

# Papua New Guinea and the Pacific

<b>Financial year</b>	<b>Regional expenditure</b>	<b>Percentage of total bilateral expenditure</b>	<b>Board target as percentage of expenditure</b>
2006-07	\$7,487,425	21.6	>20%
2005-06	\$6,863,591	22.4	>20%
2004-05	\$6,332,358	22.5	>20%

ACIAR's programs cover five regions. Papua New Guinea and the Pacific Islands are grouped as one region. Outlays for the region have been rising in recent years to meet the priorities placed on the region by the Australian aid program. For the region an expenditure target of more than 20% of our overall annual bilateral research expenditure has been set.

	<b>Page</b>
<b>Papua New Guinea</b>	<b>17</b>
<b>Pacific Island countries</b>	<b>26</b>

# Papua New Guinea

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Active projects in 2006–07	54
AOP budgeted expenditure in 2006–07	\$4,735,720
Actual expenditure in 2006–07	\$4,797,959
Expenditure in 2005–06	\$4,704,653
Expenditure in 2004–05	\$4,226,822

Key performance indicators	Performance 2006–07
Enhanced focus in project portfolio on improving the quality of commodities	Six new projects have strong emphases on processing quality: four new forestry projects concerned with wood-quality improvement; one on sweet potato marketing and postharvest handling; and one targeting increasing pyrethrum content of harvested flowers.
Maintain linkages between at least three ACIAR projects and three AusAID-funded Agricultural Innovations Grant Facility (AIGF) projects	ACIAR projects maintained links with AIGF projects on coffee growers/farmers production and marketing groups; management of potato late blight; and on enhancing the capacity of village extension workers and farmers to improve income from horticultural crops.
Greater involvement of PNG University of Technology (UNITECH) in ACIAR's program	An ACIAR scholarship scheme has been implemented to allow PNG nationals to undertake postgraduate training in-country while linking to ACIAR projects. UNITECH is also now directly involved in six ongoing ACIAR projects.
Increased emphasis in ACIAR portfolio on sweet potato research and development, commensurate with its importance as a staple food	A comprehensive portfolio of projects has been developed focusing on production and marketing of sweet potatoes, addressing pests, soil constraints, varietal selection, nutrition, marketing and postharvest technology.
Potential role of indigenous nuts in local economies defined	Key issues involved in the domestication and commercialisation of indigenous nuts and fruits of PNG were examined. Nearly all the farmers interviewed indicated a desire to grow more nut trees than they currently do, in particular for the generation of income. A new project is identifying and propagating superior nut cultivars, and developing a marketing strategy.
Extent of soil fertility decline of PNG highlands quantified and suitable research and development investments to improve soil fertility implemented	The extent of soil fertility decline and major constraints to production of the most important staple, sweet potato, were identified. The project was initiated to investigate improved nutrient and water-management options.
A major thrust to consolidate the development of inland aquaculture, with increased geographic coverage and new attention to promising indigenous species	A national meeting was held that brought together key stakeholders in the industry to discuss opportunities. A strategic industry planning exercise will be driven by the National Fisheries Authority with technical support from ACIAR. A new project on the culture of indigenous fish species is underway in Western Province.

Fingerling production and supply to inland fish farmers significantly improved in quantity and quality	A mid-project review was undertaken and remedial action agreed with key agencies to address problems encountered with fingerling production and project delivery at Aiyura Highlands Aquaculture Development Centre and at Erap.
Forty percent of new projects designed to have significant farmer or policymaker impacts within five years of completion ('Category 1')	Five out of six small research activities and two out of six new full projects are ranked as Category 1.

## 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 one of Australia's largest development partners. 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 set of projects of mutual interest, through a Record of Understanding that provides funding of \$2 million annually for support of bilateral projects. In 2003, AusAID established the PNG Agricultural Innovations Grant Facility (AIGF) which supports small projects in PNG agricultural research and extension institutions. Some of these projects relate to previous or current ACIAR-funded projects at these institutions. ACIAR will link closely with the new AusAID-funded PNG Agricultural Research and Development Support Facility, programmed to commence in 2006–07.

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.



*Project workers and villagers inspect new lalekens (small paddocks) that enhance traditional village-based food production systems*

Domestic trading of fresh produce is a very important (and often under-recognised) source of cash income. Domestically marketed food is second to oil palm in value to the economy. Forestry is PNG's third largest revenue earner and a major contributor to the overall economic and social development of the country. The PNG fisheries zone of 2.4 million square kilometres is the largest in the South Pacific. The fisheries zone includes an extended reef system, numerous islands and an extensive coastline. These create huge opportunity but also present an enormous challenge for monitoring and control. The total market value of the PNG catch is estimated at \$140–160 million.

ACIAR's program recognises the many challenges to agricultural development in PNG, including poorly developed infrastructure, weak market signals and

services, poor product quality, population pressure and future impacts of HIV/AIDS on the farming sector. Major changes to the rural environment over the last decade include greater exposure to global markets, devaluation of the kina, pressure on land and renewable resources as a result of population increases, and new pest and disease threats. These mean that as well as making a greater commitment to the implementation of the results of research, the need for ongoing development of agricultural technologies remains strong.

