

Country Profile

**Papua New  
Guinea**

**August 2004**

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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# Preface

The ACIAR Country Profiles are designed to give a snapshot of the collaborative research being carried out between Australia and our key partner countries. This publication contains short summaries of both bilateral and multilateral projects with Papua New Guinea that were active at 30 June 2004. At that time there were 27 active bilateral projects and two active multilateral projects, the latter being led by international agricultural research centres. There were another 10 projects under development, many of which are expected to start in 2004–05.

This publication also sets out the key outputs and outcomes from the six projects (five bilateral and one multilateral) that have been completed since July 2002.

In addition to these project summaries, the publication includes an extract from ACIAR's 2002–03 Annual Report covering Papua New Guinea, our near-term program as outlined in the 2004–05 Annual Operational Plan, and a record of the most recent consultations held between ACIAR and Papua New Guinea on the medium-term priorities for the joint program.

ACIAR will update this profile each year and distribute it to key stakeholders in Papua New Guinea and Australia.

We hope you find the publication useful as a record of the ongoing progress and achievements of ACIAR's collaborative research and development program with Papua New Guinea. For information on ACIAR's overall program, we invite you to visit our website at [www.aciar.gov.au](http://www.aciar.gov.au).

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August 2004

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# Papua New Guinea Report 2002–03

(extract from ACIAR Annual Report 2002–03)

Number of projects active in 2002–03	30
Bilateral country expenditure in 2002–03	\$3 171 113
Bilateral country expenditure in 2001–02	\$2 550 738
Bilateral country expenditure in 2000–01	\$2 459 835

## Position

Papua New Guinea (PNG) is one of ACIAR's most important partners. ACIAR's program in PNG has endeavoured to reflect this and over the last two years the portfolio has increased significantly. In addition to projects funded from ACIAR's appropriation, since 1998 ACIAR and AusAID have worked together to develop and fund a small set of projects of mutual interest to tackle some of the formidable challenges to agricultural development. PNG is a net food importer with high population growth rates. Village-based agriculture supports 70–80 per cent of the population and domestically traded food is very important. The main cash crops in order of export value are oil palm, coffee, cocoa and coconuts.

PNG's limited capacity is a constraint in carrying out research and development (R&D) activities and in delivery of extension services. When designing projects ACIAR works to include a training component. ACIAR is also keen to package the results of earlier research in a suitable form for uptake by farmers.

## Achievements

Several projects have had an emphasis on increasing smallholder farmer incomes through cropping improvements. A survey on peanut production, marketing and consumption practices has been undertaken, and improved germplasm has been introduced, with the aim of re-establishing the once significant peanut production industry. A testing facility for poultry feeds, an important part of smallholder farming operations, has been established near Lae. Testing of the nutritional value of feed ingredients is under way to determine the optimal feed materials.

A non-cash payment system for plantation labour in the oil palm sector has been highly successful in increasing both the supply and demand for labour while increasing production. The scheme allows holders of a *lus frut* card to harvest and sell fallen fruit, providing an income source almost equal to that of those in formal employment. Other plantation sectors are interested in examining and trialling the scheme. In the first instance, ACIAR will assist with a new project examining the relevance of the scheme for cocoa.

A project assessing biological threats to sugar production in PNG, Indonesia and Australia completed the last of four surveys of the region. The strategic Torres Strait region—important as a potential pathway for pest and disease transmission between PNG and Australia—was examined. Findings, including the extent and spread of pests, will be important in briefing quarantine staff on quarantine issues and interactions both in the Torres Strait and on Australia's Cape York. The first PNG sugarcane pest and disease manual was produced and distributed to National Agriculture and Quarantine Inspection Authority staff at a November workshop, with a similar Torres Strait sugarcane pest and disease manual also produced and distributed to Torres Strait quarantine staff. Scientists continued to release biological control agents against *Chromolaena odorata*, the major weed of pastures in PNG, and to monitor their effects. Agents have also been supplied to other countries of the South Pacific with *Chromolaena* problems.

Artisanal fisheries are also important in PNG, and are a focal point for some fisheries projects. A field survey of the sea cucumber resources of Milne Bay Province has been completed, with a final report providing stock status assessments for all commercial species. A series of recommendations made to local authorities has resulted in changes to existing management arrangements. A project on sea cucumbers has seen community-based resource management arrangements established at Obulaku

village in the Trobriand Islands, Milne Bay Province. Two possible areas for lagoon reseedling of suitable species have been identified.

An 18-month study of the status of pond aquaculture in PNG surveyed 313 fish farms, 20 markets, 16 hatcheries and 18 institutions. A workshop held in Goroka brought together all sectors of the industry and other stakeholders to consider the results of the project and to establish priorities to guide the development of a proposal for a follow-on project. A manual has been produced for the ongoing maintenance of the Papua New Guinea National Fish Collection. This valuable collection, now housed at the University of Papua New Guinea, has been partially restored and collated. Following completion of a past ACIAR project the Barramundi Fishery Management Plan was formally approved and has now been gazetted into law under the PNG *Fisheries Management Act*.

In the remote provinces of PNG there is a chronic lack of rural industries to provide cash incomes to communities and households. ACIAR's project work has supported the development of a small industry in Western Province based on distillation of essential oils. A new product based on oils from the native *Asteromyrtus* species is now marketed as bottled oil in PNG stores. Another project is analysing the marketing system for fresh produce grown year-round in PNG's temperate highlands. This year-round growth presents an opportunity to capture market share, both within and beyond PNG. Initial activities are identifying internal and external factors that constrain delivery systems, to enable improvements of both sea-borne and air-borne delivery.

A parasitic disease (surra) that causes chronic wasting in animals is a major constraint to livestock production in parts of Southeast Asia, but is yet to enter PNG. A surra outbreak would devastate the livestock industries in PNG and particularly affect pigs, which are commonly kept as stock. It would also raise the possibility of an outbreak in Australia. Molecular techniques using polymerase chain reaction testing have been developed that can detect parasite DNA in very small quantities of animal blood. Differences in parasite genetics are also being studied, revealing that some strains of the disease are more sensitive to potential treatments than others.

Sustainable forestry management, both to utilise potential products and to ensure the continued viability of existing plantation areas, is the aim of two projects that both focus on enhancing research capacity. One is focusing on management techniques, with training conducted to improve planning including in spatial planning systems, inventory methodology, the use of growth models, scheduling of regional timber harvesting and yield regulation. Data collection and analysis, including a review of inventory systems and permanent sample plot re-measurement, have also been conducted. The second project is examining the domestication of indigenous tree species. Substantial work has been done to gather information from relevant trials. Four species have been identified for use in field trials with seed collections for each completed. Trials for an additional 15 species have been established in the Lae Botanic Gardens.

ACIAR is involved in several capacity-building initiatives in PNG, in association with AusAID. A project on improving communication of scientific and technological knowledge for publication, education, and extension purposes has established a sound framework for ongoing cooperation between PNG's five universities. The 2002 pilot group of 19 lecturers from University of Technology (UniTech), University of Papua New Guinea, University of Goroka, Vudal University and Divine Word University were awarded UniTech's new Graduate Certificate in Communication of Science and Technology after completing prescribed coursework through their participation in the project's workshops in 2002. Learning materials to support delivery of two core subjects and five elective subjects were developed using a participative action learning process that also trained the participants to be trainers for new cohorts at their own institutions in 2003.

# Papua New Guinea Plan 2004–05

(extract from ACIAR Annual Operational Plan 2004–05)

Population	5.4 million
GNI per capita	AUD 976

Papua New Guinea: Bilateral research expenditure	\$m 2002–03 actual	\$m 2003–04 budget	\$m 2004–05 budget	\$m 2005–06 indicative
Active projects	3.17	2.97	1.76	0.7
Committed funds for new projects			0.87	0.6
Projects under design			0.70	1.0
Available for new projects				0.9–1.1
Total*	3.17	2.97	3.33	3.2–3.4

\*Includes AusAID funds as follows: \$1.37 m (2002–03 actual), \$1.0 m (2003–04 budget), \$2.0 m (2004–05 budget) and \$1.0 m (2005–06 indicative).

## Strategy

ACIAR's strategy in PNG is to support applied technical and economic research aimed at the enhancement of incomes for smallholders. There is an emphasis on root, plantation and horticultural crops and fish. This includes both export crops and domestically traded crops that generate smallholder income, along with support for improved food security. Project design encourages private sector/ industry and non-government organisation (NGO) linkages. Sustainability of renewable resources is encouraged through programmatic emphases on crop and livestock biosecurity and on sustainable management of forest and fisheries resources. The socioeconomic context of the scientific research is given particular attention. The PNG program has a strong emphasis on capacity building, with high priority to both training within projects and postgraduate training.

## Key performance indicators

- Growth in program budget for PNG compared with 2003–04
- Increased emphasis on projects with effective technology transfer components, including commencement of at least two new projects involving NGOs
- Graduation of at least two more PNG John Allwright Fellows
- Development of strategy for collaboration with NAQIA on quarantine aspects of fruit flies
- Inclusion of improved growth and yield modelling tools into national forest planning processes
- Expansion of new and more effective payment system for smallholder oil palm producers
- Pilot testing of new vegetable supply chains from the highlands to major lowland urban population centres
- Documentation of the current and potential role of peanut production in smallholder farming systems

## Position

Papua New Guinea is one of ACIAR's most important partners. ACIAR's investment and commitment in PNG reflects the deep, long-term relationship between the two countries. Overall, PNG is Australia's largest development partner, with a development cooperation program of over \$A300 million. Australia is committed to seeing PNG develop and prosper. ACIAR's program in PNG has endeavoured to reflect this and over recent years the portfolio has increased significantly. Since 1998 ACIAR and AusAID have worked and continue to work together to develop and fund a small set of projects of mutual interest.

PNG faces some formidable challenges to its agricultural development. It is a net food importer with high population growth rates. Village-based agriculture supports 70–80% of the population, and domestic trading of fresh produce is a very important source of cash income. By far the most important crop in PNG is sweet potato. Other root crops are also important but well below sweet potato. The main cash crops in order of export value are oil palm, coffee, cocoa and coconuts.

ACIAR has funded some highly successful projects, for instance control of the plant pest banana skipper and identification of the pheromone of cane borer (enabling its numbers to be monitored in the field), how to halt the spread of bee mites in PNG and also keep them out of Australia, conservation of indigenous plants and

management of the tuna industry. Much effort has gone into land-use planning and to developing policy for PNG's food security. A current project is establishing scientific communication training in the country's universities.

PNG's relative lack of resourcing and expertise is a constraint in R&D activities and in delivery of extension services. It is therefore crucial, when designing projects, to include training and packaging of research results for uptake by farmers.

## **Indicative priorities**

ACIAR has a formal program of consultations with PNG to establish priorities in research collaboration. These consultations are on a four-year rolling basis and were last held with PNG in August 2000; a record of the consultations is provided at [www.aciar.gov.au](http://www.aciar.gov.au) under Partner country priorities/Papua New Guinea. Consultation meetings to agree priorities for 2005-09 are due in the second half of 2004.

Overarching issues include the importance of agricultural development policy settings and research, especially with the increased role of provinces in the management of renewable resources. It is considered that the generation of income by smallholders is central to food security, community development and resilience to drought, frost and other natural disasters. Pressure on land/agricultural resources through population increases should be especially recognised in project design. There is the need for improved resource assessment of agricultural land, fisheries and forestry, recognising the diverse range of production environments in PNG.

The important role of the private sector and NGOs in R&D and implementation of research results in PNG has been identified. Identification of optimal industry models for the smallholder-commercial sector interface is also critical. Research into marketing constraints is seen as important, especially with a view to the analysis of transport constraints. Market chain information and postharvest quality systems are needed to guide resource development. It is also important to package the results of earlier research in a suitable form for uptake by farmers, and to incorporate farmer groups in training activities.

In 2004-05, new project proposals will be considered in the areas of agricultural systems/economics, crop protection, fisheries and forestry, with the current priorities being:

### *Agricultural systems economics and management*

- Land use management and government interventions in agricultural policy
- Marketing competitiveness
- Alternative approaches to extension
- Improved productivity of smallholder sweet potato and tree crop systems

### *Crop protection*

- Development of integrated pest management packages for staple and tree crops and introduced vegetables (e.g. English potato)
- Management of sweet potato weevil, *Oribius* weevil, pink wax scale, red-banded mango caterpillar, taro beetle, fruit flies, banana scab moth and exotic diseases
- Capacity building in diagnostics and indexing of viruses in PNG
- Application of non-chemical control, including biological control of weeds
- Conservation and characterisation of plant genetic resources and development of appropriate regional strategies

### *Forestry*

- Sustainable management of natural forests
- Plantation management:
  - restoration/reforestation of degraded upland grasslands
  - domestication of germplasm for agroforestry and plantation programs
  - genetic improvement of high-value species
- Postharvest processing, including reduction in waste, improved recovery through processing and preservation methods for improved durability

### *Fisheries*

- Management of shared fish stocks in the Torres Strait and Western Province
- Policy development and enhanced productivity of inland fisheries, pond aquaculture, stock enhancement and stocking of lakes and reservoirs
- Management of inshore fisheries resources:
  - community management of sedentary resources
  - training/standardisation of resource assessment management methods and policy tools
  - reef mariculture/stock enhancement studies and management of live reef fisheries

### **Key program managers**

Dr Ken Menz, Agricultural Systems Economics and Management

Dr Wendy Morgan, Crop Protection

Mr Barney Smith, Fisheries

Dr John Fryer, Forestry

Dr Greg Johnson, Postharvest Technology

### **Country Manager**

Ms Margaret Newman, ACIAR Country Manager PNG and Solomon Islands



# Active projects

## at 30 June 2004

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## **ASEM/2001/036: Maximising the economic benefits to Pacific Island Nations from management of migratory tuna stocks**

<b>Overseas Collaborating Countries</b>	Federated States of Micronesia, Fiji, Kiribati, Marshall Islands, Nauru, Palau, Papua New Guinea, Samoa, Solomon Islands, Tuvalu, Vanuatu
<b>Commissioned Organisation</b>	La Trobe University, Australia
<b>Project Leader</b>	Dr John Kennedy Phone : (03) 94792313 Email : j.kennedy@latrobe.edu.au
<b>Collaborating Institutions</b>	University of Queensland, Australia Secretariat of the Pacific Community, New Caledonia Forum Fisheries Agency, Solomon Islands
<b>Project Budget</b>	\$577,585
<b>Project Duration</b>	01/01/2002 to 31/12/2005
<b>Project Website</b>	<a href="http://www.business.latrobe.edu.au/staffhp/jkennedy/ACIARTechPapers.htm">www.business.latrobe.edu.au/staffhp/jkennedy/ACIARTechPapers.htm</a>
<b>ACIAR Research Program Manager</b>	Dr Ken Menz

### **Project background and objectives**

Shoals of tuna migrate through the exclusive economic zones (EEZs) of island nations in the Western and Central Pacific Ocean. This migratory characteristic means that no nation has control over the tuna stocks. Stocks in each EEZ depend on harvesting levels in each respective EEZ and on the high seas as well, thus each nation has special problems in managing harvesting effort within its EEZ. The member nations of the Forum Fisheries Agency (FFA) stand to gain the greatest total benefit if they unite to regulate fishing effort or catches by their domestic fleets or by distant water fishing nations. As well, the United Nations Fish Stocks Agreement seeks to set up Regional Fisheries Management Organisations for the conservation and efficient management of migratory stocks.

Against this policy background, this project is identifying and promoting strategies for Pacific Island Nations to maximise the economic benefits from their migratory tuna stocks. Researchers are gathering fishery data and undertaking economic analysis, bioeconomic modelling and policy development. They are updating biological and economic parameters of a model in order to use it for optimal year-by-year changes in access charges and fleet capacities. They aim to establish the economic negotiating positions of Pacific Island Nations (PINs) with rights to migratory tuna stocks, and of the Distant Water Fleet Nations (DWFNs) such as Japan, USA, South Korea, Taiwan and China interested in paying for access to the stocks.

### **Project progress**

#### **Year Two (01/01/2003–31/12/2003)**

An important model being used in the current project for modelling optimal harvesting decisions of the DWFNs is a bioeconomic model developed in a previous ACIAR project (ADP/1994/005: A bioeconomic analysis of tuna purse seining in the Pacific Islands region). In 2003 updating of technical and economic parameters continued as planned, and revised harvesting policies for different tuna species obtained. A technical paper on revised prices and costs, titled 'Tuna Prices and Fishing Costs for Bioeconomic Modelling of the Western and Central Pacific Tuna Fisheries' was released. A website was built to enable easy access to this and subsequent papers, and to present the aims of the project and the contact details of the project participants. The website has attracted overseas interest.

Solution times for the bioeconomic model are relatively long, for two reasons—the first is the detail in modelling the seasonal migration of tuna in the Western Central Pacific Ocean between 5 degree

squares, and the second is the very basic algorithm used for obtaining optimal solutions. Because the algorithm simulating optimal negotiation requires many runs of the model, there is the need for a faster, albeit less detailed, model. As planned, work continued in 2003 to develop a smaller, more aggregated model using a different solution process. The large model will be necessary for calibrating parameters in the smaller model. Work also started on reprogramming the large model to obtain solutions with the new optimising routine.

The special problem of obtaining international agreement on efficient management of migratory fish has been recognised in the United Nations Fish Stocks Agreement. This has led to establishment of commissions to oversee the conservation and management of migratory stocks in various parts of the world's oceans. When the project proposal was written in 2001 it was expected that a commission would be set up for the management of the migratory tuna stocks in the Western and Central Pacific Ocean. After a series of annual preparatory conferences, held since 2000 and involving the PINs and DWFNs affected, the Commission is to be convened in December 2004. The formation of the Commission should focus attention on the benefits of coordinated action by the PINs to improve efficiency in managing stocks.

A key question remains: What measures should be introduced to reduce the overexploitation of yellowfin and bigeye tuna by purse seine and longline vessels? The updated bioeconomic model is being used to study this question.

