

2023

Promoting Excellence in Agricultural Research for Sustainable Development



ANNUAL REPORT





The National Agricultural Research Institute (NARI) was established by an Act of the National Parliament of Papua New Guinea (PNG) in July 1996 as a public funded, statutory research organisation to conduct and foster applied and adaptive research into:

- I. any branch of biological, physical and natural sciences related to agriculture;
- II. cultural and socio-economic aspects of the agricultural sector, especially of the smallholder agriculture; and
- III. matters relating to rural development and of relevance to Papua New Guinea.

In its Vision for PNG, NARI sees *Prosperous PNG Agricultural Communities* through its Mission of promoting innovative agricultural development in PNG through scientific research, knowledge creation and information exchange. This is to be accomplished through the Institute's Purpose (Strategic Objective) of enhanced productivity, efficiency, stability and sustainability of the smallholder agriculture sector in the country so as to contribute to the improved welfare of farming and rural communities who depend wholly or partly on agriculture for their livelihoods.

See *Annex 8 : The Institute* for more information on the Institute.

2023 Annual Report

National Agricultural Research Institute
Lae, Papua New Guinea

Corporate Document 3 / 2024

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Message From The Minister For Agriculture

Hon John Boito

Despite the significant development and contribution of the mineral sector since Independence, agriculture remains the main source of livelihood for over 85% of our population. Our Government, under Hon Prime Minister James Marape, has taken radical steps to recognise and support agriculture as the key to our country's economic future. The Ministerial determination of September 2022, creating three additional ministries of coffee, oil palm and livestock signifies the commitment the government is placing on agriculture shifting smallholder production to commercial and macro policy agenda.

The National Agricultural Research Institute (NARI), an initiative of the PNG Government, was formed to conduct applied, adaptive and development oriented agricultural research with a view to enhance the productivity, efficiency and sustainability of smallholder agriculture in PNG; and to provide authoritative technical, analytical and diagnostic services and up-to-date information to all strata of agriculturists in PNG. Our agriculture sector is expanding fast with smallholdings shifting into medium and large commercial scale. The agriculture research for development innovation supports the government aspirations.

I am pleased with the efforts of the Institute Council, Management, and Staff who have worked to maintain a solid Institute, also taking note to adapt and align with the objectives of the Government Medium Term Development Plan, strengthening the focus on commercial agriculture. The development of strong research and technical capacity must continue to to be supported to build and ensure sustained contribution of the agriculture sector to the National economy.

I now have the greatest pleasure in presenting this report to the National Parliament, the farming community at large, the general public, development agencies, scientists and professionals, donor agencies, and international organisations. It is my fervent hope that the spirit of innovation and enterprise for improved agriculture will continue to grow in PNG.

March 28, 2024 Honourable John Boito, MP
National Parliament Minister for Agriculture

Foreword



Greetings to you all from the NARI Council. It gives us great pleasure to share NARI's progress during 2023 with you.

The Council acknowledges the NARI Management team for their initiatives laying the groundwork for a renewed NARI aligned with the Government drive to a wealthier and healthier Papua New Guinea, delivering on the MTDP 4 and Sustainable Development Goals.

We were also pleased to welcome Dr Nelson Simbiken back to the NARI family as Director General. While Dr Simbiken started his career with NARI many years ago, he brings with him valuable experience from his years building the agriculture sector with Coffee Industry Corporation, Spice Board, and especially in his last appointment leading the Department of Agriculture and Livestock, and guiding the development of the recently released National Agriculture Sector Plan. We look forward to his leadership in research driving the Government agenda.

The Council has initiated the establishment of a commercial arm, NARI Enterprises Limited, to facilitate the scaling of research technologies for commercialisation. A significant opportunity has been identified for export of frozen taro, and NARI will partner with the private sector to realise the potential of this opportunity. The first export from this partnership is expected in early 2024.

We are concerned that while the importance of agriculture is well known, the Government support through funding for agricultural research, in relative terms, has been in decline over the past 20 years. The excellent returns on research investment have been well documented for countries similar to PNG. We very much appreciate the emphasis on agriculture and response and support given by the Prime Minister, Minister for Agriculture, and Government agencies who have taken time to recognise the role and value of research and the resources needed to deliver its contribution to development objectives. We continue our call on the Government to continue to review this situation and substantially increase research funding.

We also recognise and thank the Governor for Morobe Province, Hon Luther Wenge, for the ongoing support of the Morobe Provincial Government. The commitment, during our Agricultural Innovation Show, to support the construction of an Information Centre is timely and will contribute greatly to commercialising and scaling of research technologies.

The NARI Council expresses its appreciation to all our partners and to NARI staff for their contributions and commitment which underpins the organisation's expanding achievements. NARI will continue to build in 2024 on its modest progress made in 2023 to continue to strengthen our ongoing transformation as an improved results-oriented learning organisation. We look forward to your continued support in 2024.

Mr Nimo Walter Kama
Chairman, NARI Council

Message from the Director General



While I was only in the NARI Director General chair for a few months in 2023, I have always recognised the key role research plays in the development of agriculture, and the value of research investment.

The direction shift to commercialisation requires urgent intensive research and adjustment of the funding models. The minimal funding and resource requirement to properly operationalise NARI is provided in the NARI Strategic Implementation Plan 2022-2026.

NARI has taken steps to address the National Goals through the alignment of the Institute Strategy and Results Framework 2022-2031 with the Government Medium Term Development Plan IV 2023-2027. Derived from this basis, the key research outcomes revolved around the three priority areas covering policy, commercialisation, resilience to shocks, and nutrition. We appreciate the continued support from our development partners, particularly from the Australian Government through the Centre for International Agricultural Research. We are also appreciative of the assistance provided through Taiwan ICDF, the International Atomic Energy Association and Bioversity International.

We have taken lead in several new initiatives in 2023 with the revival of the agricultural professional cadet scheme which NARI had success in early 2000 in developing highly skilled, competent scientists, economists, social and development professionals. The national seed policy is being worked on to protect the indigenous plant genetic resources, exchange of the materials, supply high quality certified seeds particularly regulate against the genetically modified seeds and importation and use of genuine materials. The national seed policy will accelerate commercial production of rice, maize, fresh vegetables and fruit tree crops.

We strengthened our relationship with CABI with introduction of the International PlantwisePlus program to build the capacity for crop protection and increased productivity across the food and commodity sectors. The ACIAR and CABI Plant Health programs will aid in the delivery of agriculture extension in a concerted and structured national plant system for commodities and food crops.

Administratively, we have made good progress to ensure NARI is effective in delivery and is responsive to the reporting requirements and changing needs. Our 2022 accounts are under audit at the time of writing and we expect the 2023 audit to closely follow. We initiated an organisational restructuring exercise in 2023 based on the resource needs identified in the NARI Strategic Implementation Plan 2022-2026, to support the NARI Strategy and Results Framework 2022-2031 and sector alignment with the MTDP 4.

The hosting of the 26th NARI Agricultural Innovation Show after two years of Covid19 restrictions was a highlight of the year. Big thanks to our partner exhibitors and to Santos as the key sponsor of the event. Special thanks also to our Ministers and Governor for Morobe Province for making time in their busy schedules.

I look forward with confidence to a progressive 2024.

Dr Nelson Simbiken

Director General

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Executive Summary

There has been good achievement of targeted outputs planned for 2023. There have been unavoidable delays due to finance constraints to engage suitable personnel. The release of Public Investment Program (PIP) funding for development of critical research infrastructure was delayed but has provided impetus for 2024.

In 2023 NARI continued to effectively manage existing partnerships and developed new collaborations and arrangements. Since Covid19 restrictions, there has been more reliance on internal funding. Still, many of the currently implemented projects continue to be collaborative, involving international donors as well as government and non-government organisations. FAO through associated Plant Genetic resources projects and ACIAR as a donor and Australian institutions as partner organisations, continue to dominate the current project portfolio.

The 2022 IFPRI collaboration on agri-food systems research delivered strong results and policy contributions. The key outcomes were presented to the sector at a seminar hosted by the PMNEC early in 2023. The case for increased funding for research to develop the agri-food sector as a whole, improving productivity and increasing the importance of mid-stream and down-stream components was highlighted. The direction shift to commercialisation requires urgent intensive research.

The Galip nut value chain work has moved into its final stages with a Public Private Partnership arrangement has also been established with a local startup, Frangipani Fresh Foods, to take the Galip marketing aspects forward. Following on from promising international response, attention in 2023 was given to quality accreditation (HACCP) to take advantage of the opportunity.

Research on Genetic Resources is a key area for NARI and PNG, but sadly relies on international donor funding. We are seeking additional and ongoing funding for this activity, mandated under the NARI Act, to ensure that agro-biodiversity and collections of valuable genetic plant and animal resources are not lost.

NARI has many good staff, but they mostly work in professional isolation, lacking the critical mass needed for technical review and support. It has been especially challenging to fill the Principal and Senior Scientist positions with experienced staff able to mentor and guide less experienced teams. We highlight that with the need for value chain analysis in the drive for commercialisation, the lack of a strong socio-economics team has left NARI with a severe capacity gap. The minimal Human Resource requirements are laid out in the NARI Strategic Implementation Plan 2022-2026.

To address this need and difficulties in recruitment the NARI Council is adding a long term view, initiating a proposal to develop and establish a sector wide multidisciplinary cadet program to support an effective research and development program across the wider National Agricultural Research and Development System. The vision arises from the long view for sustainable capacity in the sector and NARI's success in delivering with an earlier cadet program.

NARI's research funding has not seen any real increases over the past 20 years to 2023, with an actual decline in relative terms. Research is a critical need in fulfilling the Government development plans to revitalise and take agriculture forward. The IFPRI collaborative study has strongly reminded us of the need to adjust the components of the agri-food system with a move to proportionally more mid-stream and down-stream action. This requires urgent funding support to enable recruitment and support for research input into agriculture commercialisation of food and other crops and livestock.

Introduction

The *NARI Annual Report 2023* provides a review and assessment of the achievements of the Institute at different levels of operation against planned milestones, outputs and outcomes, as outlined in the *Annual Implementation Plan 2023 (AIP 2023)*. The AIP 2023 is the second annual plan to be based on the second *NARI Strategy and Results Framework 2022-2031 (SRF)* and its subsidiary *NARI Strategic Implementation Plan 2022-2026 (SIP)* which guides implementation for the first five year period of the SRF, from 2022 to 2026.

The Institute links well with the GoPNG priorities arising from the targeted development impacts of reduction of poverty, assurance of food and nutritional security and health and sustainable resources management as guided by the countries long-and medium-term development strategies. The three derived priorities of the Institute for the next 10 years for which the Institute will contribute to are:

Priority 1: Economic resilience and development by enhancing agricultural markets, value chains and trade.

Priority 2: Enhanced resilience of rural communities and systems in light of climate, economic and demographic changes and associated threats to livelihoods and the environment.

Priority 3: Enhanced consumption of healthy and sustainable diets by rural and urban households.

The Result Areas being targeted within the priority areas:

1. Fore sighting and Advocacy
2. Value Chain Support
3. Household resilience
4. Agro-ecosystem resilience
5. Biosecurity
- 6 Genetic Resources
7. Safe and nutritious Food

For each of these areas there are key cross-cutting results to ensure appropriate delivery of research outputs and ensure a significant return on research investment:

- Scaling for impact
- Gender, Youth and Social Inclusion (GESI)
- Communication for Change

All staff are required to develop and follow a personal annual implementation plan aligned with the overall NARI Strategic Implementation Plan. Overall, staff have become familiar with the new SIP. All staff personal implementation plans are monitored at the Centre level. The AIP 2023 was monitored through quarterly reports, and end of year review of the overall AIP 2023. It is the responsibility of centre management and support staff to manage resources and create an enabling environment for research to flourish. This is being addressed in the shorter term through recruitment and reporting adjustments, supported by the organisational restructure over the longer term. The assessment of the Institute

needs for effective implementation is laid out in the *NARI Strategic Implementation Plan 2022-2026*.

Section 1 of this report covers the achievements for each of the priority areas with further explanations of implementation progress. The second section includes an assessment of the overall institutional progress and achievements.

The full table of achievements against the AIP 2023 for each Result Area and Institutional Management is provided in *Annex 1: NARI Annual Implementation Plan 2023 Achievement*.

NARI Annual Implementation Plan 2023

The collaborative work with the International Food Policy Research Institute based in Washington DC has reinforced the need and value of investment in agricultural research. A key message, shared earlier in 2023 with the sector, is the need to not only support research in improving the productivity of our agricultural producers, but to invest in research supporting the development of the midstream and downstream components of the sector. Agriculture can provide employment, not only on the farm, in the value chain including in processing, and in support industries fabricating small machines, tools, packaging materials, and other farm inputs. NARI has preliminary work on processing and prepared proposals to fund for research and technology scaling in this area. The additions in the 2024 PIP R&D appropriations have given impetus to this work.

NARI currently has 26 on-going research activities/projects covering climate change, soils and fertiliser yield responses, crop protection, plant and livestock genetic resources, biotechnology, nutrition, and information development. Alongside the recurrent budget, this work has been made possible through financial support from the PNG Government's Public Investment Program (PIP), Australian Centre for International Agriculture Research (ACIAR), International Atomic Energy Agency (IAEA), and the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA). The key work areas for this reporting period are summarised as follows.

