2010 University of Puerto Rico Research Plan of Work

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I. Plan Overview

1. Brief Summary about Plan Of Work

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.

This POW receives input from stakeholders during yearly meetings of commodity groups and during workshops and field days. It also ponders recommendations received from farmers' organizations and government officials that directly contact AES staff. This input helps to identify major constraints to agricultural production and establish priorities that should be targeted by our research programs. We continue to conduct annual commodity group or research program meetings in which the progress of projects is discussed, preliminary results are shared, and further input is sought for updating the commodity's research needs and priorities. All of our project proposals, formula funded or otherwise, go through a thorough merit review process following the Administrative Manual for the Hatch (Experiment Station) Act as Amended. 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 locally competitively granted.

In contrast with most mainland states, in Puerto Rico the links between agricultural production and food consumption were gradually weakened during the second half of the 20th century. As agriculture lagged behind the growth of other economic sectors such as manufacturing, service and government, the expanded consumption of the population was gradually supplied by imports, distributed mostly through large supermarket chains. By 2004 the agricultural sector's contribution to the Gross Domestic Product (GDP) was less than 1%. Recent statistics show the continuation of this trend. The 2007 Census of Agriculture depicts an 11% decline in farm numbers and 19% in land in farms since 2002, even though local Department of Agriculture data show positive growth in several subsectors such as livestock products, ornamentals and other specialty crops.

Overall figures, however, do little to convey the continued vital role played by farming in the economy of Puerto Rico in terms of fostering demand for other final and intermediate goods, creating employment in areas where alternative opportunities do not abound, supplying produce for domestic consumption and local processing plants, and preserving the island's natural resources from alternative urban uses□□potentially more damaging to a fragile tropical□island ecosystem. The University of Puerto Rico College of Agricultural Sciences, through its research and education programs, has been an important contributor to the development of enterprises that have had a positive impact on the island's economy. Through technologies that improve and promote diversified agricultural production systems, the CAS has also helped halt the decline of traditional agricultural systems.

Current trends in global markets and the challenges they pose to the continued viability of food and agroindustrial operations in Puerto Rico, underline even more the role that a responsive research program can play in the search for alternatives to the needs of stakeholders. Although the North American (NAFTA) and Central American□Dominican Republic Free Trade Agreements (CAFTA□DR) have up to now exempted Puerto Rico from its market pricing policies, it is unclear

whether these exemptions will expire in the near future, and how they will affect our agricultural sector, particularly coffee, which has enjoyed a protected status since the 1930s. Moreover, changing market forces, such as the consolidation of wholesale and retail distributors coupled with technological innovations and changing consumer behavior, have dramatically transformed in less than a decade the way in which food business is conducted on the island and the market share of local agriculture in the total food trade. To maintain and regain part of agriculture's competitive position, research must be directed to the analysis and managed solution of problems stalling production, and to the search of alternative uses and markets for our products.

Since our initial 2007 POW submission, however, important changes have occurred in the global economic system and in the world's food and agriculture situation. In Puerto Rico, increases in the price of farm inputs have undermined the already weak position of the island's agriculture, while the prolonged fiscal crisis of the state have reduced the amount of local government payments and subsidies to farmers. Rising imported food prices have, nevertheless, attracted increased public attention to Puerto Rico's fragile food security, and to the need to urgently adopt measures to protect agricultural resources and augment the output of the farm economy. Renewed government-academia collaborations are being forged to promote farmers' entrepreneurial skills and output increasing technologies. Last year the state legislature approved a law allocating additional funds for applied research of urgent problems of the agricultural and food production industries amenable to relatively rapid solutions. We will soon implement a competitive call for proposals for these funds and expect to see projects directly targeting the priorities identified by the local Department of Agriculture (DA). In the short run, additional measures are being taken within the CAS to quickly extend research-based farming alternatives to interested stakeholders, and to educate consumers on the benefits of supporting our local farm sector. Mid-term initiatives already begun include the prospective establishment of integrated research and extension programs in the areas of food science and technology, meat production, and integrated pest management.

We are also intent on helping farmers succeed in the new local niche market for organic products, and during this year began a pilot organic farm in one of our agricultural experiment stations. Information on organic farming adapted to local conditions had been a recurrent request of some of our stakeholders, and researchers interested in addressing these needs were constrained by the lack of certified organic land in our centers, or in private farms. With institutional support and leadership, we are currently designing an integrated management plan for the organic pilot farm and applying for certified organic transitional status. Strategically, we envision this initiative as the fulcrum of a broader effort to expand agricultural experiment stations' research in sustainable agriculture, and agro-forestry research and education.

New farm bill provisions emphasizing competitive research funding and interest in promoting these integrated research and extension collaborations require changes in the local institutional culture of research development, technology diffusion, and adoption. To promote increased faculty collaboration and training in the adoption of transdisciplinary methodologies, an internal request for proposals for Hatch funded projects was drafted emphasizing systems-based, interdisciplinary approaches to high priority problem areas. We will continue to support, within the limits of our resources, ways to position our faculty to be more competitive in externally funded initiatives that address our stakeholders' needs. Nevertheless, the current unstable panorama regarding long-term funding of programs limits our ability to predict if indeed the new research and extension collaborations will be duly institutionalized, and which programs will need to be curtailed.

Although we are aware of the need to recruit more scientists to strengthen several of our programs, we realize that with the projected resources we will only be able to achieve moderate growth in our current SYs. Programs that will probably be reinforced during this period include Meat and Milk Production Systems, Natural Resources and Environment, and Food Safety, Science and Technology. While the latter is the newest and smallest of our programs, the building of a new facility and plans for faculty recruitment, projects it as one of our strategic growth areas.

In the long term, the goal of our natural and social science research program is to contribute to Puerto Rico's sustained growth and development through technological and policy recommendations that can potentially increase competitive production, improve the food security status of the island, and raise the employment level of the population. All of our planned programs share this vision and have designed specific objectives to advance the achievement of this goal in a foreseeable future.

Estimated Number of Professional FTEs/SYs total in the State.

Year	Extension		Research	
	1862	1890	1862	1890
2010	0.0	0.0	57.3	0.0
2011	0.0	0.0	58.6	0.0
2012	0.0	0.0	59.6	0.0
2013	0.0	0.0	59.9	0.0
2014	0.0	0.0	60.9	0.0

II. Merit Review Process

1. The Merit Review Process that will be Employed during the 5-Year POW Cycle

- 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 within CAS 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.

III. Evaluation of Multis & Joint Activities

1. How will the planned programs address the critical issues of strategic importance, including those identified by the stakeholders?

As previously explained, this POW incorporates the input of researchers and stakeholders who have attended workshops, seminars and commodity group meetings during the past years. During these activities, participants attempt to identify the most pressing needs that should be addressed by the AES research program. Because the AES cannot address all the issues identified at the same time, annual meetings of the commodity groups continue to be held to evaluate research progress and to reassess research priorities. The list of priorities assembled through this process will be reviewed by each program coordinator and the CAS administration, and final recommendations will be prepared for the year's call for proposals for new Hatch and Special Projects. Researchers are also encouraged to review this final list of priorities when applying for grants financed by external funds.

Progress toward AES goals will be monitored by the indicators included in this POW and discussed in the yearly program and commodity meetings. Additional program meetings will be planned by the areas' coordinators with participation of extension

faculty, to work on the incorporation of research results updating technological alternatives present for a particular problem, into the recommended management practices for different commodities.

In addition, new funds allocated by the local legislature for the solution of pressing needs of the agricultural sector will be distributed through a yearly request for proposals (RFP) that will include the priorities identified by the local DA's committee for Research and Development of Agricultural Technology. This committee has representatives from farmers' organizations, agroindustries, the Department of Economic Development and Commerce, and our CAS. We envision this process as an opportunity to develop projects targeting more immediate critical situations, while liberating other institutional funds for more complex research problems requiring a longer term commitment and an integrated interdisciplinary approach toward solutions.

2. How will the planned programs address the needs of under-served and under-represented populations of the State(s)?

A truthful evaluation of this question in the context of Puerto Rico requires further specification. Puerto Rico's population is almost totally Hispanic, with 45% of families living below the federally defined poverty line. In addition, joblessness is much higher than in any of the 50 states. Therefore, the vast majority of the island's population qualifies as "under□served and under□represented" citizens in Federal government Programs. Moreover, compared with the assistance that other sectors such as manufacturing have received over the years, agriculture and rural areas in general, have lagged behind in public investment by the Commonwealth government. In this context, this POW planned programs efforts towards the enhancement of natural resources and towards the analysis and managed solution of problems affecting agriculture, with the ultimate goal of increasing the competitive production of our commodities and raise the employment level of the population, is addressing the stated needs of a critical sector and its underlying population.

The above statement does not invalidate the need to further analyze regional and sub□sectors disparities that may still be present in our programs. Within our personnel and budget limitations this POW incorporates measures to ensure that research will benefit organic farmers, small□scale farmers with low educational levels, and rural communities in need of better decision making tools to deal with pressing public policy issues such as agricultural land preservation in land-use plans. All planned programs, for example, include the formation of integrated work groups between researchers and extension specialists, both to conduct the work planned and to translate research results into educational materials for a broad audience. This includes tailoring best management practices (BMPs) to different scales of production, varying cropping systems, and the range of soil and climatic conditions found in Puerto Rico. Research on tropical organic systems has been included into the priorities of several commodities and at least one project is underway to provide alternatives to pesticides in transitional organic systems. This year steps are been taken toward certification of a small organic experimental farm in one of our experiment stations. Collaboration by researchers in extension initiatives related to public policy issues and in a new Southern Extension and Research Activity on this topic is also underway. Altogether, this POW implementation involves the continued education of researchers on the diversity of stakeholders in Puerto Rico and on the need to incorporate their concerns into our programs.

