

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 continues to inform the current process of program assessment for our rolling five-year POW.

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
- Other (consultations with local extension agents and commodity leaders)

Brief Explanation

Stakeholders are identified by commodity group leaders, extension personnel, researchers, and through local advisory committees established by administrators of the CAS. Publicly known farmers' and agricultural professionals' organizations were contacted and invited to participate in the meetings.

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

Brief Explanation

Input from stakeholders is collected at the meetings convened by commodity group and program leaders. Stakeholders are asked to fill a written evaluation at the end of the meeting which includes questions about the most critical issues affecting their commodities and localities and about our research priorities. This information is summarized in a report made by the commodity and program leaders.

3. A statement of how the input was considered

- To Identify Emerging Issues
- Redirect Research Programs
- In the Action Plans
- To Set Priorities

Brief Explanation

Stakeholders input have been used in the determination of the research priorities of each planned program and commodity area, and these, in turn, have guided the Request for Proposals emitted by the AES Research Office during the year. The input received during the past two years from both traditional and non-traditional stakeholders have been critical for starting new pilot experimental projects in organic agriculture and in compost production, linked to our Natural Resources and Environment program, and to the coffee and ornamentals commodity groups.

Brief Explanation of what you learned from your Stakeholders

-Participants in these meetings would like to see a stronger participation from all components of the agrofood system in the dialogue: farmers, processors, distributors and government officials in charge of the agricultural sector.

-Many commodity groups share similar problems in the areas of marketing, crop protection, registration of pesticides, fertilization and production efficiency which we think can be addressed by the new research programs created under our current POW.

-The list of problems identified by our stakeholders as plaguing their operations is very long, but a closer analysis reveals that in many instances there are already technological alternatives available that have been researched and could improve their situation, if they could be more actively disseminated among Extension personnel and farmers.

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	5190430	0

2. Totaled Actual dollars from Planned Programs Inputs				
Extension			Research	
	Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
Actual Formula	0	0	4233469	0
Actual Matching	0	0	4581860	0
Actual All Other	0	0	489639	0
Total Actual Expended	0	0	9304968	0

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

V. Planned Program Table of Content

S. NO.	PROGRAM NAME
1	Milk and Meat Production Systems Resources
2	Integrated Management of New and Emerging Pests
3	Plant genetic resources, breeding and production systems
4	Natural Resources and Environment
5	Agricultural Economics, Marketing, Value Added and Community Development

Program #1

V(A). Planned Program (Summary)

1. Name of the Planned Program

Milk and Meat Production Systems Resources

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			5%	
202	Plant Genetic Resources			15%	
205	Plant Management Systems			5%	
302	Nutrient Utilization in Animals			20%	
303	Genetic Improvement of Animals			7%	
305	Animal Physiological Processes			10%	
306	Environmental Stress in Animals			15%	
308	Improved Animal Products (Before Harvest)			10%	
313	Internal Parasites in Animals			8%	
601	Economics of Agricultural Production and Farm Management			5%	
Total				100%	

V(C). Planned Program (Inputs)

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

Year: 2007	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	8.4	0.0
Actual	0.0	0.0	11.7	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	2136057	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	2044377	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	316040	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Six meetings were held to discuss the situation of the local dairy, beef, small ruminants and swine industries and to seek majority opinion on research priorities, with participation of stakeholders, researchers, extension personnel and in some cases government officials. Also a one-hour panel discussion on the prospects and situation of the dairy industry of Puerto Rico was broadcast over the UPR Radio Network.

Five field days were conducted. Specific topics included genetic improvement and rearing and finishing of beef cattle; the FAMACHA method of assessing the internal parasite status of goats; and establishment and utilization of leguminous forages, including shrubs.

Of seven seminars presented to diverse audiences, six were organized by the beef integrated working group and one by the small ruminants group. Topics included the nutritional value of local beef as human food, economics of beef breeding-herd operations, strategies of dietary supplementation for grazing animals, and marketing of sheep and goat meats. Publications for producers included two issues of "La Res Informativa", one concerning the intramuscular fat content of pasture-fed bulls and the other presenting the results of a survey of beef producers' opinions on problems effecting efficiency and profitability of their operations; and one issue of "Ruminantia" dedicated to yield, physical conformation and classification of caprine carcasses. One article on slaughterhouse-waste compost was published in the journal Waste Management in 2007, and another, on in-vitro larval activity of gastrointestinal parasites of grazing goats, was accepted by the Journal of Parasitology. Publications in the local Journal of Agriculture of the UPR included one report on release of the perennial, rhizomatous peanut var. "Henorico", and an article on physical and sensory characteristics of hindquarter muscles of bulls; and two research notes on use of exogenous hormones in artificial insemination of sows and on the leguminous shrub, leucaena, as a supplement to local grass hay diets.