ACIAR has funded some highly successful projects in PNG. Examples include control of the plant pest banana skipper and identification of the pheromone of cane borer (enabling its numbers to be monitored in the field), research on halting the spread of bee mites in PNG, conservation of indigenous plants, and management of the tuna industry. Much effort has gone into efficient use of available resources for sustainable crop/food production and supporting policy development for PNG's food security. PNG needs further support to strengthen existing R&D facilities and activities. It is therefore crucial, when designing projects, to include training and packaging of research results in a form suitable for uptake by farmers.

## Achievements

ACIAR's PNG program continued to emphasise research and development within four programmatic themes:

- applied research aimed to maintain and enhance smallholder incomes, with an emphasis on root, plantation, agroforestry and horticultural crops and aquaculture, and effort to place these in a social and economic context, particularly with respect to involvement of women farmers
- sustainable management of land, forestry and fisheries resources
- biosecurity
- institutional capacity building, socioeconomics and project assessment, through development of human and physical resources.

In attempts to enhance smallholder incomes from agriculture, a project has aimed to improve the **marketing system for fresh produce** of the highlands of PNG. It has mapped the supply chain from the highlands to the coastal markets, and this valuable new knowledge reveals how consumers form their preferences in the formal market in PNG. A more comprehensive picture of the work is provided on page 24. This project and others have sought ways to lift the participation of youth and women, for their own benefit and also to improve productivity of commodities such as vegetables, peanut, cocoa, coconut and oil palm.

## Relationship to the AusAID PNG strategy

AusAID's program supports broad-based sustainable economic growth in PNG by working with PNG government agencies and systems to ensure better use of PNG's own resources to strengthen economic management, deliver essential services and improve law and order. The importance of strengthening political governance, building sustainable government institutions, exploiting opportunities to stimulate sustainable economic growth and maintaining service delivery is recognised.

ACIAR's PNG program, which is delivered with significant long-term AusAID co-funding, supports the emphasis on fostering economic growth by working with PNG government agencies and systems. Partnership with PNG public and private-sector institutions in agricultural research and development supports better use of PNG's own resources. With over 85% of the population in rural areas, development of agricultural industries and the smallholder cash economy is critical in stimulating sustainable economic growth and in maintaining service delivery.

During the year progress was made in finding how to improve the capacity of **research and extension services in the cocoa sector**.

Two public seminars held at the Cocoa and Coconut Institute (CCI) and with the Cocoa Board in East New Britain (ENB) outlined the results of smallholder socioeconomic studies and proposed recommendations to improve research and extension services. For example, New Guinea Island Producers (NGIP) of New Britain is servicing smallholders in ENB by providing planting materials, tools and extension advice. Thus, rather than limiting its activities to buying cocoa, as has been the case in the past, the company is now becoming more involved in supporting smallholders to raise productivity and increase or rehabilitate the area under cocoa production.

A project to facilitate farmer adoption of **new management strategies among cocoa smallholder farmers** through on-farm participatory action research (PAR) and village-based extension was disrupted by the discovery of the destructive cocoa

pod borer (CPB; *Conopomorpha crameriella*) in ENB. The PNG Government declared a national state of emergency, resulting in a large-scale monitoring and eradication program. Despite the significant disruption caused by the CPB to this project, project activities and outcomes continued. An on-farm PAR-based approach termed Integrated Pest and Disease Management (IPDM) is being promoted to assist the adoption of the management strategies. Initial indications suggest that many people are adopting them, particularly when they see the impact of the management changes. They are also learning to keep records of yield and disease levels in their cocoa blocks.

There has been a strong focus on **quality improvement and marketing enhancement for peanuts**. Large-scale multiplication of selected varieties took place at Ramu Sugar to facilitate seed supply for on-farm trials. Eighteen trials in the Eastern Highlands, Upper and Lower Markham Valley, undertaken in collaboration with local farmer groups, evaluated new varieties and



*Smallholder vegetable farmers have increased production through improved pest and disease management*

management practices on farmers' fields. Active participation of researchers and farmer groups strengthened linkages between the two groups, and substantial yield benefits were observed from the combination of improved varieties and improved practices across all sites. The improved varieties also proved more drought-resistant.

A survey conducted on the **role of women in peanut production** in Lower Markham Valley showed that peanuts contribute 75% of total household income and women in the Lower Markham have two major roles in decision making—one relating to cropping (i.e. crop and variety, time of planting) and the other related to childcare. Women also play a major role in sourcing peanut seed, weeding, marketing and planting.

Efforts to lift **supply and quality of coffee** have been successful. A survey of the industry from farmer producer through processor, trader, buyer and consumer yielded a wealth of information that a research team then analysed to determine margins at each stage along the marketing chain. The team found that, for green bean, growers with reasonable access to traders and processors (and therefore not hindered by high transport costs) were receiving reasonable prices. The team recommended that growers in reasonable proximity sell their main crop (May to July) directly to mills as ripe cherry, which would lead to a final product equal to top estate coffee.