3. How will the planned programs describe the expected outcomes and impacts?

Each program has designed several outcomes to monitor progress. These indicators will be evaluated periodically to make adjustments needed to achieve the desired impacts. Most programs plan to record information about participants in program activities to follow□up on adoption of recommendations, or to assess factors affecting the achievement of the planned goals. Some programs will use official records (of commodity production, water quality in a watershed, sales of improved seeds, etc.) to monitor the impact that program interventions may have had upon the targeted population. Other programs will need to design a study to assess if the expected impacts are being achieved. At present, there is no division in our institution specialized in evaluation studies or in monitoring the impact of our research and extension programs. This deficiency will need to be addressed by the CAS administration as we progress in our plan, within the limits of the resources available.

4. How will the planned programs result in improved program effectiveness and/or efficiency?

An effective coordination of research, extension and academic activities is needed to achieve intermediate results and long□term impacts. While there has been an historic connection between these three activities, this is the first time CAS researchers will have to report progress and impacts of research beneath the traditional publications, theses, seminars and field days reported in annual reports. Similarly, while extension education programs are often based on research results, participation by extensionists in research needs to be expanded, particularly in the adaptation of research results to local production systems. Integrated research and extension projects have had important successes in the past that should help model the new integrated programs. Nevertheless, as is the case with other aspects of this POW, only periodical monitoring of the programs' progress will help determine if the program is being effective and help identify ways to improve efficiency.

Our stakeholders are a very diverse audience. Some of their problems are amenable to technological solutions while others

are more complex, market and resource-related issues deserving further study and possibly new public policy interventions. To improve and promote integrated research and extension approaches to those areas in which we share similar goals and in which there are technological recommendations for present problems, we chose this year one program in which researchers and extension specialists would meet periodically and coordinate educational activities for both extension agents and producers. This pilot collaboration involves our Integrated Management of New and Emerging Pests program and Extension's Crop Protection Program. We will monitor the progress of this initiative during next year and expect to implement similar collaborations in the future with other Extension programs for which we have a research counterpart.

IV. Stakeholder Input

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

- Targeted invitation to traditional stakeholder individuals
- Targeted invitation to non-traditional stakeholder groups
- Targeted invitation to traditional stakeholder groups

Brief explanation.

Two types of meetings are held in Puerto Rico to identify critical issues that should be addressed by AES research programs. Stakeholder input is also considered during the establishment of research priorities. First, the AES will continue 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 or 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. 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, commodity group leaders, program coordinators and directors of integrated academic departments will continue to organize thematic workshops, seminars, and field days where research results will be shared and the research and extension needs, or public policy determinations, will be discussed.

2(A). A brief statement of the process that will be 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 through commodity leaders, extension personnel and through local advisory committees established by administrators of the CAS.

2(B). A brief statement of the process that will be 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 individuals

Brief explanation

Input from stakeholders is collected at the meetings conducted by commodity and program leaders. Stakeholders are asked 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 will be considered

- Redirect Research Programs
- To Set Priorities
- To Identify Emerging Issues
- In the Staff Hiring Process

Brief explanation.

The input received in these meetings from all the stakeholders present is summarized, evaluated and presented in a concluding meeting of commodity leaders, program coordinators and research administrators, where final decisions are taken. The list of priorities assembled through this process guides the year's call for proposals for new Hatch and Special projects. When there are issues which need to be emphasized, programs are redirected to address these issues. This process may also inform decisions about recruiting new faculty members.

V. Planned Program Table of Content

V(A). Planned Program (Summary)

Program #1

1. Name of the Planned Program

Milk and Meat Production Systems Resources

2. Brief summary about Planned Program

Research conducted under this program area has the primary purpose of supporting the commercial livestock industries of Puerto Rico, of which the production of bovine milk and broiler meat are the two leaders. Smaller, but still important contributions to the gross agricultural product, include sales of the following in decreasing order: cows, bulls, heifers and calves (beef); hogs and pigs (pork); chicken eggs; replacement dairy heifers; commercial forages; meat from chicken and other classes of fowl; rabbit meat; and meat from small ruminants (sheep and goats). Milk production in Puerto Rico relies heavily on the use of expensive imported concentrate feeds (cereal grains and their by products and oil- seed meals), but this situation may be unsustainable in the long term, and thus more reliance must be placed on producing and feeding highly nutritious forages as a substitute for a considerable part of the concentrates. Our research program reflects this need, as a number of projects are devoted to developing new forage resources and better management and utilization of those already in extensive use, including both agronomical and animal nutrition aspects. Other important needs to make possible profitable dairying, topics that are or will be subjects of research projects, include practices to reduce the negative effects of high temperatures and other environmental stress factors, practices to improve the reproductive efficiency of dairy cattle, and practices to improve herd health, such as those practices to reduce the incidence of metabolic diseases in lactating cows and to combat internal parasitism in young stock. Utilization of the fertilizer value of the organic wastes generated by dairy farms in a non-polluting manner is also a matter of great importance that is being addressed. Our research in beef cattle, which includes work on genetic markers, is guided by the belief that beef from local grass-fed animals, slaughtered at an optimal stage of development, could command a premium price in competition with imported U.S. beef from grain-finished animals, because of advantages in the chemical composition which are believed to favor the health of the consuming public, in addition to the advantage of desirable flavor and tenderness properties. Our research efforts with small ruminants are closely associated with those of forages and include studies on the voluntary consumption and digestibility of novel forage resources; non-pharmaceutical-dependent methods of controlling internal parasites, such as use of shrubs with high levels of condensed tannins; haylage and silage production and evaluation; and use of underground trickle irrigation for efficient water utilization in forage production. At present the research with swine and poultry is being carried out by either graduate students as thesis requirements or special problems for course credit, or by undergraduate students participating in a project sponsored by a grant from the USDA Hispanic-Serving Institutions Program, in which the topics tend to emphasize mostly different aspects of animal feeding and by-product utilization.

3. Program existence : Mature (More then five years)

4. Program duration : Long-Term (More than five years)

5. Expending formula funds or state-matching funds : Yes

6. Expending other than formula funds or state-matching funds : Yes

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
202	Plant Genetic Resources and Biodiversity			10%	
205	Plant Management Systems			5%	
301	Reproductive Performance of Animals			15%	
302	Nutrient Utilization in Animals			20%	
305	Animal Physiological Processes			10%	
306	Environmental Stress in Animals			10%	
308	Improved Animal Products (Before Harvest)			10%	
313	Internal Parasites in Animals			5%	
403	Waste Disposal, Recycling, and Reuse			10%	
601	Economics of Agricultural Production and Farm Management			5%	
	Total			100%	

V(C). Planned Program (Situation and Scope)

1. Situation and priorities

According to data obtained in the 2007 Agricultural Census of Puerto Rico, the gross agricultural income stood at 515.7 million US dollars, representing a reduction of 65.8 million in the five years since the previous census. This alarming situation represents a challenge to the agricultural community, including those within academia intent on reversing this negative trend. Livestock and related products generate more agricultural income than crops in the local economy and these industries must be modernized, diversified and well managed if they are to spearhead a rebound of the agricultural sector. The local dairy industry has managed to avoid collapse during the current economic crisis because of a series of increases in the regulated price paid to producers for their crude milk, which were urgently needed to offset dramatic increases in the cost of imported concentrate feeds. These price increases, when passed to the consumer, have been largely responsible for a reduction in fresh milk sales (all produced locally), which has been on the order of 12 % during the past decade. These contradictory trends cannot continue indefinitely. Milk cannot be priced beyond the means of many consumers. Therefore, our research must focus on cost reduction by means of feeding and management practices that allow efficient milk production and profitable dairy farming based on affordable retail milk prices. Improvement in dairy cattle feeding, especially in the optimal use of well managed pastures and other highly nutritious forages, is a major goal. Fostering the production and utilization of high-quality forages is

equally pertinent to research with beef cattle and small ruminants. Unlike sales of fresh milk, for which the local demand is less than present production levels, the various classes of meat produced on the island cover only a minority proportion of total local consumption (approximately 15 % in the case of beef). Whereas this situation is lamentable in one sense, it also represents ample opportunity for increased sales of local meat. To contribute to this goal, our research emphasizes studies on forage-dependent feeding practices, animal management, animal genotypes, and carcass and meat characteristics. The latter will be used to devise a local system of beef grading. A major effort is also aimed at educating the consuming public as to the health benefits of locally produced grass-fed beef. With regard to other animal species, one line of research is to combat gastro-intestinal nematode infestation in small ruminants by an integrated approach, which includes use of the FAMACHA method to identify anemic animals, thus treating only these with anthelmintics, and thus retarding the development of nematode resistance to these drugs. With regard to poultry, new facilities that will permit large-scale experimentation on the production of broiler chicks and layer hens will finally come into operation at some point during the five year period considered in this POW. Swine research on environmental effects, reproduction, feeding, and meat quality will also benefit from improved and expanded physical facilities.

2. Scope of the Program

- Multistate Research
- In-State Research

V(D). Planned Program (Assumptions and Goals)

1. Assumptions made for the Program

a) The present worldwide financial crisis, from which Puerto Rico is not immune and which has necessitated substantial cuts in the budgets of all dependencies of the University of Puerto Rico, will be alleviated beginning in the second half of the year 2009, and thereafter a steady improvement will facilitate adequate institutional funding to support the research planned in this program area.

) Recommended management practices (RMP) of already proven effectiveness will be repeatedly communicated to commercial producers and adopted by the most progressive of these, thus in turn leading to increased interest on the part of other producers, many of whom will eventually follow suit.

c) Additional RMP will be forthcoming on the basis of both future research results and practical experience; and these will also be communicated to producers for their adoption.

d) Adoption of a series of RMP by a high proportion of producers could lead to increased physical output of animal products and monetary benefits for the producers. The consuming public will also benefit from a supply of top-quality and reasonably priced local meat and milk products.

