



Australian Government

Australian Centre for
International Agricultural Research



COUNTRY PROFILE 2007

PHILIPPINES



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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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Contents

1	Preface	1
2	Overview	2
2.1	ACIAR	2
2.2	Country Portfolio	3
3	ACIAR Contacts	4
3.1	Country Office	4
3.2	R&D Program	4
3.3	Policy Advisory Council member	5
4	Training	6
5	Annual Report 2006-07	7
5.1	Position.....	7
5.2	Relationship to the AusAID Philippines strategy.....	8
5.3	Achievements.....	9
5.4	Rural women take charge	11
6	Annual Operational Plan 2007–08	12
6.1	Key performance indicators (2007–08).....	12
6.2	Medium-term strategy	12
6.3	Position.....	13
6.4	Relationship to the Australia–Philippines Development Assistance Strategy 2007–11 ...	13
6.5	Thematic priorities.....	14
7	Projects (summary and progress reports)	16
7.1	Subprogram 1: Increasing the market competitiveness of Philippines agricultural products	16
7.2	Subprogram 2: Farmer-based land and water resource management for profitable and sustainable agriculture	41
7.3	Subprogram 3: Addressing regulatory, policy and technical constraints to the adoption of research outputs	57
7.4	Other	65
8	ACIAR Publications	68

1 Preface

The ACIAR Country Profiles are designed to give a snapshot of the collaborative research being carried out between Australia and our various partner countries. This publication contains short summaries of bilateral and multilateral projects with the Philippines that were active from 1 July 2006 to 30 June 2007. At that time there were 18 active bilateral projects, and four active multilateral projects, the latter being led by international agricultural research centres. There were another four projects under development, many of which are expected to start in 2007–08 financial year.

This publication also sets out the key outputs and outcomes from four bilateral projects that have been completed between 1 July 2006 and 30 June 2007.

In addition to these project summaries, the publication includes an extract from ACIAR's 2006–07 Annual Report covering the Philippines, our near-term program as outlined in the 2007–08 Annual Operational Plan, and a summary of ACIAR's training program.

ACIAR updates this profile each year and distributes it to key stakeholders in the Philippines and Australia.

We hope you find the publication useful as a record of the progress and achievements between the Philippines and Australia. For information on ACIAR's overall program, we invite you to visit our website at www.aciar.gov.au.



Peter Core
Chief Executive Officer
November 2007



Cecilia Honrado
ACIAR Country Manager, Philippines

2 Overview

2.1 ACIAR

The Australian Centre for International Agricultural Research (ACIAR) is an Australian Government Statutory Authority that operates within the portfolio of Foreign Affairs and Trade. It was established in June 1982 under the ACIAR Act to assist and encourage Australia's agricultural scientists to use their skills for the benefit of developing countries, and at the same time work to resolve Australia's own agricultural problems.

ACIAR's aims to enhance rural household incomes and broader economic growth by investing in international research partnerships that encourage agricultural development, sustainable use of natural resources and capacity-building of benefit to partner countries and Australia.

Research funded by ACIAR is mutually beneficial to Australian and developing country rural industries by harnessing Australia's outstanding strengths in agricultural research to develop partnerships with developing country research institutions.

ACIAR is based in Canberra, with offices in China, India, Indonesia, Papua New Guinea, the Philippines, Thailand and Vietnam.

Australia is in a particularly strong position to provide such assistance because it has a broad range of climates – cool and warm temperate, subtropical and tropical – that are typical of the developing world. Australia's scientists work within a very strong network of institutions, such as the CSIRO, Federal and state government organisations and universities.

The Australian Centre for International Agricultural Research (ACIAR) carries out research in the Asia-Pacific region, and currently has projects in the following regions:

- South-East Asia (Vietnam, Cambodia, Laos, Thailand, Indonesia, Philippines: >45% bilateral expenditure)
- Papua New Guinea and the Pacific islands (>20% of bilateral expenditure).
- North Asia (China: <15% of bilateral expenditure)
- South Asia (India, Pakistan, Bangladesh, Bhutan, Afghanistan, Iraq: <15% of bilateral expenditure)

ACIAR is also responsible for Australia's relationship with the International Agricultural Research Centres—the Consultative Group on International Agricultural Research (CGIAR) centres. ACIAR's annual outlay to the CGIAR centres is around \$11 million.

These funds are used to facilitate CG engagement in the Asia-Pacific and to commission projects that are consistent with ACIAR's country program strategies.

2.2 Country Portfolio

ACIAR has supported a program of collaborative agricultural research with the Philippines since 1983. Most of the program consists of bilateral projects, in which an Australian research organisation is commissioned to undertake a specified research activity in collaboration with a partner organisation in the Philippines. The Philippines is also targeted in ACIAR's multilateral program delivered in conjunction with the international agricultural research centres.

ACIAR's program with the Philippines as at 30 June 2007.

Bilateral Program

Active projects	20 with a value over their lifetime of approximately \$10,756,686
Projects under development	12
Share of South East Asia program	\$2,832,625 which represents 14.6% of the total 2006-2007 South East Asia program.
Completed projects	119

Multilateral Program

Active projects	4 with a value over their lifetime of approximately \$3,436,508
Projects under development	0
Completed projects	15

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3.3 Policy Advisory Council member

The ACIAR Policy Advisory Council is established under the Australian Centre for International Agricultural Research Act 1982. Members are appointed by the Minister for Foreign Affairs, and represent ACIAR's key stakeholders or the implementing agencies for ACIAR's program in partner countries and Australia. Council members are drawn from government departments, research providers and industry, and are therefore well placed to advise on their respective countries' development and agricultural priorities and research needs.

The current member from the Philippines is Dr Patricio Faylon, Executive Director, Philippine Council for Agriculture, Forestry and Natural Resources Research and Development (PCARRD). Dr Faylon has been a member of the Council since March 2003.

4 Training

The ACIAR training program has a budget in 2007–08 of approximately \$4.57 million. It comprises five elements:

- Fellowships for postgraduate students (John Allwright Fellowships)
- Postgraduate returnee follow-up awards (Returnee Small Project Awards Scheme)
- Leadership development opportunities for developing country scientists (John Dillon Memorial Fellowships)
- Non-award training (short courses and workshops)
- Support for the Crawford Fund, both through management of the Australian Government's contribution (\$0.70 million) and sponsorship of attendees at Master classes and other selected training activities.

Much of ACIAR's training is carried out systematically within individual projects. In addition, specialised, discipline-specific training activities may also occur within ACIAR's individual research and development programs.

The ACIAR John Allwright Fellowship Scheme accounts for approximately \$3.53 million (this figure includes \$2 million from AusAID) of the training program budget in 2007–08. The objective of the Scheme is to increase the research and development capacity of ACIAR partner country institutions. It provides funding for promising overseas researchers associated with ACIAR projects to undertake postgraduate studies in tertiary institutions in Australia.

John Allwright Fellowship Statistics

		PhD	MSc/Other
Active	Male	1	0
	Female	2	3
Concluded	Male	4	5
	Female	10	3

5 Annual Report 2006-07

Active projects in 2006-07	28
AOP budgeted expenditure in 2006-07	\$2,943,835
Actual expenditure in 2006-07	\$2,832,625
Expenditure in 2005-06	\$2,829,547
Expenditure in 2004-05	\$2,295,395

Key performance indicators	Performance 2006-07
Ongoing involvement of farmer groups and local government in participatory research and extension in ACIAR projects	Participatory research and extension is a feature of three projects commenced in 2006/07.
Priorities from 2006 Philippines-ACIAR country consultation addressed in development of new themes and projects	Several projects under design address improved quality and marketing/ market access for vegetables. In fisheries, two new projects investigate the potential for reef ranching and restocking of sea cucumbers, and opportunities to improve product quality, market access and prices for molluscs. Major scoping study on policy constraints to the adoption of research outputs conducted.
Community Agricultural Technologies Program (CATP) commenced and at least six new collaborations between Philippines ACIAR researchers and NGOs formed	CATP commenced and six collaborations formed with NGOs.
ACIAR-AusAID Landcare project farmer groups established in Agusan del Sur and Bohol, implementing livelihoods diversification approaches	Two new Landcare sites in Agusan del Sur and Bohol have been established. Livelihood diversification approaches have been successful.
40 per cent of new projects to have significant farmer or policymaker impacts within five years of completion	One of two "standard" projects developed in 2006/07 specifically designed to have "category 1 impact", in addition seven Community Agricultural Technology Program projects were implemented.

5.1 Position

ACIAR's program in the Philippines has been active since 1983. Initially the program had several projects dedicated to research on soil management issues—nutrient management, erosion control, rice cropping systems, biological nitrogen fixation and tree establishment on degraded land. Research on postharvest storage of grain and giant clam culture was also important. During the 1990s research cooperation shifted towards livestock management and biotechnology. A shift in project location, to emphasise the poorer areas of Mindanao and the Visayas but maintaining strong links to research and development expertise in Manila and Los Baños will continue.

Improving uptake of research in the Philippines is a major priority, and in collaboration with Philippines partners, ACIAR has increased its emphasis on better understanding extension processes and involving farmer and community groups in projects. In recent times there has been encouraging success with the adaptation of the Landcare approach in Mindanao, management of catchments in the Visayas island of Bohol and in the uptake of methods for successful tree establishment on degraded lands.

New research projects should be underpinned by design processes that involve the end-users of the research and address their needs. Project design should also accommodate the additional challenges that have arisen from the devolution of the management and governance of extension responsibilities to local government units, and the comparatively weak research-extension linkages that often currently exist.

With the main aim of ACIAR cooperation being to assist the Philippines to increase the marketability, international competitiveness and market access for Philippine agricultural products, ACIAR and AusAID have initiated some jointly funded activities in the areas of postharvest technology, disinfestation and pest management in fruits such as mango and in scaling out of the Landcare approach to farmer-driven natural resource management. During 2006 a new initiative (CATP) to link ACIAR-generated technologies and Philippines research providers with non-government and community-based organisations commenced.

One major international agricultural research organisation, the International Rice Research Institute (IRRI), is headquartered in Los Baños, Philippines. ACIAR provides core funding to IRRI and also supports additional initiatives aimed at maintaining rice productivity. The regional office of the International Network for the Improvement of Banana and Plantain (INIBAP), a network of the International Plant Genetic Resources Institute (IPGRI), is also headquartered in the Philippines.

5.2 Relationship to the AusAID Philippines strategy

The AusAID Philippines country strategy has three key objectives: to remove impediments to broad-based growth through stronger economic governance; to improve security and stability through counter-terrorism capacity building, support for the Mindanao peace process, and humanitarian and emergency assistance; and to improve the living standards of the rural poor in the southern Philippines. AusAID assistance to raise rural incomes includes programs to improve local government planning and service delivery, rural production and marketing, and basic health and education services as well as vocational and technical training.

5.3 Achievements

ACIAR's Philippines program in 2006-07 focused on three major themes:

- Increasing the market competitiveness of Philippines agricultural products
- Farmer-based land and water resource management for profitable and sustainable agriculture
- Addressing regulatory, policy and technical constraints to the adoption of research outputs.

In the Philippines field infestations of insects cause losses and damage levels ranging from 10 to 40 per cent. Insect damage may limit market access, particularly for small-scale farmers. A project has focused on how to improve **control and detection of seed and pulp weevils in mangoes**. For the Province of Palawan scientists have developed an integrated pest management work plan, designed to reduce usage of insecticides by 40% while improving control of pulp weevil as well as leafhoppers and fruit fly. As well, **deficiencies in the supply chain of mangoes** from producer to point of sale severely affect fruit quality and market opportunities. The project is developing a 'road map' from which technical or business priorities can be identified and strategies implemented to bring about improvements. So far the researchers have mapped the Philippine mango supply chain in detail, and this is now being validated during field visits to the production areas in Davao del Norte, Davao del Sur, and Guimaras provinces. From the same studies the researchers are gaining an overview of the major technical postharvest problems.

A project to **introduce biofumigation** has achieved its objectives. The researchers successfully tested natural fumigants produced from residues of certain varieties of brassica crops, as a substitute for methyl bromide fumigation to combat soil pathogens, including bacterial wilt (BW) and root knot nematode. They developed a rapid, efficient screening assay to quantify volatile suppression of BW and other soil-borne pathogens. The Northern Mindanao Agricultural Research Center is making its distribution of clean potato seed to farmers in Mindanao contingent on their agreement to adopt biofumigation techniques on their farms. Now farmers from the provinces of Benguet, Pangasinan, Bukidnon, Davao del Sur

and South Cotabato have started to use biofumigation within their cropping systems and have obtained around 20% increase in crop yield. Two collaborating farmers who had abandoned potato growing on their farms have returned to the crop since incorporating biofumigation as part of their BW control strategy. They are now demonstrating the concept to other farmers in the region.

Shrinking water availability and the increasing trend to direct seeding is allowing weeds to compete during rice crop establishment. Herbicide use is rising as a result, and with it comes the potential for resistance—there are two or three rice seasons in the Philippines and hence, farmers spray herbicides up to six times per year. A project is developing a framework for examining public policy towards herbicide use and preparing to deal with actual or impending resistance. The project has established an herbicide-resistance testing procedure through PhilRice, and via a field survey and a national network of extension/agronomy agents has screened a number of populations of major weeds for resistance to important herbicides. Participatory on-farm trials over several seasons at four Philippines' sites have tested an **integrated weed management (IWM)** strategy combining good land preparation, intermittent water management, and single herbicide application of a pre- or early post-emergence herbicide. The IWM strategies, tested alongside the farmers' current weed management practice, are showing better weed control, increased yields and higher profits.

ACIAR has been involved for some years in programs to **introduce Landcare principles** in parts of Mindanao. Now further research has assessed the sustainability of the approach at the original sites and tested the approach at new sites with differing needs, such as on Bohol Island. Preliminary findings highlight some key factors in institutional success—commitment, competence, leadership, incentives and effective partnerships. Progress has continued in sustaining and scaling up adoption of conservation farming systems and diversified livelihoods.

The latest project has facilitated or provided 55 major training and networking events, including training and exposure to expertise in nursery management, and production of many products such as forage, high-value vegetables, fruit trees, livestock, coffee, coconut, abaca, bamboo, mushrooms, medicinal plants, bananas, wood products and fish. Groups have received training in subjects such as integrated crop production, soil and water conservation, agroforestry, permaculture, soil testing, integrated pest management and biodynamic production.

A project is determining what factors make seasonal forecasting more valued. Farmers and industry people need reliable **seasonal climate forecasts (SCFs)** to better cope with the adverse effects of seasonal climatic variabilities like El Niño and La Niña. These forecasts are made prior to the start of any season of agricultural significance. By using sea surface temperatures and atmospheric indices a probabilistic forecast can be made. Farmer acceptance of their value relies on the ease of use, including lead time, consistency and transparency. Case studies from both the Philippines and Australia are being subjected to this value testing via an economically derived framework. The researchers aim to help farmers in rainfed agriculture in both countries to benefit by addressing their reservations surrounding forecasting accuracy.

Smallholder agroforestry systems in Leyte are being tested for **measures to improve timber yield and quality** and to improve market access. The project team has worked to define and implement local-level policy changes in relation to tree cutting and transport regulations, with increasing success. The pressing issue of limited higher quality seedling supply has emerged as a major constraint to development of the Philippines agroforestry sector, and a newly commissioned ACIAR project will investigate how to enhance tree seedling supply via economic and policy changes in the nursery sector.

Work on **sustainable use of shallow groundwater** has focused on two pilot sites within neighbouring municipalities in the province of Ilocos Norte, located on the northwestern tip of Luzon. The project team

focused on characterisation of the groundwater resources at the two locations. Data collected is helping determine sustainable yield and set up a groundwater model. The model will enable future impacts of groundwater extraction to be determined, as well as impacts of changed management.

Pumping tests have determined rates of water movement through the aquifer, and pressure loggers in a number of wells have recorded fluctuations of water levels. The researchers conducted an economic assessment of agricultural productivity within the two field sites, where rice is grown during the wet season and garlic supplemented by groundwater grown during the dry season. Results showed labour and fertiliser were the largest input costs for both rice and garlic production, although the cost of fuel for water pumps is significant for garlic. Growing one hectare of garlic generates three to four times the return of rice, but rice remains a traditional crop for two reasons—it provides a staple food for household consumption and also rice straw as mulching material for garlic.

The Philippines and Indonesia are concerned about the impacts of **illegal, unreported and unregulated (IUU)** fishing, which leads to combined losses of more than US\$3 billion per annum to their respective economies. A project was commissioned following the recommendations of an earlier small ACIAR project to further research options to combat IUU in both the Philippines and Indonesia and to implement the FAO-endorsed International Plan of Action on IUU Fishing. First, national workshops on IUU fishing were held in Indonesia and the Philippines, to clarify some of the issues that the two countries must deal in addressing IUU fishing. This was followed by a Bilateral Workshop to assess the IUU problems in the Sulawesi Sea between the two countries. Both countries shared information on national fisheries laws and regulations, licensing systems, monitoring, control and surveillance, and data collection systems. They also discussed status of stocks and IUU fishing issues in the Sulawesi Sea, arriving at a framework for cooperation to address IUU fishing in these mutually shared waters.

5.4 Rural women take charge

Throughout Asia the story is familiar. Economic pressures are pushing members of farm households to seek off-farm work. And it is usually the wife left behind to look after the farm. Thus women are changing roles from unpaid family workers to farm managers.

Mrs Lien's husband works in a private shoe factory in Ho Chi Minh City. This leaves Mrs Lien to raise the family while she single-handedly oversees the small farm's rice-growing. She describes her life since she started running the family's irrigated farm in South Vietnam: 'My husband comes home once a year ... so aside from the traditional tasks I used to do, I now have to do his jobs, such as preparing the nursery for rice seedlings, irrigating the fields, broadcasting fertiliser and spraying pesticides. After going to the market and finishing household chores, I visit our fields every day.'