Nine papers reporting research findings were presented at meetings of international scientific organizations (American Society of Agronomy, American Forage and Grasslands Council, Caribbean Food Crops Society, Latin American Association of Animal Production), and one at the local society (SOPCA). Five MS theses were completed by students of the Animal Industry Department and two by those of Agronomy and Soils. Topics included somatic cell counts of dairy cows' milk and mastitis pathogens, fibrolytic enzymes for increasing digestibility of tropical grasses, nutritional evaluation of shrub legumes, tannin-containing legumes to combat internal parasites in goats, prebreeding flushing in goat does, evaluation of hays of mixed guineagrass-clitoria vs. rhodesgrass, and agronomic and fermentative aspects of two maize hybrids. A requested report was submitted to the Advisory Committee for Developing Management Plans for the Carraizo and La Plata Watersheds of the Caribbean Office of EPA, entitled "Toward the development of precision feeding of phosphorous in dairy farms in Puerto Rico".

2. Brief description of the target audience

Farmers, Extension professionals, government personnel, scientists, and private professionals.

V(E). Planned Program (Outputs)

1. Standard output measures

Target for the number of persons (contacts) reached through direct and indirect contact methods

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
Plan	0	0	0	0
2007	0	0	0	0

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

Patent Applications Submitted

Year	Target
Plan:	0
2007 :	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

	Extension	Research	Total
Plan			
2007	0	6	6

V(F). State Defined Outputs**Output Target****Output #1****Output Measure**

- Number of meetings held with stakeholders to discuss the industries' situation and research priorities

Year	Target	Actual
2007	4	6

Output #2**Output Measure**

- Number of popular (non-refereed) publications prepared based on research results.

Year	Target	Actual
2007	4	4

Output #3**Output Measure**

- Number of field days held in research facilities and/or private farms to validate and demonstrate RMPs based on research results.

Year	Target	Actual
2007	4	5

Output #4**Output Measure**

- Number of publications made in refereed scientific journals.

Year	Target	Actual
2007	4	6

V(G). State Defined Outcomes**V. State Defined Outcomes Table of Content**

O No.	OUTCOME NAME
1	Number of participants in field days willing to adopt the RMPs demonstrated.
2	% market participation of local beef.

Outcome #1**1. Outcome Measures**

Number of participants in field days willing to adopt the RMPs demonstrated.

2. Associated Institution Types

•1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2007	20	14

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

Livestock production in Puerto Rico competes against animal products imported from lands where production costs are lower. Increased and improved local livestock production would benefit several sectors of the economy.

Quantitative data of this sort were obtained at only one of the field days, in which case 14 of 16 producers responding expressed a considerable disposition to adopt recommended practices.

What has been done

Research and extension activities were conducted with the aim of developing, testing, and implementing on private farms, new or modified RMP, e.g., use of novel or improved feed resources and more efficient feeding practices; non-drug-dependent control of internal parasites; techniques for alleviating thermal stress in lactating cows and for producing more tender beef; establishment, irrigation, fertilization and management of swards under grazing and forages for hay or silage.

Results

Interest of stakeholders in attending activities held for their benefit showed an encouraging increase over the previous year. Progress was made in obtaining stakeholders' opinions regarding the problems they face and the topics for scientific research most pertinent in this regard. Certain RMP are being widely adopted by producers, e.g., the elimination of wasteful use of concentrate feeds on non-responsive lactating dairy cows and the feeding of transition cows diets designed to prevent milk fever and other metabolic disorders at calving; also the establishment of a breeding season in beef cattle herds as opposed to yearlong breeding. The adoption of other RMP will require much additional effort, because these offer no immediate benefit in the short term to justify the cost and effort of their implementation, but in the long term would be profitable, e.g., the large scale production of tropical legume forages and their optimal use in well-balanced diets for ruminant livestock.

4. Associated Knowledge Areas

KA Code	Knowledge Area
601	Economics of Agricultural Production and Farm Management
205	Plant Management Systems
308	Improved Animal Products (Before Harvest)
202	Plant Genetic Resources
303	Genetic Improvement of Animals
302	Nutrient Utilization in Animals
306	Environmental Stress in Animals
102	Soil, Plant, Water, Nutrient Relationships
313	Internal Parasites in Animals

Outcome #2**1. Outcome Measures**

% market participation of local beef.

