NATIONAL AGRICULTURAL RESEARCH AND EXTENSION INSTITUTE

Mon Repos, East Coast Demerara

ANNUAL REPORT 2024

Office of the Chief Executive Officer

Research

Crop Development and Support Services

Plant Nurseries

National Plant Protection Organisation

Mangrove Restoration and Management

ANNUAL REPORT 2024

VISION STATEMENT

To ensure food security, the empowerment of farming communities, and to enhance their livelihoods through improved and environmentally friendly technologies.

MISSION STATEMENT

To advise, develop, and transfer appropriate systems to promote balanced, diversified, and sustained agricultural production through adaptive and investigative research using a market-driven approach and a range of regulatory services to the sector.

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ACRONYMS/ABBREVIATIONS

AIEP	Agricultural and Innovation Entrepreneurship Program
AIS	Agriculture Information System
CARDI	Caribbean Agricultural Research and Development Institute
BSD	Black Sigatoka Disease
CARICOM	Caribbean Community
CATIE	Tropical Agricultural Research and Higher Education Center (Centro Agronómico Tropical de Investigación y Enseñanza)
CDSS	Crop Development and Support Services Department
DFT	Deep Flow Technique
CFF	Carambola Fruit Fly
DWC	Deep Water Culture
FAO	Food and Agriculture Organization
FVOC	Fruits, Vegetables, and Other Crops
GAP	Good Agricultural Practices
GDF	Guyana Defence Force
GOG	Government of Guyana
GRDB	Guyana Rice Development Board
GSA	Guyana School of Agriculture
GuyMIS	Mangrove Monitoring System
HCIL	Hope Coconut Industries Limited
HQCF	High-Quality Cassava Flour
IAEA	International Atomic Energy Agency
IPPC	International Plant Protection Convention
ITC	International Trade Centre
KJWA	Koronivia Joint Work on Agriculture
LCDS	Low Carbon Development Strategy
MOA	Ministry of Agriculture
MMAN	Mangrove Management Action Network
NAREI	National Agricultural Research and Extension Institute
NFT	Nutrient Film Technique
NIS	National Insurance Scheme

NPPO	National Plant Protection Organization
PCR	Polymerase Chain Reaction
PGRFA	Plant Genetic Resources for Food and Agriculture
PPE	Personal Protective Equipment
SPS	Sanitary and Phytosanitary Measures
SPU	Special Project Unit
TERI	The Energy and Resources Institute
UG	University of Guyana
UNFCCC	United Nations Framework Convention on Climate Change
USAID-CAPA-IESC	United States Agency for International Development- Caribbean Agricultural Productivity Improvement Activity- Improving Economies for Stronger Communities
WTO	World Trade Organization
WUSC	World University Service of Canada

CHAIRMAN'S MESSAGE

As we reflect on the progress made by the National Agricultural Research and Extension Institute (NAREI) over the past year, I am honoured to present this message on behalf of the Board of Directors in furtherance of the 2024 Annual Report. NAREI remains committed to enhancing agricultural research, innovation and extension services for the benefit of our nation.

The year 2024 brought with it both challenges and opportunities, which NAREI has met with resilience and determination. Our dedicated team continued to aggressively pursue our core mission of improving agricultural productivity, sustainability, and the livelihoods of our farmers. Through extensive research, capacity-building programmes, use of multi-media, and innovative partnerships, we have achieved meaningful progress in key areas, including crop diversification, climate-resilient practices, and improved extension services to reach farmers across Guyana.

We are especially proud of the collaborative efforts with government agencies, private stakeholders and international partners that have strengthened our initiatives and expanded our impact. The year 2024 has seen the launch of several new research and extension projects that promise to transform the agricultural sector, particularly in areas such as tissue culture, soils chemical analysis, pest and disease management, hydroponics and the promotion of agro-processing.

However, we understand that the path forward will require continued focus and adaptation. With the evolving challenges of climate change, the need for food security, and the ever-growing demands of global markets, NAREI remains committed to forging ahead with innovative solutions and sustainable practices that will ensure the long-term success of Guyana's agricultural sector.

On behalf of the Board of Directors, I extend my heartfelt thanks to the CEO, Mr. Jagnarine Singh, NAREI's Management Team and Staff, and all of our partners and stakeholders for your unwavering support and collaboration.

We also extend our gratitude to His Excellency the President, Dr. Mohamed Irfaan Ali, the Minister of Agriculture, Honourable Zulfikar Mustapha, and the vibrant team at the Ministry

of Agriculture for their continued support of NAREI's work. Together, we will continue to shape a prosperous, sustainable, and resilient agricultural sector.

Joseph Singh
Major General (retd)
Chairman of the Board of Directors

CHIEF EXECUTIVE OFFICER'S STATEMENT

2024 was a highly successful year for the institute, as most of our activities focused on supporting the agricultural industry through research, training, and extension services for farmers. Thanks to these efforts, the continued support from the Minister of Agriculture, and the astute guidance from the Chairman and Board of Directors, we have seen significant growth in the sector.

Throughout the year, NAREI continued to build on the successes of the past two years. Not only did we improve the services provided to farmers, we also advanced our internal capacity-building programme. A key achievement was refurbishing the Soil Laboratory, where outdated equipment was replaced, rooms were renovated, and training for extension officers in basic soil fertility management commenced. This intervention aims to analyze a minimum of 4,000 samples in 2025.

We also continued our partnership with TERI to construct a new Tissue Culture Facility, which is expected to be completed in the first quarter of 2025. This facility will have the capacity to produce over one million plantlets annually.

Additionally, we inaugurated a new automated Acoushi Ant Bait facility, replacing the old manual production line. The new facility is now capable of producing over 50,000 packets of bait per year.

As awareness of organic agriculture continues to grow, NAREI made significant investments in a new vermicomposting facility, to produce 12 tons of organic fertilizer annually.

In the area of research, we conducted 80 research projects (including 40 research production activities) and concluded six projects. Our staff also published 3 research papers in international journals. In 2024, we continued our weekly research presentations, with 17 staff members presenting their papers for peer review. Some notable research topics included biological control of whiteflies, micropropagation protocols for blackberries, evaluation of the growth performance of two soybean (*Glycine max*) varieties, and evaluation of the entomopathogenic fungus *Beauveria bassiana* for the management of mealybugs in various crops.

Not only did we continue our research and extension programs in 2024, but we also expanded them through partnerships with the private sector to boost production and productivity. These collaborations contribute to the CARICOM 25 by 2025 initiative.

NAREI's extension department actively engaged farming communities in all 10 Administrative Regions of Guyana, providing full support to farmers as they worked to increase production and productivity throughout the year. Routine field visits to farmers' field schools, demonstration plots, and training programme enabled our farmers to receive essential technical assistance. Farmers were also provided with agricultural inputs such as seeds, seedlings, insecticides, acoushi ant poison, and farm tools and equipment. The Crop Development and Support Services (CDSS) department participated in the government's national fertilizer distribution programme, ensuring all farms received fertilizer. Training programmes addressed all aspects of crop production and also raised awareness of social issues affecting farmers' daily lives. During 2024, CDSS also collaborated with other government ministries, as well as regional and international organizations such as FAO, WFR, CARDI, and WUSC, to bring relief to local crop farmers. Additionally, farmers began adopting climate-smart agricultural practices.

In an effort to increase agricultural productivity, improve decision-making, and promote accountability, the Agriculture Information System (AIS) was introduced on October 8, 2024. This significant technological development in agriculture will help build an extensive database of farmers, including their contact information and biodata, through a farm registration module. The system also offers farm profiles, georeferencing, and a survey module for generating and analyzing farm surveys. More than 18,000 farmers' data were integrated into the AIS by NAREI's staff, with field data collected by extension officers in regions 2, 3, 5, 6, and 10.

Another area of success was the Shade House programme. We continued researching and promoting strategies for climate-smart agriculture, helping farmers adapt to changing weather patterns. This included distributing shade house materials, irrigation systems, and training farmers. During the year, we saw the construction of 219 shade houses, bringing the total to 603 from the period 2021 to 2024.

Financially, NAREI remained robust with timely support from the Minister of Agriculture, Hon. Zulfikar Mustapha. The Government of Guyana's subvention was provided promptly,

and a capital expenditure of $325,000,000 (Three Hundred and Twenty-Five Million Dollars) was strategically allocated to drive growth and improvements across various sections of NAREI. These investments not only bolstered the local economy and created employment opportunities but also contributed to sustainable development and enhanced operational efficiency. The positive outcomes from these acquisitions reflect a strong commitment to progress and innovation, positioning us for continued success in the years ahead.

In 2024, the Mangrove Department made significant strides in coastal protection and conservation, despite challenges such as erosion, sediment loss, and human-induced threats. Major achievements included the completion of breakwaters and groynes in regions 2, 5, and 6, enhancing shoreline stability and protecting communities. Research and monitoring efforts were strengthened through UAV technology and the Mangrove Monitoring System, allowing better data collection. Looking ahead, the department will focus on expanding green-grey infrastructure, strengthening scientific monitoring, promoting sustainable livelihoods, and enhancing community engagement to ensure long-term mangrove resilience and coastal protection.

INTRODUCTION

As the 2024 Annual Report is presented, it reflects on a year marked by significant achievements, unwavering commitment, and impactful contributions to the agricultural landscape in Guyana. Under the steadfast leadership of the Minister of Agriculture, Hon. Zulfikar Mustapha, the Chairman and Board of Directors, Mr. Joseph Singh, Major General (retd), and Chief Executive Officer, Mr. Jagnarine Singh, and in alignment with its mission, the National Agricultural Research and Extension Institute (NAREI) has taken great strides in enhancing the productivity and sustainability of the agriculture sector.

Throughout 2024, NAREI focused on delivering innovative research, hands-on training, and essential extension services that empowered farmers and revolutionized agricultural practices in the region. Collaborations with agencies within the Ministry of Agriculture and various stakeholders, including NGMC, GSA, GRDB, UG IRIE, UG BC, NDIA, regional and international agencies such as IICA, CARDI, CATIE, and with private sector agencies such as the GMSA, DDL/TOPCO, IPED catalyzed advancements across various areas, such as soil health, crop production, and pest management of fruits and vegetables, roots and tubers, spices, and entrepreneurship.

This year saw the successful refurbishment of the Soil Laboratory and the commencement of establishing a new Tissue Culture Facility, both pivotal in bolstering research capabilities. Noteworthy is the continued commitment to organic agriculture through investments in innovative facilities, such as the vermicomposting building, to enhance the quality of organic fertilizers available to farmers. This effort aligns with NAREI's vision to support a sustainable farming approach, ensuring the agricultural landscape adapts to modern standards of productivity and environmental stewardship.

In the quest for knowledge advancement, NAREI successfully implemented over 70 research projects and published several significant papers in prestigious international journals, significantly elevating its research profile and expertise. Furthermore, enhanced collaboration with private sector partners facilitated capacity-building initiatives that align with the CARICOM 25 by 2025 initiative.

As NAREI looks back on its accomplishments, it recognizes the importance of strong community engagement. Extension programmes actively involved farming communities across all Administrative Regions, ensuring they received the technical and material support needed to thrive. The integration of the Agriculture Information System (AIS) further enabled the provision of tailored assistance and fostered greater accountability within its operations.

The year 2024 has been a testament to NAREI's ongoing dedication to improving lives through agriculture, reinforcing its position as a vital contributor to Guyana's agricultural development narrative. The forthcoming sections of this report will detail specific achievements and initiatives, reflecting a commitment to excellence and readiness to embrace challenges and opportunities that lie ahead.

NAREI extends heartfelt gratitude to all employees who played an integral role in its successes in 2024. Cooperation, celebration of diversity, and hard work created an atmosphere suitable for progress. There is hope for another productive year as efforts continue to nurture the future of agriculture in Guyana.