2. Ultimate goal(s) of this Program

The program seeks to achieve continued development of RMP through research and their adoption by commercial producers, with special emphasis on improved utilization of a wide variety of forages and other local feed resources, thus reducing dependency on imported concentrate feeds and thus resulting in reasonable margins of profit for producers. Other RMP concerned with genetic improvement of animals, reproductive and environmental physiology, herd health and, especially, improved quality of locally produced meat and milk, also constitute important goals to the benefit of both producers and the consuming public.

V(E). Planned Program (Inputs)

1. Estimated Number of professional FTE/SYs to be budgeted for this Program

Year	Extension		Research	
	1862	1890	1862	1890
2010	0.0	0.0	11.0	0.0
2011	0.0	0.0	11.0	0.0
2012	0.0	0.0	11.5	0.0
2013	0.0	0.0	11.5	0.0
2014	0.0	0.0	12.0	0.0

V(F). Planned Program (Activity)

1. Activity for the Program

a) Compile a list of recommended management practices for each type of livestock enterprise with input from all scientific personnel of the College of Agricultural Sciences with relevance to this program area; and characterize these practices according to the relative difficulty and cost of their implementation in commercial operations.

) The program coordinator will maintain communications as frequently as necessary with the principal investigators of all active research projects in order to ensure that reasonable progress is being made in their respective experiments, considering the prevailing circumstance in each case, and in order to obtain information on important findings.

c) In collaboration with specialists of the Agricultural Extension Service, organize events in which to communicate to stakeholders (producers) useful research findings and to attempt to convince them to adopt RMP on their farms; and also to seek stakeholder opinions and observations regarding the RMP already on the list and others who are candidates for listing, and listen to their explanations regarding needed technical assistance. These events may include meetings of producer organizations, seminars, fora, outside speaker engagements or any other mutually convenient arrangement.

d) Organize training sessions in which producers acquire specific knowledge or skills (for example, practice in use of the FAMACHA method to detect anemia in small ruminants); also to organize field days either at research installations or on private farms where producers can observe RMP in operation and learn of the impact that their implementation has had.

e) Continue to publish "La Res Informativa" (for beef cattle producers) and "Ruminantia" (for producers of small ruminants) and other printed material in a simple layout suitable for easy comprehension by stakeholders.

f) Complete all aspects of experimentation undertaken and publish the results in refereed journals for the scientific community in Puerto Rico and for scientists internationally.

2. Type(s) of methods to be used to reach direct and indirect contacts

Extension	
Direct Methods	**Indirect Methods**
• {NO DATA ENTERED}	• {NO DATA ENTERED}

3. Description of targeted audience

Farm owners or renters who produce one or more of the following types of livestock and their products: bovine milk, beef cattle, sheep and goats, swine, poultry, rabbits, and forages for sale (mostly, hay or haylage); also agricultural extension agents, Department of Agriculture personnel, representatives of other local government agencies or of municipal governments, private enterprise professionals, industry scientists, students, and interested general public.

V(G). Planned Program (Outputs)

1. Standard output measures

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

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
2010	0	0	0	0
2011	0	0	0	0
2012	0	0	0	0
2013	0	0	0	0
2014	0	0	0	0

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

Expected Patent Applications

2010 :0 **2011 :**0 **2012 :** 0 **2013 :** 0 **2014 :** 0

3. Expected Peer Review Publications

Year	Research Target	Extension Target	Total
2010	6	0	0
2011	7	0	0
2012	7	0	0
2013	8	0	0
2014	8	0	0

V(H). State Defined Outputs

1. Output Target

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

  2010 6 **2011** 6 **2012** :6 **2013** 6 **2014** :6

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

  2010 5 **2011** 5 **2012** :5 **2013** 5 **2014** :5

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

  2010 6 **2011** 6 **2012** :6 **2013** 6 **2014** :6

- Number of publications made in refereed scientific journals.

  2010 6 **2011** 7 **2012** :7 **2013** 8 **2014** :8

- Number of participants in the field days coordinated with Extension

  2010 :130 **2011** :135 **2012** :135 **2013** :135 **2014** :135

V(I). State Defined Outcome

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 Target

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

2. Outcome Type : Change in Knowledge Outcome Measure

2010 :32	**2011 :** 36	**2012 :** 36	**2013** :38	**2014 :**38

3. Associated Institute Type(s)

•1862 Research

4. Associated Knowledge Area(s)

- 301 - Reproductive Performance of Animals
- 302 - Nutrient Utilization in Animals
- 306 - Environmental Stress in Animals
- 601 - Economics of Agricultural Production and Farm Management

Outcome #2

1. Outcome Target

% market participation of local beef.

2. Outcome Type : Change in Condition Outcome Measure

2010 :16	**2011 :** 16	**2012 :** 17	**2013** :18	**2014 :**18

3. Associated Institute Type(s)

•1862 Research

4. Associated Knowledge Area(s)

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

V(J). Planned Program (External Factors)

1. External Factors which may affect Outcomes

- Other (Attrition of agric. land base)
- Economy
- Natural Disasters (drought,weather extremes,etc.)
- Populations changes (immigration,new cultural groupings,etc.)

Description

-At present no one can say how long the present crisis, which has so strongly affected the USA and many other developed countries, will last. A worst case scenario would be bleak indeed for all sectors of the economy.

-The area of agricultural land in Puerto Rico is not large and there is intense competition from non-agricultural uses for the flat land available. If effective measures are not taken to protect what agricultural land remains, the more extensive agricultural and livestock industries will be doomed to disappear.

-Global warming and other factors capable of causing adverse weather conditions pose another threat to the worldwide grain supply. Puerto Rico has almost no local production of feed grains and is completely dependent on imports. As to future fuel cost, the price of petroleum on the world market is erratic in the short term, but will inevitably show an upward trend in the

long run.

-Puerto Rico cannot hope to produce all of the meat that it consumes and thus imports are inevitable, but these imports represent a problem in cases of dumping here excess U.S. production at prices that undercut the market for locally produced meat and thus depress its monetary value. After some years of fierce competition from UHT milk, at present the regulatory system requires that it be sold at a considerably higher price than fresh milk. If this situation should change the local dairy industry could be threatened again by UHT milk imports.

-As have other modern urbanized societies, Puerto Rico has experienced a trend toward less meal preparation at home and more dependence on pre-prepared foods and beverages supplied by sources such as fast-food restaurants and supermarkets. This trend has been unfavorable in depressing the demand for locally produced agricultural products.

-The two most common natural disasters affecting Puerto Rico are excessive rains and flooding, and prolonged droughts. However, in recent years weather patterns have tended to be more erratic and less predictable. This situation may well continue and become more marked as time passes because of phenomena such as global warming.

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

1. Evaluation Studies Planned

- Other (Evaluation survey and follow up)

Description

Field days and training sessions will expose producers to recommended management practices while explaining their benefits. At all such events we will request that the producers in attendance fill out a short and simple questionnaire in which they indicate the degree of their inclination to adopt the RMP in question by choosing among the options: (A) none, (B) minimum, (C) moderate, and (D) considerable. Producers who chose options C and D will be followed up by program collaborators. This follow-up can be done in various ways such as telephone calls, in person visits, and at meetings, and will have the purpose of encouraging the producers to proceed with adoption of the RMP. Extension cooperators will be responsible for verifying that the practice has in fact been implemented on the farm. Further information on the reasons why producers may not be willing to adopt the RMP will also be sought.

2. Data Collection Methods

- Unstructured
- Sampling
- Observation

Description

Agricultural Extension Agents will communicate regularly with producers in their assigned area. On farm visits will be conducted as needed to verify first hand whether RMP are really being implemented.

V(A). Planned Program (Summary)

Program #2

1. Name of the Planned Program

Integrated Management of New and Emerging Pests

2. Brief summary about Planned Program

PRAES will continue to work with stakeholders to create collaborative relationships that identify and address critical research and outreach priorities in integrated pest and disease management needs. This effort will be responsive to economic and environmental priorities and issues in agriculture sustainability in Puerto Rico. PRAES will maximize strategies to enhance multidisciplinary collaboration with key individuals and organizations to strengthen stakeholder-driven research and impact. The use of molecular techniques for fungal pathogens identification will continue to ensure rapid and accurate detection of plant diseases. Also, the enhancement of molecular diagnostic capabilities for viruses, bacterial and insects will remain a priority. Field days, workshops and open houses already initiated in the current fiscal year will be continued in order to disseminate information and to provide a forum for discussing reduced-risk options for pest and disease management.

A brief summary of research activities underway and future plans follows:

- Diagnostic capabilities have been improved for fungi, bacteria and viruses. Currently detection and diagnostics of fungal plant pathogens include DNA based methods. A total of 138 different fungal pathogens have been sequenced and identified and 26 sequences of plant pathogens were deposited in the gene bank. A plant diagnostic network is functioning for early and accurate disease diagnosis and pathogen detection for Puerto Rico and the Caribbean. The development of protocols for virus and bacteria using molecular techniques will be a priority in this fiscal year.

- Research directed toward the reduction of high risk pesticides for important pests in citrus. avocado and coffee will continue. Results indicated that the use of *Bacillus thuringiensis* subs. *kurstaki* and spinosad can control citrus leaf miner (CLM) (*Phyllocnistis citrella*), and the Asian citrus butterfly (*Papilio demoleus*). The increase of the parasitoid *M. insularis* by mass rearing and field liberations succeeded in controlling Coffee Leaf Miner (CLF). PRAES funded a project designed to establish a Pest Strategic Management Plan (PSMP) for fresh tomato and pepper production. Lack of effectiveness of pesticides was demonstrated under tomato fruit fly (TFF) outbreak conditions. The results of this study will be complemented with outreach activities directed toward the tomato industry, including small scale producers.

- PRAES continues research in viral diseases for cucurbits. A *Potyviridae* whitefly-transmitted virus involved in watermelon vine decline was identified. Two IR4 projects will search for alternative fungicides to control important diseases caused by *Phytophthora*. Use of integrated approaches to control avocado root rot has demonstrated that vegetative cover crops improved soil physical properties by increasing aggregate stability percentage, reducing bulk density, increasing moisture retention and infiltration rate. Eleven fungal genera were identified in mango inflorescences cultivars Haden, Irwin, Keitt and Parvin; these and were associated with inflorescence necrosis.

