NATIONAL AGRICULTURAL RESEARCH AND EXTENSION INSTITUTE

Mon Repos, East Coast Demerara

ANNUAL REPORT 2023

Office of the Chief Executive Officer

Research

Crop Development and Support Services

Plant Nurseries

National Plant Protection Organisation

ANNUAL REPORT

2023

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/ABBREVIATION

AIEP	Agricultural and Innovation Entrepreneurship Program
APSOL	Agricultural and Public Health Solutions
ASDU	Agriculture Sector Development Unit
CABI	Centre for Agriculture and Bioscience International
CARDI	Caribbean Agricultural Research and Development Institute
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
CPHD	Caribbean Plant Health Directors
CRC	Cocoa Research Centre
CSIDS	Caribbean Small Island Developing States
EMC	Environmental Management Consultants
EMBRAPA	Brazilian Agricultural Research Corporation
FAO	Food and Agriculture Organization
GLSC	Guyana Lands and Surveys Commission
GMSA	Guyana Manufacturing & Services Association Ltd
GRDB	Guyana Rice Development Board
GSA	Guyana School of Agriculture
GuyMIS	Guyana Mangrove Information System
IICA	Inter-American Institute for Cooperation on Agriculture
IPED	Institute of Private Enterprise Development
ITC	International Trade Centre
KJWA	Koronivia Joint Work on Agriculture
LCDS	Low Carbon Development Strategy
MOA	Ministry of Agriculture
MMAN	Mangrove Management Action Network
MOE	Ministry of Education

NAREI	National Agricultural Research and Extension Institute
NDIA	National Drainage and Irrigation Authority
NGMC	National Guyana Mangrove Committee
NPPO	National Plant Protection Organization
PGRFA	Plant Genetic Resources for Food and Agriculture
SBB	Small Business Bureau
SADP	Sustainable Agricultural Development Programme
TWG	Technical Working Group
TERI	The Energy and Resources Institute
UG	University of Guyana
UNDP	United Nations Development Programme
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
WUSC	World University Service of Canada

CHAIRMAN'S MESSAGE

The year 2023 has been a year of significant growth and development in the agriculture sector. There has been strategic financial investment by the Government of Guyana to ensure that the decisions made by the Caricom Heads of Government at the Regional Agriculture Forum, hosted by Guyana in May 2022 and the National Budget 2023, were implemented. They were to align with the following outcomes: ensure food and nutrition security across the Caribbean; reduce imports by 25% by 2025; establishment of regional logistics hubs for movement, warehousing, packaging, and distribution of agriculture commodities; and provide consumers with food that is safer, nutritious, and of the quality and pricing that are competitive.

The Government of Guyana, through the Ministry of Finance and the Ministry of Agriculture, has taken appropriate measures in 2023 to strengthen and streamline the work of NAREI in ensuring that the research and extension aspects of the Institute's mandate benefit from increased resource allocations. This has facilitated the greater alignment of NAREI's work with the national trust to increase production volume, the resilience to climate impacts, and the phytosanitary safety, quality, and sustainability of such output.

Collaboration among regional partners has seen direct benefits accruing in the availability of germplasm such as coconuts, cocoa, and coffee; the upgrading of NAREI's laboratories relating to biotechnology and tissue culture; and the transfer of technologies such as shade house cultivation and hydroponics.

NAREI has strengthened its networking and collaboration with international and regional agencies such as EMBRAPA, CABI, CATIE, IICA, CARDI, and TERI and with local partners such as the ASDU, GLSC, NDIA, GRDB, UG, GSA, NGMC, Hydromet, the Pesticides & Toxic Chemical Control Board, MPW (SRD), the GMSA, EMC Foundation, TOPCO, IPED, and the Regional Agriculture Committees.

Integrating NAREI's Extension Services with other agencies under the MOA umbrella also resulted in closer working relationships with the private sector and our farming communities and greater efficiencies in sharing data and services.

As mentioned, the Board of Directors has actively participated in the developments through its committees. I thank His Excellency the President and the Hon. Minister of Agriculture and Staff

for their unwavering support and guidance. I thank my colleagues, the Directors of the Board, for bringing their individual and collective experience and knowledge to bear on the Committees of the Board and the Board's decisions. On behalf of the Board and myself, I compliment the CEO, management team, staff, and workers of NAREI for their teamwork, resourcefulness, and commitment towards achieving the outcomes throughout 2023. They have worked assiduously in strengthening the networking with our colleagues in the MOA, the private sector, and our farmers throughout Guyana, encompassing our coastal, rural, riverine, and hinterland communities, women's organizations, and youth and students groups.

I hope all who read this report will benefit from the information and be motivated to identify niche areas of interest in furthering collaboration with NAREI towards achieving food and nutrition security throughout Guyana and the wider Caribbean.

Joseph G Singh
Major General (retd)
Chairman

CHIEF EXECUTIVE OFFICER'S STATEMENT

In 2023, we saw increased interest in agriculture production in all areas, which resulted from favourable Government policies and support from the Ministry of Agriculture and all its agencies. NAREI continued to ensure we fulfilled our mandate of promoting greater agriculture production efficiency by improving our services. With renewed effort by farmers and support from the agency's staff, we would have surpassed all the targets set during 2023.

NAREI is pivotal in Guyana's agriculture sector, championing efficiency by advocating sustainable crop production methods that are crucial for the long-term growth and development of the agriculture sector. Tasked with providing comprehensive services in agricultural research, technology dissemination, and local crop protection, NAREI is a cornerstone in advancing the nation's agricultural agenda.

As a result, we have seen growth in other crop sectors. Production for 2023 (873,785 MT) reported a seven percent growth compared to the output for 2022 (814,840 MT). Notably, coconut production experienced a remarkable surge, boasting a fifty percent rise from 49,138 MT in 2022 to 89,461 MT in 2023, signalling a substantial increase in market demand attributed to the influence of El Niño.

Similarly, fruit production increased by four percent, reaching 205,658 MT in 2023. Despite the challenges posed by El Niño, significant growth was observed in passionfruit, soursop, papaw, and banana, among others. With ongoing efforts to augment citrus fruit production, in 2023, NAREI exceeded the target of distributing 100,000 seedlings of improved citrus plants by distributing 133,804 seedlings.

Root crop production also exhibited notable improvement, registering a seven percent increase from 2022 to 2023, with eddo production leading the surge with a remarkable thirty-nine percent escalation. Moreover, spice production experienced a five percent rise, propelled by increased turmeric and black pepper production. Beans and cereals production surged by twenty-three percent, with notable contributions from soybeans and corn.

With the continued support of young professionals, investment in infrastructure and technology, and engagement in partnerships to drive innovation, the Ministry of Agriculture and NAREI are

playing a vital role in advancing Guyana's agriculture agenda and contributing to food security and economic development. NAREI's technical staff continued to work with the AIEP shade houses, and by the end of 2023, more than 40 tons of vegetables were produced by this program. The collaboration between the government of Guyana and the private sector in building the largest hydroponics shade house in Guyana is a significant step towards innovative and sustainable farming practices. This facility can produce almost 100,000 plants per cropping cycle.

Refurbishing NAREI's laboratories with new and improved equipment is a significant step towards enhancing the quality and efficiency of services provided to the farming community in Guyana. The renovation of the soils, tissue culture, pest, and disease laboratories demonstrates a commitment to staying at the forefront of agriculture research, technology, and innovation. Furthermore, the timing of these laboratory upgrades is crucial as Guyana is taking the leading role in the CARICOM agenda of reducing imports from extra-regional sources by 25% by the year 2025.

INTRODUCTION

Guyana is again leading the Caribbean Community's (CARICOM) efforts to enhance food and nutrition security. The main focus is to reduce our food importation bill by 25% by 2025 through implementing transformative projects in the Region. Collaboration between the Government and stakeholders such as farmers and regional and international agencies has propelled the success of these projects in 2023.

However, the role of NAREI in these projects cannot be understated. Throughout 2023, NAREI implemented its work programme targeting the opening of new farmlands, expanding existing farms, and resurrecting old estates. This has led to the commercial cultivation of soya beans, corn, coconuts, cauliflower, and sweet peppers, among other high-value crops.

Even though El Niño conditions affected the operations of many farmers, the other crops sector experienced continuous growth. These gains resulted from NAREI's efforts, notably in technology transfers, increased shade house cultivation, fertilizer distribution, training, and seedling distribution.

Farmer registration data collection is ongoing; however, as of December 2023, NAREI registered 18,500 farmers using the electronic data gathering platform (Kobo App). 58,513 farmers benefitted from farm visits, with an accomplishment rate of 106% and an overall increase of 36.1% compared to 2022. Field demonstrations transferred new and improved technologies, with 65 plots built, 148 annual targets attained, and a 51.1% increase compared to the previous year.

Another remarkable achievement is the distribution of 27,865 packets of ant baits. This is the first time NAREI produced and distributed this quantity. Compared to 2022, the distribution increased by 68.5% in 2023, representing 139%, and 11,325 additional baits were distributed across various regions. This is due to production facility improvements and equipment upgrades, such as installing heating lights and extractor fans.

NAREI's continued commitment to innovative agricultural practices and technology transfer is crucial in achieving our goal of reducing food imports in the Caribbean region. The collaboration

between the government, farmers, and stakeholders will drive further success in enhancing food and nutrition security in Guyana and the wider CARICOM community. With the dedication and hard work of all involved, we are confident in our ability to meet our targets and create a more sustainable and self-sufficient agricultural sector for the future. Together, we can continue to lead the way in food security efforts and make a lasting impact on the region.

