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IN RESEARCH FOR DEVELOPMENT

SPECIAL REPORT

PAPUA NEW GUINEA



## Australia's commitment to Papua New Guinea

BY WARREN PAGE

This edition of *Partners* features a special report on Papua New Guinea (PNG), Australia's nearest neighbour. Many of the stories were photographed and written by Paul Jones, a photojournalist who has worked for leading newspapers in Australia and the UK, and covered major stories such as the election of Nelson Mandela as the first post-apartheid President of South Africa.

Paul describes his travels on page 4 of this issue. During his time in PNG he met a range of people involved in ACIAR projects, each passionate about furthering development in the country. PNG faces many challenges, but there is progress and some good news emerging from ACIAR projects.

The contrasts within PNG are many. While the country is resource-rich and has positive economic growth, it is also struggling to meet the Millennium Development Goals.

Perhaps the most striking example of this is found in the World Bank estimate that there are just 400 doctors in the whole of PNG, despite a population of 7.3 million people.

**Of PNG's population, about 40% live in poverty. Increasing agricultural productivity, particularly in isolated communities, has the potential to lift many people out of poverty.**

The majority of those 7.3 million people work in and rely on the informal economy, where subsistence farming accounts for the bulk of economic activity. Of PNG's population, about 40% live in poverty. Increasing agricultural productivity, particularly in isolated communities, has the potential to lift many people out of poverty.

ACIAR's focus on agriculture draws together a range of thematic research clusters that encompass entire supply chains and are designed to deliver benefits to the rural smallholders who make up the majority of the population. The four clusters—economics and social sciences, crops, natural resources management, and livestock and fisheries—each contribute to the PNG program operated by ACIAR.

This issue reports on some of the main crops, notably research to overcome the challenges facing production of oil palm (see page 6), the emerging opportunities for vegetable production (page 24) and efforts to safeguard the leading export crops from pests and diseases.

A feature of agriculture in PNG is the role women play, including in science and research. The efforts of a small number of these women are reported on page 28, with another story, on page 16, focusing on some of the scientists working with ACIAR.

### ACKNOWLEDGING OUR PARTNERS

One of the most difficult issues we face in compiling *Partners* is how to acknowledge all the individuals involved in, and who contribute to, the success of ACIAR's projects. Just listing each person and the institute or organisation they work in would take up more than two full editions.

Inevitably we have to make hard choices, focusing stories around a particular approach or the availability of people for interview, or their presence on the ground. So we cannot include every project person. This does not mean we do not value their contributions, nor that we have ignored those contributions. It is a matter of editorial decisions and our ability to access project personnel.

Having said that we do occasionally get it wrong. In the 30th anniversary edition, on page 61 we featured a piece titled 'Happy Seeder', where we said the seeder was "a power tiller implement designed by semi-retired Australian farm manager and agronomist John Blackwell". This should have said the Happy Seeder is "a power seeder implement designed by Australian Professor John Blackwell". This was a mistake by the Executive Editor, and we extend our apologies to John. ■

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**PAPUA NEW GUINEA**



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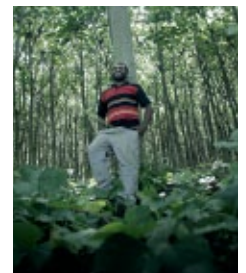
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# MY TRAVELS IN PAPUA NEW GUINEA

BY PAUL JONES

I'd heard the wild stories, but I had no idea what Papua New Guinea (PNG) was really like.

I had read PNG remained relatively untouched, isolated from most of the world, with challenging landscapes. I had also read that the country had an incredible biodiversity of flora and fauna, volcanic activity and rich soils. Not to mention more than 700 languages and as many unique cultures.

Meeting with ACIAR's PNG country manager, Emily Flowers, in Port Moresby, we headed straight for the airport. So rugged is the terrain, travel between the major centres throughout my visit was almost exclusively by air.

On landing at our first destination, the island of New Britain, I thought it was strange to hire a large four-wheel drive. It didn't take me long to realise that most roads in PNG are poorly maintained and hindered by potholes and landslides. After a two-hour drive we reached our first ACIAR project site.

Here we met with the incredibly hard workers of the PNG National Agricultural Research Institute. They proved a dedicated group of professionals keen to promote agriculture development in PNG for the economic, social and cultural wellbeing of its people.

After New Britain we flew back to the mainland to visit PNG's Central Province. This region has great potential to produce a wide range of vegetables—cabbages, broccoli, onions and others—but current production is insufficient to meet increasing demand. ACIAR has a range of projects underway to promote a new approach to helping local farmers make the most of their vegetable cultivation.

As we made our way, crisscrossing the country—visiting cocoa farmers, balsawood tree growers, scientists, researchers, palm oil specialists and food crop gardeners—I was overwhelmed by the hospitality of Papua New Guineans. On every occasion, people would welcome us and take the time to explain their involvement in the community's ACIAR projects.

Looking up from Morobe Province to the towering mountain ranges of PNG it wasn't hard to imagine that early explorers thought they were impenetrable. They appear even more formidable than their reputation. Such



landscapes highlight ACIAR's commitment in projects such as small-scale fish farms producing tilapia, carp and trout for home consumption and sale, or tree cultivation incorporated into traditional farming systems, or the development of floriculture enterprises to improve livelihoods for families in these areas.

My photographic assignment to PNG was an amazing eye-opener. Not only did I

meet dedicated individuals but I also had the opportunity to witness and photograph—in some of the most beautiful landscape settings—some truly important ACIAR projects.

I think Gorethy Dipsen, a landscape and biodiversity officer working on an ACIAR-funded agroforestry project, summed it all up; "With our ACIAR project here, there is the promise of a brighter future in PNG." ■



ACIAR's commitment to raising awareness about the role agricultural science plays in global food security and rural development extended in 2011 to sponsoring a visit to Papua New Guinea by photojournalist Paul Jones. Over the past 23 years Paul has worked as a staff photographer for the *Sydney Morning Herald* and the *Australian Financial Review* and as a freelancer for *The Australian*, *London Sunday Times*, *The Guardian*, *Associated Press* and *Agence France Presse*. He has travelled extensively throughout the world, including spending time in Jerusalem documenting the Israeli–Arab conflict and in South Africa witnessing the end of apartheid and the election of Nelson Mandela. He considers his visit to Papua New Guinea a career highlight.





# The sustainable route to a vibrant palm oil industry

Placing the palm oil industry on a sustainable and environmentally accredited footing is a key concern for Papua New Guinea that is being achieved with a little help from agricultural science.

BY PAUL JONES

**O**il palm is the most valuable export crop in Papua New Guinea (PNG), supporting about 18,600 registered smallholder families and an estimated 200,000 people.

It also drives the cash economies of the five

provinces in which it is grown: West New Britain, Northern, Milne Bay, Morobe and New Ireland.

Safeguarding the more than K1 billion (A\$471 million) derived from exports of oil palm is of critical national importance. ACIAR's partnership with the PNG Government and research agencies helps ensure these

economic benefits continue and flow down to smallholders. For the scientists working in PNG through ACIAR support this translates to a strong focus on supporting environmentally sustainable management practices.

On the ground, the net results are multi-faceted partnerships between Australia, PNG



Roadside collection of fresh fruit bunches.



A handful of palm fruits.



A palm oil mill in Papua New Guinea.

and the private sector that encompass research, extension, training, environmental accreditation and local socioeconomic development.

### SUSTAINABLE MANAGEMENT OF SOIL AND WATER RESOURCES

Sustainable oil palm cultivation is supported by ACIAR through the project *Sustainable management of soil and water resources for oil palm production systems in Papua New Guinea* (SMCN/2009/013). The Roundtable on Sustainable Palm Oil (RSPO) was formed in 2004 with the participation of all PNG oil palm producers to explicitly pursue the growth and use of sustainable oil palm products.

The scientific expertise assembled through this project makes it possible to develop practical indicators for environmental sustainability that are also of agricultural and economic value to PNG's palm oil industry, including its smallholders.

These efforts contribute to something essential for the industry's long-term viability, given international sustainability concerns over the production of food (PNG's main focus) and biofuels—environmental accreditation.

The science that makes this possible revolves around three key areas:

1. The identification of the main risks to sustainability that smallholder oil palm growers face and development of options for managing these risks.
2. The establishment of management practices that ensure sustainable use of soil and water resources.
3. The development of indicators to assess performance and guide management that is complementary to the RSPO.

Taking part is agronomist Steve Nake and his team from PNG Oil Palm Research Association (OPRA). When I met him in West New Britain Province, his team was taking soil samples from

### At a glance

Oil palm is a popular crop as it produces six to 10 times more oil per unit area than other vegetable oils such as soybean or sunflower. Due to its high yield per unit area, oil palm has become a major agricultural crop in many tropical countries where it has helped alleviate rural poverty.

In Papua New Guinea, the oil palm industry is small by international standards—in total oil palm is cultivated on 134,000 hectares, which accounts for about 1% of global palm oil production. It is nonetheless the nation's largest agricultural export earner. Oil palm is grown in plantations owned by two companies and on more than 18,000 smallholder blocks.



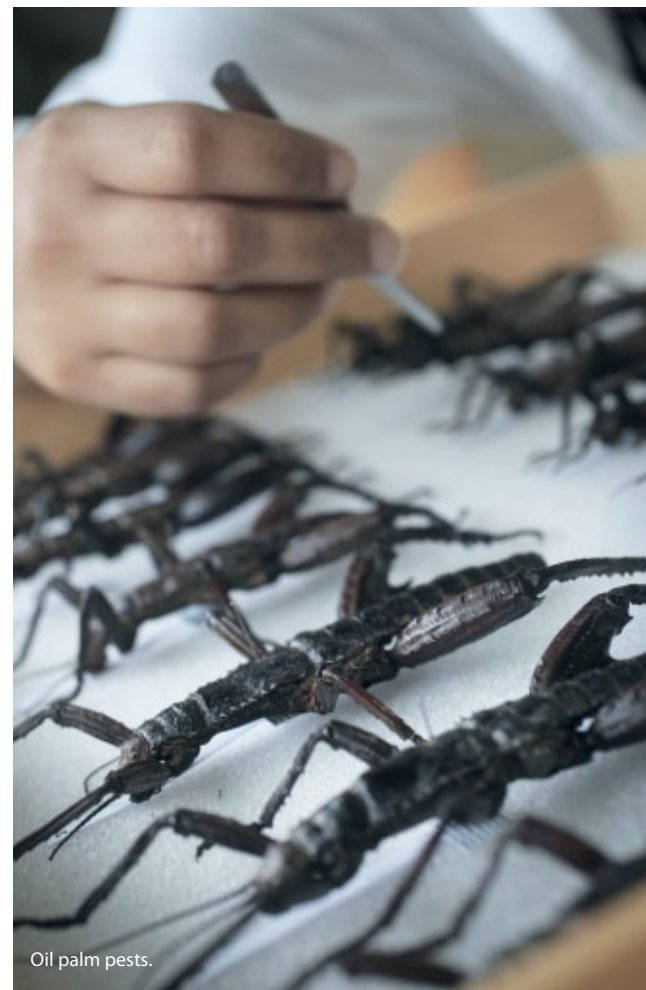
Inside the palm oil processing mill.



Oil palm pests.