3. Program existence : Intermediate (One to five years)

4. Program duration : Long-Term (More than five years)

5. Expending formula funds or state-matching funds : Yes

6. Expending other than formula funds or state-matching funds : Yes

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			20%	
212	Pathogens and Nematodes Affecting Plants			29%	
215	Biological Control of Pests Affecting Plants			17%	
216	Integrated Pest Management Systems			34%	
	Total			100%	

V(C). Planned Program (Situation and Scope)

1. Situation and priorities

The proposed changes to the program were planned considering the importance of combining research and an outreach program to respond to the needs of stakeholders. During the first year of the IPM project, new directions went toward generating biological and ecological information about important pests and their natural enemies and the use of reduced risk insecticides. Additionally, PRAES emphasized studies on the use of alternative practices for disease control, and integrated approaches for amelioration of factors that influence diseases. Project priorities were directed to 1) sustainable crop production, 2) arthropod-vectored diseases, and 3) Etiology and management of new and emerging diseases.

- *Improved detection and diagnosis of diseases and pests affecting major agricultural commodities in Puerto Rico.* Because of inadequate diagnosis and limited expertise in new and emergent diseases and pests, the control methods were inaccurate. The progress made in two years in capacity building for molecular diagnostics has improved design of control strategies. Growers who use the disease diagnostic facilities at PRAES have been able to target pests and diseases in a logical and confident manner. Also knowledge developed regarding banana, plantains, coffee and citrus about alternative control practices, plus the changes made in the delivery of the information, will ensure a positive impact in a few years.

- *Farmers have relied on the recommendations of the chemical companies for pest and disease control.* This fact has produced a culture of intensive spraying and constant outbreaks of pests and diseases. Insensitivity to some insecticides may have been responsible for failing to control disease vectors producing major losses on vegetable farms due to viral diseases. PRAES has prioritized host resistance as a critical component for managing viral diseases.

- *Risk assessments and management strategies to minimize chemical input for sustainable crop production.* This priority will need the support of new grants to validate new findings developed in the first year of the project. Fund cuts have been a step backwards for some of the advancements of the research planned.

PRAES has emphasized an IMNEP program that is stakeholder-driven. Commodity groups were invited to attend field days to discuss pest problems with a multidisciplinary group. During these activities, stakeholders presented concerns and shared experiences. PRAES responded to stakeholders immediately, and Faculty from the Integrated Management of New and Emerging Pests (IMNEP) program presented a few new problems and gaps that needed attention. The IR-4 pesticide registration program is addressing specific diseases that are threatening traditional crops and that are not attended to by regular projects. Priorities remain to be (1) fast and accurate pest and disease identification and diagnosis; (2) development of Pest Management Strategic Plans (PMSP); (3) increased testing of reduced risk pesticides; and (4) integrated pest management research and extension activities.

2. Scope of the Program

- Integrated Research and Extension
- In-State Research

V(D). Planned Program (Assumptions and Goals)

1. Assumptions made for the Program

- The scientists needed to develop this program are available, or will be recruited.
- The necessary funds will be available from a combination of internal and external resources.
- Research needed to establish the PMSPs for most crops will be conducted.
- The input of partners from Extension Service, USDA /APHIS, Puerto Rico's Department of Agriculture and producer groups will be available.
- IMP practices suggested in the pest management strategic plans will be adopted by the producers of the island.

2. Ultimate goal(s) of this Program

To decrease crop losses due to key and emerging pests and to decrease the damage inflicted upon the environment and health by unsuitable management practices. To integrate an outreach component with a new vision to ensure impact and adoption of new technologies developed.

V(E). Planned Program (Inputs)

1. Estimated Number of professional FTE/SYs to be budgeted for this Program

Year	Extension		Research	
	1862	1890	1862	1890
2010	0.0	0.0	14.1	0.0
2011	0.0	0.0	14.1	0.0
2012	0.0	0.0	14.1	0.0
2013	0.0	0.0	14.1	0.0
2014	0.0	0.0	14.1	0.0

V(F). Planned Program (Activity)

1. Activity for the Program

- Develop partner-mediated PMSPs for the crops of Puerto Rico.
- Foster the use of cutting-edge technology to implement IPM.
- Enhance our capacity to conduct fast pest and disease diagnoses.
- Conduct research on 'reduced risk' pesticides.
- Foster greater integration of Outreach and Extension.
- Promote a better understanding of the needs and expectations of stakeholders
- Disseminate research results through publications, seminars, field days, conferences, and any other method deemed appropriate to reach our target audiences: extension specialists and agents, government partners, students, producers, consumers and environmental groups.

2. Type(s) of methods to be used to reach direct and indirect contacts

Extension	
Direct Methods	**Indirect Methods**
• {NO DATA ENTERED}	• {NO DATA ENTERED}

3. Description of targeted audience

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

V(G). Planned Program (Outputs)

1. Standard output measures

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

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
2010	0	0	0	0
2011	0	0	0	0
2012	0	0	0	0
2013	0	0	0	0
2014	0	0	0	0

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

Expected Patent Applications

2010 : 0 **2011 :** 0 **2012 :** 0 **2013 :** 0 **2014 :** 0

3. Expected Peer Review Publications

Year	Research Target	Extension Target	Total
2010	5	0	0
2011	5	0	0
2012	5	0	0
2013	5	0	0
2014	5	0	0

V(H). State Defined Outputs

1. Output Target

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

2010 : 1 **2011 :** 2 **2012 :** 2 **2013 :** 2 **2014 :** 2

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

2010 :5 **2011** :5 **2012** :5 **2013** :5 **2014** :5

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

2010 :15 **2011** :15 **2012** :15 **2013** :15 **2014** :15

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

2010 :13 **2011** :15 **2012** :15 **2013** :15 **2014** :15

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

2010 :12 **2011** :15 **2012** :15 **2013** :15 **2014** :15

- 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.

2010 :3 **2011** :3 **2012** :5 **2013** :5 **2014** :5

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

2010 :4 **2011** :5 **2012** :5 **2013** :5 **2014** :5

V(I). State Defined Outcome

O. No	Outcome Name
1	Number of stakeholders with increased knowledge on emerging pests and aware of non-target pesticide effects (Short Term)
2	Number of persons who adopted reduced risk pesticides and practices
3	Number of farmers reporting decreased losses due to key and emerging pests

Outcome #1

1. Outcome Target

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

2. Outcome Type : Change in Knowledge Outcome Measure

2010 : 150	**2011 :** 150	**2012 :** 150	**2013 :** 150	**2014 :** 150

3. Associated Institute Type(s)

•1862 Research

4. Associated Knowledge Area(s)

- 211 - Insects, Mites, and Other Arthropods Affecting Plants
- 212 - Pathogens and Nematodes Affecting Plants
- 215 - Biological Control of Pests Affecting Plants
- 216 - Integrated Pest Management Systems

Outcome #2

1. Outcome Target

Number of persons who adopted reduced risk pesticides and practices

2. Outcome Type : Change in Action Outcome Measure

2010 : 25	**2011 :** 25	**2012 :** 25	**2013 :** 50	**2014 :** 50

3. Associated Institute Type(s)

•1862 Research

4. Associated Knowledge Area(s)

- 211 - Insects, Mites, and Other Arthropods Affecting Plants
- 212 - Pathogens and Nematodes Affecting Plants
- 215 - Biological Control of Pests Affecting Plants
- 216 - Integrated Pest Management Systems

Outcome #3

1. Outcome Target

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

2. Outcome Type : Change in Condition Outcome Measure

2010 : 25	**2011 :** 25	**2012 :** 25	**2013 :** 25	**2014 :** 25

3. Associated Institute Type(s)

•1862 Research

4. Associated Knowledge Area(s)

- 211 - Insects, Mites, and Other Arthropods Affecting Plants
- 212 - Pathogens and Nematodes Affecting Plants
- 215 - Biological Control of Pests Affecting Plants
- 216 - Integrated Pest Management Systems

V(J). Planned Program (External Factors)

1. External Factors which may affect Outcomes

- Other (Less number of farms)
- Appropriations changes
- Natural Disasters (drought,weather extremes,etc.)

Description

Puerto Rico is frequently exposed to the impact of hurricanes occurring mostly between August and October. It is possible that increases in the frequency or intensity of hurricanes would favor the introduction of invasive species, and thus undermine efforts geared towards controlling the impact of key pests. Drought events in the major agricultural production areas of southwest Puerto Rico may also limit the outcomes of this program. Both federal and state appropriation changes due to the economic crisis are another source of concern. Finally, further declines in farm numbers, as witnessed in the 2007 Census of Agriculture, may also affect planned outcomes.

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

1. Evaluation Studies Planned

- During (during program)
- Other (Yearly baseline indicators)

Description

Timely and thorough assessment of program success and direction will be carried out to gauge accomplishments and needed corrections. Base-line indicators will be discussed during the first program area meeting by scientists, extension specialists, and stakeholders. Progress monitoring of program outcome will be tracked using these indicators, and evaluated by program scientists. New Program direction and indicators that may arise will be evaluated once each year.

2. Data Collection Methods

- Case Study
- Other (Focus group & others)
- On-Site

Description

Researchers, extension personnel and other stakeholders attending annual meetings will establish which indicators of progress are needed and how they will be collected. Surveys, case studies, and any other method deemed appropriate for collecting the information of interest will be used.

V(A). Planned Program (Summary)

Program #3

1. Name of the Planned Program

Plant genetic resources, breeding and production systems

2. Brief summary about Planned Program

Plant breeding and production systems research is an essential component of the AES research program. The development of improved varieties and better management practices has contributed to both the maintenance and the expanded production of many local crops. Recent evaluations confirm that the CAS has the expertise, facilities, germplasm and breeding lines needed for continued development of improved cultivars as well as better field management of many traditional crops. Genetic improvement needs to be complemented with the improved efficiency of production systems that include both traditional and new crops. In order to address local problems, given our tropical environment and small farm system, much of the plant breeding and crop production research conducted in Puerto Rico is distinct from the agricultural research conducted on the US mainland. However, this unique research capability produces plant germplasm and recommended production practices that are of value to producers throughout Central America and the Caribbean.