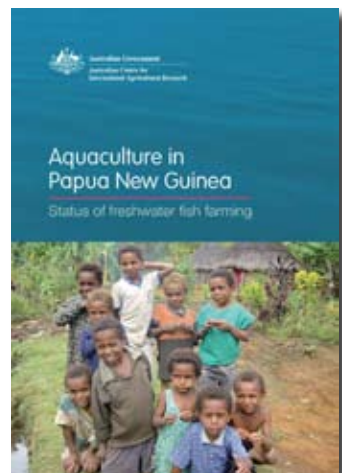
A second, lighter crop around December–January was better processed by the farmers themselves, stored at home and used like a bank account to generate funds for immediate needs. The beauty of this arrangement is its harmony with Melanesian village life.

**Inland aquaculture** is regarded as a highly promising enterprise for villagers. In October 2002 fish farmers first received the genetically improved farmed tilapia (GIFT) strain of *Oreochromis niloticus* from the Highlands

Aquaculture Development Centre at Aiyura in Eastern Highlands Province. This fish is a popular choice because of its ability to grow rapidly and produce fingerlings in earthen ponds. An ACIAR project is developing commercial and farm-made feeds for tilapia and also the giant freshwater prawn (*Macrobrachium*) in PNG and Fiji. The project team has reviewed the suitability of available ingredients (with their content analysis and costs), assessing aspects such as reliability of supply, cost, nutritional value and consistent quality, in order to formulate optimum low-cost diets. The project nutritionist has produced a basic feeds brochure for use by aquaculture extension officers and farmers in the participating countries and other Pacific island countries.

The PNG Feed Formula was used successfully in a mini project involving cage **trials for culture of tilapia** at Yonki Reservoir in the PNG highlands. A new ACIAR project, *Increasing capacity for regional fish feed manufacture in Papua New Guinea*, has been developed as a result of these trials. In 2007 ACIAR also published a monograph, *Aquaculture in Papua New Guinea: status of freshwater fish farming*, outlining the issues facing the country and prospects for advancing village-based inland aquaculture.

ACIAR's strong focus on sustainable management of forestry and fisheries resources continued. One project undertook a **review of portable sawmills** in both PNG and Solomon Islands. Small-scale milling technology has allowed owners with rights to community forests to harvest from



their own allotments, for their own purposes, in a way that was intended to maintain the resource for the long term. A project commissioned to examine current operations, define success and guide the further progress of portable mill technology sent an expert group on a 2-week visit to small mills in PNG.

The group concluded that problem areas were in the social, economic and regulatory fields, not in sawing technology, which had been mastered quite well. Of particular concern was the poor regulation of small mill operation—mills harvesting less than 500 cubic metres per year were completely unregulated. Thus the legal position needed urgent revision. The formation of a Portable Sawmill Owners Association was recommended, for advice when recasting the regulations and to introduce some degree of self-regulation of activity.

Excellent progress has been made in activities to increase the availability and use of **improved germplasm for forestry and agroforestry** in PNG. In its second year of operation the project has focused on a range of species including sandalwood and teak. Seed orchards and clone banks (to enable rapid vegetative propagation of desirable species) have been established. Project partner organisations, in particular the Foundation for People Community Development (FPCD), provided six village communities with training in how to establish village nurseries. Each trainer has conducted follow-up training to reinforce and evaluate the implementation and impacts of nursery skills within their respective villages.

ACIAR is committed to assist the sustainability of fisheries around PNG. Active projects include a survey of the biology and status of the **prawn stocks and trawl fishery** in the Gulf of Papua, and an assessment of the impact of the PNG purse seine fishery on tuna stocks. The **PNG tuna fishery** is the largest in the Pacific Islands region, and is based on total allowable catches allocated by species



*Fish sellers at Lae market, Papua New Guinea*

type (skipjack, yellowfin and bigeye tuna) and gear type (purse seine and longline). Tuna stocks appear to be declining, due in part to the use of anchored fish aggregation devices (FADs). The project team is providing information on tuna population dynamics and determining how FADs impact on the fishery.

Currently tuna stocks appear to be exploited at maximum levels of sustainability. PNG has a better chance of sustaining its tuna fisheries if it can encourage domestic fishing in the country's exclusive economic zone and phase out fishing by other nations. Responsibility for managing the fishery rests with the National Fisheries Authority, and it needs a framework to determine whether or not substituting domestic activities and the consequent loss of fees from other nations will confer net benefits to the economy. As part of this strategy an ACIAR project recently completed a survey to determine the labour cost component at a domestic cannery.

PNG must deal with a wide range of pests and diseases that affect both plants and animals. One particular scourge is **potato late blight**, which wiped out potato production in 2003. The favoured variety Sequoia is highly susceptible to the blight and, in order to keep the plants alive until maturity, the crop must be sprayed every 3 to 5 days with fungicides. Such an intensive regime may



Fungicide application is helping control potato late blight in Papua New Guinea

be too much for 'subsistence' farmers, who once relied on potatoes as a valuable cash crop. This situation will not change until late-blight-resistant varieties are available. An ACIAR project aims to provide a consistent and assured supply of seed potatoes of current and new varieties for the market place. It has supported tests of several potato varieties developed by the International Potato Centre in Peru (CIP) that have proved to be very resistant to the blight. A tissue culture laboratory at Aiyura is being prepared to produce high numbers of quality potato plantlets as a forerunner of blight-resistant Certified Seed Potatoes.