BOARD OF DIRECTORS' ACTIVITIES

Several activities were successfully executed within the past year. The activities of the Corporate Secretary in 2024 are as follows:

- Coordinate and implement the Statutory Meeting of the Board of Directors for the period January 2024 – December 2024.
- Carry out secretarial functions during the Board of Directors meetings.
- Organize activities on behalf of the Board of Directors.
- Coordinate visits by the Chairman of the Board to NAREI's locations across the country.
- Coordinate meetings between members of the Board of Directors and NAREI's stakeholders.
- Notify the respective Heads of the Department of various decisions emanating from the Programme Advisory Committees and Board of Directors.
- Draft internal reports on behalf of Management and provide legal guidance for the day-to-day activities of the NAREI.
- Prepare and review contracts between NAREI and Stakeholders.

Directors

The following persons were appointed to serve on NAREI's Board as Directors from December 8, 2023 - December 7, 2025:

1. Mr. Joseph Singh, Major General (retd), Chairman
2. Mr. Jagnarine Singh, CEO / Ex-Officio Member
3. Mr. Ricky Roopchand
4. Ms. Natasha Beerjit-Deonarine
5. Dr. Garvin Cummings
6. Dr. Gomathinayagam Subramanian
7. Mr. Gavindra Ramnarain
8. Ms. Sarah Browne-Shadeek
9. Mr. Suresh Amichand
10. Mr. Javed Shadick
11. Ms. Anjanie Seebaran

12. Mr. Kuldip Ragnauth
13. Mr. Porandatt Narine
14. Mr. Lesley Ramlall, Representative of the Guyana Manufacturing and Service Association

Committees of the Board

Section 7(1) of the NAREI Act provides for the appointment of three Programme Advisory Committees, while Section 7(2) of the aforementioned Act allows the Board to "appoint any other committee as it sees fit." As of 2024, the following Committees operated under the supervision of the Board:

1. **Appointments Committee**
    - Mr. Joseph Singh, Major General (retd), Chairman of the Board of Directors and Appointments Committee
    - Mr. Gavindra Ramnarain - Director
    - Mr. Kuldip Ragnauth - Director
    - Mr. Suresh Amichand - Director
    - Mr. Porandatt Narine – Director
    - Mr. Jagnarine Singh - CEO

2. **Research Programme Advisory Committee**
    - Mr. Gavindra Ramnarain - Chairman, Research Programme Advisory Committee
    - Dr. Garvin Cummings - Director
    - Dr. Gomathinayagam Subramanian - Director
    - Mr. Suresh Amichand - Director
    - Mr. Jagnarine Singh - CEO

3. **Crop Protection Programme Advisory Committee**
    - Mr. Suresh Amichand - Chairman, Crop Protection Programme Advisory Committee
    - Dr. Gomathinayagam Subramanian - Director
    - Mr. Ricky Roopchand - Director
    - Mr. Lesley Ramlall - Director
    - Mr. Jagnarine Singh – CEO

4. Extension Programme Advisory Committee

- Mr. Kuldip Ragnauth - Chairman, Extension Programme Advisory Committee.
- Mr. Ricky Roopchand - Director
- Ms. Anjanie Seebaran - Director
- Ms. Sarah Browne-Shadeek - Director
- Mr. Jagnarine Singh - CEO

5. Finance and Administrative Programme Advisory Committee

- Mr. Porandatt Narine - Chairman, Finance and Administrative Committee
- Ms. Anjanie Seebaran - Director
- Ms. Natasha Beerjit-Deonarine - Director
- Mr. Lesley Ramlall - Director
- Mr. Jagnarine Singh - CEO

1.0 RESEARCH

The research arm of NAREI worked diligently to provide farmers, entrepreneurs, students of primary, secondary, and tertiary institutions, researchers, and agricultural extension staff with technologies that represent best practices in the agricultural sector locally and internationally. Research evaluation and scientific observations were conducted on various aspects of crop production, including soil health, efficient laboratory services, local and exotic crop production, protected agriculture, crop protection, germplasm conservation and multiplication, expansion of coconut, spice, corn, and soybean cultivation, and coastal protection using mangrove. These efforts resulted in increased and higher yield quality, income and environmental stability, reliable and stable revenue, reduced water usage, reduced pesticide and fertilizer use and job creation. Thus, emphasizing NAREI's commitment to support Guyana's contribution in support of CARICOM's efforts to reduce its food import bill by 25% by 2025.

The Research Work Programme was conducted by seven departments with a focus on six interrelated topics on soils, nutrient use, water, livestock waste, crop adaptation, and the socio-economic and food security dimensions of climate change as addressed by The Koronivia Joint Work on Agriculture (KJWA). The KJWA is a landmark decision under the United Nations Framework Convention on Climate Change (UNFCCC) that recognizes the unique potential of agriculture in tackling climate change. This decision resonates with FAO's core mandate to eliminate hunger, food insecurity and malnutrition, reduce rural poverty, and make agriculture more productive and sustainable.

The achievements under the thematic areas are as follows:

1.1 SOILS AND NUTRIENT USE

1.1.1 Soil Health

Supporting SDG 2- promoting sustainable agriculture included the production and use of soil amendments S-SOWMix with mycorrhiza fungi for seedling production, biofertilizer inoculant with Rhizobium bacteria for legume production, production of vermicompost and

thermophilic compost as soil ameliorants. This thematic area comprised eight (8) projects, achieved 85.2% of its target and provided direct services to 625 farmers.

1.1.2 Laboratory Services

Supporting SDG 15-restoring degraded ecosystems included soil chemical and pest and disease diagnosis and recommendations providing technical services to farmers in the Intermediate Savannahs, and provision of soil data on areas of interest for crop production. This thematic area comprised four (4) projects, achieved 115% of its target and provided direct services to 591 farmers.

1.2 CROP ADAPTATION – Fruits, Vegetables And Other Crops

Supporting SDG 2 – improved good security involved quality seed production, and the strengthening of the value chains for strawberry, pineapple, plantain, beetroot, bora, pepper, coffee, cocoa, sweet potato, watermelon, and carrots. This thematic area comprised 71 projects, achieved 94.6% of its target, and provided direct services to 2,600 farmers. Additionally, plantain and banana farmers with BSD, vegetable crop farmers needing biocontrol services, coconut farmers with pests and diseases, communities with Acoushi ants, and tissue culture plants in NAREI's nurseries benefited from this programme.

1.3 WATER – Precision Agriculture

Supporting SDG 13 – combating climate change and its impacts involved Hydroponics (growing of pak choy, lettuce, kale, and cauliflower using five different planting systems), greenhouse (rose production), and the measurement of evapotranspiration from selected crops. This thematic area comprised three projects, achieved 60.5% of its target, and provided direct services to 1,192 farmers.

1.4 SOCIO-ECONOMIC AND FOOD SECURITY

1.4.1 Crop Protection

Supporting SDG 2 – improved food and nutrition security involved Acoushi Ant bait production, testing efficacy of new fungicides on BSD on plantain suckers, using biocontrol

methods to control pests and diseases of cash crops, Red Ring Disease surveys in Coconut Palms in Guyana. This thematic area comprised nine projects, achieved 102% of its target, and provided services to 484 farmers. In addition, plantain and banana farmers with BSD, vegetable crop farmers needing biocontrol services, coconut farmers with pests and diseases, communities with Acoushi ants, and tissue culture plants in NAREI's nurseries all benefited from this programme.

1.4.2 Plant Genetic Resources for Food and Agriculture

Supporting SDG 15 – Halting biodiversity loss involved the characterization, conservation, regeneration, and multiplication of cinnamon, breadnut, jackfruit, papaya, dragon fruit, sorrel, black pepper, pineapple, sorghum, tamarind, bay leaves, corn, celery, millet, sournut, peanut, maize, cassava, and red pea; and the development of Protocols for the multiplication of blackberry, breadfruit, grape, rose, coconut and molecular characterization using DNA fingerprinting. This thematic area consisted of 39 projects, achieved 78.7% of its target and provided direct services to 507 farmers, provided all the breadfruit, pineapple, banana, and plantain seedlings for the plant nursery, and served as a national commitment to the Plant Genetic Resources for Food and Agriculture (PGRFA).

1.4.3 Coconut Value Chain

Supporting SDG 12 – Sustainable consumption and production involved the establishment of a Coconut Research Unit, pest and disease surveillance, efficient production of quality seed nuts, and technical support to farmers through the collaboration with Hope Coconut Industries Ltd. This thematic area consisted of nine (9) projects, achieved 69.4% of its target, provided direct services to 306 farmers, and served as a national commitment to the Plant Genetic Resources for Food and Agriculture (PGRFA) by making available planting material through NAREI's nurseries.

1.4.4 Horticulture and Plant Nurseries

Supporting SDG 2 – Achieve food security and improved nutrition, including procuring a cassava flour processing line, three turmeric heat pump drying machines, and three complete ginger processing lines. This thematic area comprised 29 projects, achieved 77.8% of its target, and provided direct services to 541 farmers. This thematic area was also supported by a number of special projects involving the cassava value chain and the evaluation of quinoa, corn, soya bean, millet, and spices (turmeric, ginger, nutmeg, and black pepper).

2.0 RESEARCH DEPARTMENT'S ACHIEVEMENTS

Works conducted based on the policy priority directive of the government are as follows:

2.1 Soil Management and Farm Mechanization (SM&FM)

This department gave technical support for optimal soil health for vegetable production in shade houses and open field production. It provided Soil Chemical Testing Services for fertilizers, limestone, and organic matter recommendations; Soil microbiological services with rhizobia bacteria formulations to enhance legume crop production and mycorrhiza formulations to produce indigenous S-SOWMIX for vegetable seedling production; Hydroponic systems services for improved water and fertilizer use efficiency in the production of leafy and fruit type vegetables; And, Geographic Information System services for available soil data and information.

2.1.1 Achievements

1. The refurbishment of the Soil Chemistry Laboratory Services was completed. The Soil Chemical Laboratory Services was officially commissioned by the Honorable Minister of Agriculture, Zulfikar Mustapha in October 2024. The acquisition of critical pieces of equipment, such as the Atomic Absorption Spectrophotometer, will greatly enhance the capacity of the laboratory to evaluate soil fertility status and make the necessary recommendations. Other equipment that was received included a total organic carbon analyzer, Kieldahl analyzer, UV-VIS spectrophotometer, block digester, autoclave, ductless fume hood, laminar flow, laminar flow, deionizer, hot air oven, digital soil instant nutrient tester, soil/fertilizer nutrient detector, water quality probes, Rainstrip nutrient detector, digital scale, and heat plate. Extension officers from NAREI and the Guyana Rice Development Board were trained on the use of the digital soil nutrient detector (mini lab), which would enable staff to provide immediate results to farmers in the field. Five soil nutrient detectors were given to GRDB extension officers for use in regions 2, 3, and 6. Additionally, extension staff from NAREI were trained on the use of the water quality probes, pH and electrical conductivity meters and the use of N, P, K probes for instant results. Training on the operational use of equipment was completed except for the total organic carbon analyzer and the Kieldahl analyzer. Analyzed 986 (c.f. to 2,158 in 2023) of the targeted 3,000 soil samples (33%) and provided limestone and fertilizer recommendations for judicious fertilizer use in

crop production. This decrease in the number of samples analyzed is owing to the laboratory being under renovation for the most part of 2024.

2. Produced 5,324L (c.f. to 4,668L in 2023) and provided 1,980 liters of S-SOWMix for seedling production on the AIEP farm.

3. Produced 260 kg (c.f. to 30 kg in 2023) of rhizobia inoculant for distribution to legume farmers. 255 kg was produced for the Ebini/Kimbia red peas project.

4. Added 41 (c.f. to 11 in 2023) soil maps (parts of regions 5, 9, and 10) to NAREI's digital soil database. Several activities of phase one of the Soil-care Project were completed.

5. After evaluating varieties, 3 ha of onion cultivation at Mon Repos—ECD and Long Creek—SLH were established (Aquarius and Andromeda – Brazilian Accessions).