Building upon our strengths, we plan to continue the introduction of adapted germplasm that can be used to address certain production constraints, and to develop new cultivars of crops which can increase commercial yield, reduce production costs and improve the profitability of local farming systems. Research geared towards the development of best management practices (BMPs) for traditional and non traditional crops in Puerto Rico will also be conducted. BMPs will consider the need to develop production systems that conserve natural resources, improve efficiency, and promote biodiversity and natural services, such as biological nitrogen fixation and increases in soil organic matter content. A pilot organic experimental farm was established early in 2009 in one of our experiment stations, and is expected to contribute toward the initiation of an integrated organic research and education program.

3. Program existence : Mature (More then five years)

4. Program duration : Long-Term (More than five years)

5. Expending formula funds or state-matching funds : Yes

6. Expending other than formula funds or state-matching funds : Yes

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			20%	
202	Plant Genetic Resources and Biodiversity			20%	
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants			25%	
204	Plant Product Quality and Utility (Preharvest)			5%	
205	Plant Management Systems			30%	
	Total			100%	

V(C). Planned Program (Situation and Scope)

1. Situation and priorities

--Germplasm collections of crops of economic importance in Puerto Rico are needed to provide material for propagation for commercial production. New germplasm needs to be evaluated in order to identify accessions with traits of economic value to be incorporated into breeding programs or released for commercial use. The introduction of adapted germplasm can be used to address certain production constraints.

--A lack of availability of seed is an important factor limiting the production of many traditional crops. Breeding programs for crops such as pigeon peas, tropical pumpkin, and sweet peppers do not exist in the private sector or in neighboring countries. AES plant breeders can develop lines with local adaptation and can respond to the emergence of disease or pest problems.

--There is a need to improve the efficiency of production systems of traditional and new crops. Non□conventional production practices, such as hydroponics and organic farming, have unique constraints that need to be addressed with research. Increased mechanization for small□and medium□scale farmers is needed to reduce labor costs. Cropping systems should take advantage of natural services such as the biological control of diseases and pests, and biological nitrogen fixation.

--A re□evaluation of the AES recommendations for traditional production systems is needed (i.e., fertilization and irrigation practices) to provide our stakeholders with recommendations that permit profitable production and natural resource conservation.

--There is a need to develop management techniques for the profitable production of traditional tropical crops under organic farming systems.

Priorities:
*Introduction, evaluation and preservation of germplasm and cultivars of crops of economic importance in Puerto Rico.
*Development of new cultivars of crops of economic importance in Puerto Rico that lead to increased yield, lower production costs or enhanced value.
*Development of production systems that conserve natural resources, increase efficiency and promote biodiversity and natural services.
*Development of BMPs for traditional and non-traditional crop production systems in Puerto Rico.

2. Scope of the Program

- Multistate Research
- In-State Research

V(D). Planned Program (Assumptions and Goals)

1. Assumptions made for the Program

- Long□term infrastructural and financial support for research is needed to permit plant breeding programs to develop improved cultivars and germplasm, and to permit agronomists to update recommended production practices.
- Scientists with the expertise needed to develop crop cultivars, to maintain genetic resources and to conduct crop production research are available in the College of Agricultural Science.
- A seed program will continue to function to ensure the availability of seed of improved cultivars of traditional crops.
- Extreme weather conditions will not destroy field trials, germplasm collections or infrastructure needed to conduct research.

2. Ultimate goal(s) of this Program

To achieve wide-scale adoption of improved cultivars and of production practices that result in greater or more efficient crop production in Puerto Rico.

V(E). Planned Program (Inputs)

1. Estimated Number of professional FTE/SYs to be budgeted for this Program

Year	Extension		Research	
	1862	1890	1862	1890
2010	0.0	0.0	18.5	0.0
2011	0.0	0.0	18.5	0.0
2012	0.0	0.0	18.5	0.0
2013	0.0	0.0	18.5	0.0
2014	0.0	0.0	18.5	0.0

V(F). Planned Program (Activity)

1. Activity for the Program

Development and release of improved cultivars of crops of economic importance
Electronic publication of descriptions of germplasm collections
Distribution of germplasm to scientists and the public
Publication of technology packages describing best management practices for crops of economic importance.
Hosting field days for stakeholders at different Substations in collaboration with the Agricultural Extension Service, and organizing field days for visiting seed production fields, germplasm collections and other experimental fields.
Increased on□farm research to validate new technology.
Publication of research results in bulletins for farmers and in refereed journals for scientists.
Presentation of research results at scientific meetings

2. Type(s) of methods to be used to reach direct and indirect contacts

Extension	
Direct Methods	**Indirect Methods**
• {NO DATA ENTERED}	• {NO DATA ENTERED}

3. Description of targeted audience

Targeted audience consists of farmers, government professionals, county agents, scientists, USDA professionals, and professionals from the private sector.

V(G). Planned Program (Outputs)

1. Standard output measures

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

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
2010	0	0	0	0
2011	0	0	0	0
2012	0	0	0	0
2013	0	0	0	0
2014	0	0	0	0

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

Expected Patent Applications

2010 : 0 **2011 :** 0 **2012 :** 0 **2013 :** 0 **2014 :** 0

3. Expected Peer Review Publications

Year	Research Target	Extension Target	Total
2010	3	0	0
2011	4	0	0
2012	5	0	0
2013	5	0	0
2014	8	0	0

V(H). State Defined Outputs

1. Output Target

- Number of stakeholders to adopt the proposed BMPs.

2010 : 120 **2011 :** 125 **2012 :** 125 **2013 :** 125 **2014 :** 125

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

2010 :1 **2011** :1 **2012** :1 **2013** :1 **2014** :1

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

2010 :1600 **2011** :1700 **2012** :1700 **2013** :1700 **2014** :1700

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

2010 :250 **2011** :260 **2012** :260 **2013** :260 **2014** :260

- Number of participants in the field days coordinated with Extension

2010 :130 **2011** :135 **2012** :135 **2013** :135 **2014** :135

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

2010 :125 **2011** :130 **2012** :135 **2013** :135 **2014** :135

- Number of refereed publications

2010 :3 **2011** :4 **2012** :5 **2013** :5 **2014** :8

- Number of non-refereed publications

2010 :3 **2011** :4 **2012** :4 **2013** :4 **2014** :6

- Number of presentations in scientific meetings

2010 :3 **2011** :4 **2012** :4 **2013** :5 **2014** :5

V(I). State Defined Outcome

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 Target

Number of stakeholders to adopt the proposed BMPs

2. Outcome Type : Change in Action Outcome Measure

2010 :	**2011 :**	**2012 :**	**2013 :**	**2014 :**
120	125	125	125	125

3. Associated Institute Type(s)

•1862 Research

4. Associated Knowledge Area(s)

- 202 - Plant Genetic Resources and Biodiversity
- 203 - Plant Biological Efficiency and Abiotic Stresses Affecting Plants
- 204 - Plant Product Quality and Utility (Preharvest)
- 205 - Plant Management Systems

Outcome #2

1. Outcome Target

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

2. Outcome Type : Change in Condition Outcome Measure

2010 :	**2011 :**	**2012 :**	**2013 :**	**2014 :**
115	118	120	125	125

3. Associated Institute Type(s)

•1862 Research

4. Associated Knowledge Area(s)

- 202 - Plant Genetic Resources and Biodiversity
- 203 - Plant Biological Efficiency and Abiotic Stresses Affecting Plants
- 204 - Plant Product Quality and Utility (Preharvest)
- 205 - Plant Management Systems

V(J). Planned Program (External Factors)

1. External Factors which may affect Outcomes

- Natural Disasters (drought,weather extremes,etc.)
- Competing Programmatic Challenges
- Appropriations changes

Description

Germplasm collections and field trials related to plant breeding or production research are vulnerable to adverse weather, particularly hurricanes and tropical storms. Some field trials can be conducted during seasons when severe weather is less likely to occur. However, some germplasm collections and field trials need to be planted during the hurricane season. The introduction of an exotic disease or pest could also threaten some crops. The proposed activities in the plan of work are dependent on continued programmatic and fiscal support of the USDA and the Puerto Rico Agricultural Experiment Station.

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

1. Evaluation Studies Planned

- During (during program)

Description

Records of the planting material, or seed distributed for free, and of seed sales of cultivars developed by the Puerto Rico Agricultural Experiment Station will be maintained at the Substations. These records will provide a measure of the impact of the variety development program. The Puerto Rico Agricultural Experiment Station web sites containing the crop production technology packages will solicit comments and suggestions from the readers.

2. Data Collection Methods

- Other (Focus groups)

Description

Dual moderator focus groups that include farmers, extensionists and researchers will be used to obtain opinions concerning the new technologies being validated. The information from the focus groups will be used to establish research priorities and improve the quality of publications.

V(A). Planned Program (Summary)

Program #4

1. Name of the Planned Program

Natural Resources and Environment

2. Brief summary about Planned Program

The principal goal of the Natural Resources and Environment Research Program is to develop, perform and support scientific research on the impact of agricultural practices in the environment and natural resources. The program addresses key AES mission goals of supporting the Puerto Rico Department of Agriculture and the Department of Natural Resources in the management of agricultural practices by conducting the following activities: (1) development of sustainable practices for watershed protection and management (2) development of management practices for soil erosion (3) the establishment of biological indexes of contamination, and (4) sponsor forestry research, particularly in the areas of reforestation and protection of forests against fire and other threats.