Laboratory activities associated with palm oil processing.



Oil palm pests.

around an oil palm tree nestled at the base of a hill. Activities like these are one of several components involved in enhancing agricultural productivity by safeguarding the conservation of soil and water resources.

"I'm the guy on the ground in regards to research of oil palm in West New Britain," Steve Nake says. "My key concern is to determine the optimum nutrient requirements for oil palm grown in different areas. Everything works hand in hand here: look after the oil palm production and you look after the community."

**BENEFITS OF PRIVATE SECTOR INVESTMENT**

Commercial sector partnerships in the oil palm industry in PNG are part of ACIAR's research approach. It is a decision that has helped spread information about best management practices, in addition to raising smallholder productivity and incomes.

The commercial sector invests heavily in the industry, including through the provision of farm management advice, in the sale of inputs to smallholders and in the establishment of joint-venture companies with customary landowner groups.

Of particular value has been the development of effective land-use agreements between the

commercial sector and customary landowners. These agreements, along with the rollout of an innovative payment system for inputs to lift production, is helping manage the realities of smallholder production.

These positive developments rely heavily on an R&D strategy that understands smallholder issues, providing four areas for further development:

- an understanding of the socioeconomic factors that affect productivity among smallholders;
- improvements to smallholder agronomic and farm-management strategies;
- an understanding of smallholder livelihood strategies and their influence on smallholder production; and
- analysis of recent socioagronomic changes occurring among smallholder producers.

One of the participating companies is the Oil Palm Industry Corporation (OPIC) in Hoskins, West New Britain Province. One of its managers, Frank Bao, looks after 1,600 oil-palm-growing smallholder farmers.

He says the primary aim of the research is to develop appropriate extension interventions that improve smallholder oil palm productivity and strengthen the economic and social

wellbeing of smallholder households.

"Insect pests are an all-too-common production constraint," Frank Bao says. "So our role is to help the farmers identify problems and pests on their farms."

Martin Reky, a farmer who grows vegetables, coconuts and oil palm on his small farm near the township of Mai in West New Britain Province, approves of the research emphasis. "The palm oil is a good cash crop, but I do have problems with stick insects and *Sexava* grasshoppers," he says.

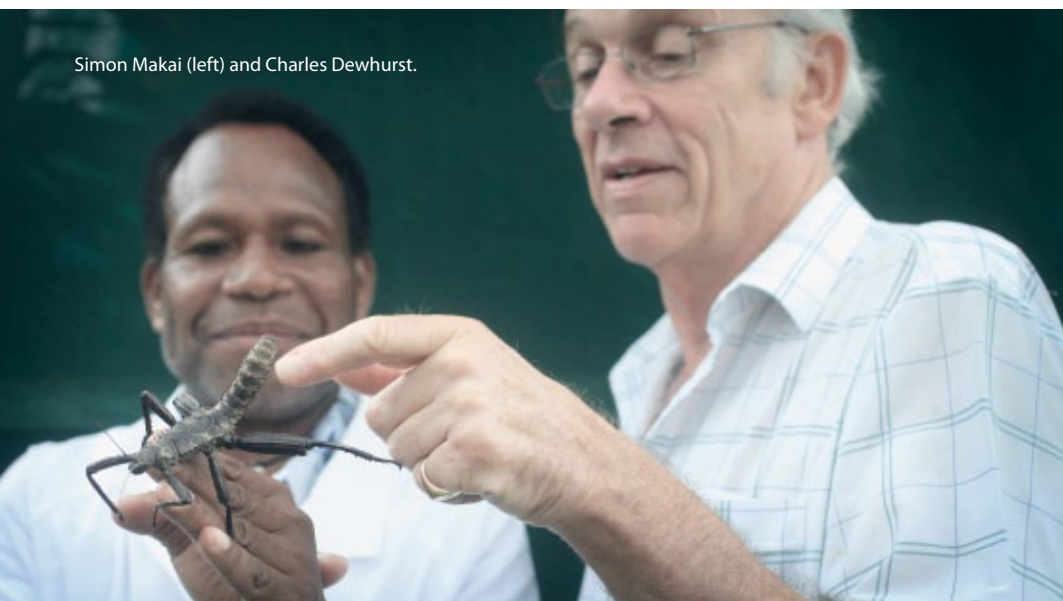
**ENTOMOLOGY AND THE CONTROL OF PESTS**

Charles Dewhurst is the head of entomology at PNG OPRA and his passion for his work shows through. His eyes light up when asked a question about his favourite insect, the *Sexava*—PNG's principal oil palm pest.

*Sexava* is a group of insect species from the Tettigoniidae family—variously known as long-horned grasshoppers, katydids or bush crickets. These insects cause damage by feeding on the oil palm fronds. Where populations are high, the resulting defoliation can be extremely severe, resulting in reductions in photosynthesis and lower fruit yields.

"Our main focus is on integrated pest

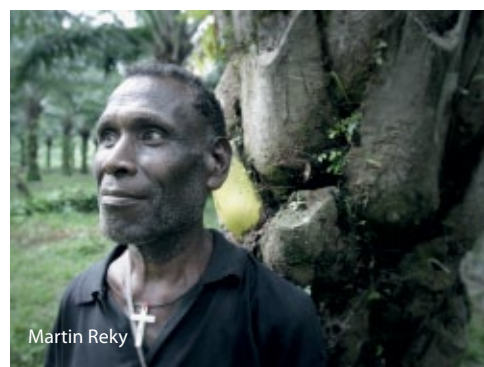




Simon Makai (left) and Charles Dewhurst.



Lazarus Kewaka



Martin Reky

management, or IPM, where we control our pests in the most environmentally friendly way," he says. "That means we minimise the use of insecticides or other chemicals."

PNG OPRA's entomology section deals with all the main pests, including long-horned grasshoppers, stick insects, bagworms, rhinoceros beetles and leafhoppers, as well as rats, snails (pests of the cover crop) and plant pests such as mile-a-minute weed and Siam weed—both of which have been the subject of successful biological control efforts supported by ACIAR.

Their research serves two main functions. They advise PNG's oil palm industry on all pest problems and make recommendations on control. They also undertake research on the control of these pests—particularly using IPM techniques—and work on the conservation of beneficial insect species such as pollinating weevils.

#### THE CONTROL OF BASAL STEM ROT

The most serious disease of oil palm is basal stem rot, caused by the wood-rotting fungus *Ganoderma boninense*. It is a disease that reduces oil palm yields in most production areas of the world. Although the cause of the disease was identified more than 50 years ago,

there is still no fully effective means to control it and the disease appears to be on the increase.

Where basal stem rot incidence increases progressively, it slowly but inevitably erodes profitability. In 1997 it was identified as a major threat to the oil palm industry in Solomon Islands. In 1998, PNG OPRA initiated a research program (funded by the European Union) that recorded disease levels in some blocks as high as 43%.

One of PNG OPRA's field technicians Lazarus Kewaka explains that *Ganoderma* produces enzymes that degrade the oil palm tissue and affect the infected oil palm xylem. This causes serious problems for the transportation of water and other nutrients to the top of the palm tree.

Basal stem rot leaves growers with little choice but to remove any infected trees in the hope of slowing its spread. This causes problems where replanting occurs in coconut and oil palm plantations. During replanting, if the felled oil palm trunks and stumps are left to rot in the field, numerous fruiting bodies of *Ganoderma* may be produced and spread the disease. The fungus is also believed to spread through the soil from infected stumps and roots.

A regional approach is emerging to tackle this issue. ACIAR has funded research in Solomon Islands, partnering with PNG OPRA

to examine management options. Researchers are seeking ways to reduce the carry-over of the disease during replanting and, for the longer term, are using molecular techniques to identify sources of resistance to the disease that can be developed through plant breeding. However, progress takes time, especially in a slow-growing crop like oil palm, where even an infected palm may take several years to manifest symptoms of the disease.

"It is sad to say, this deadly disease has long been discovered, but currently there is no effective measure to eliminate it," Lazarus Kewaka says. "*Ganoderma* is fast becoming a major threat to oil palm cultivation and palm oil production in PNG."

Field control of basal stem rot through control of the infection cycle of the pathogen is an important component of Lazarus Kewaka's research. His Plant Pathology division carries out training for both plantation and smallholder farmers in measures they can take to slow the spread and mitigate the impact of the disease.

"The most effective method is to remove the tree and expose the stem rot to sunlight," he says.

#### GROWING VEGETABLE CROPS ALONGSIDE OIL PALM

Far from focusing on the cultivation of oil palm in isolation, in PNG it is often dealt with in the context of greater food security. This is the case for Jesse Anjen, one of PNG OPRA's socioeconomists. His latest trial project is to create wider spaces between oil palm trees to enable farmers to plant food crops.

Jesse Anjen is working with Carl Tuoro, senior extension officer at OPIC, and Emmanuel Germis, an economics supervisor at PNG OPRA. This team is looking at the effect of current population growth on the oil palm areas and the increasing food demand of these local communities.

For Emily Flowers, ACIAR's country manager for PNG, this kind of commitment to smallholders and attention to detail strongly reflects a longstanding commitment to Australia's Pacific neighbour. When it comes to PNG, ACIAR is in for the long haul, she says.

"ACIAR has a formal program of consultation with PNG to establish priorities in research collaboration, as well as regular smaller consultations and industry workshops to finetune these priorities."

"PNG is one of Australia's most important development partners and ACIAR's investment is based on—and committed to—improved adoption of innovations that respond to real needs and deliver meaningful benefits to PNG." ■

# VARIETY IS THE SPICE OF PRODUCTIVITY

With its small land holdings, low resilience to risk and uncertain market access, subsistence farming presents problems for development in Papua New Guinea that ACIAR is helping to solve through projects that have a common theme: diversification.



## BY WARREN PAGE

For smallholder farmers, a poverty trap refers to a situation where growing one or two crops will never result in sufficient production to deliver surpluses. These 'traps' occur where subsistence production is the priority.

Lack of knowledge of different approaches and practices, including new crops, can be a major constraint, as can cultural issues and barriers to adoption.

A common feature of many smallholder producers, in Papua New Guinea (PNG) and elsewhere, is the reliance on one or a small number of crops.

Often the choice is between a staple and a cash crop. Cash crops are more often favoured. Some husbandry, usually of poultry or pigs, also occurs.

The prevalence of cash crops, particularly coffee, cocoa and oil palm, and the lack of market access for smallholders result in limited opportunities to grow and profit from any small surpluses achieved.

The limited size of operations does not generate economies of scale that can increase income, access to labour or other inputs. In addition this can also create a reluctance to diversify, even though this is one of the best options available to smallholders. The key is convincing smallholders that something is going to work, given the risks involved.

A recent impact assessment publication, *Lessons learned from past ACIAR impact assessments, adoption studies and experience* (IAS 69), examined the elements of a successful project. The important lessons identified included the link between the users of the research having incentives and communicating outputs, such as practice change, with reference to those incentives.

Diversification can take different paths, such as furthering the uses and opportunities around an existing production system or introducing new systems.

Sweetpotato, consumed as fresh tubers and used as pig feed, is an important staple in PNG. Processed sweetpotato products have

been successfully commercialised in a number of countries, opening up new markets. Yet at the same time small quantities of frozen sweetpotato have been imported into PNG.