BOARD OF DIRECTOR'S ACTIVITIES

Several activities were successfully executed within the past year. The activities of the Corporate Secretary in 2023 are as follows:

- Coordinate and implement the Statutory Meeting of the Board of Directors from January 2023 - November 2023.
- 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 on 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 Institute.
- 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, 2022- December 7, 2023:

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

Committees of the Board

Section 7(1) of the NAREI Act allows three Programme Advisory Committees to be appointed. In contrast, **Section 7(2)** of the Act allows the Board to "appoint any other committee as it sees fit." As of 2023, the following Committees operated under the supervision of the Board:

1. Appointments Committee
    - Major General (retd) Joseph Singh, Chairman of the Board of Directors and Appointments Committee
    - Mr. Gavindra Ramnarain - Director
    - Mr. Kuldip Ragnauth- Director
    - Mr. Suresh Amichand- Director
    - Ms. Natasha Beerjit-Deonarine- 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. Ramsay Ali- Director
    - Mr. Jagnarine Singh- CEO

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

5. Finance and Administrative Programme Advisory Committee
    - Ms. Natasha Beerjit-Deonarine- Chairperson, Finance and Administrative Committee
    - Ms. Anjanie Narine- Director
    - Mr. Porandatt Narine- Director
    - Mr. Ramsay Ali- Director

- Mr. Jagnarine Singh- CEO

6. Procurement Advisory Committee
    - Mr. Javed Shadick- Director
    - Ms. Natasha Beerjit-Deonarine- Director
    - Mr. Gavindra Ramnarain- Director
    - Mr. Kuldip Ragnauth- Director
    - Mr. Jagnarine Singh- CEO

The following must be noted:

- The service of the Board of Directors ended on December 7, 2023.

1.0 RESEARCH

Departments within NAREI's research arm work in synergy to provide stakeholders, particularly farmers, with technologies that represent best practices in the agricultural sector locally and internationally. Scientific research on various aspects of agriculture, including crop production, pest management, soil health, and agronomy, was conducted in 2023.

Our skilled staff provided technical expertise to farmers, extension workers, and other stakeholders in the agriculture sector. This expertise improved farming practices, increased yield, and promoted sustainable agricultural development, which resulted in the country moving closer to achieving Guyana's target of reducing CARICOM's food import bill by 25% by 2025.

The Research Work Programme was conducted by seven Departments under 10 thematic areas under UNFCCC's (United Nations Framework Convention on Climate Change) Koronivia Joint Work on Agriculture (KJWA) thematic areas. The KJWA is the only programme on agriculture and food security under UNFCCC. By mainstreaming agriculture into UNFCCC processes, the KJWA can drive transformation in agricultural and food systems and address the synergies and trade-offs between adaptation, mitigation, and agricultural productivity.

The achievements under the thematic areas are as follows:

1.1 SOIL HEALTH

Supporting SDG 2- promoting sustainable agriculture included the production and use of soil amendments with mycorrhiza and rhizobia. This thematic area consisted of 10 projects, achieved 88.6% of its target and provided direct services to 3050 clients. As a collective, target constraints are attributed to inadequate number of advanced computer systems for digitizing maps, limited number of tanks for fresh water storage to produce S-SOWMix, inadequate labour supply and transportation for timely delivery of inputs for compost.

1.2 LABORATORY SERVICES

Supporting SDG 15-restoring degraded ecosystems included soil chemical and pest and disease diagnosis and recommendations and providing technical services to farmers in the Intermediate Savannahs. This thematic area consisted of 6 projects, achieved 83.5% of its target, and provided direct services to 636 clients. As a collective, target constraints are attributed to inadequate number of skilled personnel, transportation and implements at Ebini, and poor awareness of the services provided by PPEWS laboratory.

1.3 FRUITS, VEGETABLES & OTHER CROPS VALUE CHAIN

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 18 projects, achieved 61.8% of its target, and provided direct services to 2362 clients and all plantain farmers. As a collective, target constraints are attributed to the absence of a seed packaging machine, unavailability of some fungicides needed to initiate trials in Black Sigatoka, inadequate number of labourers to maintain field trials, and infrequent transportation to collect sweet potato accessions.

1.4 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 shade house architecture and production systems (to determine the photosynthetic photon flux density of shade house cladding material. This thematic area comprised three projects, achieved 83.3% of its target, and provided direct services to 1,150 clients. As a collective, target constraints are attributed to insufficient tanks for storage of rainwater, especially during dry weather periods.

1.5 CROP PROTECTION

Supporting SDG 2 – improved food and nutrition security *involved* Acoushi Ant bait production, testing efficacy of New Fungicides on Black Sigatoka Disease 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 seven projects, achieved 64.8% of its target, and provided services to 1088 clients and all plantain, banana, and hinterland farmers. As a collective, target constraints are attributed to the unavailability of some fungicides needed for trials on Black Sigatoka, low survivability (60%) of grafted plants in sweet potato virus trials, low efficiency of present Acoushi production system (a semi-automated system is being implemented).

1.6 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 characterisation using DNA fingerprinting. This thematic area consisted of 19 projects, achieved 76.3% of its target and provided direct services to 67 clients, 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). As a collective, target constraints are attributed to lack of clean adaptive strawberry germplasm for multiplication; absence of dedicated transportation for collection of accessions; insufficient skilled personnel, animal intrusion and non-functional implements at Ebini; and lack of skilled personnel for the DNA Laboratory.

1.7 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 seednuts and technical support to farmers through the collaboration project ‘Alliances for the Coconut Industry Development Expansion and Enhanced Support for the Caribbean (Coconuts II) - (ITC-NAREI). This thematic area consisted of 17 projects, achieved 92.4% of its target and provided direct services to 861 clients, established a coconut orchard in Moblissa with tissue-cultured seedlings, and served as a national commitment to the Plant Genetic Resources for Food and Agriculture (PGRFA). As a collective, target constraints are attributed to absence of equipment to measure

moisture content in sand paddy shell potting mixes and to shave nut heads for germination comparison with unshaved heads.

1.8 HORTICULTURE and PLANT NURSERIES

Supporting SDG 2 – Achieve food security and improved nutrition, provided direct services to 1002 clients, established a coconut orchard in Moblissa with tissue-cultured seedlings, and served as a national commitment to the Plant Genetic Resources for Food and Agriculture (PGRFA). As a collective, target constraints are attributed to the absence of equipment to measure moisture content in sand paddy shell potting mixes and to shave nut heads for germination comparison with unshaved heads. This thematic area was also supported by a number of SPECIAL PROJECTS involving the cassava value chain, evaluation of quinoa, corn, soya bean, millet, and spices – turmeric, ginger, nutmeg, and black pepper.

2.0 RESEARCH DEPARTMENT'S ACHIEVEMENT

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 is 50% completed. Analyzed 2158 (c.f. to 2362 in 2022) of the targeted 3000 soil samples (72%) and provided limestone and fertilizer recommendations for judicious fertilizer use in crop production.

2. Produced 4668L (c.f. to 3471L in 2022) and provided 2100 litres of S-SOWMix for seedling production on the AIEP farm. The installation of a water harvesting and washing facility with storage tanks to increase production potential.

3. Produced 20 kg (c.f. to 15 kg in 2022) of rhizobia inoculant for distribution to legume farmers.

4. Added 16 (c.f. to 11 in 2022) 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; these include:

    - Soil fertility training conducted by USAID, FAO, and UWI experts.

    - Identification of pilot areas (Little Biaboo Region 5, Port Kaituma/Arakaka Region 1, and Ebini/ Kimbia Region 10), soil samples exported to Trinidad and Tobago for testing.

    - Creation of NDVI Map, Satellite Map, Soil Map, NWDI Map, Bare Soil Index Map, Unsupervised Land Use Classification Map, Assessment Unit Map, and Intervention Map of Guyana for pilot areas.

5. After evaluating varieties, 1.45 ha of onion cultivation at Mon Repos—ECD and Long Creek—SLH were established.

6. 99 soil samples were analyzed from Field Mission to Puruni, Region 7, under the Sustainable Land Development Management project (SDG 15 Sustainable use of terrestrial

ecosystems). Member countries have mandated FAO to address land degradation and sustainable soil management through a country-driven approach.

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:

    - USAID, FAO, and UWI experts conducted soil fertility training for researchers and extension officers from NAREI, GuySuCo, NDIA, GSA, GMC, MMA, and GRDB.
    - One Research Assistant from the GIS section of the SM & FM Department attended a Workshop on digital soil mapping in Trinidad and Tobago.
    - Two Research Assistants of the GIS section of the SM & FM Department, and two NAREI Extension Officers from Region 5, participated in a Regional Workshop (Guyana, Haiti, St. Lucia, Barbados, Grenada, Antigua Barbuda and Belize) on Sustainable Soil Management and High Nature Value Index (HNVI) and Climate Smart Agriculture Compliance (C-SAC). The NAREI participant conducted a training workshop on HNVI/C-SAC for researchers and extension officers from NAREI, UG, GuySuCo, NDIA, GSA, GMC, MMA and GRDB.

    - Pilot areas were identified in Little Biabu - Region 5, Port Kaituma/Arakaka - Region 1 and Kimbia - Region 10. Eleven (11) soil samples were analyzed for bulk density, and Twenty (20) soil samples were shipped to the University of the West Indies (Trinidad) for the completed analysis.

    - Thematic Maps were created for Pilot Areas on: Normalised Difference Vegetation Index (NDVI), Satellite Imagery, Soil, Normalised Difference Water Index (NDWI), Bare Soil Index (BSI), Unsupervised Land Use Classification, Assessment Unit Map, and a Map of Guyana showing location of pilot areas for intervention.