Plant Genetic Resources, seeds

The management of genetic resources for agriculture is a mandated activity for NARI. NARI has several current projects in this area. Through the International Treaty on Plant Genetic Resources for Food and Agriculture, NARI has received USD50,000 in 2023 to support on-station collections of plant genetic resources under the Biodiversity for Opportunities, Livelihoods and Development (BOLD) Initiative which aims to strengthen food and nutrition security worldwide by supporting the conservation and use of crop diversity. Under this Project, NARI



Figure 1: Planting material distribution to farmers

will clonally regenerate and characterise the 865 sweet potato accessions in the germplasm collection to identify accessions with good flowering ability.

NARI also received another USD250,000 to support research to raise the profile and utilisation of breadfruit in the PNG food system. Breadfruit is an under-utilised traditional crop which can play a larger role in mitigating the impacts of climate change especially in coastal and atoll island communities.

The ongoing Galip nut development work has been another example of how research into an indigenous nut can lead to a commercial product with export potential. While the commercial activities have been taken over by private entrepreneurs the research in 2023 continues to be supported by ACIAR and is directed to business development, training, post-harvest handling, and pest management of the Galip weevil.



Figure 2: HACCP accreditation work for GNC

Seed production is a key need to drive agricultural development. There is considerable work needed to maintain the purity quality of varieties. ICDF (Taiwan) have been strong partners over the last three years in maintaining the quality of the NARI rice variety releases. Dr. Dong Hong Wu from Taiwan Agricultural Research Institute (TARI) visited and shared experience in seed inspection with MRC team.



Figure 4: ICDF/NARI Rice solar dryer



Figure 3: Seed inspection training

The NARI Tissue Culture Laboratory at the Highlands Research Centre in Aiyura in Eastern Highlands continued to supply potato plantlets as the foundation material for the National Seed Potato Scheme. The NARI Tissue Culture laboratory also cleans viruses from selected sweet potato varieties and provides foundation material for further multiplication by FPDA under the PT program. Further research is currently ongoing at the Aiyura lab into alternative rapid multiplication techniques to speed up and lower the cost for seed potato production.

Crop Protection

Work has continued on evaluation of insecticides for FAW management with baseline sensitivity studies in progress. Similar research is in progress to assess Bt (*Baccillus thuringensis*) based insecticides and establish its baseline sensitivity. Management strategies for control of BWAP has progressed this period with knowledge generated on vectors involved in disease spread and the extent of spread in the Markham established. Tissue culture protocols have been developed for 2x Kalapua banana varieties as a source of clean planting material. Tissue culture and associated rapid multiplication techniques remain the key approach to crop disease management.

Livestock Research

While we focus on agriculture, there is a critical need to address the poor human nutrition indicators for PNG, particularly protein deficiency in young children. NARI contribution to addressing this in 2023 involves a project to develop sustainable livestock and aquaculture farming systems. In a move from reliance on commercial day-old chickens, community hatcheries using sustainable solar incubators will supply adapted poultry stock directly to the participating families while a commercial hatchery supplies them with quality breeding stock. The success and sustainability is being built on a strong foundation of research including building of family cohesion through the successful Family Farm Teams approach. These work is funded through the Government's PIP supported R&D Project on livestock. The key activity this period has involved baseline surveys to capture the measurable indicators of success for seven of the eight LLG's identified in the project. With the baseline survey, a needs assessment is providing the key information determining interventions to carry on to 2024.

Climate Change Preparedness and Mitigation

Climate change was an ongoing concern with the expected El Nino event. NARI is collaborating with the National Weather Service (NWS) and other PNG and



Figure 5: Potato Rapid Multiplication



Figure 6: Provincial uptake of PT technology

Australian partners to develop an improved farm advisory and climate warning system based on seasonal climate forecasts. The NWS climate forecasts are currently available through the NARI web site. SMS alerts/advice is being trialled in EHP. NARI has been assisting provinces to build their support for climate change resilience through training and assisting to build provincial capacity to provide planting material and livestock in the event of such adverse events. NARI is currently assisting Eastern Highlands, Jiwaka, and Simbu Provinces to establish Provincial Didiman Centres as information, planting material, and breeding stock hubs to help in building resilience to climate change. Work has concentrated in the highland's provinces with current focus following up on training workshops with supply of foundation planting material and establishment of poultry hatcheries for supply of adapted village chicken breeds. A collaborative workshop of resilience status was conducted in late November to inform progress into 2024. It is important for Districts to work with their provincial agriculture advisers to build this preparedness into their programs and budgets.

Digitisation of Information

Information is a driver of innovation and agricultural development. While NARI has always been known for its strong information resources, the accessibility of this information for farmers and investors, and the underlying technical reports is being brought online through a publicly accessible web information database housed in the cloud. There is still a lot of work to be done but the foundation is already in place and NARI is actively digitising information resources with 1800 full text records added to date. We are also getting strong support to locate resources, and this will be further expanded under the appropriation in the 2024 PIP.

NARI has been collaborating with both the Pacific Plant Health Clinic program (UOG / UQ /ACIAR) and the Centre for Agriculture and Bio sciences International (CABI) and other stakeholders in improving plant health diagnostics in PNG. The UOG/NARI program launched its program with first graduates in November. With CABI and other PNG stakeholders, the global PlantwisePlus Program has been introduced in PNG with first plant



Figure 7: Planning for CABI Plantwise Plus

doctor training in October at NARI. The PlantwisePlus program has been successfully implemented in many countries and will add to our capacity to face the challenges of plant health and other invasive species threats particularly under a changing climate, and empower all stakeholders in PNG including farmers to recognise and address biological threats. The objective of both these programs is to increase incomes, improve food security and food safety by producing more and higher quality foods with less pesticides. The data

generated from these programs will provide a key research outcome on the presence of plant health problems and actions required

Highlights from R&D Implementation:

- 1 The trial Provincial Didiman Centre approach to engage with provincial agriculture is showing promising results. Lack of support to agricultural staff within Provinces continues to hinder more rapid program development.
- 2 Galip development has generated private business interest towards export. Directed studies in product development and quality assurance continue to support this development.
- 3 Tissue culture continues to support potato and sweetpotato industry with foundation material, virus cleaning and in-vitro conservation.
- 4 A Potato Rapid Multiplication Technique using apical cuttings showing strong promise as an optional and lower cost support to the potato seed production system.
- 5 Capacity for plant breeding strengthened through training in mutagenesis with IAEA.
- 6 Digital information system launched online with full text digitised and added.
- 7 The digitisation of the agriculturally important insect collection at NAIC was progressed with online database being tested. 12,871 specimens are currently stored. Poor storage issues have been addressed with replacement generator procurement in progress.
- 8 Collaborative contribution to Plant health and diagnostics through training of plant health “doctors” with ACIAR and CABI.
- 9 Publications and policy directions through IFPRI collaboration on value chains providing focus.
- 10 Promising outcomes with BSFL as feed protein. Interest from several organisations in feed technology,

Challenges

- A shortage of scientific staff, especially experienced senior staff with skills to both deliver on research as well as mentor and direct less experienced research personnel. - challenges in funding, personnel availability and attractive remuneration.
- Lack of expertise across disciplines, notably in in key areas of business economics, social research, agronomy, crop protection, mechanisation.
- Poor, missing, or rundown research facilities and systems – PIP infrastructure and system improvements to improve research environment, support facilities and

infrastructure has made and continues to make progress. An improved research environment will help to attract experienced staff.

- Need to strengthen the value chain result areas to deliver tangible commercial outcomes.

NARI Agricultural Innovation Show

The NARI Agricultural Innovation Show recommenced following two years of Covid19 restrictions. The show was a success, run over two days with displays and exhibits with the official ceremony, followed on a second day with presentation of current research by the NARI research team.



Many thanks to our Ministers and Governor for Morobe Province who gave their valuable time to join us and to Santos and other sponsors for the generous support which made it possible. Our next show will be May 9-10, 2024.

Institution Management and Services

A highlight for 2023 was the recruitment of the NARI Director General, Dr Nelson Simbiken.

In December, Dr Simbiken joined with the NARI Council and senior management for an organisational workshop facilitated by the Institute of Directors



Figure 8: Group at Institute of Directors

Finance management, sources and trends

Agricultural research spending is in decline. This was especially apparent over the period 2013-2017 when agricultural research spending as a share of Agricultural GDP fell from 0.43 to 0.30 percent. The trend continues to 2023 with inadequate funding to improve or even maintain facilities, equipment (scientific, tractors, implements) etc. There is insufficient funding to increase staff strength in relevant disciplines with necessary competencies in research to deliver along the impact pathway.

Related to this is the need for NARI to take valuable staff resources away from research to contribute to development oriented projects with very little research outcomes, simply

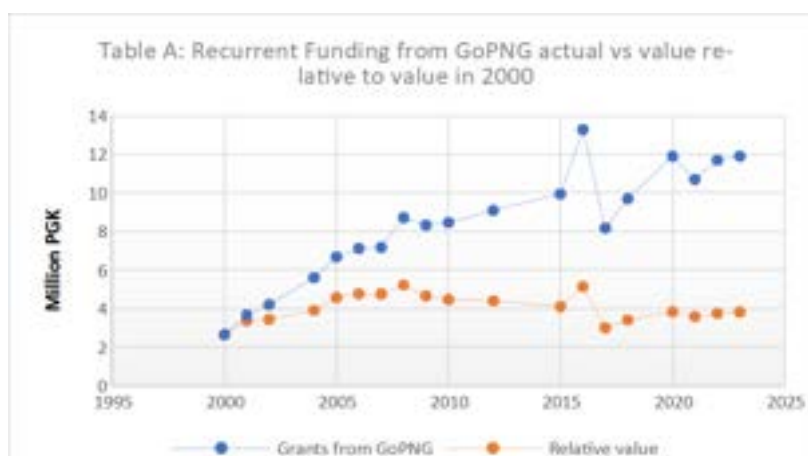
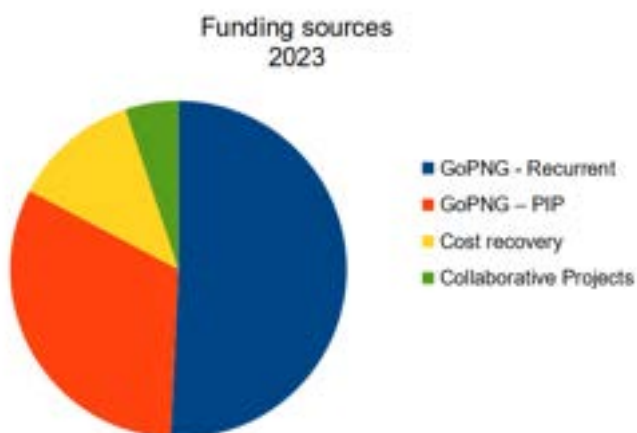


Figure 9: Funding in relative value decline

to ensure funding for staff salaries. This needs to change to allow PNG to reap the benefits from research investment.

The GoPNG **Recurrent Budget** allocated to NARI for 2023 decreased in real terms despite a marginal increase from the K11.66m allocation in 2022 to K11.9m. The 2023 allocation was still far short of the budget estimate of K23.4m requested.



K7.5m was received from K8.0m allocated under the 2023 **Public Investment Program (PIP)** budget. This has allowed work to commence

on the NARI Infrastructure Development Program and supported ongoing implementation of two components under the Research and Development Program, *“Preparedness to cope with climate induced stress”* and *“Sustainable poultry, aquaculture and goat farming for economic and nutritional well being of rural communities in Morobe and Madang Provinces”*.

The changes in funding allocations by source for 2021 to 2023 are illustrated below.

Table 1: Sources of Funds (millions):

| Funding Source | 2021 | 2022 | 2023 |
|-------------------------------------|--------------|--------------|--------------|
| Grants from GoPNG – Recurrent | 11.55 | 11.66 | 11.9 |
| Grants from GoPNG – PIP | 2 | 1 | 7.5 |
| Collaborative projects | 1.25 | 0.53 | 1.2 |
| Cost recovery from sales & services | 3.55 | 5.28 | 2.85 |
| Total Funds Available | 18.34 | 18.47 | 23.46 |

The Institute’s detailed funding and expenditure statement for the year ending December 2023 is given in Annex 4 : Income and Expenditure 2023. While salaries and wages continue to take around sixty percent (60%) of the total GoPNG grant, this remains far short of the amount required to recruit the staff needed, and unfortunately limits delivery of impacts from research. A more realistic staffing scenario has been presented as part of our Strategic Implementation Plan for 2022 – 2026. With very tight recurrent cash flow during 2023, the

Management has focused on regular and routine costs such as personnel emoluments and essential operational activities.

Table 2: Expenditure: 2020-2023 (K m)

| Expenditure Category | 2021 | 2022 | 2023 |
|--------------------------|--------------|--------------|--------------|
| Salaries and wages | 11.43 | 10.27 | 11.31 |
| Operational Expenses | 5.97 | 6.69 | 8.40 |
| Capital Formation | 0.87 | 1.04 | 2.65 |
| Total Expenditure | 18.27 | 18.00 | 22.36 |

The Institute continues to manage its expenditure under strict financial management procedures and protocols. All financial transactions in NARI are subject to annual audit by the Auditor General's Office. The Institute has always maintained a good record since its establishment in 1997. The 2022 audit is near complete at time of writing. The 2023 accounts are ready for audit following the receipt of the 2022 audit.

