Puerto Rico (University of Puerto Rico Mayaguez Campus) Annual Report - FY2025

Review Report

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Executive Summary

Overview

This report presents the most prominent research and educational achievements by the University of Puerto Rico's Agricultural Experiment Station (PRAEXS) and Agricultural Extension Service (PRAES) during FY2024–2025. All the results and achievements from this report aligned with the six Critical Issues established in the 2024–2029 approved POW:

1. Food Security, Plants and Animal Systems
2. Extreme Weather, Natural Resources, Environment, and Sustainable Energy
3. Food Safety, Science and Technology
4. Community, Economy and Sustainable Development
5. Family and Well-Being
6. Positive Youth Development

As an island in the Caribbean, Puerto Rico is exposed to adversed weather conditions which could result in economic instability. Natural disasters such as hurricanes, flooding and earth quakes pose serious threats to our agricultural sustainability and therefore, our food security. Food Security, Plant and Animal Systems continue to be central for PRAEXS where more that 60% of our research projects contribute to this critical issue. Collaboration between PRAEXS and PRAES continues to be essential to achieve our objectives on this and other shared critical issues. Agricultural production in Puerto Rico face many challenges that could limit crop productivity, profitability, and food security. Farmers rely on crop varieties that are recommended and adapted to different environmental conditions yet have limited access to genetically improved locally adapted crop varieties. The addition of emerging pest and disease pressures that limit crop yield and the dependence on chemical control, which has increased the threat of pesticides resistance build-up among insects and plant pathogens, has reduced the effectiveness of conventional control methods and raised production costs. Research in animal systems has focused on livestock productivity and adaptation to extreme weather conditions in the tropics, forage management for grazing systems, meat and milk composition, and educational initiatives to enhance student preparedness within Animal Science. Small ruminant research has also been evaluating aspects in nutrition, genetics, prevalence and control of parasites, meat yield and quality, as well as semen preservation and artificial insemination techniques. Some of the most relevant findings in small ruminant research include the development of a hybrid artificial insemination technique that is both easier and more effective.

PRAEXS currently has 28 projects addressing the critical issue area Extreme Weather, Environment, Natural Resources and Sustainable Energy. Key items of research include conservation tillage and cultural practices, addressing contaminants in water and soils, sediment transport; assessing of native small trees potential for urban corridors and the viability of their vegetative propagation; algal blooms in water reservoirs and lagoons; surface and subsurface water flow modeling to assess the impact of lagoon restoration on conditions prior to drainage; and establishing a long-term ecological research station for biodiversity. In Natural Resources, the area with the highest proportion of projects (54%), our researchers are evaluating the efficient use of potassium and phosphorus and their calibration for vegetable production; the production and evaluation of low-cost, locally available agricultural inputs; pest management strategies; agronomic management of acid soils and plantain cultivation; irrigation management and improving soil health by the use of amendments Other areas of research include the use of high tunnels for crop production and assessing the microclimates they create under varying climatic conditions across different zones in Puerto Rico and the potential of biomass gasification for heat and power production in emergency and non-emergency scenarios in Puerto Rico.

The Food Safety, Science and Technology critical area of research addresses key challenges in value-added food production and waste utilization to boost agricultural manufacturing. Research efforts in PRAEXS focused on specialty coffee fermentation and processing methods to enhance quality and develop value-added applications. Additional studies supported the use of surplus fruits to produce processed foods and evaluated yam flour as a wheat alternative for bread and pasta products. Lastly, research using natural antimicrobial compounds to address the food safety challenges has been conducted.

For the Community, Economy and Sustainable Development critical issue at the PRAEXS were a total of 10 projects were undertaken. Four were focused on education with the objective of increasing agricultural development for the next generation. It is important to increase awareness and access to FAHN education and strengthen high school students' academic preparation, professional skills and confidence to pursue graduate education in USDA related careers. Six projects were focused on research with subjects that included studying the resilience and sustainability of Puerto Rican farmers in

terms of high production costs and limited access to farm labor, leading diseases affecting the agricultural sector and mentoring farmers interested in transitioning to organic agriculture.

The programs of the Agricultural Extension Service (PRAES) in Puerto Rico constitute an integrated, interdisciplinary response to persistent socioeconomic vulnerability, environmental disruption, and structural constraints affecting households, communities, agricultural systems, and youth. Implemented within a context of prolonged economic recession, recurrent natural disasters, high poverty and migration, these programs demonstrate measurable progress in strengthening resilience, enhancing human capital, and promoting sustainable development through coordinated educational, technical, and community-based interventions.

The Community, Economy, and Sustainable Development Project addresses localized economic stagnation and institutional fragility by fostering entrepreneurship, strengthening self-management capacities, and improving emergency preparedness. Engagement with families and organizations has facilitated the creation of microenterprises and small businesses, contributing to increased household income and reduced vulnerability. Complementary initiatives include urban agriculture, integrated income generation with nutrition education and sustainable practices. Capacity-building in financial management, marketing, and digital competencies supported long-term viability, while emergency preparedness efforts have strengthened local response systems through training in water security, food access, and volunteer coordination. These interventions enhanced community cohesion, leadership, and collective problem-solving, generating replicable local development models.

Parallel progress emerged from the integration of the Healthy and Sustainable Families, Health and Well-being, and Food Security programs, which address interrelated dimensions of household resilience. These initiatives expand competencies in family functioning, preventive health, and economic stability through evidence-based nonformal education. Outcomes include improvements in parenting, communication, caregiving practices, and financial management, alongside the adoption of healthier lifestyles. Preventive interventions strengthen knowledge related to nutrition, physical activity, hygiene, and home safety, contributing to reduced health risks. The Food Security program addresses structural constraints in food access through training in local production, preservation, and emergency planning, resulting in improved dietary awareness and preparedness. Collectively, these efforts illustrate the effectiveness of integrated approaches in fostering behavioral change and improving quality of life.

In the agricultural sector, PRAES implemented diversified programs targeting productivity, sustainability, and market development. Through applied research, technical assistance, and experiential learning, producer knowledge was enhanced and improved practices were adopted. Interventions addressed challenges such as citrus disease pressures, apiculture underdevelopment, and efficiency constraints in dairy systems, while promoting sustainable and organic agriculture. Efforts in small ruminants, poultry, and coffee production strengthened technical competencies and expanded value-added opportunities. Outcomes include increased adoption of best practices, improved efficiency and product quality, and the establishment of new enterprises, contributing to economic viability and food system resilience, while strengthening producer networks and institutional linkages.

Youth development initiatives, integrating Opportunities for Youth and STEM programming within a 4-H framework, addresses structural inequities by promoting positive development, civic engagement, and workforce readiness. Experiential learning connects scientific knowledge with practical challenges, fostering competencies across agriculture, family sciences, citizenship, and STEM. Inclusive practices expanded accessibility, while participation in community service and environmental projects strengthened leadership and social responsibility. Exposure to career pathways supported postsecondary and professional outcomes, and the creation of educational resources indicates sustained impact.

Overall, the PRAES educational program demonstrates substantial progress in advancing economic opportunity, strengthening agricultural systems, improving health and family well-being, and expanding youth development pathways. Its integrated approach has generated measurable outcomes in income generation, behavioral change, capacity building, and institutional strengthening, underscoring the value of interdisciplinary strategies in addressing complex development challenges in Puerto Rico.