6. Hydroponics demonstration facility successfully completed 20 cropping cycles, cultivating leafy vegetables such as lettuce, kale, and celery across four systems: Vertical and Horizontal Nutrient Film Technique (NFT), Deep Water Culture (DWC), and Deep Flow Technique (DFT). Fruit crops like cauliflower, broccoli, and sweet pepper were grown in Dutch Bucket systems, with cucumbers also cultivated in Horizontal NFT. To support regional hydroponics expansion, NAREI developed a comprehensive technical package featuring grower manuals, cost estimates for system setup, and tailored training materials for beginner, intermediate, and advanced growers. There were 1,042 beneficiaries, including schools, farming communities, and investors, who received technical assistance through workshops, guided tours, and field visits. Hydroponic systems were donated to educational institutions, and challenges like the unavailability of hydroponic-grade fertilizers were addressed through imports. Additionally, NAREI introduced a hydroponic registry to enhance monitoring and foster community engagement in climate-smart agriculture.

7. CSIDS-SOILCARE Caribbean Small Island Developing States (SIDS) Multi-country Soil Management Initiative for Integrated Landscape Restoration and Sustainable Food Systems (SDG 17 – Partnership Initiative for Sustainable Land Management). Several activities of phase one of this project were completed. These included:

- Ground truthing for site validation and accessibility for Guyana's National Soil Survey (regions 3,4,5,6 and 10).
- Develop a superimposed General Soil Map of Guyana for cross-verification and future updates for the National Soil Survey.
- Develop 10 superimposed Regional Soil Maps of Guyana for cross-verification and future updates for the National Soil Survey.

2.2 Intermediate Savannahs Field Research Unit (ISFRU- EBINI)

Plant Genetic Resources for Food and Agriculture (PGFRA) conservation, regeneration, and maintenance are the primary goals of the ISFRU-EBINI, which aims to reclaim its position in Guyana's agricultural industry. In addition to offering extension and laboratory services (such as soil pH testing and red pea threshing) to farmers and other stakeholders in the intermediate savannahs, the unit increased the variety of crops that were grown and saved.

Additionally, the unit cultivated vegetable crops and ensured communal food security by using the established kitchen garden. In terms of research and development for 2024, ISFRU-EBINI accomplished the following:

2.2.1 Achievements

1. Thirty descriptors were recorded for mango accessions established in the field gene bank.
2. One (1) tractor and one trailer were received for the station.
3. One (1) ATV was received for the Research Assistant (RA) at the Station.
4. Repairing of the community water tank.
5. Agronomical practices such as fertilization, sanitation, and germplasm maintenance were conducted on all crops in the field.
6. Sixteen (16) accessions of red peas were planted for regeneration purposes.
7. Six varieties of millet were planted, which comprised (barnyard 1, barnyard 2, barnyard 3, Ragi 1, Ragi 2, and Pearl).
8. Three varieties of peanuts were planted (GN 92, AK 62, and forerunner) for the purpose of regenerating seed materials.
9. One variety of corn was planted, cardi 001, for the purpose of regeneration.

10. One purple variety sorrel was planted with (135.72 kg) was harvested.
11. Nine hundred and eight (908 m) fence were completed with chain link at the multiplication plot.
12. Four thousand two hundred and sixteen (4,216 kg) of red peas were threshed for farmers in the intermediate savannahs.
13. One hundred and eighteen (118) soil samples were collected from farmers.
14. One hundred and forty-four (144) packs of ant bait were distributed to farmers in the intermediate savannahs.
15. Thirty (30) farmers assisted (receiving technical advice on cultivation practices and pest and disease management, threshing of pea and ant bait).
16. Fourteen (14) accessions representing four (4) crop types (bora, red pea, peanut, and ochro) were conserved. Before conservation, 100 seed weight and germination tests were recorded for most crop types.

Accessions regenerated: Red pea (*Minica IV*), peanuts varieties (*Ak 62, Jumbo and GN92*), maize CARDI 001, sorrel (reddish purple) of a targeted 12 crops.

New crops introduced

These included:

a. Passion fruit of Local Yellow variety: 88 plants in 734m^2 that yielded 174kg of fruit with diameter varying from 5 to 8cm, and.
b. Millet of Pearl variety at plant spacing of 30cm*30cm in 4.5m^2 gave inflorescence varying from 12 cm to 20cm and yielding 2kg of seed.

Accessions multiplication

These included:

a. Peanut of GN 92 variety in 364m^2 that gave pod lengths ranging from 1.5 to 2.6cm, 100 seed weight ranging from 8 – 15g; and number of seeds per pod ranging from 1 to 3.
b. Peanut of AK62 variety in 32m^2 that gave pod lengths ranging from 1.5 to 2.6cm, 100 seed weight ranging from 5 – 10g; and number of seeds per pod ranging from 1 to 4.

c. Red peas of MINICA IV variety in 1070m^2 that yielded 115kg with pod lengths ranging from 16 to 26cm, 100 seed weight ranging from 15 – 30g; and number of seeds per pod ranging from 18 -30.
d. Pigeon peas in 50m^2 that yielded 5kg with pod lengths ranging from 6 to 12cm, 100 seed weight ranging from 15 – 28g; and number of seeds per pod ranging from 6 -10.

Soil pH Testing: 30 farmers serviced.

2.3 Biotechnology and Plant Genetic Resources

The Plant Biotechnology and Genetic Resources Department was enhanced by adding a tissue culture specialist, Mr. Vijay Thakur from The Energy and Resource Institute (TERI). This initiative was paramount to improving the efficacy of the tissue culture department through the optimization of *in vitro* protocols. Additionally, rehabilitative works of the new tissue culture facility commenced in March. Works are still ongoing.

Farmers benefited from the free distribution of plantlets all year round for pineapple and plantain. Research projects focus on establishing protocols for mulberry and avocado through nodal culture and apical meristem to produce disease-free plants for commercial use and field monitoring.

Staff participated in training programmes facilitated by the International Atomic Energy Agency (IAEA), The Public Service Ministry and the Tropical Agricultural Research and Higher Education Centre (CATIE); in areas such as mutation breeding, propagation methods for coffee and cocoa, supervisory management, monitoring and evaluation and occupation and health and safety. Training for the use of the QuantStudio5 equipment was conducted on March 21, 2024 for selected staff from the department of PPEWS and Biotechnology. The training was facilitated by Ms. ALBA Mayerly Alvarez from Puerto Rico through Clever Solutions as part of their equipment installation. Staff who attended were Amrita Churaman, Audrey Thomas, Crystal Charles, Jomeala Gikes, Maxine Stuart, Therloa Estwick and Dharsanie Bisnauth. A certificate of attendance was issued to each staff member after the conclusion of the training. The process for maintenance for all the equipment was initiated. Clever Solutions took the details of the equipment for maintenance for the year 2025.

Table 1: Tissue Culture seedling production and distribution

Crops		Production	Distribution
Plantain	Protocol 100% completed and it's in the production phase	2,300	2,464
Breadfruit	Protocol 100% completed and it's in the production phase supplying to NAREI plant nursery for sale	4,255	2,065
Sweet potato	Protocol 100% completed and it's in the production phase	1,929	
Blackberry	Protocol 100% completed; field monitoring	664	
Pineapple	Protocol 100% completed and it's in the production phase	10,347	11,813
Citrus	Protocol 100% completed and it's in the production phase	89	
Total		**19,584**	**16,342**

Projects:

1. *In-vitro* propagation of avocado (*persea americana*) from Nodal Culture.
2. Establishing an efficient protocol for micropropagation of mulberry (*Morus spp.) in vitro.*
3. Optimization of acclimatization protocol for *in-vitro*-grown breadfruit.
4. Acquisition, conservation, production, and cyclic *in vitro* propagation of pineapple (*Ananas comosus*).
5. Acquisition, conservation and multiplication of sweet potato plantlets (*Ipomoea batatas) in vitro.*
6. Acquisition, production, conservation and cyclic *in vitro* propagation of citrus SPP.
7. Acquisition, production and cyclic *in vitro* propagation of plantain & banana.

2.4 Coconut Research Unit

Coconut is the third-most economically important crop in Guyana. With the recent increased budgetary allocation by the government to highlight its importance, there has been a renewed interest by farmers across the country. Increasing coconut production is one of the main

objectives since there is a huge potential market for coconut and coconut products locally, regionally and internationally.

Guyana aims to improve its genetic resources in coconuts to boost its productivity. This has seen the importation and distribution of new and improved coconut varieties to farmers across the various regions. Hope Coconut Industries Limited (HCIL) continues to function in this regard, while the Coconut Research Unit of NAREI provides the necessary support in the research and development of our local coconut industry. Collaborative work is also conducted with sister agencies under the Ministry of Agriculture (MOA), regional and international agencies such as CARDI, ITC, FAO, etc.

Completed Project in 2024:

- Growing coconut seedlings without a mature haustorium.

Other notable activities of the Coconut Research Unit for 2024

Table 2: Varieties of coconut and the number of seedlings sown at NAREI Coconut Nursery for 2024:

Brazilian Green Dwarf	*726*
Philippines Green Dwarf	*8,000*
Malayan Green and Yellow Dwarf	*250*
Surinamese Green Dwarf	*868*

- **Coconut palms at Ogle Seawall**

NAREI continues to support the Sea Defense Board with the coconut palms along the sea defense at Ogle - Turkeyen:

- All palms were fertilized at Ogle with 3.2 kg of 15-15-15 NPK in 2024
- Unwanted, severely damaged, and diseased palms were removed.
- Monitoring and managing pests and diseases were also done throughout the year.

- **Collaborative works with Hope Coconut Industries Limited (HCIL)**

The Coconut Research Unit of NAREI collaborated with HCIL on a year-round basis in all aspects of coconut seedling production and coconut research projects. Some of the notable achievements of these collaborations are as follows:

Table 3: Results of collaboration between NAREI and HCIL

Description	Target	Actual	% Achievement
Coconut Seedlings Production	50,000	51,320	102
Seed Nuts Importation	50,000	63,000	126
New Coconut Varieties Introduced	2	2	100
New Acreage Cultivated	1,000	1,056	105
Number of Beneficiaries	1,500	1,884	125
Number of New Farmers	350	378	105
Total Number of Farmers Nationally	---	2,897	---

- ***Updating coconut database***

Updating of the coconut database continued during 2024, capturing all coconut farmers which includes abandoned and new estates. This process will continue in 2025.

- ***Coconut palm weevil survey***

For the year 2024, a total of 246 traps were established and a total of 2,542 palm weevils were captured.

2.5 Plant Pathology, Entomology and Weed Science (PPEWS)

The department continued to offer free laboratory services and technical support in pest and disease management to farmers, the AIEP shade house project, other departments within NAREI, and agricultural stakeholders. The department also provided training to technical staff and farmers alike. Surveys for significant pests affecting coconut and natural enemies of other important pests such as white fly and red palm mite were done.

PPEWS laboratories collected and diagnosed 483 samples, identifying major insects, nematodes, and diseases affecting crops. This service was provided to 350 farmers thus, surpassing the target by 133. Assistance was provided to Extension in identifying and formulating management strategies for pests of major concern.

Additionally, in 2024 the department set out to produce 10,000 packs of acoushi bait but surpassed the target and produced 11,700. Renovations of the production facility were completed and a new production line was installed and is undergoing testing.

The department explored using several biocontrol methods to manage pests of crops. Four (4) new plants, daisy, dill, chrysanthemum, and wild marigold were identified with characteristics to support insects as biocontrol agents in the field. The management of Scarlet Tip caused by mealybugs by using biocontrol agents and synthetic chemicals was studied. Unfortunately, the biocontrol agents were not effective in managing mealybugs on pineapple. Rather, the synthetic insecticides Acetamiprid and Imidacloprid were proven to be effective. Additionally, works were conducted to evaluate locally collected *Trichoderma spp*. for their use in pest management. The department produced more than two (2) kilograms of three strains.

The efficacy of different biopesticides for managing Red Palm Mites on coconut palm was researched, and three of these proved to reduce the pest populations significantly. Additionally, field works were conducted to develop an integrated pest management strategy for several pests affecting coconut. Eight pests were successfully managed.

The department also partnered with NPPO and CDSS in surveillance activities for the South American Palm Weevil **(***Rhychophorus palmarum).* The significance of this pest is linked to its recognition as a vector for a destructive disease of coconut palms *Bursaphelenchus cocophilus,* commonly known as red ring disease. Details are provided under the Coconut Unit.