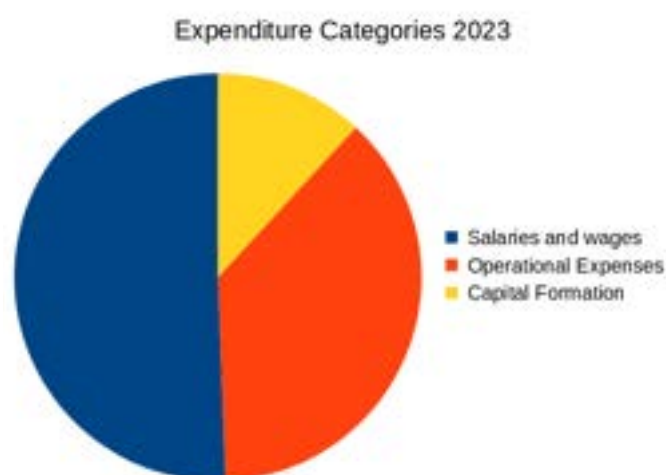


Figure 10: Expenditure categories 2023

The NARI **Human Resource** team was reduced to 3 staff members in 2023. The team was ably led by the Senior HR Officer under the guidance of the HR committee. The recruitment of a HR Manager is scheduled for early 2024. Improvements continued to be made to records management. The *NARI Terms and Conditions Management Standard* was revised and submitted to the NARI Council for consideration.

The Contract Staff numbers dropped from 110 staff in 2022 to 108 staff at the close of 2023. Those who left NARI in 2023, did so either through volunteer resignation and contract conclusion for short term projects.

Sixty percent (60%) of current contract staff are engaged in science and research activities. Thirty seven percent (40%) provided management and technical support. Gender balance is also maintained within NARI workforce, with sixty five percent (65%) Male staff and forty three (43%) percent Females staff out of the total workforce. NARI continues to provide a gender sensitive, safe and conducive working environment for all.

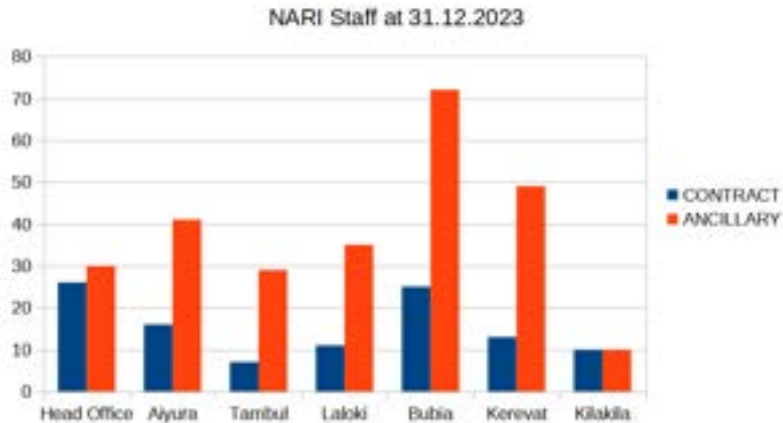


Figure 11: NARI staff category by centre

Opportunities for training and development is important for our capacity development as well as staff personal development. Five staff are currently undertaking Masters Degree programs overseas. Two staff completed their studies in October and December of 2023. One staff member has been successful in securing a place to do a Master of Science in Agriculture at the PNG University of Technology in 2024.

The **Professor John Kola Chemistry Laboratory** is accredited under the PNG Laboratory Accreditation Scheme. As an ISO/IEC 17025 registered laboratory it offers a wide range of chemical (trace and heavy metals), physio-chemical parameters (ions and anions) and bacteriological (anaerobic coliform) analyses.

While the laboratory has accreditation, scientific staff, and state of the art equipment to serve agricultural development through soil, plant, and product analysis, the demand for these services in 2023 has been disappointing. The laboratory has capacity to more widely serve the PNG agricultural industry.

Table 3: Summary of analysis of samples in 2023

| Sample Types | Water | Soil / Plant | Nat Prod /Food | 2023 Totals |
|---------------|-------|--------------|----------------|-------------|
| No of Batches | 242 | 32 | 15 | 289 |
| No of Samples | 768 | 171 | 51 | 990 |
| No of Tests | 6067 | 1291 | 147 | 7505 |

Quality Assurance Testing through round robin exchange testing program by Global Proficiency Testing, New Zealand, achieved a 70% quality for water testing, and soil testing at 77%. During the year, six soil test methods were assessed and certified as ASPAC Testing Method for 2023. The laboratory retained Accreditation to ISO/IEC Standard on Chemical Analysis Techniques of Water Testing under ISO/IEC 17025 by PNGLAS/NISIT in June 2023.

The lab is working to increase the scope of Accreditation through development of Standard Operating Procedures (SOP) and method verification and validation for metals in water, soil, plants and vanilla.

The International Atomic Energy Agency (IAEA) TC RAS 5078/S5096 SP-RA Project continues to support for food safety standards and assessments of Veterinary Drug Residues and Related Chemical Contaminants in foods. Five chemists attended overseas Technical meetings, workshops, attachment training: Mr M. Oromu, Vienna, Austria, Ms H. Sim and Mr R. Kepino, Budapest, Hungary, Ms Gloria Konia & Ms June Mark in Thailand. We sincerely thank IAEA for the ongoing support to our human resource capacity development.

NARI also continued to support industrial training at the Laboratory with Twelve Third Year Students, ten from UPNG Waigani Campus and two from UOT, Lae joining the NARI Chemistry Laboratory as interns for ten weeks during the December 2023 to Jan 2024 period. NARI sees this as important and has assisted students from tertiary institutions for industrial training over more than ten years.

NARI has two operating **Tissue Culture Laboratories (TCL)**. The smaller laboratory at the Bubia Momase Regional Centre Biotechnology Laboratory has focused on research. The larger facility at Aiyura is a shared facility between NARI and Coffee Industry Corporation (CIC).

NARI has been the manager and main user of the Aiyura TCL over recent years, primarily to supply foundation material for the National seed potato program and for producers of virus free sweetpotato planting cuttings from NARI Pathogen Tested (PT) planting material.

The Aiyura TCL maintains tissue culture of crop species for germplasm conservation, virus cleaning (PT) and mass micro-propagation for commercial purposes. The commercial use contributes to the cost of consumables and electricity, but is not yet commercially viable. 35,000 PT sweetpotato sprouted cuttings have been supplied along with 58,500 potato plantlets supplied to FPDA during 2023.

Alongside the actual tissue culture work, we are also looking at alternative methods of rapid multiplication which may be cheaper and more productive. The work in 2023 finalised the protocols for this technique.



Figure 12: Joel Pilon at IAEA

The **MRC Biotechnology Laboratory** is conducting molecular research and in-vitro mutagenesis. The laboratory has identified the Banana Wilt Associated Phytoplasma (BWAP) causing decline in bananas in the Markham Valley, its insect vectors, and developed the tissue culture technique for providing clean planting material for the *Kalapua* and *Yawa* varieties affected. The work in 2023 concentrated on understanding the insect vectors as a way to manage spread.

The work on mutation breeding is done with support of the International Atomic Energy Agency (IAEA) which involves preparing tissue culture material for mutation through radiation by the IAEA. In-vitro mutagenesis of vegetatively propagated crops relies on reproducible tissue culture protocols. Joel Pilon progressed techniques with IAEA in Austria over two months in 2023, training with experts, involving glass house experiments, field trials on mutant and plant tissue culture laboratory, plant pathology laboratory, and a drought study utilising a dry-down procedure.

Key highlights from mutation breeding techniques were gained by Laurence Uberawa at the Malaysian Nuclear Agency Agrotechnology and Biosciences Institute under IAEA sponsorship, including:

1. Radiosensitivity test on crops of interest for mutation induction - Attained Certificate of Participation for Fellowship on Mutation Induction and radio-sensitivity test in Sweetpotato.
2. Tissue culture techniques and surface sterilisation techniques for in-vitro initiation of banana.
3. Irradiation of *Gimane* and *Waghi Besta* using Gamma rays - 86 sweet potato cultures were irradiated and brought back to PNG - attained certificate of participation for training course on stable isotope techniques.



Figure 13: Gamma radiated sweetpotato returned to PNG

The **National Agricultural Insect Collection (NAIC)** is the key service activity. The collection holds more than 200,000 insect specimens, but not all have been classified. Adding specimens to the NAIC database continues to be the main task. Development of the online NAIC database has commenced with 9885 records added. The addition of photographs is delayed by access to suitable equipment, but is now scheduled to start in 2024.

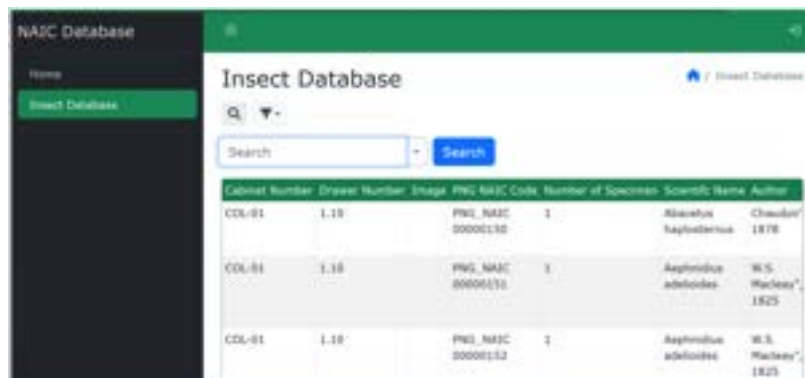


Figure 14: Screenshot from web database

We have taken action to protect the collection from further deterioration as we should note though that the virtual database collection is primarily for ease of searching, it cannot replace the need for a physical collection.

Appendix

Annex 1: NARI Annual Implementation Plan 2023 Achievement

SIP and AIP 23 Result Tracking Matrix

| Result Statements SRF 2022-2031 | Targeted Outputs SIP 2022-2026 (outputs in bold addressed in 2023) | Target 2023 | Achievement |
|--|---|--|--|
| Priority 1 Economic Development and Value Chains – Targeted Results <ul style="list-style-type: none"> Increased economic returns to value chain actors from production, sale and added value of crop and livestock products; Increased equity, inclusion and participation of women, youth and other socially vulnerable groups in priority value chains; Market system actors take up novel business opportunities in production and downstream processing of crop, livestock, aquaculture or non-food products in an environmentally sustainable manner; An efficient institutional and policy environment that promotes productivity, food safety standards, and maintains an efficient value chain in all market levels; Market accessions for export of PNG’s agricultural products that promote local content of market share; Increased localisation and import-substitution of target crops and livestock by locally based industries; Alternative agricultural export opportunities from crop, livestock, aquaculture and non-food products realised and reflected in the national agricultural development agenda | | | |
| Result Area 1. Fore sighting and Advocacy Strategic directions for investment in agricultural development explored and advocated based on assessments of domestic and international market demand, trends and opportunities for food and industrial agricultural products | | | |
| <i>Output 1: Investment Strategies</i> Investment strategies for agricultural transformation assessed and advocated | <ul style="list-style-type: none"> Information on costs and benefits of key agri-food system and investment options that are inclusive, pro-poor and targeted to promote economic growth; Relevant databases on research investment, Agriculture Science and Technology Indicators (ASTI) and other information developed and maintained | <ul style="list-style-type: none"> Technical publication on Mini Feed Mill Value Chain mapping; Policy recommendations on investment options and strategies for agricultural development | Completed 5 publications on relevant topics https://www.ifpri.org/list/pub/npr/65625 https://info.nari.gov.pg/bibliodatelist |
| <i>Output 2: Economic opportunities</i> Economic feasibility of fresh, processed and non-food agricultural production at different scales | <ul style="list-style-type: none"> Information on economic feasibility for selected crop and livestock for large scale farming (e.g. rice, spices, breadfruit, taro, yam, tropical and temperate fruits and nuts | <ul style="list-style-type: none"> Information on market opportunities and production requirements for sugar fruit, apples, spices; | Not started, lack of capacity in key social sciences and socio-economic research |