Critical Issue: Community, economy & sustainable development

Puerto Rico has faced more than a decade of economic recession, worsened by natural disasters which intensified unemployment and poverty, reduced labor participation, and prompted outward migration. During Hurricane Maria agriculture lost approximately 85% of its crop value, and rural workers moved to other sectors in search of higher income. The Community, Economy & Sustainable Development Project responds to these needs by developing sustainable economic opportunities, providing community self-management training, and strengthening local support structures, local planning, and practical capacity building. Project activities were strategically designed to strengthen community entrepreneurship, enhance emergency preparedness, address locally identified needs, and consolidate social organization and self-management capacities. Across 14 municipalities, families and community organizations were directly engaged, resulting in the establishment of microenterprises and small businesses that generated sustainable income while promoting responsible and ethical business practices. The urban garden initiative fulfilled a dual function by enabling communities to create stable revenue streams while simultaneously advancing resident education in nutrition, local product marketing, and sustainable agricultural practices. This model demonstrates how community-based entrepreneurship can produce integrated economic and educational outcomes. Capacity-building interventions included financial planning, marketing strategies, digital tool utilization, and the management of physical and online marketplaces, thereby strengthening participants' competencies for autonomous project sustainability and long-term organizational viability.

In the area of emergency preparedness, workshops, simulations, and applied exercises were conducted with community leaders to develop response strategies related to water security, food access, and volunteer mobilization. A water access initiative in Ceiba enabled the community to maintain local reserves, reducing dependence on external sources and increasing disaster response capacity. Through these activities, participants developed skills in resource organization, volunteer coordination, and effective communication, strengthening self-management and preparedness for real-world emergencies, as documented in the Puerto Rico Agricultural Extension Service's data collection and evaluation system (PEARS). Households gained access to essential resources coordinated at the community level, demonstrating measurable programmatic impact. Assessments of local needs identified significant gaps in infrastructure, technological access, and agricultural knowledge. In response, a community workshop in Luquillo trained 35 household representatives in digital literacy, sustainable agricultural practices, and basic business competencies, achieving a 25% increase in agricultural productivity and a reduction in post-harvest losses, thereby evidencing improvements in production efficiency and local resource management. Sixty-eight community leaders also strengthened their leadership, communication, and collaborative skills, fostering peer-to-peer teaching and joint problem-solving. A combination of training, demonstration projects, and knowledge transfer created replicable models for other communities, expanding the reach of project benefits.

Social organization activities further supported leadership development and volunteer engagement with 68 individuals actively organizing events, distributing resources, and mentoring peers. This participation enhanced community cohesion and strengthened collective capacity, reinforcing the sustainability of project outcomes. Monitoring mechanisms, including periodic meetings and systematic progress documentation, facilitated the assessment of improvements in decision-making, inter-institutional collaboration, and local problem-solving. Project-based educational activities enabled participants to apply acquired competencies directly within their communities, consolidating experiential and practical learning. Overall, the project demonstrated measurable progress in entrepreneurship development, emergency preparedness, and community empowerment. Initiatives such as urban gardens, water access projects, and digital skills training translated strategic plans into tangible outcomes, illustrating how the integration of training, resources, and social organization generates sustainable and replicable benefits. The 112 families and 18 community organizations involved experienced multifaceted benefits. The creation of 42 microenterprises and small businesses increased average household income by 18%, improving access to essential services and reducing economic vulnerability. The urban garden initiative generated $12,500 in additional revenue and provided nutrition education to 75 community members. Participants learned to implement value-added agricultural practices, develop marketing strategies, and use digital tools, ensuring sustainable income beyond the project's duration.

Emergency preparedness workshops strengthened safety and response capacities. The 27 trained leaders now coordinate resources for 320 households, ensuring water and food supply as well as efficient volunteer mobilization. The water access

initiative mitigated infrastructure vulnerabilities and reduced reliance on external aid, increasing community confidence in facing disasters. Additionally, improvements in social cohesion, self-management, and volunteer participation were observed. Integrating practical projects and mentorships strengthened community ownership and responsibility. The urban gardens, water access, and digital skills initiatives illustrate how local interventions can solve complex problems, generate sustainable income, and empower families and organizations.

One of the most important projects at PRAEXS is an investigation into the leading human diseases affecting Puerto Rico's agricultural sector and their impact on agricultural production following recent climatic shocks and the COVID-19 pandemic. The project identified the most common diseases and the groups most at risk in the agricultural sector. The top five diseases —heart disease, stroke, Alzheimer's, diabetes, and breast cancer—were analyzed by age, gender, and income. Deaths were highest among women over 55 who are or were housewives, men aged 35–55 working in agriculture and manufacturing, and men over 55. Statistical models confirmed that higher mortality rates are linked to being female, older, or in high-risk occupations. The project benefits the broader public by providing evidence-based information on the leading causes of death and illness, helping policymakers plan to improve rural welfare, quality of life, and economic growth in the agricultural sector. Findings are shared through digital tools and workshops, and with UPRM extension service (PRAES) specialists to reach wider audiences. This initiative increases public awareness of major health risks and their impact on agriculture and supports planning for future emergencies to build more resilient rural communities.

Another project focuses on enhancing efficiency in small coffee farms using affordable Open-Source Technology. Major activities focused on building and assembling low-cost devices for separating defective coffee beans and for monitoring and controlling coffee borer infestations. The operating software was tested and validated to ensure the systems function properly. Initial evaluation trials were launched to assess performance under real conditions, and periodic meetings with coffee farmers were held to gather feedback and identify additional opportunities for innovation. The project benefits local coffee farmers by developing low-cost, Arduino-based tools that help address labor shortages and improve quality control. These technologies support the production of higher quality coffee that meets premium and specialty market standards. As a result, farmers can expand market opportunities and increase potential revenue through value-added products. The broader public benefits from this project through strengthened local coffee production and improved product quality. By supporting farmers with affordable technologies that address labor shortages and quality control challenges, the project helps sustain local agricultural businesses and expands access to premium and specialty coffees. Increased farm revenue also contributes to rural economic stability and supports the long-term viability of the coffee sector.

Critical Issue: Extreme weather, environment, natural resources, and sustainable energy

Nothing was reported for PRAES. Due to current Federal Government approved legislation and Excecutive Orders, this program which used to rely heavily on renewable energies is under review.

The PRAEXS continues to work towards a more sustainable agriculture sector taking into consideration extreme weather, such as drought and heavy rainfall events. These events pose a significant challenge for managing and protecting agricultural land and stable ecosystems in the tropics. In many instances, after an extreme weather event, the soil health of agricultural fields is adversely affected, with negative consequences for food production and security. Strategies and practices must be developed to overcome or counteract these effects and protect our soils. One project addressing this issue explores the effects of cover crops and biochar and biopolymer amendments to overcome problems related to soil health losses due to drought and heavy rainfall events. The effects of incorporating biochar and a biopolymer (xanthan) on soil health were evaluated in an Oxisol soil from the Coto series, used mainly for agricultural production in Puerto Rico. The effects of these amendments were evaluated by their impact on growth, nutrient and anti-nutrient levels, and overall quality of Phaseolus vulgaris (Beniquez cultivar). These activities have made a significant contribution toward developing, implementing, and understanding soil conservation practices that protect the land, boost productivity and quality of cash crops, and protect soils against extreme weather events by improving overall soil health. The results of this project have been disseminated to stakeholders through seven podcasts, two conferences, and a web page that will be updated before project completion.