Rigorous scouting was conducted in the largest producing cherry area of Guyana (Laluni) to assess the tolerance of local cherry accessions tolerance to diseases during both pre- and post-harvest. A total of 69 accessions were identified as potential accessions expressing high tolerance or low susceptibility to common diseases causing significant fruit loss. Further scientific studies will be conducted to evaluate the best of the identified.

A review and update of "Common Weeds in Guyana" is ongoing and yielded five new weeds collected, identified and documented namely; *Alysicarpus monilfer, Phthirusa stelis, Hippeastrum spp., Echinochloa pyramidalis* and *Chrysopogon zizamioides.*

Moreover, in collaboration with the Guyana School of Agriculture (GSA), the department played a vital role in nurturing the academic growth of GSA students by providing hands-on experience to students enrolled in Plant Pathology, Microbiology, and Entomology courses.

Staff from PPEWS also collaborated with the Guyana Rice Development Board (GRDB) to manage the paddy bug. Several trainings were conducted with technical staff and farmers concerning pest management. These are accounted for under the training department. Further, five training videos, namely Caterpillar Infestation in Cassava Cultivation, Anthracnose in Pepper, Management of the Scarring Beetle in Banana and Plantains, Management of South American Palm Weevil, Management of Black Sigatoka in Plantains and Bananas, were produced during the reporting period. These videos targeted aspects of pest management and are available on NAREI's website. This was done in collaboration with the Communications Unit.

2.6 Fruits, Vegetables and Other Crops (FVOC)

The Department of Fruits, Vegetables, and Other Crops is excited to present its annual report for the year 2024. Throughout the year, our department has remained dedicated to enhancing agricultural productivity, promoting sustainable farming practices, and supporting local farmers. This report outlines our key accomplishments, initiatives, and the impact of our work on the agricultural community and food security in our region.

Key Achievements

1. Seed Production and Distribution

The department successfully produced a total of 57,707 grams of vegetable seeds, encompassing vital crops such as bora, ochro, squash, boulanger, hot peppers, sweet peppers, and red beans. 78,288 packs of seeds, totaling 502,622 grams were prepared for distribution across Guyana. This initiative directly benefited over 5,000 individuals, including farmers,

homesteads, farmer groups, women's organizations, and youth groups, thereby strengthening our local agricultural communities.

2. Sweet Potato and Vegetable Seedlings

44,710 sweet potato slips/cuttings, covering 1.5 hectares were distributed. Key beneficiaries included the Guyana Defence Force (GDF), Farm and the University of Guyana (UG) Agriculture Faculty, and farmers in regions 2, 3, 4, and 5.

Additionally, 1,570 vegetable seedlings were cultivated, further bolstering our mission to promote sustainable agriculture and enhance food security.

3. Sustainable Farming Practices: Thermophilic composting and vermicomposting systems.

The department successfully implemented innovative practices through the establishment of thermophilic composting and vermicomposting systems, producing 800 kg and 724.7 kg of high-quality compost for distribution to farmers and other departments within NAREI. This initiative not only promoted sustainable waste management but also improved soil health and crop yields. By providing farmers with access to nutrient-rich compost, NAREI is empowering them to enhance their agricultural productivity while minimizing dependence on chemical fertilizers. Additionally, this initiative fosters a circular economy by recycling organic waste, which not only reduces environmental impact but also provides farmers with cost-effective and environmentally-friendly resources. The availability of such high-quality compost will enable farmers to cultivate healthier crops, increase resilience against pests and diseases, and ultimately improve their livelihoods.

4. Advancements in Dwarf Coconut Seedling Production at NAREI's Coconut Nursery.

Improving the production of quality dwarf coconut seedlings was a significant highlight in 2024. Initial projections anticipated the production of 1,150 seedlings, but 2,200 healthy dwarf coconut seedlings were produced.

SPU
NAREI staff from various regions were trained in the propagation of cocoa/coffee - CATIE

SPU - SPICES

Distribution of ginger planting materials at Hobodeia, region 1

NAREI in colloboration with CAPA-USAID - Turmeric demonstration plot at St. Anslem, region 1

Distribution of ginger planting materials at Barima Koriabo, region 1

Hydrophonics demonstration facility

Minister being briefed about corn production in the Intermediate Savannahs

Farmer increasing cassava acreage

Minister and team pleased with the soyabean harvest

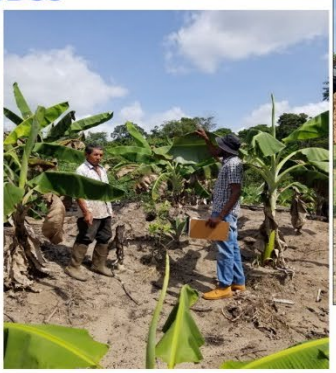
Mangrove Centre Tours

400 meters geotextile tube groynes completed at Exmount, Essequibo Coast, region 2

200 meters permeable timber breakwater completed at Dantzig

CDSS

CEO meets with farmers.



Field visit

President of ExxonMobil Guyana with team visited MOA's Model Farm region 5

Training Manager engaging farmers.

Formation of Block D /Waterloo Progressive Farmers' Group

Minister examines Tissue Culture pineapple plantlet

Officers conduct follow-up field visits

Staff of NAREI, GRDB & PTCCB trained to operate the Atomic Absorption Spectrophotometer

Commissioning of soil Chemical Services Laboratory

Mangement the South America Palm Weevil Pomeroon, region 2.

Response to caterpillar infestation

Fogging exercise to assist farmers against Acoushi ants in Kaikan, region 7

Activities to combat CFF in affected areas

AIEP fresh produce on display

Visit to the AIEP farm by our Caribbean counterparts.

Director General of UNFAO, Mr. Qu Dongyu and Minister of Natural Resources Hon. Vickram Bharrat visit AIEP Farm

Yard long bora trial at NAREI

Seeds distribution to farmers in Wax Creek, Upper Mazaruni

His Excellency, Dr. Mohamed Irfaan Ali and Hon Zulfikar Mustapha visit Santa Aratack Mission

Key Achievements: Projects

1. Varietal evaluation of three seedless varieties of watermelon (Orange Crisp, Black Tiger and Honey King) at Kildonan backdam, Corentyne and Canal # 2.

2. Evaluation of four hot pepper varieties to increase production and productivity **(**Tiger teeth *(Capsicum chinense)***,** CAB4 (*Capsicum annuum* Sp.*)*, Ancara *(Capsicum annuum* Sp.*)* and Dancara *(Capsicum annuum* Sp.*)*

3. Determining the productivity of aging coconut estates in region #5.

4. Growing coconut seedlings without a mature haustorium.

5. A comparative study in the production potential of sweet potato using tissue culture plants & stem cuttings.

6. Investigating variation in productivity of sweet potato at various rates of nitrogen.

7. Comparative analysis of beetroot propagation in shaded & open field conditions in various soil types across Guyana.

2.7 Horticulture Production Summary

2.7.1 Plant Nurseries

Nursery Production: In 2024, a total of 279,126 mixed orchard saplings were produced and distributed to farmers at a subsidized cost. Revenue generated from plant sales in 2024 amounted to $45,791,601. At the Kairuni research station, 32 kg of mixed fruit seeds were produced from the orchard and used for the production of saplings in the various nurseries.

Citrus Production: A total of 203,727 citrus saplings were produced in 2024. A total of 117,113 citrus saplings were distributed to farmers/homesteads/schools across all ten regions. A further 86,614 citrus saplings will be available for distribution in 2025.

Kairuni Research Station: A total of **62,391** mixed orchard saplings were produced during the 2024 period at the station, and **106,834** mixed fruit seeds were produced and collected from the orchard and used for the production of saplings in the various nurseries.

Research Summary - Horticulture

Achievements

Project: Vegetative propagation of Citrus rootstock by stem cuttings.

1. A total of 35,252 rough lemon cuttings were obtained from stem cuttings, where a 100% rooting rate was observed. The duration to transplant from the box to the plant bag is two months and the hardening period is six months.

2.7.2 Fresh-Cut Roses Project

Achievements and challenges:

This project highlights the potential of protected agricultural technology in cultivating cut roses under Guyana's climatic conditions. The project faced significant challenges throughout the year but highlighted the need to focus on improving soil health, monitoring pest activity, and optimizing environmental conditions to achieve better production. As an initiative to expand the production of cut flowers locally and facilitate technology transfer, steps were taken to empower single mothers in the project which led to five women being trained and oriented in cut flower production. They were then contracted on a ten-day rotational system to carry out the agronomic tasks as well as preparing bouquets under the supervision of the technical staff.

The production for 2024 was 8,807 roses, of which 3,867 were sold and 324 donated. A total revenue of $1,653,200 was earned for single roses sales, while roses sold in bouquets earned $1,740,180.

Severe disease challenges resulted in the need to procure new plants to supplement the high mortality rates experienced. A total of 243 plants were procured from two local plant shops between April and June to replant the first two houses, while in September, an additional 650 were acquired from Brazil to replant the fourth house. The houses were tilled and all necessary soil amendments was done prior to the arrival of the plants, then 320 plants were transplanted into the fourth house and 170 in house three. In October, to combat extreme heat stress experienced in the houses, mist irrigation systems were installed. However, despite following all agronomic practices, *fusarium* spp. persisted in the soil, stunting plant development and resulting in the deaths of a number of the newly transplanted plants. By December, continued efforts to treat soil pathogens showed minimal success, hindering overall improvement in production.

2.8 Special Projects Unit

The Special Project Unit (SPU) is one area of focus for climate-smart technologies, namely hydroponic systems and protected cultivation (shade houses) that help to combat adverse weather conditions. These systems generate mostly high-valued crops such as lettuce, sweet pepper, carrots, kale, broccoli, and cauliflower.

In an effort to reduce the importation of the following crops, viz spices, cassava, corn, soya, onion, coffee, and cocoa SPU Research Scientists and Assistants are working assiduously to improve production and productivity through scientific research and the adaption of new technologies.

2.8.1 Spices

The National Agricultural Research and Extension Institute (NAREI) is actively involved in promoting spice cultivation, particularly turmeric, ginger, black pepper and nutmeg in various regions of Guyana, with initiatives like providing planting materials, training, market access and establishing processing facilities.

NAREI has invested in equipment for processing spices like turmeric and ginger, including grinders and polishers, and is working to establish processing plants at Parika, Hosororo and Port Kaituma.

Guyana imports a significant amount of spices annually, and the government aims to reduce this dependence and importation by 25% by 2025 by boosting local production.

Turmeric: *Curcuma longa* L.

In 2024, a total of 20,837 lbs of turmeric planting materials were distributed to 275 farmers of regions 1,3,4, and 6. In 2024 farmers cultivated approximately 120 acres of turmeric and harvested 193,800lbs of fresh turmeric rhizomes.

NAREI in collaboration with USAID-CAPA-IESC established two turmeric demonstration plots at St. Anslem and Wykaribe, region 1. The main objective was to increase turmeric cultivation and production by teaching farmers how to inculcate good agricultural practices (GAP). The groups received turmeric planting materials, insecticides, garden tools viz, cutlasses, files and spades and a knapsack sprayer to assist in the application of insecticides. The members were briefed about the general chemical safety guidelines such as the use of personal protective equipment PPE, wear protective clothing, gloves and protect their faces and eyes at all times. They were also taught about the rate of applications of the different insecticides and how to apply the same. Harvesting and data collection will be carried out in January 2025.

NAREI procured three turmeric heat pump drying machines from HENAN GELGOOG MACHINERY CO., LTD, CHINA. These will be used to dry boiled turmeric rhizomes at the Hosororo Spice facility, region 1.

Ginger: *Zingiber officinale*

A total of 44,987 lbs. of ginger planting materials were distributed to 1,143 farmers from regions 1, 2,3,4, 6 and 10. In 2024 farmers cultivated approximately 400 acres of ginger and harvested 1,268,900 fresh ginger rhizomes.