## **ASEM/2001/037: Improving the marketing system for fresh produce of the highlands of PNG**

<b>Overseas Collaborating Countries</b>	Papua New Guinea
<b>Commissioned Organisation</b>	University of Canberra, Australia
<b>Project Leader</b>	Professor John Spriggs Phone : (02) 6201 2317 Email : john.spriggs@canberra.edu.au
<b>Collaborating Institutions</b>	National Agricultural Research Institute, PNG Fresh Produce Development Corporation, PNG
<b>Project Budget</b>	\$399,567
<b>Project Duration</b>	01/01/2003 to 31/12/2005
<b>ACIAR Research Program Manager</b>	Dr Ken Menz

### **Project background and objectives**

The PNG Highlands region represents a unique environment in which high quality temperate-zone horticultural produce is grown year-round. The region has the potential to meet produce needs of populous coastal cities of PNG as well as to supply offshore markets. The main drawback to fulfilling this potential is an inadequate marketing system, and marketing improvements have been given a high priority in the PNG Government's National Food Security Policy, 2000–2010.

This project is concerned with socio-economic change through community-based decision-making where the community of interest involves all the stakeholders in this marketing system. It involves three subprojects: (1) mapping the marketing system for Highlands fresh produce; (2) facilitating the change process; and (3) capacity-building. Project researchers are focusing on two particular supply chains—a land/sea chain (bulky, less perishable produce) and a land/air chain (highly perishable, high value produce).

### **Project progress**

#### **Year One (01/01/2003–31/12/2003)**

During 2003, significant progress was made on all three sub-projects. The year began with a significant capacity-building exercise (Subproject 3) in which the four PNG members of the research team were brought to the University of Canberra for a two-week intensive training and development course on marketing, supply chain management and group facilitation. The course was developed and presented by the Australian members of the research team. As part of that course, the research team developed an action plan for mapping the marketing system. The action plan involved: (1) secondary data analysis, (2) process mapping of the supply chain, (3) semi-structured interviews of the major stakeholders of the marketing system, (4) a random sample survey of growers and consumers and (5) a supply chain profitability analysis. The mapping exercise was carried out by the PNG-based members of the research team under the direction of project leader Prof. Spriggs. While some of the work was directed from Canberra, Prof. Spriggs also made three field trips to PNG (8 weeks in total) in pursuit of this sub-objective.

One of the issues to emerge from the field trips was the lack of specific equipment necessary for carrying out the process mapping (e.g. data loggers), and these were subsequently funded by ACIAR. The equipment has proven extremely beneficial and is currently being used at the Fresh Produce Development Company (one of the partner institutions) in pursuit of Subproject 2. The mapping exercise is ongoing, but it has already provided crucial information on the problems limiting the development of the marketing system as well as pointing the way towards possible solutions. For example, it is clear that the problems have as much to do with a lack of human infrastructure (communication and coordination) as they do with physical infrastructure. Of the five activities laid down in the mapping action plan, (3) has been completed while (1), (2) and (5) are well under way. Activity (4) has been left until 2004.

In the last quarter of 2003, the focus of the project shifted from the mapping exercise (Subproject 1) to facilitating the change process (Subproject 2). The information obtained to date from the mapping exercise was used as input into Subproject 2. This subproject began in September with a series of focus groups in Goroka, Lae and Port Moresby, facilitated by Prof. Chambers with Prof. Spriggs playing the role of knowledge navigator. Then in November, a mini-workshop was held for women involved in the fresh produce industry, recognising the special and important role that women have in the fresh produce industry and giving them an opportunity for their voices to be heard, something that is hard for them in mixed group discussions. The initial expectation of 15 women representatives in attendance eventually swelled to 25.

The year culminated in the main Workshop in late November in Goroka. (Participants came from all elements of the marketing system (grower leaders, transporters, wholesalers, banks and supermarkets as well as provincial and national government representatives). It was planned to limit the number of participants to 30, but the eventual number was 36. Many participants commented on how it was practical and, at the same time, inclusive. The Workshop led to a Concept Paper for the development of the marketing system and to the establishment of a steering committee of stakeholders chaired by Prof. Spriggs.

The project work during the first year of this three-year project has set the stage for significant developments to take place in 2004. Prof. Spriggs is scheduled to return to PNG to work with the steering committee and representatives of the National Government of PNG, to flesh out the Concept Paper as a basis for a comprehensive program for the development of the physical and human infrastructure of the Highlands-based fresh produce marketing system.

## **ASEM/2001/055: Improving yield and economic viability of peanut production in Papua New Guinea and Australia using integrated management and modelling approaches**

<b>Overseas Collaborating Countries</b>	Papua New Guinea
<b>Commissioned Organisation</b>	Queensland Department of Primary Industries and Fisheries, Australia
<b>Project Leader</b>	Dr Nageswara Rao (RCN) Rachaputi Phone : (07) 4160 0737 Email : rao.rachaputi@dpi.qld.gov.au
<b>Collaborating Institutions</b>	Trukai Industries, PNG National Agricultural Research Institute, PNG International Crops Research Institute for the Semi-Arid Tropics, India
<b>Project Budget</b>	\$399,868
<b>Project Duration</b>	01/07/2002 to 30/06/2005
<b>Project Websites</b>	<a href="http://www.dpi.qld.gov.au/fsi/4354.html">www.dpi.qld.gov.au/fsi/4354.html</a> <a href="http://www.dpi.qld.gov.au/fieldcrops/3027.html">www.dpi.qld.gov.au/fieldcrops/3027.html</a> <a href="http://www.dpi.qld.gov.au/fieldcrops/6548.html">www.dpi.qld.gov.au/fieldcrops/6548.html</a>
<b>ACIAR Research Program Manager</b>	Dr Ken Menz

### **Project background and objectives**

Peanut production in PNG was an important industry, but annual production has declined from 2500 tonnes in the 1960s to less than 1000 t in 1990s, for a number of reasons including lack of improved high-yielding varieties, inadequate seed supply and the need for cost-effective agronomic practices suited to the local farming systems. Also discussions among Queensland peanut growers have revealed the need for a decision-support package to assist them in making critical decisions regarding farm management and financial planning.

The aim of this project is to improve yield, quality and/or economic viability of peanut production in PNG and Australia. Project researchers are assessing the status of the peanut industry in PNG and also conducting a limited survey of aflatoxin contamination in peanut at three major markets. This information should help the PNG government and private agencies to develop appropriate policies aimed at sustainable peanut production including management of an aflatoxin problem. In Australian researchers are attempting to incorporate economic considerations into biophysical models dealing with the country's peanut production issues.

### **Project progress**

#### **Year One (01/07/2002–30/06/2003)**

An initial coordination and methodology workshop was held at Lae, PNG from 21 to 23 Aug 2002, in which project collaborators from PNG public and private institutions, QDPI and ACIAR have participated. The workshop resulted in a technical work plan for the 02-03 season in PNG.

As a part of this project, 35 peanut lines have been imported from ICRISAT, India into PNG and Australia for further evaluation.

The following progress was attained during 2002-03:

Under Objective 1 the National Agricultural Research Institute (NARI) conducted a survey of peanut farmers during March–May 2003, in four provinces representing the major peanut growing regions in PNG. A total of about 410 farmers were contacted during the surveys in the four provinces.

The survey showed that although peanut was considered less important as a food crop, it ranked amongst the top five crops generating income for the family and was reported as the top ranking cash crop by 43.8% of respondents. The fact that peanuts are much more widely grown and marketed in

PNG than at first considered is testimony to the role this crop plays in the farming system and rural and peri-urban economies. Overwhelmingly, the women in all regions were much more heavily involved in peanut cultivation and marketing. Most farmers harvested multiple crops per year and sold peanuts in the urban and local markets or on main roadsides.

Peanuts are sold in various ways to suit consumer preference, including fresh on bunch, fresh loose, boiled on bunch, boiled loose, roasted on bunch, roasted loose, dried loose, dried in bags, fried and salted, etc. There was very little evidence of agriculture extension agencies participation in peanut production and utilisation in all regions except Eastern Highlands Province, where 25% of the farmers had DPI officers visiting them occasionally. All farmers were unaware of aflatoxin in peanut and it was their first time to be informed of health problems associated with aflatoxin. Given the important role that women play in peanut production and marketing it appears that they are a key target group in any future efforts to develop and extend improved agronomic and post-harvest handling practices. It was observed that in all survey areas, women were both keenly aware and very vocal about their role in peanut production, as opposed to some of the other more traditional crops. The project installed a Mini-column facility to analyse aflatoxin in peanuts and train a laboratory technician at the NARI Chemistry Lab. The facility is now fully capable of providing the aflatoxin testing using the rapid and low cost Mini-column method.

The highlights of the aflatoxin survey are the very high levels of aflatoxin contamination (up to 300 ppb) found in 17% of market samples from National Capital District (NCD). The fact that there were multiple samples with high levels of aflatoxin contamination was a serious concern. The survey results indicated a need for further work on the aflatoxin survey to identify the sources and causes of contamination. Under Objective 2 researchers are using a crop-modelling approach and field experiments to develop and implement improved varietal and management approaches for economically sustainable peanut production. The Australian developed APSIM Peanut model was used to examine effects of various crop management factors such as variety, time of planting on yields and aflatoxin risk. However, the scenarios could only be conducted for Ramu Sugar and Aiyura (but with very limited data) sites due to limitation on weather data. The scenario analysis has clearly demonstrated the merit of using a model as a tool to address a number of crop management issues as a first step before embarking on expensive field experiments. The tool also provided a way to add value to the existing weather databases in assessing potential for peanut production and associated risks in various regions. However, availability of long-term daily weather data remains a problem for a number of peanut growing regions.

Varietal trials conducted at Aiyura, Keravat and Ramu Sugar showed that some of the new introductions (from ICRISAT) have out yielded local checks by 2–3 times at all locations, which generated great interest among researchers and farmers.

Under Objective 3 researchers are developing a farm economic management software package to provide the Australian Peanut Industry with improved capacity to explore economic consequences associated with production and resource management risk in peanut farming systems. The project has been fortunate to access the services of Fred Chudleigh (agricultural economist, 20%) and Dr Yash Chauhan (crop modeller, 30%) to accomplish the task of developing the decision-support package to assess potential opportunities and economic risks associated with sustainability of irrigated and dryland peanut farming systems in Queensland. The project team held discussions with peanut farmers, industry consultants and researchers to define specific decision-support needs of the irrigated and dryland peanut industry. These needs have been prioritised and currently a decision-support tool at the whole farm level is being developed for rainfed peanut farming systems. A prototype decision-support system was scheduled for testing by the end of 2003.

## **ASEM/2002/014: Improving productivity and the participation of youth and women in the Papua New Guinea cocoa, coconut and oil palm industries**

<b>Overseas Collaborating Countries</b>	Papua New Guinea
<b>Commissioned Organisation</b>	Curtin University of Technology, Australia
<b>Project Leader</b>	Dr George Curry Phone : (08) 9266 3310 Email : g.curry@curtin.edu.au
<b>Collaborating Institutions</b>	Cocoa and Coconut Research Institute, PNG Oil Palm Research Association, PNG Cocoa & Coconut Extension Agency, PNG
<b>Project Budget</b>	\$399,736
<b>Project Duration</b>	01/07/2003 to 30/06/2006
<b>ACIAR Research Program Manager</b>	Dr Ken Menz

### **Project background and objectives**

A recent ACIAR-funded project promoted interventions in the smallholder oil palm sector of PNG, including the increased participation of women in the industry through the 'lus frut mama' card scheme. These interventions led to significant increases in smallholder productivity, and this project aims to replicate such achievements in the PNG smallholder cocoa and coconut sectors. Researchers are conducting an in-depth evaluation of a promising new payment system (also arising from the earlier ACIAR project) for oil palm smallholders at Hoskins, West New Britain and seek to further adapt it for other smallholder oil palm regions and for the smallholder cocoa sector in PNG. The project is designed to promote the sharing of knowledge and expertise between the key smallholder extension agencies and research organisations in the three industries.

### **Project progress**

First progress report is due in September–October 2004.

## **ASEM/2002/050: Economic performance and management of the Gulf of Papua prawn fishery**

<b>Overseas Collaborating Countries</b>	Papua New Guinea
<b>Commissioned Organisation</b>	Australian National University, Australia
<b>Project Leader</b>	Dr Thomas Kompas Phone : (02) 6125 6566 Email : tom.kompas@anu.edu.au
<b>Collaborating Institutions</b>	National Fisheries Authority, PNG
<b>Project Budget</b>	\$269,486
<b>Project Duration</b>	01/07/2003 to 30/06/2006
<b>ACIAR Research Program Manager</b>	Dr Ken Menz

### **Project background and objectives**

Although not large by world standards, the Gulf of Papua prawn fishery is important to PNG, second only in size and value to the PNG tuna fishery. The overall objective of this project is to provide a clear, comprehensive analysis of the economics of this fishery, including an analysis of the appropriate management arrangements designed to maximise the fishery rate of return and to promote economic efficiency and profitability at sustainable levels. The project is also examining the implications for the fishery as a whole of issuing additional licenses for a small boat (inshore) fishery, and is providing considerable capacity-building for ongoing research and fishery management at the National Fisheries Authority in Papua New Guinea. There are sufficient complementarities for the study to also benefit the Australian northern prawn and Torres Strait fisheries.

### **Project progress**

First progress report is due in September–October 2004.

## **ASEM/2003/010: Farmer evaluation and multiplication of sweet potato varieties on the north coast of PNG**

<b>Overseas Collaborating Countries</b>	Papua New Guinea
<b>Commissioned Organisation</b>	World Vision Australia, Australia
<b>Project Leader</b>	Mr John Donnelly Phone : (03) 9287 2233 Email : john.donnelly@worldvision.com.au
<b>Collaborating Institutions</b>	Australian National University, Australia World Vision Trust Pacific Division, PNG National Agricultural Research Institute, PNG
<b>Project Budget</b>	\$795,937
<b>Project Duration</b>	01/04/2004 to 31/03/2007
<b>ACIAR Research Program Manager</b>	Dr Ken Menz

### **Project background and objectives**

In PNG more than 60 per cent of the population is dependent on sweet potato. The country's most important crop, it provides more than 30 per cent of total food calories. Alternative food sources are becoming more expensive with devaluation of the kina. Recent droughts and other climatic problems have significantly reduced yield. The National Agricultural Research Institute has tested new sweet potato varieties, but these have not had much penetration in coastal communities in the north. Many of the new varieties have improved drought resistance and are more robust in yield across a variety of conditions. The project is using on-farm trials and multiplication sites to extend these new varieties into coastal farming communities of Madang.

### **Project progress**

First progress report is due in May–June 2005.

## **AS1/2000/009: Development of diagnostic and control methodologies for animal trypanosomiasis (surra) in Papua New Guinea, Indonesia, the Philippines and Australia**

<b>Overseas Collaborating Countries</b>	Indonesia, Papua New Guinea, Philippines
<b>Commissioned Organisation</b>	Murdoch University, Australia
<b>Project Leader</b>	Dr Simon Reid Phone : (08) 9360 7423 Email : sreid@central.murdoch.edu.au
<b>Collaborating Institutions</b>	Research Institute for Veterinary Science, Indonesia Dinas Peternakan, Irian Jaya, Indonesia National Agriculture and Quarantine Inspection Service, PNG University of Southern Mindanao, Philippines Department of Agriculture, Region XI, Philippines Balai Penyidikan Penyakit, Sulawesi, Indonesia
<b>Project Budget</b>	\$399,880
<b>Project Duration</b>	01/01/2001 to 31/12/2005 (Project extended from 01/01/2004 to 31/12/2005)
<b>ACIAR Research Program Manager</b>	Dr John Copland

### **Project background and objectives**

Animal trypanosomiasis (Surra) caused by *Trypanosoma evansi* is endemic throughout Southeast Asia and an important constraint to productivity of smallholder livestock. It is prevalent in the Philippines and Indonesia, but has not been detected in PNG and Australia. There is a wide host range, and both native marsupial animals and livestock would be affected if it entered Australia. This project aims to: enhance capability for effective surveillance of surra in Papua, PNG and the Philippines through development and transfer of new diagnostic technologies; identify genetic markers for pathogenicity in *T. evansi* and investigate their usefulness in predicting outbreaks of clinical disease; test the effectiveness of existing trypanocidal drugs and new candidate compounds in treating *T. evansi*. Scientists from Murdoch University and Balitvet are introducing diagnostic tests for *T. evansi* to collaborating institutions through hands-on workshops and in-country training.

### **Project progress**

#### **Year 3 (01/01/2003–31/12/2003)**

*Transfer of existing technologies:* A project workshop held in Darwin on 3–4 July 2003 was attended by project staff from Indonesia, the Philippines, Papua New Guinea and Australia as well as scientists from the Northern Australian Quarantine Strategy (NAQS) and the Northern Territory Department of Primary Industries. Project outputs were presented and discussed in the context of the priorities of each partner country. Information suitable for dissemination at the smallholder level was identified and data suitable for publication were also identified.

*Application of molecular techniques to improve the accuracy of diagnosis of T. evansi:* This aspect of the project has progressed well and a prototype sample collection kit using Whatman FTA Cards has been developed and provided to project participants in Mindanao for evaluation. In addition, veterinary staff members from NAQS have purchased FTA cards and preliminary evaluation in their program in East Timor has confirmed their suitability for use to collect blood samples for surveillance for surra and other blood-borne infections. The use of FTA cards to collect blood samples in remote areas will significantly enhance surveillance for *T. evansi* in Australia and PNG.

Results of testing tissue samples from animals experimentally infected with *T. evansi* showed that lung and heart, in particular the heart valve, were positive on more occasions than other tissues and blood. This information has been provided to veterinary staff at NAQS because it will ensure the correct samples are collected during surveys of wild or feral animals in Australia and PNG where individual animals are killed and samples taken post mortem.