In the northern Philippines, another woman whose husband is a seasonal migrant says: 'If my husband is away, I supervise the farm's crop operations. My husband leaves after the land preparation to work as a carpenter in another province for at least four months. Now I have to check when the crop is ready and start hiring labourers to harvest it. I find it difficult to hire labourers because there is competition during these peak months.'

Stories from north-east Thailand are similar. The women left behind must take on new managerial responsibilities: 'Although my husband's remittances from construction work are a big help to us, particularly for our children's education, I have to manage the labourers for rice production and for crop care of the rubber plantation,' says one Thai wife. 'I make all the decisions about farm and household matters. When in doubt, I phone my husband.'

These changing roles are bringing to light another difficulty, which was outlined by Dr Thelma Paris, a social scientist with the International Rice Research Institute (IRRI). 'The women's lack of access to the information and resources they need for new crop and water management technologies can have a negative impact on the productivity and sustainability of local agriculture,' she says. 'Agricultural technologies, practices, policies and systems are based on the conventional assumption that farmers in developing countries are fulltime male farmers.'

Dr Paris is leading an ACIAR project that is looking at social changes occurring in agriculture in Asia and also Australia, and the changing roles of women as a result of off-farm employment or migration. The project involves IRRI, Curtin University of Technology (WA), Khon Kaen University (Thailand) and the Cuu Long Delta Rice Research Institute (Vietnam). The team brings a mix of social science skills, including gender specialisation, agricultural economics, sociology and extension.

'Our research should provide early warning of rapid changes that may be undermining the national and regional food security that we've worked so hard to achieve over the past several decades,' says Dr Paris. The researchers have conducted focus group discussions with women farmers in the Philippines, Thailand, Vietnam and Australia, to identify the factors that constrain or support the adoption and diffusion of technologies and to understand more of the difficulties faced by women in agriculture due to male out-migration. As part of the project 60 women who are heads of farms in selected villages from the Philippines, Thailand and Vietnam have an opportunity to test new strategies and improve their farm productivity. Their findings should prove valuable for women throughout the region.

6 Annual Operational Plan 2007–08

GNI per capita (\$US)	1,300	Bilateral actual 2005–06	\$ 2.58 m
Population	81.6 m	Bilateral estimate 2006–07*	\$ 2.94 m
Population 2015/2050	96.8/127.1 m	Bilateral budget 2007–08*	\$ 3.49 m
Active bilateral projects	16	Bilateral + multilateral budget 2007–08	\$ 4.25 m
Active multilateral projects	3		

*Includes AusAID funding of \$0.32 m (estimate 2006–07) and \$0.39 m (budget 2007–08)

6.1 Key performance indicators (2007–08)

- Strategy for future investment in community-based resource management/agribusiness programs developed and implemented
- At least two major vegetable supply chains analysed and improvements identified and communicated
- New project investments aiming to increase income generation from aquaculture designed and implemented
- Scoping study on critical policy/regulatory constraints to technology adoption completed and published
- 40% of new projects to have significant farmer or policymaker impacts within five years of completion

6.2 Medium-term strategy

The main aim of ACIAR cooperation is to assist the Philippines to increase the productivity, marketability and international competitiveness for Philippine agricultural products, taking into account the impacts of trade liberalisation. Underlying competitiveness drives the need to improve agricultural productivity to raise rural incomes through more effective extension of research results and responding to market opportunities with higher quality commodities produced at a competitive cost. Specific opportunities may come through research for development and marketing of products from aquaculture, horticulture, forestry and livestock enterprises and farmer-driven improvements in agricultural systems.

A significant proportion of Philippines farming is carried out in fragile sloping environments or sensitive watersheds, and it is important that intensification of agricultural productivity does not come at the expense of degradation. Efficient use of water will assume increased importance. ACIAR's Philippines program will increasingly emphasise involvement of local partners such as local government units, non-government organisations (NGOs) and farmer community groups in projects, in order to increase prospects for sustainable adoption of the results of research. It will also promote projects that implement the results of earlier ACIAR-supported research in the Philippines. Linkages of regionally based delivery organisations with research organisations and policymakers based centrally in Manila and Los Baños will be fostered. There will be greater emphasis on the southern Philippines, within a limited number of focal provinces in Regions X and XI (Mindanao) and Regions VI, VII and VIII (Visayas).

6.3 Position

ACIAR's program in the Philippines has been active since 1983. Initially the program had several projects dedicated to research on soil management issues: nutrient management, erosion control, rice cropping systems, biological nitrogen fixation and tree establishment on degraded land. Research on postharvest storage of grain and giant clam culture was also important. During the 1990s research cooperation shifted towards livestock management and biotechnology. A shift in project location, to emphasise the poorer areas of Mindanao and the Visayas, but maintaining strong links to research and development expertise in Manila and Los Baños, will continue.

Improving uptake of research in the Philippines is a major priority and, in collaboration with Philippines partners, ACIAR has increased its emphasis on better understanding extension processes and involving farmer and community groups in projects. In recent times there has been encouraging success with the adaptation of the Landcare approach in Mindanao, management of catchments in the Visayas island of Bohol and in the uptake of methods for successful tree establishment on degraded lands.

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With the main aim of ACIAR cooperation being to assist the Philippines to increase the marketability, international competitiveness and market access for Philippine agricultural products, ACIAR and AusAID have initiated some jointly funded activities—some in the areas of postharvest technology, disinfection and pest management in fruits such as mango, others in scaling out of the Landcare approach to farmer-driven natural resource management. During 2006 a new initiative, Community Agricultural Technology Program (CATP), to link ACIAR-generated technologies and Philippines research providers with non-government and community-based organisations commenced.

One major international agricultural research organisation, the International Rice Research Institute (IRRI), is headquartered in Los Baños, Philippines. ACIAR provides core funding to IRRI and also supports additional initiatives aimed at maintaining rice productivity. The regional office of the International Network for the Improvement of Banana and Plantain (INIBAP), a network of the International Plant Genetic Resources Institute (IPGRI), is also headquartered in the Philippines.

6.4 Relationship to the Australia–Philippines Development Assistance Strategy 2007–11

Australia's objective under the new Australia–Philippines Development Assistance Strategy (2007–11) is to 'make a contribution to improving the prospects for economic growth, poverty reduction and national stability in the Philippines'. The program will focus on three pillars: economic growth, basic education and national stability and human security.

ACIAR will contribute to the strategy particularly through the first (and largest) pillar, which includes engagement with the Philippine Government on policy issues and supporting 'local economic development in poor areas so that the rural population shares in the benefits of a stronger national economy'. Linkages between the biophysical, economic and market development research support by ACIAR will be made with the new AusAID Rural and Private Sector Development Program, as well as between ACIAR projects and the AusAID funded Philippines–Australia Community Assistance Program.

6.5 Thematic priorities

ACIAR has a program of consultations with key partner countries on a four-year rolling basis to establish priorities for research collaboration. The most recent such consultation with the Philippines was held in March 2006; a record of the consultation is available on our website, www.aciar.gov.au under *Partner country priorities/Philippines*.

Most ACIAR-supported informal and postgraduate research degree training will remain within the context of active projects. However, ACIAR will also support short-training courses that strengthen capacity to apply results of research to fit the needs of farmers and policymakers. Training will comprise the following courses: economics and social science for biophysical scientists; participatory agricultural research/extension; project evaluation and impact assessment; research business management and commercialisation; information and communication technology for R&D; training in supply chain management. Agreed priorities for collaborative research and development programs are listed under thematic areas:

Subprogram 1: Increasing the market competitiveness of Philippines agricultural products

1A: Better systems and policies for meeting market specifications

- Identification of farmer incentives for adoption of grains and horticultural postharvest systems improvements
- Facilitation of uptake of postharvest technologies for durable commodities
- Development of new quality management and food safety standards and systems for horticultural products, including organic products
- Economic analysis of marketing chains and channels for perishables, including determination of consumer preferences
- Improving alliances between fruit and vegetable suppliers, processors, institutional buyers and marketers
- Analysis of best practices for financial service schemes for small farmers

1B: Higher returns from horticultural products

- Protected cropping technologies and reduction of inputs for production of crucifers, salad vegetables and strawberry
- Nutrient and pesticide management, particularly fertigation systems, to save costs and reduce residues in vegetables and fruit
- Selection and clonal propagation of new quality mango strains and control of major pests and diseases (fruit fly, pulp weevil and anthracnose)
- Shelf life extension, product development, packaging, quality and sanitary and phytosanitary standards for markets for crucifers and salad vegetables, jackfruit, mango and new tropical fruit crops
- Management of bacterial wilt and other soil-borne diseases in solanaceous and crucifer vegetables
- More efficient production systems for disease-free seed potato (Mindanao)
- Collection and evaluation of germplasm and development of cultural packages for jackfruit, new tropical fruit crops and native vegetables (Visayas)
- Application of control methods for phytophthora in durian and diamondback moth in Brassicas (Mindanao)
- Improvements to postharvest shelf life and handling of salad and semi-temperate vegetables and strawberry (Mindanao)
- Integration of vegetable production into agroforestry systems (Luzon)

1C: Competitive and sustainable aquaculture production

- Mariculture-based strategies to provide livelihoods and enhance locally managed fisheries with an initial emphasis on sea cucumbers
- Assessment of the impacts of mariculture on community livelihoods of small fishers
- Review of opportunities and constraints in the supply chain for key aquaculture products, particularly grouper and mud crab

- Management of Viral Nervous Necrosis of marine finfish
- Integrated use and management of on-farm ponds and small water impoundments for freshwater fish production
- Opportunities for application of the results from ACIAR aquaculture projects in other countries to the Philippines
- Policy constraints to agroforestry development on small farms
- Policy constraints to the control and management of illegal, unregulated and unreported (IUU) fishing

Subprogram 2: Farmer-based land and water resource management for profitable and sustainable agriculture

- Catchment-scale adaptation of Landcare-type activities for soil and water conservation and improved incomes
- Water resource management (including groundwater and water harvesting) for high-value vegetable and fruit crops
- Valuation and financing mechanisms for environmental services in watersheds for soil and water conservation
- Integrated nutrient management for low-input farming systems
- Utilisation of urban waste and treated wastewater for peri-urban agriculture
- Market identification and utilisation of industrial trees and fast-growing agroforestry species
- Propagation systems for indigenous trees for soil and water conservation

Subprogram 3: Addressing regulatory, policy and technical constraints to the adoption of research outputs

- Development of simple replicable financial/business models for agribusiness development of small farms
- Application of better extension models for packaging earlier research results (e.g. on livestock production and health, horticulture, aquaculture and agroforestry)
- Identifying and addressing local and national policy constraints to adoption of research, including:
 - land use, land tenure, taxation and transportation policies
 - sanitary and phytosanitary standards
 - intellectual property rights

7 Projects (summary and progress reports)

7.1 Subprogram 1: Increasing the market competitiveness of Philippines agricultural products

Projects:

A: Better systems and policies for meeting market specifications

Active

- ASEM/2006/091 Enhancing tree seedling supply via economic and policy changes in the Philippines nursery sector
- CIM/2006/176 Developing molecular markers to enable selection against chalk in rice

Concluded

- ASEM/2005/062 Linking smallholder vegetable producers in the Philippines to urban markets – a scoping study

B: Higher returns from horticultural products

Active

- HORT/2001/049 Development of PRSP–V resistant papaya genotypes by introgression of genes from wild *Carica* species
- HORT/2003/071 Integrated pest management and supply chain improvement for mangoes in the Philippines and Australia
- HORT/2006/006 Development of an embryo culture manual and an embryo transplantation technique for coconut germplasm movement and seedling production of elite coconut types
- HORT/2006/111 Horticulture export produce food safety and quality assurance in the Philippines—scoping study
- HORT/2007/210 Detection surveys for mango seed and pulp weevils in Sarangani and Davao del Sur, Mindanao, Philippines
- HORT/2007/032 Detection surveys for mango seed and pulp weevils in Sarangani and Davao del Sur, Mindanao, Philippines – Phase 2

Concluded

- HORT/1997/094 Management of postharvest diseases of sub-tropical and tropical fruit using their natural resistance mechanisms

Pipeline

- HORT/2007/066 Enhanced profitability of selected vegetable value chains in the Southern Philippines
- HORT/2007/067 Improved domestic profitability and export competitiveness of selected fruit value chains in the Southern Philippines

C: Competitive and sustainable aquaculture production

Active

- FIS/2003/033 Integrated fisheries resource management (Rinconada Lakes, Philippines and New South Wales, Australia)
- FIS/2003/059 Sea ranching and restocking sandfish in Asia–Pacific
- FIS/2007/045 Evaluation of production technology, product quality and market potential for the development of bivalve mollusc aquaculture in the Philippines
- FIS/2002/077 Improved hatchery and growout technology for marine finfish in the Asia-Pacific region

Pipeline

- FIS/2006/143 Application of aquaculture technologies in the Philippines

ASEM/2006/091: Enhancing tree seedling supply via economic and policy changes in the Philippines nursery sector

Bilateral

Overseas Collaborating Countries	Philippines
Commissioned Organisation	University of Queensland, School of Natural and Rural Systems Management, Australia
Project Leader	Dr John Herbohn Phone: 07 5460 1646 Fax: 07 5460 1324 Email: j.herbohn@uq.edu.au
Collaborating Institutions	Leyte State University, Philippines World Agroforestry Centre, Philippines Department of Environment and Natural Resources, Philippines Southern Cross University, Australia
Project Budget	\$826,941
Project Duration	01/01/2007 to 31/12/2010
ACIAR Research Program Manager	Dr Caroline Lemerle

Project background and objectives

ACIAR project scientists in the Philippines have identified within the forestry nursery sector the following major constraints to the development of smallholder and community forestry:

- the current organisation of the public and private sector nurseries is not delivering seedlings of appropriate quality to tree farmers in an equitable manner.
- there are no quality protocols in most nurseries and many potential buyers have no knowledge about the existence of nurseries which can supply planting material.
- crowding out of the private sector by public sector nurseries (including those funded with development assistance money) appears to be restricting development of the sector overall, and the role of the Department of Environment and Natural Resources (DENR) within this milieu is ambiguous.
- A study commissioned by the World Agroforestry Centre (ICRAF) supported these findings, indicating that these nursery problems are widespread in the Philippines, including Mindanao, Bohol and Cebu.

As part of another ongoing ACIAR project, strong relationships and cooperation have developed between officers of the DENR, staff of Leyte State University (LSU) and Australian researchers. This new project will build upon this close relationship to identify, develop and pilot-

test policy initiatives in relation to the seedling nursery sector. Members of ICRAF will also be involved.

The project aims to improve the economic efficiency and policy environment of the Philippines Tree Nursery Sector.

Project Progress

Year 1 (01/01/2007–31/12/2007)

First progress report due in 2008.

CIM/2006/176: Developing molecular markers to enable selection against chalk in rice

Multilateral

Overseas Collaborating Countries	Philippines
Commissioned Organisation	International Rice Research Institute, Philippines
Project Leader	Dr Melissa Fitzgerald Phone: +63 2 580 5600 Fax: +63 2 580 5699 Email: m.fitzgerald@cgiar.org
Collaborating Institutions	NSW Department of Primary Industries, Yanco Agricultural Institute, Australia
Project Budget	\$998,960
Project Duration	01/05/2007 to 31/05/2012
ACIAR Research Program Manager	Dr Paul Fox

Project background and objectives

Rice is valued at every stage from production to consumption on the basis of two traits – the proportion of broken grains and chalky grains. The starch in the chalky, opaque areas is loosely packed so chalky grains generally break during milling. Chalk occurs during grain development and no breeding program has been able to overcome it. Chalk affects subsistence farmers who mill their rice by traditional pounding because pounding pulverises chalky grains; also those who pay a miller with a portion of their milled rice must pay a larger proportion of a low-value chalky sample than of a high-value sample. Minimising the occurrence of chalk would increase food security and potential income by increasing the yield of edible rice per hectare, possibly by as much as 7%.

Chalk occurs in high temperatures during grain filling. Earlier research found that tropical germplasm (tropical japonica and indica) is more chalk prone than temperate japonica germplasm. Therefore, to protect food security in developing countries where tropical rice is the staple, as well as the security of the world rice supply, it is imperative to resolve the genetic/physiological difference between temperate and tropical germplasm for low chalk, especially as our world gets warmer.

Much of the foundation plant material has already been developed and identified, and this project will further advance the work through the following objectives:

- discover genetic segments and allelic variation in tropical and temperate germplasm that lead to low chalk independently of environmental conditions
- design markers to search for variability in the genetic segments associated with chalk in diverse germplasm
- develop and validate markers for low chalk to enable incorporation of favourable alleles into agronomically superior germplasm that will ultimately be delivered to National Agricultural Research and Extension Systems (NARES)
- deliver markers to Australian collaborators for validation and optimisation in the temperate japonica genetic background.

Project Progress

Year 1 (01/05/2007–30/04/2008)

First progress report due in 2008.

Project ASEM/2005/062: Linking smallholder vegetable producers in the Philippines to urban markets - a scoping study

Bilateral

Overseas Collaborating Countries	Philippines
Commissioned Organisation	Curtin University of Technology, Agribusiness Marketing (Horticulture), Australia
Project Leader	Dr Peter Batt Phone: 08 9266 7596 Fax: 08 9266 4422 Email: p.batt@curtin.edu.au
Collaborating Institutions	University of the Philippines, Diliman, Philippines
Project Budget	\$93,535
Project Duration	01/11/2005 to 31/07/2006
ACIAR Research Program Manager	Dr Ken Menz

Project background and objectives

Increasing urbanisation in the Philippines and through South East Asia requires the development of market linkages between consumers in the cities and smallholder vegetable growers in agricultural regions. A number of regions of the Philippines, in particular Luzon and poor areas of Mindanao can produce good quality vegetables, however quality is inadequate by the time vegetables reach urban consumers, especially at the upper end of the market. This scoping study undertook preliminary investigations into the issues of enhancing quality of smallholder vegetable produce, product aggregation methods, contractual/quality/price transmission issues and the role of market intermediaries.