2. Associated Institution Types

•1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2007	13	18

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)****What has been done****Results****4. Associated Knowledge Areas**

KA Code	Knowledge Area
308	Improved Animal Products (Before Harvest)
601	Economics of Agricultural Production and Farm Management
306	Environmental Stress in Animals
302	Nutrient Utilization in Animals

V(H). Planned Program (External Factors)**External factors which affected outcomes**

- Economy
- Appropriations changes
- Public Policy changes
- Competing Programmatic Challenges
- Other (Internal restructuring and renovation of research facilities)

Brief Explanation

Experiments planned for the year under several projects were postponed or suspended due to termination of the milking operation at the Gurabo Substation in December, 2007. The Gurabo milking herd was transferred to the dairy at Lajas, in spite of the fact that the newly constructed milking parlor, free stall confinement area, and manure handling system at Lajas were not yet operational. Also, conditions of the pastures at Lajas are inferior to those at Gurabo and need much improvement.

Another problem arose with the feed-mixing operation at Lajas, where experimental formulas of concentrate feeds are prepared for use mostly with poultry and dairy cattle. The lack of functionality of a large part of the machinery, due to worn-out elements of the electrical power system, made preparation of the several-ton quantities of feed needed for experiments, an unreasonably labor-intensive task. Work on swine reproduction and poultry management (broilers and layers) at Lajas has also been delayed because new physical facilities for housing these classes of livestock and for waste management are still pending completion.

Unanticipated increases in the cost of synthetic fertilizer have had a big impact on the budgets of experiments with beef cattle under grazing. Also large increases in the cost of concentrate feeds needed for maintenance of the dairy cattle and swine herds, added to pre-existing budget problems.

V(I). Planned Program (Evaluation Studies and Data Collection)**1. Evaluation Studies Planned**

- Other ()

Evaluation Results

Key Items of Evaluation

Program #2

V(A). Planned Program (Summary)

1. Name of the Planned Program

Integrated Management of New and Emerging Pests

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
211	Insects, Mites, and Other Arthropods Affecting Plants			29%	
212	Pathogens and Nematodes Affecting Plants			43%	
213	Weeds Affecting Plants			2%	
215	Biological Control of Pests Affecting Plants			4%	
216	Integrated Pest Management Systems			22%	
	Total			100%	

V(C). Planned Program (Inputs)

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

Year: 2007	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	19.7	0.0
Actual	0.0	0.0	13.1	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	462533	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	483364	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	57097	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Research program priorities remain unchanged from 2006. Program areas are: (1) registering new pesticides; (2) testing 'reduced risk' pesticides; (3) validating and developing integrated management alternatives for pests, diseases, and weeds; and, developing pest and disease taxonomic expertise in key pathogen and insect groups. PRAES is still struggling to transition into strategic, multidisciplinary approaches to crop protection such as the development of Pest Management Strategic Plans (PMSPs). During 2007, PRAES allocated 13.1 Scientist years (SY) to address IMNEP program's goal activities, for a net reduction of 1.3 SY from FY2006. A brief activity summary follows:

-PRAES continues active participation within the Southern Pest Detection Network (SPDN). Diagnostic docents attended two specialized training symposia, and offered 5 participant training seminars for peers, government and industry. Major efforts are underway in the characterization bacterial, viral, and fungal diseases, and insect pests in cucurbits, ornamentals, coffee, palms, citrus, and other crops. In FY2007, PRAES allocated 3.8 SY (28.7%) to pest and disease diagnostic activities, or an increase of 0.5 SY from 2006.

-A Pest Strategic Management Plan (PSMP) for fresh tomato and pepper production is in progress. PRAES has as a goal to establish PSMPs for major commodities to assist with defining priorities for the program. In FY2007, PRAES allocated 0.9 SY (6%) to development of PSMPs.

-For some time now, PRAES new pesticide registration activities have been diminishing due to changes in federal legislation. Four projects (watermelon, plantain, citrus, tomato and avocado) address testing of "reduced risk" pesticides. In FY2007, PRAES allocated 1.4 SY (10%) for a net reduction of 1 SY from 2006.

-Innovative integrated pest management projects, such as management of new watermelon and avocado diseases, economic threshold development for key tomato pests, and natural enemy mass-rearing for coffee, continue to provide producers with cutting-edge pest management solutions. Other important projects now focus on new and potentially devastating problems like: the recent introduction of the coffee berry borer, cucurbit vine decline, and on black sigatoka management. For FY2007, PRAES allocated 8.9 SY (62%) to research on pest, and disease management.

2. Brief description of the target audience

- Extension Specialists and Agents; •Academic Programs Faculty; •Producers and Commodity Groups;
- Consumers; and •Federal and State Agricultural Agencies (PRDA, USDA/APHIS, USDA/ARS, USDA/NRCS).

V(E). Planned Program (Outputs)

1. Standard output measures

Target for the number of persons (contacts) reached through direct and indirect contact methods

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
Plan	0	0	0	0
2007	0	0	0	0

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

Patent Applications Submitted

Year	Target
Plan:	0
2007 :	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

	Extension	Research	Total
Plan			
2007	0	3	3

V(F). State Defined Outputs**Output Target****Output #1****Output Measure**

- Number of 'Pest Management Strategic Plans' (PMSPs) developed

Year	Target	Actual
2007	2	0

Output #2**Output Measure**

- Number of peer-reviewed articles in major scientific journals resulting from program activities.