*Determining the genetic basis for intraspecific variation in pathogenicity:* There is insufficient data to determine the genetic basis for differences observed in the pathogenicity of *T. evansi* in mice. Genetic differences have been identified between isolates of *T. evansi* from Indonesia, the Philippines and Kenya (as part of a related project), showing correlation between differences in the epidemiology of infection in camels and geographic separation in Kenya, while differences in Indonesia correlate with geographic separation.. It is difficult to interpret results from the Philippines because there are only a limited number of isolates from two regions of Mindanao.

*Evaluating the efficacy of existing trypanocidal drugs for the treatment of T. evansi:* Four separate experiments were conducted at Balitvet to determine the comparative sensitivity of 5 isolates of *T. evansi* from different geographic locations in Indonesia to three trypanocidal drugs (diminazene aceturate, quinapyramine, cymelarsan). Only cymelarsan was deemed suitable for further evaluation in large animals because both diminazene and quinapyramine failed to cure all animals, even at high potentially toxic dose rates, and quinapyramine caused overt signs of toxicity at sub-curative doses. No signs of toxicity were observed with cymelarsan.

*Epidemiology of infection with T. evansi in Mindanao:* Good progress was made in collecting data to determine some of the risk factors associated with *T. evansi* infection in Mindanao. A large data set was collected from longitudinal surveys of 50 cattle owners and 50 buffalo owners from Matalam and Kabacan. The set contained information on the prevalence of infection with *T. evansi*, factors relating to the individual livestock and their management by farmers, and information about social factors such as household income and education levels. Results show that the prevalence of infection in Kabacan has decreased markedly from 2001 to 2002.

Data analysis showed that carabao (buffalo) owners who also own goats are twice as likely to have animals that register positive to the *Card Agglutination Trypanosoma Test* (CATT), and that farmers with only elementary education are five times more likely to have CATT-positive animals compared to farmers who have secondary level education. There is also a weak association between increasing income and increasing likelihood of having CATT-positive buffaloes. These results show that communication packages must focus on farmers with elementary-level education to ensure the greatest impact. More data on other management factors are required to interpret the significance of goats and household income in the epidemiology of infection with *T. evansi*.

A Microsoft Access database has been developed to store information on the frozen isolates of *T. evansi* held at Balitvet, allowing this valuable resource to be used more effectively to study *T. evansi*. Project researchers at Murdoch University have developed a mouse model with similar features to ruminant surra in Mindanao. This research tool will be used to develop tools and methodologies for the study of the pathogenesis of surra as well as tests to detect infection.

## **AS1/2001/054: The identification of constraints and possible remedies to livestock production by zoonotic diseases in the South Pacific**

<b>Overseas Collaborating Countries</b>	Fiji, Kiribati, Papua New Guinea, Tonga
<b>Commissioned Organisation</b>	Murdoch University, Australia
<b>Project Leader</b>	Dr Simon Reid Phone : (08) 9360 7423 Email : sreid@central.murdoch.edu.au
<b>Collaborating Institutions</b>	National Agriculture and Quarantine Inspection Service, PNG Secretariat of the Pacific Community, Fiji University of Melbourne, Australia Children's Hospital, Westmead, Australia Department of Agriculture, Fisheries and Forestry, Australia WHO/FAO/OIE Collaborating Centre for Reference & Research on Leptospirosis, Australia
<b>Project Budget</b>	\$399,670
<b>Project Duration</b>	01/01/2002 to 31/12/2004
<b>ACIAR Research Program Manager</b>	Dr John Copland

### **Project background and objectives**

In some Pacific island countries zoonotic diseases (diseases that can be transmitted to humans from animals) are becoming a problem as a result of increasing human and animal density. This project is studying three zoonotic infections (trichinellosis, leptospirosis and angiostrongylosis) that have the potential to cause severe animal production loss and impact human health. The project is developing the capacity for effective surveillance of *Trichinella*, *Leptospira* and *Angiostrongylus cantonensis* infection in livestock in the Pacific Islands. It is also determining the prevalence of *Trichinella*, *Leptospira* and *A. cantonensis* infection in livestock in Fiji and Kiribati and the risk factors associated with their transmission identifying the species of *Trichinella* present in Fiji and Kiribati, and investigating how diseases arise from *T. papuae* in pigs and from *A. cantonensis* in ruminants. The findings of the project will be used to formulate a regional education and control program for zoonotic diseases and to establish a network on zoonoses.

### **Project progress**

#### **Year 2 (01/01/2003–31/12/2003)**

An ELISA test was successfully developed for *Leptospira pomona*. This ELISA has now been standardised for use in cattle and pigs. The results from testing serum collected cattle on Numundo Farm in PNG show that the test has good agreement with the standard serological test and that it had high specificity. Further work is required to test sufficient samples from PNG to determine the diagnostic sensitivity and specificity compared to the standard test. The test is now in a format suitable for transfer to partner laboratories.

A two-day workshop on diagnostic techniques for *Trichinella* infection was held at the National Veterinary Laboratory (NVL) in PNG.

Results of a retrospective serological survey of 479 people living in the Balimo area showed that the prevalence of infection with *Trichinella* of 29.5%. Antibody prevalence did not differ according to sex but there was a significant difference between age groups, and also appeared to differ significantly according to geographic region and age. These results (and those from other surveys) show that *T. papuae* is probably widely distributed in wild pigs (the most likely source of infection for humans) in the south coastal area of PNG at least as far east as Gulf Province.

At the NVL, examination of muscle digests from 31 pigs and 15 rats from the Goroka area found no evidence of *T. papuae*.

Following the discovery of *Trichinella zimbabwensis* in crocodiles in Zimbabwe AQIS has required PNG to confirm freedom from *Trichinella* infection in its crocodile meat exported to Australia from Mainland Holdings Crocodile Farm in Lae. A total of 112 samples of crocodile muscle have been tested at the NVL from captive bred and wild-caught animals. The majority of wild-caught crocodiles originate from the Kikori area (n=52) in Gulf Province. Sixteen of the 52 (30.8%) samples of meat taken from crocodiles from Kikori contained *T. papuae* larvae.

Surveys to determine the prevalence and identity of infecting *Leptospira* serovars began in 2003. Results of a cross-sectional survey of breeding cattle on Numundo Beef (West New Britain Palm Oil) show that there is a high prevalence of *Leptospira* infection in cattle older than two years of age and that the predominant infecting serovars were *hardjo*, *pomona*, *swajizack* and *medanensis*. These data confirm that active *Leptospira* infection exists in cattle herds in PNG and may be a factor in the infertility observed in cattle in PNG.

## **AS2/2001/077: Poultry feeding systems in PNG**

<b>Overseas Collaborating Countries</b>	Papua New Guinea
<b>Commissioned Organisation</b>	South Australian Research and Development Institute, Australia
<b>Project Leader</b>	Dr Phil Glatz Phone : (08) 8303 7786 Email : glatz.phil@saugov.sa.gov.au
<b>Collaborating Institutions</b>	National Agricultural Research Institute, PNG Morobe Provincial Division of Agriculture and Livestock, PNG Madang Provincial Department of Primary Industries, PNG Salvation Army Development Program, PNG Lae Feed Mills, PNG
<b>Project Budget</b>	\$399,975
<b>Project Duration</b>	01/07/2002 to 30/06/2005
<b>ACIAR Research Program Manager</b>	Dr Bill Winter

### **Project background and objectives**

During 2001, surveys and studies conducted by the National Agricultural Research Institute (NARI) in PNG to identify livestock R&D issues determined that reducing the cost of livestock feeding was of the highest priority. In particular, the smallholder broiler chicken industry that produces about 6 million birds per year (value \$A54 million) was identified as a sector where feed costs could be reduced and profitability increased with greater use of local feed resources. This project aims to establish a facility at NARI to evaluate local feedstuffs as substitutes for imported grains and to formulate poultry rations that can be produced by local feedmills for village use. Provincial Governments and an NGO are supporting the in-village demonstration trials of the new rations.

### **Project progress**

#### **Year 2 (01/01/2003–31/12/2003)**

One project objective is to establish a quality-assured research facility in PNG to determine the quality of poultry feeds. This has been achieved—the infrastructure to measure apparent metabolisable energy (AME) is completed and operating efficiently. A shipping container for feed storage was sited next to the AME building. A roof, dehumidifier and air conditioner were fitted to the container and it was also made vermin proof.

A second objective was to formulate and evaluate low-cost milled and home mix rations based on locally available feeds. The feeds tested were copra meal, palm kernel cake, wheat mill run, sweet potato, sweet potato leaves, sago, cassava, rice bran, wheat, coconut, Wewak, RDT and IFC fish meal, gliricidia leaves, Lae Feed Mills broiler starter, Lae Feed Mills broiler finisher and rice hulls. Birds fed diets with cassava, sweet potato and palm kernel meal performed to a good standard.

In Objective 3, scientists are establishing a system for the exchange of information with smallholder farmers about low-cost rations for poultry production. They have completed baseline farm surveys in Bulolo, Finschhafen, Madang and Kainantu regions of PNG during the last half of 2003. The Madang survey (100 farmers from five districts) was completed in August 2003 and the Eastern Highland survey in October 2003. Farmers were found to have similar problems to those encountered in Morobe—price of chickens and feed, no access to information and no help from the government system. Overall the broiler farmer survey involved about 250 farmers. Data have been entered into Excel spreadsheets for analyses. In Australia project scientists are making progress in establishing a free-range broiler production facility and evaluate local feeds.

## **CIM/1996/140: Biological threats to *Saccharum* germplasm and sugar production in Papua New Guinea, Indonesia and Australia**

<b>Overseas Collaborating Countries</b>	Indonesia, Papua New Guinea
<b>Commissioned Organisation</b>	Bureau of Sugar Experiment Stations, Australia
<b>Project Leader</b>	Dr Robert Magarey Phone : (07) 4068 1488 Email : rmagarey@bses.org.au
<b>Collaborating Institutions</b>	Indonesian Sugar Research Institute, Indonesia Ramu Sugar Ltd, PNG
<b>Project Budget</b>	\$825,583
<b>Project Duration</b>	01/07/2000 to 30/06/2006 (Project extended from 01/07/2004 to 30/06/2006)
<b>ACIAR Research Program Manager</b>	Dr Colin Piggin

### **Project background and objectives**

Sugar cane had its origins in Papua New Guinea and Papua, and a rich diversity of wild germplasm is still present there. But environmental disturbances and the introduction of exotic pests and diseases pose major threats to this region as well as to Australia. This project involves a survey of major diseases and insect pest species that will be undertaken from Irian Jaya through PNG to Australia's northern coastline. The scientists will also determine the effect of each pest and disease on the sugar cane and decide the best means of respective control. The project involves upgrading of laboratory facilities in PNG and Papua, and provision of extra training for local quarantine personnel and researchers.

### **Project progress**

#### **Year 3 (01/07/2002–30/06/2003)**

Updated pest and disease listings for each country are important for targeting quarantine strategies and developing appropriate controls. Surveys have been undertaken in PNG (2001), northern Australia (2002), Indonesia (2002) and Cape York and the Torres Strait (2003). These have provided an important understanding of the distribution of major pests and diseases in the region. No other coordinated sugarcane survey of the region has ever occurred. The surveys highlighted the following matters:

- Ramu stunt, a major PNG disease, was found to be much more widespread than expected in PNG and may be significantly closer to the Australian industry than previously recognised. It was not detected however in the Torres Strait in June 2003.
- No smut or ratoon stunting diseases was found on the PNG survey, across northern Australia (except for smut at the known infestation on the Ord River), on Cape York or the Torres Strait.
- The Indonesian survey highlighted that movement of sugarcane smut had occurred eastward from Java, closer to PNG and the eastern Australian industry. This had occurred with the spread of hybrid (commercial cultivars) material. This questions the adequacy of quarantine procedures in the region.
- The disease leaf scald has also spread east from Java in the same material.
- The widespread movement of hybrid sugarcane within the region became obvious. In PNG, villagers in even remote outer islands were growing sugarcane obtained from commercial crops at Ramu Sugar. This not only means that some chewing canes (*S. officinarum*) had been displaced, but that the potential for spread of several major diseases from the commercial cropping estate to disease-free areas was now significant.
- The Cape York survey highlighted the lack of significant quantities of sugarcane between the cropping areas around Mossman and the garden canes in the Torres Strait Islands. This is very

positive; it means there is less risk of pest and disease spread from PNG and the Torres Strait to the Australian sugar industry.

- The finding of the planthopper *Eumetopina* at Bamaga (tip of Cape York) in just a couple of gardens, coupled with its isolated occurrence in the Torres Strait, suggests that eradication from the mainland of Australia is a real possibility. This planthopper is the vector for Ramu stunt, a major disease of sugarcane at Ramu Sugar (PNG). *Eumetopina* was known to occur in the Torres Strait and Bamaga, but the few infested plants found suggest eradication could be possible. If eradicated then AQIS quarantine protocols would provide a barrier to any re-introduction and provide an extra layer of protection for the Australian sugar industry.
- The need for further quarantine training/materials. Two training workshops were held for Torres Strait and PNG staff but there remains a need for more training in both of these locations. There is a definite need in Indonesia. The spread of sugarcane from Java to the eastern islands of the archipelago and to West Papua is of grave concern and more work is needed in this whole region.

A sensitive assay for Ramu stunt is needed for quarantine purposes in germplasm exchange between countries/regions. Attempts to identify the causal agent have so far failed. A phytoplasma has been reported associated with the disease by another research group but this cannot yet be confirmed. Research so far has identified some unique very small nucleic acids. The early departure of the researcher has meant this finding could not be further pursued at this time.

A resistance-screening test for the stem borer *Sesamia griseocens* is needed at Ramu Sugar to improve the viability of their cropping industry. Research has proved fruitful in identifying resistance to the borer and in advancing the development of a resistance-screening test. Plant parameters that may be measured to determine the resistance of canes are being identified. Lack of borer infestation in the most recent trials has hindered progress.

Two important training sessions were delivered during the period. In November 2002, AQIS officers from all parts of the Torres Strait were trained in pests and diseases of sugarcane in a workshop on Thursday Island. Later in November 2002, PNG quarantine staff attended a three-day training workshop at Ramu Sugar. Here they saw major pests and diseases in the field and were exposed to important aspects of the project work. They left with a much clearer understanding of the significance of *Saccharum* germplasm in PNG, the need for good quarantine protocols, the importance of their role in quarantine and the nature of the pests and diseases of sugarcane within the region.

At each training workshop the first sugarcane pest and disease manuals for both the Torres Strait and PNG were distributed. These will provide an ongoing source of information for quarantine officers.

Ongoing smut resistance screening is critical to industries in Australia and Indonesia for preventing very large industry losses. Research has concentrated on storage of smut spores for resistance screening trials. The resistance screening has been ongoing with over 900 clones now screened. Results have been encouraging, and are being used to help prepare the Australian industry should a disease incursion occur. The Indonesian Sugar Research Institute has also established resistance-screening trials for ratoon stunting disease (RSD) and leaf scorch, a leaf disease that recently spread from Malaysia into Indonesia. The Institute has also embarked on an industry survey for RSD, as the disease is one of their most important. The RSD assay laboratory, established with ACIAR funding, will be central to this work.

## **CIM/1998/061: Coconut tissue culture for clonal propagation and safe germplasm exchange**

<b>Overseas Collaborating Countries</b>	Indonesia, Papua New Guinea, Philippines, Vietnam
<b>Commissioned Organisation</b>	University of Queensland, Australia
<b>Project Leader</b>	Dr Steve Adkins Phone : (07) 3365 2072 Email : s.adkins@mailbox.uq.edu.au
<b>Collaborating Institutions</b>	Philippine Coconut Authority, Philippines Cocoa and Coconut Research Institute, PNG Research Institute for Coconut Palms, Indonesia University of the Philippines at Los Banõs, Philippines Oil Plants Institute of Vietnam, Vietnam
<b>Project Budget</b>	\$711,309
<b>Project Duration</b>	01/07/2002 to 30/06/2005
<b>ACIAR Research Program Manager</b>	Dr Colin Piggin

### **Project background and objectives**

In many countries coconut farmers suffer from decreasing farm productivity, largely due to ageing of palms and natural calamities such as pests and diseases, drought and typhoons. Varieties with higher yields and better environmental adaptations, and varieties that provide high-value products are needed to increase the income of coconut farmers and promote sustainable coconut production. This project is supporting collaboration between Australia, Indonesia, the Philippines, Papua New Guinea and Vietnam, designed to facilitate the safe transfer of coconut germplasm and the propagation of elite cultivars. Scientists are working to develop protocols for the rapid production of clonal, true-to-type plants and for improved embryo culture (regeneration of rooted plants from excised embryos). They are also developing techniques for genetic analysis to ensure that plants coming from a variety of sources are true to type. As the techniques develop they are being made available to germplasm banks in the partner countries.

### **Project progress**

#### **Year 1 (01/07/2002–30/06/2003)**

Both the UQ and partner teams made good progress in the early phase of the project.

*University of Queensland:* Experiments on embryo transplantation, embryo culture, somatic embryogenesis and molecular analysis of tissue-cultured plantlets all took place at UQ in the first year.

- The first coconut seedlings, following embryo transplantation, have been successfully produced in the glasshouse. The transplantation technique used still requires improvements and is the subject of overseas collaborative work with the partners.
- Large numbers of zygotic embryos have been imported from the Philippines. They have been germinated in vitro and are being used to investigate improved methods of seedling growth, development and establishment. This work at UQ plans to examine the use of CO<sub>2</sub> enrichment for improved plantlet formation and greater soil survival.
- The UQ researchers have adapted their somatic embryogenesis protocol, previously developed for zygotic tissue explants, and are using it on explants from imported inflorescence tissues. The procedure showed a very low efficiency rate; medium additives such as coconut water and lauric acid improved the rate of success but no significant results have been achieved. From other studies, preliminary results indicate that abscisic acid (AbA) could improve the development of somatic embryos from inflorescence tissues.