Project outcomes

Arising from this scoping study, six chains were identified:

Market specialist consolidator Chain leader: Dizon Farms, as the largest vegetable consolidator in Manila, is interested in establishing better linkages with farmer groups. Issues that need addressing for the chain associated with Dizon Farms include:

- agronomic support at the farm level
- poor handling and packing procedures
- opportunism, inconsistent quantity and quality
- chemical residues and food safety.

Product specialist consolidator Chain leader: Eden Corporation, the largest specialist tomato consolidator servicing the metro Manila market. Eden ships fruit from Northern Mindanao and Luzon. Issues that need addressing for the chain associated with Eden Corporation include:

- technical expertise at the farm level
- over-ripe and small fruit
- disease issues
- lack of market understanding
- opportunism
- high costs of transport.

Vegetable processor Chain leader: GTGF Corporation, a new processor who is a key supplier of coleslaw and lettuce to Jolibee and KFC. Issues that need addressing for the chain associated with GTGF include: lack of technical expertise at the farm level:

- infrastructure, transport and packaging from the farm to processor
- quality assurance along the chain
- quality assurance at the processing factory.

CONCLUDED PROJECTS

Farmer group consolidator Chain leader: NORMIN Veggies, a collaborative farmer association mainly composed of independent farmers who are shipping better quality product to institutional markets in Manila, the Visayas and Mindanao. Issues that need addressing for the chain associated with NORMIN Veggies include:

- technical expertise at the farm level; packaging and logistics
- conflicts between small and large farmers
- poor quality due to disease and weather
- market opportunities in the Visayas.

Assisted farmer cluster groups Chain leader: Catholic Relief Services (CRS) – in Maragusan, several farm clusters are being assisted by CRS, the Kasilak Foundation and NORMIN Veggies to consolidate vegetables for institutional markets in Davao and the Visayas. Issues that need addressing for the Maragusan chain include:

- agronomic assistance
- identification of suitable markets for the quantities and qualities supplied by the farmer clusters
- the best approach for organising farmers to deliver consistent quantities of product.

Food manufacturer Chain leader: General Tuna Corporation – the largest tuna cannery in Southern Mindanao. It produces a number of canned products that require a regular and reliable supply of vegetables. Currently, it relies upon imported and dehydrated vegetables primarily because it cannot identify a reliable supply from local producers. Issues that need addressing include:

- facilitating the clustering process and the linkage to market
- technical expertise at the farm level
- quality assurance along the chain.

The first four chains already have some established market linkages. However, they each have areas for improvement and opportunities to create new linkages with collaborative farmer groups. For example, GTGF has already had discussions with NORMIN Corp and Benguet State University about creating linkages with additional groups of farmers.

The latter two chains are in the development phase and will require linkages to be established along the chain. All chains are directly or indirectly linked to the Manila market and there are opportunities for ACIAR-related activities to observe and assist chain development based around a range of drivers, stages of development, length, quality and type of relationships, product requirements and geographic locations.

HORT/2001/049: Development of PRSV-P resistant papaya genotypes by introgression of genes from wild *Carica* species

Bilateral

Overseas Collaborating Countries	Philippines
Commissioned Organisation	Griffith University, School of Biomolecular and Biomedical Science, Australia
Project Leader	Dr Rod Drew Phone: 07 3875 7292 Fax: 07 3875 7618 Email: r.drew@mailbox.gu.edu.au
Collaborating Institutions	University of the Philippines at Los Banos, Philippines Bureau of Plant Industry, Philippines
Project Budget	\$655,167
Project Duration	01/01/2002 to 30/06/2009 (Project extended from 01/07/2006 to 30/06/2009)
ACIAR Research Program Manager	Mr Les Baxter

Project background and objectives

Papaya is the fourth most important crop in the world production of tropical fruits, with 5 to 6 million tonnes being produced per year. The most serious disease that threatens the world production of papaya is PRSV-P, a virus which is spread by aphids. This disease is rapidly spreading and devastating papaya production worldwide. Papaya is a major fruit crop of the Philippines and is used for local consumption as well as export. During the last 20 years PRSV-P has caused the death of the whole papaya industry in some of its island regions and has severely decreased production in many other areas.

In Australia, where papaya production has been increasing steadily, the disease has been confined to Southeast Queensland. However, if the disease would transfer to North Queensland, where 80% of production occurs, it would devastate the Australian industry.

Consequently, the development of resistant genotypes is a research priority in both countries. Resistant genotypes have been produced by genetic transformation, however there remains a consumer resistance to genetically modified fruit crops worldwide. The plants produced by this project will be the result of traditional plant breeding systems.

This project relies on the results of a previous project in which a fertile PRSV-P resistant hybrid between papaya (*Carica papaya*) and *C. quercifolia* was developed. Its main aim is to develop stable and fertile backcross lines of papaya that are resistant to the papaya ringspot virus, form P (PRSV-P) and could be used as genetic stocks for papaya improvement. It also aims to produce elite genotypes of papaya for Australia and the Philippines which are resistant to PRSV-P, to trial these on growers' properties and to enable the transfer of associated technology to the Philippines.

Project Progress

Year 5 (01/01/2006–31/12/2006)

Incorporation of PRSV-P resistance genes into elite papaya genotypes, using fertile resistant backcross plants.

Extensive backcrossing of the F1 intergeneric hybrids and inbred lines has resulted in one PRSV-P resistant backcross plant (BC1). This plant is a crossed between inbred line 5648 and intergeneric hybrid 410. This male fertile BC1 was used for further backcrossing to generate BC2 and BC3 plants.

Selection of backcross generations for PRSV-P resistance and good agronomic traits.

A total of 137 BC2 plants were manually inoculated three times at two-week intervals in the screenhouse. Fifty plants or 38% showed typical symptoms (ranging from chlorosis to shoe-stringed leaves) of papaya ringspot virus after inoculations. Surviving healthy plants (30 plants) were transplanted in the field and were exposed to aphid vectors from susceptible papaya (inbred 4172 and Davao Solo) plants that had a high inoculum level of PRSV-P.

ELISA test results revealed that only ten out of the thirty plants tested were positive to the virus. It was also observed that four plants which showed mild infection of the virus based on visual inspection were negative to the virus. The mild infection during the first few months after field transplanting did not progress in these four plants, hence the negative ELISA result.

In Southeast Queensland, approx. 25% of BC2 plants are still virus free in a field planting after >12 months in the field in the presence of PRSV-P. All controls were infected after 2 months in the field. A total of 354 BC2 sib crosses and 124 BC3 plants which survived three manual inoculations in the screenhouse were transplanted in the field. Evaluation against natural infection to PRSV-P is in progress.

Backcross fertile resistant C. papaya x V. quercifolia F1 hybrids to C. papaya.

IPB inbred lines (4108, 4172, 5648 and 5893), resistant BC1 and intergeneric hybrid 410 were planted in the field last Nov. 2006 for further backcrossing program.

Development of molecular markers for PRSV-P resistance.

An attempt to develop a molecular marker is currently in progress. To confirm introgression, genetic fingerprinting of several genotypes of *C. papaya* and some of its wild relatives was done using simple sequence repeats (SSRs). Preliminary result indicated introgression of a putative nucleotide fragment (150bp) from *V. quercifolia*, hypothesised to mark for PRSV resistant attribute of both *V. quercifolia* and F1 intergeneric hybrids (410, 468 and 469).

In the resistant backcross progenies, a putative nucleotide fragment (100 bp) was observed to be consistent. This 100 bp could be a fragment of that putative nucleotide fragment from *V. quercifolia* which could explain the resistance of the backcross plants. Sequencing of said fragments is in progress to further validate the marker.

Micropropagation of elite papaya g

Micropropagation of some BC3 (5648 x BC2 03R-73) plantlets and clonal propagation of the remaining F1 intergeneric hybrid 410 is in progress.

Evaluation on grower's properties

Reconstituted 'Sinta' (BC2 03 R lines crossed with 4172) is now being tested along with the original 'Sinta' in the farmer's field in Batangas.

HORT/2003/071: Integrated pest management and supply chain improvement for mangoes in the Philippines and Australia

Bilateral

Overseas Collaborating Countries	Philippines
Commissioned Organisation	Queensland Department of Primary Industries and Fisheries, Queensland Horticulture Institute, Australia
Project Leader	Mr Robert C Williams Phone: 07 4064 1151 Fax: 07 4064 2249 Email: bob.william@dpi.qld.gov.au
Collaborating Institutions	Philippine Council for Agriculture, Forestry and Natural Resources Research and Development, Philippines Department of Agriculture, Fisheries and Forestry, Australia Department of Agriculture, Philippines Bureau of Plant Industry, Philippines University of the Philippines at Los Banos, Philippines
Project Budget	\$1,157,768
Project Duration	01/01/2005 to 30/06/2008
ACIAR Research Program Manager	Mr Les Baxter

Project background and objectives

Mangoes are a popular fruit in many tropical countries in Asia and in Australia. The Philippines has a mature mango industry based on the Carabao cultivar. A large proportion of this industry is based in Luzon on the southern island of Mindanao and Guimaras in the Visayas. Smallholder production, defined as farms less than three hectares, accounts for 48 per cent of total Philippines production. The Philippines produces around 880,000 tons each year. Of this between 36,000 to 40,000 is exported, making the country the world's second largest exporter after Mexico, representing around 5.9 per cent of global trade.

There is significant scope to increase this production and trade further, as pest and disease losses, production variability, fruit perishability and supply chain management all limit potential. The Australian industry does not have the breadth of problems but does have some pest control and quarantine issues.

Insect pests are a significant problem in both countries. A field infestation has the potential to cause losses of between 10 to 40 per cent. These can also limit market access domestically and internationally. Pesticides are frequently used, often to excess, prompting concerns relating to pesticide residues.

New pests emerging in the Philippines also require that Integrated Pest Management strategies address new threats and excessive pesticide use. In addition improvements in the supply chain are likely to help reduce losses and foster better pre and postharvest practices at all levels. The sustainability of mango industries in the Philippines and Australia will be enhanced through a systems approach to improving pest management and the consistency of supply and quality of mangoes for targeted markets.

Major objectives are:

1. To develop improved recommendations for integrated pest management and judicious pesticide use. (This objective has been expanded to include the additional outputs of providing pest monitoring kits and training workshops for Philippines project personnel and industry stakeholders).
2. To improve control and detection of seed and pulp weevils.
3. To identify and trial improvements to current practices and conditions for managing mango supply chains.

Project Progress

Year 2 (01/01/2006–31/12/2006)

Integrated Pest Management

In the Philippines field infestation by insects cause losses and damage levels ranging from 10 to 40 per cent, or limit market access, particularly for small-scale farmers. Systems approaches that integrate field control with postharvest treatments will reduce costs and the risk of quarantine failures and other regulatory penalties.

Using sites in Davao del Norte, Davao del Sur and Guimaras as pilot demonstration areas, collection of baseline data on farmer pest management as well as reviews of existing cultural management practices were conducted. Current yield and problems encountered by farmers were identified, to develop specific interventions. In each demonstration site, cooperators were identified and backyard and orchard mango trees were chosen.

The pre-bearing activities include pruning, sanitation, fertilization and flush management. Interventions for bearing trees were flower induction, foliar fertilization, insecticide/fungicidal sprays, flower bricking, tagging and proper harvesting and postharvest handling. Familiarisation of stakeholders with the major insect pests per site, damage symptoms and pest monitoring has also been done.

In Australia, for the second season, populations of fruit spotting bugs have been found to increase from mid- flowering through to early fruit-set in both the Atherton Tablelands and Burdekin regions. This season also experienced a high population of green vegetable bugs (*Nezara viridula*) during the flowering and fruit set period.

Mean orchard infestation levels of fruit spotting bugs began rising in August in the Burdekin and peaked at 13% in September for R2E2's and 10% for KPs. On the Tablelands fruit spotting bug populations began rising in mid September and peaked at 17% for R2E2's and 13% for KPs. Population levels were lower on all farms than the previous season.

The level of fruit drop and damaged fruit caused by fruit spotting bugs were lower on the Tablelands than the previous season being 17% and 15% for Oct and Nov for R2E2's and 21% and 10% for KPs of all collected fruit drop samples. The fruit damage results may have also been skewed higher than normal because of the similar feeding style of the green vegetable bugs that were active during the same sampling periods.

Pulp weevil and seed weevil

An IPM work plan for pulp weevil has been developed for Palawan to reduce usage of insecticides by 40% and to improve control of leafhoppers, pulp weevil and fruit fly. Field studies on pulp weevil have just been conducted and the data is being summarized. The method of fruit volatiles collection will be modified as initial analysis did not yield good results. Crude extracts from fruits, flowers, and weevils were collected and will be used in bioassays to determine attractancy and synergistic effects of blends.

Insect semiochemistry

Following earlier work in collaboration with the USDA Beltsville Laboratory, a trial pheromone blend for *Amblyopelta nitida* was deployed in sticky plastic traps. However this proved unsuccessful. Further work is required to refine the formulation with respect to constituents and the ratios required. For *Amblyopelta lutescens*, a particular isomer of one of the identified substances is required and this will be supplied by the Beltsville laboratory when available.

SPME sampling of volatile emissions of major tropical fruits is continuing to investigate attractancy. Preliminary analysis has been commenced and identification of key components will be completed when resources become available.

Compounds released by both mango seed weevil (Australia) and mango pulp weevil (Philippines) have been collected by solid-phase microextraction (SPME) field collectors to analyse for possible pheromones. They are being analysed by DPI&F.

Supply chain

In the Philippines, deficiencies in the supply chain severely affect fruit quality and market opportunities. Accurate analysis will provide a 'road map' from which technical or business priorities can be identified and strategies implemented to bring about improvements. The detailed methodology for the Philippine mango supply chain has been developed, as well as a preliminary outline describing in general terms the country's mango industry and information relevant to the development of specific supply chain maps were also initiated.

The supply chain reviews marketing information more specific to focus areas in Davao del Norte, Davao del Sur, and Guimaras. The initial supply chain map is being validated during the series of field visits to the production areas. This component is providing an overview of the major technical postharvest problems

With the support of the Australian mango industry, a Queensland Government initiative and commercial exporters, several major supply chains were monitored from farm to retail in Singapore and Hong Kong. A range of problems have been identified including unsatisfactory product handling before export, unsuitable facilities for product handling in target markets as well as unfamiliarity with Australian fruit. Preliminary training activities have been commenced in both markets to address some of the issues. As a result of the monitoring activities in Australia, deficiencies in handling and preparing fruit for export were identified. Procedures to improve practices have been discussed with supply chain members and training has been provided to their staff.

HORT/2006/006: Development of an embryo culture manual and an embryo transplantation technique for coconut germplasm movement and seedling production of elite coconut types

Bilateral

Overseas Collaborating Countries	Philippines
Commissioned Organisation	University of Queensland, Australia
Project Leader	Associate Professor Steve Adkins Phone: 07 3365 2072 Fax: 07 3365 1177 Email: s.adkins@uq.edu.au
Collaborating Institutions	Philippine Coconut Authority, Albay Research Center, Philippines
Project Budget	\$67,800
Project Duration	01/01/2006 to 31/12/2007 (Project extended from 01/07/2007 to 31/12/2007)
ACIAR Research Program Manager	Mr Les Baxter

Project background and objectives

World coconut (*Cocos nucifera* L.) productivity has been low for decades and nearly 2/3 of the existing palms are becoming too old for sustained production. Coconut farmers, mostly low income smallholders, in more than 90 countries need high yielding varieties which suit their local conditions. A systematic replanting program requires a good breeding program that relies on the availability of new germplasm.

The collection and movement of coconut germplasm must be undertaken using embryo culture technique because transporting the whole fruit is impractical and phytosanitary unsafe. A new protocol of embryo culture has been developed from an earlier ACIAR-funded project (HORT/1998/061) involving some of the coconut producing countries in South East Asia, including the Philippines.

The new protocol is more efficient in producing robust plantlets, which are easily planted in soil to give a high percentage of plant establishment. Such a new protocol will also be applicable to the production of seedlings of elite coconut types such as Makapuno and aromatic, which have a high economic value. The details of this new embryo culture protocol need to be shared with other potential users, beyond the present team.

The project's objectives are to:

1. produce a manual of zygotic embryo culture for germplasm collection and exchange. This will be published by the ACIAR in three different languages (English, Indonesian and Vietnamese)
2. develop an embryo transplantation protocol for the production of Makapuno seedlings, and germplasm exchange in the long term.

Project Progress

Year 1 (01/01/2006–31/12/2006)

Towards objective one, all the information generated during the previous project (HORT/1998/061) has now been collated and turned into a manual draft. A photographic record has been made of the steps involved in zygotic embryo culture for germplasm collection and exchange and some photographs have been made of the steps of embryo transplantation protocol for the production of Makapuno seedlings.

Towards objective two, work has started on the conversion of the laboratory-developed embryo transplantation technique to one with large scale, field applicability. This work is making use of fresh, locally available coconut fruits in the Philippines. A staff member from the Albay Research Centre (ARC) has been trained in the techniques of embryo culture and equipment has been installed at ARC to do this kind of work. So far research has been initiated on determining the most appropriate age of embryos and surrogate nuts to be used in the technique.

This study is looking at 9 and 10 month-old embryos and nuts from one cultivar Laguna Tall and each treatment is making use of either husked or dehusked surrogate nuts (a total of 720 embryos are being studied in this work). As yet, no results from this work are available. The second part of the research already initiated is looking at inter-varietal compatibility between the embryo and the surrogate nut. This study is looking at two dwarf and two tall coconut cultivars and including the Makapuno type (a total of 2000 embryos are being studied in this work). As yet, no results from this work are available.

Certain aspects of the work noted above in Objective two have been slowed due to the impact of two severe cyclones that hit the Albay region of the Philippines in late 2006. These cyclones not only damaged the research facilities at the research station but also limited the number and quality of nuts available for the research program.