Domestic processing in PNG is limited to research and product development, focusing on varietal evaluation for its suitability and potential, mainly in producing composite wheat flours for baking products.

Such work taken in isolation is unlikely to lead to benefits for smallholders.

Complementing this work is research to improve economic returns and incomes of sweetpotato farmers and supply chain operators through the adoption of improved sweetpotato marketing systems. This will focus on reducing both postharvest losses and the costs of marketing, while also identifying the major constraints to the adoption of post-harvest technologies.

Creating new approaches that result in new markets and opportunities is one facet of diversification. For most, the ultimate aim is introducing new systems. One such system is inland aquaculture.

There are already more than 10,000 small-scale fish farms in PNG producing tilapia, carp or trout for home consumption and sale. Interest in aquaculture continues to climb. However, current production levels are low when compared with South-East Asian systems.

Neither husbandry techniques nor planning can be ignored, as both present constraints to the wider adoption of aquaculture. ACIAR is supporting the development of aquaculture planning systems for management agencies and improvements in fish husbandry techniques for primarily small-scale fish farmers in PNG.

There is no simple means of diversifying, nor one path or road. Each situation is unique. ACIAR's successes, some described in the stories that follow, are based on winning smallholders over to the idea that the benefits of adopting new practices far outweigh the risks. ■



# FARMING FISH FOR CHANGE

BY JACOB WANI, WALLY SOLATO AND JESMOND SAMMUT\*

An ACIAR project to improve fish production for food and income security is having a positive social impact in Papua New Guinea (PNG). Reduction in crime, tribal war and antisocial behaviour, and increases in self-esteem in individuals and cooperation between former adversaries are just a few of the effects of the project.

A novel prisoner rehabilitation project titled Fish for Prisons, introduced by the National Fisheries Authority (NFA) of PNG in collaboration with ACIAR, is paying dividends. First trialled at Bihute Prison on the outskirts of Goroka in the Eastern Highlands Province, the program teaches both inmates and correctional officers basic fish farming.

"Most often prisoners are not rehabilitated and they find it difficult to fit back into society after release from prison," says Jacob Wani, who initiated the program. "Consequently they end up back in prison for the same, or an even more severe, offence. The ACIAR project's interventions are changing this."

Introduced in 2008, the program has trained many officers and inmates. Eight ex-inmates have since returned to their villages and established fish farms to supply both fingerlings and table fish to their local communities. Since fish farming is a new activity, the knowledge of these ex-inmates is in high demand: fellow villagers are keen to learn aspects of fish farming, as well as to be supplied with fingerlings.

These ex-inmates were once scorned and feared because of their criminal past. Now they

are respected and sought after for leadership in fish farming. This has given the ex-inmates status and respect, enabling them to be useful members of the community.

## CHANGING LIVES

Moxy, who served time at Bihute Prison, is back in his Asaro village, where he farms genetically improved farmed tilapia (GIFT) some 15 kilometres north-west of the town

Goroka. Moxy has eight ponds with a total production capacity of 2 tonnes. "Had it not been for fish farming, I would have revisited the circumstances under which I was jailed," he says.

"When I am angry or depressed, I go to the fish ponds and either feed the fish or just watch to take my mind away."

The trial at Bihute Prison has attracted the attention of other prisons and now the program is unofficially being implemented at



Former Bihute inmate Moxy holding tilapia broodstock. Moxy was trained to farm fish under the Fish for Prisons program and is now being mentored by the ACIAR team.

PHOTO: JES SAMMUT

four more prisons across PNG. According to some jail commanders, the program not only trains inmates and officers, but also provides food and income for the prison through sales of fish. With encouragement from the prison system, the NFA and ACIAR will expand the program to prisons around PNG that have suitable sites for fish farming.

"The participatory approach of the research program enables prisoners and officers to learn by working closely with the researchers," says NFA scientist and ACIAR project manager Wally Solato. "This builds trust and confidence, and the project team continues to mentor ex-inmates to ensure that they have the technical and moral support to start their own fish farms."

The project's community activities have also had a positive social and economic impact in the isolated areas of the highlands. The Nebliyer Valley, for example, experienced many years of tribal warfare and problems with serious crimes. Villagers in the valley lived in fear and isolation because of the ongoing tribal war. But arms and weapons are now being traded for spades to dig fish ponds.

Fish farming was introduced to the Nebliyer Valley by community-based government extension officers, non-government and faith-based organisations. The ACIAR project team has played an important role in training farmers in fish husbandry and pond construction. Formal and informal training have enabled the team and lead farmers to create successful learning partnerships that improve income and food security and have also resulted in improved safety and security for villagers.

### SHARING THE BENEFITS

ACIAR team members have focused their training in the villages of Tilga, Tonamb and Kombka, but the knowledge on fish farming is spreading from these project nodes.

Two of the project's lead farmers, Jacob Towa and Markus Tumba, have become advocates for fish farming in the Nebliyer Valley. Both are local leaders who, armed with knowledge of the benefits of farming fish, have been promoting farming throughout the valley and the surrounding highland provinces.

"We have a strong relationship with these lead farmers and have taught them about all aspects of fish farming," Wally Solato says. "They are an important voice for our project. People trust them and our relationship with them ensures that the research results can be disseminated widely.

"Jacob and Markus started with nothing but can now boast what fish farming has done for them individually. They have laid down weapons, like many young men in the area.

Teaching people to farm fish in Papua New Guinea has more than just added protein to their diet; it has had life-changing outcomes.



Prisoners from Bihute Prison harvesting fish.

PHOTO: JES SAMMUT

They were initially ridiculed and discouraged by warring villagers. But the success of their fish farming has turned people around. Others now want to have the same success and Jacob and Markus are willing to share their knowledge and experience."

Annual income of farmers has increased threefold and this may rise further with improved farming practices rolled out by the research project.

"Before our program, many fish farmers were preoccupied by tribal war; now they work with their former adversaries," Wally Solato says.

Many of the villagers who have participated in the ACIAR training programs have seen tangible benefits. Their diets have improved and they are now selling fingerlings and table fish to meet other basic needs. The community has changed its perception of fish farming and now recognises its value as an alternative livelihood.

Before fish farming, antisocial conduct such as smoking marijuana and producing homebrew had a negative impact on youth. There was also urban drift that left villages with a smaller workforce for local food production. Youths working with the ACIAR project team have turned to digging fish ponds to help their community to produce fish as an alternative crop.

"The youths have been turning unused land and unproductive coffee plots to fish farms," Wally Solato says. "There are now 30-plus fish

farms that are stocked with GIFT and carp. We taught the lead farmers how to produce and distribute fingerlings, and we will continue to empower them with knowledge and technical support."

The lead farmers are now the primary suppliers of fingerlings. The ACIAR project provided the broodstock and necessary training in fingerling production. The GIFT fingerlings are now being distributed as far as the Hela and Enga provinces.

"We are happy and fish farming has helped us in terms of food security and improved our daily earnings to meet other personal needs like school fees and household goods," Markus Tumba says.

The benefits of the project go beyond the prison scheme and areas affected by tribal war. Retiring military officers, new recruits, schoolchildren, university graduates and communities affected by mining are all participating in the project's research and extension activities. Farming fish can bring communities together and help individuals to build their self-esteem and reach their full potential. ■

\* Jacob Wani and Wally Solato, from the National Fisheries Authority of PNG, are the local ACIAR project leader and ACIAR project manager respectively. Jesmond Sammut is based at the University of New South Wales and serves as the Australian project leader.

# BLOSSOMING MARKETS

BY PAUL JONES

**W**omen in colourful dresses crowd around a large bucket of beautiful flowers, splendid in their diversity and range, from pink to bright yellow. These local Lae women have brought a selection of different flowers and plants to show Barbara Toni of the National Agricultural Research Institute (NARI).

Endo Gaif's face lights up as she shows off her prized Kaimuki (Macgillivrayi). "One day I would like everybody to see the beautiful flowers and colours of Papua New Guinea," she says. Tapping into this interest in floriculture, or flower farming, has the potential to help Endo and her fellow Lae women, and many others, earn an income.

"There is a great enthusiasm for demand and supply of flowers in PNG," Barbara Toni says. "With a little help, floriculture could become one of the leading income earners for women here." In PNG there is very little commercial flower production, despite the market demand, favourable water, soil and

climate conditions. Culturing flower species has rich potential as it can be done in resource-poor communities, whether situated in remote, rural or peri-urban areas.

With ACIAR support a project is underway to evaluate market opportunities to help this new industry blossom and create change amongst the women eager to embrace this industry. Parallel efforts are occurring in Fiji and among Indigenous communities in Australia's Northern Territory.

Part of that process involves evaluating the main constraints the PNG women face in developing an industry, particularly pests and diseases, limited skill levels, quality issues, and limited packaging and storage technology.

These can then be addressed with the support of appropriate technical staff and training programs. A worthwhile cut-flower industry could be built around a significant expansion of the domestic market, supplemented by niche export of specialty products. The idea is to exploit growth in the world trade of floricultural products—live



ornamental plants, as well as cut flowers and foliage—by tapping the rich biodiversity of the Pacific and Australian regions.

Realising the market opportunities for floriculture taps into ACIAR's work relating to women in agriculture, creating sustainable enterprises that generate income for Endo Gaif and her colleagues in Lae. ■



Endo Gaif (left) and Barbara Toni.

# PYRETHRUM-BASED INSECTICIDE PRODUCTION

BY EMILY FLOWERS

Despite their beauty, pyrethrum's ornamental flower heads are not what attracted Papua New Guinean highland farmers to adopt the plant as a cash crop long ago. Instead, the flower heads of the white pyrethrum daisy, *Tanacetum cinerariifolium*, are a source of a fast-acting, low-toxicity insecticide and repellent.

Pyrethrum was introduced into Papua New Guinea (PNG) in the late 1950s and grown in areas of the highlands above 2,000 metres. From the 1960s the pyrethrum industry played a major role in sustaining the livelihood of up to 85,000 people, primarily in Enga Province, until the processing factory closed in 1995.

Although the factory re-opened in 2000, the PNG industry was unable to re-establish a market for its pyrethrum products. In 2007 a 4-year ACIAR-funded project set out to recommercialise the industry.

The project, however, could not succeed without the involvement of technical and commercial collaborators. To that end, ACIAR formed partnerships with the Enga Provincial Government (through the Enga Pyrethrum Company Ltd), the National Agriculture Research Institute (NARI) and the University of Tasmania.

These organisations work with Botanical Resources Australia (BRA), a Tasmanian company that is one of the largest pyrethrum producers in the world. The company agreed to purchase PNG pyrethrum conditional on the PNG industry improving production and processing standards.

The project has proven popular, highly effective and lucrative, especially for women.

Extension and promotion officers Janet Yando and Manday Yaso have been key agents in the revival of the pyrethrum industry in Enga Province. Since 2006 they have been building awareness among the farmers of the best ways to grow pyrethrum and have distributed pyrethrum seedlings to more than 10,000 farmers. Achievements include the establishment of more than 130 pyrethrum nurseries and the distribution of some 900,000 seedlings to growers in Enga Province. Since the project began the total number of growers has more than doubled, to 7,423 in 2010. Flower production has increased six-fold and is expected to continue to increase with improved planting materials and training activities.