The accumulation of anthropogenic contaminants, such as pesticides, polyfluoroalkyl substances (PFAS), and heavy metals, is increasing in many of our agricultural and urban areas, exposing a higher proportion of the population to the adverse effects of these contaminants. In many instances, the public lacks information on the level and type of contaminants to which they are exposed. One of our projects is currently addressing this lack of information by mapping and identifying anthropogenic contaminants in soils across regions of Puerto Rico and land-use areas (agricultural, illegal landfills, urban, and low-human-activity). Upon project completion, the results on heavy metals and specific organic contaminants in Puerto Rican soils will be accessible to the public and stakeholders across the island.

To achieve our goal, 111 soil samples from 37 sites with different land uses were analyzed using portable X-ray fluorescence (pXRF). Elevated levels, in some instances surpassing EPA screening levels, of chromium, lead, nickel, and antimony were detected in urban, landfill, and agricultural soils. Further studies will evaluate contamination severity and potential remediation strategies. The effectiveness of pXRF as a rapid assessment tool for heavy metal contamination is being determined in this project. A collection of 95 soil samples from agricultural sites in western Puerto Rico was analyzed for heavy metals using pXRF, and a subset is undergoing validation with ICP-MS to compare accuracy with pXRF. The project is also evaluating the potential of bamboo biochar as an adsorbent for five PFAS, which are highly stable and not readily degraded in the environment or within the human body. Sorption studies of these five PFAS on bamboo biochar suggest a high affinity for PFOA (92%), PFNA (100%), and PFBS (96%). Dissemination of results from this project has been carried out through field trials, workshops, and presentations to agricultural agents, farmers, and community stakeholders. These results were also presented at two international conferences, the Soil Science Society of America Bouyoucos Summer Conference and the North American Biochar Conference.

Isolated communities and islands experience a higher rate of power outages than the rest of the communities, affecting their businesses, agricultural production, health, and overall quality of life. Using Puerto Rico as a case study, the potential and feasibility of biomass gasification for power and heat generation in emergency and non-emergency scenarios are being evaluated to increase the resiliency of these communities. A survey of potential biomass feedstocks for gasification in Puerto Rico has been conducted. The characterization results obtained, such as energy density, ash and moisture content, and availability, are being used to determine which of these has the highest potential to be used as feedstock. We completed experimental trials to evaluate the potential of wood ashes, a byproduct of biomass gasification, to amend acidic soils to increase soil pH and to serve as a fertilizer to supply potassium, phosphorus, and other macro- and micro-elements to soils and crops. Workshops were carried out to educate stakeholders, including the Agricultural Extension Service Family and Consumer Science Program and agronomists from the College of Agronomists of Puerto Rico. We presented information about biomass gasification and how the technology could provide energy and heat in emergencies to purify water, cook food, and power electric appliances and equipment needed to meet the most basic needs.

A pre- and post-test was administered before and after the workshops to evaluate the impact of these activities. Of the 154 participants who completed the pre- and post-test, 75% improved their knowledge of gasification technology. All participants found the information highly useful, and 94% expressed their willingness to adopt gasification technology as a heat source during emergencies. Additionally, we have identified technical and logistical barriers (e.g., low amounts of biomass with the desired characteristics to be used as feedstock) that may hamper the successful implementation and acceptance of the technology in locations similar to Puerto Rico. Addressing these challenges and identifying the current scenarios in which biomass gasification technology best fits are fundamental to the successful establishment of biomass gasification as a source of alternative energy.

Soil health and water scarcity are major constraints to food production and security, especially in arid lands. One of our projects addresses this issue by combining keyline (conservation tillage), biopolymer, and biochar (KBB) to increase soil carbon, water retention, and microbial activity and population. As an additional water source, we installed dew condensers, devices with high-IR reflective surfaces that condense water vapor from the air at night and channel it to the keyline, providing additional water for the soil and crops and reducing irrigation needs while increasing soil moisture near the keyline. This year's results show that in Mollisols, the combination of biochar and xanthan (a biopolymer) significantly enhanced soil

hydrophilicity, altered water vapor adsorption dynamics, and stimulated microbial activity, leading to increased necromass production, which is tightly correlated with many key soil health parameters. In an Oxisol, the same treatment improved plantain biomass production and significantly raised chlorophyll levels in plant tissue. The findings demonstrate the positive effects of combining biochar with xanthan on soil health indicators.

Critical Issue: Family well-being

The integration of the Healthy and Sustainable Families and the Health and Well-being programs reflects a comprehensive, evidence-based approach to strengthening individual, family and community resilience in Puerto Rico by addressing interrelated dimensions of well-being, including family functioning, economic stability, preventive health, and safe home environments. Together, these programs demonstrate substantial progress in enhancing participants' capacities for informed decision-making and the adoption of sustainable practices that contribute to long-term quality of life.

The Healthy and Sustainable Families program addresses structural challenges affecting family systems—such as population aging, food insecurity, and limited economic resources—through nonformal education, practical workshops, and individualized consultations. In 2025, the program reached 4,656 participants and implemented interventions across three core domains: family relationships, healthy lifestyles, and financial stability. Educational efforts strengthened competencies in positive parenting, effective communication, emotional regulation, and caregiving, contributing to safer and more functional family environments. Concurrently, participants developed knowledge and skills related to nutrition, physical activity, hygiene, and disease prevention, fostering the adoption of health-promoting behaviors. The financial component enhanced participants' abilities to manage income, savings, and credit, prevent fraud, and plan for financial contingencies, including the development of emergency and succession plans. Documented outcomes indicate that 3,090 participants acquired life-course-specific competencies, while measurable behavioral changes included the adoption of healthy lifestyle practices by 1,274 families, improvements in resilience and communication among 53 participants, and strengthened caregiving and parenting practices among targeted groups. In the economic domain, 1,170 participants developed financial management competencies, with tangible achievements in budgeting, savings, fraud prevention, and emergency preparedness, collectively contributing to increased household stability and self-sufficiency.

Complementing these efforts, the Health and Well-being program expanded the scope of intervention to broader preventive health and home safety practices, reaching 11,421 participants through courses, workshops, educational series, and consultations. This program addressed persistent public health challenges, including chronic disease prevalence, sedentary lifestyles, and limited access to preventive services, by promoting sustainable behavioral change through participatory, evidence-based education. Interventions encompassed healthy eating, nutrition literacy, safe food handling, physical activity, hygiene, indoor air quality, early cancer detection, and emergency preparedness. Participants demonstrated strengthened knowledge, attitudes, and practices, with 730 individuals reporting improved attitudes toward healthy lifestyles, 197 adopting at least one sustainable health practice, and 345 increasing their motivation to prevent infectious diseases. Additional outcomes include enhanced knowledge of chronic and arboviral disease prevention among 136 participants, improved household sanitation practices among 158 individuals, and increased awareness of home safety and cancer screening. These results indicate meaningful progress in the adoption of protective behaviors that reduce health risks and reinforce safe and resilient household environments.

The Food Security program further reinforced these outcomes by addressing structural vulnerabilities related to food access, import dependence, and disaster risk through education on local food production, safe handling, preservation, and emergency food planning. During Fiscal Year 2025, the program implemented demonstrations, hands-on workshops, and individualized consultations that strengthened household and community food resilience. A total of 601 participants recognized the importance of food and nutrition security, while 396 enhanced their knowledge of healthy eating and nutrition. Safe food handling practices were acquired by 477 participants in home contexts and by 251 in emergency situations. The program emphasized food preservation and reserve planning as key resilience strategies: 435 participants learned and applied at least one preservation method, 314 incorporated preservation techniques into their food security practices, and 130 planned the preparation of nutritious food reserves. Efforts to promote local production resulted in 43

participants consuming foods from home or community gardens and 21 initiating pollinator-friendly gardening practices. Measurable outcomes include 55 participants preparing a five-day emergency food supply, 77 applying safe preservation methods, 67 safely preserving nutritious foods, 99 preparing safe meals at home, and 48 sourcing foods from local farmers' markets. Additionally, 172 participants increased their knowledge of the nutritional value of local crops, and 9 reported improvements in their socioeconomic conditions following the adoption of food production and preservation practices.