HORT/2006/111: Managing trade risks arising from the use of crop protection chemicals in horticultural crops in the Philippines and Australia

Bilateral

Overseas Collaborating Countries	Philippines
Commissioned Organisation	AKC Consulting Pty Ltd, Australia
Project Leader	Dr Kevin Bodnaruk Phone: 02 9499 3833 Fax: 02 9499 6055 Email: akc_con@zip.com.au
Collaborating Institutions	Philippine Council for Agriculture, Forestry and Natural Resources Research and Development, Crops Research Division, Philippines University of the Philippines at Los Banos, National Crop Protection Center, Philippines
Project Budget	\$80,025
Project Duration	31/05/2007 to 01/06/2008
ACIAR Research Program Manager	Mr Les Baxter

Project background and objectives

The Philippines is the world's sixth largest mango producing country and as an exporter is reliant on maintaining access to markets to sustain economic viability and development. Japan, a significant export market for the Philippines, recently implemented a new 'positive list' MRL system, i.e., a detectable pesticide must have a MRL listed in the relevant government standard. Increasing levels of residue monitoring has led to a reported five-fold increase in MRL breeches for food commodities imported into Japan (e.g. in 2005 there were a total of 72 breeches detected whereas in 2006 the number had climbed to over 110 for the first quarter following the promulgation of the new MRL system).

The focus of this project is to assess the capacity of the Philippine mango industry to respond to the challenges posed by increasing scrutiny and regulatory change in export markets. This will involve undertaking assessments of analytical and technical capacity, a residue risk assessment (i.e., gap analysis with regard to standards in importing countries) and an evaluation of current regulatory mechanisms with respect to gaining pesticide access, a review of current pest management systems, an examination of current quality control procedures and an attempt to identify what linkages currently exist between the various sectors.

Project Progress

Year 1 (31/05/2006–01/06/2008)

First progress report due in 2008.

HORT/2007/210: Detection surveys for mango seed and pulp weevils in Sarangani and Davao del Sur, Mindanao, Philippines

Bilateral

Overseas Collaborating Countries	Philippines
Commissioned Organisation	Queensland Department of Primary Industries and Fisheries, Centre for Tropical Agriculture, Australia
Project Leader	Ms Leonie Wittenberg Phone: 07 4048 4665 Fax: 07 4092 3593 Email: leonie.wittenberg@dpi.qld.gov.au
Collaborating Institutions	Bureau of Plant Industry, Philippines Provincial Agriculture Office, Philippines
Project Budget	\$149,929
Project Duration	01/01/2007 to 30/06/2007
ACIAR Research Program Manager	Mr Les Baxter

Project background and objectives

Currently mango exports to major markets in the USA and Australia from Mindanao and the rest of the Philippines (with the exception of the small island of Guimaras) are prohibited, due to uncertainty over the reported presence of mango seed and pulp weevils. Since no effective control methods are available to provide quarantine security (either pre or post harvest), establishing accepted 'area freedom' status is seen as the only way to open export markets.

This activity is a six-month detection survey for both weevils. Scientists are gathering evidence to establish that the weevils are not present in Sarangani Province and conducting low-level monitoring in Davao del Sur to complement internal quarantine measures being funded by that province. The longer-term objective is to use this information to support area freedom certification and thus promote the expansion of export opportunities for mango producers in Mindanao.

Project Outcomes

Final report not yet submitted by the Commissioned Organisation.

HORT/2007/032: Detection surveys for mango seed and pulp weevils in Sarangani and Davao del Sur, Mindanao, Philippines - Phase 2

Bilateral

Overseas Collaborating Countries	Philippines
Commissioned Organisation	Queensland Department of Primary Industries and Fisheries, Centre for Tropical Agriculture, Australia
Project Leader	Ms Leonie Wittenberg Phone: 07 4048 4665 Fax: 07 4092 3593 Email: leonie.wittenberg@dpi.qld.gov.au
Collaborating Institutions	Bureau of Plant Industry, Philippines Office of the Provincial Agriculturist, Philippines
Project Budget	\$98,000
Project Duration	01/07/2007 to 31/12/2007
ACIAR Research Program Manager	Mr Les Baxter

Project background and objectives

The reported presence of Mango Seed Weevil in the Philippines prevents mango fruit from this country accessing lucrative export markets including the United States and Australia. This small activity is a six-month detection survey for mango seed and pulp weevils in the province of Sarangani and will initiate sampling on Samal Island as well as maintain a low-level monitoring program in Davao del Sur in Mindanao, Philippines, continuing from ACIAR-funded project *Detection surveys for mango seed and pulp weevils in Sarangani and Davao del Sur, Mindanao, Philippines* (HORT2007/210).

The broad objective of this project is to increase profitability of mango-growing enterprises at all levels by expanding the areas of mango production certified as being free from seed and pulp weevils, thereby increasing the export opportunities and value of Philippine mango fruit.

Project Progress

Year 1 (01/07/2007–30/06/2008)

First progress report due in 2008.

HORT/1997/094: Management of postharvest diseases of sub-tropical and tropical fruit using their natural resistance mechanisms

Bilateral

Overseas Collaborating Countries	Philippines, Sri Lanka
Commissioned Organisation	Queensland Department of Primary Industries and Fisheries, Queensland Horticulture Institute, Australia
Project Leader	Dr Lindy Coates Phone: 07 3896 9468 Email: lindy.coates@dpi.qld.gov.au
Collaborating Institutions	Department of Agriculture, Sri Lanka University of Peradeniya, Sri Lanka Philippine Council for Agriculture, Forestry and Natural Resources Research and Development, Philippines University of the Philippines at Los Banos, Philippines
Project Budget	\$991,912
Project Duration	01/07/2002 to 30/06/2007 (Project extended from 01/01/2006 to 30/06/2007)
ACIAR Research Program Manager	Mr Les Baxter

Project background and objectives

Sri Lanka, the Philippines and Australia are significant producers of tropical fruit with good prospects for market development. However with current control measures, field and postharvest disease losses can hamper productivity and hamper market access. The shelf-life of most tropical and subtropical fruit crops is limited by their high susceptibility to postharvest diseases caused by *Colletotrichum* spp. (anthracnose), *Lasiodiplodia theobromae* and anamorphs of *Botryosphaeria* spp. (stem-end rot), with losses of 20 per cent common.

In mango, anthracnose also blights flowers and can cause complete crop loss before harvest, particularly if rain occurs at flowering. Field application of fungicides (e.g. copper compounds, mancozeb), and postharvest treatment with hot water and fungicides, currently form the basis for control of these pathogens, however due to the inadequacy of current options for field and postharvest disease control, alternative strategies need to be developed. In developing disease management strategies for fruit, little attention has been given to the fact that plants have evolved powerful defence mechanisms to limit and prevent disease on developing fruit.

These include biochemical (e.g. pathogenesis-related proteins, phytoalexins) and physical (e.g. lignification) barriers to pathogen invasion, and may be constitutive (preformed) or inducible in nature. The chemical defences, involving preformed or induced chemicals, cause infections to remain localised and quiescent (with colonisation restricted).

As climacteric fruit ripen, the defence mechanisms begin to break down (antifungal compound levels drop) and disease begins to develop. Some cultivars have naturally higher levels of the constitutive antifungals (for example the cultivar Hass avocado) and so disease development in ripening fruit is delayed, allowing more fruit to be marketed and consumed before disease develops. Furthermore, constitutive mechanisms may be up-regulated (induced) by a range of elicitors, to enhance host defences (and delay disease development). This project is exploiting those mechanisms to define new options for disease control. The project is improving control options for field and postharvest diseases of tropical fruit to reduce reliance on current controls, which do not reliably ensure longer storage of fruit during retail marketing and export.

Project Outcomes

Tropical and subtropical fruit crops are particularly susceptible to deterioration by postharvest disease, and significant losses are incurred in all production areas. Current control measures rely heavily on the use of fungicides, both before and after harvest. However, for many reasons we can expect that the use of these fungicides will become increasingly limiting. It is thus imperative that alternative or complementary strategies are sought. The project was undertaken to evaluate the prospect of utilising inherent plant defence mechanisms in the management of postharvest diseases focusing on mango (Australia, Sri Lanka and The Philippines) and banana (Sri Lanka). The key diseases were anthracnose in mango and banana, caused by *Colletotrichum gloeosporioides* and *C. musae*, respectively, and stem-end rot in mango, caused by *Botryosphaeria* spp.

A significant component was to identify and evaluate activators of plant defences under field conditions. The activators were known resistance-inducing agents, including acibenzolar-S-methyl (Bion®), and elicitors derived from fungal pathogens (in banana). Another component was to characterise some of the key biochemical defences contributing to the resistance, and to identify treatments, varietal properties or other agronomic practices which may influence their relative concentrations. The final key objective was to enhance the capacity of project teams to conduct plant defence research, and provide information to respective industries via workshops and field days.

Mango was the crop common to project activities in Australia, Sri Lanka and The Philippines. In field trials, Bion® was the most consistently effective activator of resistance to anthracnose disease, when applied as a foliar spray or as a soil drench 3-5 times throughout the fruiting period. There is clearly the potential for reducing the number of fungicides applied in a given season if Bion® is applied. UV-C treatment to harvested mango activated biochemical defences and reduced anthracnose. Another key finding from field trials in Australia (cv. Keitt) and Sri Lanka (cv. Karuthacolomban) was that increasing nitrogen fertilisation enhances anthracnose levels in fruit, which was correlated with high skin nitrogen and lower levels of preformed alk(en)ylresorcinols in skin tissue.

Some mango cultivars (and rootstocks) consistently showed high levels of resistance to anthracnose, e.g. 'Keitt' in Australia and 'Gira' and 'Karuthacolomban' in Sri Lanka. There was some correlation between resistance amongst varieties and levels of constitutive defences. In Sri Lanka the galloyltannin class of compounds was identified to be a major component contributing to antifungal activity in mango peel extracts. The capacity to analyse the alk(en)ylresorcinol compounds was made possible after establishing collaboration with an expert in Poland.

All banana work was conducted in Sri Lanka. The existence and partial characterisation of several phenylphenalane-type phytoalexins accumulating in response to infection with *Phyllosticta musarum*, the pathogen causing freckle disease, was confirmed. Freckle infection also induced other biochemical defences, like PR proteins, phenolics and other structural defences.

A banana leaf bioassay system was developed for assessing resistance-inducing capacity of elicitors derived from the banana freckle and anthracnose (*Colletotrichum musae*) pathogens, and the active components were identified as 5-C polysaccharides (with a protein component for the *C. musae* elicitor). In field trials, preharvest treatment with Bion® and salicylic acid reduced anthracnose and crown rot, and stalk-end rot was also reduced by salicylic acid. Fertiliser field trials demonstrated that increased nitrogen enhances anthracnose, while application of potassium reduced anthracnose and finger-end rot, particularly in soils with low initial levels of potassium. As with mango, cultivar differences in the resistance (or susceptibility) to anthracnose were demonstrated.

CONCLUDED PROJECTS

It is recommended that further field trials focus on the incorporation of Bion® into field disease management programs, but its registration and adoption remains the decision of Syngenta. Other defence activators should be assessed as they become available. Postharvest UV-C treatment should be assessed under commercial packingline conditions, and it is hoped that this will have application to disease management in mango in the near future. The information on nitrogen fertilisation in banana and mango could have immediate impact if made widely available to growers and other agricultural/extension staff.

The short-term impact of the variety work is that growers/industry could choose more disease resistant varieties. In the longer term, the selection and adoption of more resistant rootstocks (mango) is feasible and the work on biochemical defences could lead to the development of assays for screening germplasm for resistance as part of a breeding program. The global knowledge of natural plant defence and what affects it has been significantly enhanced in this project, and the capacity of all project teams to conduct such research has been elevated. Some information is available immediately to industry and has been disseminated via workshops and field days.

FIS/2003/033: Integrated fisheries resource management (Rinconada Lakes, Philippines and NSW Australia)

Bilateral

Overseas Collaborating Countries	Philippines
Commissioned Organisation	NSW Department of Primary Industries, Cronulla Fisheries Centre, Australia
Project Leader	Dr Philip Gibbs Phone: 02 9527 8411 Fax: 02 9527 8576 Email: philip.gibbs@fisheries.nsw.gov.au
Collaborating Institutions	Bureau of Fisheries and Aquatic Resources, Philippines Econcern Pty Ltd, Australia
Project Budget	\$484,242
Project Duration	01/07/2006 to 30/06/2009
ACIAR Research Program Manager	Mr Barney Smith

Project background and objectives

World Bank economic studies of the Bicol River basin have identified the Rinconada System (Lakes Buhi, Bato & Baao-Bula) as ranking second in terms of the incidence of poverty in the Philippines. People in the surrounding communities rely on the lakes for employment, food or navigation access. Management of the system is a compromise between necessary fisheries production through wild harvest and aquaculture and other primary uses of the lakes such as irrigation and hydro-electric power generation versus conservation/sustainability objectives.

Overfishing of wild fish stocks, and the increase in cage-based fish farming (tilapia), together with siltation caused by poor land-use practices in the catchment area, have caused serious habitat deterioration and a significant decline in fisheries production. The habitat deterioration is evident from eutrophication (algal bloom), reduced fish catches, reduced growth of fish in cages, fish kills and massive colonisation of lakes by water hyacinth.

A management plan has been initiated in Lake Buhi and a draft plan formulated for Lake Bato, but local stakeholders show little inclination to adhere to the plans. Municipal officers are insufficiently equipped to enforce national regulations (and in many cases do not understand the issues). Other stakeholders, including fish farmers and fishers, have a poor understanding of the issues and there is little effective compliance or incentive to change practices.

Project objectives are to facilitate adoption by key stakeholders of actions to improve management of the Rinconada Lakes and also of selected fisheries resources in NSW, Australia; to facilitate improved fish cage management, to increase economic return and reduce impacts on water quality and effectively manage water hyacinth infestations in Rinconada system by physical removal; to document and package the ecosystem-based management findings and outcomes ready for adoption.

Project Progress

Year 1 (01/07/2006–30/06/2007)

The project Memorandum of Agreement with the Bureau of Fisheries and Aquatic Resources in the Philippines was signed in September 2006. Initial planning and preparation for the official project launch was scheduled for November 2006 to coincide with the commencement of the first phase of the project participatory consultative meetings and the commencement of the fish cage aquaculture experiments.

The study area is in the Camarines Sur and Albay provinces (Bicol region) of the Philippines. The three Rinconada Lakes (Buhi, Bato and Baao-Bula) are located within the five local government Municipalities of Buhi, Bato, Baao, Bula and Libon and involvement of municipal staff in the project has been negotiated.

Unfortunately the Bicol region was impacted by a sequence of five typhoons from late September 2006 to mid December 2006. Three of the typhoons were of a significant nature reaching Category 4 status (this is the most destructive category used in the Philippines rating system of 1 to 4).

Mount Mayon is one of the three active volcanos in the Bicol region and in November/December 2006 the 4-day duration typhoon Durian (locally known as Reming) activated a major mud flow of volcanic tuff and ash left on the slopes of Mount Mayon from the February 2006 eruption. The combination of destructive winds to 195 kph, torrential rain and mud flows in the Bicol floodplain caused considerable loss of infrastructure and many human deaths.

As a consequence of these natural disasters the project objectives and scheduling of work tasks had to be reassessed and modified to accommodate the changes in the study area associated with the disruption to peoples livelihoods, damage and loss of fish cages and the flushing of the water hyacinth from the Lake system.

After the redrafting of the project methodology and work tasks, official briefings of the Bureau of Fisheries and Aquatic Resources regional staff and the local government officials of the four Municipalities (Buhi, Bato, Baao and Bula) including the incumbent Mayors were undertaken in January 2007. All Municipalities were very supportive of the project and committed to active involvement.

The project was officially launched on 1 February 2007 in the Municipality of Buhi. The launch involved officials from all municipalities and was combined with the release into Lake Buhi by the Bureau of Fisheries and Aquatic Resources of 100,000 common and bighead carp fingerlings. This was part of the rehabilitation and enhancement of the wild capture fishery in Lake Buhi following the typhoon disaster.

After the launch capacity-building seminars for stakeholders were held. Further targeted consultative and training workshops were held in early March in Bula, mainly for members of the FARMC's (Fisheries and Aquatic Resource Management Councils) of the different municipalities. The involvement of STREAM (Support to Regional Aquatic Resources Management) in conducting the livelihoods analysis for the project and the coordination with the capacity-building activities for the local fisherfolk organisations to be done by regional staff was finalised.

Philippine project scientists travelled to Australia in March 2007 to meet with Australian project staff and project collaborators working on the water hyacinth composting technology. Visits to a number of NSW Department of Primary Industries aquaculture facilities were arranged and detailed planning of the fish cage experiments in the Philippines on stocking density, feeding rates and cage spacing was undertaken.

In late April 2007, the stocking density trials in Lake Bato with four fish farmer co-operators were started. This involved transporting and stocking 45,000 size 17 Tilapia fingerlings into 36 fish cages (3 stocking densities x 3 replicates x 4 locations). The same experimental trials were started in Lake Buhi in late May.

Agreements on the establishment of the water quality laboratories and the water quality sampling program were reached with the Local Government Units via the Mayor in both Buhi and Bato. Training of the water quality technicians from the four Local Government Units was done during the April field work in Lake Bato, and monthly water quality monitoring commenced.

Water hyacinth presence in the Lakes has been significantly reduced by the flushing effect of the typhoons. Consequently a rescheduling of the water hyacinth composting trials to 2008 has occurred. The specifications and design of the locally manufactured rice threshers was investigated in relation to possible modification for use in preparing the water hyacinth for the composting trials.