**Sweet potato** is the mainstay of PNG's food security and accounts for 63% of the dietary energy of the population. Climatic factors such as El Niño events can cause major but temporary falls in production but, aside from this, farmers and scientists have noted a gradual decline in yields and the quality of tubers for no obvious reason. This decline has implications for food security and an ACIAR project is seeking solutions. The project, which aims to assemble better performing, disease-resistant germplasm, is introducing progeny-tested material from Australia or other sources. Viruses affect productivity, and the researchers are performing preliminary identification of virus and virus-like diseases. Aphids are common vectors of sweet potato viruses, and two aphid-proof tunnelhouses (igloos) have been imported—one to be used to propagate virus-free sweet potato

cuttings, the other for virus indexing. The project is profiting from advice from CIP on virus detection and also directions for using tissue-cultured plants in heat treatment for virus removal (in-vitro thermotherapy).

The weed '**mile-a-minute**' (*Mikania micrantha*) has the capacity to smother food crops. A project is evaluating biological control through natural weed predators, based on known agents trialled or in use elsewhere. Another project is looking to control a planthopper, *Eumetopina flavipes*, that earlier ACIAR work had identified as the vector of ramu stunt disease of sugarcane in PNG. This new research is developing an integrated pest management program for its control.

At present the main pest to coffee in PNG is **coffee green scale**. A project researching the best means for its control has taken the work of ACIAR socioeconomic researchers into consideration, because they have provided insights into the type of pest management acceptable and sustainable by smallholder growers. This is helpful in guiding development of the project's control packages. As well the team's work has discovered the serious threat posed by **coffee berry borer** (CBB). Although not yet present, it is just beyond the PNG border, and its arrival will mean that all farmers except those at the highest altitudes will have to invest more time in their crop if they are to get any sort of return from growing coffee.

Efforts continued to build up PNG's institutional and individual capacity. ACIAR finalised its project to introduce science communication in PNG. The '**SciCom**' project developed an applied accredited postgraduate course in scientific communication, and developed the capacity of universities and their staff to deliver and manage the courses. Three PNG universities now have accredited postgraduate courses based on the developed module



*UNITECH graduation ceremony in April 2007. Left to right—James Butubu, Brian Takaboy, Amos Top Uriningi, Ronnie Datoana, Gure Tumaë, Peter Amatus, Prof. A. Halim, Dr Jacqui Wright, Nicholar Boas, Bandy Keponge Yombo, Densley Tapat*

The **ACIAR Scholarship Scheme** was initiated in the Department of Agriculture at UNITECH at the beginning of the first semester in March 2005. Six scholars initially undertook postgraduate studies, studying topics such as the economics of peanut production, fish nutrition, fresh produce storage systems, yield decline in sweet potato, viral diseases of taro and host resistance to the sugarcane borer.

A further seven scholars started postgraduate programs in March 2006, undertaking studies with peanut farmers, researching the incidence of leptospirosis in local cattle, developing sources of traditional feed for pigs and fish (tilapia), genotype x environment interactions in taro, studies of vesicular streak disease of cocoa, and virus detection in sweet potatoes. In the process of providing support for these scholars, a postgraduate computer laboratory was established and research funds supplied, which permitted some upgrading of existing research facilities in the department. In addition, all graduating scholars gained immediate employment in industries, research institutions and universities.

## Advancing the

Growers in the PNG highlands region can produce an amazing variety of high-quality temperate-zone vegetables year-round. They thrive in the mild climate and rich volcanic soils, and this bounty could meet the needs of PNG's populous coastal cities and maybe also supply overseas markets. For these reasons ACIAR commissioned a project back in 1983 that sought to find ways of developing a marketing system for highlands produce.

The project team assessed transport methods and also studied factors affecting produce shelf life. Project team members Dr Kevin Scott, from the NSW Department of Agriculture, and Garth Atkinson, a New Zealander working with the PNG Department of Primary Industry, produced an ACIAR Technical Report (No. 14) outlining prospects for developing a marketing chain from the highlands to populated coastal areas. That project's major achievements were to design a suitable refrigerated container,

## vegetable trade out of the PNG highlands

and complete the testing of vegetable transport and handling from the highlands to Port Moresby, using road containers between the highlands and Lae, followed by ship to Port Moresby.

In 2001, during a visit to PNG, ACIAR program manager Dr Ken Menz observed that this system had been taken up commercially in Mount Hagen in the highlands, and had been operating for a number of years without government support. It was a major supply channel, competing with air freight and non-refrigerated surface transport. Aware of this success, the Fresh Produce Development Agency (FPDA) (a government instrumentality) wanted to encourage more operators into the business, but it was not simply a matter of slotting them in. The marketing system needed a holistic appraisal from the viewpoints of all its stakeholders before it was ready to expand.

Thus, in 2003, ACIAR commissioned another project, led by Professor John Spriggs of the University of Canberra.

