



Australian Government
Australian Centre for
International Agricultural Research

ACIAR Country Profiles 2009–10



VIETNAM

ACIAR Country Profiles 2009–10: Vietnam



ACIAR

Research that works for developing
countries and Australia

www.aciar.gov.au

2009

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Contents

1	Overview.....	4
1.1	About ACIAR.....	4
1.2	Capacity building and training.....	6
2	Vietnam chapter from the Annual Operational Plan 2009–10	8
2.1	Medium-term strategy	8
2.2	Key performance indicators (2009–10).....	8
2.3	Position	9
2.4	Research priorities	9
3	Active projects in Vietnam.....	12
3.1	Subprogram 1: Securing Vietnamese market competitiveness and resilience to biosecurity and climate change challenges	12
3.2	Subprogram 2: Development of high-value aquaculture industries.....	19
3.3	Subprogram 3: Towards higher value plantation forestry products.....	25
3.4	Subprogram 4: Optimising resource management for profitable and sustainable agricultural production in south-central coastal Vietnam	30
3.5	Subprogram 5: Poverty reduction through market engagement for smallholders in the northern and north-western highlands	35
4	Projects expected to start in 2009–10.....	41
5	Vietnam chapter from the Annual Report 2008–09.....	42
5.1	Position	42
5.2	Achievements.....	42
6	Projects concluded in 2008–09.....	47
7	Impact Assessment Program	68
7.1	Impact assessments undertaken in 2008–09	68
7.2	Impact assessments planned for 2009–10	70
8	Appendix 1: ACIAR contacts	72
8.1	Country Office	72
8.2	R&D Program.....	72
9	Appendix 2: ACIAR publications.....	73

1 Overview

1.1 About ACIAR

The Australian Centre for International Agricultural Research (ACIAR) is an Australian government statutory authority that operates as part of the Australian Aid Program within the portfolio of Foreign Affairs and Trade. The core principles of Australia's aid program are:

- accelerating progress towards the Millennium Development Goals
- a recognition that, while economic growth is the most powerful long-term solution to poverty, economic growth will not, by itself, deliver fair and stable societies
- a strong emphasis on the Asia–Pacific, while also increasing our efforts in Africa and South Asia
- an emphasis on the power of education to promote development
- a commitment to continue to improve effectiveness.

These principles guide the aid program in delivering sustainable development gains.

ACIAR was established in 1982 to assist and encourage Australia's agricultural scientists to use their skills for the benefit of developing countries but also to work to resolve Australia's own agricultural problems. It contributes to the aid program objectives of advancing Australia's national interest, poverty alleviation and sustainability. Australia has an exceptionally strong capacity in agricultural research and development, and is also unique amongst developed countries in possessing large agricultural areas in the tropics and subtropics.

ACIAR's corporate mission is to achieve more productive and sustainable agricultural systems, for the benefit of developing countries and Australia, through international agricultural research partnerships. ACIAR's principal goals are to reduce poverty, improve food security and care for the natural resource base for agriculture. To achieve these goals, ACIAR facilitates and supports bilateral research and development activities in a broad range of agricultural areas, including crop production and protection, animal health and animal production, fisheries, forestry, land and water resources management and postharvest technology. ACIAR also commissions studies of the economic and policy issues concerned with the management of agricultural systems and natural resources, and helps partner countries build their capacity to engage with the increasingly global market economy.

Research is not carried out by ACIAR itself. ACIAR plans, funds and manages projects which are carried out by public sector groups including universities, state departments, and other research providers such as the Commonwealth Scientific and Industrial Research Organisation (CSIRO), in partnership with their counterparts in developing countries.

ACIAR also administers the Australian Government's contribution to the international agricultural research centres, and links the centres through multilateral projects to Australian research organisations.

ACIAR is structured into the following research program areas:

- Agribusiness (AGB)
- Agricultural Development Policy (ADP)
- Agricultural Systems Management (ASEM)

- Animal Health (AH)
- Crop Improvement and Management (CIM)
- Cropping Systems and Economics (CSE)
- Fisheries (FIS)
- Forestry (FST)
- Horticulture (HORT)
- Land and Water Resources (LWR)
- Livestock Production Systems (LPS)
- Pacific Crops (PC)
- Soil Management and Crop Nutrition (SMCN).

In developing research projects for these regions, ACIAR places emphasis on priorities determined in consultation with partner countries, balancing these against Australia's comparative advantage and capacity to assist.

Our partnership model

ACIAR develops a specific program for each partner country that is aligned with its national agricultural priorities. The programs are developed in close consultation with government and research organisations from the partner country and Australia.

ACIAR's research also closely aligns with the Australian aid program's renewed focus on poverty reduction. It is integrated closely with the Australian 'whole-of-government' aid program strategies for specific regions.

Australia's scientists work within a very strong network of institutions in Australia and partner countries, including CSIRO, federal and state government organisations and universities.

ACIAR's projects are split up into bilateral and multilateral projects. Bilateral projects are led by an Australian organisation, with collaborators in the partner country and Australia. Multilateral projects are led by an international agricultural research centre (IARC), in partnership with other research organisations.

Where we work

ACIAR carries out research in the Asia–Pacific region, and currently has projects in the following regions:

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

Working internationally

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 CGIAR engagement in the Asia–Pacific and to commission projects that are consistent with ACIAR's country program strategies.

1.2 Capacity building and training

Building the capacity of agricultural research institutions and researchers in partner countries is one of ACIAR's key priorities. The training program aims to enhance the research capabilities of institutions and individuals involved in ACIAR projects. This also assists in research adoption, productive partnerships and project development.

The ACIAR training program has a budget in 2009–10 of approximately \$6.58 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 (\$0.75 million) and sponsorship of attendees at Masterclasses 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.

John Allwright Fellowships

The objective of the John Allwright Fellowships is to increase the research and development capacity of ACIAR partner-country institutions. The fellowships are awarded to partner-country researchers involved in an ACIAR project to undertake postgraduate studies in tertiary institutions in Australia. Studies focus on areas related to the topic or theme of the ACIAR project. The ACIAR John Allwright Fellowship scheme accounts for approximately \$5.6 million (this figure includes \$3.5 million from the Australian Agency for International Development; AusAID) of the training program budget in 2009–10.

John Allwright Fellowships in Vietnam

		PhD	MSc/Other
Active	Male	9	4
	Female	2	3
Concluded	Male	7	6
	Female	1	1

Returnee Small Project Awards Scheme

The Returnee Small Project Awards Scheme provides small grants to John Allwright Fellows after they complete postgraduate studies and return to their employers in their home country. The scheme allows Fellows to undertake an activity that continues, or is related to, the ACIAR project in which they are involved. The funding is primarily for developing small-scale research projects, with the intention of catalysing longer-term support and ongoing international collaboration.

John Dillon Memorial Fellowships

John Dillon Fellowships provide career development opportunities in Australia for outstanding mid-career agricultural scientists and economists from ACIAR partner countries. The aim is to develop the leadership skills of Fellows in the area of agricultural research management, agricultural policy and/or extension technologies through exposure to Australian agriculture across a range of best-practice organisations involved in

research, extension and policymaking.

Short courses and workshops

A limited number of short courses and workshops are undertaken as part of the training program for people involved in ACIAR projects. Most activities are directly managed by ACIAR, but some are managed by the Crawford Fund. The courses and workshops are presented by both public- and private-sector providers and topics are chosen based on advice from senior officials in partner countries.

On-the-job training

On-the-job training as part of ACIAR projects has been shown to deliver excellent returns in terms of capacity building (in addition to the benefits to farmers). The partnership model for ACIAR projects means that Australian and partner-country scientists are working side by side throughout the life of the project.

2 Vietnam chapter from the Annual Operational Plan 2009–10

2.1 Medium-term strategy

ACIAR's Vietnam strategy emphasises technical and agribusiness research to enhance smallholder incomes from selected areas of high-value agriculture, aquaculture and forestry. Since late 2007, the agriculture programs have increasingly focused on the following two regions, where poverty has persisted and where Australian agricultural technical skills have an ability to assist in development:

- the south-central coast, with an emphasis on research to underpin profitable but sustainable crop cultivation and livestock production systems in challenging environments (poor, sandy soils under water-limiting conditions), and research on the development of sustainable mariculture systems for high-value species
- the north-western highlands, where opportunities exist for selected horticultural products (high-value temperate fruits, flowers and vegetables), high-value crops (maize), livestock and forestry products. Further research will focus on supply chains where smallholders have become recently connected with markets. Research impacts will emerge through better market integration, ensuring improved profitability with more sustainable agricultural management practices within farming systems, supported by collaborative research to stimulate long-term practice change.

ACIAR recognises the vulnerability of agriculture in the Mekong Basin to climate variability and change. A small program focusing on climate change adaptation and mitigation in rice systems in the Mekong Delta of Vietnam will also be developed. The emphasis of interventions at the farm scale complements catchment-level and whole-of-Mekong-Basin programs on water and climate change supported by AusAID and other donors.

ACIAR's fisheries and forestry programs, while differing in regional focus, have a common emphasis on improving incomes for farmers and the processing industry by targeting higher-value products and markets. The fisheries program focuses on aquaculture; emphasising nutrition and high-value species. The forestry program will have an increased emphasis on genetics, silviculture and processing technologies for higher-value wood products.