| Result Statements SRF 2022-2031 | Targeted Outputs SIP 2022-2026 (outputs in bold addressed in 2023) | Target 2023 | Achievement |
|---|---|---|--|
| assessed and advocated | etc.) | | |
| Result Area 2. Value Chain Support Improved technological, practical and economically approaches and adaptations for agricultural systems through facilitated innovation, foreign direct investments, and adoption processes along specific and related value chains. | | | |
| Output 1: Value chain innovations Innovations addressing key bottlenecks in sweetpotato, potato and banana are used along the value chain | <ol style="list-style-type: none"> 1 In-depth value chain mapping and research needs assessment for sweetpotato, potato and banana 2 Soil management package for sweetpotato production systems 3 Potato and sweetpotato varieties meeting end-user requirements; 4 Gaps in availability of guidelines, protocols and systems for production of certified planting material of sweetpotato, potato and banana addressed; | <ul style="list-style-type: none"> • Soil fertility improvement in banana production systems in PNG (Literature review) • Recommendations on soil management in SP systems in PNG Highlands released • Extension Booklet on options of farm by-products as nutrient source in SP systems • Information on economic benefit of the use of locally available fertilisers in vegetables, corn and sweetpotato available | <p>Not progressed trials not completed and technical publications yet to be produced</p> <p>Trials are in progress; extension of the project to 2024 due to external factors impacting on trials</p> |
| Output 2: Galip value chain Improved knowledge on current key bottlenecks in production, processing and marketing in the Galip value chain | <ul style="list-style-type: none"> • Commercial viability of business models for galip nut processing improved; • Appropriate business models for micro-enterprises developed and capacity of operators increased; • Improved production technologies developed (harvesting practices, on-farm processing; • Information on management options and strategies for the Galip weevil • Investment portfolios available for interested private sector operators; • Suitable mechanisation options available for different scales of operation; • Production and Quality standards and Standard operating procedures available; | <ul style="list-style-type: none"> • Information package summarising achievements and lessons learnt on building a sustainable Galip Nut Value chain; • The use of Galip nut in domestic markets expanded to wider range of users including Food services and food processing businesses • Understanding on enabling factors for gender sensitive micro enterprise development in the Galip Value Chain • Information on improved production practices (harvest | <p>Not progressed, project has extension for 12 months (Dec 24) to complete all activities</p> <p>Hilton Hotel purchasing Galip nut 1kg packages; other Hotels have expressed interest;</p> <p>Key domestic markets passed to FFL HACCP well progressed for export facilitation.</p> <p>Gender study is in progress; monograph planned</p> <p>Production studies are in progress to technical report, Production costings to be finalised Feb24, Weevil life cycle draft, new N flushing long life</p> |

| Result Statements SRF 2022-2031 | Targeted Outputs SIP 2022-2026 (outputs in bold addressed in 2023) | Target 2023 | Achievement |
|--|---|--|---|
| | | <p>systems, pest management, tree improvement);</p> <ul style="list-style-type: none"> • Key achievements of NARI's investment into Galip value chain development available on the NARI Website | <p>packaging study The range of publications on galip research can be found: https://info.nari.gov.pg/biblioviewlist Video record of research planned</p> |
| <p>Output 3: Pork product value chain Availability of lower cost locally produced pigs and pork products in selected retail outlets or open market increased in target provinces (SHP, WHP, Enga)</p> | <ul style="list-style-type: none"> • Effective research collaboration and networks between NARI and NAQIA on animal health & diseases. • Capacity of selected smallholder farmers on improved production practices and animal Health & welfare management tailored increased productivity and production increased. • Value chain mapping and key determinants influencing output across the value chain documented; • Safe & economically sustainable models for multiplication, supply & easy access for quality replacement stocks developed. • Demand & key requirements in production, processing and marketing to support niche markets for pork meat determined; • Awareness on biosecurity standards and practices conducted. • NARI staff and partner capacity on para-veterinary skills and knowledge increased. | <ul style="list-style-type: none"> • Information and maps available on the impact of ASF in local household of Tambul District and disease areas • Improved understanding of status of the pork value chain and gaps in research • Information on the most cost-efficient feeding regimes for weaner and for grower-finisher pigs using different commercial feeds and blended diets based on local feeds available | <p>Study delayed due to social unrest</p> <p>not started</p> <p>not started</p> |
| <p>Priority 2. Resilient Systems</p> <ul style="list-style-type: none"> • Diverse and sustainable agri-food systems at scale are established and maintained and reflected in the national agricultural development agenda. • Farming households adopt livelihood strategies that enhance their resilience to climate, physical, and biological shocks, stresses and risks; • Equitable access by stakeholders to gender-sensitive crop and livestock technologies and up-to-date socioeconomic, technical and scientific information; • More productive and equitable management of natural resources and agro-ecosystems | | | |
| <p>Result Area 3. Household resilience</p> | | | |

| Result Statements SRF 2022-2031 | Targeted Outputs SIP 2022-2026 (outputs in bold addressed in 2023) | Target 2023 | Achievement |
|--|---|---|---|
| Smallholder farming and rural communities have an increased adaptive capacity to cope with abiotic stresses due to seasonal weather patterns, climate change or natural disasters | | | |
| <p>Output 1: Climate smart solutions Climate smart use of technologies and strategies targeting gaps in household resilience to climate change induced stresses and other shocks in diverse agro-ecologies and food systems by target communities</p> | <ul style="list-style-type: none"> ● Vulnerability assessment information and maps ● Baseline on traditional cropping calendars for representative areas and regions documented ● Diversified climate resilient portfolios of crop varieties and species as well as livestock strategies and technologies adapted to climate risks available to stakeholders; ● Relevant farm practices and strategies from production to marketing (e.g. soil moisture management, storage, on-farm processing, use of seasonal farm advisory) to mitigate risks to household resilience developed and adapted; ● Livestock feeding strategies and better utilisation of existing and novel feed and forage resources advanced to supply-to-demand feed products as milled, fermented or fresh materials ● Scaling approaches applied for wider awareness and adoption of climate smart innovations in target areas; | <ul style="list-style-type: none"> ● Climate resilient crop varieties and technologies assessed (NERICA rice, Disaster Seed Kit) ● Climate smart farm practices and strategies assessed and recommendations available <ul style="list-style-type: none"> ○ Traditional Cropping calendars documented ○ Crop intervention matrix and seasonal advisories developed ● Capacity of extension agents in vulnerable districts in climate smart use of agriculture production technologies and practices built; | <p>NERICA rice study fieldwork complete – technical report in progress</p> <p>Selected NERICA also under test independently at Rigo Rice</p> <p>documentation of cropping calendars is progressed;</p> <p>Intervention matrix completed for pilot crops;</p> <p>Seasonal advisory template in use;</p> <p>Usability testing of advisory in progress</p> <p>SMS message testing currently being tested</p> |
| <p>Output 2: Disaster response Support in disaster preparedness and rehabilitation provided in timely manner within mandated areas</p> | <ul style="list-style-type: none"> ● Sufficient quality planting material and breeding stock available at NARI Centres as foundation material for rehabilitation after disaster events; ● Local seed/planting material and breeding stock production centres supported with foundation stock; ● Information packages available on | <ul style="list-style-type: none"> ● Key agricultural rehabilitation crops identified and processes in place for deployment in disaster situations; ● Weather data captured from the AWS at all Centres and captured in central database ● Climate forecast information sharing platform for Hela and SHP; | <ul style="list-style-type: none"> ● NARI has a list of crop varieties available for deployment after disaster situations; systems for rapid deployment to be improved; ● PDC system well progressed ● Resilience status report in progress |

| Result Statements SRF 2022-2031 | Targeted Outputs SIP 2022-2026 (outputs in bold addressed in 2023) | Target 2023 | Achievement |
|---|--|--|---|
| | management of severe El Nino events (before, during and after the drought) <ul style="list-style-type: none"> • Weather data available from all NARI Centres to stakeholder | | <ul style="list-style-type: none"> • AWS set up in all NARI centres – live access waiting on IT system adjustments; • Climate forecast sharing via WhatsApp group and NARI Web |
| Result Area 4. Agro-ecosystem resilience | | | |
| Sustainability of managing agro-systems and catchment areas in ADD clusters with high population density and intensified agricultural systems improved | | | |
| Output 1: Climate Change Mitigation GHG status and opportunities for CO2 sequestration and reduction in GHG emissions from agricultural sources documented | <ul style="list-style-type: none"> • Assessment of GHG emissions from agricultural sources in PNG • Assessment of opportunities for CO2 sequestration and building of soil carbon levels. • Guidelines for climate safe agricultural practice. | No activities planned | Lack of capacity |
| Result Area 5. Biosecurity | | | |
| Biotic agro-ecosystem threats are sustainably managed by smallholder farmers at different scales of operation | | | |
| Output 1: Biosecurity Management Management options of major economic biosecurity threats (pest and diseases, weeds) of crops and livestock developed | <ul style="list-style-type: none"> • Fall Army Worm Management Package and associated information available and capacity built for use by different stakeholders; • Additional environmentally safe options available to vegetable producers for effective management of Diamond-back moth; • Integrated management approaches for African Swine Fever control operating in small-scale piggeries in PNG Highlands as part of improved value chain management; • Improved understanding of the biology, population dynamics and management options of the Galip Weevil; • Effective management strategies of | <ul style="list-style-type: none"> • Information on Fall Army Worm – baseline sensitivity to newly introduced insecticides and presence of natural enemies; • Baseline sensitivity information on novel insecticide for control of Diamondback Moth • see pork value chain • Management strategies for control of BWAP | Study is in progress Study is in progress Study in progress; see above “Pork Value Chain” Incidence and prevalence of Galip Weevil in Islands Region determined Draft Galip Weevil life cycle publication draft report available |

| Result Statements SRF 2022-2031 | Targeted Outputs SIP 2022-2026 (outputs in bold addressed in 2023) | Target 2023 | Achievement |
|---|---|---|---|
| | <p>Banana-associated phytoplasma in affected areas in Morobe and Madang;</p> <ul style="list-style-type: none"> • Information on presence of BWAP related disease in other banana growing regions • Relevant information on other pest and disease management issues • Capacity built in invasive weed management, especially high priority invasive plant species already damaging agro-ecosystems in PNG including prickly <i>Mimosa pigra</i>, <i>Piper aduncum</i> (Wild daka), African tulip tree (<i>Spathodea campanulate</i>), mollases, and <i>Rottboelia</i>. • Standard operating manuals and procedures applied for production of quality, and pest- and disease-free planting material and breeding stock; | <ul style="list-style-type: none"> • Information on baseline sensitivity of <i>Phytophthora infestans</i> isolates to Chlorothalonil; • Management strategies for ascites in broiler chicken in the Highlands of PNG • Priorities for bio control for invasive weeds and pests established • Manual for planting material propagation and biosecurity procedures for field and horticultural food crops | <p>draft technical report available</p> <p>Draft technical progress report available</p> <p>Proposal developed for consideration by the NARI Research and Publications Committee</p> <p>Delayed - in progress</p> <p>Funding secured from Crop Trust for capacity building in improved PGR management including development of standards</p> |
| <p>Output 2: Biosecurity preparedness Preparedness for responding to biosecurity threats improved</p> | <ul style="list-style-type: none"> • Contributions to incursion Management Plans and risk assessments; • Contribution to data bases developed for pest alert and incursion threats by NAQIA for stakeholder advise and planning. • Pest & Disease diagnostic capacity increased in supporting the sector; | <ul style="list-style-type: none"> • Specimen in the NAIC maintained and 500 specimen digitised in an electronic database; • Potential for use of LAMP diagnostic technology assessed in Sweetpotato diagnostics | <p>New microscope camera being sourced – existing camera not usable due to incompatible software on computer replacement; Work progressed on cleaning fungal damaged specimens</p> <p>Study completed and final report available https://info.nari.gov.pg/biblioviewlist</p> <p>Plant Health clinic training progressed with both CABI Plantwise and Collaborative ACIAR PHC with UOG</p> |
| <p>Result Area 6 Genetic Resources Diversity of genetic resources is maintained and used for strengthening sustainable and inclusive farming systems responsive to market demands and climate change</p> | | | |

| Result Statements SRF 2022-2031 | Targeted Outputs SIP 2022-2026 (outputs in bold addressed in 2023) | Target 2023 | Achievement |
|---|---|--|---|
| <p>Output 1: GR Management Exploration, documentation and conservation of diversity of PNG GRFA advanced for priority resources;</p> | <ul style="list-style-type: none"> ● A pilot in-situ conservation approach to sweetpotato genetic resources is tested in four districts; ● Sweetpotato cultivars characterised, phenotyped, evaluated, documented, pre-bred for traits of importance to adaptation and resilience; ● Information on GRFA is available to stakeholders in PNG and international community; ● Germplasm of root and tuber crops, fruits and nuts, rice, wheat, maize, OP vegetable seed maintained for further research and development purposes with minimum losses; ● Breeding stock of village chicken, cross-breeds, ducks, goats and pigs maintained at NARI centres; ● Breadfruit collection established and collections of taro, yam and aibika expanded; ● Genetic characterisation of local livestock (chicken, pigs, goats, sheep) breeds ● Fact sheets on poultry and pig breeds in PNG ● Compliance with contracting parties to ITPGRFA obligations ● Genetic resources for FA management | <ul style="list-style-type: none"> ● Increased knowledge on PGRFA performance and traits – Amaranth diversity, fitness and production traits of GIF Tilapia, pro-vitamin and carotene levels in PNG banana accessions; ● Sweetpotato PGR data made available on Genesys and the Global Information System with DOIs assigned; ● All PGR collections at NARI captured with in a database; ● Core collection of sweetpotato identified and conserved <i>in-vitro</i> ● Livestock Breeding stock data captured in a database; <p>no activity planned for 2023</p> <p>no specific activities planned</p> <ul style="list-style-type: none"> ● Reports to FAO Commission on PGR and ITPGRFA submitted in timely manner; | <ul style="list-style-type: none"> ● Study on Amaranth diversity completed and report available; ● https://info.nari.gov.pg/ ● Study on assessment on carotene level in progress; ● Dataset of 70 accessions sent to the ITPGRFA secretariat for vetting; no further progress yet; ● Funding secured from Crop Trust to establish GRIN-GLOBAL information system for PGR <p>on-going; funds secured for improving management of PGR collections; study in progress to identify SP core collection and conserve SP genes in form of botanical seed in Svalbard Vault;</p> <ul style="list-style-type: none"> ● yet to be formalise; ● funding secured from the ITPGRFA Benefit sharing fund to collect, assess and document bread fruit PGR; ● Separate funding secured from Crop Trust to expand collections of yam and taro from highlands region ● 2 studies now approved from NARI R4D fund to characterise village chicken |