The integrated results of these three programs demonstrate substantial progress in strengthening knowledge, promoting behavioral change, and enhancing adaptive capacities across multiple dimensions of well-being. Participants not only improved family relationships, financial management, and health practices, but also increased their capacity to ensure stable access to safe and nutritious foods and to prepare for emergency situations. This alignment of family development, preventive health, and food security interventions has contributed to more stable households, improved nutritional and health outcomes, and greater resilience in the face of socioeconomic and environmental challenges. Collectively, these outcomes underscore the effectiveness of a coordinated, interdisciplinary approach in advancing sustainable well-being and long-term community resilience.

Critical Issue: Food safety, science and technology

Research on coffee aimed at producing specialty-grade products utilized five commercial yeast strains to conduct controlled fermentations. The fermented coffees were roasted and evaluated by a panel of Q graders, who determined that one treatment received a more favorable assessment in aroma and fragrance. They also observed that all samples exhibited a decline in attribute intensity over the course of the evaluation, which was associated with the roasting process; consequently, the roast curve parameters were adjusted. Following this modification, five Q graders re-evaluated the coffees, and the resulting scores were highly comparable across samples.

A related study focused on training panelists to assess the quality of coffees intended for specialty processing. In addition, two extraction methods for producing coffee concentrates were tested; however, both were found to be economically unfeasible in their proposed forms and require further modification. An alternative approach was proposed involving water as the extraction solvent, followed by injection into an extractive distillation system. The resulting extracts are intended for use in the production of coffee-flavored ice cream.

Research on fruit-based product development generated the necessary information to determine targeted products, including fruit marinades or dressings, dehydrated fruits with desirable textural characteristics, and pineapple wine. Development of these products is currently underway. Additionally, work has begun on establishing the processing footprint and preparing documentation for a model value-added food manufacturing facility.

The food industry faces the challenge of producing minimally processed foods formulated with fewer or natural ingredients while ensuring product safety, in response to evolving consumer trends and demands. In this context, the antimicrobial activity of two natural compounds, propolis and cannabidiol (CBD), was investigated. The pathogenic microorganisms evaluated included Salmonella spp., Listeria spp., and Staphylococcus aureus.

Under the conditions of this study, measurable—although limited—inhibition was observed, demonstrating the potential of these substances as antimicrobial agents. These findings indicate that further research is warranted to confirm their efficacy and optimize their application in food systems.

The research conducted in the FoSS&T Area supports local coffee farmers, students, and industry stakeholders by providing standardized procedures to produce specialty coffee and value-added coffee products with enhanced market competitiveness. It aims to generate commercially viable coffee extracts and related products while promoting innovation within the sector. Additionally, we focus on transforming food waste into value-added products, thereby strengthening the financial sustainability of fruit producers and contributing to Puerto Rico's food security. The development of plant blueprints is also expected to facilitate the establishment of emerging food processing facilities, generating employment and positive economic impact. New projects under this critical issue are focused on evaluating the acceptability of sweet potato cultivars

04-006 and 04-180 for potential release and increased food security. Support and advance antimicrobial resistance surveillance in retail food as part of the National Antimicrobial Resistance Monitoring System (NARMS)

Critical Issue: Food security, plant & animal systems

Puerto Rico's agricultural sector continues to face structural and external constraints, including prolonged economic instability, climate variability, pest and disease pressures, and dependence on food imports. In response, an integrated PRAES educational program was implemented to enhance productivity, sustainability, and food security across subsectors such as citrus, apiculture, dairy, sustainable agriculture, small ruminants, poultry, and coffee. These initiatives combined applied research, technical assistance, and experiential education to strengthen producer capacities, promote best management practices, and expand market opportunities.

In the citrus subsector, interventions addressed declines associated with Huanglongbing, extreme weather events, and labor shortages. A total of 182 participants completed training in integrated crop management, and 43 received instruction in propagation and grafting. Outcomes include improved practices adopted by 25 farmers and increased technical knowledge among 91 participants, contributing to enhanced productivity and sustainability.

Apiculture efforts targeted the underdevelopment of the honeybee industry. Training improved competencies in hive management and product diversification: 110 students gained foundational skills, 36 participated in hands-on training, and 108 learned value-added production. These activities resulted in five new apiaries and increased adoption of improved practices, supporting local production capacity.

In the dairy sector, programming emphasized profitability, animal welfare, and efficiency. Demonstrations of automated systems and grazing practices increased knowledge and adoption intentions, while technical assistance improved milk quality and herd management. Consumer education reached 56 participants, fostering dietary awareness and behavioral changes, complemented by youth engagement through 4-H initiatives.

Sustainable and organic agriculture efforts focused on capacity building through workshops, field activities, and educational materials, including manuals and videos. These initiatives enhanced knowledge of soil health, agroforestry, and certification, while promoting collaborative networks. Implementation of sustainable practices on four farms led to improved irrigation efficiency, reduced agrochemical use, and increased productivity.

The small ruminant program addressed production inefficiencies through training in animal health, nutrition, reproduction, and pasture management. Activities reached producers, students, and extension personnel, facilitating the adoption of improved husbandry and parasite control practices supported by technical consultations.

In the poultry sector, programming promoted small-scale egg production to address food insecurity. Educational activities reached over 250 participants, with more than 120 adopting improved practices, which resulted in increased egg production and the sustained management of over 1,600 laying hens, strengthening local food availability.

The coffee program enhanced value chains by improving production quality and market access. Training enabled 75 producers to strengthen specialty coffee knowledge, with 44 adopting quality-oriented practices. Additionally, 23 families developed value-added processing skills, while outreach to 103 stakeholders increased market awareness.

Overall, these integrated initiatives demonstrate measurable progress in enhancing agricultural productivity, technical capacity, and sustainability. Through coordinated education and technical support, PRAES facilitated the adoption of improved practices, supported income generation, and strengthened resilience, contributing to food security and long-term agricultural development in Puerto Rico.

Our research and outreach efforts focused on improving fruits, vegetables, leguminous crops plantains and starchy crops that are widely planted and consumed in Puerto Rico. Through laboratory work and field testing, we evaluated different bean

varieties to identify resistance to important diseases. Local production of root and tuber crops meets only a small part of national demand, increasing reliance on imports and the risk of supply disruptions. Tanier, an important traditional crop, depends on healthy planting material, yet many farmers lack the knowledge and resources to select and prepare it properly, leading to lower yields and more crop losses.