- A protocol for DNA extraction and purification has been optimised for coconut tissues. Good visualisation of DNA can be obtained using approximately 15 to 20 ng of DNA per reaction. Other DNA samples have been imported from CICY, Mexico and are being analysed for the methylation polymorphisms that may exist between clones.
- The team at UQ hosted a meeting in March 2003 to launch a book published by ACIAR. Titled 'The Coconut Odyssey: The bounteous possibilities of the tree of life', it was written by Mr Mike Foale, CSIRO, an associate member of the UQ team.

*Partners:* In Indonesia, PNG, Vietnam and Philippines, the embryo culture research activities are still at an early stage of development. The present work aims are to prepare sufficiently large numbers of germinating embryos for their future work needs on improving seedling establishment rates.

- The early studies undertaken include those manipulating the culture medium to aid root system development, for producing a good shoot mass to root mass ratio, and those aiming to develop better acclimatisation steps. The germinating embryos, presently being established, take up to one year before they can be used in such experimentation. Therefore, the results will only become available in the second and third years of the project.
- In PNG, work on embryo quality has just been started while one partner in the Philippines has initiated work on somatic embryogenesis.
- Meetings at the collaborating partners' laboratories (PNG, Vietnam and the Philippines) have been undertaken to sharpen the focus of the project program.
- A new internet discussion group 'ACIAR coconut' has been established to facilitate information exchange among the team members involved in the project.

## CP/1996/091: Biological control of *Chromolaena odorata* in Indonesia, Papua New Guinea and the Philippines

<b>Overseas Collaborating Countries</b>	Indonesia, Papua New Guinea, Philippines
<b>Commissioned Organisation</b>	Queensland Department of Natural Resources and Mines, Australia
<b>Project Leader</b>	Dr Michael Day Phone : (07) 3375 0725 Email : Michael.Day@nrm.qld.gov.au
<b>Collaborating Institutions</b>	Universitas Nusa Cendana, Indonesia SEAMEO Regional Centre for Tropical Biology, Indonesia National Agricultural Research Institute, PNG Parks and Wildlife Commission of the Northern Territory, Australia Gajah Mada University, Indonesia Philippine Coconut Authority, Philippines Indonesian Oil Palm Research Institute, Indonesia Centre de Cooperation Internationale en Recherche Agronomique pour le Developpement, Indonesia
<b>Project Budget</b>	\$592,875
<b>Project Duration</b>	01/07/1997 to 31/03/2005 (Project extended from 01/01/2002 to 31/03/2005 in PNG only)
<b>ACIAR Research Program Manager</b>	Dr Wendy Morgan

### Project background and objectives

*Chromolaena odorata* (Siam weed) has become one of the most serious weed problems in the wet tropics of Asia and Africa and also poses a threat to Australia. Although 225 natural enemies of the weed are known, prior to 1992 only two of these had been tested as potential biocontrol agents. In a previous ACIAR project (CS2/1991/010), releases of a *Chromolaena* leaf-feeding moth, *Pareuchaetes pseudoinsulata*, were extended into oil palm and pastoral areas in Java, Sumatra and Timor, resulting in effective control of the weed in Sumatra. After host-specificity tests a new agent, the stem-galling fly *Cecidochares connexa*, was approved for release and established at several sites in Java, Timor and Papua. During the first phase of the current project, release and monitoring of both control agents continued in Timor, the eastern islands of Indonesia and Papua New Guinea. Additional control agents were introduced and tested in Indonesia. In the Philippines, the gallfly was introduced and tested, and approval sought for its release.

The project concluded in Indonesia and the Philippines in December 2001. Objectives for this current phase of the work are (1) to mass-produce and release existing biocontrol agents in all areas of Papua New Guinea, with the ultimate objective of establishing them in all areas of the country; (2) to import and test two new biocontrol agents; (3) to monitor the establishment of the control agents and their effect on the weed through field surveys; and (4) to train PNG provincial staff in handling and releasing the biocontrol agents, monitoring release sites, and building awareness of the weed and its control in affected areas.

### Project progress

#### Year 5 (01/01/2003–31/12/2003)

The reporting and recording of new *Chromolaena* infestations within PNG continued, with 38 previously unreported infestations being found. Awareness of most of these sites arose due to ongoing public campaigns and a *Chromolaena* workshop held in Lae in August 2003. *Chromolaena* has now been found at 146 sites, covering 12 provinces. In some provinces such as New Ireland, the weed is still spreading along roadsides.

The gall fly *Cecidochares connexa* continues to be field-collected from various sites in the Markham Valley, Morobe Province and released in other provinces—14,000 galls were released in 28 sites in five provinces over the past year. The fly has now been released in 10 provinces and has established in 26 sites in eight provinces. Field populations are increasing in most areas where the fly has established, with 20 galls per plant being recorded at some sites. The fly continues to spread, at some sites up to 10 km from the point of release.

The rearing and release of the moth *Pareuchaetes pseudoinsulata* continues to be difficult. Over 21,000 larvae were released at seven sites in Madang and Morobe provinces. The moth has now been released in eight provinces but has only established in Morobe Province, where it has been found at 10 sites. Damage at some sites in the Markham Valley has been significant, with plants being severely defoliated on a seasonal basis. The rearing colony at Labu was resurrected in early 2003 but has subsequently died out.

A workshop on the biocontrol of Chromolaena was held in Lae in August, with participants from nine provinces that contain Chromolaena. Representatives from National Agricultural Quarantine and Inspection Authority (NAQIA) and the Department of Environment and Conservation (DEC) were also present. The workshop covered all aspects of the project, including identification and potential impacts of the weed and rearing, releasing, monitoring and re-distribution of biocontrol agents. Workshop participants will assist in the future release and monitoring of agents in their province.

An application to import a third agent, the leaf-mining fly *Calycomyza eupatorivora* from South Africa was submitted and approval to import by DEC and NAQIA is still pending.

An application to import the stem-boring beetle *Lixus aemulus* is currently being prepared for submission to NAQIA and DEC.

## CP/2000/044: Taro beetle management in PNG and Fiji

<b>Overseas Collaborating Countries</b>	Fiji, Papua New Guinea
<b>Commissioned Organisation</b>	Secretariat of the Pacific Community, Fiji
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<b>Collaborating Institutions</b>	CSIRO Entomology, Australia Ministry of Agriculture, Sugar and Land Resettlement, Fiji National Agricultural Research Institute, PNG
<b>Project Budget</b>	\$711,309
<b>Project Duration</b>	01/01/2002 to 31/12/2005
<b>ACIAR Research Program Manager</b>	Dr Wendy Morgan

### Project background and objectives

This project builds on work supported over a number of years by the European Union (through the Secretariat of the Pacific Community). The 4-year Taro Beetle Management program commenced on 1 January 2002, as a component of the SPC Pest Management in the Pacific (PMP) program. PMP is one of the two major projects of SPC-Plant Protection Service funded jointly by Australia (AUSAID and ACIAR) and New Zealand (NZAID). Project scientists are completing several research aspects from the earlier project, in preparation for implementation of practical control of taro beetle in two South Pacific countries (PNG and Fiji). They are developing ways to increase the effectiveness of controlling taro beetle grubs through the use of the fungal pathogen *Metarhizium anisopliae* and the viral pathogen *Baculovirus oryctes*. They are also developing sustainable methods for taro beetle control with minimal use of chemical pesticides. Further studies are developing protocols for synergistic combination of chemical pesticides and use of biological control agents to achieve optimum control. Results will be provided to taro growers in the partner countries through participatory implementation approaches in association with SPC extension services.

### Project progress

#### Year 2 (01/01/2003–31/12/2003)

Sodium metabisulphate is now used to sterilize culturing media, and rice has been found to be a suitable substrate for the low-cost production of *Metarhizium (Ma)*. This method of *Ma* production is promising but this needs to be evaluated further before the technology is transferred to farmers. Storage of *Ma* also needs to be studied so the shelf life of spores can be extended.

The technical progress in 2002 and 2003 was reviewed at the 3rd Taro Beetle Management Technical Coordinators Meeting (May 2003) and at the 4th Taro Beetle Technical Committee Meeting (November 2003) in Fiji. The following progress was noted: three field trials were planted in PNG to select appropriate doses of *Metarhizium* for application; six field trials were planted in Fiji.

## CP/2001/032: Impact and management of *Oribius* weevils in Papua New Guinea

<b>Overseas Collaborating Countries</b>	Papua New Guinea
<b>Commissioned Organisation</b>	Queensland University of Technology, Australia
<b>Project Leader</b>	Dr Anthony Clarke Phone : (07) 3864 5023 Email : a.clarke@qut.edu.au
<b>Collaborating Institutions</b>	National Agricultural Research Institute, Agricultural Research Division, PNG
<b>Project Budget</b>	\$336,045
<b>Project Duration</b>	01/07/2002 to 31/12/2004
<b>ACIAR Research Program Manager</b>	Dr Wendy Morgan

### Project background and objectives

*Oribius* weevils are a group of insects native to PNG (and far north Queensland). They feed on leaves, shoots and fruits of a number of different horticultural crops, and are a widespread and serious agricultural problem. This project aims to discover more about their biology and habits. Scientists are measuring in detail the damage levels and overall impact of *Oribius* weevils on citrus, coffee, carrot, tomato, potato and French bean (seedlings or juvenile plants, and mature plants), and studying which commercially available insecticides are effective for short-term control while IPM strategies are developed. They are also determining aspects of their biology and habits that could be manipulated in order to assist in their management. Also a preliminary taxonomic revision of *Oribius* and closely related weevils (PNG and northern Australian species) will provide a sound basis for understanding biological differences among this group of pests. This is a straightforward biological investigation of a little known pest, with focus on establishing the scope of the problem, recommending practical management practices, and providing knowledge of how to reduce damage in the short-term with insecticides.

### Project progress

#### Year 1 (01/07/2002–30/06/2003)

Research and industry stakeholders met with project staff to prioritise target crops and endorse the project at a start-up meeting at Aiyura in August 2002, and fieldwork commenced in October 2002.

500 *Oribius* species have so far been collected or recognised in collections, and a synopsis of the genus is being prepared. This work is being undertaken through collaborative research between PNG and Queensland Museum staff. Five pest species (*O. destructor*, *O. inimicus*, *O. cruciatus*, *O. cinereus* and *O. improvidus*) have been confirmed, while two other species are recognised but specific identifications are yet to be confirmed. Three related genera, causing similar damage to *Oribius* have also been recognised: *Aulacophrys*, *Apiocalus* and *Idiopsodes*. Identification guidelines for the key pest species have been sent to the field based researchers.

The immature (egg and larval) stages of *Oribius* have been identified and collected from the field for the first time. This allows more targeted efforts to understand the life-cycle of the insect and habitat preferences in the field.

Field-based impact trials have been designed and established to quantify *Oribius* damage on citrus, coffee, avocado, strawberry, capsicum and cabbage. An agricultural economist has been involved in these trials from their initiation, to ensure maximum inferences can be drawn about weevil impacts on the local agricultural community.

## **CP/2002/013: Biology, damage levels and control of red-banded mango caterpillar in Papua New Guinea and Australia**

<b>Overseas Collaborating Countries</b>	Papua New Guinea
<b>Commissioned Organisation</b>	Queensland Department of Primary Industries and Fisheries, Australia
<b>Project Leader</b>	Dr Bruno Pinese Phone : (07) 40484666 Email : bruno.pinese@dpi.qld.gov.au
<b>Collaborating Institutions</b>	Department of Agriculture, Fisheries and Forestry, Australia National Agricultural Research Institute, PNG National Agriculture and Quarantine Inspection Authority, PNG
<b>Project Budget</b>	\$357,290
<b>Project Duration</b>	01/07/2003 to 30/06/2006
<b>ACIAR Research Program Manager</b>	Dr Wendy Morgan

### **Project background and objectives**

Red-banded mango caterpillar (RBMC) is found throughout most of Southeast Asia, in Papua New Guinea (PNG), on a few islands in the Torres Strait, and recently on mainland Australia. In PNG and Indonesia it is considered to be a significant pest of mango, and this makes it a serious quarantine concern to Australia. Management is hampered because very little is known about RBMC, and a priority need for both PNG and Australia is greater understanding of its life cycle, full host range and the role of pheromone as a monitoring tool. This project, which involves the PNG government working with Department of Primary Industries Queensland, is augmenting work already in progress in PNG. Scientists are searching for an effective method to eradicate, or at least control and monitor, RBMC in commercial mango-producing areas.

### **Project progress**

First progress report is due in September–October 2004.

## **CTE/2000/162: Scientific communication in Papua New Guinea**

<b>Overseas Collaborating Countries</b>	Papua New Guinea
<b>Commissioned Organisation</b>	University of Queensland, Australia
<b>Project Leader</b>	Associate Professor Robert J.S. Beeton Phone : (07) 5460 1321 Email : nrsm@uqg.uq.edu.au
<b>Collaborating Institutions</b>	University of Papua New Guinea, PNG Papua New Guinea University of Technology, PNG Vudal University College, PNG
<b>Project Budget</b>	\$1,219,175
<b>Project Duration</b>	01/01/2002 to 30/06/2005 (Project extended from 01/01/2005 to 30/06/2005)
<b>ACIAR Research Program Manager</b>	Mrs Heather Briggs

### **Project background and objectives**

The need for training PNG agricultural research scientists in the procedures and techniques for writing and publishing the results of their research has long been an area of concern to government instrumentalities, agricultural research agencies and research funding bodies. While there have been a range of short scientific communication courses organised through various funding bodies for different organisations, these have targeted practising scientists and have not addressed the underlying gaps in initial training, leading to an on-going lack of confidence in the communication process. The goal of this project is to improve the overall effectiveness of all aspects of scientific communication within the scientific community of Papua New Guinea. It aims to enhance the capacity of PNG tertiary institutions to effectively deliver scientific communication training at undergraduate and post-study levels, on a sustainable basis. Its major objectives are to improve the scientific communication skills of PNG practising scientists, journalists and tertiary lecturers, through the development and delivery of a post-study in-service course; and to enhance the scientific communication skills of undergraduate students, through professional development of teaching staff and course review/revision. Achievement of these objectives is being supported through efficient project administrative, management and monitoring and evaluation services.

### **Project progress**

#### **Year 2 (01/01/2003–31/12/2003)**

In March 2003 the PNG University of Technology (UniTech) accredited the Graduate Certificate in Scientific and Technological Communication as an award of its Department of Language and Communication Studies. The 19 core lecturers from four universities who had participated in subject and course materials development during 2002, and who had completed a minimum of two core subjects and two electives, were awarded the Graduate Certificate.

By the end of 2003, 15 course workshops had been run by these course graduates at five different locations: Forestry Research Institute; UniTech; University of Vudal; University of Papua New Guinea; University of Goroka; and Divine Word University. In each case, the trainers were supported by a project staff member as an additional resource person. A total of 101 participants were enrolled in the Graduate Certificate, all of whom had completed at least one subject. Participants were from the following categories: academic (64, including 14 agriculture and forestry staff), agricultural and forestry research (22), medical research (5), research publications and training (3), and other (7). Within the universities, participants were drawn from a range of faculties: for example, UniTech participants came from surveying, mining, engineering, forestry and applied science. On average, 36% of workshop participants are women.

After a series of workshops in February 2004, up to 40 enrollees are expected to be eligible to take out the Graduate Certificate.

## **FIS/2001/034: Inland pond aquaculture in PNG—assessment of the industry and evaluation of smallholder research and development needs**

<b>Overseas Collaborating Countries</b>	Papua New Guinea
<b>Commissioned Organisation</b>	University of Western Sydney, Australia
<b>Project Leader</b>	Dr Paul Smith Phone : (02) 4620 3329 Email : pt.smith@uws.edu.au
<b>Collaborating Institutions</b>	University of Papua New Guinea, PNG Department of Agriculture and Livestock, PNG National Fisheries Authority, PNG Highlands Aquaculture Development Centre, PNG
<b>Project Budget</b>	\$140,726
<b>Project Duration</b>	01/07/2001 to 30/09/2004 (Project extended from 01/07/2002 to 30/09/2004)
<b>ACIAR Research Program Manager</b>	Mr Barney Smith

### **Project background and objectives**

Pond aquaculture is one of the fastest growing forms of agriculture inland in Papua New Guinea, and an important contributor to family nutrition and income in some of its more populous and protein-deficient regions. At the commencement of the project scientists estimated there were 6000 fish farms active, making them of growing importance within sections of PNG's national planning process. This project is determining the status of inland pond aquaculture in PNG through a comprehensive survey of the industry and a desktop study of recent reports. At the start researchers held a training workshop for technical assistants, and towards the end presented a stakeholders workshop. Researchers and fisheries administrators are gaining a clearer picture of the structure of the industry and the areas in need of resources. The project is helping ACIAR and other research donors to determine the priority issues to target for developing a sustainable industry.

### **Project progress**

#### **Year 2 (01/07/2002–30/06/2003)**

The team has completed all fieldwork and analysis. Members are currently completing the project report and preparing a proposal to be submitted to ACIAR for a follow-on project (FIS/2001/083). The findings of the project are to be published by ACIAR in its Working Paper Series.

The following is a brief outline of the findings.

In May 2003 at a Workshop in Goroka EHP the project team presented the findings of its study of inland pond aquaculture in PNG and received input from fish farmers, officers and other stakeholders. The initial estimate of 6000 farms had now moved to approximately 10,000 and the annual production of the aquaculture industry was valued at K5 million.

The survey of 313 farms, as well as hatcheries, institutions and markets revealed that there are three kinds of fish farmers:

- new comers (NU PELA) who have not harvested yet, representing 45–55% of the industry;
- established farmers (OLD PELA LIK LIK) who have harvested at least one crop and have less than 1000 fish in their ponds, representing 40–45% of the industry;
- pioneer farmers (OLD PELA) who have harvested at least once, have more than 1000 fish stocked, have considerable infrastructure and are focused on selling to restaurants or exports and they represent 5–10% of the industry.

The median farm had two ponds with a total area of 60m<sup>2</sup>. Some of the most relevant findings were that common carp was farmed in more than 90% of farms. Home consumption accounted for 40% of farmed fish, indicating that fish was an important source of protein for smallholder farmers and 70% of farmers have a high or very high intention of constructing more ponds. The three most significant areas for research identified in the survey were feed/nutrition, fingerling supply, and marketable species.