This time the research focused on socioeconomic change, involving all the people along the chain. The project's major aim was to help the stakeholders—representatives from along the supply chain including farmers, wholesalers, community associations, supermarkets, transporters, government agencies and researchers—come to the best decisions with regard to marketing highlands fresh produce. Through a process known as 'critical action research' stakeholders had opportunities to learn from the results of research conducted by the project team. They were also encouraged to contribute at project workshops and to become directly involved in the action plans drawn up for marketing system development and further research.

It became evident that there was a strong call to develop the physical infrastructure for marketing fresh produce. The stakeholders strongly supported the establishment of consolidation depots in the major highland centres of Goroka and Mount Hagen, served by satellite district

depots in the surrounding production regions, and efforts have begun to put these in place. Attention is also being given to developing a quality-management system for the produce.

Village extension workers performed a valuable role. These are full-time farmers who act as conduits of technical and market information from the FPDA and other sources to farmers, and also relay production information from the farmers back to the FPDA. This process opened the eyes of farmers to the reality of markets previously unknown to them.

The marketing trials have also opened up opportunities that should lead to more young people staying on the land. They may also attract new people into farming to commence productive use of their land, and give existing farmers a reason to expand production.

# Pacific Island countries

Active projects in 2006–07	42
AOP budgeted expenditure in 2006–07	\$2,468,344
Actual expenditure in 2006–07	\$2,689,466
Expenditure in 2005–06	\$2,158,938
Expenditure in 2004–05	\$2,105,536

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Key performance indicators	Performance 2006–07
Agricultural systems policy options to secure trade liberalisation opportunities (including domestic adjustments) developed for at least two countries	A model for the Fiji economy was tested, evaluated and used to perform a range of policy simulations and related options to securing trade liberalisation. The results of this work have been communicated to stakeholders and the academic community through a range of working papers. Economic models have also been used to analyse policy options facing Pacific countries in relation to maximising the economic benefits from the management of migratory tuna stocks.
Design and commence two new forestry projects with linkages to value-addition through processing	Projects commenced will develop commercial processing methods and provide technical information to underpin the manufacture and acceptance of coconut wood in the high-value flooring market. They will also develop approaches to maximise wood quality and value in Vanuatu's emerging whitewood plantation industry.
Delivery of improved nutritional information for consumers and extension providers	A series of food health and nutrition fact sheets covering 18 crops have been produced and distributed to growers, consumers and extension workers in Samoa and other Pacific nations. Sweet potato cultivars are being evaluated to improve vitamin A status.
Progress the sustainable management of Pacific fisheries through completion of at least two studies on stock replenishment and re-establishment	Restocking of trochus shell broodstock in Samoa has demonstrated partial success, with a small number of juvenile recruits on the release reefs. Establishment of management regimes for sea cucumber resources in Solomon Islands have been hampered by social and political developments. Hatchery-produced black-lip pearl oyster shell was restocked onto local reefs in Kiribati.
Demonstrated capacity-building achievements through effective partnerships and dissemination plans on all projects	Plans are included in all projects.
Develop farmer group testing of at least three integrated crop management packages	Integrated crop management packages in taro in Solomon Islands, ginger in Fiji (HORT/2004/049), brassica crops in Fiji and Samoa, and sweet potatoes in Solomon Islands and PNG are being tested by farmer groups to foster sustainable crop production under high stress, pest and disease pressure.

## Relationship to the AusAID PNG strategy

AusAID's Pacific Regional Aid Strategy 2004–09 states that 'Australia will continue to work cooperatively with Pacific Regional Organisations to support their improved effectiveness and impact in the region....' It identifies 'stability as the fundamental underpinning factor of development, by supporting a strong policy and economic environment and strengthening the drivers of economic growth'. There are four regional themes, including stronger broad-based growth (improving economic competitiveness as well as expanding the productive sectors that drive broad-based growth, with a focus on providing income generation and employment opportunities and sustainable management of the environment); more effective, accountable and democratic government; improved law and justice and security; and enhanced service delivery. There is also a commitment that an increased proportion of assistance will be focused on the countries of Melanesia.

ACIAR's Pacific program assists this strategy, particularly the first thematic area of broad-based growth. It recognises that agriculture and fisheries (along with tourism and remittances) are the main sources of income for many Pacific countries, but that there is a need to secure the production of major existing crops and fishery products as well as to explore development of potential new niche farm, fisheries and forestry products. The program has a strong emphasis on marketing to support the twin roles of agriculture for income generation as well as food security. Work on agricultural policies and quarantine assists with the first two objectives. The ACIAR program also has a strong emphasis on working with Pacific regional organisations (such as SPC, FFA and USP) to improve their effectiveness in agriculture, fisheries and forestry. Over the last three years an increased percentage of the ACIAR budget is being invested in Melanesian countries.

## Position

ACIAR's program with the Pacific islands will continue to develop in line with broader Australian foreign-policy and development-assistance priorities. The long-term development challenges of the region depend heavily on the potential of agriculture, fisheries and forestry for economic growth. The sustainable management of these resources, while also raising producer incomes, remains a central focus of ACIAR's research agenda. In this context, sound locally owned policies and practices will be further developed. The development of an agricultural-enabling environment, including training, extension, land tenure and suitable production systems for primary-industry sectors that are often under-performing, is an ongoing objective.