Plantain farming in Puerto Rico and the Caribbean is challenging because of the Black Sigatoka fungus, which can severely reduce yields if not controlled. The main commercial variety, Maricongo, produces well but is highly vulnerable to this disease. After hurricanes Irma and Maria, farmers introduced new plantain varieties, creating more diversity. The Agricultural Experiment Station ~~(AES)~~ has added three of these new cultivars—FHIA-20, Curare enano (MxH), and a locally claimed variety MS60—to its collection. Early evaluations show that FHIA-20 is more resistant to Black Sigatoka, while MxH is better against red rust thrips and has yellow fruit preferred for fresh consumption. MS60 still needs proper evaluation. Studying these new cultivars will help identify alternatives to Maricongo, reduce production costs, and provide farmers with reliable, diverse plantains. Agronomic evaluation of yield and tolerance to major diseases of five plantain cultivars produced by tissue culture established at Corozal Substation was repeated at Gurabo Substation in December 2024. Included was one new cultivar, MP1, and a second plot that used vegetative seed from the same five cultivars. Tolerance to major diseases will be evaluated three, six, and nine months after the December planting and at the harvest. The agronomic traits (number of fruits, weight of fruit) and desirable characteristics would be evaluated at harvest. The two experimental plots at Gurabo Substation have four repetitions of five treatments (MP1, MS60, 3/4 Macho x Hembra, and Maricongo and FHIA-20 as controls); each repetition has 28 plants per cultivar. The distribution of the cultivars and repetitions were randomly selected. Data on the agronomic traits and desirable characteristics per plantain cultivar will be collected this semester.

The Puerto Rico Plant Diagnostic Clinic (PRPDC) also played a critical role in safeguarding ornamental plant exports by ensuring compliance with international phytosanitary standards. These diagnostic services have made the Plant Diagnostic Clinic an essential resource, supporting plant health certification and facilitating safe domestic and international trade. At the same time the Entomology Laboratory carried out important research on insect pests affecting local agriculture. Surveys and assessments focused on thrips impacting leguminous crops, leafhoppers affecting various plant species and insect borers damaging mango trees. Surveys to determine the abundance of C. stephanoderis across five arabica varieties continued in Adjuntas, Las Marias, Maricao and Ututado. Coffee berries were sampled, dissected, and incubated to assess pest and parasitoid levels. Early results indicate that parasitoid abundance varies among coffee varieties. In coffee, research efforts will continue in the evaluation of new planting techniques and rust resistant varieties against Hemileia vastatrix. Research findings on best performing varieties of crops, optimal cultural practices, integrated management of coffee berry borer and leafminer, market feasibility and consumer preference studies, will be disseminated to growers and agronomists. In courses, summer practice and volunteer work, students benefited through hands-on training and workforce development. Graduate and undergrad students received practical experience in germplasm evaluation, morphological description, field management and postharvest handling of crop accessions and fruit varieties.

Research in animal systems has focused on livestock productivity and adaptation to extreme weather conditions in the tropics, forage management for grazing systems, meat and milk composition, and educational initiatives to enhance student preparedness within Animal Science. More specifically milk yield and composition have been evaluated in response to forage management practices in bovines and small ruminants. Small ruminant research has also been evaluating aspects of nutrition, genetics, prevalence and control of parasites, meat yield and quality, as well as semen preservation and artificial insemination techniques. Some of the most relevant findings in small ruminant research include the development of a hybrid artificial insemination technique that is both easier and more effective. Regarding dairy, research has focused on cattle management practices in milk yield and composition, antibiotic resistance, as well as the physiology and endocrinology of slick haired vs wild type Holsteins. Specific molecular markers associated with post-partum metabolic diseases in dairy cattle are being investigated. Beef cattle research is evaluating the effectiveness of strategic supplementation as a means to offset slow weight gains post-weaning while simultaneously reducing cattle age at slaughter in Senepol and Senepol x Red Angus bulls. A strong emphasis is also being placed on carcass and meat quality attributes as a response to cattle's genetic composition. Findings so far suggest that a brief pre-weaning supplementation period significantly decreases low average

daily gains within the next 30 days after weaning and produces heavier carcasses in yearling bulls despite genetic variations in cattle. Significant attention has been given to student mentoring as educational grants promote experiential learning, readiness, and competence in students interested in the scientific process. Research in animal systems is having a positive impact among industry stakeholders interested in improving production in challenging environmental and economic scenarios as those present in Puerto Rico.

Critical Issue: Positive youth development

Adolescence in Puerto Rico occurs within a context of persistent socioeconomic vulnerability and recurrent environmental disruptions: approximately 58% of children and youth live below the federal poverty level, schooling and services were disrupted by successive disasters and the COVID-19 pandemic, and standardized assessments indicate limited gains in early-grade mathematics proficiency. The two programmatic strands for this critical issue —Opportunities for Youth (OYE) and Elevating Youth Voices in STEM can help to solve daily problems --were implemented by PRAES 4-H to mitigate these structural deficits by strengthening protective factors, expanding educational and postsecondary pathways, enhancing civic engagement, and developing workforce-relevant competencies through non-formal, experiential learning in Agriculture, Family and Consumer Sciences (FCS), Citizenship, Community Service, and STEM.

The Leadership Equity Institute served as a catalyst for the OYE model by establishing five youth–adult leadership teams across the island that designed interdisciplinary initiatives to promote full citizenship and positive youth development. The En Señas initiative addressed barriers faced by deaf and blind youth by training staff and youth leaders in American Sign Language (ASL) interpretation and by producing ASL educational media. This initiative resulted in 60 direct beneficiaries, with five youth leaders delivering ASL workshops, 15 youth earning ASL certification, and six PRAES staff members completing basic and intermediate ASL training. Institutionalization of simultaneous ASL interpretation of the 4-H Pledge at the local, regional and state events reflects a systemic shift toward inclusive delivery. More than 100 participants—youth, volunteers, and Extension staff— also increased knowledge of children's and youth's rights, participative program design, and anti-discrimination practices through targeted capacity-building efforts. In the STEM program, the expanding Bug Camp route trained 30 educators, Extension agents, and volunteers to deliver entomology education; four Extension educators and four volunteers represented Puerto Rico 4-H as mentors and facilitators at national events, and selected youth and volunteers received scholarships to attend national development opportunities such as Ignite 2025.

Program activities generated substantial civic engagement and community service outputs. Within OYE, 522 youth participated in community projects, including pollinator garden initiatives, field experiences with members of blind associations, and the redesign of a pollinator garden at the Botanical Garden in San Juan. An additional 274 youth collaborated with community organizations to collect school supplies, clothing, and toys for children in foster care, homeless, or receiving mental health services. The School for All project provided educational materials to six families in the Fajardo region, supporting continuity of learning during economic hardship, and enabled youth leaders and volunteers to secure scholarships to national events.

The STEM, Agriculture, and FCS initiatives reached diverse and significant cohorts. The Cuatro Patas animal welfare curriculum engaged more than 900 youth in learning about animal care, relevant legal frameworks, career pathways, and volunteerism; participants conducted a community donation campaign for animal shelters and constructed sustainable dog toys from recycled textiles. Food production and gardening activities engaged 1,515 participants in seed selection, plant care, pollinator roles, and the establishment of school and community gardens; post-program feedback indicated strong commitment among youth and volunteers to sustain garden maintenance and to replicate home gardening, with specific school projects influencing participants' career choices in agronomy and nutrition. Food preservation training reached 359 participants and produced an online, self-directed dehydration course available via Google Sites. Pollinator Habitat Ambassadors established gardens in urban and forest contexts; at the University Garden High School (UGHS) 191 students reported increased confidence in discussing how science, engineering, and technology address everyday problems, and 25 members of the Carmen L. Feliciano School engaged with Casa del Árbol programming and climate dialogues. The traveling Bug Camp connected participants to land-grant facilities and botanical resources, reinforcing field-based