2.2 Intermediate Savannahs Field Research Unit (ISFRU- EBINI)

The ISFRU-EBINI strives to regain prominence within the agriculture sector in Guyana, with the main focus on conserving, regenerating, and maintaining Plant Genetic Resources for Food and Agriculture (PGFRA). The unit expanded the number of cultivated and conserved crop types, while providing extension and laboratory services (soil pH testing and pea threshing) for farmers and stakeholders in the intermediate savannahs.

Living accommodation renovations, which included the repairs of the roof, steps, bathrooms, windows, and repainting, was one of the significant activities for the reporting period since it ascertained the enhancement of the living conditions for six personnel housed in two single flats and two duplex houses on the station.

The unit also reestablished a kitchen garden to cultivate vegetable crops and food security for the community. ISFRU-EBINI achieved the following in the area of research and development for the year 2023:

2.2.1 Achievements

1. Twenty-one descriptors were recorded for mango accessions established in the field gene bank.

2. 122 kg of avocado pears were harvested from avocado trees established in a field gene bank.

3. Agronomical practices such as fertilization, sanitation, and germplasm maintenance were conducted on all crops in the field.

4. Fifteen crop types were introduced and established in the field gene bank (c.f. to 4 in 2022).

5. Fourteen accessions representing five crop types (Bora, red pea, peanut, sorghum, and ochro) were conserved. Before conservation, 100 seed weight and germination tests were recorded for most crop types.

6. Four peanut varieties (GN 94A2, florunner Jumbo and AK62) and one maize (CARDI 001) variety were cultivated for multiplication purposes, yielding **6 kg** Jumbo, GN92A - **22kg,** and AK62- **15kg**.

7. Red pea was cultivated for purification purposes.

8. Of the six accessions of red pea (farmer's collection) that were previously conserved for nine months and regenerated, only two accessions survived the damage caused by animals, which resulted in data collection (length of pod- 16.6 & 21.3 cm, # of pea per pod - 13 & 16 and # of pods per plant - 4 & 7 respectively for the remnant plots representing the two farmers (S. Flemming and M. Mitchel). Meanwhile, remnants of the two sorghum accessions regenerated yielded **115g** (**7 g** Giza 114 and **108.54g** M91051).

9. Forty-seven pH soil samples (**c.f. to 55 in 2022**) were analyzed at the ISFRU, and recommendations were provided.

10. Sixteen farmers assisted (receiving technical advice on cultivation practices and pest and disease management, threshing of pea and ant bait).

11. **15,620 kg** of peas were threshed (c.f. to 7619kg in 2022) for farmers in the intermediate savannahs, and 39 packs of ant bait were distributed (**c.f. to 14 in 2022**).

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

New crops introduced: 16 crops were introduced (dragon fruit, millet (Ragi and Barnyard), sorghum (Giza 114 and M91051), black pepper, cinnamon, bay leaf, jack fruit, jumbo peanuts, sweet corn, sweet tamarind.

Accessions multiplication: 4 of targeted 5 (peanuts - Ak 62, jumbo and GN92A, red pea), (pigeon pea – not multiplied).
Threshing of legumes for farmers: 15620 kg of 15000kg
Soil pH Testing: 47 farmers serviced.

2.3 Fruits, Vegetables and Other Crops (FVOC) Department

The department made significant strides in sustainable agriculture by focusing on critical areas such as germplasm conservation of vital crops, developing high-quality seeds of locally adapted varieties, creating technological packages for sustainable farming practices, and streamlining production techniques for fruits, vegetables, and other crops. Impressive results include the production of 60.19 kg of vegetables and fruit seeds, 48,025 packets (330.1 kg) of packaged seeds, and the distribution of 43,688 seed packs (269.6 kg) to local farmers.

In addition, 10,000 (0.7 ha) sweet potato slips/ cuttings were distributed to the Mazaruni Prison, CARDI, GSA, BV Practical Centre, and farmers in Regions 2, 3, 4, and 5, and 2,254 vegetable seedlings have been cultivated, further contributing to the mission of promoting sustainable agriculture and ensuring food security.

Projects undertaken by this department throughout 2023 are:

1. Evaluation of vegetable, grain, and bean seeds at four storage temperatures.
2. The use of a different combination of black sand and paddy shells for germinating and growing coconuts.
3. Germinating coconut at a different angle (vertical, flat & 45^{o}) of sowing.

4. Determining the effects of different rates of NPK fertilizer on the properties of coconut water.
5. Germination of shaved seed nuts vs whole seed nuts.
6. The germination (time and percentage) of fall dry nuts vs harvested dry nuts.
7. Agronomic evaluation of three exotic kale varieties (Tuscan De Nero, Red Russian, Dwarf curly green) in Guyana.
8. Varietal evaluation of carrots (var. Ideal, New Kuroda, Kuroda, AGR-123 F1.

2.3.1 Achievements:

To promote sustainable agricultural practices and reduce waste within the industry, the FVOC department undertook two innovative projects focused on waste management and resource utilization. One such project involves harvesting 281.2 kg of vermicompost, commonly known as vermicomposting. Another notable project by FVOC includes creating thermophilic composting systems, which have successfully harvested 1,000 kg of compost.

Furthermore, FVOC made significant strides in improving the production of quality dwarf coconut seedlings. In 2023, projections estimated an output of 800 seedlings, however, FVOC managed to produce 1,593 healthy seedlings, surpassing expectations and showcasing their dedication to advancing agricultural techniques and supporting the growth of the industry.

2.4 Biotechnology and Plant Genetic Resources

10,179 disease-free plantlets were produced, of which approximately 7,000 were distributed to farmers at no cost. Meanwhile, 2,681 breadfruits were set aside for commercial use. The laboratory's production capacity will significantly increase in 2024 due to the government's yearly interventions. The department’s technical capacity was improved by acquiring equipment totaling $328,887,000.

The projects undertaken in 2023 were directed toward import substitution, increased production and productivity, and plantation crops. Significant strides were made in research focused primarily on the import substitution of exotic crops, such as blackberry, strawberry, and mulberry.

Continuous cyclic plantain, pineapple, and breadfruit multiplication was facilitated *in vitro* for conservation, research, and production purposes. *Ex vitro* germplasm was monitored at a three-month interval to collect data for agronomic characteristics and disease severity. *In vitro* gene banks of sweet potato, coconuts, pineapple, and rose augmentations were maintained through a conservation medium.

In addition to the micropropagation of plantlets, the department also worked on the following projects:

- **Optimization of Acclimatization protocol for *in-vitro-grown* Breadfruit**
- ***Optimization of Micropropagation Protocol for In vitro Strawberry***
- ***(Fragaria Ananassa) to enhance Root Development***
- **Establishment of Micropropagation protocols for Blackberries (*Rubus subg spp*.)**

The role of plant growth-promoting bacteria in agricultural crop enhancement

- Micropropagation of rose
- Micropropagation of grape (*Vitis Vinifera*)
- In vitro propagation of avocado (*Persea americana*) from nodal culture.

2.4 Horticulture

2.4.1 Plant Nurseries

NAREI operates plant nurseries throughout Guyana that sell plants (seedling and grafted) to the public at subsidized prices. This ensures farmers have access to low-cost, high-quality planting materials. In 2023, nine nurseries sold 147,906 plants to the public, accounting for 54% of the yearly objective and a 26% increase from 2022.

Revenue increased by 36.4%, with $36,030,550 generated for the year, achieving 120% of the yearly objective. Monthly revenue peaked in November 2023, with total revenues of $4,034,555. The top five nurseries that contributed the most to the overall earnings in 2023 are Mon Repos, Benab, Timehri, Pouderyen, and Charity. Nurseries produced 205,176 plants and 75% of their yearly objective. However, there was a 3.2% decrease in 2023 compared to 2022.

In the 2023 Budget statement, the Minister of Finance declared that the "government will expand distribution to 100,000 seedlings to farmers" to improve citrus output. As of December 2023, NAREI exceeded this aim, with 133,804 citrus seedlings grown. Of the saplings produced, 48,708 were sold to farmers, and 1,685 were donated to farmers/schools/householders. At the end of December, there were 17,677 citrus seedlings for sale, with 66,744 in the hardening/budding stage.

2.4.2 Fresh-cut Roses Project

The One Guyana Fresh-cut Roses Project gained momentum in 2023, with individuals and businesses becoming aware of this product that NAREI is offering. Total cut rose production for the year was 24,000, representing 57% of the annual rose import (42,000 roses). Sales of roses were observed to peak on special occasions. The highest sale was recorded on Valentine’s Day (1,593), followed by a decrease in order by international women’s (797) and Mother’s Day (630).

- Revenue from the sale of roses amounted to $5 M.
- Donations accounted for 4,066 roses (valued at $2 M)
- Sale price averaged at $396.27 versus $330.66, the unit cost of production (+$65.71 or +20% profit per rose).

2.5 Pant Pathology, Entomology, and Weed Science

To ensure sustainable farming practices, the department offered free laboratory services and technical support in pest and disease management to farmers, as well as the AIEP shade house project, the plant nursery, the hydroponics facility, the Soils Department, and other agricultural stakeholders. The department also provided training and surveyed significant pests affecting coconut.

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.

The department also partnered with NPPO and CDSS in surveillance activities for the **South American Palm Weevil (***Rhychophorus palmarum).* The programme was initiated due to a recently developed coconut project. The significance of this pest to the unit is linked to its recognition as a vector for a destructive disease of coconut palms, *Bursaphelenchus cocophilus*, commonly known as red ring disease.

The traps used in the surveillance were initially established on functional estates suspected to contain palms infected by the red ring disease. However, most traps were readjusted and placed off the farms to propel the pests away.

The surveillance team executed strategic and arduous efforts towards the threat emanating from the presence of the native South American Palm Weevil and the potential spread of Red Ring Disease outside of earlier delineated regions. The unit established more than 100 traps across Regions 1, 2, 3, 4, and 5 to detect and delimit a survey for this pest.