Linkages to the programs of AusAID and other donors working in these regions, such as the Danish International Development Agency (DANIDA), are being developed, and there will be a particular focus on linking central research institutes with provincially based research and extension departments and mass organisations. Cross-cutting themes include: a particular emphasis on applying Australian expertise in crop protection and biosecurity to prevent product losses and improve quality; agricultural economic studies to back the application of technical research; and the development of targeted communications strategies appropriate to each ethnic group and other beneficiaries.

2.2 Key performance indicators (2009–10)

- implementation of the first two projects of a new agricultural livelihoods program in the north-western highland provinces
- introduction of cost-effective and environmentally friendly aquaculture feeds for a wider range of species, backed by economic analysis
- development of technologies for fast-growing forest plantations for high and sustainable productivity, particularly on degraded soils

- production and management practices developed for two indigenous vegetables and two temperate fruit species based on regional/market comparative advantage in northern Vietnam
- development of management practices for sustainable and profitable farming systems best suited to local conditions in south-central coastal Vietnam.

2.3 Position

Vietnam has undergone significant economic growth in recent years and is expected to achieve 'middle income' country status soon. Much of the significant economic growth in agriculture (and the rest of the economy) is due to market competitiveness and demand for exports. The benefits of the significant economic growth have primarily influenced the urban areas of Ho Chi Minh City, Hanoi and adjacent regions, but there has been little trickle-down to rural areas. Vietnam will continue to have a comparatively high percentage of rural population over the next decade, and so issues of rural poverty and structural adjustment remain at the top of the policy agenda. Productivity on a land or labour basis is still very low, and the small scale of production on individual farms, fragmented land holdings and increases in input costs are significant problems. Ethnic minority groups and those in remote regions are particularly disaffected, and the Government of Vietnam is providing greater focus on programs to assist these groups.

During 2008–09 the program was re-shaped to address a targeted number of major areas where Australian expertise has the ability to impact on smallholder livelihoods. New programs addressing management of soil, water and livestock systems constraints for improved incomes in south-central coastal Vietnam, and development of high-value agricultural products from highland north-western Vietnam, have been formulated to address socioeconomic and marketing issues as well as specific technical constraints. Australian technical expertise in managing poor soil fertility and limited water will be crucial to the program in south-central coastal Vietnam, while Australian expertise in temperate agriculture (including horticultural and livestock production) will be valuable in north-western Vietnam. ACIAR will also continue to seek greater involvement of the private sector and non-government organisations (NGOs) in projects, linkages with other research and development activities and donors, and development of closer linkages between central Vietnamese research organisations and province-based research and extension capacity.

Our program aligns with the Vietnamese Government's 2006–10 Five-Year Agricultural and Rural Development Plan, particularly the first strategy (improvements in agricultural productivity, product quality and marketing) and second strategy (development of processing for agricultural and forest products). ACIAR also aligns with the Paris Declaration and Hanoi Core Statement by integrating its work closely with Government of Vietnam programs and other donors wherever possible.

2.4 Research priorities

ACIAR has a program of annual consultations with major partner organisations in Vietnam to discuss program strategies and new projects. Regional consultations to establish specific priorities for cooperation in south-central coastal Vietnam were held in March 2008, and for north-western highland regions in September 2008. The full record of the consultations is at <www.aciar.gov.au>. The majority of ACIAR-supported informal and postgraduate research degree training will continue to be delivered within the context of active projects; however, ACIAR will also support short-course training in selected areas. Indicative priorities are grouped under the following subprogram themes.

Subprogram 1: Securing Vietnamese market competitiveness and resilience to biosecurity and climate change challenges

- Assessment of domestic structural impacts of trade agreements, including sanitary and phytosanitary standards and market access
- Enhancement of quarantine capacity, particularly relating to disease diagnosis and management
- Risk assessment of climate change to rice production in the Mekong Delta region and analysis of technical and policy approaches to reduce emissions from rice-based systems.

Subprogram 2: Development of high-value aquaculture industries

(regional focus: Mekong Delta (Can Tho, Soc Trang); central coast (Nha Trang); north-eastern Vietnam (Haiphong, Quang Ninh))

- Introduction of cost-effective and environmentally friendly aquaculture feeds
- Development of profitable and environmentally responsible grow-out technologies for marine cage culture and pond culture in sandy coastal areas
- Transfer of existing knowledge from ACIAR aquaculture projects, particularly for culture of high-value species.

Subprogram 3: Towards higher value plantation forestry products

(regional focus: north-eastern Vietnam, Red River Valley, central highlands)

- Development of technologies for fast-growing forest plantations for high and sustainable productivity, particularly on degraded soils
- Improvement of plantation wood-processing efficiency, especially for small eucalypts and acacias through small-scale sawing, drying and preservation, and through development of engineered products.

Subprogram 4: Optimising resource management for profitable and sustainable agricultural production in south-central coastal Vietnam

(provincial focus: Binh Thuan, Ninh Thuan, Khanh Hoa, Phu Yen and Binh Dinh)

- Analysis of markets and supply chains to identify critical points for selected commodities, to focus technical intervention for delivery of market impact
- Enhancements in supply-chain performance, including assessment of incentives for improved quality at the farmer level, including better postharvest handling
- Development of sustainable crop production systems that target market opportunities through:
 - integrated management strategies for efficient use of available nutrient and water resources for improving soil fertility and sustaining crop production
 - sustainable irrigation practices that make greatest use of on-farm water resources and protect groundwater resources from salinisation
 - sustainable and cost-effective cropping systems suited to local conditions, including intercropping systems using legumes with cashew and mango, and interventions to increase the profitability and productivity of vegetable cropping
- Better integration of beef cattle production with crop production systems through:
 - analysis of factors affecting the efficiency of fattening cattle for the development of feeding options at different times of the year

- use of available on-farm and off-farm feed resources
- evaluation of benefits of using cattle manure for soil structural and fertility improvement in crop production.

Subprogram 5: Poverty reduction through market engagement for smallholders in the northern and north-western highlands

(provincial focus: Son La, Dien Bien, Lai Chau, Lao Cai and Yen Bai)

- Better integration of smallholders into profitable markets for high-value crops, through:
 - market and supply-chain analysis to identify critical points to enhance stakeholder relationships and focus technical interventions to improve competitiveness
 - alternative methods for smallholders to access local markets and improved market information
 - market research and quality standards development for enhanced market access for fresh and processed products
 - improving production and processing technologies for temperate fruit and vegetables
- Improved natural resources management to sustain crop productivity and profitability on sloping lands through:
 - improving crop nutrient and land management techniques on sloping lands
 - alternative second crop options and integration of agroforestry into farming systems
 - quantifying soil fertility changes under different cropping systems and integration of local knowledge to improve management
- Improved management and marketing systems for smallholder ruminants and pigs through:
 - identification of constraints in the livestock supply chains
 - improved feed availability and integration of appropriate forage varieties into the farming system
 - improved management of reproduction and disease prevention and control
- Enhanced capacity of local service providers (public and private sector) to increase the long-term sustainability and profitability of smallholders through:
 - alternative methods for delivery of advisory services appropriate for ethnic minorities
 - identification of policies that support more sustainable use of sloping lands.

3 Active projects in Vietnam

3.1 Subprogram 1: Securing Vietnamese market competitiveness and resilience to biosecurity and climate change challenges

Increased economic integration arising from trade agreements poses both threats and opportunities. There is a greater emphasis on quality and marketing for both domestic and export destinations. As a major rice exporter, Vietnam is a significant contributor to regional food security, but low-lying areas in the Mekong Delta are particularly prone to both biosecurity (pest and disease) risks and the anticipated impacts of climate change. A new program of research is being designed in 2009 to assist adaptation to climate change at the farm level, emphasising more efficient use of soil and water resources. Better soil and water management, along with improved application and timing of nitrogenous fertilisers, should also reduce emissions from smallholder rice-based systems.

<i>Project number</i>	<i>Project title</i>
ADP/2003/060	Implementation of rodent management in intensive irrigated rice production systems in Indonesia and Vietnam
AGB/2005/113	Structural adjustment implications of trade liberalisation in Vietnam
AH/2004/040	The epidemiology, pathogenesis and control of highly pathogenic avian influenza (HPAI) in ducks in Indonesia and Vietnam
LPS/2005/063 (multilateral)	Improving the competitiveness of pig producers in an adjusting Vietnam market (ILRI)
SMCN/2002/073	Efficient nutrient use in rice production in Vietnam achieved using inoculant biofertilisers

ADP/2003/060: Implementation of rodent management in intensive irrigated rice production systems in Indonesia and Vietnam

Rodent pests are one of the main causes of rice losses throughout Asia. In Indonesia (number one pest) and Vietnam (in top three), preharvest losses are a chronic problem, often resulting in chemical or poison use by farmers. Despite this approach, farmers have indicated that rodents are the problem of which they have the least control. Past ACIAR research developed integrated management approaches that target rodent population cycles and significantly reduce rice losses. Work with World Vision in Vietnam has helped refine these approaches at the village level, and provided insights into extending the approach in such settings. This will now be continued in Indonesia and Vietnam's lowland irrigated rice-growing areas.