A major goal of this research program is the development of sustainable practices for watershed protection and management. Water quality research will continue with work already begun on the characterization of the chemical and biological status of the most important watersheds of Puerto Rico. Currently, all reservoirs in Puerto Rico are listed as impaired due to the violation of the dissolved oxygen (DO) aquatic criteria and flawed understanding of the mechanisms controlling DO dynamics in tropical reservoirs. Results from program's studies will generate the database and knowledge to elucidate the controversy and will determine the actual DO status of our water reservoirs. Information to determine whether the watersheds of the island are impaired for aquatic life is also been collected. Another project aims to reduce the environmental impact of waste-water of coffee processing systems in watersheds.

Dairy operations in the island are known to export large volumes of manure and nutrients to adjacent lands. Research underway on the performance of covered anaerobic lagoons for energy, nutrient and carbon recycling is expected to have a positive impact on the dairy industry by providing additional income to the producers in the form of biogas, and by reducing the dairy manure sludge that contribute to water quality degradation and to foul odors.

Other studies related to the transport of nutrients and pollutants included in our planned program are: the evaluation of nutrients in runoff from soils amended with dairy manure, and the measurement of nutrients and chemicals in runoff waters and nearby soils of ornamental production greenhouses. Finally, research on biodiversity and conservation, threats to agriculture and natural ecosystems, and forestry-related issues includes: a project to protect native and endangered cacti in Puerto Rican dry forests from a new invasive mealybug, the regeneration of native and introduced species in dry forest in response to multiple disturbances (fires, hurricanes, dominance by exotic tree), and reforestation alternatives for steeply sloping land incorporating high value timber species.

3. Program existence : Intermediate (One to five years)

4. Program duration : Long-Term (More than five years)

5. Expending formula funds or state-matching funds : Yes

6. Expending other than formula funds or state-matching funds : Yes

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			21%	
104	Protect Soil from Harmful Effects of Natural Elements			9%	
111	Conservation and Efficient Use of Water			17%	
112	Watershed Protection and Management			18%	
123	Management and Sustainability of Forest Resources			6%	
133	Pollution Prevention and Mitigation			6%	
136	Conservation of Biological Diversity			6%	
405	Drainage and Irrigation Systems and Facilities			17%	
	Total			100%	

V(C). Planned Program (Situation and Scope)

1. Situation and priorities

Agriculture can be a serious pollutant source for the environment, but more reliable scientific data are needed to support these claims, to quantify the contribution of agriculture in relation to other pollution sources, and to measure the short and long term impact of agricultural operations on the environment. Accordingly, one of the priorities of this program is the characterization of the impact of agricultural activities on stream water quality, but also of point sources such as sewage, wastewater treatment plants and industrial effluents.

Unlike in the mainland US, in Puerto Rico many commercial farmers use microirrigation systems to achieve adequate yields. Microirrigation requires a high level of management to avoid plant stress and yield reductions as water use efficiency increases. Research to determine the irrigation schedule most suitable to the conditions of different crops is therefore needed and remains a priority of our program.

The conservation of forest resources in Puerto Rico calls for studies on the regeneration of forests on the island, since exotic species have introduced fire into ecosystems where it was previously absent and have changed successional trajectories. Research on forest management in the dry zone of Puerto Rico will continue to study the interactions and effects of exotic species and fire on native forest dynamics, and means to protect these dry forests form invasive pest species. New lines in forestry research include the development of a system for planting high value timber species in steeply sloping land, wherein most of the management necessary for achieving tree survival to a self-sustaining stage is provided at planting.

Future research plans for this POW's time-frame include documenting the pathways of entry, impact, and management of invasive species, a major threat to the island ecosystem. In summary, the main problems to be addressed by this program are

the limitations of water and land in Puerto Rico, problems associated with the transport of nutrients and pollutants, and conservation of biodiversity. Priority areas for this cycle are water resources quality and management; management of nutrients and chemicals runoff;and conservation and biodiversity.

Emerging research needs, as identified by AES stakeholders and researchers during the past two years according to their Knowledge Area codes are:

101 Identification of highly productive and potential agricultural lands, using the geographical information systems and remote sensing technology

111 Development of hydrologic sustainability indicator for agricultural use

131 Inventory and appraisal of agricultural land use in Puerto Rico

133 Impact of aquatic weeds and management practices on agricultural water systems

136 Impact of agricultural management practices on natural ecosystems

136 Management approaches for protecting and conserving natural ecosystems from agricultural management practices

136 Management approaches for controlling environmental contamination due to bad odors, mainly from dairy and poultry production.

2. Scope of the Program

- In-State Research
- Multistate Research

V(D). Planned Program (Assumptions and Goals)

1. Assumptions made for the Program

1. Reasonable funds will be available throughout project duration.
2. Personnel with adequate skills and understating of the subject will be working in the program by virtue of availability or recruitment.
3. Support and input of related agencies, such as the Department of Agriculture of PR, USDA, NRSC, EPA, local Environmental Quality Board, and the Department of Natural Resources of PR, will be available for the activities proposed and developed.
4. Watershed, soil erosion and biodiversity conservation management practices developed in the program will be adopted by producers and the general public.

2. Ultimate goal(s) of this Program

To improve the quality of the water resources of the island by decreasing the presence of chemical pesticides and nutrients' runoff,documenting the impact of point and non-point pollution sources, and recommending management practices and policy alternatives to regulating agencies; to increase the efficiency in the use of water on farms with microirrigation systems; to reduce soil erosion and improve the fertility of highly eroded soils; to increase land in forests for timber production and the protection of forests against fires and other threats; and to develop alternative agricultural and environmental management practices and policies for environmental quality.

V(E). Planned Program (Inputs)

1. Estimated Number of professional FTE/SYs to be budgeted for this Program

Year	Extension		Research	
	1862	1890	1862	1890
2010	0.0	0.0	10.0	0.0
2011	0.0	0.0	11.0	0.0
2012	0.0	0.0	11.0	0.0
2013	0.0	0.0	11.5	0.0
2014	0.0	0.0	11.5	0.0

V(F). Planned Program (Activity)

1. Activity for the Program

1. Conduct research on microirrigation scheduling, sustainable practices for watershed protection, detection of pollutants in streams, soil conditioners for highly eroded soils, management and sustainability of forest resources, and biodiversity and conservation in Puerto Rico
2. Publish research results in bulletins newspaper articles, popular magazines for farmers and in refereed journals for scientists.
3. Develop educational materials for stakeholders interested in the management and preservation of natural resources and agricultural sustainability
4. Disseminate research results through publications, seminars, field days, workshops, conferences, exhibitions and any other method deemed appropriate to reach our target audiences.

2. Type(s) of methods to be used to reach direct and indirect contacts

Extension	
Direct Methods	**Indirect Methods**
• {NO DATA ENTERED}	• {NO DATA ENTERED}

3. Description of targeted audience

Extension Specialists and professionals, government partners, producers, consumers, and environmental groups.

V(G). Planned Program (Outputs)

1. Standard output measures

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

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
2010	0	0	0	0
2011	0	0	0	0
2012	0	0	0	0
2013	0	0	0	0
2014	0	0	0	0

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

Expected Patent Applications

2010 :0 **2011 :**0 **2012 :**0 **2013 :**0 **2014 :**0

3. Expected Peer Review Publications

Year	Research Target	Extension Target	Total
2010	0	5	0
2011	0	5	0
2012	0	5	0
2013	0	5	0
2014	0	5	0

V(H). State Defined Outputs

1. Output Target

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

  2010 :15 **2011** :15 **2012** :20 **2013** :20 **2014** :20

- Number of Peer Reviewed publications.

  2010 :5 **2011** :5 **2012** :5 **2013** :5 **2014** :5

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

  2010 :10 **2011** :10 **2012** :10 **2013** :10 **2014** :10

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

  2010 :2 **2011** :2 **2012** :2 **2013** :2 **2014** :2

V(I). State Defined Outcome

O. No	Outcome Name
1	Number of stakeholders gaining knowledge on natural resources enhancement, 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 biodiversity threats and losses
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 watersheds for which a Total Maximum Daily Load (TMDL) for nutrients have been developed

Outcome #1

1. Outcome Target

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

2. Outcome Type : Change in Knowledge Outcome Measure

2010 : 100	**2011 :** 125	**2012 :** 150	**2013 :** 150	**2014 :** 200

3. Associated Institute Type(s)

•1862 Research

4. Associated Knowledge Area(s)

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

Outcome #2

1. Outcome Target

Number of farmers adopting microirrigation management practices

2. Outcome Type : Change in Action Outcome Measure

2010 : 30	**2011 :** 40	**2012 :** 50	**2013 :** 60	**2014 :** 70

3. Associated Institute Type(s)

•1862 Research

4. Associated Knowledge Area(s)

- 111 - Conservation and Efficient Use of Water

Outcome #3

1. Outcome Target

Number of persons adopting practices that prevent biodiversity threats and losses

2. Outcome Type : Change in Action Outcome Measure

2010 : 50	**2011 :** 60	**2012 :** 60	**2013 :** 65	**2014 :** 70

3. Associated Institute Type(s)

•1862 Research

4. Associated Knowledge Area(s)

- 123 - Management and Sustainability of Forest Resources
- 136 - Conservation of Biological Diversity

Outcome #4

1. Outcome Target

Number of farmers adopting methods to increase soil organic matter content

2. Outcome Type : Change in Action Outcome Measure

2010 :20	**2011 :** 30	**2012 :** 40	**2013 :**50	**2014 :**60

3. Associated Institute Type(s)

•1862 Research

4. Associated Knowledge Area(s)

- 102 - Soil, Plant, Water, Nutrient Relationships
- 104 - Protect Soil from Harmful Effects of Natural Elements

Outcome #5

1. Outcome Target

Number of farmers reporting increased water use efficiency in their farms

2. Outcome Type : Change in Condition Outcome Measure

2010 :20	**2011 :** 30	**2012 :** 40	**2013 :**50	**2014 :**60

3. Associated Institute Type(s)

•1862 Research

4. Associated Knowledge Area(s)

- 111 - Conservation and Efficient Use of Water
- 112 - Watershed Protection and Management

Outcome #6

1. Outcome Target

Number of persons that adopted practices to improve water resources.