*Feed:* Garden vegetables, kitchen leftovers, worms and termites were the only food sources for most farms, though in 10% of farms, commercial pelleted feed was supplemented. The cost of pellet feed is a highly significant problem. No fertilisers were used in 59% of farms, 79% of farms used a flow through system and very few small-holder farms could be described as integrated.

*Fingerling supply:* Highlands Aquaculture Development Centre (HAQDEC) was the main source of fingerlings for PNG, though OLD PELA farmers generally had developed their own hatcheries. Nevertheless, fingerling supply was either a highly or very highly significant problem for 63% of farmers. Transport times for fingerling supply from HAQDEC ranged from a few hours to several days and transport-related mortalities were common.

*Marketable species:* NU PELA farmers grew common carp, while OLD PELA farmers cultured the greatest range of species, including carp, trout, tilapia, barramundi and crocodiles. Experienced farmers tended to search for the species that is most marketable and appropriate for their circumstances. The GIFT tilapia, an improved strain developed under the WorldFish Center's Genetic Improvement of Farmed Tilapia (GIFT) project, appears to be gaining in popularity in 2003. Nevertheless there is a strong push for trout farming by some highlands farmers and this is supported by research providers (Stirling University) and NGOs (ADP), even though it appears to be a non-economic species for farmers in PNG. On the other hand there is a strong desire, particularly in Western Province, for culturing native species (e.g. crayfish such as *Cherax* and *Macrobrachium* species, catfish and eel-tailed catfish).

## **FIS/2001/075: Sustainable aquaculture development in Pacific Islands region and northern Australia**

<b>Overseas Collaborating Countries</b>	Fiji, Kiribati, Papua New Guinea, Samoa, Solomon Islands, Tonga, Vanuatu
<b>Commissioned Organisation</b>	Queensland Department of Primary Industries and Fisheries, Australia
<b>Project Leader</b>	Dr Mike Rimmer Phone : (07) 4035 0109 Email : mike.rimmer@dpi.qld.gov.au
<b>Collaborating Institutions</b>	Secretariat of the Pacific Community, New Caledonia WorldFish Center, New Caledonia
<b>Project Budget</b>	\$762,855
<b>Project Duration</b>	01/01/2004 to 31/12/2006
<b>ACIAR Research Program Manager</b>	Mr Barney Smith

### **Project background and objectives**

Fisheries resources are important in the Pacific Islands, but require sustainable management. Aquaculture has considerable potential to alleviate pressures on fisheries, assist with and enhance food security and provide income and employment opportunities. The disease-free, good-quality waters, combined with low labour costs make aquaculture a potential success in Pacific communities. Northern Australia also shares many of the characteristics of unrealised aquaculture potential. The project team is working with the Secretariat of the Pacific Community (SPC) and Pacific communities to identify and implement targeted research extending the outcomes of past ACIAR and WorldFish Center projects. Post-larval fish capture and culture, and sea cucumber production and reseeding are focal points. Through these and related activities the technical and research skills of partner institutions will also be enhanced.

### **Project progress**

First progress report is due in January–March 2005.

## **FIS/2002/056: Biology and status of the prawn stocks and trawl fishery in the Gulf of Papua**

<b>Overseas Collaborating Countries</b>	Papua New Guinea
<b>Commissioned Organisation</b>	CSIRO Marine Research, Australia
<b>Project Leader</b>	Dr Neil Loneragan Phone : (07) 38267255 Email : neil.loneragan@csiro.au
<b>Collaborating Institutions</b>	National Fisheries Authority, PNG University of Tasmania, Australia
<b>Project Budget</b>	\$399,930
<b>Project Duration</b>	01/07/2003 to 30/06/2006
<b>ACIAR Research Program Manager</b>	Mr Barney Smith

### **Project background and objectives**

The Gulf of Papua prawn fishery is one of the most valuable fisheries in PNG, with an annual catch from all prawn species approximately 1000 tonnes and value of K10 million (\$A5 million). But as new and more efficient vessels replace the ageing fleet, the industry's capacity to catch prawns will increase. Scientists need to measure the fishing power of the industrial fleet so that the National Fisheries Authority (NFA) can prepare to manage an increase in effective fishing effort. This project is assessing the current status of the prawn stocks and the fishery in the Gulf of Papua, examining the levels of effort in the fishery and the current management regime, and consulting with NFA managers and the industry about the best management options. The project is helping to ensure that the Gulf of Papua prawn fishery is managed in ways that are sustainable, efficient and profitable in the long term, minimising any risk of collapse. Bringing NFA scientists, economists and managers together to collaborate on a single fishery should enhance management of this and other fisheries in PNG.

### **Project progress**

First progress report is due in September–October 2004.

## **FST/1998/113: Development of a sustainable, community-based essential oil industry in the Western Province of Papua New Guinea using the region's woody-plant species**

<b>Overseas Collaborating Countries</b>	Papua New Guinea
<b>Commissioned Organisation</b>	CSIRO Forestry and Forest Products, Australia
<b>Project Leader</b>	Dr John Doran Phone : (02) 6281 8319 Email : john.doran@csiro.au
<b>Collaborating Institutions</b>	North Queensland Essential Oils Co-operative Association Ltd, Australia University of New South Wales, Australia University of Papua New Guinea, PNG Papua New Guinea Forest Authority, PNG James Cook University, Australia G R Davis Pty Ltd, Australia Queensland Department of Primary Industries and Fisheries, Australia
<b>Project Budget</b>	\$522,372
<b>Project Duration</b>	01/01/2000 to 30/06/2005 (Project extended from 01/01/2003 to 30/06/2005)
<b>ACIAR Research Program Manager</b>	Dr John Fryer

### **Project background and objectives**

In the Western Province of PNG there is a strong demand for medicinal essential oils, currently met by expensive imported oils. A fledgling local industry exists, with the potential to become a significant enterprise. This project aims to realise that potential by developing a community-based, sustainable essential oils industry that will eventually be self-sufficient. An earlier CSIRO project identified tree species that produce oils with valuable medicinal properties. Building on this study, scientists are refining the culture of these tree species, identifying additional species that produce useful oils and enhancing yields of established oil-producing species such as tea tree. There are also potential benefits for the Australian tea tree oil industry.

### **Project progress**

#### **Year 4 (01/01/2003–31/12/2003)**

Outputs from the PNG components of the project are to determine socio-economic issues and work towards their resolution, map and provide quantitative information on the extent of the resource of the two main target species, *Asteromyrtus symphyocarpa* and *Melaleuca quinquenervia*. Other issues are identification of additional useful species for utilisation, addressing questions of ecological sustainability, resolution of technical problems, provision of appropriate equipment for oil production, and to improve marketing arrangements.

Design and construction of three new condensers and three fireboxes to replace the poorly manufactured, locally made condensers and fireboxes replaced the objective of establishing two new stills in the region under this project. A separator to collect heavier-than-water oil was designed and constructed in Australia for use with the Bensbach still as a prerequisite to testing the feasibility of commercial harvesting of platyphylol (a compound with insecticidal properties) from *Melaleuca cajuputi*. These materials were supplied and installed during this reporting period.

Establishment of a workshop at Daru for still construction and maintenance was dropped because of on-going security problems. Local oil producers will continue to depend on external agencies to provide these services.

The original Objective 5, which included the statement 'Facilitate links with the Western Province Coastal Zone Management Project (WPCZMP)', has been revised. The AusAID-funded WPCZMP was to address marketing issues affecting the project but this has not been implemented, and responsibility for the market development component has now been incorporated into this project. The new objective is to foster commercial arrangements that provide stable markets for the oil and deliver satisfactory returns to the village producers, and to disseminate information on the project.

## FST/1998/115: Domestication of Papua New Guinea's indigenous forest species

<b>Overseas Collaborating Countries</b>	Papua New Guinea
<b>Commissioned Organisation</b>	CSIRO Forestry and Forest Products, Australia
<b>Project Leader</b>	Dr Brian Gunn Phone : (02) 6281 8258 Email : brian.gunn@csiro.au
<b>Collaborating Institutions</b>	Papua New Guinea National Forest Service, Forest Management Division, PNG
<b>Project Budget</b>	\$1,356,635
<b>Project Duration</b>	01/01/2000 to 30/06/2005 (Project extended from 01/07/2003 to 30/06/2005)
<b>ACIAR Research Program Manager</b>	Dr John Fryer

### Project background and objectives

Papua New Guinea and Australia have diverse forest genetic resources that could contribute to the socioeconomic development of both countries. However, PNG has a low capacity to exploit its forest resources. The goal of this project is to assist PNG to develop the use of indigenous forest tree species for essential reforestation and agroforestry. CSIRO scientists have initiated domestication and conservation strategies for potentially important species. They are providing improved germplasm for community and commercial plantations and developing propagation, seed handling and storage techniques. By developing human resources and infrastructure the project is also strengthening PNG's technical and scientific capacity.

### Project progress

#### Year 4 (01/01/2003–31/12/2003)

The overall objective is to build capacity within the PNG Forest Research Institute to undertake tree species domestication activities and to strengthen the National Tree Seed Centre at Bulolo. The project objectives are divided into five components with a number of activities within each component plus project management. Progress was made in undertaking the following activities:

#### *Domestication of indigenous species*

- Assess and document the performance of PNG's lesser-known species (i.e. those species which have not already been through a process of domestication as for example *Araucaria hunsteinii*) in current and completed (archived) trials.
- For four priority non-domesticated target species (*Calophyllum euryphyllum*, *Dracontomelon dao*, *Pometia pinnata* and *Casuarina oligodon*) determine their natural distribution, undertake seed collections and establish field trials to assess performance over a range of sites. Validation of these species was subject to a marketing assessment undertaken at the inception phase of the project. The committee formed to undertake the assessment comprised invited participants mainly from PNG National Forest Service.
- Establish an *Acacia mangium* breeding population for conversion to a seed orchard.
- Establish a species trial at the Lae Botanic Gardens.
- Undertake isozyme studies on *Toona ciliata* to assess genetic variation. The studies are to include seed from SPRIG collections as well as from this project. Results are to be published.

#### *Germplasm conservation strategies*

- Develop conservation strategies for two indigenous forest species linked to the domestication process (*Santalum macgregorii*, and one species within the genus *Aquilaria* now referred to as *Gyrinops ledermannii*) by gathering biogeographical and community information on the selected species.
- Establish an *ex situ* conservation stand for one of the conservation species i.e. *S. macgregorii*.

### *Propagation*

- Undertake research into developing efficient vegetative propagation techniques on the four targeted domestication species for application in mass clonal propagation.
- Using vegetative and seed propagation techniques, screen a range of species (20) to assess optimum propagation techniques and seed storage methods. Publish a booklet on propagation of PNG target species.
- Conduct studies into methods for assessing seed characteristics of two recalcitrant species (*P. pinnata* and *C. euryphyllum*).

### *Human resource development*

- Provide human resource development to staff of the PNG National Forest Service (NFS) who are associated directly with the project. Extend opportunities for personnel of other organisations to participate in structured training courses—for example, forestry students from UniTech in Lae.
- Through training and development of a business plan, enhance the capacity of PNG's National Tree Seed Centre (NTSC), to enable it to meet PNG's tree seed needs. In so doing NTSC should become a financially independent entity within the PNG NFS through sale of seed and be in a position to explore other financially viable activities.

### *Infrastructural strengthening*

There are a number of specific items which are needed in order to facilitate the project:

- Establish computerised seeds data base at the NTSC
- Equipment to upgrade the FRI nursery at Lae in order to provide facilities for rooting cuttings under different conditions and increase security of the site.
- Computer for the herbarium to facilitate data entry of the reference collection.
- Two vehicles, one for the Tree Plantation Program and the other for the NTSC.
- Extension to the existing NTSC building to accommodate equipment, provide drying facilities for seed and increase security.

## **FST/1998/118: Planning methods for sustainable management of timber stocks in Papua New Guinea's forests**

<b>Overseas Collaborating Countries</b>	Papua New Guinea
<b>Commissioned Organisation</b>	Bureau of Rural Sciences, Australia
<b>Project Leader</b>	Dr Rod Keenan Phone : (02) 6272 5582 Email : rodney.keenan@brs.gov.au
<b>Collaborating Institutions</b>	Papua New Guinea Forest Research Institute, PNG Southern Cross University, Australia Queensland Forest Research Institute, Australia Australian National University, Australia
<b>Project Budget</b>	\$640,143
<b>Project Duration</b>	01/07/2001 to 30/06/2005 (Project extended from 01/07/2003 to 30/06/2005)
<b>ACIAR Research Program Manager</b>	Dr John Fryer

### **Project background and objectives**

The native forest resources of Papua New Guinea contribute substantially to the national economy and provide much needed income to many rural communities. But a lack of basic resource information affects management of the resources. This project is assisting the PNG Forest Authority's program to introduce improved forest management and planning systems and technologies. Scientists are reviewing current methods for strategic and operational forest inventory and recommending improvements to current practice, developing new volume and biomass equations for important forest species and adapting the existing forest growth models to the PNG forest estate planning system. They are assessing the impacts of alternative harvesting options on residual growing stock and biomass, using this model to estimate sustainable harvesting levels and develop and test forest planning and management systems. They are also analysing the impact of forest development alternatives on timber yields and carbon stocks. PNG staff are receiving training in yield simulation, model development, forest inventory and management planning.

### **Project progress**

#### **Year 2 (01/07/2002–30/06/2003)**

Tropical rainforests are important for a wide range of environmental, conservation, commercial and community values. They are also threatened by conversion to other land uses, fire, poor harvesting practices and climate change. Papua New Guinea has over 28 million hectares of tropical forest, the third largest expanse of tropical rainforests in the world, and an area of major importance for conservation of tropical forest biodiversity and for the livelihood and development of rural and forest-dwelling communities. Forty percent of PNG forests are considered exploitable for timber production with current technology.

Strategic planning for use of the forest resource remains rudimentary and operational planning and control procedures have proved difficult to implement due to lack of resources or adequately trained staff. Improved planning systems need developing to integrate national and regional conservation objectives, and open up options for the involvement of customary owners.

There have been serious concerns raised about the sustainability and quality of the logging operations in PNG, especially since the rapid rise in harvesting levels during the 1980s and 1990s. Better inventory and planning systems will assist in developing improved estimates of different forest resources available and how these can be managed in the long term to produce timber while minimising impacts on other forest values.

Most importantly, the project will help to strengthen the capacity of the PNG staff to understand and improve the management of their forest ecosystems.

So far the project has identified a number of issues with the current inventory, planning and mapping systems. Project scientists developed a series of recommendations to improve these processes and then presented a report to the PNG Forest Authority. They are holding ongoing discussions with the Authority and relevant donors (notably AusAID and the World Bank) to support possible approaches to implement these recommendations.

The project is laying the groundwork for improvement of PNG's forest inventory and planning systems. For example, project staff have been asked to contribute to the World Bank PNG Forestry and Conservation Project, which will commence shortly and provide a substantial budget (A\$80 million) to improve forest management and conservation in PNG. Pilot studies done as part of the ACIAR project will guide some of the technical work in the World Bank project. This will provide a direct pathway for implementing many of the results from this ACIAR project.

**FST/2002/010: Domestication and commercialisation of multi-purpose indigenous trees and shrubs for food and other products in Papua New Guinea, the Solomon Islands and Queensland: a feasibility study with special reference to *Canarium* nut**

<b>Overseas Collaborating Countries</b>	Papua New Guinea, Solomon Islands
<b>Commissioned Organisation</b>	James Cook University, Australia
<b>Project Leader</b>	Professor Roger Leakey Phone : (07) 4042 1573 Email : roger.leakey@jcu.edu.au
<b>Collaborating Institutions</b>	National Agricultural Research Institute, PNG Queensland Department of Primary Industries and Fisheries, Australia Macro Agribusiness Consultants Pty Ltd, Australia Michael Davis Consultants, Australia Commodities Export Marketing Authority, Solomon Islands
<b>Project Budget</b>	\$203,606
<b>Project Duration</b>	01/01/2004 to 31/12/2004
<b>ACIAR Research Program Manager</b>	Dr John Fryer

**Project background and objectives**

A lack of food and income security affects many poor farmers in Papua New Guinea and the Solomon Islands. A variety of indigenous trees produce edible fruits and nuts that could provide increased dietary protein and an additional income source. Elsewhere in the tropics domestication of such trees is providing additional income and enhancing food security. Selection and breeding of such trees in PNG and the Solomons could substantially increase edible produce. The project is identifying the key issues involved in the domestication and commercialisation of trees and their produce, using the *Canarium indicum* tree, known as Galip nut in PNG and Ngali in the Solomons, as a test case. Participatory approaches are being included to establish community attitudes to Galip nut and other fruits and nuts in household diets. The potential to develop markets for these products is being examined in PNG, the Solomon Islands and Australia.

**Project progress**

First progress report is due in January–March 2005.

## **PHT/1995/136: Cocoa fermentation, drying and genotype product quality assessment**

<b>Overseas Collaborating Countries</b>	Papua New Guinea
<b>Commissioned Organisation</b>	Queensland Department of Primary Industries and Fisheries, Australia
<b>Project Leader</b>	Mr Greg Mitchell Phone : (07) 3406 8542 Email : greg.mitchell@dpi.qld.gov.au
<b>Collaborating Institutions</b>	Cocoa and Coconut Research Institute (CCRI), PNG University of New South Wales, Australia
<b>Project Budget</b>	\$639,892
<b>Project Duration</b>	01/01/1998 to 31/12/2004 (Project extended from 01/07/2001 to 30/06/2004 and from 01/07/2004 to 31/12/2004)
<b>ACIAR Research Program Manager</b>	Dr Greg Johnson

### **Project background and objectives**

The first phase of this project evaluated the applicability of minibox and other small-scale (200 kg) fermentation technologies and solar dryer and solar-assisted fuel-fired dryer designs for PNG cocoa producing areas, and formulated draft revisions to PNG cocoa regulations and legislation. The quality attributes of selected cocoa lines were assessed, and all were found to produce cocoa of acceptable 'PNG flavour' standard. Training and capacity building of PNG research and extension staff in use of the minibox and solar dryer technologies was undertaken, and links were built with an AusAID-UNDP cocoa dryer initiative on Bougainville. The project is partly funding involvement of CCRI in a four-country project of the International Cocoa Confectioners' Organisation (ICCO) on quality evaluation of cocoa fine/flavour.