FIS/2003/059: Sea ranching and restocking sandfish (*Holothuria scabra*) in Asia-Pacific

Multilateral

Overseas Collaborating Countries	Philippines
Commissioned Organisation	WorldFish Center, Philippines
Project Leader	Mr Len Garces Phone: +63 2 580 5659 Fax: +63 2 580 5699 Email: l.garces@cgiar.org
Collaborating Institutions	Department of Agriculture, Fisheries and Forestry, Australia University of the Philippines, Philippines University of the Philippines Mindanao, Philippines James Cook University, Australia Tasmanian Seafoods Pty Ltd, Australia National Fisheries Research and Development Institute, Philippines
Project Budget	\$937,549
Project Duration	01/06/2007 to 31/05/2011
ACIAR Research Program Manager	Mr Barney Smith

Project background and objectives

Overfishing of sea cucumbers and consequent lost livelihoods of artisanal fishers is a pantropical crisis. Underscoring the severity of this problem, the United Nations-FAO and ACIAR have spearheaded recent initiatives to improve tools for managing sea cucumber fisheries. Throughout the Asia-Pacific, stocks of the 'sandfish' (*Holothuria scabra*) have been chronically over-exploited. This high-value species is easily harvested from inshore habitats, and better management of the fishery is a high priority. Here, aquaculture and stocking technologies can motivate communities into conserving wild breeding stocks while generating income and speeding stock recovery.

Commercial operations have recently invested in on-growing sandfish within leased sea beds, referred to as 'sea ranching'. Using optimal hatchery and stocking methods, this nascent approach could be economically viable. Alternatively, breeding populations in reserves could be 'restocked' to rejuvenate larval supply to nearby fishing grounds. This project is designed to apply the technology developed in ACIAR project FIS/1995/703 for producing sandfish in hatcheries and in ACIAR project FIS/1999/025 for releasing them in the wild.

The project has the following objectives:

1. to test a new livelihood option in the Philippines and Australia through releasing cultured sandfish in managed inshore habitats and allowing communities to harvest them at market size after 3 years;
2. to replenish selected sandfish populations in the Philippines through restocking into marine reserves, designed to rebuild a critical mass of spawning adults.

Project Progress

Year 1 (01/06/2007–31/05/2008)

First progress report due in 2008.

FIS/2007/045: Evaluation of production technology, product quality and market potential for the development of bivalve mollusc aquaculture in the Philippines

Bilateral

Overseas Collaborating Countries	Philippines
Commissioned Organisation	University of the Sunshine Coast, Australia
Project Leader	Dr Peter Duncan Phone: 07 5430 2831 Fax: 07 5430 2881 Email: pduncan@usc.edu.au
Collaborating Institutions	University of the Philippines in the Visayas, Institute of Fisheries Policy and Development Studies, Philippines
Project Budget	\$50,497
Project Duration	01/06/2007 to 30/06/2008
ACIAR Research Program Manager	Mr Barney Smith

Project background and objectives

Philippine aquaculture production is increasing, but mollusc culture is poorly developed and uncompetitive locally and internationally, due to volume and quality issues. There is also regional variability in production and value, e.g. >50% lower value in Visayas. Bivalve aquaculture has potential to sustain small-scale coastal communities across the whole country and contribute to economic growth, provided problems of production, regulation, postharvest practices, food safety and marketing can be identified and addressed.

This scoping study will examine bivalve industries in Visayas, and compare them with better performing regions in Luzon. Collected data will be analysed and used to develop a clearer understanding of the factors underlying the relative underperformance of these industries in terms of productivity and economic performance, and to identify priorities for future research.

Major objectives are to:

1. collect comparative information, including quantitative data and site selection issues, on bivalve production methods in Western Visayas and Luzon
2. collect and compare information on product quality, safety and post-harvest aspects of bivalve production between these regions and compare with international standards
3. determine domestic and international market potential for Philippine bivalve species

4. analyse legal and policy framework for aquaculture management, environmental impact, production, processing and marketing to determine compliance and regulatory influence on regional production and competitiveness
5. prepare a detailed report of the results of the study with clear recommendations for future research.

Project Progress

Year 1 (01/06/2007–31/05/2008)

First progress report due in 2008.

FIS/2002/077: Improved hatchery and growout technology for marine finfish in the Asia-Pacific region

Bilateral

Overseas Collaborating Countries	Indonesia, Philippines, Thailand, Vietnam
Commissioned Organisation	Queensland Department of Primary Industries and Fisheries, Agency for Food and Fibre Sciences - Fisheries and Aquaculture, Australia
Project Leader	Dr Mike Rimmer Ph: +62 813 6091 3790 Email: mikerimmer@iprimus.com.au
Collaborating Institutions	Southeast Asian Fisheries Development Centre, Philippines Central Research Institute for Aquaculture, Indonesia Research Institute for Aquaculture No. 1, Vietnam Network of Aquaculture Centres in Asia Pacific, Thailand Sam Ratulangi University, Indonesia Research Institute for Coastal Aquaculture, Indonesia Gondol Research Institute for Mariculture, Indonesia Directorate General Aquaculture, Indonesia
Project Budget	\$959,214
Project Duration	01/07/2004 to 31/12/2008 (Project extended from 01/01/2008 to 31/12/2008)
ACIAR Research Program Manager	Mr Barney Smith

Project background and objectives

Aquaculture is an important source of supply, particularly of high-value marine finfish. Interest in pursuing this has grown, reflecting both the incomes on offer to smallholders and the potential easing of pressure on wild stocks, both driven by the lucrative (up to US\$70/kg) paid in some parts of Asia.

The sustainability of aquaculture production continues to grow, as research delivers improvements to fish grow-out survival rates. ACIAR-supported research (FIS/1997/073) developed improved diets and rearing strategies for some species. Despite this success some problems remain to be addressed: wild fry and fingerlings being used as a source of seed stock, the poor survival in rearing from larvae and the role of trash fish (low-value species usually found as by-catch in fishing for higher-value species).

With marine finfish playing an important role in the economic well-being of many coastal communities, ensuring the sustainability of aquaculture is important to maintaining wild fisheries. Without such production, fishing pressure on wild stocks will increase, fisher folk will increasingly be forced to trawl for trash fish and increasing numbers of wild fry and fingerlings will be removed from wild populations to act as a source of seed stock. The overall objective of the project is to enhance the sustainability of marine finfish aquaculture in the Asia-Pacific region by improving hatchery production technology and facilitating the uptake of compounded feeds for grow-out.

Project Progress

Year 3 (01/07/2006-30/06/2007)

Overall, project progress is adequate, although some problems with the spawning performance of broodstock at Research Institute for Mariculture Gondol (particularly with coral trout) have caused some delays in project activities. Where possible, project activities have switched to other species to avoid further delays.

Collaborative work at Research Institute for Mariculture Gondol has shown promise for using Vitamin C to reduce deformities in larval and juvenile grouper. The optimum enrichment method of L-ascorbyl-2-monophosphate in *Artemia* was found to occur at a dose rate 0.9 g/L for 6 h. The highest percentage of abnormalities was found in grouper larva fed with unenriched *Artemia* and commercial diet (control), indicating that vitamin C has an important role in controlling abnormality of humpback grouper larvae.

However, it was noted that the deformities (nature and frequency) are highly variable, and that there may be some issues of consistency of results as a consequence.

Preliminary experiments done at Research Institute for Mariculture Gondol suggest that opercular deformities in juvenile grouper can be reversed using high doses of Vitamin C in the diet, but this finding requires more rigorous experimental follow-up.

Research into the digestive system of larval groupers has shown that they have weak enzyme activity during the endogenous nutrition stage of development (< Day 3 post-hatch) and that significant changes in enzyme activity correlate with digestive tract development events prior to Day 20 post-hatch. There are significant increases in the level of all enzymes after completion of stomach formation and onset of metamorphosis at Day 28 (tiger grouper) onwards.

Of four rotifer strains isolated from North Sulawesi, Manembo-nembo strain was found to be the smallest, and thus more suitable for first feeding of grouper larvae. The smallest rotifers (<120 µm) appear when cultured at salinities of 20 and 30 ppt for Manembo-nembo strain. There was no linear relationship between salinity and rotifer size.

Effect of dietary protein and lipid level on growth performance of tiger grouper during late-stage grow-out was evaluated at Research Institute for Mariculture Gondol using test diets with five levels of protein (38, 42, 46, 50, 54%) and two lipid levels (9, 15%). The results indicate that a dietary protein level of 38% is sufficient to support good growth of larger (>250g) tiger grouper. Fish fed high lipid diets were fatter and more energy of the diet was retained as body fat.

An evaluation of the digestibility of feed ingredients at RICA Maros has shown that tiger grouper efficiently digest animal feed ingredients, indicating that these ingredients have potential to be used as dietary replacements for fish meal. Some caution is advised for golden snail meal since its overall digestibility was inexplicably poor, perhaps indicating that unknown factors may be affecting its nutritional value. However, plant meals were less digestible than animal meals.

On-farm validation of grow-out feeds is being undertaken in Labuange Bay, Southern Sulawesi, where there are five commercial farms growing tiger grouper. Three treatments are being assessed: 'trash' fish, moist pellet, and commercial pellet. This trial started in April 2007 and is still under way.

The Asia-Pacific Marine Finfish Aquaculture Network (APMFAN) continues to expand. Formalisation of the network has begun with three Regional Resource Centres proposed for Indonesia as well as four for India. In addition, 25 Regional Resource Experts have been proposed.

The electronic dissemination of information continues to be popular with users. APMFAN eMagazine (four issues/year) averaged 1575 downloads; while the APMFAN eNews (monthly) averaged 600 downloads. Training news and reports downloads were >600–1,370. Around 30–40% of traffic on the NACA website discussion forums is related to marine finfish aquaculture.

The 4th Regional Grouper Hatchery Production Training Course was held at the Brackishwater Aquaculture Development Centre Situbondo, 20 November–9 December 2006. Twenty participants from 13 countries successfully completed the course, including two participants from BADC Ujung Batee, Aceh (supported by FIS/2006/002).

APMFAN also organised a marine finfish hatchery training course on behalf of the Secretariat for the Pacific Community for a group of six from Pacific Islands in May 2007 at Krabi Coastal Fisheries Research and Development Centre (Krabi CFRDC) of DOF Thailand.

ACTIVE PROJECTS

Corporate sponsorship (from Skretting Asia) continues to contribute to support of APMFAN. The current agreement is to 2007–08 and includes:

- scholarships for grouper hatchery training course
- support for web site, news and communications
- further R&D cooperation and national marine fish aquaculture extension workshops are planned with additional funding support from Skretting Asia.

7.2 Subprogram 2: Farmer-based land and water resource management for profitable and sustainable agriculture

Projects:

Active

ASEM/2002/051	Sustaining and growing Landcare systems in the Philippines and Australia
ASEM/2003/009	Bridging the gap between seasonal climate forecasts and decision-makers in agriculture
ASEM/2006/059	Community agricultural technology program: phase 2
SMCN/2003/006	Enhancing agricultural production in the Philippines by sustainable use of shallow groundwater
SMCN/2003/011	Herbicide use strategies and weed management options in Philippines and Australian cropping
SMCN/2004/069	Minimising agricultural pollution to enhance water quality in Laguna de Bay (Philippines) and Mt Lofty Ranges (Australia)
SMCN/2004/078	Evaluation and adoption of improved farming practices on soil and water resources, Bohol Island, the Philippines

ASEM/2002/051: Sustaining and growing landcare systems in the Philippines and Australia

Bilateral

Overseas Collaborating Countries	Philippines
Commissioned Organisation	Queensland Department of Primary Industries and Fisheries, Centre for Subtropical Fruits, Australia
Project Leader	Noel Vock Phone: 07 5444 9614, Mobile 0412 119 048 Fax: 07 5441 2235 Email: noel.vock@dpi.qld.gov.au
Collaborating Institutions	University of Queensland, Australia SEAMEO Regional Centre for Graduate Study and Research in Agriculture, Philippines World Agroforestry Centre, Philippines Catholic Relief Services, Philippines University of the Philippines at Los Banos, Philippines Landcare Foundation of the Philippines Inc, Philippines
Project Budget	\$2,016,435
Project Duration	01/07/2004 to 30/06/2009 (Project extended from 01/07/2007 to 30/06/2009)
ACIAR Research Program Manager	Dr Caroline Lemerle

Project background and objectives

Although Landcare systems were not introduced to the Philippines as part of an ACIAR project, their development and growth were key outcomes of past ACIAR-supported research. The project helped facilitate the growth of Landcare at three nodes in Mindanao (Claveria, Lantapan and Ned). More than 400 groups have been established, with up to 60 per cent of farmers in each location adopting some form of conservation farming.

Farmers involved in Landcare reported positive impacts on productivity and profitability. Almost 50 Local Government Units and NGOs have also become actively involved. This success has seen the approach adopted by agencies involved in development activities in Mindanao. These agencies, and others operating elsewhere in the Philippines and beyond, are requesting additional information on planning, implementation and evaluation. Adopting the Landcare approach as a means of addressing rural poverty in Mindanao is now also being examined.

There are, however, questions over the sustainability of Landcare in the longer term, particularly whether the success at the three sites can be replicated elsewhere in Mindanao and beyond into the Visayas. Creating linkages to broader Landcare networks will be an aim, to

help broaden the reach of the program. The role of Landcare in southeast Queensland will also be examined, following on from the previous project, including a component examining Landcare in horticulture industries in Queensland that revealed the spread of urbanisation in the southeast of the state was creating additional pressures for agriculture.

The environmental imperatives on farmers in peri-urban areas, close to major waterways and tourism areas are growing. The effectiveness of Landcare in helping the horticulture industry in southeast Queensland to improve its viability and sustainability will also be examined. The Philippines component is improving the standard of living, social capital and environmental stewardship of poor rural communities in the southern Philippines, through:

- implementing, sustaining, and scaling-up effective landcare practices and the associated institutional structures and processes within selected vulnerable landscapes
- analysing and evaluating the appropriateness of models used to sustain and scale-up landcare processes.

Project Progress

Year 2 (01/07/2006-30/06/2007)

In the Philippines component, progress against the objective of strengthening institutional support structures for landcare included:

- The project's research on institutional models for landcare was completed and the results captured in a project Working Paper Learning from institutions and designing a Landcare support agency.
- To better inform the development of the two-year project extension a series of workshops and consultative meetings with management and staff of LFPI and project partner agencies were conducted in April 2007.
- There was an encouraging strong growth and diversification of landcare institutional support at the site level throughout the year.
- In the new scaling-up site of Bohol, the process of establishment and consolidation of landcare in the three pilot municipalities of San Isidro, Alicia and Pilar was completed, with good evidence of local ownership at the LGU and farmer levels.
- In the other new scaling up 'greenfield' site of Agusan del Sur the process of establishment of landcare in the five pilot municipalities of Bayugan, Bunawan, Sibagat, Sta Josefa and Trento was completed.
- The project's Landcare Coordinators Network continued to provide a professional networking and collaborative training resources across the five project sites.

Progress against the objective of sustaining and scaling up adoption of conservation farming systems and diversified livelihoods included:

- During the period under review, 69 major training and networking events were facilitated by the project across the five project sites, involving more than 2500 farmers.
- In the new scaling-up sites a total of 1000 adopters had been recorded by the end of the period under review – 468 in Bohol and 532 in Agusan del Sur.
- Adoption of diversified livelihoods was evident in more than 80% of the more than 2500 farmers involved in training and networking events.

Progress against the objective of analysing and evaluating impacts included:

- With the conclusion of the three-year original term of the project, all project outputs, outcomes and impacts, were collected and are being consolidated and analysed for publication in an impact evaluation report to be published by December 2007.
- A major two-day participatory evaluation of the landcare program by project staff and partner agency personnel was conducted during the Second Review Workshop in Bohol in August 2006. Participants provided reflections on what had been learnt as well as suggestions on what form an expansion of the landcare program should take.
- A number of individual research projects undertaken by project staff were completed and will be published as working papers in late 2007.
- A major study of the economic impacts of landcare, based at the Bohol site, was established and continued during the period under review. The study completed a survey of farmers at two sites and initial work on analysing the aggregated impact of changing land use from landcare at the watershed level using crop, household and watershed modelling.

Progress in the coordination and management of the project included:

- Two major project team review workshops were conducted during the period under review – the first in Bohol in August 2006, and the second in Davao in April 2007.
- To assist in the identification and promotion of the project, a project visual expression was developed and a project logo initiated.
- The web-based image management system for project images, located on the project internal web portal, was completed and made available to project staff.
- A major external review of the project, commissioned by ACIAR to assess progress against objectives and guide future project directions in a potential project extension, was conducted in November 2006.

ACTIVE PROJECTS

- Through additional funding from AusAID, a delegation of 20 personnel from the Philippines was organised and facilitated on a 10-day study tour of Australian landcare, including attendance at the Second International Landcare Conference in Melbourne.
- In addition to the Australian Landcare Study tour, project staff undertook specialised training in seven major training events, including two at a national level and five at a local or personal level.

For the Australian component, progress against objectives included:

- In the Hunchy study site, the biophysical and socio-economic datasets that had been gathered previously were further interrogated by overlaying data pertaining to State Government vegetation laws, local government special management areas and local government compliance codes for specific development activities.
- A collaborative partnership was established with the Centre for Rural and Regional Innovation of the University of Queensland to undertake the major survey of landholders within the study sites.

ASEM/2003/009: Bridging the gap between seasonal climate forecasts and decision makers in agriculture

Bilateral

Overseas Collaborating Countries	Philippines
Commissioned Organisation	South Australian Research and Development Institute, Climate Risk Management Unit, Australia
Project Leader	Peter Hayman Phone: 08 8431 6926 Email: hayman.peter@saugov.sa.gov.au
Collaborating Institutions	Philippine Atmospheric, Geophysical and Astronomical Services Administration, Philippines Philippine Institute for Development Studies, Philippines Leyte State University, Philippines University of Sydney, Australia NSW Department of Primary Industries, Australia
Project Budget	\$833,024
Project Duration	01/01/2005 to 31/12/2008
ACIAR Research Program Manager	Dr Caroline Lemerle

Project background and objectives

Climate variability is particularly problematic in rainfed agricultural systems, such as those found in the Philippines and eastern Australia. One main cause of variability in both countries is the El Niño Southern Oscillation (ENSO). The ENSO phenomenon causes higher season-to-season variability relative to other regions at the same latitude.