In conjunction with the International Trade Centre (ITC) projects for agriculture in Guyana, some traps were established in Regions 6 and 10 to aid the project's pest management area. The vector has been confirmed within Regions 1, 3, and 4. However, PPEWS continuously conducts tissue analysis for sufficient confirmation of the nematode.

2.5.1 Achievements

- **Acoushi Ants Bait Production: produced 23,567/ 20,000 Acoushi ant bait, surpassing** our target by **3,567**.
- **Laboratory Services:** Logged and diagnosed **322**/275 pest and disease samples; thus, surpassed our target by **47**.

Projects undertaken by the department throughout the year are:

- ✓ The use of several biocontrol methods to control pests and diseases of cash crops
- ✓ Review and update of "**Common Weeds in Guyana**"
- ✓ Review of Pests and Diseases Associated with Coconut Palms in Guyana: Emphasis on Red Ring Disease.

Location of traps	No. Of APW
Hope Estate	1274
Hope Lowland	715
Cane Grove- Non Pariel	366
Ruby EBE	173
Kuru Kururu	134
Hill Foot	120
Moblissa	48
East Coast Demerara (Agriculture Road, Ogle, etc.)	862
Silver Hill	16
Clonbrook	1279
Haruni	91
Swan	8
Pomeroon	69
Upper Pomeroon-Jacklow-Siriki	293
Dartmouth-Charity	18
Supenaam	123
Eastern Hogg Island	214
Siriki Sands New Haven	328
Lower Pomeroon	172
Mahaicony	118
Bengal	141
Phillipi	26
Moleson Creek	8
Canal 2	104
Hubu	103
Kairuni	8

Total number of South American Palm Weevil found in 2023 = 6,811

TRAINING

FARMERS' GROUP

EXTENSION SERVICES

PLANT NURSERY

SHADE HOUSE

HYDROPONICS

AIEP

CUT FLOWER

MICRO B

SOILS

FVOC

PPEWS

MANGROVE

N P P O

SPU - ONION

SPU - COCOA

SPU - SPICES

2.6 Mangroves

Mangroves are vital contributors to coastal resilience and biodiversity, offering a range of ecosystem services, including coastal protection, climate regulation, and cultural significance. Recognizing the vulnerability of Guyana's low-lying coastline, the Government has prioritized mangrove preservation within its strategic framework for sustainable development.

In alignment with Guyana's Low Carbon Development Strategy (LCDS 2030), the National Agricultural Research and Extension Institute (NAREI) has directed its efforts towards mangrove restoration and management. Through the Mangrove Action Plan 2022-2032, NAREI aims to manage and protect these ecosystems sustainably, enhancing resilience and promoting restoration initiatives.

Throughout 2023, NAREI has focused on employing a green-grey infrastructure approach for mangrove restoration. With a capital investment of GYD$200 million, significant progress has been made in constructing groynes and breakwaters to support mangrove rehabilitation efforts. This investment is projected to restore over 2 kilometers of mangroves, bolster the resilience of coastal communities, benefit over 1,000 residents, and improve 900 hectares of farmlands.

In addition to the restoration programme, NAREI has prioritized knowledge dissemination and stakeholder engagement. Establishing a dedicated "Mangrove Centre" and launching the Guyana Mangrove Information System (GuyMIS) have facilitated improved access to mangrove-related data and information. Furthermore, the Mangrove Management Action Network (MMAN) formation underscores enhanced collaboration among agencies for effective mangrove management.

An analysis of mangrove changes from 2022 to 2023 indicates that Region 1 experienced substantial mangrove loss, with an overall net decrease of 805 hectares. Conversely, Region 6 exhibited the most significant net gain, adding 1642 hectares of mangrove cover during the same period. Overall, Guyana's mangrove cover saw a net gain of 1,276 hectares.

Main activities executed:

1. Permeable breakwaters along the Dantzig, Mahaicony foreshore

- Construction of a 300m timber breakwater completed. The completed structure is designed to restore sediments on the foreshore, and the mangroves lost due to erosion.

2. Geotextile tube groynes along the Paradise/Jib, Region 2 foreshore
    - Works 75% completed.
    - Two of four groynes were constructed.

3. Restoration of 1km along the shoreline of Whim/Liverpool, Region 6
    - 20 Community seedling nurseries established to produce 40,000 black mangrove seedlings
    - 90% of seedlings produced to date

4. Baseline data of mangrove regeneration
    - Geotechnical investigations were completed along four villages in Region 6.
    - Data will be used to support the design of restoration interventions.

5. Systematic monitoring of shoreline changes to support mangrove restoration and management
    - Topographic surveys were completed along 11 km of foreshore from Kilmarnock to Epson, Region 6 to assess and monitor changes in shoreline elevation.

6. Developing a system for monitoring and management of Guyana's mangroves
    - Guyana Mangrove Information System (GuyMIS) was launched in September 2023. The online application provides free downloadable data on Guyana's mangrove cover, change analysis over 10 years, and assessment of NAREI's restoration interventions.

7. Mapping and monitoring of mangroves using drones
    - Drone monitoring of coastline changes and the impact of restoration interventions were completed from regions 1 to 6.

- Notable observations were extensive natural regeneration in region 4 and the accretion rate resulting from the construction of groynes in regions 4 and 2.
- Ongoing erosion and loss of the mangrove vegetation in region 5 was also monitored.

8. Comparative assessment of the impact of mangrove restoration interventions
    - Infield data was collected to assess the impact of Geotextile tube groyne constructed at Non-Pariel and rock groyne constructed at Beterverwagting, Region 4.
    - Preliminary analysis indicates extensive natural regeneration at both sites.

9. Increase national awareness and knowledge about the importance of mangroves
    - The Mangrove Centre was opened on the 8th December, 2023. The centre will serve as a dedicated space to provide visitors with an immersive mangrove experience. Additionally, space will be provided for training and meetings of the Mangrove Action Network, a showcase for livelihood products, and a meeting area for researchers.

    - Ten community engagement sessions (meetings and trainings) were completed, resulting in over 250 persons becoming aware of the importance of mangroves.

    - To increase national awareness about the importance of mangroves, a Mangrove Walk/Tour was conducted to celebrate International Mangrove Day, and a graphic information sign board was erected at Ogle.

10. A comprehensive assessment of livelihood opportunities available based on mangrove extent by regions.
    - A consultant was engaged in November 2023 through the Guyana Conservation Initiative to conduct an assessment of livelihood opportunities linked to mangrove restoration and conservation. The results of this assessment will provide data to

guide capacity building and financing to foster community-level mangrove value chain enterprises.

11. Streamline coordination and management of mangroves
    - The Mangrove Management Action Network (MMAN), hosted by NAREI, was convened in December 2023. The MMAN comprises representatives of key government agencies, NGOs, and the private sector. It serves as a platform to guide the implementation of the National Mangrove Action Plan 2022-2032 and sustainable mangrove management.

2.7 Special Projects Unit

The Special Projects Department implemented several projects to increase the production of non-traditional crops and reduce food importation, while promoting climate-smart agriculture technology to mitigate extreme weather conditions. The department collaborates with other departments and agencies to achieve the institution's overall goals. Some projects undertaken by the Unit include: the expansion of spice production, the revitalization of the cocoa and coffee industry, and the commercial production of onions.

Spices: The Spice Unit helps diversify the agricultural sector and satisfies the national policy of developing a spice industry in Guyana. Presently, spices like turmeric, ginger, black pepper, nutmeg, etc. are grown in Guyana in an organized way. The climatic and soil factors prevailing in the country are congenial for these commodities. The hinterland regions are more conducive to spice cultivation.

The main objectives of the department are to generate and provide planting materials to farmers/stakeholders, to conduct field trials in spices and to increase cultivation, production, and productivity of spices with a goal to reduce the importation of spices by 25% by the year 2025. In 2023, the target was to generate 11,250 black pepper cuttings, 2,000 nutmeg seedlings, 1,000

cinnamon seedlings, 1,000 mint cuttings and increase the acreages of ginger and turmeric by 117 acres and 100 acres respectively.

2.7.1 Ginger - *Zingiber officinale.*

1. A total of 141.6 hectares (350 acres) of ginger were planted between August 2022 and May 2023. In region 1, 121.4 hectares (300 acres) were cultivated whereas in region 3 a total of 20.2 hectares (50 acres) were cultivated. This was expected to yield more than 3,000,000 pounds of fresh ginger rhizomes.

2. To support this increase in production, NAREI purchased three complete ginger lines and three turmeric heat pump drying machines from GELGOOG, China.

3. Work has commenced on the three buildings at Hosororo, Port Kaituma, and Parika, which will house the ginger lines and turmeric heat pump drying machines.

2.7.2 Turmeric - *Curcuma longa*

1. In 2022-2023, 42,288 lbs. of turmeric planting materials were distributed to several farmers, which would have increased cultivation by 100 acres.

2. NAREI discussed expanding turmeric cultivation and increasing production with a team from USAID-CAPA-IESC. The team confirmed that they met with the Hon. Minister of Agriculture, Zulfikar Mustapha, who endorsed the initiative. Plans are afoot to establish two 2.5-acre plots at St. Anselm and Waikarebi.

2.7.3 Nutmeg - *Myristica fragrans.*

To continuously expand nutmeg cultivation in Guyana, the following were done:

1. Collected and conserved 2,065 nutmeg seedlings in the nursery at Hosororo.

2. Nutmeg comes into production within 5-7 years.
3. A total of 150 nutmeg seedlings were distributed to farmers across region 1.
4. Expand nutmeg cultivation by 2 hectares (5 acres) at Hosororo Hill Station, region 1.