2. Outcome Type : Change in Condition Outcome Measure

2010 :20	**2011 :** 30	**2012 :** 40	**2013 :**50	**2014 :**60

3. Associated Institute Type(s)

•1862 Research

4. Associated Knowledge Area(s)

- 111 - Conservation and Efficient Use of Water
- 112 - Watershed Protection and Management

Outcome #7

1. Outcome Target

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

2. Outcome Type : Change in Knowledge Outcome Measure

2010 :1	**2011 :** 1	**2012 :** 1	**2013 :**1	**2014 :**1

3. Associated Institute Type(s)

•1862 Research

4. Associated Knowledge Area(s)

- 102 - Soil, Plant, Water, Nutrient Relationships
- 112 - Watershed Protection and Management
- 133 - Pollution Prevention and Mitigation

V(J). Planned Program (External Factors)

1. External Factors which may affect Outcomes

- Natural Disasters (drought,weather extremes,etc.)

Description

Puerto Rico is frequently exposed to the impact of hurricanes and heavy rains that complicate existing problems of soil erosion and nutrient transport, particularly in the central mountain region.

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

1. Evaluation Studies Planned

- Other (Undecided yet)

Description

No formal study is planned at this point. However, as part of their ongoing projects' activities, will continue monitoring the status of the principal watersheds on the island and of lands in forests.This program combines several lines of research that would have to be evaluated as individual units. Participants in the program feel they need more time, and training on program evaluation methods, to be able to design a study that would do justice to their efforts.

2. Data Collection Methods

- Other (Undecided yet)

Description

No formal study is planned at this point. However, as part of their ongoing projects' activities, will continue monitoring the status of the principal watersheds on the island and of lands in forests.This program combines several lines of research that would have to be evaluated as individual units. Participants in the program feel they need more time, and training on program evaluation methods, to be able to design a study that would do justice to their efforts.

V(A). Planned Program (Summary)

Program #5

1. Name of the Planned Program

Agricultural Economics, Marketing, Value Added and Community Development

2. Brief summary about Planned Program

Many of the problems faced by Puerto Rico's agricultural sector have already been partially studied under the research program carried out for decades by the integrated research and extension faculty of the Department of Agricultural Economics and Rural Sociology of the CAS. Nevertheless, the continuing challenges faced by farmers and rural communities in Puerto Rico, coupled with the reduced ability of the government to provide increased incentives or subsidies to these sectors because of a current and prospective fiscal crisis, underline the need to conduct more narrowly defined research of topics identified as vital for farming and rural community growth. Studies planned under this program include those that (1) explore new markets for our traditional products (2) make effective use of marketing tools to exploit products' full potential (3) explore new uses for conventional products through processing (4) research the market for "specialty products" as a possible new alternative for our tropical crops (5) examine efficiency problems at the level of farm management (6) evaluate the performance of plans and programs implemented in the areas of agricultural economics, marketing, value added and community development (7) document the status of community food systems and alternative community agricultural projects, and (8) research, analyze and educate on agriculture and natural resource policy alternatives and consequences.

3. Program existence : Intermediate (One to five years)

4. Program duration : Long-Term (More than five years)

5. Expending formula funds or state-matching funds : Yes

6. Expending other than formula funds or state-matching funds : Yes

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
601	Economics of Agricultural Production and Farm Management			34%	
604	Marketing and Distribution Practices			32%	
606	International Trade and Development			9%	
607	Consumer Economics			19%	
608	Community Resource Planning and Development			1%	
610	Domestic Policy Analysis			5%	
	Total			100%	

V(C). Planned Program (Situation and Scope)

1. Situation and priorities

Farming and rural community development in Puerto Rico continue to face constant challenges. The agricultural sector's contribution to the Gross Domestic Product is still less than 1%, and the sagging island's economy coupled with reduced tax revenues offer little hope that the government may increase its investment in the sector in the near future. During the last two decades the agricultural land base of the island has experienced dramatic reductions, as part of its acreage has been converted to alternative urban development uses. In structural terms, the 2007 Census of Agriculture confirms that significant declines have also occurred since 2002 in the number and amount of land controlled by mid-sized (50-259 acres) and low sales ($1,000-$7,499) farms. Given these trends, it is reasonable to expect continued production problems in most commodities, and a decline in production efficiency. Moreover, as globalization continues to restructure local wholesale and retail distribution outlets, remaining farmers increasingly complain about fewer markets for their crops, whereas many communities lack enough employment opportunities and have limited access to quality fresh foods. Food imports of most items are also increasing, thus confirming the poor competitive position of local products vs. imported. The examination of these conditions and related trends is vitally important for the development of local agroindustries with the potential of improving community employment, and for strengthening the marketing and overall situation of our agricultural and livestock commodities. Puerto Rico needs to diversify the basis of its economic model, and a community-oriented agricultural development strategy is an option that should be incorporated into this plan. In addition, Puerto Rico needs to increase the competitiveness of its traditional agriculture and find new opportunities and niches in which it could be competitive. Recent initiatives at the PR Department of Agriculture are focusing on products that have a high probability of being economically successful, and at building tight bonds with the AES to help them in this process. This offers an excellent opportunity to increase the effectiveness of our research efforts. During this POW, priority will be given to studies of economic efficiency, marketing, new markets, community agricultural development and public policy issues research and education. Both research and extension faculties will be involved in all aspects of the program.

2. Scope of the Program

- In-State Research
- Multistate Research

V(D). Planned Program (Assumptions and Goals)

1. Assumptions made for the Program

- Better knowledge of production costs, consumers' preferences and local markets will translate into marketing strategies that will allow producers to identify niches to penetrate, and support expanded commodity production.
- The institutional funding and staff needed to conduct this program will be available.
- The technology needed to increase the physical output of the selected commodities is economically available.
- An expansion in the agricultural sector production will improve the employment situation of rural communities
- A strong extension component will be developed to translate research results into effective marketing and community development strategies.

2. Ultimate goal(s) of this Program

Increase local, marketable, agricultural production and improve the quality of life and food security situation of households and communities, through the development of economic efficiency and marketing studies of selected commodities, community food system profiles, promotion of community agricultural projects, identification and documentation of alternative marketing channels for farmers and community production, and through the creation of research-based, educational programs that enable rural dwellers to effectively participate in public policy decisions affecting their well-being.

V(E). Planned Program (Inputs)

1. Estimated Number of professional FTE/SYs to be budgeted for this Program

Year	Extension		Research	
	1862	1890	1862	1890
2010	0.0	0.0	2.0	0.0
2011	0.0	0.0	2.0	0.0
2012	0.0	0.0	2.0	0.0
2013	0.0	0.0	2.0	0.0
2014	0.0	0.0	2.0	0.0

V(F). Planned Program (Activity)

1. Activity for the Program

Research to determine farmers' costs of production, consumer preferences, marketing margins, and farmers' and other participant's shares in the marketing channels of selected agricultural commodities will be 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. In collaboration with Extension faculty and agents, results will be translated into recommendations for farmers and community organizers. Publications will be prepared and presentations to producers' associations and agricultural professionals will also take place.

2. Type(s) of methods to be used to reach direct and indirect contacts

Extension	
Direct Methods	Indirect Methods
• {NO DATA ENTERED}	• {NO DATA ENTERED}

3. Description of targeted audience

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

V(G). Planned Program (Outputs)

1. Standard output measures

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

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
2010	0	0	0	0
2011	0	0	0	0
2012	0	0	0	0
2013	0	0	0	0
2014	0	0	0	0

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

Expected Patent Applications

2010 :0 **2011 :**0 **2012 :** 0 **2013 :** 0 **2014 :** 0

3. Expected Peer Review Publications

Year	Research Target	Extension Target	Total
2010	2	0	0
2011	2	0	0
2012	3	0	0
2013	2	0	0
2014	3	0	0

V(H). State Defined Outputs

1. Output Target

- Number of refereed publications

  2010 2 **2011** 2 **2012** :3 **2013** 2 **2014** :3

- Number of presentations in scientific meetings

  2010 4 **2011** 4 **2012** :4 **2013** 4 **2014** :4

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

  2010 4 **2011** 4 **2012** :4 **2013** 4 **2014** :4

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

  2010 :120 **2011** 120 **2012** :125 **2013** :135 **2014** :140

V(I). State Defined Outcome

O. No	Outcome Name
1	Number of stakeholders gaining knowledge about new markets and marketing tools (medium term measure)

Outcome #1

1. Outcome Target

Number of stakeholders gaining knowledge about new markets and marketing tools (medium term measure)

2. Outcome Type : Change in Knowledge Outcome Measure

2010 :350 **2011 :** 375 **2012 :** 400 **2013 :**425 **2014 :**450

3. Associated Institute Type(s)

•1862 Research

4. Associated Knowledge Area(s)

- 601 - Economics of Agricultural Production and Farm Management
- 604 - Marketing and Distribution Practices
- 607 - Consumer Economics
- 608 - Community Resource Planning and Development

V(J). Planned Program (External Factors)

1. External Factors which may affect Outcomes

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

Description

In Puerto Rico *natural disasters* such as storms and heavy rains are relatively common. These situations can interfere with data collection, farmers' decisions and consumer priorities. The decisions on what to buy change dramatically after these events. If agricultural production is affected, the supply of fresh foods will be reduced. Also, Puerto Rico is undergoing a period of economic instability in which the capacity of the government to meet its current obligations and service new debt is being reduced. Consumers' attitudes and food preferences may change with the changing economic outlook. Moreover, in volatile economic situations public policy priorities may also shift to meet new demands, and this may compromise the ability of researchers to accomplish their long term plans.

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

1. Evaluation Studies Planned

- Other (Focus group)

Description

In the third year of the program (2010) a focus group will be conducted with representatives of program stakeholders to evaluate progress to date and changes that may be implemented to achieve outcomes.