Year	Target	Actual
2007	3	3

Output #3**Output Measure**

- Peer reviewed articles in local Scientific Journals resulting from program activities.

Year	Target	Actual
2007	5	10

Output #4**Output Measure**

- Abstracts or oral presentations in professional scientific society meetings resulting from program activities.

Year	Target	Actual
2007	8	20

Output #5**Output Measure**

- Poster presentations in professional scientific society meetings resulting from program activities

Year	Target	Actual
2007	9	4

Output #6**Output Measure**

- Number of joint Research-Extension activities that include pest diagnostics and identification, use of reduced impact pesticides, or research on pesticide impact assessment on non-target beneficial organisms.

Year	Target	Actual
2007	1	3

Output #7**Output Measure**

- Number of program-sponsored scientific events, like symposia, topic conferences, and open houses

Year	Target	Actual
2007	2	0

V(G). State Defined Outcomes**V. State Defined Outcomes Table of Content**

O No.	OUTCOME NAME
1	Number of stakeholders with increased knowledge on emerging pests and aware of non-target pesticide effects
2	Number of persons that adopted reduced risk pesticides and practices
3	Number of farmers reporting decreased losses due to key and emerging pests

Outcome #1**1. Outcome Measures**

Number of stakeholders with increased knowledge on emerging pests and aware of non-target pesticide effects

2. Associated Institution Types

•1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2007	50	200

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

Farmer/producer demographic profiles still point at a mostly poorly educated and trained workforce. Most producers and agricultural professionals can not readily distinguish between beneficial and pest organisms, and likely can not understand the full biological effects of commonly-used pest chemical control actions. By understanding appropriate integrated pest control measures farmers could help protect natural enemies, lessen the negative environmental impacts, and save money.

What has been done

PRAES Integrated Management of New and Emerging Pests program has as a primary goal to continue training scientists in the correct identification of pests and diseases, including those of quarantine and/or economic significance. At the same time, the program strives to document and evaluate the impact of pest management practices on natural enemies, through testing the efficacy of 'reduced risk' pesticides and other low environmental impact practices on key pests, weeds and diseases.

Results

Current research and specialist training has allowed PRAES scientists to identify new pests and diseases affecting important tropical crops. In pumpkin and watermelon a new vector-transmitted viral disease causing vine decline has been identified. The finding has clarified the erroneous identification of the disease as a fungus, and has allowed producers to stop using ineffective fungicides to control the disease. New and important invasive insect pests have been identified his past year in several crops and this is due effective taxonomy and identification training. The use of biological pest control methods is now for he first time being tried on a large scale to control key pests pf coffee by means of mass rearing and augmentation. Success of this initiative may result in savings of over \$1 million per year to producers. Another activity, now underway, is identifying natural enemies associated with key fruit crops which should result in the preparation of a field guide.

4. Associated Knowledge Areas

KA Code	Knowledge Area
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Pathogens and Nematodes Affecting Plants
215	Biological Control of Pests Affecting Plants

Outcome #2**1. Outcome Measures**

Number of persons that adopted reduced risk pesticides and practices

2. Associated Institution Types

•1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2007	0	0

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

The same farmer profile (i.e., poorly educated and/or trained) makes them unlikely to judge correctly on the effectiveness or safety of chemical control tools. The development of simple efficacy guidelines, based on local research that evaluates efficacy, applicator safety, and non-target effects, would help producers in the most efficient use of modern pest management tools. Currently, most producers are more likely to use informal recommendations at the moment of choosing chemical control.

What has been done

Another PRAES Integrated Management of New and Emerging Pests program goal is to emphasize research on the efficacy and registration of 'reduced risk' pesticides as key components of tropical IPM programs. PRAES continues to register effective chemical control alternatives to weed control in plantains; of IPM in tomatoes, avocado and citrus; and disease control in cucurbits. This current approach is new here, and proper documentation and appraisal of adoption trends lag.

Results

Current IPM research continues at an adequate rate. Work is underway to establish economic injury levels in chemical control intensive crops, such as tomato. Current data show that producers can eliminate 3-5 applications per growth cycle at savings of close to \$0.5 million per year. Research on the use of 'reduced risk' pesticides in citrus has already identified cost-effective products that are able to manage most injurious insect pests. Much work is needed however in efficiently transferring these technologies to producers. One approach had been the development of stakeholder-driven 'pest management strategic plans' for key crops. PRAES, in partnership with Extension Service colleagues will strive towards attaining this strategic goal.