A weekly market has been set up in Wabag for growers and transporters to deliver and sell their produce. Six cooperative societies were formed to act as local district 'centres'



Village life for subsistence farmers in Papua New Guinea.



Handpicking pyrethrum flowers, Enga Province.



Villagers helping with the establishment of a new pyrethrum seedling nursery, Enga Province.

for pyrethrum production, with emphasis on seedling production and trade in harvested flowers. This strategy has enabled economies of scale to be achieved through communal land tillage, harvesting and marketing.

Farmer training workshops have been held in local and remote villages, covering crop establishment, management, harvesting and postharvest storage. A bonus outcome has been increased awareness of HIV/AIDS and gender issues. Since many of the growers are women, village workshops have included distribution of HIV awareness pamphlets and condoms.

Growers receive K2.50 (A\$1.15) per kilogram at the market, potentially providing up to K125 (A\$57.50) per week. Income from pyrethrum usually stays with the women and is spent on the household, including children's school fees, food and health care.

This injection of money into the village economy provides a multiplier effect to the community. Income is used to improve the standard of living and to meet social commitments such as compensation payments and bride price.

Another very important outcome from this ACIAR project has been the capacity building of PNG participants.

One senior NARI research scientist, Kud Sitango, was awarded a John Allwright Fellowship during which he completed a masters degree in agricultural science at the University of Tasmania.

Teams of up to four PNG officers associated with extension, chemistry, crop production and factory operations have visited BRA in Tasmania. In addition, BRA staff have made 14 visits to PNG to provide guidance and support on all aspects of the pyrethrum production chain.

One of the major outcomes from this project is that pyrethrum can be incorporated into a smallholder mixed cropping system. For instance, it can be grown in rotation with a range of vegetable crops such as potatoes, carrots, beans and onions.

The success of this cropping system could become a sustainable industry strategy with long-term benefits for the community in terms of reduced poverty, empowerment of women, and better education and health outcomes. ■

Galip nut



## INDIGENOUS NUTS AND FRUITS

BY PAUL JONES

“Did you know these trees produce nuts, timber and traditional medicine?” says Simon Minnah, a field technician at the National Agricultural Research Institute (NARI).

As he prunes a row of *Canarium* nut trees, Simon explains that *Canarium indicum*, or galip nut tree, is indigenous to the lowland forests of PNG where it has been a culturally important and traditional food for thousands of years.

For smallholders indigenous nut species have income-generating potential and can concurrently improve food and nutritional security. Such far-reaching and long-term endeavours, however, first require research to overcome some of the main barriers to increasing commercialisation and smallholder involvement in new and emerging markets.

The domestic market for canarium has strong demand, but postharvest handling and processing to separate the nut from the fruit have previously produced poor-quality nuts.

Past ACIAR research has identified a range of improvements in the processing of the nuts. A



James Maora,  
Matthew Poienu  
and Simon Minnah.

new project, building on domestic demand, is also investigating value-adding and processing opportunities. The work includes examining export potential.

In the past few years there has been a number of projects funded by ACIAR and the European Union aimed at the wider commercialisation of the species.

NARI researchers James Maora and Matthew Poienu are looking at ways to improve the livelihoods of rural households as they work to advance the domestication and commercialisation process.

“Currently the market for canarium nuts is growing and the demand for nuts in the region exceeds supply,” Matthew Poienu says. “While the opportunity exists for commercialisation, we have to keep in mind that the scale of operations and level of technology must be viable at the village level for commercialisation to succeed.”

The outcomes of past ACIAR research to improve postharvest management and processing have provided a platform to build on. Developing markets and products is the next step to bring the goal of commercialisation a step closer to smallholders. ■

# PNG's scientific evolution

A nation as dependent upon agriculture as Papua New Guinea appreciates the value it gains from developing the scientific expertise of its people.

BY PAUL JONES

**M**ore than 85% of Papua New Guinea's 7.3 million people depend directly on farming for a livelihood. Much of this farming is at the subsistence level, despite the richness of the soils and potential for increased production.

Meeting the challenge of increasing production depends on helping farmers grow more. That task is difficult, given the remoteness of many villages, the diversity of languages and lack of infrastructure. Building capacity to create a strong domestic agricultural research sector is crucial to long-term sustainability. ACIAR is working to help the evolution of Papua New Guinea (PNG) agricultural capacity and deliver improvements to smallholders.

It is an ambition shared by the PNG National Agricultural Research Institute (NARI). The publicly funded statutory research organisation was established in July 1996 to conduct research on food crops, emerging cash crops, livestock and resource management issues. The institute also provides technical and diagnostic services, along with up-to-date information, to the agriculture sector. Its head office is located in Lae, in Morobe Province.

"What's NARI's vision for PNG?" asks NARI's director-general, Raghunath Ghodake. "We would like to see prosperous agricultural communities throughout PNG."

To help achieve this overarching vision, NARI's activities tap into a coalition of public, private and civil organisations at regional, national and international levels. These include AusAID, which provides funding, ACIAR project partnerships that engage Australian scientific expertise, the PNG University of Technology, the research centres of the Consultative Group on International Agricultural Research and the Secretariat of the Pacific Community.

"In addition to delivering technical and extension projects, each year we continue to develop further the institute and build on relevant capacities to create a congenial environment for agricultural research for development," Raghunath Ghodake says. "This too helps improve service delivery efforts to our primary clients—the smallholder farmers of PNG."

With so much riding on agricultural innovation, the breadth of NARI's activities is quite simply extraordinary. This is true of its institutional programs—which encompass Agricultural Systems Improvement, Enabling Environment, Information and Knowledge, and Institutional Management and Development—and geographical reach, with five regional research centres.

Making it all possible is NARI's dedicated and highly motivated staff, among them the following:

Raghunath Ghodake



**NORAH OMOT** is director of NARI's Enabling Environments Program. Standing around a whiteboard with four team members, brainstorming ideas on marketing, social economics, impact assessments and work monitoring, she actually identifies something else entirely as her key concern: "The big project we have been working on is climate change and its effects in PNG and Solomon Islands."

Norah Omot



## ACIAR SCHOLARSHIPS AND THE NEXT GENERATION OF PAPUA NEW GUINEAN SCIENTISTS

BY JAPHET NIVI\*,

ACIAR SCHOLARSHIP RECIPIENT 2009-10

Upon completion of my undergraduate studies at Papua New Guinea University of Technology (PNG Unitech) in 2008, I was awarded an ACIAR scholarship to undertake postgraduate studies at PNG Unitech.

In 2009, I started my postgraduate diploma program with a research major in Plant Protection and Ecology.

My research was entitled *Efficacy of native entomopathogenic nematodes (EPNs) as potential biological control agent for sweetpotato weevil in lowland humid conditions of PNG*, which was the first work on this topic in PNG and also the neighbouring Pacific islands.

I completed my postgraduate diploma research in 2009 and won ACIAR's award of excellence for best research presentation for a postgraduate diploma.

Because of the pioneering nature of the study in PNG, in 2010 I upgraded

to a Master of Philosophy (by research work). I successfully completed the research dissertation the same year and qualified for the masters degree. The awards I have obtained during my studies have also helped me to qualify for employment opportunities.

The ACIAR scholarship has contributed a lot in my personal academic development in PNG. Furthermore, it made many positive contributions to the Department of Agriculture with its Staff Training and Development program. Most of all, the scholarship has helped my poor parents in their financial burdens, thus my family are indebted to ACIAR for the job well done in PNG.

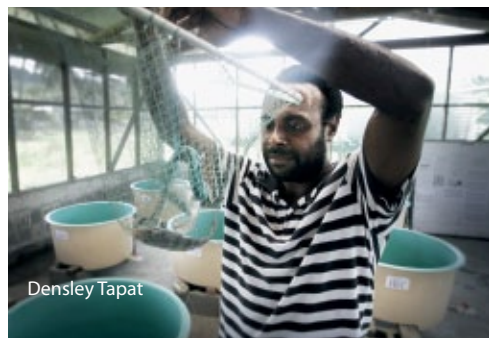
Without doubt, I believe the ACIAR scholarship is the best and most reliable scholarship scheme and that it can make you someone in the future. I have benefited a great deal from the scholarship during my two years of studies and also in my current work on the research projects in





Sim Sar (right) training scientists.

■ **SIM SAR** is NARI's director for Agriculture Systems Improvement Program. He looks after a wide range of research from crops through to livestock. Gains to productivity are his main focus. Sim Sar has worked extensively throughout PNG. "Research is not a short-term but a long-term fix for PNG," he says.



Densley Tapat

■ In NARI's Aquaculture section **DENSLEY TAPAT** keeps and breeds carp and tilapia, which are then distributed and sold to farmers around the country. He also conducts research into producing sustainable fish feed. "In here we have fingerlings and it is great to know that these fish will go all over the country to small aqua farms," he says, on a tour of the facilities.



Peter Gendua and Julie Sip.

■ **PETER GENDUA** is NARI's Rice and Grain project manager. His main focus is rice genetics and biodiversity, as rice cultivation is relatively new for farmers in PNG. "People in PNG like eating rice; the problem is suitability for the highlands and lowlands and the cultivation technology is new for the farmers of PNG, it's not part of their culture," he says while visiting a field trial site at Bubia with technical assistant **JULIE SIP**.



Matthew Poienu

■ **MATTHEW POIENOU**, an agronomist at NARI, has been working on drought-resistant crop varieties. PNG faces a 'mega drought' in the future, according to NARI scientists. It is believed that the 2012 El Niño-induced drought will be severe and pose a huge threat to human lives as well as threaten food security for more than two million Papua New Guineans, especially in rural areas. "We have been working on a source of drought-resistant yams, a specific crop the trials identified as suitable," he says. ■



(From left) Emily Flowers, Metasha Sode (third prize winner), Cyprioni Puli (first prize), Lyeann Nants (second prize) and Roxanne Martens.

### PRIZING EDUCATION

Three PNG high school students were awarded prizes for their winning entries in the Australia Week 2012 Essay Competition. The event was sponsored by ACIAR and the Australian High Commission and asked students for their thoughts on two socially important issues: how can PNG overcome the ethnic divisions that often lead to conflict and how can a sense of national identity be built?

The first prize, a laptop, was won by Cyprioni Puli, a grade 12 student at St Joseph's International Catholic College. Second and third prize winners were Lyeann Nants and Metasha Sode respectively.

The award ceremony was attended by ACIAR country manager Emily Flowers and the wife of the Australian High Commissioner, Roxanne Martens, who had judged the submitted essays. Australia's Parliamentary Secretary for Pacific Island Affairs, Richard Marles MP, and Parliamentary Secretary for Defence, Senator David Feeney, presented the awards.