Overseas collaborating countries

Indonesia, Vietnam

Commissioned organisation

CSIRO Sustainable Ecosystems, Australia

Project leader

Mr Peter Brown
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Collaborating institutions

World Vision Vietnam, Vietnam
Plant Protection Department, Vietnam
International Rice Research Institute, Philippines
Assessment Institute for Agricultural Technology, Indonesia

Project budget

\$757,881

Project duration

01/04/2006 to 30/09/2009
(Project extended from 01/10/2009 to 31/03/2010)

ACIAR Research Program Manager

Dr Simon Hearn

Website

<www.aciar.gov.au/project/ADP/2003/060>

AGB/2005/113: Structural adjustment implications of trade liberalisation in Vietnam

Vietnam has achieved remarkable economic growth since it liberalised its markets, and further economic growth and opportunities are predicted both within and outside the agriculture sector. However, significant structural adjustment pressures are expected in the short to medium term. The effect of these pressures on rural household income will be regionally and commodity specific, with some households gaining from increased opportunities while others will be worse off. Understanding the nature and magnitude of the distributional impacts of trade liberalisation, the difference between short-run and long-run costs and opportunities associated with structural adjustment is essential for designing effective policy. This project will assess structural adjustment issues associated with trade liberalisation, using quantitative economic models. This will involve identification of vulnerable groups and industries and assessment of domestic policy options for facilitating structural adjustment. The economic cost associated with 'avoidance' policies will also be quantified. A set of existing/known/developed modelling tools will be used to focus on different scales of the problem. This will draw on existing trade models, but the main emphasis will be on developing capacity for analysing incomes and responses at the household level. The effectiveness of the economic models and subsequent domestic policy will also be assessed.

Overseas collaborating country

Vietnam

Commissioned organisation

Australian National University, Crawford School of Economics and Management, Australia

Project leader

Dr Donna Brennan
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Collaborating institution

Institute of Policy and Strategy for Agricultural and Rural Development, Vietnam

Project budget

\$396,071

Project duration

01/03/2008 to 28/02/2010

ACIAR Research Program Manager

Mr David Shearer

Website

<www.aciar.gov.au/project/AGB/2005/113>

AH/2004/040: The epidemiology, pathogenesis and control of highly pathogenic avian influenza (HPAI) in ducks in Indonesia and Vietnam

Highly pathogenic avian influenza (HPAI or 'bird flu') is a virus infecting poultry and humans. A major pandemic is continuing in South-East Asia, North Asia and eastern Europe, where control of the disease in poultry is hampered by a lack of understanding of ducks as transmitters of the virus to chickens and to humans. Ducks may not always show signs of illness when infected with HPAI. The objectives of this project are to determine the epidemiological and virus-transmission characteristics of HPAI in intensive and smallholder mixed duck production systems in Indonesia and Vietnam and to develop more effective control strategies. The priority of the objectives has been confirmed by The Association of Southeast Asian Nations/Food and Agriculture Organization of the United Nations (ASEAN/FAO) and the Australian Government Department of Agriculture, Fisheries and Forestry. The objectives will involve both field and experimental activities. The Australian Biosecurity Cooperative Research Centre (CRC) and its partners, the Australian Animal Health Laboratory/CSIRO Livestock Industries and the University of Queensland will collaborate with the international partners. The Indonesian partners are the Department of Animal Health and the District Investigation Centre at Waites/Yogyakarta, Directorate General of Livestock Services and the Research Institute for Veterinary Science in Bogor. Partners in Vietnam include the National Institute for Veterinary Research (Hanoi) and the Department of Animal Health of Vietnam's Regional Animal Health Centre (Ho Chi Minh City). The results of this project will directly influence the national vaccination campaigns in both Vietnam and Indonesia and feed into an AusAID project on emerging zoonotic diseases, ASEAN, FAO and World Organisation for Animal Health (OIE) activities in the South-East Asian region.

Overseas collaborating countries

Indonesia, Vietnam

Commissioned organisation

Australian Biosecurity Cooperative Research Centre for Emerging Infectious Disease, School of Veterinary Science, Australia

Project leader

Dr Joanne Meers
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Fax: 07 3365 1255
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Collaborating institutions

University of Queensland, Australia
CSIRO Livestock Industries, Australia
Research Institute for Veterinary Science, Indonesia
Directorate General of Livestock Services, Indonesia
National Institute of Veterinary Research, Vietnam
Department of Animal Health, Vietnam

Project budget

\$1,501,340

Project duration

01/03/2006 to 28/02/2009
(Project extended from 01/03/2009 to 31/12/2009)

ACIAR Research Program Manager

Dr Doug Gray

Website

<www.aciar.gov.au/project/AH/2004/040>

LPS/2005/063: Improving the competitiveness of pig producers in an adjusting Vietnam market

In Vietnam, demand for pork is increasing rapidly. Successful commercial smallholder pig farming may help to meet demand while serving as a vehicle for alleviating some of the country's widespread rural poverty. The overall aim of this project is to identify options for technology, policy and forms of market institution or coordination that will give smallholder pig producers in Vietnam better access to higher-value market chains and thus help them to raise their incomes. The work will lead to a strategy to involve development and/or private-sector partners in Vietnam in pilot-testing a set of recommended options.

Overseas collaborating country

Vietnam

Commissioned organisation

International Livestock Research Institute, Kenya

Project leader

Dr Stephen Staal
Phone: 254 20 422 3000
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Email: s.staal@cgiar.org

Collaborating institutions

University of Queensland, Australia
Institute of Policy and Strategy for Agriculture and Rural Development, Vietnam
International Food Policy Research Institute, United States of America
Oxfam GB, Vietnam

Project budget

\$782,785

Project duration

01/04/2007 to 31/03/2010

ACIAR Research Program Manager

Dr Peter Horne

Website

<www.aciar.gov.au/project/LPS/2005/063>

SMCN/2002/073: Efficient nutrient use in rice production in Vietnam achieved using inoculant biofertilisers

Since the 1980s, the plant growth-promoting rhizobacteria (PGPR) have been known to promote the nutrient-efficient growth of cereal crops. Preliminary research funded by ACIAR and AusAID has verified in field trials near Hanoi that the PGPR effect can reliably increase the average yield of rice by 10–20%. A biofertiliser product, now registered as Biogro, has been developed. This new project seeks to understand the function of the biofertiliser, while at the same time promoting its wider adoption in Vietnam and possible commercialisation. Simple product quality control will be developed. Experiments with Biogro on paddy rice in Australia will commence.

Overseas collaborating country

Vietnam

Commissioned organisation

University of Sydney, Faculty of Agriculture, Australia

Project leader

Professor Ivan R. Kennedy
Phone: 02 9351 3546
Fax: 02 9351 5108
Email: i.kennedy@usyd.edu.au

Collaborating institutions

CRC for Sustainable Rice Production, Australia
Hanoi University of Science, Vietnam
Institute of Agricultural Sciences of Southern Vietnam, Vietnam
Can Tho University, Vietnam
National Institute for Soils and Fertilisers, Vietnam
Vietnam Academy of Agricultural Sciences, Vietnam

Project budget

\$558,956

Project duration

01/07/2004 to 30/06/2007
(Project extended from 01/10/2008 to 30/09/2010)

ACIAR Research Program Manager

Dr Gamini Keerthisinghe

Website

<www.aciar.gov.au/project/SMCN/2002/073>

3.2 Subprogram 2: Development of high-value aquaculture industries

To effectively service the explosive growth of its aquaculture sector, the Government of Vietnam has invested heavily in research infrastructure and staff development. The ACIAR program has been tailored to complement this effort through targeted capacity building in key skill areas (genetics, fish nutrition), and the timely transfer and adaptation of suitable aquaculture technologies developed elsewhere under ACIAR-supported programs. Fish nutrition remains an important action area, with a focus on development of cost-effective formulated feeds to replace direct feeding of low-value or 'trash' fish for a range of key culture species (lobsters, mud crabs, barramundi, cobia, grouper). Increasing collaboration within Vietnam between aquaculture nutrition scientists and industry is a priority as is increased capacity in feed extrusion technology for manufacturers and new strategies for farmers to use pelleted feeds.

<i>Project number</i>	<i>Project title</i>
FIS/2002/077	Improved hatchery and grow-out technology for marine finfish in the Asia–Pacific region
FIS/2005/114	Building bivalve hatchery production capacity in Vietnam and Australia
FIS/2006/141	Improving feed sustainability for marine aquaculture in Vietnam and Australia
FIS/2006/144	Strengthening regional mechanisms to maximise benefits to smallholder shrimp farmer groups adopting better management practices
FIS/2007/094	Policy, institutional and economic constraints to aquaculture research adoption in Vietnam

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

Aquaculture of high-value marine finfish from the larval stage is hampered by poor survival rates. This barrier is impeding more widespread aquaculture activities, especially among smallholders, who stand to benefit through increased incomes. Seed-stock also continue to come mainly from wild fry and fingerlings. Developing diets to rear larvae, based on local ingredients, particularly in remote areas will cut down on unsustainable capture of seed-stock from the wild. Additional research will build on a previous project, developing more cost-effective diets. A socioeconomic study of constraints to technology will also be undertaken. Combined, this research should result in the development of more sustainable finfish aquaculture by increasing the supply of valuable finfish species.

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
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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
CSIRO Marine Research, Australia
Directorate General Aquaculture, Indonesia

Project budget

\$989,214

Project duration

01/07/2004 to 31/12/2007
(Project extended from 01/10/2009 to 31/03/2010)

ACIAR Research Program Manager

Dr Chris Barlow

Website

<www.aciar.gov.au/project/FIS/2002/077>

FIS/2005/114: Building bivalve hatchery production capacity in Vietnam and Australia

Bivalves, an excellent source of high-quality protein, are a popular food source in Vietnam. But the country trails its Asian neighbours in production, despite its 3,000-kilometre coastline and many native clams, mussels and oysters with excellent production potential. Only one-third of its 190,000-tonne production comes from aquaculture. Vietnam and China have many species in common, but China's production capacity has increased as it has moved from gathering natural seed to hatchery-produced seed. So far, attempts to establish hatcheries in Vietnam have been largely unsuccessful. In this project, Vietnam is embarking on a guided program of training and potential species evaluation to develop bivalve hatcheries.