Another achievement was the completion of the ginger processing facility at Grove/Hyde Park, Parika, East Bank Essequibo. The ginger processing line, which includes apparatus to wash, dry, grind and even package ginger powder was transported to the facility. The contract for the electrical installation and assembling of the processing plant was approved.

Meanwhile, a similar processing facility is being erected at Mabaruma. The processing line was procured and is awaiting the completion of the facility, which is about 85% completed, to be transported to region 1.

Black pepper: *Piper nigrum* L.

A total of 11,050 black pepper cuttings were generated in the nurseries at NAREI, Mon Repos and Hosororo, region 1 using the serpentine method of multiplication. NAREI distributed 1,545 black pepper cuttings to farmers from regions 1, 4 and 10. These black pepper cuttings were used for expanding black pepper cultivation. NAREI also provides farmers with live standards (*Gliricidia sepium* sticks) for trailing the black pepper vines. NAREI also provides farmers with live standards (*Gliricidia sepium*) for trailing the black pepper vines.

Nutmeg: *Myristica fragrans*

A total of 1,849 nutmeg seedlings are in the nursery at Hosororo, region 1. NAREI distributed 463 nutmeg seedlings to farmers and 210 were planted in the demonstration plot at Hosororo, region 1. The plant will take approximately 5-7 years to start fruiting. Further expansion of nutmeg cultivation will continue in 2025.

Cinnamon: *Cinnamomum verum*

A total of 735 cinnamon seedlings were collected and conserved in the nursery at NAREI Mon Repos. These seedlings will be distributed to farmers in 2025 for the expansion of cinnamon

cultivation in Guyana. 328 cinnamon seedlings were distributed to two farmers from Christina Lust and Linden Soesdyke Highway.

Mint: *Mentha spicata*

A total of 1,110 mint cuttings were generated in the nursery at NAREI Mon Repos. These cuttings will be distributed to farmers to expand mint cultivation in 2025.

Spice Facility at Hosororo, Region 1

General maintenance of all equipment in the factory at Hosororo. The 25kva generator was routinely serviced.

2.8.2 Onions

As part of Guyana's commitment to CARICOM 25 by 2025 Vision – the reduction of the food import bill across the region by 25 percent by 2025, onion is one of the crops that is targeted for reduced importation. This vision is also in keeping with the Ministry of Agriculture's crop diversification program of reducing the importation of certain crops such as onions, Irish potatoes, broccoli, strawberries, etc. To achieve this reduction, the large-scale production of onions must be mechanized. The acquisition of one manual onion seed planter, one four-row motorized planter, and an eight-row tractor-driven planter will greatly improve productivity and reduce the cost of production. Thirty packs of the Aquarius variety were purchased for the 2025 cropping season. Additionally, 15kg of a new variety (Yellow Ball), was acquired for research purposes (suitability trials). One cropping cycle of large-scale onion cultivation was completed for 2024 at Mon Repos and Long Creek, Soesdyke Linden Highway.

For 2025 this project will focus on both the research and production aspects. Research to select new varieties that are adaptable to our local agro-ecological conditions will continue with the evaluation of eighteen varieties of onions (Yellow Ball, Basic F1, Red Wave, Alvara, Santamaria, Radier F1, HA 9, White Dawn, Red Duke, White Alburn, Granex 429, Saturn, Neptune, Blanqisimo, Sweet Mongolia, Nomad, Duster and Red Sensation F1. In terms of production, an average of 2.16ha will be under cultivation at Mon Repos, East Coast Demerara. A crop will be done for demonstration purposes at the Tarlogie Model Farm, region 6 as a high

value crop. Technical assistance will also be provided to farmers who are involved in onion cultivation.

Table 4: Production of Onions (2024).

Location	Cropping Cycle	Yield
NAREI – Mon Repos	1st	2040.17kg
Long Creek	1st	2627.78kg
NAREI – Mon Repos (Brazilian Project)	1st	363.63kg

2.8.3 Cassava

In 2024, the cassava expansion programme saw an exponential increase in the number of hectares cultivated in non-traditional areas. The crop grew significantly owing to the favorable weather conditions that prevailed over the growing season. More lands were prepared and cultivated with high-yielding varieties, which increased farmers' yields by over 20 % when compared to previous years. The cultivation of high-yielding cassava varieties coupled with improved production practices reduced the cost of production to the point where cassava is competitive with food grains such as wheat, corn and rice for local consumers. Additionally, farmers on the coastland were able to supply farmers in the hinterland, specifically regions 1 and 9, with 90 metric tons of cassava planting materials. Fresh cassava was also procured from farmers on the coastland and distributed in the hinterland for food consumption.

Production of High-Quality Cassava Flour (HQCF)

A new five-ton cassava flour processing line was procured by the Government of Guyana/NAREI to process fresh cassava roots into cassava flour for the local and regional markets. This initiative would assist over 200 farmers in marketing fresh cassava roots. It is estimated that around 20 tons of fresh cassava roots will be processed daily. This achievement will significantly reduce post-harvest losses and enhance the processing of perishable commodities like cassava roots into value-added products. Cassava is one of the most important root crops, and it is extensively used in Guyana and other countries worldwide.

Projects:

- Effect of cassava (*Manihot esculenta* Crantz) intercropping with legume crops on weed biomass, yield and yield components of cassava at Salem, Parika, Guyana.

- Morphological and agronomical characterization of 20 cassava (*Manihot esculenta* Crantz) accessions at Kairuni Research Station Soesdyke, Highway

2.8.4 Hydroponics

This project focuses on the design, installation, and operation of five distinct hydroponic systems in a shade house: Vertical Nutrient Film Technique (NFT), Horizontal Nutrient Film Technique (NFT), Deep Water Culture (DWC), Deep Flow Technique (DFT), and Dutch Bucket. The hydroponic shade house serves as a research and educational facility aimed at building the capacity of staff, farmers, students, and institutions. Through a combination of theoretical knowledge and practical experience, the facility offers tours and workshops to demonstrate the design, operation, and suitability of these hydroponic systems for various crop types.

In 2024, the hydroponics facility completed multiple cropping cycles of leafy vegetables across four distinct hydroponic systems: Vertical Nutrient Film Technique (NFT), Horizontal NFT, Deep Water Culture (DWC), and Deep Flow Technique (DFT). Leafy crops such as pak choy, bak choy, lettuce, kale, mint, dill, celery, and parsley were successfully cultivated. Additionally, fruit crops like cauliflower, broccoli, and sweet pepper were grown in the Dutch Bucket system. A single cropping cycle of cucumber was also conducted within the horizontal NFT system. The hydroponics demonstration facility successfully achieved its target of 20 cropping cycles throughout the year.

Technical Package

A comprehensive technical package including a hydroponics operational manual and three distinct training manuals and workbooks tailored to beginner, intermediate, and advanced growers were developed. These materials benefitted in excess of 1,042 persons who participated in training sessions held at NAREI, schools, and incorporated into the hydroponics module for the CARICOM Agriculture Building Training Programme. Additionally, NAREI

provided cost estimates to assist farmers with system installation and operation, considering different investment levels and planting densities.

Throughout these interactions, common areas of interest from potential and active hydroponics farmers included system operations, seedling production, suitable crops, the shelf life of produce, the practicality of using creek water, government assistance, availability of nutrients, and sourcing substrates. A key challenge identified was the lack of hydroponic-grade fertilizers in the local market. In response, NAREI imported and made these fertilizers available to farmers. Furthermore, a hydroponic registry was established as a reference and monitoring tool for those interested in or currently engaged in hydroponic farming.

2.8.5 Corn and Soybean

Guyana is growing corn and soybean production with the goal of becoming self-sufficient in livestock feed by 2025. This will minimize the country's dependency on imports and lower feed prices. In 2023, Guyana produced approximately 10,000 acres of corn and soybeans. Guyana's corn and soybean production in 2024 was 12,000 acres. The plan is to cultivate 30,000 acres of corn and soybeans by the end of 2025. The government has invested in rural infrastructure, including roads and silos. The government has also provided tax breaks and additional incentives for importers. The effort is expected to save approximately US$30 million in foreign currency by 2025. The plan will generate agriculture and related jobs. The program will cut the price of meat, particularly poultry. The program will make Guyana a net exporter in the Caribbean. The government has partnered with the corporate sector to develop corn and soybeans. During 2024, a total of four (4) investors cultivated corn and soya beans as shown in the *Tables below*:

Table 5: Total area of corn and soybean cultivation and production in 2024

Corn and Soya Cultivation		
Commodity	**2024**	
	Acres	**Production (MT)**
Soya	7,856	8,193
Corn	3,662	13,290
Total - Corn and Soya	**11,518**	**21,483**

Table 6: Total area of soybean cultivation and production by investor in 2024

Soya Cultivation		
Investors	**2024**	
	Acres	**Production (MT)**
Tacama Gold (David Fernandes)	5,250	4,960
Farmland Inc. (Ms. Abigail Welch)	1,500	1,860
Japarts & Nand Persaud (Mr. Terry Singh)	1,000	1,240
Ireng Int. Farm (Johil) (Mr. Marcello Claudio)	106	133
Total	**7,856**	**8,193**

Table 7: Total area of corn cultivation and production by investor in 2024

Corn Cultivation		
Investors	**2024**	
	Acres	**Production (MT)**
Tacama Gold (David Fernandes)	250	To harvest in 2025
Guyana Manioc Developments, Limited (Alex Mendez)	100	To harvest in 2025
Ireng Int. Farm (Johil) (Mr. Marcello Claudio)	770	To harvest in 2025
Small farmers	2,542	13,290
Total	**3,662**	**13,290**

Projects:

Evaluation of the performance of two corn (*Zea mays* L.) accessions and varieties and soybean (*Glycine max* (L.) Merr.) varieties grown in La Grange, region 3.

Evaluation of the stale seed-bedding weed management technique in corn (*Zea mays* L.) and soybean (*Glycine max* (L.) Merr.) cultivation in field-17 NAREI, Mon Repos.

An evaluation of the morphological and agronomical characterization of two corn (*Zea mays* L.*)* accessions and two soybean (*Glycine max* (L.) Merr.) varieties grown in Zeelugt, West Coast Demerara.

Evaluation of growth performance of soybean (*Glycine max* (L.) Merr.) using vermicompost and thermophilic compost grown at NAREI.

An evaluation of the morphological and agronomical characterization of two corn (*Zea mays* L.*)* and soybean (*Glycine max* (L.) Merr.) varieties grown at the National Agricultural Research and Extension Institute Plant Nursery, Kairuni.

2.8.6 Cocoa and Coffee

NAREI, through the Ministry of Agriculture in collaboration with the Inter-American Institute for Co-operation on Agriculture has embarked on a coffee and cocoa revitalization in Guyana with assistance from CATIE (Tropical Agricultural Research and Higher Education Centre), Costa Rica.

A key intervention by NAREI was to import new accessions of *coffea liberica* along with cultivars of *coffea arabica.* Twelve kilograms of *coffea liberica* and 9 kilograms of *coffea arabica* (marselesa, catigua and obata) seeds were imported to help boost local coffee production. With this, coffee plants were distributed in regions 1,2,4,8 and 9.

Liberica plants were mostly distributed to coastland areas, whereas arabica to mountainous regions, such as regions 1 and 8. To date, approximately 2,400 plants have been distributed, increasing the acreage by 50 acres for 2024, an 80% increase compared with the area cultivated in 2021.

Within region 1, 32 villages have received coffee plants. 250 farmers are benefiting from this programme. At region 8, three villages were targeted: Paramakatoi, Bashville, and Bamboo Creek, with 45 farmers starting coffee cultivation.

In the first quarter of 2025, 20,055 plants will be distributed to farmers nationwide. Once cultivated, these plants will increase the coffee plantations by 100 acres. Technical assistance was also sought from CATIE, Costa Rica, and AGROSAVIA, Colombia, to help develop coffee and cocoa cultivation and production. Moreover, NAREI and CATIE conducted a five-day training course on cocoa and coffee agronomy and propagation to boost the technical capacity of staff. The training was conducted by specialists from CATIE, where more than 50 persons benefited.