2.7.4 Black Pepper - *Piper nigrum L.*

To increase the cultivation and production of black pepper in Guyana, the following were done by NAREI:

1. Generated 9,185 black pepper cuttings in the nurseries at Mon Repos and Hosororo using the serpentine method of multiplication. These cuttings will be used to expand black pepper cultivation and supply interested farmers with planting materials.
2. A total of 2,045 black pepper cuttings were distributed to farmers of regions 1 and 10.
3. Two hectares (5 acres) of black pepper were established across regions 1 and 10.

2.7.5 Cinnamon - *Cinnamomum verum*

In 2023, NAREI incorporated cinnamon in the spice program. The main objective was to generate seedlings and distribute them.

1. A total of 2,350 cinnamon seedlings were collected and conserved in the nursery at NAREI Mon Repos.
2. NAREI donated 25 cinnamon seedlings to the Aroraima farmers group and established a field trial at Cookrite Savannah, Berbice River, and region 10.

2.7.6 Cocoa

The following are activities we carried out in 2023 to revitalize the cocoa industry:

- Of the Forty-five leaf samples from cocoa accessions sent to the Cocoa Research Centre (CRC) in Trinidad for DNA fingerprinting analysis in 2022, four varieties were positively identified. They are: ICS 1, ICS 95, ICS 40 and ICS 60.

- Phylogenetic analysis showed that nine samples have Amelonado ancestry, accessions with solid cocoa flavor. In addition, eight samples have high Contamana ancestry, and these may have resistance to witches' broom. Twenty-four out of the forty-five samples are good candidates for fine-flavored cocoa.

- A cocoa/ coffee germplasm plot was established adjacent to the AIEP shade houses at Mon Repos. Temporary and permanent shade crops (forest and Musa spp.) were planted and growing.

- Two shade houses were rehabilitated and currently accommodate 4,000 Cocoa seedlings (rootstocks) awaiting scion from Costa Rica (CATIE). The scions are from five improved varieties: CATIE R1, CATIE R2, CATIE R6, PMCT 58, and ICS 95. These are high-yielding and specially bred for the tropical environment.

- 2,000 cocoa plantlets are being nurtured at Hosororo, 1,000 of which are of various stages and will be used to bud known varieties located at Mabaruma. The remaining 1,000 will be used to graft stem cuttings from Costa Rica.

2.7.7 Coffee

- 1,000 seeds of *Coffea liberica* collected from Wakapau and sown at the Mon Repos nursery, from which selections will be made.

- Improved lines of *Coffea liberica* are expected from Costa Rica also. Eight genotypes will be imported as seeds and distributed to Charity, Wakapau, Mon Repos, Timehri, Mabaruma and Moruca.

- A total of 24,000 seeds will be sown at the aforementioned locations. (Charity 10,000, Wakapau 2,000, Mon Repos 5,000, Timehri 5,000, Mabaruma 1,000 and Moruca 1,000).

- Plans are in place for a new species of coffee- *Coffea arabica* to be introduced to Paramakatoi, Mabaruma, Kairuni and Moruca. *Coffea arabica* needs highlands (at least 1,000 m above sea level) and will be set up as trials at these locations. Using trials will introduce four varieties: Esperanza, Marsellesa, Catigua and Obata. At Paramakatoi and Mabaruma, 10,000 seeds each will be sown and distributed among farmers, and this will be replicated at Kairuni and Moruca, with 2,000 and 10,000, respectively.

- Residents of Paramakatoi welcomed the introduction of *Coffea arabica* and chose to sow the seeds themselves.

2.7.8 Berries Project

- A total of 118 raspberry, 97 blueberry and 86 blackberry plants were received from Brazil and transplanted at field 17, NAREI Mon Repos, under shade house cultivation.

- Raspberry plants adapted very well under shaded conditions, and within the first year, plants started to produce berries.

- Samples of berries (raspberry, blueberry, and blackberry) were taken and stored at the tissue culture laboratory.

- 200 raspberry cuttings were propagated using simple stem-cutting techniques.

- Blackberry plants are thriving, but flowering has not started.

- A shoot tip technique for rapid propagation was conducted.

2.7.9 Corn

Corn is a commodity on the list of high demand in the stock feed industry in Guyana. Over the years, Guyana has been importing corn mainly for animal consumption which amounts to about

30,000 metric tons at an approximate cost of US$10,934 annually. To lessen this significant figure on the importation bill, the Ministry of Agriculture, along with NAREI, has established several measures in its strategic plan to assist in alleviating the high cost by a minimum of 15% annually and by 50% by 2025.

Over the years, various studies have been conducted to evaluate the production competencies under different conditions in Guyana. The studies noted that some of the varieties did well; however, some significant challenges relating to the practices needed to be resolved to increase the yield of these varieties of corn.

Achievements

- Four corn accessions and two corn varieties were collected and morphologically characterized using eight morphological descriptors. Additionally, six corn varieties were identified and prepared for morphological characterization.
-An experimental trial was extended to a farmer in Canal No. 1 who showed interest in cultivating corn.
-A corn thresher machine was procured through an ASDU initiative.

2.7.10 Cassava Department

This department aims to build a sustainable cassava production sector that positions Guyana as the home of cassava production and processing of high-quality cassava flour and a reliable supplier of cassava-based products for local and regional markets.

Approximately 2000 hectares of sweet cassava (Manihot esculenta Crantz) are currently under cultivation on the coastal plain of Guyana. Twenty acres of improved cassava germplasm were planted in nurseries across region 9, namely Aishalton, St. Ignatius, and Moco Moco. The objective is to have quality planting materials available for sustainable regional production.

Achievements

1. 25 cassava accessions were characterized morphologically using 18 morphological descriptors (8 qualitative and 10 quantitative). Additionally, 20 accessions were identified and prepared for morphological characterization.
2. Five elite cassava varieties were evaluated at multiple locations in Guyana.
3. Over 70 hectares of cassava were cultivated in non-traditional areas along the coastal belt of Guyana.
4. Over 3 acres of high-yielding cassava varieties were produced.
5. Cassava yields significantly increased from 19 t/ha^{-1} to 35 t/ha^{-1} with the application and utilization of Good Agricultural Practices and high yielding varieties respectively.
6. Improved cassava planting materials were distributed to over 20 farmers.
7. Multiplication and distribution of elite cassava planting materials to farmers increased.
8. Several training sessions were conducted to improve farmers' knowledge about cassava cultivation.
9. Procurement processed for a cassava flour processing line was established.
10. NAREI collaborated with farmers in Parika, Naamryck, and Salem areas to cultivate 3 hectares of high-yielding cassava varieties which moved production from 19 t/ha to 30-35 t/ha yield.

2.7.11 Brazilian Green Dwarf Coconuts:

- Better variety for water

- Over 300 farmers from regions 2, 3, 4, 5, 6, 7, 9, and 10 are trained in coconut crop production technology.

- 13,000 Brazilian Green Dwarf (BGD) seed coconuts were imported in 2023 for distribution to farmers.

- **216** farmers benefitted from the distribution of BDG in 2023. Year to date, **10,220** coconut seedlings have been distributed. It is expected an additional 1,200 will be distributed by

the end of the year, bringing the total to 11,420 coconut seedlings, which equates to 191 acres.

2.7.12 Hydroponics:

- A shade house 7 m x 15 m was rehabilitated to evaluate five types of hydroponic systems: DWC (deep water culture); Horizontal and Vertical NFT (Nutrient film technique) systems; DBS (Dutch bucket system) and DFT (deep flow technique). Crops cultivated included pak choy, cauliflowers, kale, and lettuce. The horizontal NFT has a production potential of 472 plants; while the vertical NFT has a production potential 180. The horizontal NFT system produced 3,304 heads of pak choy over seven cropping cycles.

- Assessment of the growth of kale, lettuce, and pak choy was completed in the DFT system. These crops adopted and performed well in the system with a twenty-five percent yield increase and a two-week reduction in crop duration.

- Forty pounds of kale was harvested from 64 plants over one cropping cycle, 128 heads of lettuce over two cropping cycles, and 192 heads of pak choy over three cropping cycles.

- The Dutch Bucket system assessed cauliflower growth over three cropping cycles. It was noted that the crop duration was eleven weeks with a production potential of half pounds per head. Crops evaluated across five hydroponics systems showed pronounced adaptability since there was a reduction in the duration of cropping cycles by forty percent and yield increase by at least twenty-five percent.

2.7.13 Shade Houses

The effects of climate change are becoming more apparent, and farmers have the task of boosting production and productivity. In this regard, NAREI continues to assist in developing shade homes around the country. Shade houses are donated to schools, charities, and farmers' groups. Farmers

are also provided with subsidized shade house materials. 105 new shade houses were built throughout the year. 33 schools, 36 farmers, 29 farmer's groups, one children's home/orphanage, four plant nurseries, and two cocoa/coffee farmers are all beneficiaries of shade houses.

Please refer to Appendices Table 2 for a summary of shade houses.

2.8 Agricultural and Innovation Entrepreneurship Programme (AIEP)

In 2023, the Agricultural and Innovation Entrepreneurship Programme (AIEP) showcased significant achievements. With 50 beneficiaries, the programme emphasized gender inclusivity, with 55% of participants being female. The initiative delved into agro-processing, introducing innovative products to highlight the potential in this sector.

Agro-processing activities started in September; the program unveiled various products, including cauliflower rice, croutons, pepper jelly in three hotness variants, carrot jam, and carrot marmalade. These products aimed to demonstrate the diverse possibilities within agro-processing.

Furthermore, the programme excelled in seedling production, generating over 2,000 trays of seedlings. It also successfully implemented an internship program in collaboration with the University of Guyana, engaging students from the Faculty of Agriculture and Forestry.