Agriculture and fishing comprise a majority of the livelihoods for Pacific islanders. Many smallholders live in isolated rural communities dependent on household food production and intermittent crop, fish and small livestock sales. Improving and transforming these systems into an income-generating activity through improved productivity and marketing will enhance self-reliance and reduce poverty over time.

Commodity exports include sugar, fruit and vegetables, vanilla, pepper, kava, hardwood logs and timber, softwood timber, fish and other marine products. Substantial income is also gained from foreign vessel access fees to fishing grounds within each country's exclusive economic zone.

Many of the limiting factors for sectoral growth and development of Pacific island countries will continue over the medium and even long term. These include small size, physical isolation, limited natural resource base, inadequate communications infrastructure, aid or remittance dependence of many economies, limited opportunities, human development constraints, lack of competitiveness in a global trading

environment, high population growth, and the challenges of environmental degradation and resource depletion.

One of the four key themes of the Australian Pacific Regional Aid Strategy (2004–09) is to promote stronger broad-based growth, including 'strengthening the enabling environment for public sector development... improving economic competitiveness...with a focus on providing income generation and employment opportunities and sustainable management of the environment'\*. ACIAR's Pacific program aims particularly to underpin this theme of the strategy.

Participation in regional or multi-country programs, and projects that address common problems, will help to overcome constraints including lack of capacity of many countries to engage in collaborative activities. Projects must also be designed to meet the risks associated with institutional and staff resource limitations. ACIAR specifically encourages the involvement of International Agricultural Research Centres (IARCs) in the region.

## Achievements

The main Pacific island countries (PICs) involved in ACIAR research are Fiji, Solomon Islands, Vanuatu, Tonga, Samoa and Kiribati. Much of the program in the Pacific is delivered through regional organisations, but ACIAR recognises that in some instances

these nations have different priorities and requirements. It therefore continues to support a limited number of single country-specific projects on major issues. In 2006–07 ACIAR's Pacific program focused on four themes:

- improving incomes through more productive farming systems
- sustainable management of forestry and fishery resources
- biosecurity and pest and disease management
- farming systems economics and marketing.

The horticulture industry has potential for many Pacific communities. In Tonga the leading horticultural export is squash, earning \$10.8 million in 2002. Squash is quick and easy to grow with a lucrative market in exports to Japan. A project is in progress to improve **field-based crop protection and market quality of squash** by addressing pests and diseases such as powdery mildew, silver leaf whitefly and virus diseases—also to better manage weeds. Trials in 2005 and 2006 in Tonga and Australia showed that using environmentally friendly chemicals was just as effective in controlling powdery mildew as using traditional fungicides. The researchers screened weed species and other cucurbit crops in the search for alternative hosts for viruses and, using ELISA tests, they identified two weeds that carried two virus diseases affecting squash. This led to the



*Evaluation of superior vegetable varieties for Solomon Islander smallholders*

\*Source: Commonwealth Government: Pacific Regional Aid Strategy 2004–2009, AusAID 2004.

recommendation of weed control around squash plantings as an important aspect of virus control.

In Solomon Islands both the farming and research communities lack resources to address the many pests and diseases they encounter. A project is helping to develop **integrated pest management (IPM) strategies for major food crops**, and also to increase the awareness among government staff and the community about plant pests and diseases, leading to improved and sustainable crop management. Pests and diseases under study include a chysomelid beetle that damages the popular local vegetable 'sliperi kabis', the lethal virus disease *aloma*e found on taro grown in Malaita for the Honiara market, diamondback moth infestation of water cress grown at Mamara near Honiara, and gummy stem blight, a serious fungal disease of watermelon. The project is also surveying vegetable growers supplying the Honiara market, to ascertain their use of pesticides. This is part of the move to increase awareness and understanding of plant pests and diseases among government staff and the community that will help to improve pest management and sustainable crop production.

**Soil-borne pathogens affect ginger** in Fiji and Australia. During May and September 2006 disease and pest surveys were carried out in Fiji with a particular focus on such pathogens. Farm and factory inspections revealed damage caused by fungal rots and nematode infestations. Quality of planting material is a significant problem for both the Fijian and Australian ginger industries. Tissue-cultured plants are being multiplied and several farms in Australia have been established as 'clean seed' producers. Their planting material is in demand. Fiji has also experimented with 'clean seed' schemes in the past and is keen to reintroduce such a program. The project is supporting these industry-led initiatives by provision of tissue-cultured stock material.