entomology learning. Collective participation across literacy-based, interdisciplinary STEM, FCS, and agriculture learning experiences reached 1,246 youth and exposed participants to methods such as forest walks, photomarathons, food laboratories, and hands-on demonstrations. As a result, 688 youth identified STEM-related professions and career pathways, and 257 UGHS students actively engaged in Agriculture, FCS, and STEM programming. Participation contributed to observable postsecondary outcomes: 43 4-H students were admitted to postsecondary programs attributable to their involvement in program activities. Individual success stories illustrate these linkages between experiential learning and academic trajectories: two Humacao gardening participants entered agronomy and nutrition programs; Nedielys Rivera's participation in Cuatro Patas led to acceptance into a veterinary camp and preparation for veterinary studies; Roy J. Rivera's leadership resulted in admission to an engineering faculty; Yolmarie Santiago pursued nutrition and dietetics; and Eliam Cuadrado continued studies in Agricultural Sciences. In addition to admissions, credentialing outcomes include Eduardo Diaz's professional ASL interpreter certification, which has enabled him to provide statewide interpretation, teach ASL courses and support ongoing 4-H access initiatives. OYE youth also presented the 4-H Pledge in ASL at national venues (National 4-H Congress, National 4-H Conference, and the True Leaders in Equity Institute during 2024-2025), amplifying the program's visibility and youth voice. Pedagogically, the combined initiatives employed experiential, interdisciplinary approaches that linked scientific principles to community challenges. Garden-to-Table sequences, high-tunnel production, entomology field routes, and STEAM integrations—such as the Teatro Rodante dengue prevention Mosquito Theater Lab attended by 472 children and youth—demonstrated how hands-on, place-based learning can address food security, pollinator decline, disaster resilience, and public health. Teatro Rodante further developed curricular modules to prevent age discrimination and foster intergenerational engagement, thereby equipping youth to design intergenerational projects and public dialogues. Instructional resources produced by program participants and staff—ASL educational videos, an online food preservation course, and curricula for intergenerational engagement—indicate moves toward permanence and sustainability. Partnerships with university´s campuses, land-grant stations, PRAES specialists (including entomology and phytopathology), community organizations, and national sponsors (such as Corteva Agriscience-PR and the National 4-H Council) expanded resource access and facilitated training, scholarship pathways, and institutional linkages.

In conclusion, the integrated efforts of OYE and the STEM-focused initiatives achieved measurable progress in capacity building, inclusive practice adoption, civic engagement and facilitation of pathways to postsecondary education, as well as sustained community projects such as gardens, pollinated habitat restoration, and animal welfare campaigns. Experiential learning strategies effectively connected STEM and FCS learning to immediate community needs, developing youth skills and supporting vocational orientation.

Merit and Scientific Peer Review Process

Updates

During Fiscal Year 2025, the PRAES Planning and Evaluation Director, in collaboration with the Extension Assistant Dean and Extension Programmatic Leaders, implemented the Merit Review process utilizing a qualitative methodological approach. Specifically, a focus group was conducted to assess the effectiveness of existing collaborations with programmatic partners, including both governmental agencies and nongovernmental organizations. Additionally, the focus group served to identify emerging needs and to prioritize the most relevant issues from the range of needs identified for future programmatic action.

Stakeholder Input

Actions to seek stakeholder input that encouraged their participation with a brief explanation

PRAES stakeholders are formally invited to participate in an annual meeting convened at the local AES offices. The invitation underscores the significance of their engagement, emphasizing that their contributions are essential to the development of the Annual Plan, which is designed to address priority needs identified within their respective sectors. Participants are thereby afforded a meaningful opportunity to articulate and represent the perspectives of farmers, families, youth, and communities, ensuring that programmatic priorities are informed by stakeholder input.

Methods to identify individuals and groups and brief explanation

PRAES participants are identified by the Extension Agents at each local office and are selected to represent each of the program areas of PRAES: Agriculture, Family and Consumer Sciences, 4-H and Community Development.

Methods for collecting stakeholder input and brief explanation

Among the two qualitative methodologies initially proposed by PRAES, the Nominal Group Technique was selected and implemented to enable stakeholders to systematically prioritize the most relevant issues from the list of identified needs. This approach facilitated the development of a Plan of Work that is closely aligned with stakeholders' articulated needs and aspirations.

A statement of how the input will be considered and brief explanation of what you learned from your stakeholders

The PRAES Committee, composed of the Director of the Planning and Evaluation Office, the Extension Planning and Evaluation Specialist, and the Program Area Leaders, oversaw the prioritizing of stakeholders' needs and resources in Nominal Group sessions. The committee engaged a graduate student specializing in qualitative data analysis to support the analytical process. Using the data collected, frequency distributions and content analysis were conducted to systematically interpret stakeholder input.

The committee proceeded to analyze the findings to integrate them to FY2025 POW. Subsequently, the committee disseminated the findings, accompanied by strategic recommendations, to all Extension personnel. These efforts were intended to enhance responsiveness to stakeholder needs while promoting an integrated approach across the four Extension programmatic areas.

Highlighted Results by Project or Program

Critical Issue

Community, economy & sustainable development

There are no Projects or Programs with highlighted results for this Critical Issue or category.

Critical Issue

Extreme weather, environment, natural resources, and sustainable energy

Project

	Results	Organization	Project Director
Delineating estuaries and their catchment using ground base remote sensing	1	University of Puerto Rico Mayaguez Campus	Luis Perez-Alegria

Critical Issue

Family well-being

Program

	Results	Organization	Initiator
Health and Well-being	1	University of Puerto Rico Mayaguez Campus	Jaime Curbelo

Critical Issue

Food safety, science and technology

There are no Projects or Programs with highlighted results for this Critical Issue or category.

Critical Issue

Food security, plant & animal systems

Program

	Results	Organization	Initiator
Added value to create and expand marketing opportunities for crop producers.	1	University of Puerto Rico Mayaguez Campus	Robinson Rodriguez-Perez

Program

	Results	Organization	Initiator
Developing educational strategies to improve local food security	1	University of Puerto Rico Mayaguez Campus	Robinson Rodriguez-Perez

Program

	Results	Organization	Initiator
Honeybee Research and Extension Program	1	University of Puerto Rico Mayaguez Campus	Robinson Rodriguez-Perez

Project

	Results	Organization	Project Director
Improvement of reproduction and profitability of criollo ewes in a tropical environment	1	University of Puerto Rico Mayaguez Campus	John Fernandez-VanCleve

Program

	Results	Organization	Initiator
Increase local food availability by farm production and urban agriculture.	1	University of Puerto Rico Mayaguez Campus	Jaime Curbelo

Critical Issue

Positive youth development

Program

	Results	Organization	Initiator
Curiosity in Action: Strengthening Youth			

Engagement through STEM-A Experiential Learning in 4-H	1	University of Puerto Rico Mayaguez Campus	Robinson Rodriguez-Perez

Appendix

Research Projects

Critical Issue	Projects
Community, economy & sustainable development	4

Project

	Results	Organization	Project Director
Enhancing Efficiency in Small Coffee Farms Using Affordable Open-Source Technology	1	University of Puerto Rico Mayaguez Campus	Javier Huertas

Project

	Results	Organization	Project Director
Evaluation of Alternative Coffee Harvesting Methods for Puerto Rico	1	University of Puerto Rico Mayaguez Campus	Francisco M. Monroig

Project

	Results	Organization	Project Director
Local and Regional Food Systems Extension and Research: network development,	1	University of Puerto Rico Mayaguez Campus	Vivian Carro-Figueroa

emerging issues and policy development

Project

	Results	Organization	Project Director
Rural health and agricultural production in Puerto Rico	1	University of Puerto Rico Mayaguez Campus	Alicia Barriga