Overseas collaborating country

Vietnam

Commissioned organisation

New South Wales (NSW) Department of Primary Industries, Port Stephens Research Centre, Australia

Project leader

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Collaborating institution

Research Institute for Aquaculture No. 1, Vietnam

Project budget

\$395,850

Project duration

01/07/2007 to 30/06/2012

ACIAR Research Program Manager

Dr Chris Barlow

Website

<www.aciar.gov.au/project/FIS/2005/114>

FIS/2006/141: Improving feed sustainability for marine aquaculture in Vietnam and Australia

Three previous ACIAR projects have focused on nutrition of important aquaculture species. This new project will profit from the results of the earlier projects and combine research efforts into the main issue in common—the reliance on low-value fish as the main feed source for aquaculture. This new project will study issues related to diet development and low-value fish replacement, and bring together a collective of important aquaculture sectors in Vietnam. The key subjects for study will be finfish (barramundi/Asian sea bass, grouper and cobia), mud crabs and spiny lobster. The research team will seek to identify the extent of feed ingredient resource risks and the barriers (perceived and real) to adoption of manufactured feed by marine aquaculture sectors. Understanding the risks (scientific, social, economic and environmental) will give the team a platform for developing strategies to address them—ideally leading to greater adoption of manufactured feed in Vietnam and improved use of alternative raw materials in both Vietnam and Australia. Having one collective project will ensure maximisation of resource-sharing and knowledge transfer among both the Vietnamese and Australian collaborators.

Overseas collaborating country

Vietnam

Commissioned organisation

CSIRO Marine and Atmospheric Research, Australia

Project leader

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Collaborating institutions

Dr Craig Foster, Australia
Mr David Smith, Australia
Dr Kevin Williams, Australia
Advanced Choice Economics Pty Ltd, Australia
Research Institute for Aquaculture No. 2, Vietnam
Research Institute for Aquaculture No. 3, Vietnam
Research Institute for Aquaculture No. 1, Vietnam
Nha Trang University, Vietnam

Project budget

\$1,504,713

Project duration

01/06/2009 to 31/05/2014

ACIAR Research Program Manager

Dr Chris Barlow

Website

<www.aciar.gov.au/project/FIS/2006/141>

FIS/2006/144: Strengthening regional mechanisms to maximise benefits to smallholder shrimp farmer groups adopting better management practices

Better management practices (BMPs) in the aquaculture context outline norms for responsible farming of aquatic animals. In aquaculture, BMPs have been developed largely for shrimp and salmon, although some efforts are presently being made to develop them for other aquatic commodities (e.g. tilapias, catfish, molluscs, eels). This project built on the ongoing shrimp BMP programs in the Asia–Pacific region (e.g. in Australia, Indonesia, India, Vietnam and Thailand). It sought to create a robust regional mechanism for networking and exchange of information—specifically focused to benefit small-scale shrimp farmers in Asia—to reduce disease risks, improve yields, produce quality shrimp, access better markets, address socioeconomic sustainability and comply with international principles.

Overseas collaborating countries

India, Indonesia, Thailand, Vietnam

Commissioned organisation

Network of Aquaculture Centres in Asia–Pacific, Thailand

Project leader

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Collaborating institutions

University of Sydney, Australia
Directorate General Aquaculture, Indonesia
Department of Fisheries, Thailand
Marine Products Export Development Authority, India
Central Institute for Brackishwater Aquaculture, India
National Fisheries Quality Assurance and Veterinary Directorate, Vietnam

Project budget

\$77,190

Project duration

01/06/2007 to 30/11/2009

ACIAR Research Program Manager

Dr Chris Barlow

Website

<www.aciar.gov.au/project/FIS/2006/144>

FIS/2007/094: Policy, institutional and economic constraints to aquaculture research adoption in Vietnam

Within its portfolio of aquaculture research in Vietnam, ACIAR has funded two projects on developing low-cost diets for catfish and tilapia (FIS/2002/068) and mud crabs (FIS/2000/065). These projects focused on technical aspects of aquaculture diet formulation. The overarching objective of this project is to examine the policy, institutional and economic constraints to the adoption of ACIAR-developed formulated diets. This will involve studying the economic viability of these diets from a whole-of-household perspective, identifying the business environment policies and regulations for the establishment and running of aquaculture operations, identifying issues in the allocation of land and marine areas, investigating weaknesses in extension networks and also the current and potential quality, food safety and environmental protection requirements that may constrain the adoption of these diets. Other matters for study include trade policy issues and the need for policy, institutional, economic and research reforms.

Overseas collaborating country

Vietnam

Commissioned organisation

Advanced Choice Economics Pty Ltd, Australia

Project leader

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Collaborating institutions

Queensland University of Technology, Australia
CSIRO Marine Research, Australia
Department of Fisheries, Western Australia, Australia
Vietnam Fisheries College, Vietnam
Research Institute for Aquaculture No. 1, Vietnam
Research Institute for Aquaculture No. 3, Vietnam
Vietnam Association of Seafood Exporters and Producers, Vietnam
Vietnam Institute of Fisheries Economics and Policy, Vietnam

Project budget

\$149,900

Project duration

01/04/2008 to 31/12/2009

ACIAR Research Program Manager

Dr Chris Barlow

Website

<www.aciar.gov.au/project/FIS/2007/094>

3.3 Subprogram 3: Towards higher value plantation forestry products

The introduction of Australian acacias and eucalypts to Vietnam, supported in part by ACIAR, has had a major economic impact, with several hundred thousand hectares of plantations now supplying a major processing industry. This project cluster aims to add further value to this investment by providing an additional level of sophistication to the generation and deployment of improved genetic material of these species. This will be achieved through development of silvicultural approaches that optimise the production of higher value products, and by overcoming impediments to the production of high-quality products from sawlogs. Other species will be included where appropriate.

<i>Project number</i>	<i>Project title</i>
FST/1999/095	Improving the value chain for plantation-grown eucalypt sawn wood in China, Vietnam and Australia: genetics and silviculture
FST/2001/021	Improving the value chain for plantation-grown eucalypt sawn wood in China, Vietnam and Australia: sawing and drying
FST/2006/087	Optimising silvicultural management and productivity of high-quality acacia plantations, especially for sawlogs
FST/2008/007	Advanced breeding and deployment methods for tropical acacias

FST/1999/095: Improving the value chain for plantation-grown eucalypt sawn wood in China, Vietnam and Australia: genetics and silviculture

Eucalypts are a potentially high-value wood for use in construction joinery and furniture. Poor yields result from growth stresses released upon sawing that cause distortion and splitting in logs, so eucalypts in many developing countries are mainly used for fuelwood, pulp and poles. Research will focus on genetic and silvicultural controls to reduce losses. (Other research is examining sawing methods.) Breeding strategies and management regimes will be examined, beginning with an overview of plantation resources. Levels of control offered by genetics and silviculture will be assessed to increase quality and other critical traits. Breeding strategies for key species will be developed and communicated, enhancing capacity building.

Overseas collaborating countries

China, Vietnam

Commissioned organisation

State Forests of New South Wales, Tree Improvement, Australia

Project leader

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Collaborating institutions

Guangxi Forest Research Institute, China
China Eucalypt Research Centre, China
Queensland Department of Primary Industries and Fisheries, Australia
Hunan Provincial Forestry Department, China
Chinese Academy of Forestry, China
Forest Science Institute of Vietnam, Vietnam

Project budget

\$682,611

Project duration

01/07/2005 to 30/06/2009
(Project extended from 01/07/2009 to 31/12/2009)

ACIAR Research Program Manager

Dr Russell Haines

Website

<www.aciar.gov.au/project/FST/1999/095>

FST/2001/021: Improving the value chain for plantation-grown eucalypt sawn wood in China, Vietnam and Australia: sawing and drying

Eucalypts are a potentially high-value wood for use in products such as construction joinery and furniture. Poor yields, the result of growth stresses released upon sawing that cause distortion and splitting in logs is a major constraint to use. Eucalypts, now widely established in plantations in many developing countries, are mainly used for fuelwood, pulp and poles. The focus of this research is sawing methods. (Other research is examining the dynamics of growth stresses and strategies to reduce losses.) Sawing and recovery strategies developed through experimental technologies will be trialled, including a focus on economic viability. Technology transfer and capacity building will also be undertaken.