2. Data Collection Methods

- Other (Focus group)

Description

In the third year of the program (2010) a focus group will be conducted with representatives of program stakeholders to evaluate progress to date and changes that may be implemented to achieve outcomes.

V(A). Planned Program (Summary)

Program #6

1. Name of the Planned Program

Food Safety, Science and Technology

2. Brief summary about Planned Program

The mission of the FSST program is to promote the quality of life and economic feasibility of the agricultural sector by means of a continuous improvement process of current, and development of new, food and non□food products and their respective manufacturing and related processes. In so doing, the Program shall consider such aspects as food safety, nutritional value, environmental impact, education and information dissemination needs, consumer and industry support needs, technology development, transfer and adaptation, and other research needs.

The construction of the new research and education facility ended. Furnishing, as well as equipment acquisition and installation, is underway and should be completed by late 2009. Hiring of the vacant researcher position will resume shortly and is expected to be completed by late 2009. For the second half of the fiscal year, efforts shall focus on revising the strategic plan and research priorities for the next year. In the meantime, researchers shall continue seeking funds to address identified needs, seminars and workshops will be offered to industry, and technical support will be provided upon request.

3. Program existence : Intermediate (One to five years)

4. Program duration : Long-Term (More than five years)

5. Expending formula funds or state-matching funds : Yes

6. Expending other than formula funds or state-matching funds : Yes

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
501	New and Improved Food Processing Technologies			20%	
502	New and Improved Food Products			10%	
503	Quality Maintenance in Storing and Marketing Food Products			40%	
504	Home and Commercial Food Service			20%	
701	Nutrient Composition of Food			10%	
	Total			100%	

V(C). Planned Program (Situation and Scope)

1. Situation and priorities

Nourishment is essential for life to exist. It is the role of the agro-industry to ensure a safe and sufficient supply of nutritious food at an affordable price, while minimizing the impact on the environment. Yet succeeding in such a role requires agro-industry to juggle its own objectives along with consumer demands, governmental regulations and market push towards the implementation of quality management systems.

On the government side, federal agencies such as the Food and Drug Administration (FDA), the United States Department of Agriculture (USDA) partner with local agencies (i.e., Puerto Rico's Department of Health and Puerto Rico's Department of Agriculture) to oversee the safety and wholesomeness of the produced goods. They also impose restrictions on package labeling and information, handling and storage conditions, construction and design of manufacturing and service facilities, sanitation, and general production operations (i.e., GAP, GMP).

In contrast with this need to implement controls and systems that increase cost, there are consumer pressures for an affordable and nutritious supply of goods. Furthermore, current consumer trends in the food industry, for example, show the need for such supply to have a wide array of gourmet flavors mixed with convenient sizes and added functionality.

The following prime objectives were identified during the early stages of the program and still hold their importance.

- Development of formulations and manufacturing and packaging processes for nutritious value added products from agricultural goods.
- Establishment of adequate post harvest practices to ensure product quality and food safety.
- Characterization and reuse of post harvest, slaughter, or food manufacturing wastes, residues and by-products for the generation of value added products.
- Quality determination and valuation of locally produced market fresh agricultural products, including nutritional value, in comparison to national standards.

In pursuing our identified objectives we will execute the following strategies as part of the current Plan of Work.

- Complete furnishing and capacity building efforts of the Agro-Industrial Technology and Innovation Center (CITAI) of the University of Puerto Rico at Mayagüez.
- Establish general collaboration agreements with local industry and farmer cooperatives that facilitate the development of specific research and support projects in an agile way.
- Establish general collaboration agreements with other universities and research centers abroad to strengthen our research and support capability.

2. Scope of the Program

- In-State Research

V(D). Planned Program (Assumptions and Goals)

1. Assumptions made for the Program

- The high cost of manual labor on the island, compared to that of our competitors in the Caribbean and Latin America limits the market-fresh potential of our agricultural system. As a result, Puerto Rico has an underutilized agricultural production potential that can become productive with relative ease.
- In order for agriculture to become a more economically attractive alternative, Puerto Rico needs to move farmers away from field production for fresh market and onto a community-oriented agricultural development strategy to deliver value-added products.
- Should new feasible value-added product alternatives become available, Puerto Rico's farmer cooperatives and industry will embrace the new markets and exploit them.
- The establishment and of CITAI, including allocation of necessary funds and human resources, will position the Program to act as leader in the development and adaptation of technology to improve production processes of value-added agricultural products.
- External funding will be obtained to support research and related activities of the Program.

2. Ultimate goal(s) of this Program

The program's ultimate goal is to positively impact the agro-industrial economic sector through the generation of new business opportunities (i.e., jobs, enterprises, products) or by process and/or product improvements that enhance the

competitiveness of current industries.

V(E). Planned Program (Inputs)

1. Estimated Number of professional FTE/SYs to be budgeted for this Program

Year	Extension		Research	
	1862	1890	1862	1890
2010	0.0	0.0	1.7	0.0
2011	0.0	0.0	2.0	0.0
2012	0.0	0.0	2.5	0.0
2013	0.0	0.0	2.5	0.0
2014	0.0	0.0	2.8	0.0

V(F). Planned Program (Activity)

1. Activity for the Program

- Presentations, journal articles, Extension Service publications, and other contributions that make research results available to users and/or to establish guidelines or recommendations for process improvement or compliance with government regulations.
- Seminars, short courses and workshops on various topics with open registration to industry and particular individuals.

. Project collaborations with industries to research specific issues affecting their product or process.

2. Type(s) of methods to be used to reach direct and indirect contacts

Extension	
Direct Methods	Indirect Methods
• {NO DATA ENTERED}	• {NO DATA ENTERED}

3. Description of targeted audience

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

V(G). Planned Program (Outputs)

1. Standard output measures

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

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
2010	0	0	0	0
2011	0	0	0	0
2012	0	0	0	0
2013	0	0	0	0
2014	0	0	0	0

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

Expected Patent Applications

2010 :0 **2011 :**0 **2012 :** 0 **2013 :**0 **2014 :** 0

3. Expected Peer Review Publications

Year	Research Target	Extension Target	Total
2010	2	0	0
2011	3	0	0
2012	3	0	0
2013	4	0	0
2014	4	0	0

V(H). State Defined Outputs

1. Output Target

- Number of Courses, seminars and workshops offered on the topics covered by the Program

2010 2 **2011** 3 **2012** :4 **2013** :4 **2014** :8

- Number of projects or industry collaboration agreements established

2010 :1 **2011** 2 **2012** :2 **2013** :4 **2014** :4

V(I). State Defined Outcome

O. No	Outcome Name
1	Total Number of Enterprises Impacted by the Program
2	Food Manufacturing Exports in million dollars
3	Food Manufacturing Imports in million dollars

Outcome #1

1. Outcome Target

Total Number of Enterprises Impacted by the Program

2. Outcome Type : Change in Knowledge Outcome Measure

2010 :30	**2011 :** 35	**2012 :** 40	**2013 :**45	**2014 :**50

3. Associated Institute Type(s)

•1862 Research

4. Associated Knowledge Area(s)

- 501 - New and Improved Food Processing Technologies
- 502 - New and Improved Food Products
- 503 - Quality Maintenance in Storing and Marketing Food Products
- 504 - Home and Commercial Food Service
- 701 - Nutrient Composition of Food

Outcome #2

1. Outcome Target

Food Manufacturing Exports in million dollars

2. Outcome Type : Change in Action Outcome Measure

2010 :4943	**2011 :** 4981	**2012 :** 5000	**2013 :**5400	**2014 :**5400

3. Associated Institute Type(s)

•1862 Research

4. Associated Knowledge Area(s)

- 501 - New and Improved Food Processing Technologies
- 502 - New and Improved Food Products
- 503 - Quality Maintenance in Storing and Marketing Food Products
- 701 - Nutrient Composition of Food

Outcome #3

1. Outcome Target

Food Manufacturing Imports in million dollars

2. Outcome Type : Change in Condition Outcome Measure

2010 :2900	**2011 :** 3000	**2012 :** 3000	**2013 :**3000	**2014 :**3000

3. Associated Institute Type(s)

•1862 Research

4. Associated Knowledge Area(s)

- 501 - New and Improved Food Processing Technologies
- 502 - New and Improved Food Products
- 503 - Quality Maintenance in Storing and Marketing Food Products
- 504 - Home and Commercial Food Service

- 701 - Nutrient Composition of Food

V(J). Planned Program (External Factors)

1. External Factors which may affect Outcomes

- Economy
- Public Policy changes
- Government Regulations

Description

Economy – Puerto Rico is currently suffering an economic recession. Although it is expected that the economy will pick up, while the recession prevails the amount of funding available to invest in research or new ventures will be limited. Recently, the University budget was reduced by $20 million. This action greatly affected funding available for travel and for acquiring materials needed to seek external funding and establish industry collaborations.

Public policy changes – The agricultural sector is highly susceptible to changes in public policy as dictated by the local Department of Agriculture. The newly elected government's strategies are attempting to strengthen the links between the Department of Agriculture and the College of Agricultural Sciences of the University of Puerto Rico.

Government regulations – Governmental regulations can affect the import and export of agricultural commodities, thus affecting the local farmers' ability to produce goods at a competitive market price. Regulations can also affect the establishment and expansion incentives for both the new and the existing industries.

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

1. Evaluation Studies Planned

- Other (Semiannual meetings)

Description

Semiannual meetings are conducted to track Program performance and to agree on the mission, objectives, and strategies of the Program (previously drafted on the basis of informal input). Meeting participants will include the program coordinator, commodity group leaders, Extension Service agents, active and inactive program researchers, and a representative of the Agricultural Experiment Station administration. The meeting will compare output performance against projected goals and will determine whether specific actions are required. Also, feedback gathered on the needs of stakeholders (i.e., commodity groups) will be reviewed in order to identify changes in research priorities and needed updates on this plan of work.

2. Data Collection Methods

- {NO DATA ENTERED}

Description
{NO DATA ENTERED}