2.8.7 Shade Houses

Between 2021 and 2024, 603 units of shade houses were erected as part of NAREI's climate-smart agriculture agenda. These structures shielded high-valued crops from adverse weather, producing higher local yields. Some beneficiaries of shade houses were schools, orphanages, farmers, and organizations. The distribution of shade structures across the different regions reflects a commitment to equitable agricultural development.

Table 8: Summary of Shade Houses 2021 -2024 @ 31/12/2024

SUMMARY BY BENEFICIARIES 2021 – 2024						
	2021	**2022**	**2023**	**2024**	**TOTAL**	**%**
Schools	8	13	34	21	76	12.6
Farmers Groups	10	14	30	67	121	20.1
Farmers	125	43	38	96	302	50.1
Orphanage/Children's Home	-	2	1	1	4	0.7
AIEP	-	54	-	25	79	13.1
GSA	-	0	-	-	0	0.0
Roses	-	4	-	-	4	0.7
Strawberries/Blueberries, etc	-	2	-	-	2	0.3
Plant Nurseries	-	-	4	6	10	1.7
Cocoa/Coffee	-	-	2	3	5	0.8
TOTAL	**143**	**132**	**109**	**219**	**603**	**100.0**

Table 9: Table shows the number of shade houses constructed between 2021 and 2024

SUMMARY BY REGION 2021 – 2024						
	2021	**2022**	**2023**	**2024**	**TOTAL**	**%**
1	9	0	8	35	52	8.6
2	29	26	18	16	89	14.8
3	32	6	7	17	62	10.3
4	28	70	42	62	202	33.5
5	16	16	7	6	45	7.5
6	9	8	11	50	78	12.9
7	3	2	8	4	17	2.8
8	1	0	0	0	1	0.2
9	4	0	5	27	36	6.0
10	12	4	3	2	21	3.5
TOTAL	**143**	**132**	**109**	**219**	**603**	**100.0**

2.9 Agricultural and Innovation Entrepreneurship Program

The Agricultural and Innovation Entrepreneurship Program (AIEP) in Guyana is a government effort aimed at increasing food production and creating entrepreneurial opportunities, particularly for young people.

AIEP continued the internship program in collaboration with the University of Guyana, engaging students from the Faculty of Agriculture and Forestry. These training sessions covered various aspects of agriculture, including agro-processing, seedling production, pest and disease management, soil health, agronomical practices, post-harvesting techniques, marketing strategies, and the cost of production.

In 2024, AIEP showcased significant achievements such as introducing agro-processing activities including cauliflower rice, croutons, pepper jelly in three hotness variants, carrot jam, and carrot marmalade in the Guyana Shop.

The program actively engaged with stakeholders, hosting delegates from within the Caribbean region, local farmers' groups, interest groups, and schools. The AIEP's management team participated in important events such as the University of Guyana's Career Day, farmers' market days nationwide, The Guyana Energy Conference and Supply Chain Expo, and career days at various schools.

Youth participation in agriculture is the main emphasis of AIEP, which intends to introduce 300 young people to advanced hydroponic farming techniques. Three new facilities in regions 2, 5, and 10 are nearing completion, paving the way for innovative agricultural approaches.

3.0 CROP DEVELOPMENT AND SUPPORT SERVICES (CDSS)

In 2024, the number of farmers and farming activities increased across the country owing to direct investments by the Government in the coastland and hinterland regions. This new and/or renewed interest by farmers is propelling the sector towards achieving President Dr. Mohamed Irfaan Ali's vision of reducing the CARICOM food import bill by 25% by the year 2025.

As farmers worked to achieve production and productivity during the year, the Crop Development and Support Services (CDSS) Department was fully supportive. Routine field visits, Farmers' Field Schools, demonstration plots, and training programmes enabled farmers to acquire the necessary technical support.

The CDSS Department also supported farmers with critical services such as soil, water, pest and disease analysis and provided the necessary recommendations. Farmers were also supported with much-needed agricultural inputs. Notably, CDSS Department was directly engaged in the government's national fertilizer distribution programme, which saw all farmers

receiving fertilizer. Other inputs distributed included seeds, seedlings, pesticides, Acoushi ant bait, farm tools and implements.

Data collection also forms part of our core mandate. As the Ministry of Agriculture continues to enhance the central Agriculture Information System (AIS), the CDSS Department is continuously updating the farmers' database. Farmers' groups were also supported through group meetings and group formation across the regions. The training programme addresses all aspects of crop production and enlightens farmers on social issues that may affect their daily lives. During 2024, CDSS also collaborated with other Government Ministries, Regional and International Organizations such as FAO, WFP, CARDI, WUSC, etc., in bringing relief to local crop farmers.

Farmers also adapted climate-smart agricultural practices. Two hundred and nineteen new shade houses were constructed during the year. These interventions enabled farmers to combat the effects of climate change. Please refer to *Table 10* for the targets and achievements of 2024 for the CDSS Department.

Table 10*:* Crop Extension targets and achievements of CDSS Department of NAREI

Activities	**Target**	**Actual**	**% Ach**
Visit to Remote/Riverain Communities	890	1,295	145.5
Field Visits	19,200	21,488	111.9
Farmers Visited	55,500	75,246	135.6
Farmers' Open Days	735	1,105	150.3
Meetings/Outreach Programs	525	945	180.0
Farmers' Field Schools	110	133	120.9
Demonstration Plots	120	99	82.5
Soil Sample Collection	230	264	114.8
Water Sample Collection	117	3,445	2,944.4
Pest and Disease Sample Collection	85	250	294.1
Acoushi Ant Management	20,500	10,378	50.6
Number of farmers benefitting from non-cash assistance	4,620	18,809	407.1
Number of New Shade Houses Constructed	200	219	109.5
Number of Seeds distributed to farmers (kg)	45.0	61.6	136.9

1) **Farmers' Training**

Farmers' training continues to form part of the main responsibility of the CDSS Department. During 2024, training sessions were conducted in all aspects of crop production where some of the more pertinent topics were soil nutrient management, crop nutrient management, pest and disease identification and management, drainage and irrigation management, post-harvest management, etc. Farmers were also trained in some social aspects such as financial management, stress management, anger management, etc.

To encourage agriculture at an early stage, the CDSS also provided training for schools and other institutions. It has been noted that these institutions are showing an increased level of interest in agricultural activities. Training of our Extension Officers is also very important since they must be equipped with the necessary knowledge that should be imparted to our farmers. Please refer to *Table 11* for the achievements in training for 2024.

***Table 11*: Training targets and achievements of CDSS Department of NAREI**

Activities	Target	Actual	% Ach
Farmers' Training Sessions	311	381	122.5
Farmers Trained	4,565	9,790	214.5
Sessions for Extension Officers & Other Staff	100	103	103.0
Extension Officers & Other Staff Trained	600	1,813	302.2
Sessions with Schools and Institutions	45	62	137.8
Students and Teachers Benefitted from Training	1,125	1,991	177.0
Total Sessions	**456**	**546**	**119.7**
Total Attendance	**6,290**	**13,594**	**216.1**

SUMMARY OF NAREI ACTIVITIES ON MOA MODEL FARMS IN GUYANA

The Model farms were established by a vision of the Minister of Agriculture, Hon. Zulfikar Mustapha, to promote and support agriculture development by facilitating the adaptation of new technologies in the regions and towards achieving President Dr. Mohamed Irfaan Ali's vision of reducing the CARICOM food import bill by 25% by the year 2025.

Model farms were established in regions 2,5,6 and 10 and were funded by the Inter-American Development Bank and executed by the ASDU of the MOA, which were completed and handed over to NAREI and fully operational in 2024.

These facilities were mainly used for demonstration purposes and Farmer's Field School to promote the production of high-value crops such as cauliflowers, broccoli, carrots, bell peppers, celery, kale, dragon fruits, lettuce, etc. and building the capacity in climate-smart practices of farmers, students, Agriculture Science teachers, institutions, prospective farmers and business entrepreneurs.

In 2024, the model farms attracted a significant number of visitors from schools, farmers' groups, universities, private agro-chemicals companies, other CARICOM countries and the general public.

Table 12: Table showing training and visits

Region	No. of Training Programmes	Farmers' Group Exchange Visits	Schools Visits	Local & Foreign Visits
2	8	3	2	
5	21	15	14	6
6	8	4	6	1
10	6	2	5	
Total	**43**	**24**	**27**	**7**

Table 13: Crop Production Data

MOA MODEL FARMS Production Data (Lbs.)							
Regions	**Celery**	**Sweet Peppers**	**Lettuce**	**Kale**	**Pak Choi**	**Hot Peppers**	**Cauliflower/ Broccoli**
2	30	25	50		25	35	
5	650	480	220		120	140	30
6	45	80	130		60	20	-
10	-	20	30	25	25	-	-
	725	**605**	**430**	**25**	**230**	**195**	**30**

2) Support to Farmer's Group

Farmers' groups enable farmers to better address most of their common farming issues and concerns through interaction with their fellow farmers. In support of this, the CDSS Department assisted farmers in assembling themselves into groups to better serve their everyday farming needs. Apart from group formations, CDSS also visited groups to ascertain their functionality and provided the necessary guidance to enhance their performance. Some groups formed were Laluni Farmers' Group, Cove & John Farmers' Group, No. 7 Cash Crop Farmers' Group, No.54 Neighbouring Farmers' Group, No.56 Progressive Farmers' Group, and Bloomfield Progressive Farmers' Group.

During the year, CDSS also facilitated visits by farmers' groups to different geographical locations to observe the practices of other farmers to transfer best practices to their farms to boost productivity.

Table 14: **Farmers' Group Support targets and achievements of CDSS Department of NAREI for 2024.**

Activities	Target	Actual	% Ach
Farmers' Group Formation and Strengthening	28	47	167.9
Farmers' Group Meetings	80	58	72.5
Group Exchange Visits	28	20	71.4

4.0 NATIONAL PLANT PROTECTION ORGANIZATION

The successful implementation of NPPO's 2024 Work Programme contributed significantly to the increased quantity of agricultural produce exported to markets, regionally and internationally. The department also provided necessary safeguarding continuum for important quarantine pests and diseases, including the Tropical Race 4 (TR4) disease that is a threat to the region and is presently in neighbouring countries such as Columbia and Venezuela.

The provision of quarantine and plant protection services remained central to the operations of the department. Quarantine Officers working at the various ports of entry ensured produce exported and imported met the highest phytosanitary standards for trade. Protection Officers, on the other hand, carried out survey and surveillance activities in the fields to determine Guyana's quarantine pests and diseases status and to implement control and/or eradication activities/ programmes for any present.

Plant Quarantine Services

Throughout the year, NPPO provided quarantine services.

Table 15 below shows the various services offered:

Indicators	Target 2024	Reported 2024	% Achievement in 2024
Number of inspections of imports	22,182	25,897	117%
Number of Import Permits issued	1,399	1,716	123%
Number of inspections of ships	2,553	3,274	128%
Number of Flights monitored (passenger, cargo, etc.)	3,301	4,122	125%
Number of Vehicles Inspected at ports of entry	37,925	72,473	191%
Number of rice fumigation conducted (containers, etc.)	6,008	6,116	102%
Number of export inspections	20,082	75,444	376%
Number of Phytosanitary certificates issued	4,663	4,213	90%
Number of farms inspected for certification	688	761	111%
Number of farms certified	200	236	118%
Number of visits/meetings from trading partners	3	8	267%

Number of Enquiries answered	12	73	608%
Number of Comments, Reviews and/or Questionnaires submitted to WTO/IPPC	5	15	300%
Number of PRAs conducted	5	27	540%
Number PRA Data/ Information sheets provided to countries to initiate trade	4	4	100%
Number of regions surveyed	8	9	113%
Number of traps monitored	2,000	1,866	93%
Number of CFF (Fiber board) control monitored	5,000	5,083	102%
Number of traps distributed and monitored	100	353	353%
Number Coconut Palms treated	1,800	-	
Number of Dry Coconuts treated	1,200,000	1,490,827	124%
Number of meetings, etc	132	142	108%
Number workshops, training	117	223	191%
Number In-services staff sessions	28	28	100%

Trade Negotiations

In 2024 the NPPO worked closely with the NPPO of other countries to strengthen trade relations and ensure the smooth movement of commodities traded. In a similar light, and following the initiative by the Governments of Guyana, Barbados and Trinidad and Tobago for discussions to formalize a Regional Ferry Service. This ferry service is intended to transport agricultural produce, other goods, and services initially between the three mentioned counties. The NPPOs of the three countries held several meetings and provided the governments involved with a proposal and a framework for the implementation of the ferry service. This

will include provisions for a pre-clearance system to facilitate the smooth and efficient movement of produce, goods, and people within the region.