Overseas collaborating countries

China, Vietnam

Commissioned organisation

CSIRO Forest Biosciences, Australia

Project leader

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Collaborating institutions

Forest Science Institute of Vietnam, Vietnam
China Eucalypt Research Centre, China

Project budget

\$519,932

Project duration

01/07/2005 to 30/06/2009

ACIAR Research Program Manager

Dr Russell Haines

Website

<www.aciar.gov.au/project/FST/2001/021>

FST/2006/087: Optimising silvicultural management and productivity of high-quality acacia plantations, especially for sawlogs

Vietnam has a rapidly expanding plantation estate of acacias. Community/smallholder farmers account for a substantial part of that estate, and solid wood from acacias offers them an opportunity to generate a high income. However, success depends on the quality of silvicultural systems adopted. The underpinning objectives of this project are to quantify the role of pruning and thinning in community forests to optimise tree size and log distribution, to examine the roles of site and soil management in the sustainable production of community forests grown for sawlogs and pulpwood, to relate potential productivity of *Acacia auriculiformis* and *Acacia* hybrid to site parameters in resource-limited environments in Vietnam, and to develop tools to support improved management. Such tools will assist farmers to manage plantations already in the ground, helping them to produce high-value sawlogs rather than lower-value pulpwood. Another outcome will be a simple decision-support system on which to base optimum site selection and well informed silvicultural management of sawlogs (and pulpwood) that includes maximising tree health.

Overseas collaborating country

Vietnam

Commissioned organisation

CSIRO Sustainable Ecosystems, Australia

Project leader

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Collaborating institutions

University of Tasmania, Australia
Forest Science Institute of Vietnam, Vietnam
Forest Science Sub-Institute of South Vietnam, Vietnam

Project budget

\$927,862

Project duration

01/07/2008 to 30/06/2012

ACIAR Research Program Manager

Dr Russell Haines

Website

<www.aciar.gov.au/project/FST/2006/087>

FST/2008/007: Advanced breeding and deployment methods for tropical acacias

This project builds on a substantial body of work in Vietnam in the breeding of acacia species and hybrids, which has enhanced the production of high-value germplasm required to meet the Government of Vietnam's objectives for an expanded plantation estate for sawlog and fibre production. Vietnam now has an acacia plantation estate of over 400,000 hectares, including over 150,000 hectares of clonal *Acacia mangium* × *A. auriculiformis* (*Acacia* hybrid), whose large-scale operational use has been pioneered by Vietnamese scientists. This project comprises a key element in a suite of linked ACIAR projects designed to underpin the sustainability of, and add value to, Vietnam's acacia and eucalypt plantation estates, and the processing industries based on them. The major objectives are: 1. to design and implement an enhanced clonal production and deployment strategy to deliver an ongoing stream of tested *Acacia* hybrid clones to tree farmers throughout Vietnam (the program will integrate appropriate breeding, seed production management, propagation and information management strategies); 2. to refine and demonstrate deployment strategies for sexually propagated *A. mangium*, to expand utilisation of seed from the elite selections planted in the Forest Science Institute of Vietnam orchards; 3. to continue development of new polyploid varieties with potential for improved wood properties and reproductive sterility. It is projected that the smallholder sector could contribute an additional \$14 million per annum to the gross domestic product (GDP) within 7–10 years if new hybrid clones with higher wood basic density can be developed and deployed efficiently.

Overseas collaborating country

Vietnam

Commissioned organisation

University of Tasmania, Department of Plant Science, Australia

Project leader

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Collaborating institutions

CSIRO Sustainable Ecosystems, Australia
Forest Science Institute of Vietnam, Vietnam

Project budget

\$1,102,340

Project duration

01/06/2009 to 31/05/2014

ACIAR Research Program Manager

Dr Russell Haines

Website

<www.aciar.gov.au/project/FST/2008/007>

3.4 Subprogram 4: Optimising resource management for profitable and sustainable agricultural production in south-central coastal Vietnam

The initial integrating focus is on development of more profitable but sustainable field and tree crop cultivation and beef cattle production systems, in challenging environments (poor sandy soils under water-limiting conditions), through technical cooperation in areas where Australian agencies have the necessary expertise. Initially, the emphasis will be on parts of the drier central and southern provinces, particularly on coastal and sloping areas under 400 metres above sea level. Research will address the vulnerability of the central coast of Vietnam to the impacts of climate change and desertification.

<i>Project number</i>	<i>Project title</i>
LPS/2004/073	Capacity building on cattle production at Dong Giang district, Quang Nam province, Vietnam
SMCN/2003/035	Improving the utilisation of water and soil resources for tree crop production in coastal areas of Vietnam and New South Wales
SMCN/2007/109	Sustainable and profitable crop and livestock systems for south-central coastal Vietnam

LPS/2004/073: Capacity building on cattle production at Dong Giang district, Quang Nam province, Vietnam

World Vision Vietnam has implemented projects for the poor in Dong Giang district (Quang Nam province, central Vietnam) to improve their living standards through activities such as health services, education and livestock development. This initiative will augment the World Vision Vietnam Area Development Plan by improving the capacity of World Vision staff and community leaders in administrating and managing projects. Extension staff in the district and communes will gain in technical and extension knowledge. Local people will be exposed to applying suitable technologies to improve cattle productivity. It is anticipated that improved cattle production and increased income from livestock for participating households will be achieved within the project period, with wider-scale benefits in the longer term.

Overseas collaborating country

Vietnam

Commissioned organisation

World Vision Vietnam, Vietnam

Project leader

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Project budget

\$64,800

Project duration

01/04/2005 to 31/03/2009
(Project extended from 01/04/2009 to 30/09/2009)

ACIAR Research Program Manager

Dr Peter Horne

Website

<www.aciar.gov.au/project/LPS/2004/073>

SMCN/2003/035: Improving the utilisation of water and soil resources for tree crop production in coastal areas of Vietnam and New South Wales

The coastal provinces of central Vietnam are amongst the poorest in the country because agricultural development is hampered by lack of water combined with sandy soils that are infertile and difficult to irrigate. A promising approach to improve agricultural development in this region is expansion of cashew nut production using small-scale farm dams to capture wet-season run-off and irrigation technologies that are economically and socially appropriate. There is also potential to improve soil fertility and integrate nut production with forage production using groundcover species such as *Arachis pintoii*. The objectives of the project are to improve smallholders' incomes by improving the profitability of cashew nut production. The project will demonstrate the potential for developing and utilising small-scale on-farm water storages, evaluate the use of waste materials as soil amendments for improving water- and nutrient-use efficiency, and promote strategies that will enhance adoption of management regimes which enable high irrigation efficiency and long-term soil fertility improvement in Vietnam and New South Wales, Australia.

Overseas collaborating country

Vietnam

Commissioned organisation

Southern Cross University, Australia

Project leader

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Collaborating institutions

Vietnam Academy of Agricultural Sciences, Vietnam
National Institute for Soils and Fertilisers, Vietnam
Department of Agriculture and Rural Development, Vietnam

Project budget

\$666,198

Project duration

01/01/2007 to 31/12/2009
(Project extended from 01/01/2010 to 31/12/2010)

ACIAR Research Program Manager

Dr Gamini Keerthisinghe

Website

<www.aciar.gov.au/project/SMCN/2003/035>

SMCN/2007/109: Sustainable and profitable crop and livestock systems for south-central coastal Vietnam

ACIAR and the Vietnam Ministry of Agriculture and Rural Development (MARD) have agreed on integrated research and development to produce sustainable and profitable crop and livestock systems for the south-central coastal region of Vietnam. This region is characterised by sandy infertile soils and a long dry season (6–9 months) and has lower income levels than other regions of Vietnam. Thus, this multidisciplinary project aims to identify and facilitate adoption of promising resource management practices for sustainable and profitable crop and livestock production systems best suited to local conditions and able to improve market engagement—focusing on the provinces of Binh Dinh, Phu Yen and Ninh Thuan with an emphasis on coastal and sloping areas less than 400 metres above sea level. It involves four linked components; the first three are part of this project, and the fourth is part of project SMCN/2003/035. The components are: value-chain analysis for sustainable and profitable farming systems on the south-central coast; sustainable cropping systems for sandy soils of south-central Vietnam; better integration of beef cattle production with crop production systems in south-central coastal Vietnam; and improving the utilisation of water and soil resources for tree crop production in coastal areas (SMCN/2003/035). Focus areas are: cashew and/or mango intercropped with legumes (such as peanut and soybean) or non-legumes (such as cassava) on aeolian and granitic sands; vegetable production systems (onion, garlic, tomato) on coastal sands; and beef cattle production integrated with forage and field crop production.

Overseas collaborating country

Vietnam

Commissioned organisation

Department of Agriculture and Food, Western Australia, Australia

Project leader

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Collaborating institutions

Murdoch University, Australia
University of Tasmania, Australia
Agricultural Science Institute for Southern Central Coast of Vietnam, Vietnam
Southern Horticultural Research Institute, Vietnam
Southern Sub-Institute of Agricultural Engineering and Postharvest Technology, Vietnam
Hue University of Agriculture and Forestry, Vietnam
Institute of Agricultural Sciences of Southern Vietnam, Vietnam
CSIRO Sustainable Ecosystems, Australia
Research and Development Centre for Animal Husbandry in the Central Region, Vietnam
University of Queensland, Australia
Department of Agriculture and Rural Development, Binh Dinh, Vietnam
Department of Agriculture and Rural Development, Ninh Thuan, Vietnam
Department of Agriculture and Rural Development, Phu Yen, Vietnam

Project budget

\$2,709,530

Project duration

01/01/2009 to 31/12/2012

ACIAR Research Program Manager

Dr Gamini Keerthisinghe

Website

<www.aciar.gov.au/project/SMCN/2007/109>

3.5 Subprogram 5: Poverty reduction through market engagement for smallholders in the northern and north-western highlands

Many smallholders in the north-western highlands have not seen the same benefits to livelihood improvements from engagement in the global economy as has the rest of Vietnam. Emerging markets created by improved infrastructure development have created an opportunity for market engagement by smallholders. To meet increasing market demand, which is rapidly changing, farmers from the north-western highlands are expanding cultivation, especially of maize, into sloping lands. This has been accompanied by poor management practices, resulting in soil degradation and declining crop yields. Current land-management practices to control the rate and level of erosion are inadequate, resulting in the loss of nutrient-rich topsoil, potential soil structural issues and reduced agricultural productivity. There is a need to identify suitable integrated management practices for local agroecological conditions that will have socioeconomic impacts for smallholders and address the constraints to sustainable crop production on sloping lands. With changing dietary preferences, livestock production is providing an opportunity for smallholders to integrate ruminants and pigs as a profitable component of their farming system that can improve livelihoods. There is a need to influence changes in sustainable practice that address socioeconomic constraints to improve agricultural management and consider a whole-of-supply-chain approach. This will require fostering of institutional capacity to take promising research outcomes into broader application.