4. Associated Knowledge Areas

KA Code	Knowledge Area
216	Integrated Pest Management Systems
213	Weeds Affecting Plants
211	Insects, Mites, and Other Arthropods Affecting Plants

Outcome #3**1. Outcome Measures**

Number of farmers reporting decreased losses due to key and emerging pests

2. Associated Institution Types

•1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2007	0	0

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

Ultimately, the best indicator of success is a measure of the effective use of PRAES-developed technology in the control of pest, disease and weed problems. Science-based approaches to integrated management of emerging and new pests should result in reduced environmental and health impacts, while simultaneously maximizing producer's earnings, consumer safety, and overall social wellbeing.

What has been done

PRAES key activity in this regard is the Plant Diagnostic Clinic. Services of this Clinic besides identification include written orientation to producers about best management options. Results of current IPM research are often put into simple and practical advice to producers and other users of its services. As with the previous Outcome, documentation and appraisal of adoption trends lag.

Results

The Diagnostic Clinic served over 800 customers in the past year, each the recipient of best IPM practices for their needs.

4. Associated Knowledge Areas

KA Code	Knowledge Area
211	Insects, Mites, and Other Arthropods Affecting Plants
216	Integrated Pest Management Systems
212	Pathogens and Nematodes Affecting Plants
213	Weeds Affecting Plants
215	Biological Control of Pests Affecting Plants

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Competing Programmatic Challenges
- Other (Challenge of dealing with multiple crops, weakness of commodity groups, need to improve transfer mechanisms)

Brief Explanation

Currently, one disappointing aspect of the IMNEP program has been our inability to gauge progress in technology adoption outcomes. The basic approach of research and development programs in agriculture is to seek solutions to important problems affecting agricultural sectors. Often, much trial and error is involved, and it is not easy to measure impact when programs are in their initial years. Furthermore, a new way of doing business requires constant communication with stakeholders to ensure the appropriateness of research in the solution of their most pressing problems. Our frustration has been not to be able to simultaneously seek new research directions to attain results based on cutting edge science, while at the same time gauging stakeholder satisfaction and approval. One aspect of this failure is given in the nature of agriculture in Puerto Rico, where commodity groups are mostly non-existent or weak. Instead of 3-5 main commodities, we deal with many crops some grown in thousands of acres; others just in a handful of acres. We need to improve the connection between research and extension and develop transfer mechanisms tailored to the conditions of different types of farmers. In essence, it is conceivable that IMNEP-based research is in fact being adopted, and better pest management is occurring thanks to our research, but we are still trying to find a reliable mechanism to ascertain this fact.

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

1. Evaluation Studies Planned

- During (during program)
- Other ()

Evaluation Results

{No Data Entered}

Key Items of Evaluation

{No Data Entered}

Program #3

V(A). Planned Program (Summary)

1. Name of the Planned Program

Plant genetic resources, breeding and production 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
201	Plant Genome, Genetics, and Genetic Mechanisms			25%	
202	Plant Genetic Resources			25%	
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants			25%	
205	Plant Management Systems			25%	
	Total			100%	

V(C). Planned Program (Inputs)

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

Year: 2007	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	12.9	0.0
Actual	0.0	0.0	12.7	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	1455065	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	1646740	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	27042	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Research and release of improved cultivars of crops of economic importance
 dash; The UPR AES and the USDA cooperatively released the white bean variety 'Verano'. This heat tolerant bean cultivar also has resistance to common bacterial blight, Bean Golden Yellow Mosaic Virus and Bean Common Mosaic Virus.
 dash; One cycle of recurrent selection of the 'Suresweet' sweet corn population has been completed.
 dash; Sources of resistance to pigeon pea pod fly from ICRISAT were used as parents in crosses to develop locally adapted pigeon peas with enhanced levels of resistance.

Electronic publication of descriptions of germplasm collections
 dash; A web site for Regional Hatch Project H-94 was developed. This project describes the activities and achievements of the germplasm projects in the EEA.
 dash; Electronic versions of the bean and maize technology packages have been prepared

Distribution of germplasm to scientists and the public
 dash; AES germplasm collections on Substations were used as sources of genetic material for local producers
 dash; Plantings on Substations produced seed of varieties of traditional crops that were developed and released by the AES. In some cases, the AES is the only reliable source of seed.

Conduct research to identify BMP for crop production in Puerto Rico
 dash; Research was initiated addressing the need to develop efficient sustainable/organic production systems for horticultural crops.

Publish technology packages describing best management practices for crops of economic importance.
 dash; A technology package describing BMP for tomato production was published

Hosting field days for stakeholders at different Substations in collaboration with the Agricultural Extension Service, and organize field days to seed production fields, germplasm collections and other experimental fields.
 dash; Farmers and other stakeholder were invited to attend the annual meetings of the Commodity Groups. Researchers presented research results and farmers participated in a discussion that led to the establishment of priorities for research during the upcoming year.