The main activities during the second phase of the project are concerned with participatory construction, testing and maintenance of the dryer units in wetter areas, and in promoting profitable use and maintenance of units in East New Britain (ENB). Design features identified through computer simulation modelling are being incorporated into the Solar Dryer Construction and Maintenance manual. Further training is being undertaken in test unit regions and other sites to foster successful uptake and maintenance of fermentation and drying technology. Under the ICCO project, comparative documentation of PNG standard fine cocoa for use as a 'benchmark' is being developed. The project team is exploring opportunities for producing PNG brand name chocolate in Australia or PNG.

### **Project progress**

#### **Year 6 (01/01/2003–31/12/2003)**

*Repairs/maintenance to existing solar dryers in East New Britain:* The project leader delayed repairs and maintenance until design work on modified dryers was completed. The final design alteration enabled construction and testing of a flat-roofed dryer. The tests demonstrated good performance. This, together with advantages in ease of maintenance and in operation, has now made it the preferred design. The intention is now to replace the original units with this type of dryer in six locations around ENB.

*Construction and assessment of combination dryers for Bougainville* was completed on schedule, and installation of six of these is now going ahead on schedule in Bougainville.

*Development of a training package* is largely complete but will now be changed to accommodate the new dryer design.

*ICCO Project: Comparative documentation of PNG standard fine cocoa for use as a 'bench-mark'*  
Initial work on fermentation and drying of selected genetic material to determine the best fermentation times and roasting protocols for the samples from the different countries (PNG, Venezuela, Ecuador,

and Trinidad and Tobago) is largely completed, although flavour assessments from MARS, UK, are awaited. Dried bean samples of the selected clones were produced during the previous year and samples forwarded to Queensland Department of Primary Industries for chemical analyses. Testing is being finalised. The planned exchange of samples between participating countries has been delayed by problems with organoleptic testing. The liquors have been returned to Brisbane and negotiations are now under way with MARS, UK.

*Revision to the PNG Cocoa Inspectors and Assessors Manual, the PNG Export Regulations and the PNG Cocoa Act of 1982:* The document has been completed and given to the Cocoa Board. Discussions with export and industry bodies (e.g. Growers association) within PNG are anticipated once the final discussions have concluded with the Cocoa Board.

A change to the Cocoa Act of 1982 was also suggested. In the Act of 1982, a set figure of K40 per ton was the levy imposed to finance the Cocoa Board, CCRI (and today) CCEA. Now K40 is worth much less. It is to be suggested that a formula, which will be a multiple of the export price of cocoa, is entered into the Act. The Cocoa Board are now developing their own revisions.

## **PHT/2001/016: Microbial contaminants associated with sago processing and storage in Papua New Guinea**

<b>Overseas Collaborating Countries</b>	Papua New Guinea
<b>Commissioned Organisation</b>	James Cook University, Australia
<b>Project Leader</b>	Associate Professor Warren Shipton Phone : (07) 4781 4123 Email : warren.shipton@jcu.edu.au
<b>Collaborating Institutions</b>	Queensland Department of Primary Industries and Fisheries, Animal Research Institute, Australia University of Technology, Department of Applied Sciences, PNG University of Papua New Guinea, School of Humanities and Social Sciences, PNG
<b>Project Budget</b>	\$399,858
<b>Project Duration</b>	01/07/2002 to 31/12/2005 (Project extended from 01/07/2003 to 30/06/2005)
<b>ACIAR Research Program Manager</b>	Dr Greg Johnson

### **Project background and objectives**

The area under sago palms in Papua New Guinea is in excess of 1 million hectares. Sago harvesting and consumption form an important part of subsistence agriculture and sago is the staple diet in selected areas of PNG. However, this resource is under-utilised and does not contribute as much as it might to food supply security in the country, partly because of health risks associated with consumption of the processed products. Health risks are of two related types: the first relates to the presence of mycotoxins in the starch (causing haemolytic disease); the second to contamination of the food with pathogenic bacteria and viruses (leading to food poisoning). This project is determining the causes and extent of health risks to consumers from contamination of village-produced sago, then identifying options to reduce those risks and improve marketability of the processed sago.

### **Project progress**

#### **Year 1 (01/07/2002–30/06/2003)**

A survey was conducted of the processing and storage technologies for sago starch in selected areas of the Sepik and Western Provinces. The surveys were conducted by the commissioned organization (James Cook University) and the University of Papua New Guinea (collaborating institution). These data showed that a mixture of old and emerging practices were being used as far as storage was concerned. Processing methods were largely untouched by modern technology. The processing survey results showed weaknesses in a number of areas of human activity where microbial contamination could enter the food chain.

Samples of sago were collected from villages surveyed and the microbial contamination was assessed in terms of well-known food poisoning organisms, the presence of haemolytic microbes and the presence of common mycotoxins. Five well-known food poisoning bacteria were identified, but, except for one organism, were generally present in low numbers. Various haemolytic bacteria, yeasts and filamentous fungi have been isolated. Some of these were represented in high numbers. Some have been identified and further work is planned on the metabolic products they elaborate, as some species isolated are potentially associated with human illness. Sago samples analysed to date for the presence of mycotoxins commonly associated with human illness have given negative results. This does not mean that mycotoxins are not present, but just that those tested for are not present.

The ability of food-borne bacteria of public health significance to survive in sago has been tested under laboratory conditions. This involved the seeding of both fresh and older sago starch samples with known populations of selected bacteria, and following their history. Surprisingly, all the pathogens selected showed very low survival rates over the time frames studied. This is presumably due to the strong fermentation conditions that develop in bundles of sago with the vigorous growth of lactobacilli

and associated decline in pH. These studies are continuing so as to gain a more realistic idea of the major microbial interactions that occur in sago bundles.

The survey of production and storage practices, when combined with the results of the subsequent scientific information, has led to the identification of some weak areas where microbial contaminants enter the food chain. These preliminary observations will form the basis of a more structured study at selected villages to refine the scientists' concept about the feasibility of making a difference to the microbiological flora of sago at the time of eating by manipulating the critical control points associated with the microbial hazards. They believe that some diminution of microbial hazards is possible through alterations to harvesting practices.

## SMCN/1998/028: Diagnosis and correction of nutritional disorders of yams

<b>Overseas Collaborating Countries</b>	Papua New Guinea, Tonga, Vanuatu
<b>Commissioned Organisation</b>	University of Queensland, Australia
<b>Project Leader</b>	Dr Jane O'Sullivan Phone : (07) 336 54811 Email : j.osullivan@mailbox.uq.edu.au
<b>Collaborating Institutions</b>	Ministry of Agriculture and Forestry, Tonga Department of Agriculture Livestock and Horticulture, Vanuatu National Agricultural Research Institute, PNG
<b>Project Budget</b>	\$855,308
<b>Project Duration</b>	01/07/1999 to 31/12/2004 (Project extended from 01/07/2003 to 31/12/2004)
<b>ACIAR Research Program Manager</b>	Dr Christian Roth

### Project background and objectives

Yams (predominantly *Dioscorea alata* and *D. esculenta*, but recently also *D. rotundata*) are important staple foods in the Pacific, and hold an esteemed place in cultural heritage. Among the tropical root crops, they are the most demanding of high soil fertility, and this has contributed to the decline in yam production as pressure on land and labour has increased. However, a healthy yam crop can be highly productive and give very high economic returns. This project aims to determine the extent to which South Pacific yam yields are limited by nutritional stresses, and whether yields can be economically increased using appropriate soil fertility management. Local information to help increase quantity and quality of yam crops will be made available to farmers in PNG, Tonga and Vanuatu. An economic study is evaluating the effects of improved nutrient management. A major component of the project is the production of a colour-illustrated field guide on the diagnosis of nutritional disorders in yams—a companion volume to those produced on the other three main root crops, namely cassava, sweet potato and taro.

### Project progress

#### Year 4 (01/07/2002–30/06/2003)

The following activities were achieved in the year to June 2003:

At the University of Queensland, solution culture experiments were conducted inducing deficiencies of iron, boron, manganese and zinc, and toxicities of boron, manganese, zinc and copper. Improvements in nutrient management resulted in much better growth of the yams in solution culture than in previous seasons. Planned experiments on copper and molybdenum deficiencies were not conducted due to failure of sprouting of the planting material.

Some 3000 leaf samples were processed for analysis, including samples from the overseas programs and carry-over from last year. However, temporary decommissioning of the laboratory due to building refurbishment has prevented completion of this season's analyses. A critical concentration for manganese deficiency has been determined at 10 mg/kg in leaves of the 5th and 6th nodes from the tip. Yam germplasm maintenance continued, with the whole collection being planted at Redland Bay Farm for the first time.

In PNG, the project has installed a new 9000 litre plastic water tank and plumbing on the laboratory building at Bubia, to supply high quality rainwater for distillation purposes. This has allowed pot trials to be conducted. A sand culture experiment to induce nutrient deficiency in *D. esculenta* yam has been completed. Symptoms of most deficiencies were successfully induced and photographed. Leaf nutrient levels are awaiting analysis at UQ. On-station active fallow and live-staking demonstration plots with *D. rotundata* and *D. esculenta* completed their first crop of yam. The first season of on-farm yam trials at Dugumor, Madang Province were harvested in August 2002 and the plots replanted in October 2002. A fertiliser response trial was also planted in October 2002. On-farm trials were

established on Kiriwina Island, Milne Bay Province, including four *Gliricidia* live stake plots (to be planted with yam in the 2003-04 season), and two fertilizer response trials in yam gardens. Demonstration plots of active fallow and live-staking with *gliricidia* were further developed at Tanam and Mutzing sites in Markham Valley, but only the Tanam plot could be planted this season, and yams grew poorly apparently due to zinc deficiency. Experiments to address the zinc deficiency are planned for the coming season. The socio-economic surveys in East Sepik, Madang and Milne Bay Province (conducted between May 2000 and February 2002) have been collated and a report drafted.

In Tonga, experiments continued to focus on the phosphorus response of yam, and on the contribution of a *Mucuna cochinchinensis* (velvet bean) cover crop to the nitrogen (N) and phosphorus nutrition of subsequent crops. In Vanuatu, 10 field trials were conducted during the year. Eight evaluated fertilizer responses, based on deficiencies identified through pot trials. One experiment examined effect of *Gliricidia* leaf mulch, and another (still in progress) is comparing planting sets of high and low nutrient status.

The year reported was to be the final year of the project. Research efforts in all programs were expanded, in an effort to make up for delays in the first two years. Good progress was made, with most project objectives achieved by the end of the year. However, some prescribed items remained to be completed, and in other areas an extension would allow promising initiatives to come to fruition. An extension of 18 months was granted to the end of 2004, allowing one additional cropping season and time to collate results.

## **SMCN/2000/046: Overcoming magnesium deficiency in oil palm crops on volcanic ash soils of Papua New Guinea**

<b>Overseas Collaborating Countries</b>	Papua New Guinea
<b>Commissioned Organisation</b>	CSIRO Land and Water, Australia
<b>Project Leader</b>	Ms Suzanne Berthelsen Phone : (07) 4753 8534 Email : <a href="mailto:suzanne.berthelsen@csiro.au">suzanne.berthelsen@csiro.au</a>
<b>Collaborating Institutions</b>	Oil Palm Research Association, PNG
<b>Project Budget</b>	\$617,632
<b>Project Duration</b>	01/07/2002 to 30/06/2007
<b>ACIAR Research Program Manager</b>	Dr Christian Roth

### **Project background and objectives**

In West New Britain—the main area of oil palm production in PNG—palm oil production on new volcanic soils in high-rainfall lowland areas suffers seriously from a type of magnesium (Mg) deficiency that has proved difficult to alleviate. The problem appears to lie in the chemistry of these volcanic soils (Andisols) in combination with the high annual rainfall (>3000 mm pa). Project scientists are working with the Oil Palm Research Association (OPRA) in New Britain and elsewhere to test novel ways of applying sources of slowly available magnesium while they survey the extent of the soil problem. They intend to further elucidate the underlying soil and plant chemistry, and train OPRA scientists in appropriate analytical techniques. Smallholders produce a significant proportion of the palm oil in the region (they have 50% of the oil palm area), thus they too should benefit as much as the plantation (estate) sector from an economic solution to the magnesium-deficiency problem.

### **Project progress**

#### **Year 1 (01/07/2002–30/06/2003)**

The first year of the project has seen a number of trials started in both countries. It has also seen the start of studies into palm physiology, amendment properties and modelling of water and solutes through the soil profiles. Specifically we have:

- planned four field trials in PNG, completing the establishment of one and getting the other three well under way. These field trials are examining the effectiveness of alternatives to the standard Mg fertiliser (soluble kieserite) in overcoming Mg deficiency.
- established nutrient omission pot trials in both PNG and Australia (two trials in each country) to determine nutrient limitation independently of field trials in PNG
- characterised some of the chemical properties of several potential Mg fertilisers
- measured the response of Mg concentration in fronds of various ages that are suffering various degrees of Mg deficiency symptoms
- run simulation models of water and solute movement through soil profiles to assess the potential of alternative Mg fertiliser strategies.
- collected samples of soil and leaf material throughout main oil palm growing areas in order to identify regions most likely to be susceptible to Mg deficiency
- presented the results of research to members of the Scientific Advisory Committee of the Oil Palm Research Association and senior staff of New Britain Palm Oil Ltd.

In addition, through this project we have also taken the opportunity to:

- investigate the nutritional status of locally produced vegetable crops, and
- start a preliminary investigation into the nutritional consequences of Finschhafen disorder—a disorder primarily of coconuts but which has recently been found to affect oil palm. The potential for widespread infestation of oil palm is currently unknown.

## CP/2001/068: Technical support for regional plant genetic resources development in the Pacific

<b>Overseas Collaborating Countries</b>	Cook Islands, Fiji, Kiribati, Malaysia, Nauru, Papua New Guinea, Samoa, Solomon Islands, Tokelau, Tonga, Tuvalu, Vanuatu
<b>Commissioned Organisation</b>	International Plant Genetic Resources Institute, Malaysia
<b>Project Leader</b>	Dr V. Ramanatha Rao Phone : + 60 3 89423891 Email : v.rao@cgiar.org
<b>Collaborating Institutions</b>	Secretariat of the Pacific Community, Fiji
<b>Project Budget</b>	\$585,000
<b>Project Duration</b>	01/01/2002 to 31/12/2004 (Project extended from 01/01/2005 to 30/06/2005)
<b>ACIAR Research Program Manager</b>	Dr Wendy Morgan

### Project background and objectives

The unique and important diversity maintained in the perennial crop-based production systems of Pacific Island countries is becoming better recognised. However despite efforts to collect, conserve and improve plant genetic resources (PGRs) such as roots and tubers, bananas, coconuts and breadfruit, progress has occurred only with a few crops in a limited number of countries. ACIAR supported a workshop in Lae PNG in 1999 to develop a framework for PGR conservation, management and use in Pacific agriculture. A working group formed at the workshop has drawn up that framework, and funding to progress it has been made available through New Zealand Official Development Assistance. ACIAR is funding a coordinator to supervise the project work and to provide technical advice, and is also augmenting the activities provided with NZODA funding.

### Project progress

#### Year 2 (01/01/2003–31/12/2003)

*Recruit a PGR Adviser for SPC.* Luigi Guarino was jointly recruited as PGR Adviser by SPC and IPGRI and took up the post in June 2002. He has since been liaising with national partners through email, regional meetings and country visits, in particular with regard to carrying out national plant genetic resources stakeholder consultations, to stimulating the exchange of information, and to provide training as necessary. National consultations have been held in five countries. A PAPGREN pamphlet and poster have been published and circulated. A draft list of regional plant genetic resources contacts and a regional directory of genebanks have been prepared in collaboration with partners.

*Support the development of guidelines for intellectual property rights (IPR)-related issues.* A brochure entitled 'Policy Issues Relating to Plant Genetic Resources in the Pacific. A Guide for Researchers and Policymakers' has been published in English and translated into French. Draft Material Transfer Agreements (MTAs) have also been developed by SPC for use by the Regional Germplasm Centre (RGC). Efforts are under way to increase the awareness of countries regarding the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA) and the Global Crop Diversity Trust.

*Develop and implement complementary conservation strategies.* A project proposal was developed in 2003 in collaboration with Dr Lois Englberger, a nutritionist with the NGO Island Food Community of Pohnpei, for the conservation of traditional food crops through their promotion for better health and nutrition, with a focus on Micronesia.

A regional consultation on breadfruit conservation in the Pacific was organised in 2002. The consultation resulted in the identification of needs and opportunities and the development of a list of priority activities. The PAPGREN meeting in May 2003 discussed sweet potato yield decline and its significance for genetic resources conservation of this crop. The initial elements of a work plan were agreed. It was felt necessary to investigate yield decline through surveys throughout Melanesia (including PNG highlands and lowlands), to identify stable varieties, and to set up a participatory plant breeding programme based on them. To address this, a project proposal on sweet potato in Melanesia is being developed by the Queensland University of Technology, the University of Queensland and the RGC for ACIAR support.

A major activity in 2003 was the organization of the 3rd Taro Symposium 21-23 May 2003 (<http://www.spc.int/cis/tarosym/Index.htm>). This was held in Nadi, Fiji, with support from IPGRI, CTA, FAO and Japan. Over 60 participants from all the major taro-growing areas of the world participated. The objectives were to review progress in taro research, analyse needs and priorities, develop a strategy for future work in taro research and development, explore new ways to use genetic diversity and improve taro quality and production, and stimulate international collaboration, information exchange and networking. The proceedings are being prepared for publication in 2004. To address the priority issues identified, the RGC is undertaking research on cryopreservation and on seed conservation (in collaboration with Vudal University in PNG), and also entering into an extensive exercise of field testing of virus-indexed taro varieties in partner countries throughout the region.