The 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.

The programme actively engaged with stakeholders, hosting delegates from within the Caribbean region, local farmers' groups, interest groups, and schools. It participated in important events such as the University of Guyana's Career Day, farmers' market days nationwide, the Agri-Investment Forum and Expo, and career days at various schools.

Production data for 2023:

- Bell Peppers - 3,482.90 lbs
- Broccoli - 213.60 lbs

- Carrot - 1,757.80lbs
- Cauliflower - 3,040lbs
- Celery - 4522.70lbs
- Chilli peppers - 4,668.60lbs
- Cilantro - 95.40lbs
- Kale - 1,367.50lbs
- Beet - 732.50lbs
- Garlic - 60lbs
- Hot pepper - 2,213lbs
- Lettuce - 42,308 EA
- Mint - 451.90lbs
- Parsley - 867.90lbs
- Sweet peppers - 7,134.10lbs
- Tomatoes - 1,156.50lbs

3.0 EXTENSION AND TRAINING

In 2023, the Crop Development and Support Services Department (CDSS) continued to address farmers' needs by providing all the necessary support to realize the government's agenda of reducing the CARICOM food import bill by 25% by 2025. Farmers have responded favourably to this call. The country is witnessing an upsurge in farming activities, leading to increasing production and productivity.

Extension staff have worked diligently to meet the everyday needs of farmers. Field visits, outreaches, Farmers' Field schools, and other interactions to support farmers were done throughout the year. Services such as soil, water, pest, and disease sampling and analyses were conducted to provide the necessary recommendations to farmers to boost production.

Partnerships with Regional and International agencies, Non-Governmental Organizations, private sector businesses, among other bodies, contributed to the growth experienced. Technology transfer and provision of assistance in the form of agro-inputs significantly increased. This saw farmers employing adaptation and mitigation strategies to combat the effects of climate change, such as the El Niño conditions. The need for quality planting materials was adequately addressed in all agricultural communities.

3.1 Crop Extension Services

CDSS has done exceptionally well in 2023 by achieving all targeted areas of its planned work programme. Farmers benefitted from technical support and guidance through field/farm visits, farmers' clinics, and various outreaches. The transfer of new and improved farming technologies was aided by the many field demonstrations and the hosting of Farmers' Field schools in the various aspects of crop production.

Corrective actions by farmers to ensure optimum productivity were assisted by the collection and analysis of soil, water, pest, and disease samples. Farmers' requests for assistance with agro-inputs were adequately addressed by donating seeds, seedlings, garden tools, farm equipment, fertilizers,

pesticides, acoustic, and bait, among other items. The budgeted number of new shade houses were erected and utilized by the beneficiaries.

Please refer to Appendices *Table 3* for the targets and achievements of the CDSS Department.

3.2 Farmers' Training

Training exercises 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, all aspects of crop husbandry, post-harvest management, etc. Farmers were also trained in some social factors such as financial management, stress management, anger management, etc.

Like our farmers, extension officers benefitted significantly from technical and professional development with support from the Sustainable Agricultural Development Programme (SADP) under the Ministry of Agriculture. Officers were trained by experts drawn from across the various agencies in areas of animal production, fisheries studies, rice development, crop agronomy, and marketing to support the centralizing of the Ministry's extension service. Extension officers also received critical training needs from experts within NAREI, which further enhanced their capacity to deliver critical extension services, which included training in Red Ring Disease Surveillance and Black Sigatoka Management, among others.

The training department supported several agencies and International Organizations, such as the World University Service of Canada (WUSC) and UNDP, and local bodies, such as Guyana Council of Organizations for Persons with Disabilities, MOE, SBB, ITC, and NGMC, through capacity-building. Partnerships were also made between local input suppliers, including APSOL, Green Agro, Agro, and UPL.

Many schools and institutions also benefitted from training in climate-resilient and vertical agricultural practices and have implemented projects that support their educational and financial objectives.

With the United Nations Sustainable Development Goal 5 as a "benchmark," NAREI ensured that both males and females attended training sessions. Furthermore, the Institute believes including women and girls in agriculture could achieve Sustainable Development Goal 2 (Zero Hunger). Of the 10,310 persons trained, 42.2 percent were females, while 3 percent were youths.

Please refer to appendices *Table 4* for the achievements in training for 2023.

3.3 Support to Farmers' Group

Farmers' issues and concerns are better addressed through farmers' groups, and agro-input assistance is more efficiently utilized collectively rather than by individual farmers. To this end, the formation of groups was encouraged and supported across the regions. Guidance is given to these groups.

Farmers' exchange visits were conducted among groups from different regions and farming communities to aid in transferring technology among farmers.

Please refer to Appendix Table *5* for achievements in support of farmers' groups.

4.0 NATIONAL PLANT PROTECTION ORGANIZATION

NPPO relentlessly executed survey and surveillance activities, strategically targeting early pest detection. The focus remains on fruit flies and palm pests, recognized for causing substantial yield declines and disrupting markets in affected regions. Protective measures are imperative, given the pivotal role of non-traditional exports in Guyana's agricultural development. Guyana remains free of the Mediterranean fruit fly.

Throughout 2023, the department prioritized quarantine inspection and treatment of trade-related agricultural commodities alongside phytosanitary certification of farms, nurseries, and facilities. This ensures that exported goods meet market requirements and uphold quality standards. Additionally, NPPO invested in talent development, enhancing its pool of experts through institutional, national, and regional/international capacity-building initiatives.

As we reflect on the achievements of 2023, it is evident that NPPO successfully met most of the set goals and objectives, contributing to the robust protection of Guyana's agricultural and environmental interests.

4.1 Protection Services

NPPO conducted surveillance activities in adherence to International Standards for Phytosanitary Measure (ISPM) 6 and other relevant ISPMs and guidelines. ISPM 6 delineates the elements crucial for effective and efficient survey and monitoring programme necessary for pest detection and provision of information for pest risk analyses, establishing pest-free areas or areas of low pest prevalence, and in some instances, formulating national pest lists.

In the review period, the department conducted specific pest surveillance for five quarantine pests: the Carambola fruit fly, Mediterranean fruit fly, Red Palm Mite, Red Palm weevil, and *Tuta absoluta*. Host surveys were carried out for Carambola, Mediterranean, and *Anastrepha* species of fruit flies.

Carambola Fruit Fly (*Bactrocera carambolae*)

Monitoring efforts covered nine Administrative Regions; the exception being Region 7. The results of this monitoring prompted the Unit to recognize the necessity of implementing control measures to mitigate its prevalence in all areas where the Carambola Fruit Fly (CFF) was detected.

In 2023, the Plant Protection Department maintained its strategic approach to controlling and managing the Carambola Fruit Fly. Of the three focus areas identified in 2021[1] for intensive management, measures were implemented in two specific areas: St. Cuthbert's Mission and Lethem and surrounding communities.

The activities carried out within the CFF control programme included the implementation of the Male Annihilation Technique (MAT) through the distribution of Fibreboard blocks, mass trapping using McPhail traps and Torula yeast to target both male and female Carambola Fruit Flies, collecting and bagging damaged fruits to destroy CFF larvae, and servicing Jackson Traps to assess the effectiveness of control actions. Continuous public awareness campaigns were also conducted to educate residents and farmers on Carambola Fruit Fly control and how they too can contribute to the cause.

Fruit Sampling Surveys were conducted strategically, with the focus on the regions along the coast that are in proximity to the primary laboratory. However, a satellite laboratory for fruit fly rearing was designated within Region 9 to augment the survey within that region. This continues to serve as an important step towards mitigating the risk of moving infected samples trans-regionally and allows for efficiency in assessing host status in Guyana.

The laboratory saw a total of 10 batches submitted within the designated laboratories. Further, these batches resulted in the examination of 128 individual fruit samples. Fruits that were investigated included; *Astrocaryum vulgare*, *Averrhoa bilimbi*, *Averrhoa carambola, Anacardium occidentale, Chrysophyllum cainito*, *Citrus aurantifolia, Citrus limon, Citrus paradise, Citrus reticulate, Citrus sinensis, Inga fecuillei, Nephelium lappaceum*, *Mammea Americana, Mangifera*

[1] Areas identified were Canal Polder (region 3), St. Cuthbert's Mission (region 4) and Lethem and surrounding communities (region 9)

indica, Manikara zapota, Melicoccus bijugatus,Pasiflora edulis, Phyllanthus acidus, Malpighia emarginata, Psidium guajava, Psidium, Punica granatum, and *Ziziphus mauritiana.*

Red Palm Weevil Survey

The Survey and Surveillance Unit continued surveillance activities for *Rhychophorus ferrigenius*, commonly referred to as the Red Palm Weevil, to facilitate the verification of pest status. Further, the preliminary focus for surveillance was placed around active/functional coconut estates. This pest is of economic importance since it poses a threat to Guyana's vibrant coconut industry.

For 2023, the unit continued its strategic regional surveillance using pheromone traps. The traps were elevated from ground level, and more durable traps were developed. The team also emphasized targeting high-risk areas for pest entry and improving the previously established trapping lines. This approach was employed to establish an organized way of assessing the status and geographic distribution of Red Palm Weevil across Guyana and to establish the communities and region as pest-free areas. The traps were established in Region 4 within the East Bank Demerara District. Traps were also established and serviced in Administrative Regions 1 and 5. There is no evidence of red palm weevil within these regions.