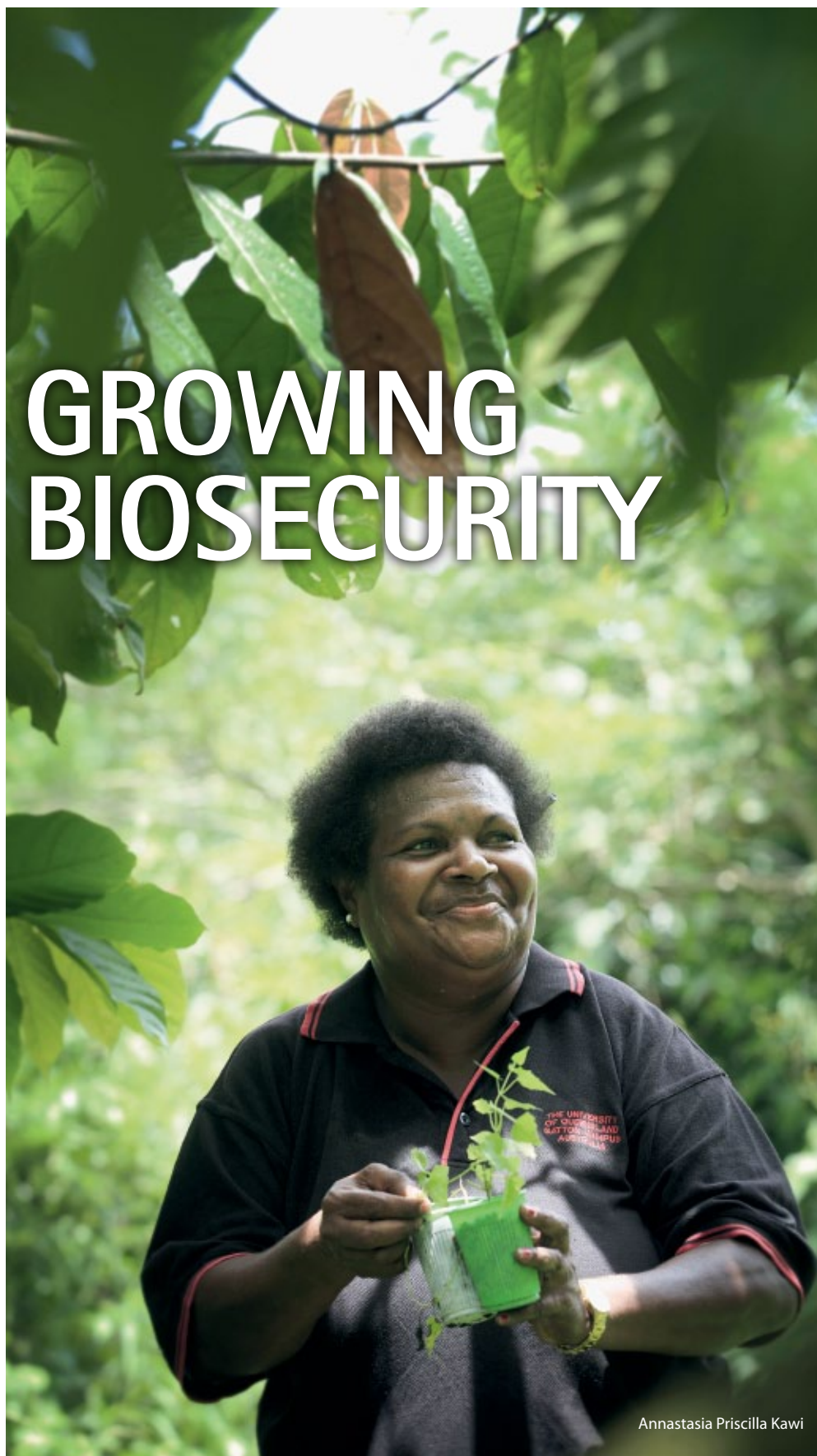


Japhet Nivi

PNG with Pacific Adventist University and ACIAR collaborative research with the Tasmanian Institute of Agricultural Research on varietal trials and plant protection aspects of vegetable value chain research.

Finally, I am grateful to ACIAR and the team for selecting me to be part of this capacity-building program, which is very useful for the unfortunate ones in rural areas of PNG where the scholarship cannot reach them. I look forward to collaborating closely with ACIAR in PNG if possible in the future.

\* Japhet Nivi works as a researcher and lecturer at the Pacific Adventist University. He serves as principal researcher for an ACIAR project in which vegetable cultivars are evaluated, particularly in agronomic and plant protection trials. The project is bringing vegetables with improved nutritional value from the Central Province to the Port Moresby market. A taped interview with Japhet Nivi discussing his current research activities can be viewed at the ACIAR website ([www.aciar.gov.au](http://www.aciar.gov.au)).



# GROWING BIOSECURITY

Annastasia Priscilla Kawi

Since agricultural production is so important to the Papua New Guinean economy, it is not just farmers that stand to lose when pests and diseases threaten crops.

BY PAUL JONES

Just four crops account for more than 90% of Papua New Guinea's (PNG's) agricultural exports: coffee, cocoa, coconuts and oil palm. Pest and disease outbreaks in these production systems have the potential to seriously affect the nation's economy. There is also a less quantifiable impact on food security as pests and diseases gnaw away at smallholder food crops.

Australian biosecurity expertise can play a vital part in helping to find viable, long-term solutions to a range of pest and disease problems, including helping scientists to equip smallholders with the means to manage these problems. Many ACIAR projects contain a biosecurity component, often integrated into broader project approaches that help producers deal with multifaceted issues, from improving quality to optimising supply chain opportunities.

## CASH-CROP CASE STUDY: COCOA

Cocoa is PNG's second largest agricultural export crop after oil palm. Existing plantings are highly concentrated geographically in the islands region, but many other areas in the country are suitable for cocoa production.

Smallholder production has been increasing by about 5% a year over the past 10 years. About 70,000 producers now account for 70% of total output.

Otto Kuinba is a manager at the NGIP Agmark Group, a company that trades in and exports PNG cocoa and has its headquarters in Kokopo, East New Britain Province. It also contributes to national workshops for the cocoa sector.

"We purchase cocoa from large and small producers countrywide," Otto Kuinba says. "But in the workshops we teach farmers to recognise and adopt good cocoa farming practices."

The workshops teach cocoa farmers about frequent harvesting, sanitation and pruning. "The real challenge is that most smallholders are not aware of the seriousness of cocoa pod borer (CPB) spreading and how to deal with it."

As a result, the cocoa industry in PNG is facing the most significant dilemma in its history. In spite of growth in production and exports over the past 10 years, the arrival of CPB (which is a mosquito-sized moth in the adult phase of its life cycle) in 2006 threatens to devastate the industry in East New Britain Province, its major producing region, and the provinces of Madang and East Sepik.

The CPB larvae feed inside cocoa pods on the material that surrounds the individual cocoa seeds. The larval feeding causes the seeds to stick together, which produces undersized seeds. These poor-quality cocoa beans are unmarketable.

The pest was first detected in the Kerevat area of East New Britain Province in March 2006 and later confirmed in Aitape of West Sepik Province in June.

Eradication operations, implemented in East New Britain Province after the first detection, were not fully implemented, and CPB re-emerged in smallholder blocks on the Gazelle Peninsula in March 2007.

With ACIAR assistance, efforts are underway to implement systematic and long-term CPB management strategies. This has led to strengthening surveillance and monitoring efforts, while stakeholders are provided with pragmatic resource-matched and location-specific integrated pest management (IPM) programs.

Tolik Wartoto is a local Kokopo cocoa farmer who, until recently, was thinking twice about cocoa farming. "The CPB had been destroying my crops," he says. "But since learning about how to get rid of the cocoa borer my harvest has increased from 800 kilograms per hectare to 2 tonnes per hectare."

The steps to control CPB are good crop hygiene, shade reduction, regular and complete pod harvesting, insecticide applications and insect trapping.

As a result there is a saying among PNG cocoa pod farmers: "Every pod. Every tree. Every week!"

Senior agriculture economist Joachan Lummini and his assistant Kathleen Neitre have seen dramatic changes to the cocoa seed industry since the introduction of CPB control.

"Over 150,000 households depend upon cocoa for their livelihoods in PNG," Joachan Lummini says. "And they are being directly threatened by this pest. We hope, with training, cocoa farmers can learn more about cocoa pests and diseases and how to protect their crops."

#### HOUSEHOLD PRODUCTION CASE STUDY: BANANAS

More than 85% of rural farmers throughout PNG grow a particular variety of bananas for their own household consumption. Surplus of the variously coloured bananas—once ripe the fruit can be yellow, purple or red—are sold cheaply in the local fresh food markets.

Studies by PNG National Agricultural Research Institute (NARI) entomologists based at Keravat have found that fruit flies and scab threaten this important staple food. At present the damage is not significant as production is only at subsistence level, but fruit flies and scab can cause economic yield reductions if control measures are not taken.

NARI scientist John Bokosou is at the front line of the control of pests and care for

banana trees in PNG. "Banana is a staple food crop for us. One of the things I look at is the multiplication and distribution of planting materials of varieties tolerant to drought conditions," he says.

Research programs such as NARI's are helping to build technical and scientific capacity around banana production, which is essential given national interest in developing this crop. Ofara Petilani is the NARI Islands Regional Centre manager at Keravat. "It is great to work in the development of agriculture for PNG," he says.

#### A PEST TO ALL CROPS

An invasive weed prevalent in PNG, Fiji and Samoa—mile-a-minute (*Mikania micrantha*)—poses a major problem for farmers no matter what their production system. Hugo Joseph, a farmer in Keravat, East New Britain Province, described how invasive the species can be. "The weed had gotten into 90% of my small farm," he says. "I have cocoa, coconuts and banana trees, and every crop had mile-a-minute on it or nearby."

The weed is thought to have arrived in PNG in the early 1900s as a contaminant of various imported products. Local farmers quickly came to refer to it as the weed that travels a mile a minute.

It is equally at home smothering estate crops such as sugarcane, vanilla, cocoa, coconuts, bananas, coffee, kava and oil palm as readily as among the crops such as taro, papaya and green vegetables grown in food gardens.

The weed is capable of significantly reducing yields, compromising food security and burdening growers with the need for effective weed control measures. Manual and chemical controls, however, are too expensive for most farmers.

So with ACIAR support and input from the Secretariat of the Pacific Community, a project

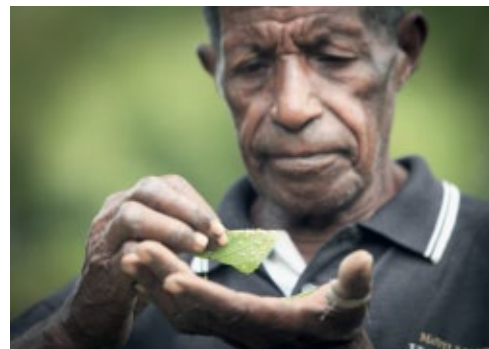
is underway to evaluate biological control agents. Showing promise is a fungus, *Puccinia spegazzinii*, which causes rust disease in mile-a-minute. The fungus feeds on the weed's leaves and stems, leaving behind copper-coloured lumps on the dead plant.

NARI scientist Anastasia Priscilla Kawi is the project leader on the ACIAR project to control *M. micrantha* in PNG. She is with the Entomology section, based at the Islands Regional Centre, Kerevat, in East New Britain Province.

"Mile-a-minute is a serious weed, it smothers plantation crops and food crops causing competition for soil nutrients, reducing the photosynthesis process and therefore causing unwanted deaths in young crops," Anastasia Priscilla Kawi says.

Anastasia Priscilla Kawi has helped oversee the release of the rust-causing fungus *P. spegazzinii*, first in trials and now more broadly. Ultimately, helping farmers such as Hugo is the aim of the research.