<i>Project number</i>	<i>Project title</i>
AGB/2002/086	Improving postharvest quality of temperate fruits in Vietnam and Australia
AGB/2006/066	Improving productivity and fruit quality of sweet persimmon in Vietnam and Australia
AGB/2006/112	Increasing the safe production, promotion and utilisation of indigenous vegetables by women in Vietnam and Australia
AGB/2008/002	Improved market engagement for sustainable upland production systems in the north-western highlands of Vietnam
HORT/2000/043	Huanglongbing management for Indonesia, Vietnam and Australia

AGB/2002/086: Improving postharvest quality of temperate fruits in Vietnam and Australia

The small temperate fruit industry in the northern Vietnamese uplands is the subject of much research, however the industry will be limited without improved postharvest fruit handling and effective disease controls. Currently, 25% of fruit is lost and marketed produce is often small and immature. Determining postharvest disease problems associated with production and distribution practices is needed, along with improvements in the knowledge and skills of orchardists. The project is focusing on identifying and implementing feasible improvements, including appropriate logistical and technical options. Linkages to ACIAR projects involving the Australian temperate fruit industry are being utilised to examine potential chemical input reductions, both in Australia and Vietnam.

Overseas collaborating country

Vietnam

Commissioned organisation

NSW Department of Industry and Investment, Gosford Horticultural Institute, Australia

Project leader

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Collaborating institutions

Food Crops Research Institute, Vietnam
Research Institute of Fruit and Vegetables, Vietnam
Queensland Department of Primary Industries and Fisheries, Australia
Department of Agriculture and Rural Development, Vietnam
Department of Employment, Economic Development and Innovation, Australia

Project budget

\$906,074

Project duration

01/07/2004 to 31/12/2007
(Project extended from 01/01/2008 to 30/11/2009)

ACIAR Research Program Manager

Mr David Shearer

Website

<www.aciar.gov.au/project/AGB/2002/086>

AGB/2006/066: Improving productivity and fruit quality of sweet persimmon in Vietnam and Australia

Persimmon fruit is used extensively in Vietnam for ceremonial occasions, and the Government of Vietnam considers it to have the potential to develop into a large commercial industry. Currently, the available varieties and management technology are of poor quality and result in low yields. This is compounded by poor postharvest handling which means less than 30% of the fruit produced in Vietnam is of marketable quality. This project aims to enhance the productivity, yield and fruit quality of persimmon, to develop low-input, cost-effective, best orchard management practices for Vietnamese conditions, to improve the postharvest handling of astringent and non-astringent varieties to increase penetration in the domestic market, and to transfer new technologies using appropriate extension methods. The work aims to significantly improve the socioeconomic standing of poorer, rural ethnic groups living in mountainous regions of Vietnam.

Overseas collaborating country

Vietnam

Commissioned organisation

Department of Employment, Economic Development and Innovation, Australia

Project leader

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Collaborating institutions

NSW Department of Primary Industries, Australia
Plant Protection Research Institute, Vietnam
Research Institute of Fruit and Vegetables, Vietnam
NSW Department of Industry and Investment, Australia

Project budget

\$700,043

Project duration

01/01/2008 to 31/12/2011
(Project extended from 01/01/2011 to 31/12/2012)

ACIAR Research Program Manager

Mr David Shearer

Website

<www.aciar.gov.au/project/AGB/2006/066>

AGB/2006/112: Increasing the safe production, promotion and utilisation of indigenous vegetables by women in Vietnam and Australia

There is increasing demand for indigenous vegetables in Vietnam, and a significant role played by women in their production. Increasing demand also exists within Australia for products within the Asian vegetable range. The aim of this project is to improve farm income in rural areas of Vietnam by increasing the skills of women in the safe production, promotion and utilisation of indigenous vegetables. The project will also analyse and quantify existing and potential market opportunities, assess factors that may improve the competitiveness of those vegetables in the marketplace and develop supply chains that will continue to support the development of community-based indigenous vegetable production.

Overseas collaborating country

Vietnam

Commissioned organisation

NSW Department of Industry and Investment, Gosford Horticultural Institute, Australia

Project leader

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Collaborating institutions

Vietnam Academy of Agricultural Sciences, Vietnam
Vietnam Women's Union, Vietnam

Project budget

\$1,024,980

Project duration

01/03/2008 to 28/02/2012

ACIAR Research Program Manager

Mr David Shearer

Website

<www.aciar.gov.au/project/AGB/2006/112>

AGB/2008/002: Improved market engagement for sustainable upland production systems in the north-western highlands of Vietnam

Lack of market integration, inappropriate and unsustainable land management and limited ability of poor smallholders (mostly ethnic minority people) to absorb risk have resulted in continued poverty within the north-western highlands region of Vietnam. The aim of this project is to increase smallholder engagement in competitive value chains associated with two farming systems; one based around maize and the other temperate fruit. Project work will first focus on promising locations where the two farming systems are practised and there has been recent improvement in market connectivity. The research team regards such locations as having high potential for improved market engagement and resource management that would lead to the adoption of more sustainable and profitable farming systems. The project will first identify and analyse constraints, needs and opportunities for the target groups. Subsequent activities will involve on-farm activities to introduce and evaluate improved crop-management approaches and value-chain development for marketing produce. Pilot trials will enable the research team to select promising methodologies that will be subsequently incorporated into government and non-government development strategies.

Overseas collaborating country

Vietnam

Commissioned organisation

University of Queensland, School of Journalism and Communication, Australia

Project leader

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Collaborating institutions

Northern Mountainous Agricultural and Forestry Science Institute, Vietnam
Centre for Agrarian Systems Research and Development, Vietnam
Plant Protection Research Institute, Vietnam
Hanoi Agricultural University, Vietnam
National Institute for Soils and Fertilisers, Vietnam
International Center for Tropical Agriculture, Vietnam

Project budget

\$2,200,010

Project duration

01/06/2009 to 30/06/2013

ACIAR Research Program Manager

Mr David Shearer

Website

<www.aciar.gov.au/project/AGB/2008/002>

HORT/2000/043: Huanglongbing management for Indonesia, Vietnam and Australia

Huanglongbing disease (HLB) (the Asian form of citrus greening) is the major constraint to citrus production in Asia, having ceased completely in some areas when all trees died. In Indonesia, the disease has spread from west to east as far as Irian Jaya, from where it may well spread into Papua New Guinea and from there threaten Australia's citrus industry. Farmers have not readily accepted previous management strategies, which tended to be unreliable through lack of sufficient scientific knowledge. This project aims to provide the facts on which to base a sound strategy, focusing on the pathogen itself, the insect vector (the citrus psyllid) and the interactions between the two. In Vietnam, the French Agricultural Research Centre for International Development (CIRAD) is focusing on the pathogen and ACIAR is supporting the entomology and pathogen–vector relationships. In Indonesia, ACIAR-funded scientists are surveying the distribution of the vector and its natural enemies, then comparing the natural enemy spectrum in Indonesia with that known from Vietnam and identifying potential natural enemies for a biocontrol program. They are also determining the possible role of petroleum spray oils in vector control.

Overseas collaborating countries

Indonesia, Vietnam

Commissioned organisation

University of Western Sydney, Centre for Horticulture and Plant Science, Australia

Project leader

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Collaborating institutions

Gajah Mada University, Indonesia
CSIRO Entomology, Australia
Southern Fruit Research Institute, Vietnam
Food Crops Research Institute, Vietnam
Centre de Cooperation Internationale en Recherche Agronomique pour le Developpement (CIRAD), Vietnam
Research Institute for Citrus and Subtropical Horticulture, Indonesia

Project budget

\$1,089,160

Project duration

01/01/2003 to 31/12/2005
(Project extended from 01/06/2009 to 30/09/2009)

ACIAR Research Program Manager

Mr Les Baxter

Website

<www.aciar.gov.au/project/HORT/2000/043>

4 Projects expected to start in 2009–10

<i>Project number</i>	<i>Title</i>	<i>Country</i>
FIS/2006/126	Sandfish pond culture in Indonesia, Philippines and Vietnam	Indonesia Philippines Vietnam
FST/2008/039	Enhancement of production of acacia and eucalypt veneer and bamboo timber products in Vietnam	Vietnam
LPS/2008/049	Smallholder livestock systems in the mountainous regions of north-western Vietnam: strengthening productivity and market linkages	Vietnam
LWR/2009/040	Climate change meta analysis	Bangladesh Cambodia China East Timor India Indonesia Lao PDR Pakistan Papua New Guinea Philippines Vietnam
SMAR/2008/021	Spiny lobster aquaculture development in Indonesia, Vietnam and Australia	Indonesia Vietnam
SMCN/2009/021	Adaptation to climate change for rice-based cropping systems in Mekong Delta	Vietnam

5 Vietnam chapter from the Annual Report 2008–09

5.1 Position

In 2008–09, ACIAR's program in Vietnam has focused on two regions where poverty has persisted: the south-central coast and the north-western highlands. Australian agricultural expertise is well matched to both regions, in the south with poor, sandy soils under water-limiting conditions and in the north-western highlands with high-value temperate horticulture crops. The focus on the two regions reflects the significant economic growth that has occurred in Vietnam in recent years. Vietnam is now on the verge of becoming a 'middle-income' country, the recent growth being driven by market competitiveness, a demand for exports and increasing levels of foreign investment. Despite this growth, rural areas have received less in benefits, in particular in the two areas of focus for ACIAR.