This variability causes difficulty for farmers in decisions regarding planning and managing seasonal activities. Drier seasons result from ENSO events, often dramatically reducing productivity in many systems, especially cropping. Longer ENSO events can lead to drought. For farmers this can also result in the adoption of more conservative mind-sets, with a reduced willingness to take risks, both real and perceived (such as planting a previously untried variety that may be well suited to drier conditions).

Forecasting based on ENSO indicators can be developed on a seasonal-scale. The Philippines meteorological service (PAGASA) issues climate forecasts based on recently developed ENSO knowledge. Despite this questions remain over the value of seasonal climate forecasting (SCF) amongst farmers and policy-makers. Users of SCF have yet to adequately integrate forecasting identifying rainfall odds, based on ENSO, as all uncertainty is not eliminated. A framework that helps them to address such concerns is needed, to build end-user confidence into using and integrating SCF decision-making.

The framework is being established to:

- improve the capacity of PAGASA to develop and deliver SCF
- distil key practical and methodological features of economic and psychological approaches to valuing SCF
- estimate the potential economic value of SCF for farm and policy or industry level case studies in the Philippines and Australia
- identify those factors leading to a gap between actual and potential values of SCF
- develop and implement strategies to better match forecasts with decision maker's needs.

Project Progress

Year 2 (01/01/2006–31/12/2006)

The ongoing drought in Australia and typhoons in the Philippines combined with a high level of media coverage regarding climate change has ensured interest in the results of this project on bridging the gap between climate science and decision makers.

The project has provided resources to improve the capacity of PAGASA to deliver Seasonal Climate Forecasts for the regions in the case studies. More importantly it has enabled PIDS and LSU to work with PAGASA to better link the climate science with the user community.

Some of the climatically risky decisions we are examining are policy decisions of how much rice to import into the Philippines; what variety of corn and how much fertiliser to use in the central Philippines and the Isabella north of Manila; variety choice and sowing time to maximise yield but avoid frost in southern Australia; the optimum amount of cropping and pasture on a farm in central west NSW. By engaging with decision makers in these diverse contexts we not only are having an immediate impact on the way that SCF are used, but we are also learning about the challenges of using climate information and ways of better placing a value on seasonal climate forecasts.

Surveys of farmers in the Philippines show a high degree of concern about climate risk and a high level of awareness of El Nino but only moderate use of the information in decision making. A paper that reviewed much of the survey work in Australia also highlighted difficulties in applying probabilistic SCFs to decisions. As part of the project (Objective 2) we have further refined an Excel based game that allows participants to consider how they would use forecasts that are much better than guessing, but a long way short of perfect information in decision making.

The project team were successful in having a symposium accepted for the 26th Conference of the International Association of Agricultural Economists (IAAE) which was held on the Gold Coast, Queensland, in August 2006. The title of the symposium was 'Valuing Seasonal Climate Forecasts'. This conference along with a workshop on the Science of SCF organised by the Australian Academy of Science on 2nd and 3rd of August and an International Conference on climate impacts and adaptation in Cairns in July provided excellent opportunities for the Philippine and Australian team to learn and discuss the theory and practice of valuing SCFs.

ASEM/2006/059: Community Agricultural Technology Program*Bilateral*

Overseas Collaborating Countries	Philippines
Commissioned Organisation	International Institute for Rural Reconstruction, Philippines
Project Leader	Ms Sheila Vergara Phone: +63 46 414 2417 ext 521 Email: sheila.vergara@iirr.org
Project Budget	\$322,857
Project Duration	01/08/2006 to 31/12/2007 (Project extended to 31/12/2007)
ACIAR Research Program Manager	Dr Caroline Lemerle

Project background and objectives

During 2006 this new initiative, Community Agricultural Technology Program (CATP), commenced. Its purpose is to acquaint farming communities with ACIAR-generated technologies and assist Philippines research providers to work with non-government and community-based organisations. It is using an action-learning approach which involves analysis and planning, implementation (adoption/behavioural change) and review and learning. This will start with interaction and exchanges between researchers, extension workers and farmers, to familiarise them with information about ACIAR technologies arising from past projects and to generate ideas about how these technologies can help farmers improve their agricultural production and increase their incomes.

Project Progress**Year 1 (01/08/2006–31/07/2007)**

Farmers were invited to a series of workshops and focus group discussions to help them identify what their particular needs are and how to address these needs through the adoption of a specific ACIAR technology. Action plans were formulated and Statements of Intention and Achievement were distributed and filled-up by farmers to serve as baseline data in assessing improvement of their agricultural production and income after one production cycle.

Most of the CATP NGOs have satisfactorily incorporated results of past ACIAR researches in their field activities. Most of them took the initiative to contact researchers from Visayas State University who were previously involved in past ACIAR research activities. Some of these researchers have already conducted courses in the NGOs' covered communities.

Soil and Water Conservation Foundation Inc. (SWCFI) benefited from the services of Prof. Francisco Gabunada Jr. of Visayas State University who gave a training on forage and pasture management together with some technical staff of Ubay Stock Farm. Monitoring of farmers will be done by Prof. Gabunada once the farmers have already established their forage gardens.

The staff from Ubay Stock farm will also monitor the farmers and check whether they have planted the grasses they have acquired from the stock farm. SWCFI has identified 14 farmer instructors in their covered barangays. They have conducted four training sessions and workshops, coordinated with researchers and local government units in monitoring the activities of the project and held four farmers' meeting to address issues and concerns regarding the implementation of the project. Farmer-beneficiaries are now practicing a goat management system and have adopted correct feeding practices.

ACTIVE PROJECTS

Mag-ugmad Foundation Inc. (MFI) was able to convince its farmers to do natural vegetative strips technologies which greatly improved the soil and water condition of its covered upland community. The planting of forage along the contour has also helped in soil and water conservation and provided feeds for livestock. Some farmers who replicated the recommendations of the carbon dynamics and nutrient content research (LWR1/1994/048) on their farms got good harvests after the adoption of this technology. Hence, other farmers have expressed interest to apply this research in their individual farms in the next cropping season. The research concept has motivated them to improve their farm practices and undertake individual action research to increase production of their crops.

Community Awareness and Services for Ecological Concern, Inc. (CASEC) was able to engage Dr. Alberto Taveros of Visayas State University to help them in their pig production project. Dr. Taveros conducted a training course which discussed in detail the outcome of his ACIAR project entitled 'Defining problems and opportunities for smallholder pig production in the Philippines' (AS2/1994/121). Farm planning was also done on farmers' areas where a survey and plotting of forage planting sites were undertaken. A forage development training course was also held where farmers acquired knowledge on the uses and types of forages for their livestock and on forage planting systems.

Participatory Research, Organisation of Communities and Education towards Struggle for Self-reliance (PROCESS) has conducted goat production and pasture management training. The training was conducted by the Office of the Provincial Veterinarian and the Central Visayas State College of Agriculture, Forestry and Technology. PROCESS is the only CATP NGO that has not yet conducted a training that was led by a local researcher with a past ACIAR research. But it has solicited the assistance of the Ubay stock farm in the farmers' collection of forage and pasture grasses. The 12 species of improved grasses collected were in turn shared to other farmers. Anglo-Nubian and Boer goat breeders were also purchased from Ubay Stock Farm. Veterinary supplies and medicines were procured with the help of the Office of the Provincial Veterinarian.

Landcare Foundation on the Philippines, Inc. has recommended the adoption of the past ACIAR research to ensure that harvesting, transporting and marketing of planted timber trees are better facilitated. The farmers were also encouraged to plant falcata tree because of its high demand in the market. They also practiced other silvicultural practices such as pruning, fertiliser application and ring weeding for newly planted trees.

Changes in farmers' production/management practices were also observed. Corn farmers have conducted soil analysis (using soil testing kits), used Bio-N, followed the recommended fertiliser rate, properly timed fertiliser application and utilised organic compost as supplementary fertiliser. Field demonstrations were also conducted.

SMCN/2003/006: Enhancing agricultural production in the Philippines by sustainable use of shallow groundwater

Bilateral

Overseas Collaborating Countries	Philippines
Commissioned Organisation	CSIRO Land and Water, Australia
Project Leader	Dr Peter Dillon Phone: 08 8303 8714 Fax: 08 8303 8750 Email: peter.dillon@csiro.au
Project website	http://www.clw.csiro.au/research/urban/reuse/ ; http://www.clw.csiro.au/research/water/groundwater/
Collaborating Institutions	Bureau of Soils and Water Management, Philippines
Project Budget	\$399,788
Project Duration	01/07/2004 to 31/12/2007
ACIAR Research Program Manager	Dr Gamini Keerthisinghe

Project background and objectives

In the Philippines most low-land agriculture is in part dependent on rainfall, which is usually abundant. Rainfall also recharges lowland aquifers, which are used to supplement rainfall in irrigated cropping. This combination of rain and recharging ensures sufficient water for production. In Ilocos Norte Province there are two seasons, dry from November to April and wet from May to October. The balance between these has, to date, been enough to ensure that groundwater levels remain sustainable.

There is, however, a danger of groundwater overexploitation. High-value dry season crops — mung bean, onion, garlic and other vegetables — are increasing pressure for the use of groundwater. An instance of drought or prolonged reduced rainfall could dramatically increase such pressures. Exploitation can lead to crops failing, wells drying up, loss of base-flows from water courses, saline intrusion and in severe instances land subsidence. All would also impair farmers' productivity, both in the short and also long term, creating economic and social pressures.

Currently groundwater extraction is expensive, the main reason water use has remained at sustainable levels. Extraction relies on diesel-fuelled pumps, a fuel source likely to change as electricity generation becomes more widespread. Deeper-drilling pumps and increased awareness of the benefits and returns from groundwater irrigation will also increase extraction rates. Planning and development of management options before resources such as wells, mainly controlled by individuals, reach and exceed capacity is the best way to avoid exploitation and groundwater depletion. The longer this is left the less effective it is likely to be. Exploiting shallow groundwater sustainably, based on the project's findings, will increase crop production in lowland, rain-fed agricultural areas of the Philippines.

Project Progress

Year 3 (01/07/2006–30/06/2007)

Work on groundwater management within the Philippines has focused on two pilot sites within neighbouring municipalities of the province of Ilocos Norte, namely Burgos and Pasuquin, which are located on the northwestern tip of Luzon, Philippines. For year 3, activities within these two sites focused on construction and calibration of groundwater models, and scenario testing using these models. Also, preliminary water use and management strategies were formulated based on the results of the modelling under different scenarios and on field observations.

ACTIVE PROJECTS

Demand side water management (i.e., to reduce water consumption), aerobic rice seed was distributed to selected farmers of both Burgos and Pasuquin. Aerobic rice was introduced to reduce water consumption in rice production.

During the Nov–Feb. 2006 cropping of garlic, a techno-demo farm on water management aspects for garlic production was established in both sites in which farmer-cooperators were taught how to monitor soil moisture in the root zone during the cropping period. They recorded soil tensiometer readings on a daily basis, and static and pump water levels at every irrigation application.

In June 2006, a training course in groundwater modelling was held in BSWM offices in Manila. A one day introductory seminar was attended by 26 staff from BSWM and other agencies concerned with water management. Eight of these staff then received hands-on training using the MODFLOW software. Following this course, Engineers Jane Fantilanan and Oscar Carpio took part in a three week advanced training program in Adelaide in November 2006, where they began construction of a groundwater model for the Burgos site, under the guidance of Dr Peter Cook (CSIRO) and Mr Paul Howe (REM). Paul Howe then spent three days at BSWM in Manila in June 2007, to assist Engrs Fantilanan and Carpio set up the model for the Pasuquin field site.

In the modelling exercise, the scenarios they simulated include the possibility of increasing the areas for garlic production during dry season cropping, assuming the current level of recharge in both basins continues. The possible effect of reduced rainfall due to drought and or dry spell (i.e., usually associated with El Niño phenomenon) was also studied. In the process, the number of wells and the possible expansion areas were determined such that future groundwater extraction will not exceed the rate of recharge. The initial results of the groundwater modelling will be presented to farmers and local policy and decision makers during the scheduled consultation-workshop in the third week of July.

Work is also underway within Australia, to design water pre-treatments for managed aquifer recharge systems for use in unconsolidated sandy aquifers that predominate in lowland areas of the Philippines. An evaluation of the performance of roughing filters in removal of colloidal kaolin as a pre-treatment for biofiltration (slow sand filtration) was completed. The method was found to be highly effective and required minimal maintenance.

A review of biofiltration was undertaken and a testing facility established adjacent the stormwater harvesting wetland at Urrbrae Agricultural High School, South Australia into enable evaluation of biofiltration design variables. Stormwater from the local catchment and from Melbourne were used to test different biofiltration media. Removal of colloidal material was effective but removal of dissolved biodegradable organic carbon was only partially effective. This suggests that these treatments will be adequate for consolidated carbonate aquifers, such as at Burgos and parts of Pasuquin, but would only be effective for unconsolidated sand aquifers if the labile organic carbon content of water is low.

A report is in preparation on methods to characterise labile nutrients in stormwater as a predictor of biofilm growth and clogging in injection wells. More direct measures of clogging potential are also in evaluation with the aim of producing a simpler and more direct assessment method that is relevant to local aquifers.

SMCN/2003/011: Herbicide use strategies and weed management options in Filipino and Australian cropping

Bilateral

Overseas Collaborating Countries	Philippines
Commissioned Organisation	University of Western Australia, Australia
Project Leader	Dr David Pannell Phone: 08 9380 2539 Fax: 08 9544 8659 Email: dpannell@uwa.edu.au
Collaborating Institutions	Philippine Rice Research Institute, Philippines CSIRO Sustainable Ecosystems, Australia
Project Budget	\$508,091
Project Duration	01/07/2004 to 30/06/2008
ACIAR Research Program Manager	Dr Gamini Keerthisinghe

Project background and objectives

Weed management in the Philippine's rice sector is increasingly being linked to the use of herbicides. These are being used because of changes from traditional approaches to growing, where seedlings are grown then transplanted into paddies. Increasing economic and environmental factors are resulting in direct seeding taking over from transplanting.

Water availability is a key issue, the less water the greater imperative to direct seed. At the same time labour costs have risen, this being a key input in transplanting rice, requiring 50 per cent more labour. Herbicide costs, another key input into direct seeding have fallen. Traditional approaches using transplanting have, as a result of increased costs, been replaced in many areas by direct seeding. Almost half (44 per cent) of all rice is now grown by direct seeding. The main drawback to this system is weeds and their control. Traditional practices utilise Integrated Weed Management but direct seeding, requiring less water and flooding, offers greater opportunities for weed establishment.

The main form of weed control now used for direct seeding is herbicides. Without their use direct seeding is not viable, with yield losses from uncontrolled weeds at between 45 – 95 per cent. Experience in other countries shows that if not properly managed herbicide use can lead to resistance in weeds. Once resistance is established herbicide options can quickly become limited, making direct seeding all but impossible. Acting during the early stages of resistance build-up is the best option against resistance reaching uncontrollable levels.

Weed management options, based on scenarios and modelling will be examined in both the Philippines and Australia, including by:

- sampling and documenting farmers' current weed practices, perceptions and information sources in relation to direct-seeded rice
- testing, evaluating and adapting a promising (low herbicide use) direct seeded rice production method in farmers' fields through farmer participation
- assessing the status of herbicide resistance in rice weeds in the Philippines.

Project Progress

Year 3 (01/07/2006–30/06/2007)

Objective 1. To sample and document farmer's current weed management practices, perceptions (including HR and health risks due to herbicide) and information sources in relation to direct seeded rice in the Philippines.

A survey was conducted to (1) determine the farmer-cooperators' perception of the effectiveness of IWM technology for weed management, (2) determine the uptake of the IWM technology in the farmer-cooperators' fields, and (3) assess diffusion of the IWM technology to other farmers' fields at the midterm of project implementation.

Results indicate that uptake of the IWM technology to the farmer-cooperators is fast. After four seasons involved in the trial, 75% had adopted all components of IWM on their farms. The remaining 25% had adopted it partly. Fifty-six percent of the farmer cooperators in Iloilo rated IWM effectiveness as very good while the remaining 44% rated it as good. In Nueva Ecija, 80% of the farmers rated it good while 20% rated it very good. Farmers also said that they have reduced their herbicide applications from 2–3 per season to just one per season.

Farmers had shared their knowledge on IWM with other farmers. Forty-five percent of all neighbouring farmers were aware of the IWM technology. Of the IWM components, the use of the Weed Control Action Indicator (WCAI) and use of post-emergence herbicides after WCAI assessment were the least familiar to the farmers. Factors identified by farmers that limit adoption included relative advantage, difficulty in understanding and applying the complex new technology, and risk. The neighbouring farmers said that for them to adopt IWM, they need training, to see a successful IWM farmer in the community, and to be convinced of the clear benefits of IWM.

Objective 2. To test, evaluate and adapt a promising (low herbicide) direct seeded rice production method in farmer's fields in the Philippines.

Participatory on-farm trials were established in eight sites: Rizal (2) and Aliaga (3) in Nueva Ecija, and Barotac Nuevo (1) and Dingle (2) in Iloilo. The trials have tested an integrated weed management (IWM) strategy consisting of a combination of good land preparation, intermittent water management, and single herbicide application of a pre- or early post-emergence herbicide. The WCAI was used to help farmers decide on subsequent weed management strategy at 15, 30 and 45 DAS, if need be.

During the dry season, an 8-week training using a participatory approach and consisting of half day meetings and field visits was conducted in newly added sites to reinforce concepts about integrated weed management as well as integrated crop management. Results of the field trials from the new sites were similar to the results obtained in the previous sites, and indicated better weed control, increased yields, and higher profits with the use of integrated weed management as compared to current farmers' practice.