In the Pacific islands both large and smallholder farmers grow **brassicas—mainly head cabbage, Chinese cabbage and watercress**. Increasing production in recent years has opened opportunities for diamondback moth infestations to spread. Control is gained through the use of insecticides, but the moth is best tackled through integrated pest management (IPM) that limits insecticide use while maintaining control. A project is encouraging the adoption of IPM, tailoring appropriate packages to each country. Regional surveys (on farms and research stations) are underway to determine the key insect pests of Brassica crops and their associated natural enemies. The work will continue until May 2008 to build up a substantial inventory. Local scientists have been trained in survey techniques and insect identification. The project schedule includes participatory trials to demonstrate the elements of effective brassica IPM, and the development of a 'farmer field school' approach to educate community and farmer groups and extension officers. Selective plant-protection products, for example a formulation extracted from the Neem tree, have been sourced and transported to Fiji and Samoa for testing. An IPM toolkit developed through the project is also being tested.

In Solomon Islands, a project is developing improved systems of **village-based poultry production** by identifying rations for village-based layer and meat birds based on locally available feedstuffs.



*Peri-urban production of Chinese cabbage*



A poultry farm training site, Solomon Islands

At the SI College of Higher Education (SICHE) maize, sorghum, mung beans and pigeon peas were planted on campus to demonstrate the potential for villagers to grow these as feeds for poultry. The crops were harvested, dried and stored for nutrition trials. A 16-pen poultry research facility was constructed and commissioned. Test diets comprising different mixes of components such as sorghum, pigeon pea and locally available fresh coconut and paw paw leaves and fruit were evaluated. The project team is interacting with farmers and farmer groups to trial the diets and gather feedback about the value of these rations. A survey of 90 village poultry farmers in 31 villages from Guadalcanal, Western Province, Malaita and Central Province gave cause for optimism. The team found that most farmers considered chickens were easy to care for and a good enterprise for providing cash income and extra food for the family.

The project to detect **nutritional disorders of yams** has concluded, having provided diagnostic information for nutritional problems of major yam species in the field



Yam production has increased in Vanuatu through better plant nutrition

and laboratory in PNG, Tonga and Vanuatu. It developed and evaluated strategies to improve yam nutrition in low-external-input systems and, in addition, it addressed many of the problems associated with yam nutrition research, providing future researchers with a much sounder methodological base. One item of significance was the discovery that yams, and particularly *Dioscorea esculenta*, showed particular susceptibility to deficiencies of manganese. In the Tonga program, where soils are highly phosphorus-fixing, *D. alata* crops responded well to phosphorus fertiliser applications. With phosphorus alleviation, yield increases of 30–100% were obtained, providing attractive economic returns for farmers. Instead of fertiliser, the planting of a green manure crop was found to contribute substantial nitrogen and phosphorus to subsequent crops.

Disease-free, good-quality waters, combined with low labour costs, make aquaculture a potential success in Pacific communities. A project team is working with the Secretariat of the Pacific Community (SPC) and Pacific communities to identify and implement **targeted research on aquaculture**, extending the outcomes of past ACIAR and WorldFish Center projects. Together they have developed a series of mini projects, and one of these has undertaken a preliminary investigation into the potential for aquaculture of *Macrobrachium lar* (an indigenous giant freshwater prawn species) in the Pacific region. Trial farming of this species took place in Vanuatu (monoculture) and Wallis & Futuna (integrated prawn–taro farming). The project exhibited high survival rates and successfully grew *M. lar* to commercial size in four months in both countries. The farmers accepted the culture techniques well, indicating the suitability of this species as a new aquaculture commodity, but there seemed little advantage in integrating freshwater prawn farming with taro crops. The enterprises gave a good return; Vanuatu farmers for example received a price of \$10/kg from restaurant owners.

Another project (already mentioned from a PNG perspective) aimed to review the availability and cost of **local feed ingredients** for tilapia and to a lesser extent *Macrobrachium* in both PNG and Fiji, and to develop feed formulation tools for commercial and farm-made feeds. Feed pellets were successfully developed and trialled. From the mini project a new project 'Freshwater prawn aquaculture in the Pacific: Improving culture stock quality and nutrition in Fiji' has been developed, aimed at improving *Macrobrachium* production through improved culture stock and development of an optimum, low-cost diet. The project nutritionist has produced a basic feeds brochure to help aquaculture extension officers and farmers in the participating countries and other PICs.

Another mini project has tested the **viral-disease status of *Penaeus monodon* (black tiger shrimp)** broodstock among natural populations in the Fiji Islands. This shrimp is the most highly favoured species for aquaculture worldwide because of its fast growth rate, large size at maturity and high meat quality and quantity. The natural isolation of the Fiji Islands makes it potentially an ideal site for culturing and maintaining viral-free *P. monodon* as a basis for a regional aquaculture industry. The project was able to show that a number of important viruses are absent from Fiji. The laboratory at the University of the South Pacific in Fiji is now a reference centre for Fiji and neighbouring countries, able to provide information on which government and industry can develop policy regarding importation and export of shrimp stocks. There is a new awareness of the need to test for viruses in shrimp imported into Fiji Islands.

A forestry project aims to reduce the risk of **serious damage by exotic pests** to the valuable timber resources of Fiji and Vanuatu (as well as Australia) by establishing efficient detection systems for target pests in high-hazard sites. This is part of a 'neighbourhood

watch' approach to incursion management that will benefit all regional countries, including Australia.