Increased on-farm research to validate new technology
 dash; On-farm trials were conducted to validate the performance of legumes as cover crops for citrus orchards.

Publication of research results in bulletins for farmers and in refereed journals for scientists.
 dash; Thirteen articles were published in refereed journals by program personnel.

Presentations of research results at scientific meetings
 dash; Thirty one presentations at scientific meetings were made by program researchers.

2. Brief description of the target audience

Targeted audience consists of farmers, government professionals, county agents, scientists, USDA professionals, and professionals from the private sector. Farmers in Puerto Rico produce a diversity of crops using a wide range of levels of technology. BMP recommendations need to consider differences in cropping systems, soil type and rainfall distribution on the island.

V(E). Planned Program (Outputs)

1. Standard output measures

Target for the number of persons (contacts) reached through direct and indirect contact methods

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
Plan	0	0	0	0
2007	0	0	0	0

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

Patent Applications Submitted

Year Target
Plan: 0

2007 : 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

	Extension	Research	Total
Plan			
2007	0	13	13

V(F). State Defined Outputs

Output Target

Output #1**Output Measure**

- Number of stakeholders to adopt the proposed BMPs.

Year	Target	Actual
2007	100	113

Output #2**Output Measure**

- Focus groups of collaborators' opinions of the new technologies being validated

Year	Target	Actual
2007	1	0

Output #3**Output Measure**

- The number of "hits" on project-related web sites Records of the sale of hard copies of AES publications.

Year	Target	Actual
2007	1000	1306

Output #4**Output Measure**

- Records of the number and type of germplasm accessions distributed to scientists and the public.

Year	Target	Actual
2007	200	200

Output #5**Output Measure**

- Number of participants in the field days coordinated with Extension

Year	Target	Actual
2007	100	100

Output #6**Output Measure**

- Number of students attending field days to seed production fields, germplasm collections and other experimental fields.

Year	Target	Actual
2007	100	100

Output #7**Output Measure**

- Number of refereed publications

Year	Target	Actual
2007	2	13

Output #8**Output Measure**

- Number of non-refereed publications

Year	Target	Actual
2007	1	15

Output #9**Output Measure**

- Number of presentations in scientific meetings

Year	Target	Actual
2007	1	31

V(G). State Defined Outcomes**V. State Defined Outcomes Table of Content**

O No.	OUTCOME NAME
1	Number of stakeholders to adopt the proposed BMPs
2	Records of the sales of seed of improved cultivars at the Substations.

Outcome #1**1. Outcome Measures**

Number of stakeholders to adopt the proposed BMPs

2. Associated Institution Types

•1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2007	110	113

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
202	Plant Genetic Resources
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
205	Plant Management Systems

Outcome #2**1. Outcome Measures**

Records of the sales of seed of improved cultivars at the Substations.

2. Associated Institution Types

•1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2007	100	100

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems
202	Plant Genetic Resources
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants

V(H). Planned Program (External Factors)**External factors which affected outcomes**

- Economy
- Appropriations changes
- Competing Programmatic Challenges
- Other (Increase in the price of fertilizer)

Brief Explanation

A significant increase in the cost of fertilizer has resulted in decreased use of this input for some crops. Future research activities dealing with soil nutrient management should address the need use fertilizer more efficiently and to promote natural processes such as biological nitrogen fixation.

Research was also affected by the cancelation of the USDA-CSREES-TSTAR program in 2007. This program represented a significant source of funds for plant breeding and cropping systems research at the University of Puerto Rico. No new proposals were funded and several ongoing projects will be terminated early due to the lack of funding

V(I). Planned Program (Evaluation Studies and Data Collection)**1. Evaluation Studies Planned**

- During (during program)

Evaluation Results

{No Data Entered}

Key Items of Evaluation

{No Data Entered}

Program #4

V(A). Planned Program (Summary)

1. Name of the Planned Program

Natural Resources and Environment

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			28%	
104	Protect Soil from Harmful Effects of Natural Elements			9%	
111	Conservation and Efficient Use of Water			10%	
112	Watershed Protection and Management			5%	
123	Management and Sustainability of Forest Resources			10%	
133	Pollution Prevention and Mitigation			38%	
Total				100%	

V(C). Planned Program (Inputs)

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

Year: 2007	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	3.3	0.0
Actual	0.0	0.0	3.3	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	164861	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	388513	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	75784	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

-Research on microirrigation scheduling, nitrogen-fixing trees, field extraction and analysis of chemical pesticides, soil conditioners for highly eroded soils, wildfires and forest management, and biodiversity and conservation in Puerto Rico, was conducted according to annual work plans.

- An educational article on the restoration of eroded soils by planting trees and grasses was published in a non-refereed journal; a manuscript entitled "Evaluation of microirrigation levels on growth and productivity of avocado trees" was submitted for publication on a local refereed journal.