A row seedling method was also tested as suggested by farmers and extension workers side-by-side with farmers' practice of hand broadcasting the seeds. Field days were conducted in different sites to demonstrate the importance and effects of integrated weed management. The on-farm trials will be on-going in further seasons and be adapted to local situations in collaboration with farmers and extension workers.

Objective 3. To assess the status of herbicide resistance in rice weeds in the Philippines.

Progress was made on the screening for herbicide resistance to pretilachlor in barnyard grass (*Echinochloa* spp.). Seven populations of barnyard grass previously identified as butachlor+propanil resistant were also found to be resistant to pretilachlor. Six populations exhibited resistance and one was rated as developing resistance. Response dose assay showed that only two populations did not survive the 4 L/ha dose which is four times the recommended application rate for pretilachlor.

The F2 generation of the surviving plants from the previous resistance screening test for butachlor + propanil were also tested for resistance heritability. The F1 generation of the seven populations were highly resistant with 50 to 70% survival rate. In the F2 resistance heritability screening test, the survivors ranged from 18 to 78%. The 78% survival rate was observed in one population from Nueva Ecija. One population from Iloilo had greater than 50% survival rate.

A survey was conducted in the direct seeded areas of Nueva Ecija and Iloilo to determine the extent of infestation of weedy rice and to collect samples of weedy rice biotypes present in these areas. Laboratory and greenhouse experiments were conducted to determine the morphological and agronomical characteristics of these weedy rice biotypes. Five biotypes were found to be associated with cultivated rice in 32 municipalities of Nueva Ecija, and eight biotypes were found in five municipalities of Iloilo.

Objective 4. To develop an economic framework for policy analysis of herbicide resistance and weed management issues in the Philippines and Australia.

The survey of growers in the Philippines highlighted the real and perceived likelihood of weed mobility across and between properties. Together with the increasing level of costly forms of resistance in Australian grain-growing, this has made research into the economics of herbicide resistance management in the presence of weed (and resistance) mobility a priority. Results from economic analyses so far have begun to demonstrate: the reduced incentive for investment in resistance prevention when gaining resistance from a neighbour is likely; the importance of determining actual resistance risks; and the economic benefits of preventing mobility.

SMCN/2004/069: Minimising agricultural pollution to enhance water quality in Laguna de Bay (Philippines) and Mt Lofty Ranges (Australia)

Bilateral

Overseas Collaborating Countries	Philippines
Commissioned Organisation	CSIRO Land and Water, Australia
Project Leader	Dr Rai Kookana Phone: 08 8303 8450 Fax: 08 8303 8565 Email: rai.kookana@csiro.au
Project website	http://www.clw.csiro.au/cecr/ ; www.clw.csiro.au/staff/KookanaR/
Collaborating Institutions	University of the Philippines at Los Banõs, Philippines Laguna Lake Development Authority, Philippines
Project Budget	\$657,501
Project Duration	01/05/2006 to 30/04/2009
ACIAR Research Program Manager	Dr Gamini Keerthisinghe

Project background and objectives

Laguna de Bay is the Philippines' largest and most important freshwater resource, being made up of three bays that form one lake. The eastern of these bays is intended to provide Metro Manila with water in the near future. Heavy wastewater discharge and runoff cause pollution in the western bay.

The eastern bay's main water source is the Pagsanjan River, a part of the Pagsanjan-Lumban sub-catchment, most of which is used for agriculture and is increasingly a source of nutrient and pesticide pollutants. Identifying and quantifying these pollutant sources will be undertaken as part of a comprehensive biophysical and hydrological characterisation of the sub-catchment. Complementary activities are being undertaken in the Mt Lofty Ranges in Australia.

Project Progress

Year 1 (01/05/2006–30/04/2007)

This project aims to develop a comprehensive biophysical and hydrological characterisation of the Pagsanjan-Lumban sub-catchment of Laguna de Bay, and to identify and quantify the sources of pollutants (sediments, nutrients and pesticides) from agricultural activities and their potential impact on the health of Laguna de Bay in the Philippines. Complementary activities will be undertaken as part of a larger research program to protect water bodies in the Mt Lofty Ranges in Australia.

Major activities undertaken during this period include:

Philippines component

- A tour of the Pagsanjan-Lumban sub-catchment (study site) was made on Sept. 9 to allow the Australian collaborators to understand the sources of contaminants to the rivers draining into Laguna de Bay.
- A highly successful two-day workshop was held on Sept. 12 and 13 wherein the team went through all of the project objectives/activities and agreed upon staff involvement and activities that needed to be undertaken to meet the objectives.
- As a follow-up from the project launch and the workshop, a meeting between the LLDA and UPLB teams was held on October 10 to go through collaborative arrangements between the organisations and agree on specific assignments of individual team members. A coordination meeting was held on December 7 to follow up on individual commitments and contributions to the Annual Progress Report.
- Meetings with members of the Pagsanjan-Lumban River Basin Management and Development Foundation, Inc. were held on September 8 and October 12 to discuss possible engagement of volunteers for specific project activities.
- A training module on GIS and RS technology has been developed by the LLDA GIS Team.

- The criteria for the selection of sites for instrumentation such as auto samplers have been developed by Dr. Sammy Contreras.
- The description of sampling methodology and protocols for the eco-toxicological studies that will be conducted under the project has been developed by Ms Cristy Bajet.

Australian Component

- In the Lenswood Creek sub-catchment of the Mt Lofty Ranges, study sites were selected in consultation with stakeholders including Apple and Pear Growers Association, SA Water, EPA and other agencies.
- Four auto-samplers and flow data loggers at three sites in the Mt Lofty Ranges have been installed.
- A stakeholders meeting allowed several agencies to visit study sites after installation of auto samplers.
- The analytical methods for pesticide analyses for over 60% of the chemicals used in the three landuses being studied, namely grapes, apples and cherries, have been developed and optimised.
- Analyses have been made on the water collected so far for sediment, nutrients and pesticides. However, the very low rainfall this year has resulted in only a small number of water samples that could be collected.
- Five growers have been interviewed so far about chemical use in the Mt Lofty Ranges and a PIRI assessment made of chemical usage at the three sites where the auto samplers are located.

SMCN/2004/078: Evaluation and adoption of improved farming practices on soil and water resources, Bohol Island, the Philippines

Bilateral

Overseas Collaborating Countries	Philippines
Commissioned Organisation	University of Western Sydney Faculty of Science, Technology and Environment, Australia
Project Leader	Professor H. John Bavor Phone: 02 4570 1264, 02 4570 1423 Fax: 02 4570 1267 Email: j.bavor@uws.edu.au
Collaborating Institutions	Bureau of Soil and Water Management, Philippines Department of Environment and Natural Resources, Philippines University of Sydney, Australia World Agroforestry Centre, Philippines
Project Budget	\$840,299
Project Duration	01/01/2007 to 31/12/2010
ACIAR Research Program Manager	Dr Gamini Keerthisinghe

Project background and objectives

Soil erosion and associated loss of crop productivity and degraded water resources are serious threats to agricultural livelihoods in upland areas of the Philippines. The impacts of common cropping systems on soil and water degradation and farm incomes in the Inabanga watershed were studied in project LWR/2001/003. This watershed, the largest on Bohol Island, has more than 50% of its 61,000 ha used for agriculture.

The data gathered were analysed in a GIS framework developed for the project, and this tool was used to identify areas of the Inabanga watershed at high risk of soil erosion. The researchers identified and mapped 'hotspots' – areas at highest risk of soil erosion. The project team demonstrated that cultivation of corn/cassava on steeply sloping, highly erodible soils was the major contributor to soil erosion. Corn/cassava cultivation also resulted in the lowest economic returns to the farmers and was the main contributor to siltation of the Malinao Dam.

Outcomes of the earlier project revealed that opportunities existed for farmers to reduce some of the negative aspects of agricultural activity through introduction of conservation techniques, undertaken in association with existing landcare approaches that provide training and encourage adoption.

Building on the experience and expertise developed through the earlier ACIAR projects LWR/2001/003 and ASEM/2002/051, the overall aim of the project is to promote the adoption of improved farming on highly erodible soils on steeply sloping uplands in two upper watersheds in Bohol. This will be achieved through the implementation and demonstration of erosion amelioration practices, and measurement of the environmental, economic and agronomic consequences.

Project Progress

Year 1 (01/01/2007–31/12/2007)

First progress report due in 2008.

7.3 Subprogram 3: Addressing regulatory, policy and technical constraints to the adoption of research outputs

Projects:

Active

- ASEM/2003/052 Improved financial returns to smallholder tree farmers in the Philippines
- PLIA/2000/039 Impact of migration and/or off-farm employment on roles of women and appropriate technologies in Asian and Australian mixed farming systems (IRRI)

Concluded

- FIS/2002/019 Management and policy frameworks for illegal, unreported and unregulated (IUU) Fishing in Indonesian and Philippine waters
- PLIA/2005/151 Philippine policy linkage scoping study

Pipeline

- PLIA/2006/134 Policy environment and adoption of research case study from scoping study—Philippines

ASEM/2003/052: Improving financial returns to smallholder tree farmers in the Philippines

Bilateral

Overseas Collaborating Countries	Philippines
Commissioned Organisation	University of Queensland, School of Natural and Rural Systems Management, Australia
Project Leader	Dr John Herbohn Phone: 07 5460 1646 Fax: 07 5460 1324 Email: j.herbohn@uq.edu.au
Collaborating Institutions	Visayas State University, Philippines Department of Environment and Natural Resources, Philippines Southern Cross University, Australia
Project Budget	\$698,128
Project Duration	01/01/2005 to 31/12/2007
ACIAR Research Program Manager	Dr Caroline Lemerle

Project background and objectives

In the province of Leyte, as elsewhere in the Philippines, forest industry development is considered a priority. Economically forestry is a viable industry for many farmers, particularly if underutilised land is used. Knowledge of market demands is also needed by smallholders to better deliver in-demand products. Most of the land farmed by smallholders is marginal and sloping with few other uses.

With areas of the province deforested, or at best marginally productive, forestry and agroforestry addresses a second need, positive environmental management. Pressure to log native forests, in turn increasing deforestation, can be relieved through greater smallholder involvement. Most plantings are undertaken for production forestry and conservation.

In Leyte forestry does not meet provincial demand for timber, this being met by importing logs. Smallholders and community forestry practitioners rely on timber for on-farm and household use, but less so as a supplementary income. Past ACIAR research has demonstrated greater financial returns are possible if these two groups had better market access and knowledge of prices. This would likely result in the planting of appropriate species to meet timber demand, greater volumes being produced per unit of cost and improved log size and quality.

Barriers to market entry, including improved registration processes through the Department of Environment and Natural Resources also exist and will be a focal point of project activities.

A strategy to improve financial returns to existing tree farmers and intending smallholder tree farmers is being implemented, to:

- assist DENR to overcome policy constraints to tree registration and log transport
- assist smallholder tree growers to satisfy market requirements and improve productivity
- identify and promote livelihood systems and policies which incorporate forestry and recognise the socio-economic circumstances of smallholders.

Project Progress

Year 2 (01/01/2006–31/12/2006)

During the year significant progress has been made towards the project objectives. The first objective of the project is to assist DENR to overcome policy implementation constraints to tree registration and log transport. During 2006 we worked closely with DENR staff to identify key constraints and how to overcome them. We set up a School of the Air radio program on tree farming policies with active participation of Department of Environment and Natural Resources personnel, municipal mayors, councillors and municipal agricultural officers.

Further policy and action research workshops were held during the year with key stakeholders to discuss issues with various policy impediments and to identify strategies to overcome these impediments. One result of these workshops was the finalisation of the *Primer on Tree Registration, Harvesting, Transport and Marketing in Private Lands*. The primer has now been reproduced in three languages (English, Waray-Waray, Cebuano). The primer has been widely distributed on Leyte and to key institutions and government departments elsewhere in the Philippines. The World Agroforestry Centre has provided funding to reproduce additional copies.

The second objective of the project is to assist tree growers to satisfy market requirements and improve productivity. An extension program has been developed and trialled which aims to test mechanisms to improve the silvicultural skills of farmers. As part of this program, the use of 'bus tours' taking smallholder tree farmers to demonstration sites in order to delivery key information about silviculture has been developed.

During 2006, two further pilot tours were undertaken and their effectiveness is currently being assessed. In addition, a pilot program involving cost effective ways of linking buyers and sellers of timber was ran throughout the year and a follow-up assessment will be undertaken in 2007.

A key part of Objective 2 is to identify the market requirements for timber and a number of interrelated activities have been conducted in this area. During the year 51 owners of timber enterprises were interviewed from Leyte, Cebu and Samar. The survey has provided a wealth of information which is currently being analysed.

In addition, a detailed assessment of the current timber resource on Leyte was largely completed by field teams measuring both timber quantity and log quality from existing tree farms. Data have been collected on 5664 trees from 532 plots established on 119 tree farms. Analysis of this data has commenced.

As part of Objective 3 we are identifying and promoting livelihood systems and policies which incorporate forestry and which recognise the socio-economic circumstances of smallholders. During 2006 we conducted a socio-economic survey to collect the necessary data. The questionnaire was administered to all tree farmers who have their tree farms measured as part of activities conducted as part of Objective 2. These data are currently being analysed.

PLIA/2000/039: Impact of migration and/or off-farm employment on roles of women and appropriate technologies in Asian and Australian mixed farming systems

Multilateral

Overseas Collaborating Countries	Philippines, Thailand, Vietnam
Commissioned Organisation	International Rice Research Institute, Philippines
Project Leader	Dr Thelma Paris Phone: +63 2 845 0563 , 844 3351 ext 312 Email: t.paris@cgiar.org
Collaborating Institutions	Curtin University of Technology, Australia Khon Kaen University, Thailand Cuu Long Rice Research Institute, Vietnam
Project Budget	\$496,764
Project Duration	01/01/2004 to 31/12/2007 (Project extended from 01/07/2007 to 31/12/2007)
ACIAR Research Program Manager	Dr Jeff Davis

Project background and objectives

Migration from farms, either to seek off-farm employment as an income supplement or to move to areas for greater opportunities is common throughout much of Asia. Off-farm employment is seen as a way to boost income particularly in smallholder family owned farms. This may increase income but at the cost of reduced farm labour inputs and the likelihood of reduced farm output. Increasing economic pressures from trade liberalisation, globalisation and their impacts, together with constraints from environmental, disease and weed pests and water availability are increasing trends to migrate and or to work off-farm.

The wider these pressures and their affects are felt, the greater the probability of reduced farm productivity impacting on the broader economy. The main group involved in migration and increasingly off-farm employment is men. This is resulting in far-reaching changes to household structures, and in cases of long-term or permanent migration, economic and social changes. Women are increasingly being left with the task of farm management, including having to overcome production constraints, mainly from lost labour inputs of husbands, brothers and other male workers.

Such changes are also occurring in some farming communities in Australia, creating many of the same issues. Little research has been done regarding these changes, their impacts and farm management. Of particular interest are technologies that can be used to alleviate production constraints caused by labour

shortages, to help women in Asian and Australian farming systems to manage farms. The overall goal of this project is to better understand the changes occurring in rural agriculture in Asia and Australia in relation to the changing role of women as a result of off-farm employment and/or migration and the ways in which constraints and needs differ between male and female household heads. In particular, the project will identify possible strategies and technologies to help women heads to better manage farms.

Project Progress

Year 3 (01/01/2006–31/12/2006)

This year, the project accomplished the following objectives: 1) assessed the impact of family migration/off-farm employment on agricultural productivity, farm efficiency, women's empowerment and the changing roles of women at the household and farm level; 2) examined key constraints faced by women heads and other poor women in increasing their productive capacities; 3) identified on-farm strategies and technologies that could help address these constraints; 4) tested and evaluated the identified strategies and interventions through participatory approaches; 5) communicated/disseminated information to stakeholders, including women, farm households, research institutions, government bodies and NGOs.

To achieve Objectives 1 and 2, 800 farm households (with and without migrants) were interviewed in each collaborating country (Philippines, Thailand and Vietnam) using a structured questionnaire. Probit analysis was used to identify the factors which determine the probability of a family member to migrate. Ordinary Least Square (OLS) was used to determine the impact of migration, socio-economic factors and farm variables on household income.

In the three countries, the share of remittance earnings to household income ranged from 20 to 50% with the highest share in the Philippines which showed high incidence of international migration. Remittance earnings were spent mainly on food, children's education, debt repayments, and farm inputs. Although remittance earnings helped prevent further income erosion of poor farming households, the pressure to maintain rice yields are shouldered by the family members left behind, particularly the female members. Maximum Likelihood Estimate (MLE) was used to determine the impact of migration on rice productivity and farm efficiency.

In-depth surveys of 200 farm households, a subset from the 800 households were also conducted to determine changes in gender roles as a result of labour out-migration, women's decision-making authority in household and farm-related matters and constraints women farmers face in the absence of men. Women's Empowerment Index was developed to assess women's decision-making authority compared to men. WEIs were found to be higher among households with migrants than those without migrants. Wives are compelled to make 'on-the-spot' decisions when husbands are away on a long-term basis. Their roles have begun to shift from unpaid family workers to de facto farm managers.

Traditionally, women manage the allocation of cash for household expenditures. However, with male absence, they are now getting involved in allocating the limited budget for farm inputs as well. Constraints to increasing women's productive capacity were lack of access to technical knowledge in all aspects of rice production, particularly in the efficient use of inputs and reducing the costs of rice production. Majority of the women have not received any training in relation to new methods of crop/farm management.

On-farm strategies, technologies and training needs were identified through focus group discussions conducted in the villages. Participatory action research (PAR) included testing and evaluation of improved rice production and post harvest practices with emphasis on seed health and pest management in the Philippines, use of biofertiliser, golden snail control, use of bio-insecticide in Thailand and rice pest management such as IPM (Vietnam).