The NPPO initiated discussions on trade with several countries including Malaysia, Kuwait, Costa Rica, and Suriname. In addition, the NPPO participated in meetings at the level of the Ministry of Foreign Affairs in relation to trade with other countries including Belize, Cuba and Caricom.

WTO/SPS & IPPC Enquiry and Notification Points

The Institute, through the NPPO, continues to ensure that Guyana meets its international obligation to the WTO/SPS and IPPC in terms of being the focal point for all queries and notifications and for providing answers and clarifications for agricultural trade-related issues to trading partners and other stakeholders.

Plant Protection

Carambola Fruit Fly (*Bactrocera carambolae*)

The Carambola Fruit Fly (CFF) is known to be polyphagous and causes significant economic losses to fruit crops. In 2024, regions 1, 2, 3, 4, 5, 6, 8, 9, and 10 were monitored. Based on the results, the Unit recognized the need to implement control measures in all areas where CFF was detected to reduce the pest's prevalence.

All areas affected by the pest were targeted. Activities executed under the CFF Control Programme included:

- Implementing the Male Annihilation Technique by distributing fiberboard blocks.
- Mass trapping with McPhail traps and Torula yeast to target both male and female CFF.
- Collecting and bagging damaged fruits to destroy CFF larvae.
- Servicing Jackson traps to determine the effectiveness of control actions.

Public awareness campaigns were conducted continuously to educate residents and farmers on CFF control methods. Training sessions were also conducted for government part-time workers in regions 6 and 9 to expand the pool of trained personnel assisting with control actions.

Key achievements include:

- 1,839 trapping sites visited and investigated, representing 93% of the target.
- 5,081 baits distributed, achieving 100% of the target.

Fruit sampling

- **125 host** samples collected**.**
- Successful rearing and identification of **804 fruit flies** within the genera *Anastrepha* and *Bactrocera*.

Confirmed hosts for CFF:

The following are confirmed host plants for the Carambola Fruit Fly (CFF) in Guyana.

Averrhoa carambolae; Averrhoa bilimbi; Chrysophyllum caimito; Psidium guajava; Manilkara zapota; Malpighia emarginata; Inga fellea; Ziziphus mauritiana; Citrus aurantifolia; Citrus limon; Citrus sinensis; Citrus spp.

Confirmed hosts for *Anastrepha* spp.:

The following are confirmed host plants for the *Anastrepha spp* in Guyana.

Averrhoa carambolae; Chrysophyllum caimito; Psidium guajava; Manilkara zapota; Inga fellea; Malpighia emarginata

Mediterranean Fruit Fly (*Ceratitis capitata*) - No indication of the presence of this pest in Guyana.

Red Palm Mite (*Raioella indica*)

The Red Palm Mite, an economic pest primarily affecting palms, plantains, bananas, and *Heliconias*, was discovered on Wakenaam Island, Guyana, in late 2013. Since its introduction, NAREI has diligently monitored and managed its spread with support from CDSS. In 2024, the NPPO promoted good agricultural practices and enhanced plant nutrition. Quarantine measures focused primarily on post-harvest procedures, including the fumigation of host materials from the island. A total of **1,566 brooms**, **1,719 water coconuts**, and **1,490,827 dry coconuts** were fumigated using Phostoxin tablets as part of internal quarantine measures.

Red Palm Weevil (*Rhynchophorus ferrugineus*)

The Red Palm Weevil is a destructive pest that primarily affects palms, including coconut and date palms. It is considered one of the most damaging pests to these crops globally due to its ability to bore into the trunks and destroy the internal tissues, leading to tree death. Effective monitoring and management are crucial to prevent its establishment and spread in vulnerable areas.

In 2024, the unit continued its strategic regional surveillance for the Red Palm Weevil. The primary mechanism employed was using pheromone traps in conjunction with enhanced trapping mechanisms and placement. Traps were elevated from ground level and upgraded with more weatherproof materials to improve efficiency.

The surveillance team focused on high-risk areas for pest entry and enhanced previously established trapping lines in:

- **Region 1**: Mabaruma and surrounding communities.
- **Region 4**: East Bank Demerara and East Coast Demerara (stretching from Providence to Timehri and from Mahaica to Plantation Phoenix).
- **Region 5**: West Coast Berbice.

No evidence of Red Palm Weevil was detected in regions 1, 4, or 5, reaffirming the pest-free status of these areas.

***Fusarium oxysporum f.sp. cubense,* Tropical Race 4 (TR4)**

Tropical Race 4 (TR4), an aggressive strain of Panama disease caused by *Fusarium oxysporum f. sp. cubense*, poses a significant threat to Guyana's agriculture, particularly to banana and ginger crops. These staples are crucial for local livelihoods, domestic consumption, and exports. TR4, already present in neighboring Colombia and Venezuela, poses a high risk of spreading to Guyana, with region 1 being especially vulnerable due to its proximity to Venezuela. Factors such as migrant farming practices and the daily smuggling of TR4-host crops further exacerbate the threat. Immediate preventative measures are essential to protect Guyana's agriculture, economy, and food security from the devastating impacts of TR4.

In 2024, the unit continued its surveillance for this destructive disease and conducted efficacy trials of the Formosa banana variety, which is considered less susceptible to TR4. These

activities were carried out in collaboration with the Biotechnology, Nursery, and Crop Development and Support Services (CDSS) Departments.

Key Achievements

- Surveillance was conducted in region 1, with no evidence of TR4 detected.
- Strategic distribution and monitoring of 535 Formosa variety plants as part of ongoing trials.

These efforts represent a proactive approach to preventing the introduction and spread of TR4 while exploring viable solutions for crop resilience.

5.0 MANGROVE

NAREI's mangrove management programme is crucial in Guyana's coastal protection strategy by advancing mangrove conservation, restoration, and public awareness initiatives. Guided by the Low Carbon Development Strategy (LCDS) 2030 and the National Mangrove Management Action Plan 2022-2032, the Mangrove department has implemented key projects to enhance coastal resilience through green-grey infrastructure, scientific monitoring, and community engagement.

In 2024, the department achieved significant milestones despite challenges such as erosion and sediment loss.

MAJOR ACHIEVEMENTS:

Mangrove Restoration

Throughout the year, the Mangrove Department made remarkable progress in the restoration and protection of coastal areas. Over 260 million dollars was invested in capital works as part of the department's green-grey infrastructure approach to mangrove restoration. In region 5, phase 2 of the 500-meters Dantzig breakwater mangrove restoration project was completed with the construction of a 200-meter permeable timber breakwater. The completed structures will support the restoration of the mangrove ecosystem, benefitting 500 residents and safeguarding 1,000 hectares of farmland, which are currently unproductive due to saline intrusion. In region 2, at Exmouth, a 150-meter geotextile tube groyne was constructed, the

restored mangroves will provide protection to 236 residents and 67 households. Further, in Aberdeen/Colombia, region 2, the construction of a 120-meter rubble mound groyne was completed, to support the restoration of the lost mangrove ecosystem and offer improved security for 573 residents and 155 households. Additionally, in region 6, at Letter Kenny, 23,000 mangrove seedlings were planted to restore the coastline. However, erosion led to a high mortality rate of the seedlings, prompting the strategic planting of Spartina grass to help consolidate the area.

Research and Monitoring

The Guyana Mangrove Information System (GuyMIS) was transferred to NAREI for hosting, ensuring that data remained accessible to researchers and partner organizations. UAV technology was successfully deployed to track the progress of mangrove restoration efforts, helping to inform decision-making for improving coastal resilience. The department also procured essential monitoring equipment, including a server, a laptop for updating GuyMIS, and seven electric cycles to improve ranger accessibility in monitoring activities.

Between 2023 and 2024, Guyana experienced a net loss of 1,478 hectares in mangrove cover, decreasing from 23,387 hectares in 2023 to 21,909 hectares in 2024. The most significant reductions occurred in region 6, which lost 813 hectares, and region 1, which saw a decrease of 567 hectares. Region 5 also experienced a notable decline of 279 hectares. Conversely, regions 3 and 4 showed positive trends, gaining 244 and 106 hectares respectively, while region 2 had a relatively minor loss of 169 hectares. Despite restoration efforts in some areas, the overall decline highlights the need for strengthened mangrove protection and rehabilitation initiatives across the country.

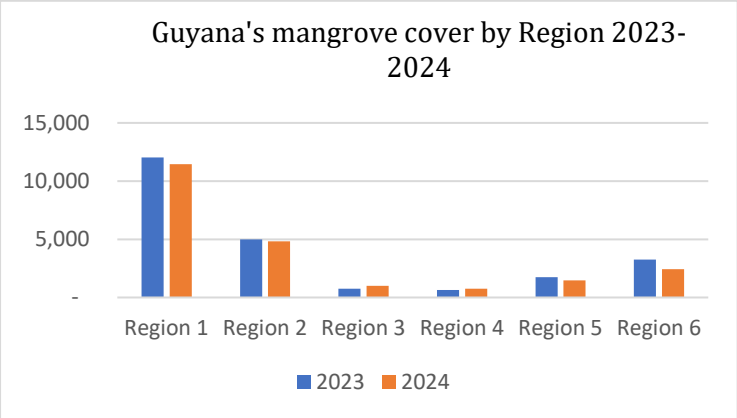


Figure 1 Guyana's Mangrove Cover 2023-2024

Public Awareness and Education

Public awareness and education efforts were significantly strengthened in 2024. The Mangrove Centre hosted 56 tours, attracting 1,642 visitors, who learned about the importance of mangrove conservation. NAREI continued to benefit from the Guyana Conservation Initiative. To further advance the Mangrove Centre tour experience, a branded tour bus was commissioned and enhancements were made to the Centre to provide external seating for students and visitors. Several educational resources were published, including *The Wonderful World of Mangrove Children's Activity Booklet* and the *Mangrove Restoration Booklet*. Additionally, 185 individuals across regions 3 to 6 received training in mangrove conservation. The department established four *Mangrove Library Corners* in three schools and the National Library, thereby increasing educational access. A new mangrove informational signboard was launched at the Kingston Seawall Promenade as part of a mangrove exhibition to celebrate International Mangrove Day 2024.

Partnership and Improved Mangrove Protection

The Mangrove Management Action Network (MMAN) and subcommittees convened seven times in 2024, supporting NAREI in implementing the National Mangrove Action Plan. One of its most significant achievements was its contribution to the successful development and gazetting of new mangrove regulations under the Sea and River Defence Act in December 2024. Additional regulations under the NAREI Act and Forest Act were drafted and are expected to be enacted.

Livelihood Opportunities

The department also advanced efforts to support sustainable livelihoods and ecotourism. A comprehensive assessment of livelihood opportunities identified community micro-enterprise projects, including tour guiding, beekeeping, and the development of honey by-products, particularly in regions 1-6.

6.0 HUMAN RESOURCES DEPARTMENT

The Human Resources Department has positively impacted NAREI operationally and functionally. Its achievements align with the strategic plans outlined in the department's 2024

work programme. They also emphasized NAREI's dedication to fostering employee satisfaction by ensuring the working environment is conducive to growth and development.

NAREI plays a significant and strategic role in the process of revitalizing the agricultural sector. Given the mandate of the sector, which is to enhance agricultural productivity, support farmers, and provide opportunities for women and youths in agriculture, - NAREI - increased its staff count to ensure adequate technical support as well as operational and functional capabilities are met.