Critical Issue

Extreme weather, environment, natural resources, and sustainable energy

Projects

12

Project

	Results	Organization	Project Director
Absorbent method for measuring molalities and thermodynamic activities of inorganic electrolytes in the aqueous phase of unsaturated vadose zone soils	1	University of Puerto Rico Mayaguez Campus	Victor Snyder

Project

	Results	Organization	Project Director
Agroecological Practices Adapted to Extreme Weather Conditions	1	University of Puerto Rico Mayaguez Campus	Jose Dumas

Project

	Results	Organization	Project Director	
Climate-smart agricultural practices to assess greenhouse gases in plantains	1	University of Puerto Rico Mayaguez Campus	Rebecca Tirado-Corbala	

Project

	Results	Organization	Project Director	
Delineating estuaries and their catchment using ground base remote sensing	1	University of Puerto Rico Mayaguez Campus	Luis Perez-Alegria	

Project

	Results	Organization	Project Director	
Fertilizer-P and -K calibration studies for vegetable production in Puerto Rico	1	University of Puerto Rico Mayaguez Campus	DAVID SOTOMAYOR-RAMIREZ	

Project

	Results	Organization	Project Director	
Identification and distribution of potentially toxic contaminants in Puerto Rican soils	1	University of Puerto Rico Mayaguez Campus	Daniel Bair	

Project

	Results	Organization	Project Director	
Implementing subsurface drip irrigation and air injection as innovative water and	1	University of Puerto Rico	Elvin Roman-Paoli	

nutrient management of fruit trees and vegetables		Mayaguez Campus	

Project

Increasing biodiversity and lowering the maintenance cost of urban forest corridors	**Results**	**Organization**	**Project Director**
	1	University of Puerto Rico Mayaguez Campus	Sally Gonzalez

Project

Integrative Strategies to Enhance Soil and Plant Health using Biochar-Biopolymer-Microbe Amendments, Cover Crops, and Adjusted Fertility Practices	**Results**	**Organization**	**Project Director**
	1	University of Puerto Rico Mayaguez Campus	Jose Dumas

Project

Low Cost and Locally Available Inputs and Sustainable Practices for Increasing the Resiliency and Sustainability of Food Crops	**Results**	**Organization**	**Project Director**
	1	University of Puerto Rico Mayaguez Campus	Christian Rivera-Goyco

Project

	Results	Organization	Project Director
Soil acidity and soil acidity factors, major constraints to soil quality and crop production	1	University of Puerto Rico Mayaguez Campus	Miguel Munoz

Project

	Results	Organization	Project Director
Synergistic effects of windbreaks and natural enemies on CLM (Leucoptera coffeella, Guerin-Meneville) control: Ecosystem resilience and sustainable coffee production	1	University of Puerto Rico Mayaguez Campus	Fernando Gallardo

Critical Issue	Projects
Family well-being	0

There are no Projects with results for this Critical Issue or category.

Critical Issue	Projects
Food safety, science and technology	5

Project

	Results	Organization	Project Director
Controlled Fermentation Studies in the Manufacture of Specialty Coffees	1	University of Puerto Rico Mayaguez Campus	Javier Huertas

Project

	Results	Organization	Project Director
Development of High-Quality Value-Added Products Made from Coffee	1	University of Puerto Rico Mayaguez Campus	Javier Huertas

Project

	Results	Organization	Project Director
Enhancing Microbial Food Safety by Risk Analysis	1	University of Puerto Rico Mayaguez Campus	Maria Plaza

Project

	Results	Organization	Project Director
Formulations and Manufacturing Methods for Fruit Value Added Products	1	University of Puerto Rico Mayaguez Campus	Fernando Perez-Muñoz

Project

	Results	Organization	Project Director
Manufacture of Yam (Dioscorea rotundata) flour as a possible ingredient in the preparation of pasta, bread, and extruded products	1	University of Puerto Rico Mayaguez Campus	Rosa Chavez-Jauregui

Critical Issue	Projects
Food security, plant & animal systems	36

Project

	Results	Organization	Project Director
Assessing the status of Insect Species in Puerto Rico and Mitigation Approaches	1	University of Puerto Rico Mayaguez Campus	Irma Cabrera

Project

	Results	Organization	Project Director
Assessment of the effect of forage maturity, cow comfort and water accessibility on bovine milk yield and components	1	University of Puerto Rico Mayaguez Campus	Jaime Curbelo

Project

	Results	Organization	Project Director
Breeding Phaseolus Beans for Resilience, Sustainable Production, and Enhanced Nutritional Value	1	University of Puerto Rico Mayaguez Campus	Elva Consuelo Estevez De Jensen

Project

Comparison of pleiotropic candidate genes and genomic estimations of reproductive efficiency as possible selection alternatives for tropically adapted bovines

Results	Organization	Project Director
1	University of Puerto Rico Mayaguez Campus	Melvin Pagan-Morales

Project

Determination of an optimal creep feeding supplementation period on performance and beef quality of Senepol and Senepol x Red Angus bulls in Puerto Rico

Results	Organization	Project Director
1	University of Puerto Rico Mayaguez Campus	Katherine Domenech-Perez

Project

Effect of organic soil amendments on soil quality and production of tomatoes (Solanum lycopersicum) grown under high tunnels

Results	Organization	Project Director
1	University of Puerto Rico Mayaguez Campus	Jorge Perez-Arocho

Project

Enabling climate-smart dairy production by characterizing milk productivity and the underlying thermotolerance mechanisms of dairy breeds better adapted to extreme heat	**Results** 1	**Organization** University of Puerto Rico Mayaguez Campus	**Project Director** GUILLERMO ORTIZ

Project

Enhancing Management of Watermelon Vine Decline	**Results** 1	**Organization** University of Puerto Rico Mayaguez Campus	**Project Director** Elva Consuelo Estevez De Jensen

Project

Enhancing Small Ruminant Breeding in the Tropics: Semen Preservation and Artificial Insemination Techniques	**Results** 1	**Organization** University of Puerto Rico Mayaguez Campus	**Project Director** Marine Lugo-Ruiz

Project

Evaluation of New Plantain (Musa spp.) Cultivars for Potential Commercial	**Results** 1	**Organization** University of Puerto Rico Mayaguez Campus	**Project Director** Martha Giraldo

Production in Puerto Rico

Project

	Results	Organization	Project Director
Evaluation of QoI Fungicide Resistance in Pseudocercospora fijiensis Populations Affecting Bananas and Plantains in Puerto Rico	1	University of Puerto Rico Mayaguez Campus	Merari Feliciano

Project

	Results	Organization	Project Director
Evaluation of different microclimates and their influence on the efficiency of Tamarixia radiata (Waterston) as a parasitoid of Diaphorina citri Kuwayama in Puerto Rico	1	University of Puerto Rico Mayaguez Campus	Edda Martinez

Project

Evaluation of dragon fruit (Hylocereus sp) varieties, the effect of phosphorus, potassium fertilizers and cross pollination to increase flowering, fruits and size.	**Results** 1	**Organization** University of Puerto Rico Mayaguez Campus	**Project Director** Jose Zamora	

Project

Exploring Opportunities and Trade-offs for Urban Agroecology in Puerto Rico: Biodiversity, Productivity and Nutritional Security	**Results** 1	**Organization** University of Puerto Rico Mayaguez Campus	**Project Director** Georges Felix	

Project

Facilitating Registration of Pest Management Technology for Specialty Crops and Specialty Uses	**Results** 1	**Organization** University of Puerto Rico Mayaguez Campus	**Project Director** Wilfredo Robles	