To date the fungus *P. spegazzinii* is showing significant promise, having been released in all 15 provinces of PNG where mile-a-minute is present. The biocontrol is now established in at least four provinces, offering hope to Hugo Joseph and other farmers for a brighter future. ■



Hugo Joseph



Ofara Petilani

# MONEY CAN GROW ON TREES

A tradition of including trees within traditional farming systems is being given a modern twist in Papua New Guinea by the inclusion of commercially valuable species that also provide in-country opportunities to further develop timber processing ventures.

BY PAUL JONES

Everywhere in Papua New Guinea (PNG), trees and their management are incorporated into both traditional and modern farming systems. Given this natural tendency to combine agricultural and forestry production systems—a farming technique called agroforestry—ACIAR saw an opportunity to improve farmer livelihoods by supporting the cultivation and processing of commercially valuable tree species.

In a now completed project, ACIAR determined that where a critical mass of

resources can be established, commercial tree species appear a good prospect for landowners with otherwise limited income-generation alternatives.

ACIAR also identified suitable tree species, production systems, candidate regions and partners for commercial timber production. Farmers learned how to grow and plant high-value trees such as teak and *Eucalyptus pellita*. Within a few years farmers were able to sell *E. pellita* poles for house construction and teak trees should provide substantial incomes for farmers in 20-30 years' time.

Now, ACIAR is building on those foundations by encouraging the adoption of commercial-scale, high-value tree growing by communities in two regions of PNG. These ventures are being fostered through relationships between landowners and selected business partners and non-government organisations, with scientists providing technical support.

As a result, more diverse, sustainable and profitable production systems are slowly appearing in PNG as agroforestry with a commercial twist is adopted by farmers.



Jaupo Mimituna

## TEAK

Beads of sweat slowly roll down the face of farmer Lukus Namai as he squats over a small teak tree, gently pushing down the earth around it. The farmer taps into his 10 years of experience as he explains that he is planting teak trees now so that in years to come his village will have timber for building houses.

Lukus Namai points to the mountains that surround his small village of Marawasa in PNG's Morobe Province; most of the lower slopes have been converted to grasslands over many years. "If we need timber now, we have to travel

a long way to buy it, then carry it back to the village."

Overseeing the teak planting on Lukus Namai's small plot of land is agroforestry project officer David Adzab. He explains that teak trees are an ideal investment for villages in PNG wishing to develop a 'green portfolio', while the eucalyptus trees offer a good opportunity for short-term returns as housing materials.

"Teak is a fast-growing species that is in demand around the world," he says. "And these trees are ideally suited for PNG conditions."

Teak trees are noteworthy for their capacity

to withstand changes in the weather and seasons. The trees' resilience while in the ground is matched in their timber, which is noted for its remarkable strength, durability and dimensional stability. The end product is a highly sought-after commodity with a global market.

These properties are not lost on New Britain Palm Oil (Ramu AgriIndustries) landscape and biodiversity officer Gorethy Dispen. At a small-scale tree nursery surrounded by sugarcane fields, she tends to small teak seedlings with a motherly touch.



Lukus Namai

"Teak is very important, it is a high-value timber and it's good to plant teak for commercial timber production in the future," she says.

"The ACIAR project has helped broaden the availability of high quality teak seed, which is now being grown for distribution to the farmers."

Wielding a large pair of pruning cutters, forestry technician Peter Konia is tending an ACIAR teak trial site, where seedlings from different locations are being compared in terms of their growth characteristics. It is surrounded by the mountains of Morobe Province where one can see large areas of grasslands with distant forest-clad ridges and fields of green, with the occasional small patch of land cleared for gardens and villages. He points to another trial site 100 metres away.

"Those teak trees are from Laos. See how well they are growing?" he says. "These ones are from Thailand. They don't grow as fast. This week and next I will prune the teak trees to improve the form of the trees and the value of the timber. They are a part of our lives now."

### BALSA

With an established balsa growing and wood processing industry in East New

Britain Province, ACIAR is providing the expertise needed to enhance this industry's value, sustainability and its accessibility to smallholders. It is an especially significant project since income from cocoa production has been suffering due to predation by the moth pest—the cocoa pod borer.

Balsa (or *Ochroma pyramidale*) cultivation is an attractive land-use option for both PNG smallholders and larger landowners. This fast-growing tree can reach 30 metres in height in 5 years and is the source of balsawood—a valuable lightweight material with an expanding market. There are few barriers to its adoption by smallholders, although to be sustainable there needs to be growth of markets along with expansion in the area of trees.

The low density and high strength of balsawood makes it a popular material for building light, stiff structures from model bridges to full-sized light aeroplanes. It is also used as a core material in composites—for example, in the blades of wind turbines—and in laminates with glass-reinforced plastic (fibreglass), aluminium and carbon fibre that find uses in the defence, energy, marine and aerospace industries.



Daniel Weady

Ecuador is the world's largest balsawood supplier. The South American tree was introduced to PNG in the 1930s and is now the basis of a commercial industry in East New Britain Province. With an 8% market share by volume and 6% by value, PNG is the world's second largest balsa supplier.

An earlier ACIAR scoping study found that 500 smallholder growers and two larger commercial interests cultivate about 5,000 hectares on 5-year rotations. Exports of processed wood from these plantings were valued at about K11.2 million (A\$5.4 million) in 2008, with the dominant markets being China (43%) and India (20%).

To bolster growth in this promising industry, ACIAR is helping smallholders take advantage of the opportunities to use balsa to boost incomes, with research subjects that span the supply chain, including:

1. analysis of smallholder livelihoods, decision processes and farming systems;
2. identification and facilitation of smallholder organisation and communication strategies and structures;
3. optimising value recovery in balsa processing, including wood delivery logistics and primary and secondary processing;
4. optimising supply of improved germplasm and crop management for smallholders; and
5. development of enabling systems for the certification of PNG smallholder balsa.



Gorethy Dipsen



Sylvester Kulanz (left) and Neville Howcroft.

Working on this project are Sylvester Kulanz, Jaupo Miniunu and Daniel Weady—technical officers at the PNG University of Natural Resources and Environment in Vudal, in East New Britain Province, under the guidance of Neville Howcroft. One of the activities undertaken locally involves growing a variety of balsa seedlings in the university greenhouse to help understand the best management regime for balsa.

"I would like to think that in years to come, some good will come from the research I have done on balsa trees," Jaupo Miniunu says.

For that to happen, Daniel Weady says R&D into the development of practices that allow smallholders to grow high-quality balsa

sustainably and productively in managed plantations must continue. That information would provide the essential foundation for the entire industry.

At the other end of the supply chain there are the balsa processing mills, such as the one at Kokopo. Visiting the mill as it operates in full swing is a local plantation manager, John Ohana.

"The industry has become quite sophisticated and the quality of the balsawood being grown needs to be maintained and improved," John says. "This is important, given that processed balsa is used in a number of specialised engineered products such as wind turbine blades and boats, where lightness and strength are required." ■

## The growing sophistication of the Papua New Guinean balsa industry

BY EMILY FLOWERS

The Papua New Guinea Forest Authority aims to build a forestry sector that is sustainable and highly profitable, while recognising the importance of promoting community forestry activities to empower rural communities and alleviate poverty.

The established balsa industry in East New Britain Province is the best example nationally of a successful value-adding forest industry involving smallholder tree-growing.

Smallholders engage in balsa growing both individually and, increasingly in the past decade, as groups working collaboratively. About 75% of the planted area is smallholder plantation and almost all of this is managed as blocks of less than 20 hectares by landowners who have pooled their resources to maximise their returns.

Balsa is an alternative to cocoa because of the impact of cocoa pod borer (CPB). The CPB infestation is leading to a reduction in the area planted to cocoa, a principal smallholder crop, and to an increase in smallholder interest in alternative crops. Balsa could offer an attractive alternative.

The ACIAR project that supports these smallholder agroforestry ventures was launched in September 2011. *Improving the Papua New Guinea balsa value chain to enhance smallholder livelihoods* (FST/2009/016) aims to enhance the value, value recovery and international competitiveness of the PNG balsa industry as a way of optimising benefits for smallholder growers.

It achieves this by addressing issues, constraints and opportunities along the entire balsa value chain, from smallholder decision-making and organisation through to improving germplasm and management of balsa crops and on to transport, processing, marketing and product development.

Research has helped to identify the key issues along this chain:

- For smallholders: the optimal incorporation of balsa-growing into their farming system, the availability of adequate labour, plantation management capacity and the nature of supply arrangements with processing industries.
- In management of balsa plantations: optimising germplasm and silviculture, and realising management standards adequate for forest certification.
- For processors: optimising value-recovery strategies from the forest through to the wharf, including improved sawing and drying practices.
- In marketing and product development: enhancing market analysis, developing innovative product development opportunities and synchronising log production with processing capacity and market demands.

As such, the project is expected to deliver economic, environmental and social benefits to the entire PNG economy.

# A profitable patch



The need for quality vegetables in Papua New Guinea's major urban centres is growing.

BY PAUL JONES

**D**emand for higher-value food products is growing in Papua New Guinea (PNG), particularly in large and expanding urban areas such as Port Moresby. Understanding the drivers of this demand is vital to linking smallholders into the market opportunities emerging. ACIAR-funded research has identified three demographic factors driving changes in both food preferences and where the food is consumed. These are: population growth estimated at about 2.1%, increasing migration from rural to peri-urban areas and the expansion of the gas and mining industry.

One outcome is greater market demand for temperate vegetables. Supply, however, is limited by poor transport infrastructure from

production areas, typically located in various highland regions. There is also the challenge to maintain consistent product quality as demand becomes more market orientated.

These factors create an opportunity for farmers in the major alluvial valleys in Central Province. There, the national road network provides easier routes to market and a relatively dry climate limits disease pressure, while perennial streams have sufficient flow to meet the farmers' irrigation needs.

To take advantages of these circumstances, farmers need to select the correct vegetables; adopt appropriate land, soil and water management practices; and implement the agronomic strategies required to grow quality produce.

Helping Central Province farmers solve these vegetable supply chain challenges are technical experts in both Australia and PNG, supported by ACIAR. The project aims to equip farming communities to enter the temperate vegetable market in a way that improves their livelihoods and ensures the sustainability of those gains.

## FROM SUBSISTENCE PRODUCTION TO VIABLE AGRIBUSINESSES

On the outskirts of Port Moresby, agronomist Philmah Seta-Waken checks the progress of her latest research as part of the project 'Increasing vegetable production in Central Province PNG for Port Moresby markets', led by the Tasmanian Institute of Agricultural Research. She is trying a new approach to helping local farmers grow





Japhet Nivi

different varieties of vegetables.

“What we are looking at here is the vegetable evaluation trial,” Philmah Seta-Waken says. “We are working on which vegetables will do well at the three different altitudes we have here in PNG—high, medium and low.” These sites are located at Tapine (high), Soger (medium) and Laloki, Koiari and Rigo (low).

The range of western vegetables growing under field trial is impressive. Included are tomatoes, beans, capsicum, eggplant, corn, carrots and broccoli, to name a few.

Dickson Benny, an economist from PNG National Agricultural Research Institute (NARI), is also involved in the project. For two years he has been learning what is needed to increase food production in the country and where the obstacles to greater food productivity lie.