Women cooperators were trained in the use of these technologies. In Vietnam, before the training, women were given tests on their existing knowledge on pest identification, weed management, cultural practices to maintain healthy plants, reduce inputs and high yield as well as the methods of pest control. Leaflets (about 1000) which include the important roles of women in rice farming were also distributed in the communes and villages. Training materials were developed with the help of Director of Extension Center at Cu Ulong Rice Research Institute (CLRRI) as well as other specialists. Women participants were given T-shirts with slogans on the front 'Phu Nu Tao Dung Tuong Lai' which means 'Women are keys to a better future'.

In Australia, the project completed the review of literature, conceptualized action research and conducted workshops and road shows. These workshops were conducted to communicate research results of surveys, to introduce action research and determine on-site needs. One milestone of the project is the organization of a training course for WiRL (Women in Rural Leadership) which aims to develop a pathway for women to increase women's participation, representation and leadership by developing essential skills for rural women that will lay the foundation for future leadership roles in their own farm business, communities and in agribusiness and influential organizations. This course given in Esperance was successful. There is a demand for other areas and have received invitations to hold WiRL in the wheatbelt, MidWest Bunbury and Kimberley.

FIS/2002/019: Management and policy frameworks for illegal, unreported and unregulated (IUU) fishing in Indonesian and Philippine waters

Bilateral

Overseas Collaborating Countries	Indonesia, Philippines
Commissioned Organisation	University of Wollongong, Centre for Maritime Policy, Australia
Project Leader	Professor Martin Tsamenyi Phone: 02 4221 3224 Email: martin_tsamenyi@uow.edu.au
Collaborating Institutions	Department of Foreign Affairs, Maritime and Ocean Affairs Centre, Philippines Agency for Marine and Fisheries Research, Research Centre for Capture Fisheries, Indonesia
Project Budget	\$399,533
Project Duration	01/07/2003 to 31/03/2007 (Project extended from to 31/03/2007)
ACIAR Research Program Manager	Mr Barney Smith

Project background and objectives

Illegal, unreported and unregulated fishing is a major impediment to the sustainable management of fisheries. Effective fisheries management relies on accurate data collection, especially relating to fish catches and setting of catch quotas at sustainable levels. Without these forms of control, overfishing is likely and if continued will result in a collapse of a fishery.

In March 2001 the Food and Agriculture Organisation (FAO) Committee introduced the International Plan of Action to Prevent, Deter and Eliminate IUU Fishing. This plan requires FAO members to develop a National Plan of Action by October 2004. The FAO Plan calls for bilateral, regional and international cooperation to deal with IUU fishing. This is especially the case for shared fisheries that require coordination between countries. One such shared fishery is the Sulawesi or Celebes Sea, shared by Indonesia and the Philippines.

The key factors contributing to the IUU problem in the Sulawesi Sea include:

- lack of agreement between Indonesia and Philippines on a maritime boundary
- the complex administrative and legal structures (national, provincial and district interactions) on both sides of the Sulawesi Sea

- the difficulties of harmonising management, administrative and policy measures across two national boundaries
- the high incidents of illegal foreign fishing activities in the area.

In addition to developing National Plans of Action, a cooperative framework between Indonesia and Philippines is required to comprehensively deal with the IUU fishing problem between the two countries because they share a number of fish stocks. Cooperation is, in fact, a significant requirement under the International Plan of Action on IUU Fishing. The groundwork for this has been established in a previous ACIAR project (FIS/2000/163), which initiated discussions between the two countries leading to a cooperative framework to tackle IUU fishing.

Another objective is to research the options for developing policy and management frameworks to deal with the extensive IUU fishing Indonesia and the Philippines, and in so doing, implement the outcomes of the 2001 ACIAR Small Project.

Project Outcomes

The research identified gaps in the current national fisheries policy and regulatory frameworks against the requirements of the International Plan of Action to Combat IUU Fishing. These gaps, as well as the measures that would need to be adopted by Indonesia and the Philippines to address IUU fishing, are elaborated in the research papers written for the project and discussed extensively in the national workshops conducted in September 2004 for the Philippines and in March 2005 for Indonesia.

From these studies and activities, the research generated sufficient information to assist the two countries in developing their National Plans of Action. Reports have also been written on IUU fishing issues in the Sulawesi Sea, which were discussed during the bilateral workshop held in June 2006. Discussions in the bilateral workshop led to the formulation of a proposed regional framework to address IUU fishing in the Sulawesi Sea.

The research successfully achieved all its objectives and implemented the components of the project. The outputs of the research contributed to the understanding of IUU fishing in Philippine and Indonesian waters. The main outcomes of the research are the audit of IUU fishing in the Philippines and Indonesia, drafting of the national plans of action to combat IUU fishing, and the development of a regional framework for addressing IUU fishing in the shared waters of the Sulawesi Sea.

The research assisted the Philippines and Indonesia in implementing their commitments under the IPOA-IUU and facilitated policy and legislative reforms to promote sustainable management of fisheries in the waters of these States. The research also generated enormous national awareness on IUU fishing in Indonesia and the Philippines, particularly on the negative impacts of IUU fishing and the need to adopt a holistic approach to address the problem. National Committees on IUU fishing were established in both countries to draft the national plans of action and serve as the focal point for policy discussion and recommendation to fisheries administrations of the respective countries. The members of these committees included government officials, academics, and stakeholders who have contributed significantly to the IUU fishing project.

At the bilateral level, the project assisted in improving the fisheries relationship between Indonesia and the Philippines, resulting in the resumption of bilateral discussions on fisheries matters in the Sulawesi Sea. During the bilateral workshop, a framework for bilateral cooperation to address IUU fishing was agreed to by the Philippines and Indonesia. This framework includes measures that would address not only the IUU fishing problems in the Sulawesi Sea but also the general fisheries management resource issues in the area. Hence, the research project promoted greater bilateral cooperation and consultation between Indonesia and the Philippines in managing joint fish stocks in the absence of agreed boundaries.

The project also had an impact at the greater Southeast Asian and Asia Pacific regions. When the Food and Agriculture Organisation held the Regional Workshop on IUU Fishing in the Southeast Asian region in 2004, this research was cited as one of the first significant projects on IUU fishing in the region which assisted countries like Indonesia and the Philippines to fulfil their international commitments to formulate national plans of action to address the problem. To date, the Philippines and Indonesia remain the only two countries in Southeast Asia which have drafted their national plans of action. More recently, Australia and Indonesia have convened a Senior Officials Meeting to promote responsible fishing practices and address IUU-related problems in the Asia Pacific region. The research project served as a catalyst in increasing the awareness on IUU fishing in the region and the need for regional efforts to address the problem. Fifteen research papers were prepared for the project, and these have been collated into a monograph.

PLIA/2005/151: Philippine policy linkage scoping study

Bilateral

Overseas Collaborating Countries	Philippines
Commissioned Organisation	Centre for International Economics, Australia
Project Leader	Dr Sandy Cuthbertson Phone: 02 6245 7800 Fax: 02 6245 7888 Email: scuthbertson@thecie.com.au
Collaborating Institutions	SEAMEO Regional Centre for Graduate Study and Research in Agriculture, Philippines
Project Budget	\$77,400
Project Duration	16/06/2006 to 15/03/2007
ACIAR Research Program Manager	Dr Jeff Davis

Project background and objectives

This is a scoping study which will review the economic and policy environment in the Philippines, especially for the agriculture, forestry and fisheries sectors. It will assess the importance of this environment as a constraint to the adoption of ACIAR funded project outcomes. A workshop will be held in the Philippines to consider the findings and determine whether there are follow-up projects on some of these issues which could achieve some changes in the environment and thus improve the likelihood of future adoption. If appropriate it will develop a project proposal for the follow-up activities.

Project Outcome

The project provided a comprehensive review of the agricultural policy environment in the Philippines and possible aspects of this which may constrain adoption of research outcomes. However, it was not able to relate this closely to current and future ACIAR research. This will be done as part of follow-up activities such as the new Horticulture mega multidisciplinary projects.

The study established good collaborative links between senior practical policy people in the Philippines and the Australian research group. The study report has been considered by the ACIAR Philippine group and is now being finalised for publication.

7.4 Other

Projects:

Active

CIM/2002/106

Fertilisation-independent formation of embryo, endosperm and pericarp for apomictic hybrid rice (IRRI)

CIM/2002/106: Fertilisation-independent formation of embryo, endosperm and pericarp for apomictic hybrid rice

Multilateral

Overseas Collaborating Countries	Philippines
Commissioned Organisation	International Rice Research Institute, Philippines
Project Leader	Dr John Bennett Phone: +63 2 8450563 Fax: +63 2 8450606 Email: J.BENNETT@cgiar.org
Collaborating Institutions	CSIRO Plant Industry, Australia International Rice Research Institute, Philippines
Project Budget	\$1,500,001
Project Duration	01/07/2003 to 30/06/2008
ACIAR Research Program Manager	Dr Paul Fox

Project background and objectives

Stagnating productivity of irrigated rice (*Oryza sativa*) over the past decade has seen the rate of increase in production fall below the rate of population increases. This creates concerns for medium to long-term food security. Throughout Asia rice is the staple crop food, with more than 90 per cent of all rice grown in the region and 50 per cent of dietary calories coming from rice consumption. Hybrid rice, incorporating two or more differing rice lines with traits from both parents, has been shown to provide yield boosts.

In China the introduction of hybrid rice accounted for a one-off yield increase of around 30 per cent in production per hectare. Other Asian countries are hoping to use hybrids to reproduce this boost. Most hybrid varieties are intraspecific (for instance two lines from the same type – indica/indica). It is expected that these hybrids will be superseded by interspecific hybrids that offer greater advantages through combining two lines of different types with a combined traits of both parents.

Making high-yielding hybrid varieties available to the poor may be helped by one-line or apomictic production. This is potentially cheaper and more flexible than multi-line hybrids while still offering the same advantages. One line hybrids reproduce asexually through apomixis (fertilisation of the egg by non-sexual means). In rice this process is possible through synthetic activation of apomixis. Achieving this in single line hybrids would be cheaper and more likely to ensure equal yields than in multi-line hybrids.

Through this project research will address key issues in developing apomictic rice, focusing on the role of fertilisation independent genes in other plants for their application to hybrid rice.

Project Progress

Year 3 (01/07/2006–30/06/2007)

Our goal is to make the benefits of hybrid rice available to poor farmers by developing a cheaper and more flexible form of hybrid seed production that allows farmers to multiply seeds in their own fields. We aim to fix the heterozygosity of hybrids through a form of apomixis – seed production in which the genetic constitution of progeny plants is identical to that of the hybrid. To maintain a constant genetic constitution, the embryo of the progeny seed must be formed without undergoing meiosis, a form of sexual recombination. The form of apomixis that we plan to introduce into rice is known as apospory and exists in many wild grasses but not in rice or its close relatives.

In wild grasses, apospory develops in cells alongside the megaspore mother cell (MMC) of the rice ovule. These cells (aposporous initials, AI) are similar to the MMC but differ from it in failing to undergo meiosis. Multiple secondary MMCs are observed in the ovules of the *mac1* mutant of maize and the *msp1* mutant of rice. We hypothesised that these secondary MMCs may be a first step towards apospory and that the next step would be to by-pass meiosis in the secondary MMCs.

Unfortunately, the *msp1* mutant is not a convenient platform from which to develop AIs in rice because it is male-sterile. Staff of IRRI searched for a rice gene other than MSP1 that could be inactivated to produce secondary MMCs in the ovule without causing male sterility. Based on studies in *Arabidopsis thaliana* we suspected that MSP1 protein interacts with a small protein that we term TPD1-like1, or TDL1.

We found two close homologues of TPD1 in the rice genome (TDL1A and TDL1B). Furthermore, these two genes are co-expressed during meiosis with MSP1. We used yeast 2-hybrid analysis and bimolecular fluorescence complementation to show that TDL1A is a ligand of MSP1. Furthermore, when we used RNA interference (RNAi) to down-regulate the OsTDL1A gene, we found that the OsTDL1A-RNAi transgenic plants produce secondary MMCs in the ovule without causing male sterility. This work has been submitted to *Plant Journal* for publication. We are now developing a method for by-passing meiosis in the secondary MMCs to produce AIs in rice.

Naturally occurring AIs form embryo sacs that undergo parthenogenesis to produce embryos without fertilisation. Again, studies on *Arabidopsis thaliana* suggested that inactivation of the polycomb complex is essential not only for parthenogenesis but also for autonomous endosperm formation. Staff of CSIRO Plant Industry have, accordingly, isolated the genes encoding the rice polycomb complex. We used either RNAi or insertion mutagenesis to interfere with the expression of these genes and found that two distinct checkpoints in the sexual development of the ovary have been overcome: (i) the checkpoint that prevents ovary enlargement in the absence of fertilisation and (ii) the checkpoint that prevents endosperm formation without fertilisation of the cell central of the embryo sac.

The rice homologue of the *Arabidopsis* gene CLF appears to be especially important in this context. The next steps are (i) to combine these two features to obtain large autonomous endosperms and then (ii) to manipulate the polycomb complex further to obtain parthenogenetic embryo formation. For step (ii), we are exploring the rice homologues of the *Arabidopsis* gene MSL1, which mediates signalling between endosperm and embryo.

In summary, our data support the emerging consensus that the sexual and aposporous pathways of plant seed production share many genes but differ at two major stages:

1. the onset of meiosis
2. the checkpoints preventing seed development in the absence of fertilisation. This consensus raises the intriguing evolutionary question as to whether sexuality is a modification of apomixis or vice-versa.

8 ACIAR Publications

This is a list of ACIAR publications produced in 2006-07. Print copies are available by emailing comms@aciarc.gov.au, or electronic versions may be downloaded from ACIAR's website www.aciarc.gov.au.

Monographs	
119a	Guidelines for surveillance for plant pests in Asia and the Pacific [Indonesian translation]. Teresa McMaugh, Indonesian translation by Andi Trisyono, 2007, 192 pp.
123a	Agricultural development and land policy in Vietnam [Vietnamese translation]. Sally P. Marsh, T. Gordon MacAuley and Pham Van Hung (eds), Vietnamese translation by Pham Van Hung, 2007, 272 pp.
124	Economically important sharks and rays of Indonesia. W.T. White, P.R. Last, J.D. Stevens, G.K. Yearsley, Fahmi and Dharmadi, 2006, 330 pp.
125	Aquaculture in Papua New Guinea: status of freshwater fish farming. Paul T. Smith (ed.), 2007, 123 pp.
126	Agricultural development and land policy in Vietnam: policy briefs. Sally P. Marsh, T. Gordon MacAulay and Pham Van Hung (eds), Vietnamese translation by P.V. Hung, 2007, 72 pp.
127	Postlarval fish capture and grow-out. Cathy Hair, Regon Warren, Ambo Tewaki and Ronnie Posalo, illustrated by Kisi Mae, 2007, 32 pp.

Proceedings	
122	Improving yield and economic viability of peanut production in Papua New Guinea and Australia. Rao C.N. Rachaputi, Graeme Wright, Lastus Kuniata and A. Ranakrishna (eds), 2006, 118 pp.
124	Heart rot and root rot in tropical Acacia plantations. Karina Potter, Anto Rimbawanto and Chris Beadle (eds), 2006, 92 pp.
125	Coconut revival: new possibilities for the 'tree of life'. S.W. Adkins, M. Foale and Y.M.S. Samosir (eds), 2006, 104 pp.

Technical Reports	
64	Towards improving profitability of teak in integrated smallholder farming systems in northern Laos. Stephen Midgley, Michael Blyth, Khamphone Mounlamai, Dao Midgley and Alan Brown, 2007, 96 pp.
65	A review of animal health research opportunities in Nusa Tenggara Timur and Nusa Tenggara Barat provinces, eastern Indonesia. Bruce M. Christie, 2007, 76 pp.
66	Modelling minimum residue thresholds for soil conservation benefits in tropical, semi-arid cropping systems. M.E. Probert, 2007, 36 pp.

Working Papers	
62	Report on a review of ACIAR-funded projects on Rhizobium during 1983–2004. David F. Herridge, 2006, 48 pp.
63	Economics and market analysis of the live reef-fish trade in the Asia–Pacific region. Brian Johnston (ed.), 2007, 172 pp.

Impact Assessment Series Reports	
44	Impact assessment of capacity building and training: assessment framework and two case studies. Jenny Gordon and Kevin Chadwick, 2007, 120 pp.
45	Development of sustainable forestry plantations in China: a review. John W. Turnbull, 2007, 78 pp.
46	Mite pests of honey bees in the Asia–Pacific region. Michael Monck and David Pearce, 2007, 32 pp.
47	Improved Australian tree species for Vietnam. Hayden Fisher and Jenny Gordon, 2007, 36 pp.
48	Assessment of capacity building: overcoming production constraints to sorghum in rainfed environments in India and Australia. Chloe Longmore, M. Cynthia Bantilan and Jenny Gordon, 2007, 44 pp.
49	Minimising impacts of fungal disease of eucalypts in South-East Asia. Hayden Fisher and Jenny Gordon, 2007, 36 pp.
50	Improved trade in mangoes from the Philippines, Thailand and Australia. Michael Monck and David Pearce, 2007, 48 pp.
51	Growing trees on salt-affected land. James Corbishley and David Pearce, 2007, 44 pp.

Corporate publications	
	ACIAR Annual Report 2005–06. October 2006
	ACIAR Annual Operational Plan 2007–08. June 2007
	Adoption of ACIAR project outputs: studies of projects completed in 2002–2003. J. Gordon and J. Davis (eds), 2007, 64 pp.
	ACIAR Publications Catalogue 2007
	Partners in Research for Development magazine Winter 2006 Spring 2006 March–June 2007 July–October 2007
	More crop per drop from Australian International Research (Report on how Australian benefits from ACIAR water research)

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ACIAR is an Australian Government Statutory Authority that operates within the portfolio of Foreign Affairs and Trade. ACIAR aims to enhance rural household incomes and broader economic growth by investing in international research partnerships that encourage agricultural development, sustainable use of natural resources and capacity-building of benefit to partner countries and Australia.

ACIAR works collaboratively with AusAID in areas of mutual priority, with both organisations contributing to the whole-of-government emphasis of the aid program.

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