Red Palm Mite

The Red Palm Mite, an economic pest affecting palms, Musa spp, and Heliconias, was discovered on Wakenaam Island, Guyana, in late 2013. Since its introduction, NAREI has diligently monitored and controlled its spread. In 2023, the primary focus was promoting good agricultural practices and enhancing plant nutrition. Quarantine measures primarily targeted post-harvest procedures, specifically fumigating host materials from the island. The implementation of these internal quarantine measures resulted in fumigating a total of 1,950 brooms and 2,665,283 dry coconuts with phostoxin tablets.

***Tuta absoluta* (Tomato Leaf miner)**

Tuta absoluta is an invasive pest that threatens crops, particularly the Solanaceae family. In Guyana, Tomato and eggplant are grown on medium-scale cultivation and are important sources of income for farmers. In 2023, active surveys were conducted in regions 3 and 5. Three traps

were set up on a tomato plot in Naamryck Back, Parika, Region 3, while two were established on a tomato plot in Mahaicony, Region 5. The pest was not detected in any of the traps serviced.

***Fursarium oxysporum cubense*, tropical race 4 (TR4)**

Tropical Race 4 (TR4) is an aggressive variant of the Panama disease, a soil-borne fungal pathogen (*Fusarium oxysporum f. sp. cubense*), predominantly affecting banana plants, notably the widely cultivated Cavendish variety. This strain poses a significant global threat to banana production, causing substantial losses in yield and economic impact.

Plantain, banana (*Musa spp*.), and ginger (*Zingiber officinale*) are crucial crops in Guyana, supporting local farmers and contributing significantly to domestic consumption and export. The imminent danger of TR4, originating from nearby countries like Colombia and Venezuela, poses a severe risk to Guyana's agricultural sector.

The highest risk is identified in region 1, covering communities like Mabaruma and Khan's Hill, due to their proximity to Venezuela. An influx of Venezuelan migrants further compounds this risk, some turned farmers practicing suboptimal agricultural methods. Reports indicate daily smuggling of produce, including TR4-hosts like bananas and ginger, from Venezuela into Guyana.

In 2023, NPPO initiated an emergency action plan to prevent the introduction and spread of TR4. These measures included: creating public awareness materials, participating in identification and diagnosis training, conducting simulation exercises, and collaborating with the Caribbean Plant Health Directors (CPHD) Forum Musa Technical Working Group (TWG) for TR4 resistant materials efficacy trials.

Immediate action is essential to safeguard Guyana's plantain, banana, and ginger industries. The potential impact on local production and export underscores the urgency to prevent TR4 from reaching Guyana's shores. Delays observed in market access issues highlight the necessity for proactive measures to secure the country's agricultural future. In the latter part of the year, equipment and reagents for molecular identification were procured, with a survey planned for 2024.

4.2 Plant Quarantine Services

Throughout the year, NPPO provided plant quarantine services. The table below shows the various services offered:

Services	Target	Jan – Dec 2023 Reported	Achievement in %	Remarks
Inspection of Imports	13,500	21,126	156%	Ports of Entry include Moleson Creek, Springlands, Ogle International Airport, Port Georgetown (Boat House), Cheddi Jagan International Airport and Lethem.
Import Permits Issuance	1,200	1332	111%	Exotic fruits (apples, grapes, berries, etc.), vegetables, potatoes, onions, seeds, garlic, wooden furniture, etc.
Inspection of Ships	1,300	2,431	187%	Ships were inspected at Port Georgetown and Moleson Creek; all complied with National and International requirements for ships entering foreign territories.
Inspection of Flights (Passenger, Cargo, etc.)	3,500	3,144	90%	Domestic and international flights were monitored at Ogle and Cheddi Jagan International Airports.
Inspections of vehicles at Ports of entry	53,000	36,119	68%	Vehicles were inspected at the ports of Lethem, Georgetown, and Moleson Creek before they were allowed to enter or leave Guyana.
Inspection of Rice Fumigation (Containers, etc.)	6,000	5,722	95%	Containers, etc. No non-compliance report was received from Trading Partners.
Inspection of exports	16,500	19,126	116%	Both commercial and non-commercial items to more than 40 countries
Phytosanitary certificates issued	5,000	4,441	89%	Inspections were conducted to ensure compliance to WTO's Sanitary and Phytosanitary (SPS) Agreement, to facilitate trade regionally and internationally.
Farm visits	520	655	126%	These were farm visits and farm certification were conducted across the ten Administrative Regions.
Farm certification	300	301	100%	

4.3 Pest Risk Analysis (PRAs) and Market Access Information

Pest Risk Analysis (PRA) is crucial in protecting plant resources from diverse threats. It systematically evaluates the potential risks posed by newly discovered or emerging pests and pests

already regulated for plants and plant-based products. Through a comprehensive analysis of scientific, economic, and environmental factors, PRAs inform the development of appropriate phytosanitary controls. These controls, ranging from inspections and treatments to import restrictions, aim to prevent the introduction and establishment of harmful pests, protecting agricultural productivity, natural ecosystems, and biodiversity.

Market Access or PRA Data Sheets are vital in streamlining the PRA process for initiating international trade. These standardized templates, aligned with international standards, provide a structured framework for gathering and presenting the necessary information.

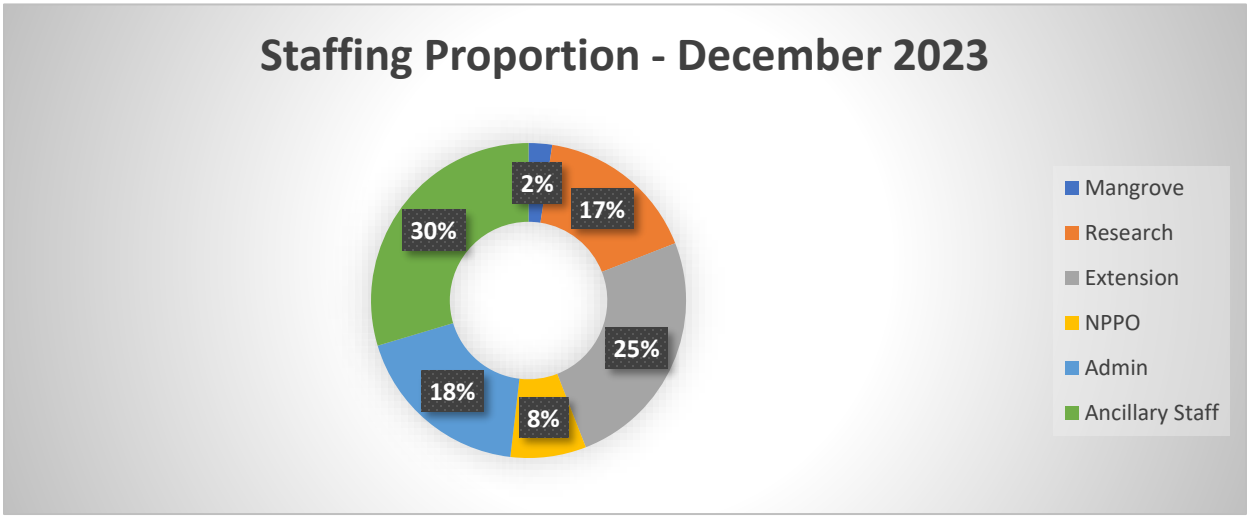
Notably, 2023 saw a remarkable achievement: the completion of four PRAs and four market access data sheets exceeded the targeted goal by over 100%. The success of this initiative demonstrates the commitment to protecting plant health and ensuring the flow of safe, pest-free products across borders.

5.0 HUMAN RESOURCES REPORT

As of December 2023, the staff complement for the Institute stood at five hundred and forty (540) employees:

Department	As of Dec 2023
Mangrove	13
Research	90
Extension	131
NPPO	42
Admin	100
General Workers	160
Contracted Employees	536
Extension Agents	4
Total	**540**

Actions	No. of Staff
Recruitment	74
Resignation	16
Voluntary Withdrawal of Service	29
Termination	01
Non-renewal of contract	06
Promotion	19
Transfer	07
Non-Contracted Employees	04



In 2023, the HR Department continued its focus on fostering a vibrant and inclusive work atmosphere by curating various engaging social activities in line with national events and holidays. Staff participation was encouraged in Phagwah, Easter, Eid al-Fitr, Arrival Day, and Emancipation Day observances, fostering cultural appreciation and unity.

Additionally, activities like the Inter-Faith Service, Health and Fitness Walk, and Health Fair promoted holistic well-being among the staff. The Inter-Agency Cook-Off, Food Security Sip and Paint, and the Agriculture Month Day of Sports activities provided creative expression and

camaraderie platforms. These initiatives contributed to a more cohesive and energized work environment, enhancing teamwork and morale throughout the year.

The HR Department also initiated impactful outreach visits to various NAREI locations nationwide, bolstering employee engagement and disseminating crucial information regarding HR policies. These visits spanned a range of locations, including Linden, Timehri, Kairuni, Fort Wellington, Benab, Pouderoyen, Bartica, Anna Regina, Charity, and Talgori. Engaging 150 staff members throughout the year, these visits served as platforms for open dialogue, enhancing communication channels, and fostering a more profound sense of unity and collaboration within the Institute.

Professional development is highly encouraged within the Institute. Consequently, one hundred and two staff members benefited from various short courses and training programmes. These programmes encompassed Contract Management, Leadership Development, Stores Management, Procurement Procedures, and Occupational Safety and Health.

Moreover, several staff members took the initiative to pursue further academic qualifications independently. Notably, eight staff members obtained their Bachelor's degrees, ten achieved their Master's degrees, and two earned their Doctorates during the year under review. Additionally, a total of twelve staff members are currently benefiting from study leave.

In 2023, the Institute's Library continued to serve as a vital resource hub for intellectual exploration and academic advancement, providing access to various intellectual materials within the agriculture field. Leveraging our Assistant Librarian’s specialized skills in book care, the staff assisted in digitizing all of the Institute’s active personnel files and uploaded them to the Institute's server. This initiative streamlines administrative processes, ensuring efficient access to crucial documents and enhancing operational efficiency.