-More than fifteen papers were presented in seminars, workshops and conferences to disseminate the findings of these projects. Work continues on developing ways to provide this information to non traditional stakeholders. Results on the role of wildfires and tree response important to forest managers are being shared through a series of interpretative activities and signage. A formal workshop for farmers on microirrigation research activities and results was conducted in collaboration with the Extension Service.

2. Brief description of the target audience

Extension Specialists and professionals, government partners, farmers, consumers, environmental groups, students, forest managers and public users of the forest.

V(E). Planned Program (Outputs)

1. Standard output measures

Target for the number of persons (contacts) reached through direct and indirect contact methods

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
Plan	0	0	0	0
2007	0	0	0	0

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

Patent Applications Submitted

Year	Target
Plan:	0
2007 :	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

	Extension	Research	Total
Plan			
2007	0	2	2

V(F). State Defined Outputs

Output Target

Output #1**Output Measure**

- Oral or poster presentations in professional scientific society meetings resulting from program activities

Year	Target	Actual
2007	3	15

Output #2**Output Measure**

- Number of Peer Reviewed publications.

Year	Target	Actual
2007	3	2

Output #3**Output Measure**

- Number of trainings, research demonstration activities and meetings with stakeholders to discuss research results and priorities.

Year	Target	Actual
2007	1	4

Output #4**Output Measure**

- Number of graduate students completing a MS degree and submitting theses under research projects in this program

Year	Target	Actual
2007	4	3

V(G). State Defined Outcomes**V. State Defined Outcomes Table of Content**

O No.	OUTCOME NAME
1	Number of stakeholders gaining knowledge on natural resources management, dry forest ecology and management, microirrigation scheduling, and other soil enhancement and water conservation practices
2	Number of farmers adopting microirrigation management practices
3	Number of persons adopting practices that prevent dry forest fires
4	Number of farmers adopting methods to increase soil organic matter content
5	Number of farmers reporting increased water use efficiency in their farms
6	Number of persons that adopted practices to improve water resources.
7	Number of fires reported on dry forests
8	Number of watersheds for which a Total Maximum Daily Load (TMDL) for nutrients have been developed

Outcome #1**1. Outcome Measures**

Number of stakeholders gaining knowledge on natural resources management, dry forest ecology and management, microirrigation scheduling, and other soil enhancement and water conservation practices

2. Associated Institution Types

•1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2007	50	120

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
104	Protect Soil from Harmful Effects of Natural Elements
123	Management and Sustainability of Forest Resources
133	Pollution Prevention and Mitigation
112	Watershed Protection and Management
111	Conservation and Efficient Use of Water

Outcome #2**1. Outcome Measures**

Number of farmers adopting microirrigation management practices

2. Associated Institution Types

•1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2007	0	30

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
111	Conservation and Efficient Use of Water
102	Soil, Plant, Water, Nutrient Relationships

Outcome #3

1. Outcome Measures

Number of persons adopting practices that prevent dry forest fires

2. Associated Institution Types

•1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2007	0	5

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Tropical dry forests in Puerto Rico are facing new environments related to the introduction of exotic species that change disturbance regimes and patterns of forest succession. The introduction of non-native grass species in pasture systems has changed fire dynamics in forest ecosystems. Fires have become an increasing problem in dry forests and research that focuses on conservation of natives species and evaluates various management techniques is needed by forest managers.

What has been done

We have conducted a preliminary study of burn intensity by using calorimeters; set up an experiment to determine tree species susceptibility to fire; set up 100 seed traps to determine the difference in seed rain from burned to intact sites; planted 160 trees in a tropical dry forest restoration project; and disseminated project results. Two graduate students and three undergraduate research assistants have learned techniques in fire ecology measurement and reforestation.

Results

Calorimeter data suggest that fires in grass-dominated dry forest areas are patchy in both extent and intensity, despite appearing to be relatively uniform in cover. Closed canopy dry forests, even if dominated by fire intolerant species, help to minimize grass cover and to reduce mortality of saplings after a fire. After a fire, stems and branches of saplings in closed canopy areas tend to survive and releaf even if leaf loss is total. Stems in open areas are killed to ground level and post-fire survival is attained by resprouting from the root collar. Second fires that occur within 1.5 years of the first fire result in much greater mortality. These results are informing forest managers about the role of wildfire and tree response. This will lead to more informed damage and impact assessments following future wildfires. We are currently developing ways to provide this information to public users of the forest through a series of interpretive activities and signage.

4. Associated Knowledge Areas

KA Code	Knowledge Area
123	Management and Sustainability of Forest Resources

Outcome #4

1. Outcome Measures

Number of farmers adopting methods to increase soil organic matter content

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2007	25	25

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)****What has been done****Results****4. Associated Knowledge Areas**

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
104	Protect Soil from Harmful Effects of Natural Elements

Outcome #5**1. Outcome Measures**

Number of farmers reporting increased water use efficiency in their farms

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2007	25	0

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

This is a long term outcome for which no data is available during this year.