| Result Statements SRF 2022-2031 | Targeted Outputs SIP 2022-2026 (outputs in bold addressed in 2023) | Target 2023 | Achievement |
|---|---|--|---|
| | strategy updated; | | <p>eco-types held by NARI at Kervat and Tambul</p> <ul style="list-style-type: none"> completed; Report to FAO CPGR submitted in February 2023; 2nd Compliance report to the ITPGRFA submitted on 12 October 2023 |
| <p>Output 2 GR use and access: Diversity of GR is used sustainably enhancing diversity and adaptation of crops and livestock to social, economic and ecological conditions</p> | <ul style="list-style-type: none"> Locally adapted sweetpotato varieties (early maturing, drought tolerant, purple and orange fleshed) bred with farmers' participation; Tissue Culture protocols for yam mass-multiplication Seed systems enhanced to promote adapted sweetpotato varieties and other crops; Seeded crops such as vegetables, legumes and pulses assessed for improvement and utilisation; Improved rice and corn varieties released; New spice and essential oil varieties introduced and basic information generated; New Crop varieties and livestock breeds available with traits that are meeting end-user demand; Standard operating procedures operating in all NARI centres for production of foundation crop planting materials and breeding stock; Facilities, equipment and infrastructure in place for production and post harvest | <ul style="list-style-type: none"> Diversity of SP varieties increased in pilot sites in Morobe, Madang, EHP, Central; Increased knowledge on quality planting material of sweetpotato by target communities; New and improved crop varieties introduced to target communities; 64 introduced rice varieties assessed and most promising accessions identified for on-farm trials; Standard operating procedures for poultry breeding stock production Multipurpose shed incl seed processing set up at MRC Seed laboratory developed at MRC, | <p>Communities in target sites have received sets of new SP varieties from NARI collections; received sets of new hybrids generated from botanical seed and participated in Participatory Plant Breeding Exercises;</p> <p>not started</p> <p>see above; new varieties have been introduced (land races and hybrids)</p> <p>micro plot trials completed; advanced trials established with 7 selected varieties</p> <p>funding secured (USD 42,000) to improve PGR management</p> <p>in progress; In progress – contract signed.</p> |

| Result Statements SRF 2022-2031 | Targeted Outputs SIP 2022-2026 (outputs in bold addressed in 2023) | Target 2023 | Achievement |
|---|---|---|--|
| | <p>processing and safe storage of seed and planting material at NARI centres;</p> <ul style="list-style-type: none"> • Facilities, equipment and infrastructure in place for improved supply of poultry breeding stock at NARI Centres; • Stakeholders access to and supply with quality breeding stock and planting material of priority crops and varieties improved; | <p>SRC/ICDF</p> <ul style="list-style-type: none"> • Seed handling system at HARC, HRC, MRC SRC IRC <ul style="list-style-type: none"> • 2 breeding sheds and hatchery set up at MRC • System established at NARI to capture production and distribution of breeding stock and planting material; | <p>seed laboratory equipment received; fully functional lab yet to be completed</p> <p>Seed systems in progress – funding now in place; In progress; renovations of sheds completed. New integrated livestock at planning stage – funds available.</p> <p>mechanism for capturing planting material and breeding stock production and distribution in discussion – DB developer not available in 2023, to be progressed in work plan 24;</p> |
| <p>Priority 3. Nutritious Food and Healthy Diets</p> <ul style="list-style-type: none"> • Increased availability of and access to diverse nutrient-rich and safe foods; • Partnerships operating to promote implementation of agriculture for nutrition and health strategies for agri-food value chain/food system innovations and interventions at scale; • Evidence-based nutrition-sensitive policies are designed accompanied by effective implementation strategies; • Consumers (rural and urban) and producers have capacity to make more informed food choices among healthier and safe foods that meet their needs and preferences | | | |
| <p>Result Area 7. Safe and nutritious Food Increased access to and use of safe and affordable nutritious food by consumers in rural and urban areas in PNG supported</p> | | | |
| <p>Output 1: Improved diets Target communities are enabled to produce and consume greater diversity of nutritious crops and livestock</p> | <ul style="list-style-type: none"> • Improved capacity of households to practice sustainable village poultry farming and other appropriate livestock systems in target communities and districts; • Enhanced active involvement in households and community on equitable use and consumption of livestock and fish products from village poultry or other | <ul style="list-style-type: none"> • Information on needs and baseline on status of food and nutritional security generated; • 8 project desks and district hatcheries constructed and operating; • Hatchery operators skilled; • Baseline/Needs assessment insights shared with Provincial and District Stakeholders | <p>Baseline/needs assessment surveys completed in Madang (2 LLGs), Morobe (Finschafen, Watut, Menyamya, Kabwum); planned survey in Teptep on hold due to logistic issues with NAC (availability and safety issues)</p> <p>not started</p> |

| Result Statements SRF 2022-2031 | Targeted Outputs SIP 2022-2026 (outputs in bold addressed in 2023) | Target 2023 | Achievement |
|--|---|--|---|
| | livestock/aquaculture systems; | <ul style="list-style-type: none"> 4 Family Farm Team Training units delivered; | |
| <p>Output 2: Advocacy on safe and nutritious food Information packages on safe food production and processing practices and nutritious food for rural and urban consumers available</p> | <ul style="list-style-type: none"> Information generated on threats to food safety and health from unsafe crop and livestock production and processing practices; Information materials produced and disseminated on nutritional properties of crop and livestock products | <ul style="list-style-type: none"> Information materials on nutritional properties of crop and livestock products | Not started |
| <p>Cross-cutting - Scaling: Output: Improved understanding on key drivers and innovations that enhance desirable system changes in scaling of AR4D out put and outcomes</p> | <ul style="list-style-type: none"> Inclusive and equitable partnership models and improved institutional arrangements for scaling of research outputs and providing sustainable support to target value chains, vulnerable communities and other target beneficiaries; Research outcomes and impacts assessed and key drivers of success determined; Technical feasibility and commercial viability of research outputs determined; Systems and processes in place for upscaling of supply of planting material and breeding stock; | <ul style="list-style-type: none"> Operational Provincial Didiman centres with selected provinces for climate change adaptation support Agreements with 4-8 Districts/Provinces in Madang and Morobe on operating model livestock breeding centres supporting for livestock development signed Information and understanding on key scaling factors for selected staple crops; Commercial viability of business models for galip nut processing improved; Provincial administration and relevant stakeholders are engaged to manage and promote sustainable farming of village poultry, fish and goats at households in selected communities; | <p>Provincial Didiman Centres established 6 highland provinces – active WhatsApp group network</p> <p>discussions held with DDAs during baseline surveys</p> <p>not started</p> <p>reported under Galip value chain</p> <p>not started</p> <p>In progress through PDC engagement. To be extended in 2024</p> <p>advanced planning and preparation</p> |

| Result Statements SRF 2022-2031 | Targeted Outputs SIP 2022-2026 (outputs in bold addressed in 2023) | Target 2023 | Achievement |
|---|--|---|---|
| | <ul style="list-style-type: none"> ● Innovative learning approaches and activities in knowledge transfer and information access to reach rural communities in ADDs developed and applied; ● Events organised enabling exchange and sharing of insights into lessons learnt from R4D interventions among stakeholders and policy makers; ● Stakeholders supported with efficient and affordable analytical services; | <ul style="list-style-type: none"> ● Provincial administration and relevant stakeholders are engaged to support resilient farming in selected higher risk provinces ● Facilities at NARI MRC and SRC upgraded ● TOT modules incl suit of learning materials fully developed for 5 modules ● Plant Health Clinic model – Pilot Assessment ● Annual Innovations Show relaunched; ● Stakeholder workshop on climate adaptation action in highlands ● Increase of sample submission and analysis compared to baseline (2022) ● Reduction in sample turnover time compared to baseline (2022) ● TC delivery targets met | <p>not started</p> <p>Plant Health clinic training progressed with both CABI Plantwise and Collaborative ACIAR PHC with UOG</p> <p>NARI AIS held on 18 October 2023</p> <p>Stakeholder workshop held in May/June 2023 / Resilience status workshop Nov23</p> <p>Chemlab has not increased total number of samples</p> <p>TC targets improved with generator replacement</p> <p>Potato RMT study is in progress with good progress results; extended to Dec 2024</p> |
| <p>Cross-cutting – Gender, Youth and Social Inclusion: Agricultural innovations process is gender sensitive, inclusive and responsive of needs and aspirations of women, youth and other disadvantaged social groups</p> | <ul style="list-style-type: none"> ● Information access takes into account education and literacy (basic and technical literacy such as use of ICT) as well as a client friendly design of NARI’s infrastructure. ● Assessments on the specific needs of gender, youth and other vulnerable groups are incorporated in the design of projects and programs to ensure that interventions enable equal participation and opportunity to access benefits across different social groups ● R4D programs are tailored to capture the | <p>Examples of learning materials for farmer level learning are suitable for learning by groups with low literacy</p> <p>Gender analysis data captured from survey reports</p> | <p>Consideration of GESI is generally part of the design in most projects especially those that have engagements with target communities; more effort needs to be made to actively address GESI related issues during design and implementation;</p> <p>need for social research capacity to be built;</p> |

| Result Statements SRF 2022-2031 | Targeted Outputs SIP 2022-2026 (outputs in bold addressed in 2023) | Target 2023 | Achievement |
|---|---|--|--|
| | interest of young people in the rural areas using approaches in capacity building and communication appropriate for the targeted age groups; | Youth of both gender feature in target population | 2 publications staff under recruitment |
| Cross-cutting – Communication for Change: Communication innovations effectively support delivery of research outcomes | <ul style="list-style-type: none"> • Communication Strategy • GIS databases and applications • Scientific, technical and general information accessible from on-line platforms and other media platforms; • Internal Information system with on-line databases on research management, Finance, HT and Assets management | <ul style="list-style-type: none"> • Communication Strategy developed; • Status information on current soil data and information as well as Soil expertise and research capacity in PNG; PNGRIS; Data user needs analysis; • NARI Information system launched • Funding proposal for digitisation and extended e-doc availability • Information on agricultural innovations made available through print, electronic and other media • Research management database • Trip and activity report database • Online HT Management/Leave Management System | In progress Inception meeting in May Information System for publications and research information now available at: https://info.nari.gov.pg/ PIP approved for 2024 implementation https://info.nari.gov.pg/ HT management database final checks |

Strengthen Institutional Efficiency and Effectiveness

| Targeted Outputs SIP 2022-2026 | Target 2023 | Achievement |
|--|---|--|
| Strengthen Institutional Efficiency and Effectiveness <ul style="list-style-type: none"> • High visibility of the Institute’s progress and achievements; • Improved institutional arrangement, policies and increased investment in AR4D and agricultural development; • AR4D agenda is resourced with adequate resources (expertise, financial and material resources); • An enabling internal value-based institutional policy environment created and maintained. • Legislation reviewed to enable better governance and to enable NARI to improve capacity to address related functions which have been outside current mandates | | |
| Managing for Results | | |
| Annual Corporate Implementation Plans are prepared in timely manner directing implementation of priority interventions for the reporting period | Annual Corporate Implementation Plan 2024 submitted to NARI Council in Dec 24 | Not started |
| Institute M&E system – Stage I Basic capacity for M&E at project level | No specific activity planned | M&E officer transferred to HQ and started to work on developing initially project based M&E and assisting HQ in Institute level M&E and reporting needs |
| Institute M&E system – Stage II Institute level framework | Not started | Not started |
| Institute M&E system – Stage III Integrated system for tracking, reporting of M&E information | Not started | Not started |
| Resourcing the Institute | | |
| 1. Advocacy and Visibility | | |
| Avenues for increased level of advocacy and dialogue at policy level created | No specific activities planned but ongoing effort | Active engagement with GoPNG departments (DNPM, DPM, Treasury) on resourcing needs of the Institute |
| NARI achievements presented in diverse media and its profile raised | Media articles (Radio, TV, Newspaper,); Video clips; Social media posts; Press releases reporting on NARI key activities | |
| Diversify funding sources | | |
| Business plans for key internal revenue activities completed and implemented | Business plans for key income earning activities developed Annual revenue targets met as per Business plan | More active engagement with Centre Managers to develop Business plans for selected small business activities at Centres; NARI Council endorsed the establishment of a business arm “NARI Enterprise Ltd.” to be further developed in 2024 |