ACIAR's research priorities have, in the past, included links with the AusAID Capacity Building for Agriculture and Rural Development (CARD) program. New linkages to AusAID programs as well as those of other donors, including NGOs, are being developed. Research projects are designed to build links between central research institutions and provincial research and extension departments. Projects operate within five subprograms: market competitiveness through improved agribusiness and biosecurity systems; development of mariculture industries; higher value plantation products; and subprograms focusing on the south-central coast region and the north-western highlands.

5.2 Achievements

Subprogram 1: Securing market competitiveness of Vietnamese agricultural, fisheries and forestry products through agribusiness and biosecurity

Diseases cause large losses to crops across the central provinces of Vietnam. Plant disease diagnostic laboratories have been established at each of the Plant Protection Subdepartments (PPSDs) in Nghe An, Quang Nam and Thua Thien-Hue provinces, and at the School of Agriculture and Forestry at Hue University, serving approximately 1.5 million farmers. Co-funding enabled establishment of greenhouses at Quang Nam and Nghe An PPSDs. Seven team members from the provincial subdepartments have received training in laboratory and field diagnostics and the design and management of field trials and data analysis. Trainees are now able to independently diagnose common root, stem and foliar fungal and bacterial pathogens; design, implement and analyse field trials; develop integrated disease management (IDM) strategies; and teach IDM and best-practice fungicide use to district and commune staff and farmer groups. Furthermore, they can now consult with Australian counterparts on diagnoses via the internet in English with digital images.

Studies on huanglongbing (citrus greening) and the vector that transmits this disease (the Asiatic citrus psyllid *Diaphorina citri*) continued in Vietnam and Indonesia. As in previous years, populations of *D. citri* and the incidence of huanglongbing remained low in an 0.5-hectare guava-interplanted king orange orchard in which mineral oils, pesticides and other management strategies are being compared for control of the psyllid in southern Vietnam. The orchard, at Cai Be in Tien Giang, was planted in 2004. Differences among treatments remained undetectable and no psyllids were observed. Other studies and observations in the Mekong Delta, and research in Indonesia and China, continued to indicate that low incidence of the psyllid and the disease is due to the impact on psyllid behaviour of volatile compounds released by the guava trees.

In Vietnam, demand for pork is increasing rapidly. Successful commercial smallholder pig farming may help to meet demand while alleviating some of the country's widespread rural poverty. A project is identifying options for technology, policy and forms of market institution or coordination that will give smallholder pig producers in Vietnam better access to higher value market chains and thus lead to higher incomes. Findings from the project so far are relevant to Vietnam's long-term strategy for the development of its livestock industries, and Vietnamese Government officials involved in the formulation of this strategy have shown interest in project results.

Subprogram 2: Development of high-value aquaculture industries

Molecular genetic methodologies are integral to the study of wild fish populations and are invaluable in aquaculture, helping to maintain high levels of productivity and long-term sustainability in culture lines. Senior scientists at Vietnam's Research Institute for Aquaculture No. 3 (RIA3) have identified building a strong capacity in applied genetics as a major goal, and recognise that any development in this area must be sustained for the future. A project provided training, capacity building and experience in small model projects on local fish species of importance for RIA3 scientists destined to be part of the new applied genetics research group. The scientists also learnt how to develop basic learning modules that could be incorporated into advanced undergraduate/postgraduate units for the University of Fisheries at Nha Trang.

Smallholder shrimp farming has been important for rural development for three decades in South-East Asia. More recently, disease issues and oversupply of global markets have meant that shrimp farming no longer represents a viable livelihood for many smallholders. Many ponds have been abandoned (up to 70% in some countries/regions) and farmers are eager to find alternative species to farm that present a lower risk than shrimp. Sandfish (sea cucumber *Holothuria scabra*) has many traits that could make it an ideal species to replace shrimp for smallholders. It is a low-food-chain species that grows well feeding only on organic matter in the enriched sediments of shrimp ponds.

Research in Vietnam has developed hatchery and juvenile production techniques capable of operating at an appropriate technology level to replace shrimp farming. Now an ACIAR-funded study has greatly furthered the knowledge about required water management in ponds. Early trials of pond farming were marred by high mortality rates associated with an influx of fresh water during tropical wet seasons. Farming sandfish in ponds now appears a reality for Khanh Hoa (north of Nha Trang) farmers due to the effective water management systems developed.

Within its portfolio of aquaculture research in Vietnam, ACIAR has funded a project to develop low-cost diets for catfish and tilapia, another for mud crabs, and a third focused on sustainable tropical spiny lobster aquaculture. A project is revisiting this work, with the overarching objective of examining the policy, institutional and economic constraints to the adoption of the low-cost formulated diets developed in these technical projects. The first activity is value-chain analysis, where prices, costs and margins at each stage of the value chain are being analysed to indicate where the policy or institutional environment may be creating distortions. Initial value chains for the three fish species of focus (lobster, mud crab and tilapia) have been drafted. A second activity is whole-of-household economic modelling, which will help to assess the cost-effectiveness of potential pelleted diets formulated in the ACIAR-funded technical projects compared with current diets, and to analyse the economic impacts of potential policy and institutional constraints on adoption of these diets.

Subprogram 3: Towards higher value plantation forestry products

Vietnam has a rapidly expanding plantation estate of acacias. Community/smallholder farmers account for a substantial part of that estate, and solid wood from acacias offers them an opportunity to generate a high income. However, success depends on the quality of silvicultural systems adopted. A project seeks to quantify the role of pruning and

thinning in community forests to optimise tree size and log distribution, to examine the roles of site and soil management in the sustainable production of community forests grown for sawlog and pulpwood production, and to relate potential productivity of *Acacia auriculiformis* and acacia hybrids to site parameters in resource-limited environments in Vietnam. It is developing tools that will assist farmers to manage plantations already in the ground, thus helping them to produce high-value sawlogs rather than lower value pulpwood. In early work, trials are being established to quantify the roles of fertiliser use, pruning and thinning to optimise tree size, log distribution and economic returns from plantations managed for sawn timber.

Subprogram 4: Optimising water and soil management for profitable and sustainable production in south-central Vietnam

Vietnam is the second-largest coffee producer in the world, and approximately 40% of national coffee output originates from Dak Lak province. In recent years, coffee production in Dak Lak has been significantly constrained by dry-season water shortages, and the sustainability of smallholder coffee production in the region has been questioned. Increasing irrigation water-use efficiency on coffee smallholdings in Dak Lak would generate sizable social welfare increases to inhabitants. A study found that coffee smallholders were inefficient irrigators, applying more than twice the amount of water required to maximise coffee yields. By adopting a technically efficient irrigation schedule, water input could be reduced from the current average application of around 1,050 litres to 550 litres per tree per irrigation. Achieving this water input would increase production by around 0.5–5.0 tonnes per hectare, and achieve an average 10% reduction in variable irrigation costs.

World Vision Vietnam has implemented projects for the poor in Dong Giang district (Quang Nam province, central Vietnam) to improve their living standards through activities such as health services, education and livestock development. An ACIAR-funded initiative is contributing to the World Vision Vietnam Area Development Plan by improving the capacity of its staff and community leaders to administer and manage projects. It is anticipated that improved cattle production and increased income from livestock for participating households will be achieved within the project period, with wider-scale benefits in the longer term. In cooperation with the local District Agriculture Extension Station and Hue University of Agriculture and Forestry, the project has helped to improve project planning and management for the local hamlet facilitator's network. A 3-day training course on credit loan management has also been conducted for commune accountant and commune members. Currently, each project commune has a recycle credit loan scheme for cow raising. Monitoring results showed that, after the training, eight of the 10 communes managed their loans better. More than 60 commune and hamlet cadres and about 300 farmers with basic knowledge of cow raising also received more advanced training, and the farmers received three different leaflets specially written for them.

A promising approach to improving agricultural development in the coastal provinces of central Vietnam is to expand cashew nut production using small-scale farm dams to capture wet-season run-off, and irrigation technologies that are economically and socially appropriate. There is also potential to improve soil fertility and integrate nut production with forage production using groundcover species such as *Arachis pintoii*. A project is seeking to improve smallholders' incomes by increasing the profitability of cashew nut production. The project is demonstrating the potential for developing and using small-scale on-farm water storages, evaluating the use of waste materials as soil amendments for improving water- and nutrient-use efficiency, and promoting strategies that will enhance adoption of management strategies that enable high irrigation efficiency and long-term soil fertility improvement. Achievements during the second year of this project include: establishment of cashew and mango irrigation field experiments and demonstration trials in Binh Dinh and Ninh Thuan provinces; establishment of biochar field

experiments with groundnut and cashew in Binh Dinh province; completion of a soil nutrient management workshop and intensive small-group technical sessions for the Vietnamese team; and a Binh Dinh cashew farmer field day held by the Vietnamese partners.