## **FIS/1999/025: Optimal release strategies for restocking and stock enhancement of the tropical sea cucumber, sandfish (*Holothuria scabra*)**

<b>Overseas Collaborating Countries</b>	Papua New Guinea, Solomon Islands
<b>Commissioned Organisation</b>	International Centre for Living Aquatic Resources Management, Coastal Aquaculture Centre, Solomon Islands
<b>Project Leader</b>	Dr Johann Bell Phone : + 604 641 4623 Email : jbell@cgiar.org
<b>Collaborating Institutions</b>	Australian Institute of Marine Science, Australia Ministry of Agriculture and Fisheries, Solomon Islands
<b>Project Budget</b>	\$785,060
<b>Project Duration</b>	01/04/2000 to 30/06/2005 (Project extended from 01/04/2004 to 30/06/2005)
<b>ACIAR Research Program Manager</b>	Mr Barney Smith

### **Project background and objectives**

In 1995 ACIAR and ICLARM commenced a strategic research partnership to develop, assess and transfer the technology for propagating and releasing tropical sea cucumbers. Three separate stages were defined: (1) development of cost-effective methods for producing juveniles; (2) identification of strategies for optimising survival of released juveniles; and (3) evaluation of mass releases of juveniles to existing fisheries. ACIAR funded the first phase, during which work concentrated on sandfish (*Holothuria scabra*), a high-value species of significant commercial importance. The research established that *H. scabra* is suited to restocking and stock enhancement, due to its high value, wide distribution, relative ease of culture and rapid growth at high densities on simple, low-cost diets. Scientists also found that sandfish larvae can be reared *en masse* in hatcheries on micro-algal diets, and the juveniles grown out in simple land-based nursery systems with minimal input of food. This follow-on project is undertaking the second phase of the research, to determine how, when and where to release juveniles for optimum survival, and to identify the most cost-effective stocking densities.

### **Project progress**

#### **Progress to March 2004**

This project was originally located at the WorldFish Coastal Aquaculture Centre in Guadalcanal, Solomon Islands. With the destruction of the centre and all its facilities and violence to staff members during the ethnic tensions of 2000, the project was moved to New Caledonia in consultation with ACIAR, and collaborations with local agencies developed. WorldFish recruited new international and local staff co-located at the SPC Headquarters in Noumea. The project continued to focus on the development of technologies for all developing countries of the Pacific region.

The project has encountered three main problems in operating in New Caledonia. First and foremost, the high cost structure has been debilitating and significantly reduced what can be achieved in all areas. The team has taken on additional projects such as breeding black teatfish (*Holothuria nobilis*) and stock assessments of sea cucumber for each of the Provinces in a bid to bring in additional funding. Second, the breeding season for sandfish in New Caledonia is seasonal (approximately October to February) which reduces the capacity of the hatchery to produce juveniles and restricts ecological studies. These contrast with the situation in the Solomon Islands where there is year-round spawning and juveniles could be produced for much of the year. Lastly, the sea cucumber hatchery and production facilities previously available in the Solomon Islands had to be re-established in New Caledonia. This has required additional resources and greater time than was identified in the original proposal. Meeting these challenges has also required a shift in the balance of the project, with more emphasis given to production systems than was the case in the original proposal, which emphasised release strategies.

Since relocation of the project, a small but serviceable hatchery has been established; sandfish juveniles are being produced; research into genetic stock identification is being progressed; new tagging methods have been developed; and a number of scientific publications have been produced. Other areas of research making good progress include the development of transportation methods, and polyculture of sea cucumbers with shrimp. Preliminary studies into release strategies using enclosures and small numbers of sandfish have provided encouraging results. The challenge is now to undertake larger-scale ecological studies that are more relevant to stock restoration.

Following a review, the project has been extended to capitalise on the investments in facilities and trained personnel. The emphasis of the ongoing work is on the development of practical measures for the production of large numbers of juveniles at reasonable cost, and on release strategies for optimal survival.

# Concluded projects

1 July 2002–30 June 2004

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## **ASEM/1999/084: Improving productivity of the smallholder oil palm sector in Papua New Guinea: a study of biophysical and socioeconomic interactions**

<b>Overseas Collaborating Countries</b>	Papua New Guinea
<b>Commissioned Organisation</b>	Australian National University, Australia
<b>Project Leader</b>	Katherine Gibson Phone : (02) 6125 3154 Email : katherine.gibson@anu.edu.au
<b>Collaborating Institutions</b>	Oil Palm Research Association, PNG Curtin University of Technology, Australia
<b>Project Budget</b>	\$299,784
<b>Project Duration</b>	01/07/2000 to 31/12/2002 (Project extended from 01/01/2002 to 31/12/2002)
<b>ACIAR Research Program Manager</b>	Dr Ken Menz

### **Project background and objectives**

Oil palm is one of PNG's most successful rural industries. While the plantation sector has a strong presence, the smallholder sector is important, covering almost half the total production area. Yields are lower in the smallholder sector, and productivity levels vary considerably within the sector. Much of this variability is attributed to sociological and economic factors, and this project examined how these factors interact with biophysical factors. Recently one of the companies operating in the industry has instituted a program of payments for women smallholders who gather 'lus frut' (oil palm kernels that fall from the bunch during harvest) and there was a need to evaluate this initiative.

The project's primary objective was to gain a more comprehensive picture of biophysical and socioeconomic interactions in the PNG smallholder sector. A secondary objective was to evaluate the Lus Frut Mama Scheme to gain insight into its effect on oil palm production and how it had reshaped women's relationship to the oil palm production process. A third objective was to develop strategies for more effective interventions within the smallholder sector.

The research project focused on two of the oil palm growing regions of PNG, namely the Hoskins project and the Popondetta/Oro project. The program consisted of site visits and grower surveys to assess the production capability of smallholders. In-depth interviews were given to a selection of growers and households. Upon completion of the site visits and sample surveys in each project area a workshop held with Oil Palm Industry Corporation (OPIC) field extension officers reviewed initial findings, and officers were invited to participate in the research process. The research team considered a plan of action research involving smallholders, women and OPIC extension officers, to draw into the process their knowledge and ideas of how to improve productivity in the smallholder sector.

### **Project outcomes**

The study found that under-harvesting was a major contributor to lower productivity in the smallholder sector and traced this practice to a number of key issues that also contributed to the failure to administer fertiliser and maintain blocks. Increased population pressure meant that many blocks were now supporting multiple households. Where multiple families resided on the blocks a variety of production systems had evolved. Highest productivity was achieved where family members worked together in a shared *wok bung* production system. Many families, however, resorted to a rotation system, *makim mun*, whereby different households took turns to harvest the crop and receive the oil palm cheque. This could lower the labour input and often resulted in poorer productivity. Remuneration for labour performed on the blocks was a contested issue that was not governed by clear agreement and as a result labour was withheld from the oil palm production system.

A second major finding of the research was the extent of reliance upon food gardens. This was one of a diversity of economic activities that placed other key constraints on oil palm productivity. Traditional pursuits at certain times of the year, e.g. fishing, were more lucrative than oil palm. Although such alternative demands upon labour time could have a negative effect on oil palm productivity, the researchers noted that in the context of rapid population growth they could have a positive impact on productivity, through reducing conflict and providing additional sources of capital for farm investment.

Land insecurity was a further constraint, in that it provided a disincentive to invest in long term-block improvements such as fertiliser uptake or replanting.

In the face of such factors contributing to lower production levels, the study found that key industry and OPIC interventions were having a major positive impact on smallholder productivity. The 'Lus Frut Mama' scheme was providing substantial benefits for approximately 3000 local women. Each received a 'Mama card' to record her own collection output, and from this it was found 'lus frut' collection represented approximately 25% of total production. These results were an encouragement to widen the scheme to other oil palm or cash crop areas.

Managers of the Oil Palm Industry Corporation believe that this project has already contributed to a change in industry attitudes. Benefits include increased yields from smallholder blocks, an increase in income for women and new spinoff schemes they established—for instance many formed groups to market used clothing, and they also wanted to market their garden produce.

In August 2003 the Centre for International Economics completed an Impact Assessment of the Mama Lus Frut Scheme for ACIAR. The assessment focused on the poverty reduction impacts of the project, concluding that the scheme had increased the incomes of oil-palm producers, many of who were barely above the poverty line. This has had a corresponding effect on improving welfare among oil-palm producers beyond that attributable to the income increase. Channeling a greater percentage of household income to women increased total expenditure on items such as food, clothing and education, empowered the women by granting them a greater degree of economic independence, and empowered children because the households now could find money for school fees.

## **CTE/2000/167: Research capacity building within NARI and training in agricultural chemistry**

<b>Overseas Collaborating Countries</b>	Papua New Guinea
<b>Commissioned Organisation</b>	Consultant, Australia
<b>Project Leader</b>	Mr Tim Healy Phone : (02) 6276 6026 Email : timhealy@ozemail.com.au
<b>Collaborating Institutions</b>	National Agricultural Research Institute (NARI), PNG
<b>Project Budget</b>	\$150,000
<b>Project Duration</b>	01/01/2001 to 30/06/2003
<b>ACIAR Research Program Manager</b>	Dr John Skerritt

### **Project background and objectives**

This project arose following requests from the NARI Council and Director General to ACIAR for assistance in fulfilling NARI's mandate 'to formulate national agricultural research priorities, define sectoral research priorities and recommend on the allocation of funds for agricultural research'. The objectives of the project were to design a framework for assessing strategic directions and priorities for PNG, design a process for assessing NARI's project portfolio within the national framework, and provide input to NARI's resource allocation process consistent with its strategic priorities. Training of NARI staff in strategic planning and priority setting for R&D was to be provided, and steps taken to institutionalise the process to ensure its sustainability.

### **Project outcomes**

A framework for assessing national strategic directions and priorities for agricultural R&D was prepared and agreed with NARI senior management, and Areas of Research Opportunity (AROs) were established. Setting of national and sectoral R&D priorities was largely achieved through a national planning workshop. Some fine tuning remains to be done to reconcile national priorities with regional priorities in recognition of the different agro-ecologies and state of development of the regions. NARI now has the tools and competence to do this without further external inputs. Some further work is needed with the tree crop research institutes to apply a similar process for their mandated crops. They each participated in the national planning workshop and contributed to the development of the ARO statements and definition of research issues. This process should proceed through ongoing consultation with NARI for those many farming systems in which tree crops are grown in concert with food crops. NARI will need to take the results of the project into the wider national policy arena where resource allocations are made.

NARI has successfully developed its own strategic directions within the national framework and now has the tools enabling it to undertake further analysis of its programs at the regional level, reflecting the four agro-ecological zones in which its stations operate. This will flow naturally into analysis of the current project portfolio and how this might change to better reflect national and NARI priorities.

Project outputs have linked seamlessly to the AusAID-funded Australian Contribution to a National Agricultural Research System (ACNARS) project. Through the participatory process adopted in the workshops and tasking between them moderated by the project team, and with the assistance of ACNARS advisors, NARI staff have developed competence in the strategic planning and R&D priority-setting process.

NARI management has taken steps to institutionalise the process and this will be carried forward with the preparation of a resource manual, adoption of the process at the regional level by NARI's four regional research stations, and application within NARI's appraisal and decision-making processes on its project portfolio.

## **FIS/1998/024: The biology, socioeconomics and management of the barramundi fishery in the Fly River and adjacent coast of Papua New Guinea**

<b>Overseas Collaborating Countries</b>	Papua New Guinea
<b>Commissioned Organisation</b>	CSIRO Marine Research, Australia
<b>Project Leader</b>	Dr Steve Blaber Phone : (07) 3826 7200 Email : stephen.blaber@marine.csiro.au
<b>Collaborating Institutions</b>	National Fisheries Authority, PNG Department of Environment and Conservation, PNG Ok Tedi Mining Ltd (Environment Division), PNG James Cook University, Australia
<b>Project Budget</b>	\$699,491
<b>Project Duration</b>	01/07/1999 to 31/12/2003 (Project extended from 01/07/2002 to 31/12/2003)
<b>ACIAR Research Program Manager</b>	Mr Barney Smith

### **Project background and objectives**

Barramundi was once the fourth most valuable export commercial fishery in Papua New Guinea, with total catches greater than 200 tonnes per year. However, in about 1990 this rather unregulated commercial operation collapsed because of poor catches—with catches down to about 4 tonnes/year. But although the commercial fishery has virtually ceased, the fish remains important economically for artisanal fishers in PNG's Western Province. Barramundi occur on the coast and inland in all rivers of southern PNG west of Port Moresby, but populations are particularly large in the Fly River. About 200 small-scale fishers work this area, and barramundi is their most valuable catch. However, these catches were also declining, with figures as low as 10 tonnes per year recently, of which at least 60% are juvenile fish. Rehabilitating the barramundi populations in PNG's Western Province is therefore an important issue. A one-year study of fishing logbook data, funded by ACIAR in 1996, showed that there were still large gaps in knowledge of many aspects of the biology of barramundi in the area and of the operations of the traditional fishery. In particular, biologists needed to know more about the spawning grounds and the origin of the fish that were being caught. Also unknown was the age structure of the Fly River population and whether it was genetically discrete. Many questions also remained about the socio-economics of the artisanal fishing in the area. This project has attempted to fill those gaps through studies of the biology, ecology and socioeconomics of the barramundi fishery.

The ultimate aim was to assist with the development of a draft Barramundi Fishery Management Plan for the Fly River and adjacent coastal community that is acceptable to all stakeholders: the fishers (being the local communities along the Fly River and coastal regions west of the Fly), the fish processors (primarily in Obo and Daru), and the National Fisheries Authority. In order to achieve this the objectives were firstly, to re-examine the biological basis for the current understanding of the life cycle of barramundi in Papua New Guinea, then to identify the most vulnerable life history stages that need to be protected in order for the population to increase to such levels to allow an ecologically sustainable artisanal fishery in the Fly River and adjacent coast of PNG. Secondly, local stakeholders were closely involved with the project during socioeconomic surveys that were undertaken to determine the importance of barramundi to the local economy. This community work was also to document the extent of local knowledge of the fish, its customary management, and local views on the various management options. Current data on the size of this fishery, its age composition and its social and economic significance were to be fed into modelling of the optimal management of barramundi in Western Province.

The project was initially designed to complement studies by an AusAID-funded Coastal Zone Management Study into the coastal artisanal fishery in Daru. When this proposal was discontinued, the delivery pathways of the barramundi project were redesigned so that the refinement of the Fishery Management Plan and definition of a recovery strategy for the artisanal barramundi fishery would draw on the biological, social and economic results of this ACIAR study alone.

## **Project outcomes**

Conclusive genetic and biological evidence was found to demonstrate that there is only one stock of barramundi living in the Fly River and associated coastal waters. The stock extends into West Papua, thereby constituting a cross-border resource, but it differs from barramundi found in the far east of PNG. This finding was unexpected, based on the predictions from studies conducted in Australia.

The biological studies showed no evidence of changes from earlier (1970s) estimates of biological parameters of growth, reproduction and feeding. However, otolith microchemistry data showed conclusively that the migration patterns of Fly River barramundi do not follow a regular set pattern as they do in Australia. Many fish only visit the sea once during their lives, and some individuals remain upriver for extended periods. Analyses of net selectivity for barramundi coupled with reproductive data indicated the importance of conserving large females, i.e. restricting the use of large mesh gill nets.

The socioeconomic study found that the fishing communities along the waterways were unaware that resources, in particular barramundi, are finite and must be managed for sustained yield. No local group had indigenous knowledge of the complex breeding and migratory habits of this species, in waters claimed and fished by a large number of different villages and language groups. Although coastal villages and river clans claimed rights (contested by other groups) to exclude outsiders from waters over which they claimed tenure, no group had traditional resource management practices.

Using the data from all of these studies, the researchers constructed a computer model of the fishery, predicated around searching for a combination of effort controls (size limits, mesh sizes and closed seasons) that would lead to the most efficient use of the available resource. It was used to investigate different management options, such as how the fishery might respond to variations in distribution of fishing effort among the different communities. After appropriate consultation, a Barramundi Fishery Management Plan involving mesh size restrictions as well as closed seasons and areas was accepted by stakeholder representatives then by the National Fisheries Board, and signed into law by the PNG government in April 2003. A Barramundi Management Advisory Committee has been established to oversee implementation of the Plan. The Ok Tedi Foundation and the National Fisheries Authority are continuing to engage in community consultation and education activities in barramundi fishing communities of Western Province.

## **FIS/1999/038: Sustainable artisanal bêche-de-mer fisheries through the incorporation of socioeconomic considerations in the development of community based fisheries management plans**

<b>Overseas Collaborating Countries</b>	Papua New Guinea
<b>Commissioned Organisation</b>	Australian Maritime College, Australia
<b>Project Leader</b>	Mr Nick Rawlinson Phone : (03) 6335 4414 Email : N.Rawlinson@fme.amc.edu.au
<b>Collaborating Institutions</b>	National Fisheries Authority, PNG National Research Institute, PNG Milne Bay Provincial Fisheries Administration, PNG
<b>Project Budget</b>	\$149,948
<b>Project Duration</b>	01/07/2001 to 31/12/2002
<b>ACIAR Research Program Manager</b>	Mr Barney Smith

### **Project background and objectives**

There is evidence that overfishing of sedentary species such as bêche-de-mer and trochus is causing a decline in catch in the waters around Papua New Guinea. Since these fisheries are a major source of cash income for the local communities, better management arrangements are vital to enhance the productivity and sustainability of the resource. The government of PNG announced a policy of 'community management of fisheries', but there was a large gap between the principles expressed in this policy statement and the achievement of management plans on the ground. The primary objective of this project was to develop a methodology to produce community-based management arrangements for sustainable artisanal fisheries in PNG. The project focused on bêche-de-mer (produced from sandfish), as this is economically most important to many coastal communities in Milne Bay Province, but sought a methodology that could also be applied to other marine resources. Other objectives were to identify and develop community-based management and enforcement strategies that reflect national, provincial and local management rights, and to assess the socioeconomic impacts of current management and enforcement strategies. The case study approach used was designed to benefit the local communities involved and also to contribute to capacity building of local researchers in the area of community-based fisheries management.