Australian project participants, in cooperation with the Fiji and Vanuatu collaborators, have developed a 47-page field guide, *Forest health guide: symptoms of insect and fungal damage on trees*, to aid the identification of pest and disease damage symptoms. The Department of Primary Industries and Fisheries, Queensland, published the guide in September 2006. Project collaborators received copies and received training in its use at a workshop held in Suva in September–October 2006. The guide features images and descriptions of generic types of insect and fungal damage, as well as specific information on some of the key agents targeted in this project (e.g. mahogany shoot borer, bark beetles, erythrina gall wasp and eucalypt rust). The guide also includes a list of equipment required for field surveys and a copy of the forest-health field form.

The **sandalwood project** is providing vital genetic information to ensure that trees for replanting in Vanuatu are fast-growing with excellent wood and high-quality oil, and that suitable planting conditions are in place. The project established a 'host' trial in Port Vila (sandalwood is a root parasite and must have a host of another species). Species under trial are *Canarium indicum*, *Casuarina equisetifolia* and *Pterocarpus indicus*. Ni-Vanuatu project participants are learning how to establish sandalwood plantings, gaining skills in nursery establishment and procedures, sandalwood propagation, plantation establishment and plant improvement. A related study is undertaking a rough census of wild sandalwood stocks in Vanuatu to provide scientific underpinning for a conservation strategy. Two new forestry initiatives involve better **silvicultural management of whitewood** (*Endospermum medullosum*) for plantation forestry in Vanuatu, and improving value and marketability of **coconut wood** in Fiji and Samoa.

ACIAR has supported the development and implementation of strategies for the effective conservation and use of the Pacific region's **plant genetic resources (PGRs)** for food and agriculture (including neglected and under-utilised species). At meetings of the Pacific Agricultural Plant Genetic Resources Network (PAPGREN) in 2004 and 2005 there was agreement on the elements of a regional strategy for ex-situ conservation. This involves developing a consistent approach for establishment of field gene banks, in-vitro preservation and cryopreservation to conserve the allotted species, and relies on effective collaboration among all stakeholders within the region and beyond. The major species of interest are taro, breadfruit, banana and coconut. To complement these strategies for staple crops, the 2006 annual PAPGREN meeting agreed on a regional strategy for the development of neglected and under-utilised crops.

Efforts continued to find ways of controlling the **invasive weed mikania** (mile-a-minute) in Fiji. A database has been established and the distribution of mikania in Fiji and also PNG is being recorded. So far surveys and herbarium records have counted over 150 sites in Fiji and nearly 50 in PNG where mikania is present and many more are expected. Potential biological control agents include the larvae of two butterflies and a rust fungus.

An economic and market analysis of the **live reef-fish food trade** in Asia-Pacific has given researchers a comprehensive picture of the key factors driving the future sustainability of this trade across the Asia-Pacific region, and provided a blueprint for governments and fishers to act on to assure future sustainability. The studies have identified four critical areas where sustainability of the trade needs improvement: 1) better governance of wild-caught fisheries; 2) sustainable development of reef-fish aquaculture; 3) integrated policies for assisting low-income fishing communities; 4) more informed consumer choices.

Another project is identifying and promoting strategies for Pacific island nations to maximise the economic benefits from their **migratory tuna stocks**. Shoals of tuna migrate through the exclusive economic zones of island nations in the Western and Central Pacific Ocean. This migratory characteristic means that no nation has control over the tuna stocks. The member nations of the Forum Fisheries Agency have long adopted a mutually beneficial coordinated regional management approach to regulate the catches of their own domestic fleets and those of distant water fishing nations. The projects outputs—economic analyses, bioeconomic modelling and policy development—are all potentially valuable aids to establishing the economic negotiating positions of Pacific island nations with rights to migratory tuna stocks, as well as the positions of the distant water fleet nations (DWFNs) such as Japan, USA, South Korea, Taiwan and China, who are interested in paying for access to the stocks.



*ACIAR-funded research has improved feed quality and breeding and larval-rearing techniques for groupers*

Fiji needs reliable information on rural incomes, together with agricultural and fisheries production data from the smallholder and subsistence sectors, market information on food price changes, and their effects on producers and consumers. A project is underway to collect this information and provide the tools to develop a **flexible framework for integration into broader policy development**. An early success was to obtain the agreement of the Fiji Islands Bureau of Statistics to use data from their Household Income and Expenditure Survey 2002–2003 (HIES) in the project. These data will provide the sampling frame for both the urban and rural surveys, so the project has the benefit of a recent and full enumeration of urban and rural households to work from. One of the key priorities emerging from a

Pacific Extension Summit hosted by Tonga in November 2005 was the need to build the **capacity of extension staff and associated institutions** to undertake participatory research and extension (PARE). In response, ACIAR commissioned a small R&D activity to determine the particular situation for a range of Pacific islands and different institutions. By accounting for variations in context (e.g. social and cultural differences, previous institutional experiences, farmers' needs) and differences in institutional roles (e.g. of tertiary institutions, NGO networking agencies, government extension and research staff) ACIAR and partner institutions are now in a far better position to guide the development of tailored training and capacity-building programs.



*Veterinary checks for village livestock in Fiji*