| Targeted Outputs SIP 2022-2026 | Target 2023 | Achievement |
|---|---|---|
| Chemistry laboratory Business plan developed | Business Plan developed that shows increasing level of cost coverage / decreasing operational subsidy by NARI recurrent funding | Not started |
| Legal and operational framework for establishment of a NARI Business arm developed | No specific activities planned | To be done in 2024 |
| NARI centre management structure and systems adjusted for improved delivery on assigned functions including revenue generation | Restructuring plan submitted to Council | Dialogue with DPM initiated and plan forward developed; Restructuring consultant input in progress |
| Analysis of national and international practice to support development of a policy for industry funding support to research through levy / other. | No specific activities planned | Not started |
| Active engagement with GoPNG and donors result in annual award of diverse research for development grants and funding support | New proposals submitted to donors, GoPNG | Submissions developed for the Minister Agriculture for special projects; engagement with ACIAR and DFAT for new project(s) Engagement with DNPM and Treasury on funding requirements <ul style="list-style-type: none"> • 3 new PIP approved 2024 / increased recurrent funding for 2024 |
| Investing in Human Talent | | |
| Human Talent Management and Development Strategy (HTMDS) developed | Review of organisational structure and proposal for adjustments approved through Council and SCMC; | A discussion paper is available with a review of current and past structure and suggestions on re-organisation needs; a proposed structure is captured in the SIP 2022-2026; Engagement with DPM to understand the re-structuring process in May 23 / Restructuring consultant input in progress Oct-Nov23 |
| Performance based Appraisal system operating | Staff Annual Workplans submitted through rank and file by set deadlines; Annual PDR review time table implemented | Annual Workplans were produced by the majority of contract staff; A PDR exercise was conducted in March/April 2023; the majority of staff submitted the PDRs CMs, all scientific and technical staff, some support staff categories issued new performance based duty statements; |
| On-line HT Management system operating | Online leave management system operating; | The on-line leave management system undergoing final checks |
| Management of financial and material resources | | |

| Targeted Outputs SIP 2022-2026 | Target 2023 | Achievement |
|--|---|--|
| Improved finance management system in NARI established with online access to reporting and project managt info | New Accounting Software operational across NARI Centres; | Initial assessment of available packages within an affordable cost range; requires more in-depth assessment and purchase of trial licences – Progress being made with input from previous EU Auditor |
| Medium-term assets and facility management and development plan developed and annual targets met | <ul style="list-style-type: none"> • Online fixed assets register • NARI land use mapping and zoning plan developed • Field research area mapped, demarcated and land use history database developed all centres | Database in place – full stocktake scheduled for 2024 (Auditor report) In progress in progress |
| Housing estate management policy and strategy developed for NARI establishments | Policy document developed and submission made for Council endorsement | Not started; |
| Security risk mitigation strategy developed and implemented | Analysis of security risks and mitigation strategies | Not started |
| Infrastructure Development Strategy and Implementation Plan for NARI Centres developed and implemented | <ul style="list-style-type: none"> • Infrastructure Development Strategy and Implementation Plan for NARI Centres implemented | CMs have been tasked as part of new duty statements issued to work on land use plans, and establish centre development needs that will inform a longer term infrastructure development strategy |
| NARI land resources secured with title and ownership ascertained | 6 portions of land at HRC to get titles and secure | Currently no specific work done; management of on-going court cases at Laloki, Tambul |
| Governance, Policies, Processes | | |
| Revised Organisational Structure at corporate level and centres in place | Restructuring plan submitted to Council | See above; restructuring plan will not be ready until Q1 2024 |
| HT Management policies updated and/or revised | <ul style="list-style-type: none"> • NARI Management Standards reviewed and revised and new Standards developed for arising areas of need; • Training plan for NARI staff developed including cadetship program; | Management Standards Terms and Conditions of Employment for Citizens/Non-Citizens reviewed and suggested amendments submitted to Council for Endorsement (80 th Council Meeting); not started – to be done in conjunction with the re-structuring exercise |
| Financial Management and procurement policies and processes updated | Financial Management standard updated and submitted for endorsement by Council | Not started |
| ICT management policy developed | Policy developed and submitted to Council for endorsement | Not started |
| Review of the NARI Act | No specific activity planned | For DG, Council to take forward in consultation with Minister; to 2024 |

Annex 2: Alignment with MTDP IV Planning Framework

The following summary alignment of NARI priorities with the MTDP IV framework

| DIP Reference | MTDP IV Investment Programs | Sector Aligned Investment Programs/Projects | Implementing Agency | Location | MTDP IV Funding Estimates (K'mill) | | | | Total Cost(K'mill) | Funding Sources |
|--------------------|--|--|-------------------------------|---------------------|------------------------------------|------|------|------|--------------------|-----------------|
| | | | | | 2024 | 2025 | 2026 | 2027 | | |
| 1.1,1.5, 1.11, 9.3 | National Agriculture Development Program | 1. Scaling for agricultural SME production and commercial value-added products | NARI/DAL/ Commodity boards | National | 14.7 | 10.0 | 8.2 | 7.2 | 40.1 | GoPNG |
| | Fresh Produce Development Program | | | | | | | | | |
| | Agriculture Research | | | | | | | | | |
| 1.1 | Rice Development Program | 2. Value chain innovations supporting the scaling of rice production in the country | NARI/DAL | HRC, IRC, SRC, MRC | | 2 | 2 | 2 | 6 | GoPNG |
| 1.1, 1.11 | National Livestock Development Program | 3. Stakeholder access to and supply with quality improved small livestock breeds (village chicken, ducks, goats, Honey bees) and breeding stock improved | NARI/DAL/ LDC | HARC, IRC, MRC, SRC | | 4 | 4 | 4 | 12 | GoPNG |
| 1.1, 1.11 | Spice Development Program | 4. Increased access to improved varieties and planting material and production methods of priority spices supporting value chain development | NARI/DAL/ Spice Board | IRC, MRC, SRC | | 1.5 | 0.5 | 0.5 | 2.5 | GoPNG |
| 9.2 | Environment & Bio-science Research | 5. Exploration, conservation and use of diversity of PNG Genetic resources for Food and Agriculture | NARI/Prov. Govt/CEPA | National | | 2.5 | 1 | 1 | 4.5 | GoPNG |

| | | | | | | | | | | |
|-------------|--|---|-----------------------------|-------------------|----|---|---|---|----|--------------|
| | Support Program | | | | | | | | | |
| 9.3 and 9.6 | Agriculture and Food Security Research | 6. Equipping and positioning NARI to better deliver research results for PNG economic and development outcomes | NARI | National | 2 | 2 | | | | PIP |
| | Support Program | 7. Building Agriculture research capacity through National the Cadetship program | NARI and NARS | National | 10 | 8 | 6 | 6 | 30 | GoPNG |
| 9.5 | Socio Economic Policy Research Support Program | 8. Increased capacity for delivering policy recommendations on agricultural investment strategies and economic feasibility of fresh, processed and non-food agricultural production at different scales | NARI | | | 2 | 2 | 2 | 6 | GoPNG/Donors |
| 9.6 | Food Security | 9. Smallholder farming and rural communities have an increased adaptive capacity to cope with climate change | NARI and partners | National | | 2 | 2 | 2 | 6 | GoPNG |
| | | 10. Sustainable poultry, aquaculture and goat farming for economic and nutritional well-being of rural communities throughout PNG | NARI and selected Districts | Madang and Morobe | 2 | 2 | 2 | 2 | 8 | PIP |

Annex 3 : Research Activity

Table 4: Continuing Projects and studies

| No. | Project Code No. | Name of Project/Study | Project Leader and team | Funding body |
|-----|------------------|--|-----------------------------|-------------------------|
| 1 | A10224 | Aggro-morphological Characterisation of PNG Highlands Sweetpotato Germplasm for Establishment of Core Collection and their Conservation | Boney Wera | NARI Research fund |
| 2 | A10225 | Responding to emerging pest and disease threats to horticulture in the Pacific islands – HORT/2016/185 | Robert Geno | ACIAR 2016/185 |
| 3 | A10226 | Sustaining soil fertility in support of intensification of sweetpotato cropping systems Phase II – ACIAR SMCN 2012/105 | William Sirabis/ Tai Kui | ACIAR SLAM/2017/041 |
| 4 | A10229 | Evaluation on the performance of two Potato Rapid Multiplication Techniques on growth, potato tuber yield and quality of three commercial potato varieties at Aiyura and Tambul Stations | W. Maso | PIP R&D CC |
| 5 | A10230 | PNG Preparedness to Cope with Climate Change induced Stresses (Drought (frosts), Excess Moisture and Salinity) | Johannes/Stanley | PIP R&D CC |
| 6 | A10232 | Regeneration, Conservation and Safety Duplication of Papua New Guinea Sweetpotato Germplasm Collection through Botanical Seeds at the Svalbard Global Seed Vault | Boney Wera | BOLD/Crop Trust |
| 7 | B40328 | On-station evaluation and selection of suitable 64 new rice varieties in PNG | Charlie Suruban | NARI Research fund |
| 8 | B40323 | Investigation into Banana Wilt Associated Phytoplasma in the Markham valley | Gou Rauka | NARI/PIP funds |
| 9 | B40325 | Banana (Musa sp) and Sweet potato in vitro mutagenesis in Papua New Guinea | Joel Pilon | IAEA/NARI Research Fund |
| 10 | B40329 | Climate Smart Agriculture opportunities for | Ruth Baiga | ACIAR |

| No. | Project Code No. | Name of Project/Study | Project Leader and team | Funding body |
|-----|------------------|--|--|------------------------------|
| | | enhanced food production in PNG | | ASEM/2017/026 |
| 11 | B40333 | In situ Conservation and Utilization of Sweetpotato (<i>Ipomoea batatas</i>) for Climate Smart Agriculture Vulnerable Farmers in Papua New Guinea | Jeffrey Waki | ITPGRFA Benefit Sharing Fund |
| 12 | B40336 | Upgrading National Genebanks in the Global System | Jeffrey Waki | Bioversity International |
| 13 | HQ40214 | Equipping and positioning NARI to better deliver research results for PNG economic and development outcomes | Thomas Omot | PIP Infrastructure |
| 14 | HQ40215 | Better soil and land information for improving PNG's agricultural production and integrated land use planning - building a revitalised PNGRIS2 | Mark Tinah Department of Agriculture lead | ACIAR/ CSIRO |
| 15 | K10006 | Enhancing private sector- led development of the canarium industry in PNG (Phase II) | Godfrey Hannet | ACIAR FST/2017/038 |
| 16 | K10007 | Behavioural response of galip weevil to host-plant volatiles | Jacob Yombai | ACIAR FST/2017/038 |
| 17 | K10008 | Characterising productivity of village chicken eco-types under free-range semi-intensive and intensive management systems in Kerevat, Papua New Guinea | Fred Besari | PIP R&D |
| 18 | L10025 | Assessing the effectiveness of Grow Hariap Foliar Fertilizer (GHFF) in managing crop productivity relative to conventional fertiliser practices. | Philmah Seta-Waken | NARI Research fund |
| 19 | T20330 | Investigating the epidemiology and economic impact of the African Swine Fever (ASF) in Tambul, WHP | Stanley Amben | NARI Research fund |
| 20 | T20331 | Strategies to alleviate ascites in broiler chicken production in the high-altitude areas of Papua New Guinea (PNG). | J. Ahizo | NARI Research fund |
| 21 | T20332 | Assessing the baseline productivity of native | Jeremiah Ahizo | PIP R&D |

| No. | Project Code No. | Name of Project/Study | Project Leader and team | Funding body |
|-----|------------------|---|-------------------------|--------------------|
| | | chickens from different ecotypes adapted to highlands conditions | | |
| 22 | U10013 | Optimum switch over time from starter to finisher for two broilers genotypes fed different commercial feeds | Elly Solomon | NARI Research fund |
| 23 | U10014 | Rearing Black Soldier Fly Larvae (BSFL; <i>Hermetia illucens</i>) as an alternative source of high protein from regenerating organic farm wastes into feed for fish and chickens (Project U10008: Phase 2) | A. Roberts | PIP R&D |
| 24 | U10015 | Sustainable poultry, aquaculture and goat farming for economic and nutritional well being of rural communities in Morobe and Madang Provinces | Michael Dom | PIP R&D |
| 25 | U10017 | Case study on how a Rural Village Chicken Hatchery could be sustained through Family Farm Teams in communities displaced by volcanic eruptions in Bogia District, Madang Province | Janet Pandi | ARSF III 063 |
| 26 | U10018 | Baseline survey for the sustainable poultry, aquaculture and goat farming for economic and nutritional well being of rural communities in Morobe and Madang Provinces project | Michael Dom | PIP R&D |

Annex 4 : Income and Expenditure 2023

Table 5: Income and Expenditure 2023 (Interim)¹

| Descriptions | Q 1 | Q 2 | Q 3 | Q 4 | Total 2023 |
|---|----------------|----------------|-----------------|-----------------|-----------------|
| Income | | | | | |
| GoPNG - Recurrent | 5203254 | 1488840 | 2233254 | 2977670 | 11903018 |
| GoPNG - PIP | 0 | 4500000 | 3000000 | 0 | 7500000 |
| Cost recovery | 959612 | 696673 | 578313 | 619311 | 2853910 |
| Collaborative Donor Projects | 329047 | 249269 | 19677 | 602184 | 1200176 |
| Total Funds Available | 6491913 | 6934782 | 5831243 | 4199165 | 23457104 |
| Expenditure | | | | | |
| Salaries & Allowances | 2472748 | 3177231 | 2790232 | 2872431 | 11312642 |
| Travel Expenses | 54450 | 177403 | 149946 | 189235 | 571035 |
| Office Materials &Supplies | 30822 | 41616 | 39022 | 37157 | 148616 |
| Operational Materials/Supplies and Other | 737648 | 742757 | 2520684 | 860768 | 4861856 |
| Transport & Fuel | 40496 | 65045 | 83910 | 65932 | 255383 |
| Administrative Consultancy Fee | 0 | 0 | 0 | 62194 | 62194 |
| Council | 8150 | 50332 | 78934 | 119843 | 257259 |
| Legal | 0 | 54300 | 0 | 54163 | 108463 |
| Security | 22846 | 54857 | 24038 | 43237 | 144979 |
| Training costs | 0 | 1540 | 4438 | 50814 | 56792 |
| Medical Insurance | 0 | 137280 | 0 | 4943 | 142223 |
| Electricity and Water | 119324 | 150707 | 146925 | 189217 | 606173 |
| Information and Communications Technology | 56553 | 103552 | 105045 | 113600 | 378750 |
| Membership Fee | 45744 | 67465 | 0 | 23039 | 136247 |
| Routine Maintenance | 50196 | 158014 | 169539 | 201446 | 579196 |
| R&M Substantive | 5676 | 6017 | 16544 | 60601 | 88838 |
| Furniture & Office Equipment | 49105 | 22069 | 84807 | 77591 | 233572 |
| Purchase of Vehicles | 0 | 0 | 184911 | 362297 | 547209 |
| Plant, Equipment & Machinery | 211936 | 167138 | 82690 | 716241 | 1178004 |
| Construction of Building, Fencing etc | 52000 | 55373 | 392545 | 194651 | 694569 |
| Total Expenditure | 3957694 | 5232695 | 6874213 | 6299397 | 22363999 |
| Net Surplus (Deficit) | 2534219 | 1702087 | -1042970 | -2100231 | 1093105 |

¹The audited 2023 financial report was not available at time of printing the Annual Report 2023.