Project

Feeding strategies, genetics, and castration on performance, carcass, and retail	**Results** 1	**Organization** University of Puerto Rico	**Project Director** Abner Rodriguez-	

cuts yield, and meat quality of criollo and crossbreeds lambs		Mayaguez Campus	Carias

Project

	Results	Organization	Project Director
Fertility and embryo characterization of slick hair Holstein cattle	1	University of Puerto Rico Mayaguez Campus	Veronica Negron

Project

	Results	Organization	Project Director
General Administration of Federal-Grant Fund Research	1	University of Puerto Rico Mayaguez Campus	Julia OHallorans

Project

	Results	Organization	Project Director
Impacts of Stress on Performance, Health, and Well-Being of Animals	1	University of Puerto Rico Mayaguez Campus	Abner Rodriguez-Carias

Project

	Results	Organization	Project Director
Improvement of reproduction and profitability of criollo ewes in a tropical environment	1	University of Puerto Rico Mayaguez Campus	John Fernandez-VanCleve

Project

Incidence of Leucoptera coffeella, Hypothenemus hampei and Xylothrechus quadripes: at different enviromental conditions, elevations and varieties of coffee in Puerto Rico

Results	Organization	Project Director
1	University of Puerto Rico Mayaguez Campus	Jesus Gomez

Project

Integrated management of young Giant Key lime (Citrus aurantifolia) orchards using cover crops, irrigation, and fertigation techniques

Results	Organization	Project Director
1	University of Puerto Rico Mayaguez Campus	Rebecca Tirado-Corbala

Project

Optimun preservation of pigeonpea seed for research and commercial purposes

Results	Organization	Project Director
1	University of Puerto Rico Mayaguez Campus	Angela Linares-Ramirez

Project

Ovulation synchronization and

Results	Organization	Project Director

estrus detection protocols comparison in Tropical Holstein	1	University of Puerto Rico Mayaguez Campus	Veronica Negron

Project

	Results	Organization	Project Director
PLANT TISSUE CULTURE AND A STORAGE SYSTEM MODEL AS CATALYSTS FOR YAM FOOD SECURITY	1	University of Puerto Rico Mayaguez Campus	Merari Feliciano

Project

	Results	Organization	Project Director
Population Outburst of Stem borers in Tropical Fruits in the South of Puerto Rico	1	University of Puerto Rico Mayaguez Campus	Irma Cabrera

Project

	Results	Organization	Project Director
Reproductive Performance, Cow Productivity, and Temperament Assessment of Purebred Senepol and Angus x Senepol Cows in the Tropics	1	University of Puerto Rico Mayaguez Campus	Americo Casas

Project

	Results	Organization	Project Director
Reproductive endocrinology and liver physiology of		University of Puerto Rico	

slick hair Holstein cows	1	Mayaguez Campus	Esbal Jimenez

Project

	Results	Organization	Project Director
Research Advances in Agricultural Statistics	1	University of Puerto Rico Mayaguez Campus	Raul Macchiavelli

Project

	Results	Organization	Project Director
Restoring Degraded Grass Stands by Integrating Legumes to Enhance Grass-Fed Meat and Dairy Production in Puerto Rico	1	University of Puerto Rico Mayaguez Campus	Elide Valencia

Project

	Results	Organization	Project Director
Role of plant-parasitic nematodes in the production of sweet potatoes (Ipomoea batatas) in Puerto Rico: The missing link in an IPM Program	1	University of Puerto Rico Mayaguez Campus	Roberto Vargas

Project

	Results	Organization	Project Director
S009: Plant Genetic Resources	1	University of Puerto Rico	Carlos Flores

Conservation and Utilization		Mayaguez Campus	

Project

	Results	Organization	Project Director	
Sustainable Rotational Grazing System for Small Ruminants	1	University of Puerto Rico Mayaguez Campus	Alfredo Aponte-Zayas	

Project

	Results	Organization	Project Director	
Sustainable development in coffee production in the absence of manpower for nursery operation and plantation establishment	1	University of Puerto Rico Mayaguez Campus	Carlos Flores	

Project

	Results	Organization	Project Director	
Tropical adaptation assessment of purebred Senepol and Senepol x Red Angus crossbred heifers	1	University of Puerto Rico Mayaguez Campus	Hector Sanchez-Rodriguez	

Project

	Results	Organization	Project Director
Use of companion crops in the management of invasive insects &			

other key pests & diseases of tropical crops: Research & demonstration project for transitioning organic farmers	1	University of Puerto Rico Mayaguez Campus	Rosa A. Franqui-Rivera

Critical Issue

Positive youth development

Projects

0

There are no Projects with results for this Critical Issue or category.

Extension Programs

Critical Issue

Community, economy & sustainable development

Programs

1

Program

	Results	Organization	Initiator
Community Self-Management, Economic Development, and Volunteer Resilience During Critical Times	1	University of Puerto Rico Mayaguez Campus	Robinson Rodriguez-Perez

Critical Issue

Extreme weather, environment, natural resources, and sustainable energy

Programs

1

Program

	Results	Organization	Initiator

Natural resource protection amid weather variations and natural disasters	1	University of Puerto Rico Mayaguez Campus	Robinson Rodriguez-Perez

Critical Issue

Family well-being

Programs

3

Program

	Results	Organization	Initiator
Food Security	1	University of Puerto Rico Mayaguez Campus	Robinson Rodriguez-Perez

Program

	Results	Organization	Initiator
Health and Well-being	1	University of Puerto Rico Mayaguez Campus	Jaime Curbelo

Program

	Results	Organization	Initiator
Healthy and Sustainable Families	1	University of Puerto Rico Mayaguez Campus	Jaime Curbelo

Critical Issue

Food safety, science and technology

Programs

0

There are no Programs with results for this Critical Issue or category.

Critical Issue	Programs
Food security, plant & animal systems	7

Program

	Results	Organization	Initiator
Added value to create and expand marketing opportunities for crop producers.	1	University of Puerto Rico Mayaguez Campus	Robinson Rodriguez-Perez

Program

	Results	Organization	Initiator
Developing educational strategies to improve local food security	1	University of Puerto Rico Mayaguez Campus	Robinson Rodriguez-Perez

Program

	Results	Organization	Initiator
Enhancing Crop Health to Maximize Plant Production	1	University of Puerto Rico Mayaguez Campus	Robinson Rodriguez-Perez

Program

	Results	Organization	Initiator
Honeybee Research and Extension Program	1	University of Puerto Rico Mayaguez Campus	Robinson Rodriguez-Perez

Program

	Results	Organization	Initiator

Increase local food availability by farm production and urban agriculture.	1	University of Puerto Rico Mayaguez Campus	Jaime Curbelo

Program

Results	Organization	Initiator
Research and Extension Small Ruminant Program	1	University of Puerto Rico Mayaguez Campus	Jaime Curbelo

Program

Results	Organization	Initiator
Urban Poultry Farming	1	University of Puerto Rico Mayaguez Campus	Robinson Rodriguez-Perez

Critical Issue

Positive youth development

Programs

2

Program

Results	Organization	Initiator
Curiosity in Action: Strengthening Youth Engagement through STEM-A Experiential Learning in 4-H	1	University of Puerto Rico Mayaguez Campus	Robinson Rodriguez-Perez

Program

Results	Organization	Initiator
	University of Puerto Rico	

Opportunities for youth in equity (OYE)	1	Mayaguez Campus	Jaime Curbelo

Other Projects / Programs

Type
Projects / Programs without a Critical Issue
Projects / Programs

Type
Multistate Projects
Projects

Type
Integrated Projects / Programs
Projects / Programs