To meet the institute's growing demand, a total of ninety-one (92) new employees were welcomed into NAREI's workforce from January to December 2024. Further, strengthening the cohort of dedicated workers. As of December 2024, NAREI's staff complement was five hundred and sixty-eight (568) employees.

Job descriptions/specifications serve as a vital communication tool that clearly outlines the tasks, responsibilities, and performance standards expected from employees in their respective roles. Thus, throughout 2024, the Human Resources Department prioritized creating, reviewing, and updating job descriptions/specifications. This was necessitated by the growing dynamics of the agricultural sector and NAREI's resulting demand for human resources to meet their national research, plant protection and extension obligations. Thus far, approximately eighty-five (85) percent of the positions have corresponding job descriptions/specifications.

A quick reference handbook on NAREI's policies was completed and is available to all staff within the various departments. It was created to improve accessibility and efficiency. It serves as a readily available, condensed version of NAREI's HR manual. The objective is to provide employees, supervisors, and managers with easier access to essential information, such as key policies, procedures, and guidelines in a concise format.

The Human Resources Department conducted an orientation exercise for all new employees who joined the institute within the period, June to September 2024. The initiative was geared at promoting retention, reducing employee turnover, and integrating and orienting the new employees to NAREI's policies, procedures, benefits, and services. Additionally, resource personnel and some key stakeholders, including representatives from the National Insurance

Scheme (NIS), NALICO, and NAREI's OSH committee, were invited and made presentations on pertinent information the staff would need during their employment at the institute.

Other accomplishments include the conduct of several HR-related outreaches with staff at our various locations throughout Guyana. A number of staff in outlying regions are now educated about critical HR services and information. Another notable accomplishment is the digitization of the HR records. Although the process is continuous and documents are being processed daily in the HR department, digitization of all current staff files has been completed.

During 2024, the Human Resources Department planned and successfully implemented various HR initiatives aimed at fostering an engaged workforce, attracting and retaining talent, promoting diversity, ensuring compliance with regulations, and supporting continuous personal and organizational improvements.

Capacity building and professional development for staff remained paramount throughout 2024. Capacity-building opportunities played a vital role in enhancing workforce effectiveness by improving skills, fostering engagement, promoting innovation, strengthening collaboration, aligning capabilities with NAREI's organizational goals, and creating a culture of continuous improvement. To this end, the HR department facilitated approximately forty (40) technical and non-technical training sessions benefiting staff from every department, including Research, Extension, Quarantine, Administration, Security and General Workers.

Table 16: The table below shows NAREI's staff compliment by department

STAFF COMPOSITION BY DEPARTMENT											
Departments	Mangrove	Research	Extension	NPPO	Admin	One Guyana AIEP	Other One Guyana Projects	General workers	Contracted Employees	Extension Agents	**Total staff complement**
No. of staff	**15**	**92**	**132**	**39**	**108**	**18**	**28**	**133**	**565**	**3**	**568**

Table 17: The table below is a summary of Human Resources procedures and the respective number of staff impacted.

Actions	No. of Staff
Recruitment	92
Non-Contracted Employees	3
Resignation	12
Dismissal	0
Termination	4
Non-Renewal of Contract	17
Voluntary Withdrawal of Service	26
Death	4
Promotion	10
Transfer	13
Training of Staff	127
Paid Study Leave	6
Unpaid Study Leave	3
NAREI Scholarship	5

7.0 COMMUNICATIONS UNIT

The Communications Unit continued to serve as a crucial link between NAREI and the public in 2024, ensuring effective and accurate dissemination of information. The unit played a major role in communicating the organization's vision, mission, goals, and objectives by providing timely updates on the work of each department. We implemented diverse communication strategies to enhance NAREI's visibility and reputation, promoting key messages and initiatives.

Collaboration was central to our approach, as we worked closely with other units within NAREI to align all communication efforts with the Institute's overall goals and objectives. The Communications Unit supported NAREI's participation in several key exhibitions, including Regional Science Fairs, and World Food Day/Ministry of Agriculture's Open Day. These events provided valuable opportunities to engage with the public and showcase NAREI's contributions to the agricultural sector.

Leveraging technology to expand our reach and engage stakeholders was a priority. We focused on increasing NAREI's digital presence through strategic use of social media, multimedia content, and other online channels. Platforms like Facebook, Thread, TikTok, and Instagram were utilized to organically highlight our products and services, demonstrating the impact of NAREI's work.

Key Achievements:

Website Development: Though live and accessible, the website remains a work in progress. The website received approximately 2,000 clicks in 2024. It served as an important resource for accessing import permits and other documents related to the activities of the National Plant Protection Organization (NPPO).

Content Creation: The Unit prioritized content creation for the website, resulting in the production and circulation of several videos, including features on Pineapple Production at Mashabo, Spices Production in region 1, and Container Agriculture.

Print and Design: The Unit compiled and printed the 2023 Annual Report and retractable banners for NAREI's Open Day. For instance, a flow chart of the Soils Chemical Laboratory was designed for the Commissioning of that lab. That chart is now hung on the wall of the lab to assist users.

Public Interaction: The Communications mobile phone line continues to be utilized by the public to gather information, with callers being directed to the appropriate department for assistance. The Unit also actively monitors comments on social media, ensuring that feedback, inquiries, and even criticisms are directed to the relevant departments for timely response. This proactive approach has demonstrably improved NAREI's public image.

In conclusion, the Communications Unit remains dedicated to strengthening the connection between NAREI and the public, promoting transparency, and fostering a greater understanding of the Institute's vital role in advancing agricultural development in Guyana.

8.0 INFORMATION SYSTEM

The IT Department worked on several projects during 2024. Highlights of significant projects are below:

Farmer's Database

The IT Department worked closely with the Ministry of Agriculture Planning Unit to transfer existing database to the Agriculture Information System (AIS). This application offers enhanced analysis and reporting capabilities for Extension. The application was officially launched by the Minister of Agriculture, Hon. Zulfikar Mustapha in October 2024.

Training sessions were held for Extension staff across regions 1, 2, 3, 4, 5, 6, 9, and 10 to familiarize them with the new AIS.

Server

In October 2024, a second UNIFI Dream Machine Pro Firewall was integrated with the Dell EMC R550 Server, enhancing the security of the data stored on the File Server. Ongoing improvements to the server continue to enhance the user experience within NAREI.

Several new features have been introduced to enhance data and information security, storage, and transfer. These include faster internet speeds, improved protection against viruses and malware, and selective access to the server for storing essential documents available to designated individuals across various departments. Additionally, communication among multiple departments and locations nationwide has been strengthened, while the system now identifies potential threats such as viruses and insecure websites. It also tracks the software and web applications consuming bandwidth and detects rogue computers that may be accessing malicious websites. Furthermore, the system allows access to the Farmer's Database via the Cloud, ensuring greater user flexibility and security.

Support Services

In 2024, the IT Technical team visited various departments and regions to complete a range of tasks, including:

1. Replacing around 30 computers, hard drives, monitors, and UPS units.

2. Upgrading approximately 130 systems to enhance their performance and support new programs more efficiently.

3. Updating Wi-Fi routers in several departments to adopt more advanced technologies.

4. Improving internet connectivity for the Mangroves Department.

5. Connect an additional 20% of NAREI's computers to the File Server.

6. Continuing to provide IT support to GLDA, which lacks specialized IT staff. This support involved setting up new systems, repairing existing computers, monitoring their network infrastructure, and ensuring the security of their cybersecurity policies.

7. Assisting GSA with the implementation of a new network and File Server.

9.0 FINANCE REPORT (DRAFT)

NATIONAL AGRICULTURAL RESEARCH & EXTENSION INSTITUTE			
STATEMENT OF FINANCIAL POSITION			
AS AT 31 DECEMBER, 2024			
	Note	31.12.2024	31.12.2023
Assets			
Non Current Assets			
Property, Plant & Equipment	3	782,399,625	451,817,026
Total Non Current Assets		782,399,625	451,817,026
Current Assets			
Cash and Cash Equivalents		233,244,769	193,833,040
Accounts Receivables	4	12,951,645	11,321,053
Inventory	5	146,162,442	151,965,242
Total Current Assets		392,358,856	357,119,335
Total Assets		1,174,758,481	808,936,361
Equity & Liabilities			
Shareholders' Equity			
Grant from Foreign Sources		51,897,479	51,897,479
Government fo Guyana Contribution		1,027,774,144	669,684,638
Revaluation of Stock		341,781	341,781
General Reserves		851,537	851,537
Accumulative Surplus/(Deficit)		57,064,500	33,089,506
Total Shareholders' Equity		1,137,929,441	755,864,941
Non Current Liabilities			
Ministry of Public Works		5,606,815	5,606,815
Total Non Current Liabilities		5,606,815	5,606,815
Current Liabilities			
Payables	6	31,222,225	47,464,605
Total Current Liabilities		31,222,225	47,464,605
Total Equity & Liabilities		1,174,758,481	808,936,361
On Behalf of the Board of Directors			
Chairman			
The accompanying notes form an integral part of these financial statements.			

NATIONAL AGRICULTURAL RESEARCH & EXTENSION INSTITUTE
STATEMENT OF COMPREHENSIVE INCOME
FOR THE YEAR ENDED 31 DECEMBER, 2024

	Note	31.12.2024	31.12.2023
		$	$
REVENUE			
Government of Guyana Subvention		2,563,707,786	2,287,064,731
Income from Operations		49,808,496	56,714,096
Rental of houses		350,000	340,000
Other Income		289,721,665	626,258,152
Interest Earned		839,970	168,030
Income Adjustment under IAS 20		60,000,000	57,335,000
Total Revenue for the Year		2,964,427,917	3,027,880,009
Expenditure			
Benefits & allowances		56,963,542	66,982,270
Cleaning & extermination		2,651,953	3,145,180
Capital expenses		103,537,529	
Depreciation	2	60,000,000	57,335,000
Drugs & Medical supplies		5,301,072	5,572,885
Equipment & Maintenance		5,013,915	7,382,957
Field materials & Supplies		127,377,389	85,661,910
Fuel & Lubricant		34,532,116	33,294,181
Local travelling & subsistence		17,154,557	13,976,250
Maintenance of Infrastructure		2,930,612	2,734,312
Mangrove Expenses		2,533,026	3,463,424
National Insurance Scheme (employers)		96,075,961	83,911,637
Office materials & supplies		16,673,595	14,993,872
Old Age Pension		928,608	1,286,026
Other direct labour costs		94,970,181	78,958,657
Other Goods & Services		14,883,739	16,113,621
Other Operating Expenses		69,420,117	46,031,745
Print & non print materials		19,949,988	14,612,757
Project Expenses		221,580,251	908,243,948
Rental & Maintenance of Buildings		137,965,321	42,144,261
Security services		17,918,365	24,624,577
Training		13,653,385	8,598,635
Transport, Travel & Postages		40,855,345	30,386,797
Utility Charges		49,844,991	41,177,228
Vehicle maintenance & service		33,199,314	27,948,904
Wages & Salaries		1,661,448,545	1,376,209,469
Total Expenditure for the year		2,907,363,417	2,994,790,503
(Deficit)/Surplus		57,064,500	33,089,506

10.0 APPENDICES

List of Publications of Technical Research Papers

1. Integrating SAR, Optical, and Machine Learning for Enhanced Coastal Mangrove Monitoring in Guyana by Kim Chan-Bagot [1, 2*], Kelsey E. Herndon [3,4], Andréa Puzzi Nicolau [2,5], Vanesa Martín-Arias [3,4], Christine Evans [3,4], Helen Parache [6], Kene Mosely [1], Zola Narine [1] and Brian Zutta [2].

2. Effects of Biopesticides on the Management of *Myzuz persicae* Sulzer and *Phenacoccus manihoti*: Contributors - Califa Estwick, Analesa Skeete and David B Fredericks: June 2024.

3. Response of lettuce (*Lactuca sativa* L) inoculated with *Rhizpphagus irregularis* to charcoal amended sand by Denisia Whyte.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NAREI


Guyana