Annex 5: Human Talent Status

Table 6: Staff roles at 31st December 2023

| Distribution of Contract Staff as Per Various Categories | | | | | | | | | | | | | |
|--|---------|-----------------|-------------|------------|-----------|------------|------------|------------|--------------|-----------|-------------|------------|-------------|
| Staff/Category | Grades | Non-PNG Citizen | PNG Citizen | Sub Total | HQ | HRC Aiyura | HRC Tambul | SRC Laloki | SRC Kilakila | MRC Bubia | IRC Keravat | Total | % |
| Executive | Ex 4 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0.93% |
| Director/Manager | 10 - 12 | 2 | 3 | 5 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 4.63% |
| Research Coordinator | 5 - 9 | 0 | 6 | 6 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 6 | 5.55% |
| Research staff | 4 - 8 | 0 | 60 | 58 | 1 | 13 | 5 | 7 | 6 | 19 | 9 | 60 | 55.56% |
| Management | 2 - 7 | 0 | 36 | 36 | 19 | 3 | 2 | 2 | 2 | 5 | 3 | 36 | 33.33% |
| Cadets | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0% |
| Total Staff | | 2 | 110 | 112 | 29 | 17 | 8 | 10 | 9 | 25 | 14 | 112 | 100% |
| Male | | | | 65 | | | | | | | | 65 | 60% |
| Female | | | | 43 | | | | | | | | 43 | 40% |

Table 7: Staff categories at 31st December 2023

| LOCATION | CONTRACT | ANCILLARY | TOTAL | PERCENT (%) |
|--------------|------------|------------|------------|-------------|
| Head Office | 26 | 30 | 56 | 14.97% |
| Aiyura | 16 | 41 | 57 | 15.24% |
| Tambul | 7 | 29 | 36 | 9.63% |
| Laloki | 11 | 35 | 46 | 12.30% |
| Bubia | 25 | 72 | 97 | 25.94% |
| Kerevat | 13 | 49 | 62 | 16.58% |
| Kilakila | 10 | 10 | 20 | 5.35% |
| TOTAL | 108 | 266 | 374 | 100% |

Table 8: Staff movements

| Staff Movement | Quarter: 1 | Quarter: 2 | Quarter: 3 | Quarter: 4 | Total |
|----------------|------------|------------|------------|------------|-------|
| Staff Exiting | 2 | 1 | 2 | 1 | 6 |
| New Hires | 2 | 2 | 0 | 1 | 5 |
| Transfers | 0 | 0 | 0 | 0 | 0 |

Table 9: Staff Training & Development in 2023

| Name | Work Location | Training | Institute | Completion Status |
|------------------------|---------------|----------------------------------|--|--|
| 1. Wilfred Wau | Kerevat | Masters in Agriculture Science | University of South Queensland. Australia | On going – complete in June 2024 |
| 2. Rodney Aku | Aiyura | Masters in Agriculture Science | University of New England, Australia | On going – complete in June 2024 |
| 3. Mr. Raywin Ovah | MRC Bubia | Master of Agricultural Economics | University of Western Australia | Commenced 11 th July 2023 to 24 th December 2024 |
| 4. Tai Kui | Aiyura | Masters in Agriculture Science | Niigata University in Japan | On going – Complete in 31 st March 2025 |
| 5. Yapo Jeffery | Aiyura | Masters in Agriculture Science | National Pintung University, Taiwan | Completed in November 2023 |
| 6. Maima Sine | Tambul | Masters in Agriculture Science | University of Melbourne, Australia | Complete in December 2023 |
| 7. Mr. Godfrey Hanneth | Acting RDC | Masters in Agriculture Science | Successful in securing a place at University of Technology for studies in in 2024 - 2025 | Commence in 2024 - 2025 |

Annex 6: Plant Genetic Resources

Number of accessions of different crops held in ex-situ collections at NARI Centres

| Crop | HRC Aiyura | | MRC Bubia | IRC Keravat | SRC Laloki | HARC Tambul |
|--|----------------|-----------------|-----------------|----------------|---------------|----------------|
| | <i>Ex-situ</i> | <i>In-vitro</i> | <i>Location</i> | | | |
| Sweetpotato (<i>Ipomea setosa</i>) | 839 | 17 | 149 | 52 | 39 | |
| Aibika (<i>Abelmoschus manihot</i>) | | | 15 | 12 | 36 | |
| Cassava (<i>Manihot esculenta</i>) | | | 7 | 9 | 129 | |
| Yam (<i>Dioscera esculenta</i>) | | | 1 | | 55 | |
| Yam (<i>D. alata</i>) | | | 16 | | 42 | |
| Yam (<i>D. nummularia</i>) | | | 7 | | 10 | |
| Yam (<i>D. bulbifera</i>) | | | | | 5 | |
| Yam (wild species) | | | | | 2 | |
| Taro (<i>Colocasia esculenta</i>) | | | 216 | 12 | 67 | |
| Banana (<i>Musa</i> spp.) | | | 53 | 30 | 259 | |
| Winged Bean (<i>Psophocarpus tetragonolobus</i>) | | | | | 15 | |
| Breadfruit (<i>Artocarpus altilis</i>) | | | | | 26 | |
| Amaranthus (<i>Amaranthus</i> spp.) | | | | | 25 | |
| Night shade (<i>Solanum nigrum</i>) | | | | | 3 | |
| Chinese Taro (<i>Xanthosomans</i>) | | | 8 | 3 | | |

| | | | | | | |
|--------------------------------|--------|--------|--|----|---|---|
| sagittifolium) | | | | | | |
| Other Aroids | | | | | 6 | |
| Potato (Solanum tuberosum) | | 2 2 | | | | 6 |
| Durian (D. zibethinus) | | | | 13 | | |
| Rambutan (Nephelium lappaceum) | 1 3 | | | 13 | | |
| Mango (Mangifera indica) | 1 5 | | | 15 | | |
| Carambola (Averrhoa carambola) | 5 | | | 5 | | |
| Ton (Pometia pinnata) | 7 | | | 7 | | |
| Kava (Piper methysticum) | 3 | | | 3 | | |
| Galip (Canarium indicum) | 5 | | | 5 | | |
| Other fruit/nuts/spices | 1 9 | | | 19 | | |

Short-term plant Genetic Resources Collections for evaluation and selections at NARI Regional Centres

| Crop | MRC Bubia | HARC Tambul |
|--|------------------|--------------------|
| Rice (<i>Oryza sativa</i>) | 63 | |
| Tomato (<i>Solanum lycopersium</i>) | 11 | |
| Cucumber (<i>Cucumis sativus</i>) | 12 | |
| Pumpkin (<i>Curcubita.moschata</i>) | 9 | |
| Eggplant (<i>Solanum melongena</i>) | 10 | |
| Soybean (<i>Glycine max</i>) | 10 | |
| Yard long bean (<i>Vigna unguiculata</i> <i>subsp. sesquipedalis</i>) | 11 | |
| Lablab (<i>Lablab purpureus</i>) | 4 | |
| Cowpea (<i>Vigna unguiculata</i>) | 5 | |
| Wheat (<i>Triticum aestivum</i>) | | 26 |

Annex 7 : Publications

Journal Publications

- Eyland, D., Breton, C., Sardos, J., Kallow, S., Panis, B., Swennen, R., Paofa, J., Tardieu, F., Welcker, C., Janssens, S.B., Carpentier, S.C., 2020. Filling the gaps in gene banks: Collecting, characterizing, and phenotyping wild banana relatives of Papua New Guinea. *Crop Science*. <https://doi.org/10.1002/csc2.20320>
- Ahizo, J.; Amben, S.; Lobão, M.W.; Roberts, A.D.; Pandi, J. (2023) Restricting conventional feed intake for pasture-raised broilers in Papua New Guinea: effect on growth parameters and carcass yield, In: *Journal of Animal Science and Veterinary Medicine*, Vol.8 (6), 247-254, URL: <https://doi.org/10.31248/JASVM2023.384>
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Annex 8 : The Institute

The **National Agricultural Research Institute (NARI)** was established by an *Act of the National Parliament of Papua New Guinea (PNG)* in July 1996 as a public funded, statutory research organisation to conduct and foster applied and adaptive research into:

- IV. any branch of biological, physical and natural sciences related to agriculture;
- V. cultural and socio-economic aspects of the agricultural sector, especially of the smallholder agriculture; and
- VI. matters relating to rural development and of relevance to Papua New Guinea.

Under the NARI ACT (1996), the Institute was given responsibility for the following functions:

- to generate and adapt agricultural technologies and resource management practices appropriate to the needs, circumstances and goals of smallholders.
- to promote and facilitate applied and adaptive research in food crops, livestock, alternative cash crops, and resource management.
- to promote the use of appropriate technologies and provide essential technical services to improve the productivity, income, nutritional status and food security, resource base and quality of life of rural households and communities.
- to develop and promote ways of improving the output, quality, harvesting, post-harvesting, handling and processing and marketing of food crops, livestock produce and alternative crops.
- to maintain and conserve the diversity of genetic resources for food and agriculture, act as custodian for these resources, and promote the effective utilisation of these resources in the country; and to update and maintain the national inventory on soil resources.
- to develop, promote and maintain sustainable practices in agriculture.
- to provide agricultural information services, extension service support and other such assistance packages to the agricultural sector.
- to provide liaison and access to international agencies that promote agricultural development
- to formulate national agricultural research policies, define sectoral research priorities and allocate funds and advise the Minister and the National Executive Council on these matters.

Governance

The Institute Council reports to the Minister for Agriculture.



Figure 15: NARI Council - SRC, December 2023

Table 10: Composition of the Council, 2022-2025

| Name | Constituency Represented |
|------------------------------------|--|
| Mr Nimo Walter Kama Chairman | Smallholder Farmers |
| Mr Pius Piskaut Deputy Chairman | University of Papua New Guinea |
| Dr Patrick Michael | PNG University of Technology |
| Mrs Maria Linibi | Smallholder Women Farmers |
| Mr Humphrey Saese | Smallholder Farmers |
| Mr Ronnie Ilam | Growers' Association |
| Dr Sergie Bang | Department of Agriculture |
| Mr Sioni Ioa | Department of Treasury - Secretary's Nominee |
| Dr Nelson Simbiken | NARI Management – Director General |

The National Agricultural Research Institute Act, 1996, sets forward the roles and responsibilities of the NARI Council in providing governance for the organisation. This ensures the separation of governance from the management. It is the Council's role to approve strategic directions and structures for control and accountability. The Council safeguards and supports the implementation of the mission of the organisation, integrates organisational interests and stakeholder interests, and serves as a link to NARI's constituencies. The Director General manages the affairs of the organisation to deliver the objectives and targets according to NARI's strategic directions as determined by the Council, and in compliance with the NARI Act and Council approved policies and procedures.

The Council is the final authority of NARI. The Institute was reporting to the Minister for Higher Education, Research, Science and Technology until recently through National Gazette No# G690 of 31st August 2022 on Determination of Titles and Responsibilities of Ministers, NARI is now reporting to the Minister for Agriculture. The membership is made up of nominated representatives from the agricultural sector, Higher Education, and Ex-Officio representatives of key Government Departments.

The non-Ex-Officio Council members were appointed in April 2022. The Council convened on three occasions in 2023.