What has been done

A formal workshop for farmers on microirrigation research activities and results was conducted in collaboration with the Extension Service.

Results**4. Associated Knowledge Areas**

KA Code	Knowledge Area
111	Conservation and Efficient Use of Water

Outcome #6

1. Outcome Measures

Number of persons that adopted practices to improve water resources.

2. Associated Institution Types

•1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2007	0	10

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
112	Watershed Protection and Management
111	Conservation and Efficient Use of Water

Outcome #7

1. Outcome Measures

Number of fires reported on dry forests

2. Associated Institution Types

•1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2007	3	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
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Outcome #8**1. Outcome Measures**

Number of watersheds for which a Total Maximum Daily Load (TMDL) for nutrients have been developed

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2007	0	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
133	Pollution Prevention and Mitigation
112	Watershed Protection and Management

V(H). Planned Program (External Factors)**External factors which affected outcomes**

- Economy
- Appropriations changes
- Public Policy changes
- Competing Programmatic Challenges
- Other ()

Brief Explanation**V(I). Planned Program (Evaluation Studies and Data Collection)****1. Evaluation Studies Planned**

- Other ()

Evaluation Results

{No Data Entered}

Key Items of Evaluation

{No Data Entered}

Program #5

V(A). Planned Program (Summary)

1. Name of the Planned Program

Agricultural Economics, Marketing, Value Added and Community Development

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
604	Marketing and Distribution Practices			53%	
607	Consumer Economics			12%	
608	Community Resource Planning and Development			21%	
610	Domestic Policy Analysis			14%	
	Total			100%	

V(C). Planned Program (Inputs)

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

Year: 2007	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	1.5	0.0
Actual	0.0	0.0	1.7	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	14953	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	18866	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	13676	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Research to determine consumer preferences, marketing margins, and farmers' and other participant's share in the marketing channels of selected agricultural commodities was conducted. Also, studies to identify the diverse strategies local food system stakeholders are currently using or might use to create and manage ongoing or potential change, and their information needs, were performed. Publications and presentations based on research findings have been delivered at local and international forums related to food and marketing of agricultural products. In collaboration with Extension Faculty and Agents, results have been also delivered to stakeholders and interested audiences in meetings and workshops.

2. Brief description of the target audience

Farmers, Extension professionals, community leaders and organizers, producers associations and other professionals.

V(E). Planned Program (Outputs)

1. Standard output measures

Target for the number of persons (contacts) reached through direct and indirect contact methods

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
Plan	0	0	0	0
2007	0	0	0	0

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

Patent Applications Submitted

Year	Target
Plan:	0
2007 :	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

	Extension	Research	Total
Plan			
2007	0	2	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of refereed publications

Year	Target	Actual
2007	2	2

Output #2

Output Measure

- Number of presentations in scientific meetings

Year	Target	Actual
2007	3	7

Output #3

Output Measure

- Number of non-refereed publications (posters, newspaper articles, etc.)

Year	Target	Actual
2007	2	5

Output #4

Output Measure

- Number of participants attending workshops coordinated with Extension on program's results

Year	Target	Actual
2007	40	50

V(G). State Defined Outcomes**V. State Defined Outcomes Table of Content**

O No.	OUTCOME NAME
1	Number of stakeholders gaining knowledge about new markets and marketing tools
2	Number of alternative marketing projects identified as existing in Puerto Rico (long-term

Outcome #1**1. Outcome Measures**

Number of stakeholders gaining knowledge about new markets and marketing tools

2. Associated Institution Types

•1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2007	20	25

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
604	Marketing and Distribution Practices

Outcome #2**1. Outcome Measures**

Number of alternative marketing projects identified as existing in Puerto Rico (long-term)

2. Associated Institution Types

•1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2007	5	5

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
604	Marketing and Distribution Practices
608	Community Resource Planning and Development

V(H). Planned Program (External Factors)**External factors which affected outcomes**

- Other (need to recruit additional faculty)

Brief Explanation

This program's total FTE are insufficient to address the expected needs in this area, and although the CAS administration has plans to recruit new faculty members, it has been difficult to attract candidates to Puerto Rico with the required expertise in agricultural economics and marketing. This problem has been more acute in recent years due to the taking of study leaves by several faculty at the MA level, and the acceptance of senior administrative positions by four faculty members associated with this program.

V(I). Planned Program (Evaluation Studies and Data Collection)**1. Evaluation Studies Planned**

- Other (Focus group with program partici)

Evaluation Results

{No Data Entered}

Key Items of Evaluation

{No Data Entered}