6.0 COMMUNICATIONS UNIT

In 2023, the Communications Unit continued to serve as a crucial link between NAREI and the public by ensuring that the information disseminated was effective and accurate. The Unit was responsible for implementing communications mixes to enhance the visibility and reputation of our organization, as well as to promote our key messages and initiatives.

The Unit collaborated closely with other units within the organization to ensure that all communication efforts were aligned with our overall goals and objectives. It supported the Institute's participation in exhibitions such as Regional Science Fairs, World Food Day/ Ministry of Agriculture's Open Day, and the Agri-Investment Forum and Expo.

The Communications Unit also leveraged technology to reach a wider audience and engage stakeholders. Emphasis was placed on increasing NAREI's digital presence through social media, multimedia content, and other online channels. For instance, using platforms like Facebook, TikTok, and Instagram highlighted our products and services. It is noteworthy that NAREI does not sponsor posts. All post-reach is done organically.

A significant achievement of the Unit was the redesigning of NAREI's website. The website now has a more modern appearance and is user-friendly. While it is live and persons are already accessing information and necessary forms, the website is a work in progress and is expected to be completed by the end of March 2024. Other achievements include compiling and printing the 2022 Annual Report, redesigning 15 brochures, and producing three videos.

7.0 Information System

The IT Department worked on several projects during 2023. Two significant projects are highlighted below:

7.1 Farmers' Database

An online Farmers' Database was designed and implemented in February 2022. Extension staff were equipped with electronic tablets, which facilitated offline data entry. In 2022, 10,300 farmers

were registered, the process continued into 2023 with approximately 8,100 farmers being registered, closing the year with approximately 18,400 farmers within the Database.

7.2 Server

In December 2022, NAREI successfully secured a state-of-the-art Dell EMC R550 equipped with Intel Xeon Silver Processor, 64 Gig RAM, 13 Terabytes Storage Capacity and a UNIFI Dream Machine Pro Firewall. This server began operating in January 2023 and has revolutionized the computer experience within NAREI. Many features were introduced to allow greater security, storage, and transfer of data and information. Some of these will include:

1. Faster internet
2. Enhanced protection against viruses and malware
3. Access to the server for storing important documents (This access will be given to selective persons within various departments).
4. Increased communication among multiple departments and locations countrywide.
5. Identification of threats via viruses or insecure websites.
6. Identification of software and web applications that are utilizing the bandwidth.
7. Identification of rogue computers (computers that are connecting to dangerous websites) that are connected to the server.
8. Allows access to the Farmer's Database via Cloud.

7.3 Support Services

The IT Technical team visited various departments and regions during 2023; the technicians replaced approximately 20 computers, multiple hard drives, monitors, and UPS and upgraded over 100 systems to allow them to run new programmes efficiently. Upgrades were done to the boardroom to ensure the latest technologies (hardware and software) are used for greater efficiency.

8.0 Financial Statements

Draft Accounts

NATIONAL AGRICULTURAL RESEARCH & EXTENSION INSTITUTE
STATEMENT OF FINANCIAL POSITION
AS AT 31 DECEMBER, 2023

	Note	31.12.2023	31.12.2022
Assets			
Non Current Assets			
Property, Plant & Equipment	3	426,287,854	332,931,446
Total Non Current Assets		426,287,854	332,931,446
Current Assets			
Cash and Cash Equivalents		234,157,701	44,495,047
Accounts Receivables	4	11,336,363	11,704,005
Inventory	5	164,156,026	149,759,070
Total Current Assets		409,650,090	205,958,122
Total Assets		835,937,944	538,889,568
Equity & Liabilities			
Shareholders' Equity			
Grant from Foreign Sources		51,897,479	51,897,479
Government fo Guyana Contribution		744,075,973	728,408,000
Revaluation of Stock		341,781	341,781
General Reserves		851,537	7,646,564
Accumulative Surplus/(Deficit)		6,719,912	(282,088,978)
Total Shareholders' Equity		803,886,682	506,204,846
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	26,444,447	27,077,907
Total Current Liabilities		26,444,447	27,077,907
Total Equity & Liabilities		835,937,944	538,889,568
On Behalf of the Board of Directors			
Chairman			Director
The accompanying notes form an integral part of these financial statements.			

DRAFT ACCOUNTS

NATIONAL AGRICULTURAL RESEARCH & EXTENSION INSTITUTE
STATEMENT OF COMPREHENSIVE INCOME
FOR THE YEAR ENDED 31 DECEMBER, 2023

	Note	31.12.2023	31.12.2022
		$	$
REVENUE			
Government of Guyana Subvention		2,287,064,731	1,584,654,474
Income from Operations		56,714,096	33,468,536
Rental of houses		340,000	680,000
Other Income		835,633,202	152,154,654
Interest Earned		168,030	160,458
Income Adjustment under IAS 20			39,494,000
Total Revenue for the Year		3,179,920,059	1,810,612,122
Expenditure			
Benefits & allowances		66,982,270	48,336,676
Cleaning & extermination		3,145,180	1,429,844
Capital expenses			-
Depreciation	2		39,494,000
Drugs & Medical supplies		5,572,885	11,291,214
Equipment & Maintenance		7,486,777	4,845,058
Field materials & Supplies		77,895,682	36,599,933
Fuel & Lubricant		33,294,181	30,788,670
Local travelling & subsistence		13,976,250	13,116,163
Maintenance of Infrastructure		3,244,312	553,412
Mangrove Expenses		3,463,424	1,854,995
National Insurance Scheme (employers)		83,911,637	72,827,983
Office materials & supplies		14,993,872	12,090,432
Old Age Pension		1,286,026	980,332
Other direct labour costs		78,958,657	60,159,271
Other Goods & Services		16,113,621	17,934,667
Other Operating Expenses		46,031,745	35,805,491
Print & non print materials		14,612,757	11,435,996
Project Expenses		849,145,162	30,207,430
Rental & Maintenance of Buildings		42,144,261	41,536,707
Security services		24,624,577	22,673,155
Training		8,598,635	12,431,701
Transport, Travel & Postages		30,386,797	26,642,918
Utility Charges		41,177,228	40,778,594
Vehicle maintenance & service		27,948,904	24,166,251
Wages & Salaries		1,376,209,469	1,206,003,059
Total Expenditure for the year		2,871,204,309	1,803,983,951
(Deficit)/Surplus		308,715,750	6,628,170

9.0 Appendices

Table 1: Tissue culture seedling production

Crops	Plantlet production	Remarks
Breadfruit	2,681	Commercial use
Coconut	58	Field monitoring
Pineapples	3,312	Distribution
Plantain	3,617	Distribution
Blackberry	171	Field monitoring
Sweet potato	340	Field monitoring
Total	**10,179**	

Table 2: Summary of Shade Houses

SUMMARY BY BENEFICIARIES 2021 - 2023					
	2021	**2022**	**2023**	**TOTAL**	**%**
Schools	8	13	33	54	14.2
Farmers groups	10	14	29	53	13.9
Farmers	125	43	36	204	53.7
Orphanage/Children's Home		2	1	3	0.8
AIEP		52		52	13.7
GSA		2		2	0.5
ROSES		4		4	1.1
Strawberries/Blueberries,etc		2		2	0.5
Plant nurseries			4	4	1.1
Cocoa/Coffee			2	2	0.5
TOTAL	**143**	**132**	**105**	**380**	**100.0**

SUMMARY BY REGION 2021 - 2023					
REGION	**2021**	**2022**	**2023**	**TOTAL**	**%**
1	**9**	**0**	8	17	4.5
2	29	26	18	73	19.2
3	32	6	7	45	11.8
4	27	70	42	139	36.6
5	16	16	7	39	10.3
6	9	8	11	28	7.4
7	3	2	4	9	2.4

8	1	0	0	1	0.3
9	4	0	5	9	2.4
10	13	4	3	20	5.3
TOTAL	**143**	**132**	**105**	**380**	**100.0**

Table 3: Crop Extension Targets and Achievements of CDSS Department

Activities	Target	Actual	% Ach
Visit to Remote/Riverain Communities	850	938	110.4
Field Visits	19,000	20,525	108.0
Farmers Visited	55,000	58,508	106.4
Farmers' Open Days/Farmers' Clinics	700	982	140.3
Meetings/Outreach Programs	500	656	131.2
Farmers' Field Schools	28	112	400.0
Demonstration Plots	44	65	147.7
Soil Sample Collection	220	518	235.5
Water Sample Collection	120	264	220.0
Pest and Disease Sample Collection	80	139	173.8
Acoushi Ant Management	20,000	22,371	111.9
Number of Farmers Benefiting from Non-Cash Assistance	4,400	14,965	340.1
Number of New Shade Houses Constructed	100	105	105.0
Number of Seeds Distributed to Farmers (kg)	40.0	68.4	171.1

Table 4: Training Targets and Achievements of CDSS Department

Activities	Target	Actual	% Ach
Farmers' Training Sessions	244	387	158.6
Farmers Trained	3,660	8,206	224.2
Sessions for Extension Officers & Other Staff	64	70	109.4
Extension Officers & Other Staff Trained	512	2,104	410.9

Table 5: Farmers' Group Support Targets and Achievements of CDSS Department

Activities	Target	Actual	% Ach
Farmers' Group Formation and Strengthening	34	21	61.8
Farmers' Group Meetings	80	48	60.0
Group Exchange Visits	16	33	206.3


CHOP IT
LIKE IT'S
HOT


2" Pump
& Fittings


SHUBH
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MINISTRY OF AGRICULTURE