NARI is guided by five core values:

Our Core Values

The five Core values provide the foundation for an organisational culture in NARI that is focused on leading in agricultural research for development and delivering innovative solutions to its stakeholders in agricultural and rural development.

Leadership is a key value for the future of the Institute. NARI needs leaders who are visionary, apply systemic thinking and serve as inspiring role models at different levels of the operation. Leaders should wish to serve, help others to see beyond the obvious and look forward to the new possibilities of shaping the future. This leadership aspiration extends to the aim for NARI to be a leading agricultural research organisation in PNG and the Pacific.

Innovativeness is a leading principle for the Institute as a leader in Agricultural Research for Development (AR4D). This encompasses catalysing, facilitating and incentivising creativity in all facets of organisational behaviour to ensure responsiveness to the changing external environment and encouragement of innovation as an on-going process in agricultural development.

Integrity at all levels of the organisation is the basic moral fabric that guides our behaviour and conduct. We uphold high transparency and accountability standards and believe in consistency between words and deeds, trust, unity and honesty within the organisation, with our valued partners and engagement with rural communities and other stakeholders.

Communication is a foundational value for NARI to reach all stakeholders. Communication needs to be clear, intentional, and effective and incorporate feedback as essential part in on-going organisational learning.

Organisational Excellence and Relevance is applied at all levels of the Institute. With a strong client focus, we plan and strive to be systematic and efficient and promote scientific rigour in research for development at high standards.

Our Strategy

In its Vision for PNG, NARI sees *Prosperous PNG Agricultural Communities* through its Mission of promoting innovative agricultural development in PNG through scientific research, knowledge creation and information exchange. This is to be accomplished through the Institute's Purpose (Strategic Objective) of *enhanced productivity, efficiency, stability and sustainability of the smallholder agriculture sector in the country so as to contribute to the improved welfare of farming and rural communities who depend wholly or partly on agriculture for their livelihoods*.

Our strategy aligns and contributes directly to the achievement of the GoPNG Development Goals, which also cascade from the UN Sustainable Development Goals (SDGs), the PNG Vision 2050, and PNG's DSP 2030, PNG Medium-Term Implementation Plan (MTDP3) 2018-2022, and the Agriculture Medium Term Development Plan (AMTDP), 2020-2022. The medium-term strategies and priorities are documented in the NARI Strategy and Results Framework 2022-2031 and NARI Strategic Implementation Plan (SIP) 2022-2026, and have guided the NARI research directions for 2022.

To deliver on its research mandate, NARI has its head office situated in Bubia, Lae, Morobe Province with regional centres established according to agro-ecological areas covering the dry lowlands, wet lowlands, highlands and high altitude highlands (Fig. 16). See Annex 8 : The Institute for more details on the NARI regional centres.

NARI Regional Centres

NARI Head Office is located outside Lae, at Bubia in the Morobe Province. There are five regional centres and tree technical facilities. The regional centres are distributed throughout the country to enable adaptive research specific to the respective agro-ecological zone where they are located. While the centres primarily serve the region where they are located with research, information, and genetic resources, the location allows the centre to conduct research which can then be applied to similar agro-ecological zones anywhere in PNG. All centres have recently been equipped with automatic weather stations which are networked with the NARI website, and will supplement the national climate data collated by the National Weather Service.

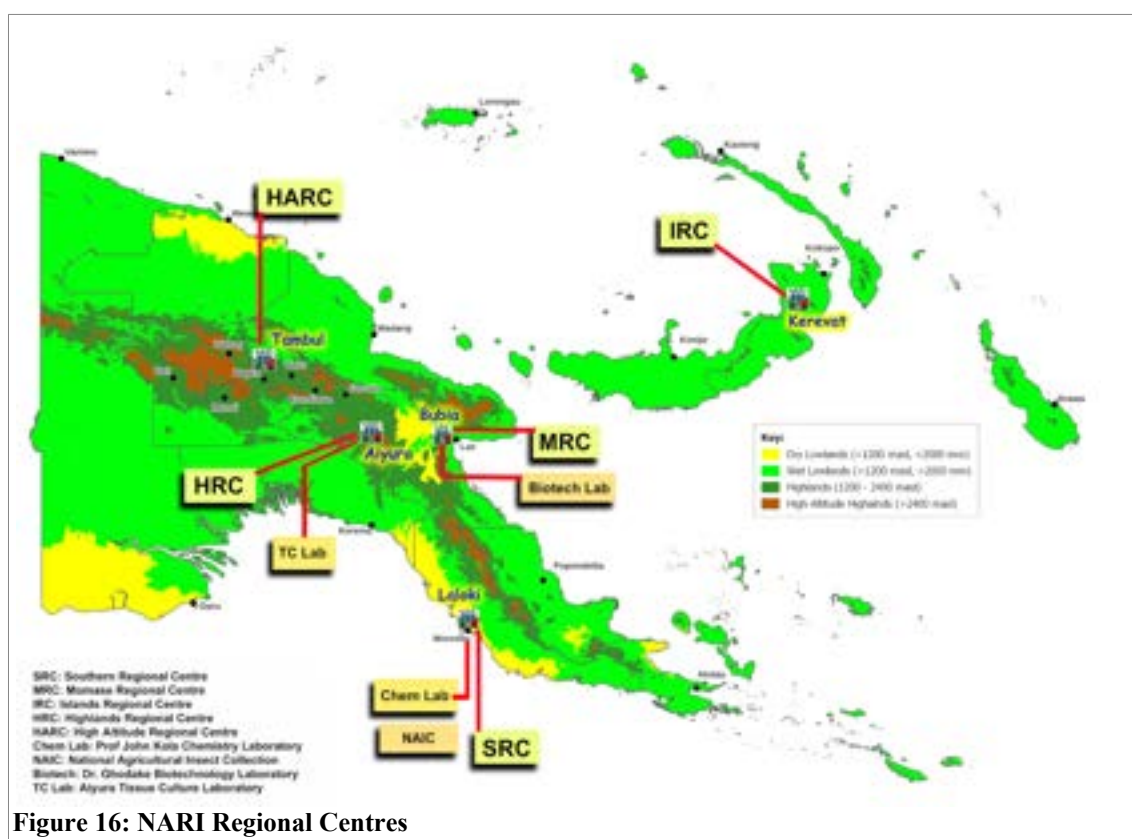
Highlands Regional Centre

The Highlands Regional Centre (HRC) is in the Aiyura valley, close to the township of Kainantu, Eastern Highlands province. HRC Aiyura is situated at an altitude of 1664 metres above sea level (masl). The centre supplies the demand for foundation planting material for improved crop varieties and other planting materials for both commercial production and building of resilience to climate change and other natural disasters. HRC is the centre for several research studies in soil management and pest management, particularly in relation to the sweetpotato value chain.

High Altitude Regional Centre

Tambuli in the Western Highlands province at 2200masl focuses on locations in the higher altitude range, from 1,800 to 2,850 masl.

The centre maintains planting material to supply foundation stock for adapted village chickens and high altitude adapted crop varieties for both commercial production and building of resilience to climate change and other natural disasters. Key focus crops have been potato, sweetpotato, wheat, and pyrethrum.



Islands Regional Centre

The agro ecological zone for the Islands Regional Centre (IRC) is the wet lowland and islands including atolls. Formerly known as Lowland Agriculture Experimental Station (LAES), the IRC is based at Keravat in the Gazelle Peninsula of the East New Britain Province. It services the agricultural research needs of the five island provinces of East New Britain, West New Britain, New Ireland, Manus and the Autonomous Region of Bougainville.

Galip research and development piloting value chains of quality Galip primary and secondary product (kernel, oil), has been a key focus for the Islands Regional Centre. Apart from Galip, maintenance of germplasm collections of food and cash crops of the region and implementation of the EUCCR and CSA projects have been key activities.

Momase Regional Centre

The Momase Regional Centre (MRC) research and development activities are coordinated from Buba, Lae, Morobe province. Research and development initiatives at MRC is focused on both

livestock and food crop improvement; germplasm maintenance; pest and disease management; post harvest and food technology; lowlands food crop screening, evaluation and multiplication; integrated farming systems, and marketing systems.

The main focus of livestock research for development is on the delivery of appropriate technologies to make smallholder livestock production more effective and sustainable, especially on developing low cost feeding options through enhanced utilisation of local feed resources for priority small livestock such as pigs, chickens, ducks, goats, sheep and rabbits.

MRC also hosts a biotechnology research laboratory. The current focus has been on disease diagnosis using molecular tools, development of tissue culture protocols for the response to BWAP, and development of protocols for preparation of materials for invitro mutagenesis.

Southern Regional Centre

The Southern Regional Centre (SRC) is located at Laloki in the Central Province, about 30 km outside the capital, Port Moresby. Research and development activities of the Centre are focused on dry-lowland areas of the country. The Southern Region includes the Western Province through to Gulf and Central to Milne Bay and Oro Provinces.

Most of the current research and development activities are related to building climate change resilience under a European Union funded action, and multiplication of quality foundation seed with assistance from the Taiwan Technical Mission (Taiwan ICDF). The Centre also conducts conservation, characterisation, evaluation, maintenance and documentation of the national plant genetic resources (PGR) ex-situ collections of banana, yam, cassava and aibika.

National Agricultural Insect Collection

The National Agricultural Insect Collection (NAIC) located at Kilakila, Port Moresby. NAIC provides an insect identification service and holds more than 10,000 insect specimens.

Prof John Kola Chemistry Laboratory

The John Kola Chemistry Laboratory located at Kilakila, Port Moresby. It is an ISO/IEC 17025 registered laboratory and offers a wide range of services including chemical (trace and heavy metals), physio-chemical parameters (ions and anions) and bacteriological testing.

Aiyura Tissue Culture Laboratory

The tissue culture laboratory in HRC Aiyura is a shared facility with the Coffee Industry Corporation (CIC). NARI manages the facility and has been able to consistently provide pathogen free potato plantlets to the Fresh Produce Development Agency (FPDA) as foundation material for the national seed potato scheme. Supply of foundation planting material of potato late blight (PLB) resistant potato varieties continues as a key contribution to the commercial potato industry, reducing the need for chemical fungicides. The laboratory also provides pathogen free (PT) sweetpotato cuttings of commercial varieties.

Annex 9: Acronyms and Abbreviations

| | |
|---------|--|
| ACIAR | Australian Centre for International Agricultural Research |
| AIP | Annual Implementation Plan |
| AR4D | Agricultural Research For Development |
| BCS | Bogia Coconut Syndrome |
| CABI | Center for Agriculture and Biosciences International |
| CCR | Climate Change Resilience |
| CSA | Climate Smart Agriculture |
| CIP | International Potato Centre |
| CPL | City Pharmacy Limited |
| DAL | Department of Agriculture and Livestock |
| ENB | East New Britain |
| EU | European Union |
| EUCCR | European Union funded action for climate change resilience |
| FAW | Fall Army Worm |
| FFL | Frangipani Fresh Foods |
| FPDA | Fresh Produce Development Agency |
| CNC | Galip Nut Company |
| GRFA | Genetic Resources For Agriculture |
| HARC | High Altitude Regional Centre |
| HRC | Highlands Regional Centre |
| IAEA | International Atomic Energy Agency |
| ICDF | Taiwan International Cooperation and Development Fund (TTM Taiwan) |
| IPM | Integrated Pest Management |
| IRC | Islands Regional Centre |
| ITPGRFA | International Treaty on Plant Genetic Resources for Food and Agriculture |
| KIT | Kernel in Testa (Galip) |
| LAES | Lowlands Agricultural Experiment Station |
| LLG | Local Level Government |
| MRC | Momase Regional Centre |
| NAIC | National Agricultural Insect Collection |
| NARI | National Agricultural Research Institute |
| NAQIA | National Agricultural Quarantine Inspection Authority |
| NGO | Non-Government Organisation |
| NIP | Nut in Pulp |
| NIS | Nut in Shell |
| PGR | Plant Genetic Resources |
| PIP | Public Investment Program |
| PMNEC | Department of Prime Minister and National Executive Council |
| PPP | Public Private Partnership |
| PT | Pathogen Tested |
| RA | Result Area |
| R4D | Research for Development |
| SIP | Strategic Implementation Plan |
| SP | Sweetpotato |
| SRC | Southern Regional Centre |
| SRF | Strategy and Results Framework |
| SSS | Storage, Seed, Sprouting |
| TADEP | Transformative Agriculture & Enterprise Development Program |
| TLC | Tissue Culture Laboratory |
| TOT | Training of Trainers |



NARI Logo - The letters NARI are the initials of the National Agricultural Research Institute. The PEOPLE symbolise those included in the mandate of NARI such as farmers, researchers, extension agents, partners, NGOs etc., backed with **BLUE** to encompass the sky and the macro environment. The LEAF symbolises crops, backed with **GREEN** to depict the crop environment. The PIG and CHICKEN heads symbolise livestock. The **RED** background portrays the toil and sweat of the people.

Our international development partners play a key role in enabling the National Agricultural Research Institute to achieve its development objectives. The Institute gratefully acknowledges the generous support of our international partners.



Contact NARI



National Agricultural Research Institute
Sir Alkan Tololo Research Centre
P.O. Box 4415, LAE 411
Morobe Province, Papua New Guinea

Phone: (+675) 4784000

Email: naripng@nari.gov.pg

Website: <https://www.nari.gov.pg>



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