### **Project outcomes**

The community selected to participate in the development of community-based management arrangements was Obulaku village on Kiriwina Island in the Trobriand Islands. Obulaku village consists of 62 households, with a population of 298. The village contained six separate clans. Most people only speak the local language *Kilivila* with only a few speaking English or Pijin. The approach adopted was based on the Facilitated Community Action Process (FCAP) that had been used through a three-year AusAID project in Samoa. A series of meetings were held with each of the clans to identify problems, causes, their impacts on the community, solutions, and actions required. Some of the actions generated from the process included a set of precautionary measures, for example size limits, a ban on the use of destructive harvesting techniques, and bans on dumping of rubbish in the marine area, to improve the marine environment.

A series of surveys established baseline data about the village and assessed the relative importance of bêche-de-mer to the community. Although the survey results confirmed that bêche-de-mer provides a significant proportion of the income of Obulaku households, the villagers do rely on a number of other sources of income, which will become more important if bêche-de-mer catches decline further or there is a reduction in the amount that can be legally harvested.

As part of the community-based management program in Obulaku, the community agreed to monitor their bêche-de-mer harvest. The project staff developed a simple diary for recording the daily harvest of bêche-de-mer. It was observed that the value of sandfish harvested by fishers from Obulaku was significantly higher than landings by fishers from other villagers, and there were less rejects. The

researchers concluded that the community-management process made fishers from Obulaku aware of the importance of harvesting the larger size classes of sandfish from both a conservation and economic perspective.

## **FIS/2001/059: Research for sustainable use of bêche-de-mer resources in Milne Bay Province, Papua New Guinea**

<b>Overseas Collaborating Countries</b>	Papua New Guinea
<b>Commissioned Organisation</b>	CSIRO Marine Research, Australia
<b>Project Leader</b>	Mr Tim Skewes Phone : (07) 3826 7249 Email : tim.skewes@marine.csiro.au
<b>Collaborating Institutions</b>	Conservation International, PNG National Fisheries Authority, PNG
<b>Project Budget</b>	\$98,934
<b>Project Duration</b>	01/07/2001 to 31/12/2002 (Project extended from 01/07/2002 to 31/12/2002)
<b>ACIAR Research Program Manager</b>	Mr Barney Smith

### **Project background and objectives**

The bêche-de-mer (holothurian) fishery is one of the most important sources of income for rural coastal dwellers throughout Papua New Guinea and with increasing commodity prices exploitation rates have pushed beyond sustainable limits. Milne Bay Province is the country's largest bêche-de-mer producer and thus the main target of National Fisheries Authority (NFA) management efforts. In this project scientists undertook abundance surveys to provide preliminary information of stock status, to determine safe future catch levels and management strategies that can support the sustainable exploitation of these valuable sedentary resources, and to break the all too common 'boom-bust' cycle.

The activity was jointly funded by ACIAR and Conservation International (CI), an NGO committed to a longer term program aimed at community-based approaches to the sustainable use of marine resources in Milne Bay Province.

The overall objective of this project was to provide a better understanding of stock size and stock status for each species of commercially important bêche-de-mer in Milne Bay, as a first step in a review of existing management arrangements.

### **Project outcomes**

The survey of holothurians on shallow reefs and shoals (0–20 m deep) at 1126 locations throughout a large section of Milne Bay Province enabled the scientists to estimate the distribution and abundance of commercial species in the area, and to assess their fishery status. They estimated that the overall average density of commercial holothurians was 21.2 per ha, which equated to a total live wet weight of 15,000 tonnes liveweight or approximately 920 t of dried bêche-de-mer.

The most abundant commercial species was *Holothuria atra* (lollyfish—49% by weight) followed by *Stichopus chloronotus* (greenfish—17 %) and *Thelenota anax* (amberfish—8 %). Premium value bêche-de-mer species—*H. nobilis* (black teatfish), *H. fuscogilva* (white teatfish), *H. scabra* (sandfish) and *T. ananas* (prickly redfish)—comprised only 9% by weight of all commercial holothurians.

While the project team found there was still a significant population of commercial holothurians in Milne Bay Province, low survey densities and a comparison of historical catch data indicated that sandfish and black teatfish populations were grossly overexploited, especially in some local-level government areas (LLGs). The overall density of commercial species in Milne Bay was very low when compared to similar fisheries in eastern Torres Strait and the northern Great Barrier Reef.

The LLGs within Milne Bay that had been traditionally fished heavily were the most depleted. Also since 1990 there had been a 58% reduction in the proportion of the catch made up of premium-value species. The total number of species exported has increased from 14 in 1993 to 18 in 2001, but all additional species were low-value. The project team recommended that management measures should be implemented immediately to curb fishing effort in depleted LLGs, especially for species such as sandfish and black teatfish. The scientists noted that efforts were needed to ensure that the

fishing effort was not just transferred from protected species/areas to more abundant species/areas in the province.

The total allowable catch (140 t TAC) for the fishery had been substantially greater than the lowest estimated maximum sustainable yield (108 t) and would not allow for a recovery of depleted areas and species, and for a subsequent increase in yield from the fishery. Given the recent history of the TACs being exceeded in the Province, the scientists recommended that catches should be monitored carefully and TACs strictly enforced.

## **FIS/1998/013: Development of new artisanal fisheries based on the capture and culture of postlarval coral reef fish**

<b>Overseas Collaborating Countries</b>	Papua New Guinea, Solomon Islands
<b>Commissioned Organisation</b>	International Centre for Living Aquatic Resources Management, Coastal Aquaculture Centre, Solomon Islands
<b>Project Leader</b>	Dr Johann Bell Phone : + 604 641 4623 Email : jbell@cgiar.org
<b>Collaborating Institutions</b>	Ministry of Agriculture and Fisheries, Solomon Islands Australian Institute of Marine Science, Australia
<b>Project Budget</b>	\$410,941
<b>Project Duration</b>	01/01/1999 to 31/12/2003 (Project extended from 01/01/2002 to 31/12/2003)
<b>ACIAR Research Program Manager</b>	Mr Barney Smith

### **Project background and objectives**

In the early 1990s an industry was established to collect tropical marine fish for the aquarium trade (mainly for sale in North America and Europe) and harvest groupers, snapper and the napoleon wrasse for sale as live fish for human consumption—often to up-market restaurants in Hong Kong, Taiwan and China. The industry grew rapidly and soon virtually every country in the South Pacific and Southeast Asia supplied one or both of these markets. The high value of the trade led to over-exploitation in several places. In addition, the collection methods often damaged fish stocks. Of particular concern was the use of sodium cyanide to ‘stun’ fish, which could then easily be collected. In the process, many fish and other organisms were killed.

Non-destructive fishing methods for these species existed, and various NGOs trained coastal communities in their use. However, despite these good intentions, there was growing concern that harvests of coral reef fish were simply not sustainable. A possible solution was to collect postlarval fish in numbers that would not affect the replenishment of natural populations and culture these to marketable size, using simple techniques and readily available food sources. For best results, the fish would be caught whilst still in abundance, which meant before they suffered the naturally high mortality that occurred during their growth.

Fish could be caught either using light traps or crest-nets. Research was needed to determine which method was preferable, as well as to assess levels of abundance and any seasonal fluctuations, and to develop methods for coastal villagers to grow selected species to marketable size. This project concentrated on the situation in Solomon Islands, a country that typified tropical reef fish operations in the South Pacific. Coastal villagers collected about 150 species for exports, although only about 40 species accounted for the majority of sales.

The project aimed to increase the production of marketable coral reef fish—and reduce reef damage—by providing the means to capture and then rear the postlarvae of desired species in a sustainable fashion.

### **Project outcomes**

The project substantially achieved its research objectives despite a period of civil disturbance that required the evacuation of the on-site project leader, and despite ongoing uncertainty in Solomon Islands. The researchers found that temporal variation in most species captured was low and generally unpredictable, with the only major exception being the puerulus lobsters, which showed peak abundances in July, August and September during the two years of sampling.

Light traps were found to capture large numbers of low-value fish species and were relatively expensive to construct and operate. Researchers recommended that no further development of this technology for capture of post-larval reef fish in Solomon Islands was justified.

Crest nets, however, captured smaller numbers of high-value species, including lobsters and shrimps. The number of invertebrates and finfish captured in crest nets indicated that further development of this technology could provide an economically viable technology for collection of post-larval fish for the aquarium trade. Thus researchers recommended that further capture technology development should focus on crest nets. In their current form they resulted in substantial mortality of captured fish, so a redesign was advocated.

Neither crest nets nor light traps captured sufficient numbers of fish to supply the live reef fish food trade. The project thus focused on marine aquarium fish. Feedback from the aquarium fish exporter in Honiara indicated that captured-then-cultured fish showed better adaptation to captivity than wild-caught fish, in that they were less 'nervous' in the tanks and more readily accepted food.

A rough cost:benefit estimate indicated that, using catch and value data from the project, a fisher could expect to repay the capital cost of a collection device after about 25 nights fishing. The project team identified a number of potential sites throughout Solomon Islands where modified reef crest collection devices could be established. Reviewers recommended a program of follow-on research, development and extension activities to realise the benefits of the project for coastal communities in the South Pacific.



# Projects under development

at 30 June 2004

## **Bilateral**

ASEM/2004/011: Evaluating domestic tuna fisheries projects

CP/2003/029: Management of potato late blight in Papua New Guinea

CP/2003/041: Fruit fly survey in Papua New Guinea

CP/2003/042: Fruit fly quarantine in Papua New Guinea

CP/2004/001: TaroPest: A computer based information and diagnostics package for taro pests of the South Pacific

FIS/2001/083: Inland aquaculture in PNG: improving fingerling supply and fish nutrition for smallholder farms

FST/2004/009: Domestication of Papua New Guinea's indigenous forest species part 2

FST/2004/013: Preservation of the wood of Casuarina species for rural construction in the highlands of Papua New Guinea

PHT/2003/015: Enhancing cocoa production through improvement of disease control in Papua New Guinea

PHT/2004/017: Mechanical dryers for coffee in the PNG highlands



# Papua New Guinea consultations

1–2 August 2002

Priorities for collaborative agricultural research and development between Australia and Papua New Guinea (PNG) were discussed on 1–2 August 2000 at a consultation between ACIAR and representatives of relevant PNG Government departments, statutory authorities, research organisations and the private sector.

These priorities are not to be considered as officially sanctioned priorities of the Government of Papua New Guinea. They are priorities expressed by participants at a consultation at a particular point in time. ACIAR will use them as a framework when assessing proposals for collaborative projects to be supported by ACIAR, subject to further advice and information from PNG.

Researchers intending to seek ACIAR support for collaborative research projects with PNG counterparts should, in the first instance, approach one of ACIAR's Research Program Managers.

At the consultation, consensus was achieved on several over-arching issues. These included the importance of agricultural development policy settings and research, especially with the increased role of provinces in the management of renewable resources. It was considered that the generation of income by smallholders was central to their food security and resilience to drought, frost or natural disasters. Pressure on land/agricultural resources through population increases should be especially recognised in project design. There is the need for improved resource assessment of agricultural land, fisheries and forestry, recognising the diverse range of production environments in PNG.

The role of the private sector and NGOs in R&D in PNG and implementation of research results was identified. Identification of optimal industry models for the smallholder/commercial sector interface will also be critical. Research into marketing constraints was seen as especially important, especially with view to the analysis of transport constraints. Market chain information and post-harvest quality systems will be needed to guide resource development. Lack of capacity was identified as a major constraint in both R&D and the delivery of extension services. Thus training must be key element in project design. It will also be important to package the results of earlier research in a suitable form for uptake by farmers, and to incorporate farmer groups in training activities.

The following priorities are listed under ACIAR Program areas for convenience.

## **Agricultural Economics and Agricultural Development Policy**

- Land-use management and land tenure implications for agriculture
  - utilisation of existing databases and outcomes of past projects
  - social and economic implications of settlement and urban migration
  - relationship between use rights to customary land and uptake of agricultural developments
  - community involvement in resource utilisation
- On-going refinement of research management
  - inclusion of farmers and NGOs in research, research policy and training
  - Impact of Government interventions for poverty alleviation
  - land use implications of establishment of road infrastructure or freight subsidies
  - disincentives for agriculture when other income sources are available
  - evaluation of, and access to agricultural credit schemes
- Competitiveness of marketing institutions

## **Animal Sciences**

- Efficient householder livestock production in both peri-urban and rural areas
- Integration of livestock into farming systems (sheep, goats, cattle, rabbits)
- Compilation of baseline data on stock, feed and disease status
- Utilisation and compounding of available feeds for non-ruminants, with emphasis on location and cost
- Social and economic factors affecting technology uptake by smallholders
- Investigation of disease impact on livestock/ human health

### **Crop Sciences**

- Socio-economics of smallholder tree crop production systems
- Alternative approaches to smallholder tree crop extension and farming systems
- Application of biotechnology to coffee, coconut, cocoa improvement
- Conservation and characterisation of plant genetic resources and development of appropriate regional strategies
- Varietal assessment and agronomy of staple crops (sweet potato, banana, taro)
- Establishment of nutritional analysis for traditional/indigenous PNG crops
- Pest and disease management
  - especially of sweet potato weevil, oribius weevil, pink wax scale, red-banded mango caterpillar, taro beetle, fruit flies, banana scab moth and exotic diseases
  - development of IPM packages for staple and tree crops and introduced vegetables
  - capacity-building in diagnostics and indexing of viruses in PNG
  - application of non-chemical control, including weed biological control

### **Fisheries**

- Management of shared fish stocks in the Torres Strait and Western Province
- Policy development and enhanced productivity of inland fisheries, pond aquaculture, stock enhancement and stocking of lakes and reservoirs
- Management of inshore fisheries resources
  - community management of sedentary resources
  - training/standardisation of resource assessment management and policy tools and methods
  - spillovers from reef mariculture/stock enhancement studies
  - management of Live Reef Fisheries
- Evaluation of past experiences with village-scale and community fishing enterprises

### **Forestry**

- Sustainable management of natural forests, including biology/socioeconomic analysis, approaches for increased wood recovery and utilisation of non-wood forest products
- Plantations
  - restoration/reforestation of degraded upland grasslands
  - domestication for provision of germplasm for both agroforestry and plantation programs
  - genetic improvement of high-value species
- Postharvest processing
  - reduced waste/improved recovery through processing
  - preservation methods for improved durability leading to wider utilisation
- Development of information systems for herbarium management and domestication

### **Land and Water Resources**

- Land management information systems, including the use, development and management of GIS databases, access to information from land-use archives
- Survey-based development of national weed management policy and systems
- Sustainable land management benchmarking through practical technology transfer models from long-term sites
- Nutrient management in intensive vegetable production and to shorten fallows in field crops
- Agroforestry for fallow management, fertility maintenance, and development of economic multiple cropping systems
- Impacts of excessive/deficient soil water from drought or flooding in traditional or innovative cropping systems

### **Postharvest Technology**

- Market and product quality analysis for domestically-consumed crops and potential export crops
- Reduction of post-harvest losses in domestically-marketed food crops
- Development of processing methods for vanilla, sweet potato and sago
- Enhanced product quality and management of coffee and cocoa processing wastes

# ACIAR publications

This list is a selection of titles from ACIAR's range of scientific publications that are relevant to PNG's agricultural research and development sector. Hard copies are available by emailing [comms@aciar.gov.au](mailto:comms@aciar.gov.au), or may be requested through ACIAR's PNG office. Titles marked with an asterisk may also be downloaded from ACIAR's website, [www.aciar.gov.au](http://www.aciar.gov.au).

## Monographs

- 06 Chemistry of Tropical Root Crops: significance for nutrition and agriculture in the Pacific
- 12 Biological Control – Pacific Prospects: Supplement 1
- 20 Biological Control – Pacific Prospects: Supplement 2
- 28 The Economics of Papua New Guinea Tuna Fisheries
- 32 Working with Mycorrhizas in Forestry and Agriculture
- 33 Illustrated Guide to the Identification of Banana Varieties in the South Pacific
- 40 Essential Oils of Tropical *Asteromyrtus*, *Callistemon* and *Melaleuca* Species
- 44 The Major Invertebrate Pests and Weeds of Agriculture and Plantation Forestry in Southern and Western Pacific
- 45 Report on ACIAR-Funded Research on Viroids and Viruses of Coconut Palm and Other Tropical Monocotyledons 1985-1993
- 48 Nutrient Disorders of Sweet Potato
- 52 Improving Smallholder Farming Systems in *Imperata* Areas of Southeast Asia
- 54 Survey Toolbox for Livestock Diseases: practical techniques for developing countries\*
- 58 Understanding Animal Health in Southeast Asia\*
- 66 A Review of Papua New Guinea's Red Meat Industry
- 76 Plant Genetic Resources in the Pacific
- 80 Setting Policy Priorities for the Development of Tree Crop Industries in Papua New Guinea
- 81 Policy Options for the Tree Crop Industries in Papua New Guinea
- 83 How to Unravel and Solve Soil Fertility Problems\*
- 85 Fruits of Oceania
- 94 Survey Toolbox for Aquatic Animal Diseases: A Practical Manual and Software Package\*
- 99 Developing agricultural solutions with smallholder farmers (available from CIAT: [www.ciat.cgiar.org/asia](http://www.ciat.cgiar.org/asia))
- 101 The Coconut Odyssey: the bounteous possibilities of the tree of life\*
- 102 Lantana: Current Management, Status and Future Prospects\*
- 108 Pig Husbandry in New Guinea: a literature review and bibliography\*

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