He says one of the main challenges is transporting food from the productive areas to the population centres. For that reason the project focuses on different vegetables for different areas of the country. “This way, the costs for production and transport can be kept at a minimum.”

Philmah Seta-Waken points to the nearby mountains where a patchwork quilt of village farms is visible. There you can walk past gardens filled with kaukau (sweetpotato), taro, cassava and banana trees—PNG’s traditional staple crops that have sustained people for many years.

“Most people are subsistence farmers, growing their own food and selling anything extra they produce in village markets,” she says. “I believe that if farmers have the best crops to grow, that will lead to a sustainable livelihood and help improve their diets as well.”

The variety trials are crucial to those aspirations. They are needed to test performance

under realistic growing conditions over several seasons and to identify the best agronomic options for optimal production levels.

These are issues familiar to Japhet Nivi—the field research officer from Pacific Adventist University, an ACIAR scholarship recipient.

“Sometimes I think of PNG as one really big farm,” he says. Through systematic trials he is helping to identify vegetable varieties and agronomic practices that turn subsistence vegetable gardens into small agribusinesses.

He has no doubt that Central Province has great potential to produce a wide range of vegetables—cabbages, broccoli, onions and others—but current production is not sufficient to meet the increasing demand.

The project has held a series of meetings and workshops with various stakeholders to understand which research activities would address constraints to improving vegetable production. Issues identified include declining soil fertility, pressure on land from population growth, pests, diseases and lack of market information.

In addition to the variety trials, the project also focuses on natural resource management, marketing and socioeconomics. Clifton Gwabu, an agriculture economist and facility manager at the NARI office in Laloki, Central Province, concentrates on this area.

“The things I look at are the profitability and marketing system,” he says, while assessing a field sown with the tropical green leaf vegetable aibika, commonly known as Pacific cabbage. “This is a common veggie crop all over PNG. It is very strong and grows well everywhere, even without much fertiliser. The green leaf of the aibika is the most popular green vegetable eaten throughout PNG.” ■



Philmah Seta-Waken and Dickson Benny.



Clifton Gwabu

Poultry researcher Janet Pandi is looking for ways of reducing the cost of poultry diets.

# More than just chicken feed



## Livestock producers boost profits using local feed ingredients.

BY MANDY GYLES

Villagers in remote parts of Papua New Guinea (PNG) are putting science from an ACIAR project into action by testing poultry feeds especially formulated with a portion of local products.

Jan Dumu and her husband Lokowa Dumu from Tambul, in PNG's Western Highlands Province, raised eight batches of chickens using a concentrate feed ration mixed with either locally produced sweetpotato (kaukau) or cassava, which they compared to chickens on the more expensive commercial diets.

"The village farm trial results were very encouraging, there were only small differences in growth of birds observed between the different diets," says Janet Pandi, a researcher at the PNG National Agricultural Research Institute (NARI) who is looking for ways of reducing the cost of poultry diets.

"The aim was to test whether the birds reached market weight after 5 to 6 weeks on diets comprising a 50:50 mix of sweetpotato and a low-energy concentrate, or cassava mixed with a high-energy concentrate.

"We found a commercial broiler starter can be fed to chicks from day one to day 21, then the NARI broiler concentrate mixed with mashed sweetpotato or cassava can be fed from day 22 up to day 42 to get the birds to a market weight of more than 2 kilograms," Janet Pandi says.

### LONG-TERM GOAL

"Improving the profitability of village broiler farming through the use of locally available feedstuffs has been a high priority in the PNG livestock sector for more than 10 years," says ACIAR project leader Phil Glatz of the South Australian Research and Development Institute. "The viability of village broiler farms is continually threatened by the rising costs of imported ingredients used in commercial feeds."

"The broiler feeding system technology being promoted to growers by NARI was developed over an 8-year period through ACIAR-funded research that evaluated various locally available resources as broiler feed," he said.

Phil Glatz led an earlier project that developed a feeding system for broilers using PNG protein meals to produce a concentrate that could be mixed with 50–80% of local ingredients. "The latest research has finetuned the feeding system and made use of sweetpotato and cassava, which are in abundance in the highlands and lowlands respectively.

"As feed costs rise, the viability of broiler production is threatened by the rising costs of commercial diets, because most of the ingredients are imported and expensive," he says. "The recent research found that broiler production costs could be reduced by about 30% by mixing concentrate feed with cassava or sweetpotato to replace broiler finisher feed."

### FIELD TESTING

Farm trials of the feeding system have now been carried out by the Lutheran Development Services in the Morobe Province, the Christian Leaders Training College based in Banz in the Western Highlands Province and by Ok Tedi Mining in the Western Province.

Due to the promising results in the regional trials, each NGO selected village farmers to run trials to compare the concentrate feeding system with a standard broiler feed.

"Broiler performance—particularly the sweetpotato diet—compared favourably with standard feed in all the village farm trials," Janet Pandi says. "There was also strong interest expressed by other broiler farmers not involved in the trials."

Interestingly, farmers also prefer the flavour of meat from birds fed with the concentrate mixed with sweetpotato or cassava.

The benefits of the broiler feeding system in PNG are being promoted by field days, training and demonstration sessions run by NARI and other NGO partners, through the distribution of publications and via the media. Fact sheets

have been developed for college, university and NGO curricula, along with a video on how to use the feeding systems.

### LOCAL MILLING

The cost of locally milling broiler concentrate in mini-mills in PNG has been assessed to be about K800 (A\$366) a tonne. This is more than competitive with commercial full rations, at K2000 (A\$915) a tonne, and concentrate, at K2400 (A\$1098) a tonne. Fishmeal, copra meal, mill run and premix are the ingredients intended for the production of the local concentrate.

Goodman Fielder International is conducting similar trials in Fiji. They have produced a concentrate feed that is transported to nearby islands where farmers blend their local ingredients into the diet. Further trials are being run in PNG in conjunction with Niugini Table Birds to further demonstrate the feeding system.

Phil Glatz says work on the ACIAR poultry feed project is directly applicable to other monogastric animals and a new initiative is furthering this work to broaden the benefits for PNG.

"Development of user briefs for small-scale feed mills will also allow the pig and aquaculture industry the option of investing in their own feed manufacturing to produce diets that are cheaper than commercial diets," he says.

Smallholder and semi-commercial aquaculture, pig and poultry farming are making an important contribution to the livelihoods of rural households in PNG. "Currently the monogastric sector in PNG has a market value of A\$190.5 million per annum, comprising about 600,000 small farmers," Phil Glatz says.

"It is crucial to assist the sector to develop cheap, balanced diets and to provide a service to the industry by encouraging the establishment of small-scale feed mills to make cheaper concentrate diets based mainly on local feed resources rather than imported ingredients." ■

**More information: An interview with Janet Pandi can be viewed at the ACIAR website.**

## Milling adds value to cassava crops

Women around Domil, in the newly created Jiwaka Province in the highlands of Papua New Guinea, can now add value to their cassava crop through improved postharvest and processing techniques using a model cassava mini mill. The mill will produce cassava flour, cassava starch and the broiler cassava finisher stock feed, which will be sold to surrounding communities. Apart from the cassava mill, there will also be a small-scale poultry-processing unit.

Community members have undergone training in handling and

harvesting techniques as well as processing methods of incorporating cassava into other useful products, along with livestock and aquaculture production.

A local cooperative has created a revolving scheme where registered members can obtain a loan. In May 2012 the first batch of 1,600 birds was processed and packed. The target is to produce around 3,000 to 5,000 packaged chicken a month by the end of 2012 and increase the rate to 10,000 a month in the coming years.

# Celebrating women's contribution to agriculture



International Women's Day at the High Commission in Port Moresby.

BY MANDY GYLES

The Australian High Commission in Port Moresby celebrated the theme of International Women's Day, 'Empower Rural Women: End Hunger and Poverty', at a special event on 8 March 2012.

At the event a group of Papua New Guinea's (PNG's) leading agricultural researchers met with Australia's Parliamentary Secretary for Foreign Affairs and Pacific Island Affairs, Richard Marles, PNG's Minister for Treasury, the Hon. Don Polye MP, and Australia's High Commissioner to PNG, Ian Kemish.

"PNG women play a critical role in agriculture," Richard Marles said. "It is one of



Annastasia Priscilla Kawi



Janet Lipai



Angela Pora and team.



Hilda Sim

Philmah Seta-Waken



the nation's most significant industries and supports up to 85% of the population. It was a great pleasure to meet with a group of PNG's leading female agricultural researchers, many of whom are valued partners of ACIAR."

During his meeting with the agricultural researchers at the Australian High Commission in Port Moresby, Richard Marles also had the opportunity to view a photo collection featuring images taken by photographer Paul Jones during a visit to ACIAR's PNG projects (which can also be viewed on the ACIAR website).

The women—mainly researchers at the PNG National Agricultural Research Institute (NARI)—along with private sector and industry bodies are delivering improvements in agricultural production and marketing.

The main strategy of ACIAR's program in PNG is to secure improvements in food supply and rural incomes for smallholder farmers. The ACIAR program also has a project that specifically examines the role and effectiveness of women's groups in rural industries, in terms of efficiency and equity in agricultural and marketing systems. ■

Global Conference on Women in Agriculture held in New Delhi, India, from 13 to 15 March 2012.



## Women in agriculture

BY PAUL JONES

**Maria Linibi is the founder and president of Papua New Guinea (PNG) Women in Agriculture, a non-profit organisation for women across all areas of agriculture.**

She says 85% of women in the country are involved in agriculture and the idea behind the group is to raise the profile of women in agriculture across primary production, rural industries and communities in PNG.

She says the patriarchal social structure in PNG is the biggest issue facing women.

"We help women in fisheries, in agroforestry, in bee keeping, in horticulture, in livestock, in agrotourism," Maria Linibi says. "Yes, women are taking the initiative in PNG.

"There's a lot of undermining by the men, there's a lot of pressure, there's a lot of women who do most of the labour work and sometimes the women are forgotten."

Maria Linibi says some women take on management roles but, in the end, the men decide where the money is spent. But she says the attitude is changing, with some men letting women take leadership roles in the family.



## Global conference on women in agriculture

BY MANDY GYLES

ACIAR sponsored six women involved in ACIAR projects—including two from Papua New Guinea (PNG)—to attend the Global Conference on Women in Agriculture held in New Delhi, India, from 13 to 15 March 2012.

Themed 'Empowering Women for Inclusive Growth in Agriculture', the conference was organised by the Indian Council of Agricultural Research and the Asia Pacific Association of Agricultural Research Institutions (APAARI).

About 300 delegates attended the conference, which was inaugurated by the President of India, Her Excellency Smt. Pratibha Devisingh Patil. ACIAR's principal adviser Simon Hearn, who is on the APAARI executive committee, chaired a session at the conference.

The conference had the following themes:

1. assessing women's empowerment in agriculture;
2. agricultural innovations for reducing drudgery;
3. linking women to markets;
4. the role of women in household food and nutritional security;

5. access to assets, resources and knowledge: policies and services; and
6. impact of and responses to climate change related risks and uncertainties.

The ACIAR-sponsored delegates were:

- Silinthone Sacklokh—head of department of Rural Economics, National University of Laos;
- Norah Omot—senior researcher, PNG National Agricultural Research Institute;
- Lilly Sar—Communication and Development Studies, PNG University of Technology;
- Felister Makini—deputy director, Outreach and Partnerships, Kenya Agricultural Research Institute;
- Jemimah Njuki—team leader, Poverty and Gender, International Livestock Research Institute, Kenya; and
- Atien Priyanti—Indonesian Center for Animal Science Research and Development.



PHOTO: MIKE HUGHES

## Cleaning up potato production

(From left) Niligur Rangan (PNG NARI), Sandra Dennien (Queensland DAFF), Dorcas Homare (PNG NARI) and Winnie Maso (PNG NARI) conducting the ELISA test to detect sweetpotato viruses.

Three scientists recently undertook specialist training in Australia in the vitally important areas of sweetpotato virus identification and virus-free tissue cultivation.

BY CATHY READE

Identifying and eliminating disease-causing pathogens from potato and sweetpotato crops are skills with huge food security benefits for Papua New Guinea (PNG). These pathogens, including potato late blight—the disease responsible for the Irish potato famine in the mid-19th century—are a continuing threat in PNG.

Three Papua New Guinean women have undergone biosecurity training and are now playing crucial roles helping to safeguard food security from disease threats in PNG. The new biosecurity capability especially targets sweetpotato, which is doubly important to PNG households as it serves both as a staple food and an income-earning cash crop.

The training was undertaken in response to serious disease threats to sweetpotato crops. PNG lacks virus diagnostic capabilities and cannot export material to Australian laboratories for virus testing due to quarantine restrictions.

So three scientists working for the PNG National Agricultural Research Institute (NARI)—Winnie Maso, Niligur Rangan and Dorcas Homare—were supported by the Crawford Fund to undertake training in virus identification, elimination and in the

multiplication of clean planting material.

Winnie Maso is manager of tissue culture production in the micro-propagation laboratory in Aiyura, Eastern Highlands, while Niligur Rangan manages the tissue culture laboratory at Kerevat, East New Britain Province.

Dorcas Homare is working on an ACIAR sweetpotato project led by Mike Hughes of Queensland's Department of Agriculture, Fisheries and Forestry (DAFF). With the encouragement of Rudolf De Boer from the Victorian Department of Primary Industries, Dorcas Homare's expertise was expanded to include potato viruses.

As part of their training, the scientists spent time in Victoria and Queensland honing the skills needed to help PNG minimise production losses from sweetpotato viruses. They are now producing virus-free propagation material of sweetpotato and further, they are improving the efficiency of the seed potato multiplication program for the 'English' potato. The new in-country biosecurity capacity is also being applied to other food crops.

"This training not only helps PNG, but also Australia," Rudolf De Boer says. "For example the work around late blight helps enhance Australia's disease awareness and preparedness, and assists the biosecurity of the region." ■

## The importance of sweetpotatoes

BY PAUL JONES

"Did you know that the humble sweetpotato is a member of the morning glory family and it is not related to the common potato?" asks Elick Guaf. The senior scientist and agronomist at the Papua New Guinea (PNG) National Agricultural Research Institute (NARI) is involved in an ACIAR project to improve sweetpotato production.

Sweetpotato is one of the world's most important food crops and an important staple food in PNG. It is valuable in the diet of its 6.3 million people, with more than 60% producing this low-input crop. Currently, just less than 3 million tonnes are produced annually in PNG, with the total harvest worth an estimated A\$700 million.

It provides good ground cover, grows on soils with limited fertility and has a short growth period with a high yield. The tuberous root is high in food value, fibre and energy, and it is rich in sugar and vitamin C. It also contains good quantities of vitamin A, vitamin B, calcium and iron. Sweetpotatoes can be steamed, baked, boiled, roasted or fried.

This makes sweetpotato a high priority for food security but, ominously, it is susceptible to drought and climate change. In both PNG and Solomon Islands, yields have been in decline. Apart from climatic factors such as El Niño events, which cause major but temporary falls in production, farmers and scientists have noted a gradual decline in yields and the quality of tubers. The cause is not always obvious.

In response, ACIAR has made it a high priority to introduce and adapt technologies so as to produce consistently high-yielding and nutritious sweetpotato crops.

"Selection and distribution of clean materials is very important and we are also planning to train farmers in best practices in the production of other staple crops under the NARI Information and Knowledge program," Elick Guaf says.

Sweetpotatoes grown in the lowlands take more than 4 months to mature, but planting early-maturing clean materials and using best management and production practices promote crops to mature in only 3 months with good quality and increased yields.

Nearby, in a sweetpotato trial field, we find Tony Maima and Paul John, two local farmers pulling out weeds from around their sweetpotato crop. "We are very happy to be involved with the sweetpotato trials," Tony Maima says.

## ROUNDUP

To keep up to date with the latest events, projects and happenings at ACIAR please visit our website ([aciarc.gov.au](http://aciarc.gov.au)), our blog ([aciarcblog.blogspot.com](http://aciarcblog.blogspot.com)) or visit us on Twitter ([twitter.com/ACIARAustralia](http://twitter.com/ACIARAustralia)). You can also subscribe to our RSS feed ([aciarc.gov.au/RSSfeeds](http://aciarc.gov.au/RSSfeeds)) to get updates on the latest happenings at ACIAR.

## NEW PUBLICATIONS

### CORPORATE PUBLICATIONS



#### ACIAR Annual Operational Plan 2012-13

ACIAR, 130 pp. Plus Vietnamese and Indonesian translations. Contact ACIAR for copies.

### TECHNICAL REPORTS



#### Opportunities for the smallholder sandalwood industry in Vanuatu

Tony Page, Hanington Tate, Colin Bunt, Anna Potrawiak and Alick Berry, TR 79, 67pp. \$36

### PROCEEDINGS



#### Asia-Pacific tropical sea cucumber aquaculture

Cathy A. Hair, Timothy D. Pickering and David J. Mills (eds), PR 137, 209 pp. \$50



#### Animal biosecurity in the Mekong: future directions for research and development

Adams L.B., Gray G.D and Murray G. (eds), PR 137, 114 pp. \$52

### IMPACT ASSESSMENT SERIES



#### The contribution of agricultural growth to poverty reduction

Bhajan Grewal, Helena Grunfeld and Peter Sheehan, IAS 76, 59 pp. \$52



#### Rice-wheat cropping systems in India and Australia, and development of the 'Happy Seeder'

Clare Saunders, Lee Davis and David Pearce, IAS 77, 48 pp. \$47



#### A methodology for assessing the poverty-reducing impacts of Australia's international agricultural research

David Carpenter and Mark McGillivray, IAS 78, 46 pp. \$25



#### Developing and testing a tool for measuring capacity building

Anni Dugdale, Chris Sadleir, Robin Tennant-Wood and Mark Turner, IAS 79, 36 pp. \$31



#### Oil palm pathways: an analysis of ACIAR's oil palm projects in Papua New Guinea

Hayden Fisher, Cassandra Winzenried and Lilly Sar, IAS 80, 63 pp. \$45

### MONOGRAPHS



#### Practical methods for the quality control of inoculant biofertilisers

Rosalind Deaker, Mihály László, Michael Timothy Rose, Khanok-on Amprayn, Ganisan Krishnen, Tran Thi Kim Cuc, Vu Thuy Nga, Phan Thi Cong, Mgyuen Thanh Hien and Ivan Robert Kennedy, MN 147, 101 pp. \$35



#### Making value chains work better for the poor: a toolkit for practitioners of value chain analysis [Indonesian translation]

Making Markets Work Better for the Poor (M4P) project, UK Department for

International Development (DFID), MN 148, 146 pp.



#### Hatchery management of tiger grouper (*Epinephelus fuscoguttatus*): a best-practice manual

Ketut Sugama, Michael A. Rimmer, Suko Ismi, Isti Koesharyani, Ketut Suwirya, N.A. Giri and Veronica R. Alava, MN 149, 66 pp. \$25



#### Nursery management of grouper: a best-practice manual

Suko Ismi, Tatam Sutarmat, N.A. Giri, Michael A. Rimmer, Richard M.J. Knuckey, Anjanette C. Berding and Ketut Sugama, MN 150, 44 pp. \$20

### FINAL REPORTS (AVAILABLE ONLINE ONLY)

FR2011-32 to FR2011-35

FR2012-01 to FR2012-20

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## NEW STAFF

### NEW RESEARCH PROGRAM MANAGERS

**Dr Mike Nunn** – Research Program Manager, Animal Health

Mike comes to ACIAR from the Australian Government Department of Agriculture, Fisheries and Forestry (DAFF), where he was the Principal Scientist for Animal Biosecurity.

**Dr Evan Christen** – Research Program Manager, Land and Water Resources

Evan comes to ACIAR from CSIRO where he was Principal Research Scientist in the Land and Water Division.

**Dr Eric Huttner** – Research Program Manager, Crop Improvement and Management

Eric comes to ACIAR from Diversity Arrays Technology (DAT) Pty Ltd—a company dedicated to developing and delivering genetic analysis technology to plant breeders and

scientists worldwide—where he was General Manager.

### NEW CORPORATE STAFF

**George Xenoulis** – Information Systems Support Officer

**Nabeweyah Jattiem** – Receptionist

**Gary Leckie** – Financial Accountant

### NEW GRADUATE OFFICERS

**Rebecca McBride** – Graduate Officer

Rebecca holds a Masters in Agricultural Business (University of Adelaide) and has completed an AYAD in Vietnam. Rebecca has commenced her graduate experience working with the Agribusiness Program.

**Jenny Hanks** – Graduate Officer

Jenny studied at Charles Sturt University and holds a Bachelor of Veterinary Science/Bachelor of Veterinary Biology. Jenny is working across

the Livestock Production Systems and Animal Health Programs.

### THE NEW AIFSC TEAM

The Australian International Food Security Centre comprises four full-time staff. **Melissa Wood** is the Director, bringing a wealth of knowledge from the Rome-based Global Crop Diversity Trust, where for two years she was Director of Operations. **Dr Wendy Henderson** is Manager – Research, Communications and Partnerships. Prior to joining ACIAR, Wendy was working as the Senior Program Coordinator and Project Leader, Detection & Prevention Program, Invasive Animals Cooperative Research Centre. **Bronwyn Anderson-Smith** is the Executive Officer and **Joanne Huang** is the Program Support Officer.

For more details, go to ACIAR's staff directory: [http://aciarc.gov.au/staff\\_directory](http://aciarc.gov.au/staff_directory)

## ACIAR'S VISION

ACIAR looks to a world where poverty has been reduced and the livelihoods of many improved through more productive and sustainable agriculture emerging from collaborative international research.



The Australian Centre for International Agricultural Research (ACIAR) operates as part of Australia's international development cooperation program, with a mission to achieve more productive and sustainable agricultural systems for the benefit of developing countries and Australia. ACIAR commissions collaborative research between Australian and developing-country researchers in areas where Australia has special research competence. It also administers Australia's contribution to the International Agricultural Research Centres.



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Back cover: Papua New Guinean children encounter ACIAR's photojournalist Paul Jones as he travels between project sites.

Front cover: Lukus Namai, a farmer from the village of Marawasa in PNG's Morobe Province, adopts high-value tree cultivation on his plot of land with the support of agroforestry specialists in both PNG and Australia.