In Ninh Thuan, a table grape field trial was established to demonstrate how irrigation scheduling using mini-evaporation-pans and drip irrigation could improve water- and nutrient-use efficiency and reduce nutrient leaching. Irrigation using the mini-evaporation-pan reduced irrigation inputs by more than 30% without any apparent consequences for grape yield or quality. Widespread farmer adoption of these simple, inexpensive irrigation strategies could reduce nutrient leaching at the catchment scale, ultimately delivering environmental and community health benefits by improving the quality of groundwater used for drinking, livestock and irrigation.

Subprogram 5: Developing market opportunities for communities in the northern and north-western highlands of Vietnam

The north-western provinces of Vietnam are characterised by upland agricultural systems, relatively high levels of poverty and high levels of ethnic diversity. Although many large donor organisations are focusing on these poorer provinces with community-based development projects, only limited research results suited to the region's agroecological and socioeconomic conditions are available so far to help farmers improve their farming practices. An ACIAR-funded study conducted a general profiling of agricultural research and development priorities and activities in all six provinces of the north-western part of Vietnam (Lai Chau, Lao Cai, Yen Bai, Dien Bien, Son La and Hoa Binh), and collected detailed information on agricultural research and development needs and opportunities at provincial, district, commune and village levels only in Lai Chau, Lao Cai and Yen Bai provinces.

The study found that the main constraint faced in livestock management was the lack of available feed of adequate quality and in sufficient quantity, particularly during the winter season, causing poor animal health and even death under severe climatic conditions. Veterinary services were limited outside the district capitals. Crop management is based mainly on traditional practices, and farmers have limited access to agricultural inputs, technologies and information due to remoteness and communication barriers. Specifically, farmers and local officers expressed the need for locally adapted varieties of both seasonal food crops and perennial cash crops such as tea and fruit, suitable crop and pest management practices tailored to agroecological and socioeconomic conditions, and postharvest technologies to add value to the produce for marketing purposes.

Vietnamese sources have identified non-astringent persimmon as a new commercial crop. A project is enhancing the productivity, yield and fruit quality of persimmon in Vietnam by changing from the traditional astringent varieties to new non-astringent varieties that can be grown using low-cost, best orchard management practices. To enable new technologies for growing persimmons to reach Vietnamese farmers, four demonstration orchards have been set up on selected farmers' properties and two research stations. The project team has carried out top-working of traditional astringent persimmon trees by grafting in new non-astringent varieties, which can be eaten when hard and will carry to market while still firm. Bud wood of Fuyu and Jiro varieties was collected in July and September 2008 from high-quality sources in Australia, and prepared and exported to Vietnam.

There is increasing demand for indigenous vegetables in Vietnam and for women to play a significant role in their production. Increasing demand also exists within Australia for products within the Asian vegetable range. A project seeks to improve farm income in rural areas of Vietnam by increasing the skills of women in the safe production, promotion and use of indigenous vegetables. The project has commenced in three communes in Tan Son district, Phu Tho province. In line with the participatory focus of the project, commune

teams have formed and selected indigenous vegetables to focus on in each commune. Workshops were held to increase the understanding of participatory approaches among local officers, extension workers and Women's Union staff.

The project is also analysing and quantifying existing and potential market opportunities, assessing factors that may improve the competitiveness of those vegetables in the marketplace and developing supply chains that will continue to support the development of community-based indigenous vegetable production. The Centre for Agrarian Systems Research and Development, whose central tenet is to make markets work better for the poor, has undertaken research to establish economic benchmarks and market potential for development of selected indigenous vegetables in the three communes.

Other projects

Protein is frequently the main constraint for the improvement of pig performance in South-East Asia. Because of this, most Asian pig production countries have high dependence on importation of various protein meals. The long-term viability of such pig industries is dependent on the ability of these countries in the future to access cheaper local sources of non-conventional feeds. Rubber seeds are a substantial by-product of rubber production that currently have little use in animal feeding because, despite having a reasonable level of protein content, they also have an anti-nutritive component. A project is attempting to make the rubber seeds more digestible for pigs by processing them to remove cyanide. A digestibility experiment conducted at the Institute of Agricultural Sciences of Southern Vietnam evaluated the digestible energy and amino acid value of diets composed of various treated rubber seed meals (RSMs). The results indicate that the treatment protocol has successfully improved the feeding value of rubber seed in pig diets when compared to the normal commercially available RSM.

Preliminary research funded by ACIAR and AusAID has verified in field trials near Hanoi that the plant-growth-promoting rhizobacteria effect can reliably increase the average yield of rice by 10–20%. A biofertiliser product, now registered as BioGro, has been developed. A project seeks to understand the function of the biofertiliser, while at the same time promoting its wider adoption in Vietnam and possible commercialisation. Field experiments, mainly in Vietnam, have led to greater understanding about when and how to inoculate with BioGro to obtain maximum benefits for farmers. In particular, the project extended experimentation with the biofertiliser to the Mekong region in southern Vietnam; a major rice-growing area. The field experiments demonstrated the reality of the biofertiliser principle that chemical fertiliser applications can be halved while obtaining yields similar to those with normal farmer fertiliser application rates. Much of the benefit appears to flow from the reduced use of urea and associated cost savings.

6 Projects concluded in 2008–09

AGB/1998/005: Managing pest fruit flies to increase production of fruit and vegetable crops in Vietnam

Vietnam needs comprehensive information about local fruit fly species in order to develop an export trade in fresh fruits and certain vegetables. Also, in north-western Vietnam, new plantings of temperate and subtropical fruits, established partly for development of poor areas and partly for opium substitution, are suffering close to 100% fruit fly damage. Farmers have become disillusioned and will abandon the development schemes unless solutions are found quickly. This project ascertained the economically important species of fruit fly and the host fruits of every species in each region studied. It also measured damage levels of the major species and their seasonality, and introduced environmentally friendly, preharvest control by bait-spraying. Training programs assisted with identification, biological studies, and development and implementation of field control campaigns. The project was conducted alongside an AusAID initiative that aimed to implement field control of fruit flies and included the results of the ACIAR work.

Overseas collaborating country

Vietnam

Commissioned organisation

Griffith University, Faculty of Environmental Sciences, Australia

Project leader

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Collaborating institutions

Plant Protection Research Institute, Vietnam
Fosters Asia, Vietnam
Southern Fruit Research Institute, Vietnam
Aventis Vietnam, Vietnam
University of Western Sydney, Australia

Project budget

\$853,890

Project duration

01/07/2001 to 31/12/2008
(Project extended from 01/07/2005 to 31/12/2008)

ACIAR Research Program Manager

Mr David Shearer

Project outcomes

Extensive collections of adult fruit flies obtained from male lure traps and reared from host fruits (cultivated and wild) in over 23 provinces covering northern, central and southern Vietnam revealed eight species of fruit flies with economic importance to horticultural

production and export trade in Vietnam. These were *Bactrocera dorsalis*, *B. carambolae*, *B. correcta*, *B. cucurbitae*, *B. latifrons*, *B. pyrifoliae*, *B. zonata* and *B. tau*. The species causing the greatest damage in northern Vietnam were *B. dorsalis*, *B. pyrifoliae* and *B. cucurbitae*, whereas those in southern Vietnam were *B. dorsalis*, *B. correcta* and *B. cucurbitae*. Crop losses ranging from 40% to 100% were recorded in a wide range of fruits and vegetables when no control measures were applied.

To assist with field control studies and help other ACIAR-funded projects to improve postharvest fruit quality, laboratory colonies of *B. cucurbitae*, *B. dorsalis* and *B. pyrifoliae* (reared on artificial diet) were established at the National Institute of Plant Protection (NIPP). At the Southern Fruit Research Institute (SOFRI), colonies of pest species *B. correcta* and *B. dorsalis* were successfully established. These laboratory colonies now provide adult flies for laboratory and field-attractancy testing to determine on-going quality control of the new protein bait produced at Foster's Tien Giang brewery (annual production capacity is about 50,000 litres of protein).

The protein product has been officially registered in Vietnam under the trade name SOFRI Protein 10DD (yeast protein + fipronil insecticide) and is being made available for sale to farmers through a local pesticide distribution company with numerous outlets in the Mekong Delta. The price has been kept low and is controlled by a steering committee comprising Griffith University, ACIAR Vietnam, SOFRI, Foster's Tien Giang and Cantho Pesticide Company.

The use of SOFRI Protein 10DD both in small farms and over large areas has provided excellent control of pest fruit flies across a range of fruit and fruiting vegetable crops in Vietnam, resulting in major income increases for farmers. For example, H'Mong minority hill tribe people in the northern province of Son La, Moc Chau district, cultivate peach as their main crop but have always had to harvest the fruits hard green because ripe fruits are 100% infested by fruit flies. Using the spot spray protein bait technology, fruit fly damage was reduced to less than 5%, resulting in farmers harvesting ripe fruits from which they obtained higher yields and better prices.

Overall this resulted in a fourfold increase in incomes in one season for the peach farmers. Barbados cherry farmers in Go Cong province in the Mekong Delta have also experienced a similar benefit with a twofold increase in incomes resulting from higher yields in orchards using SOFRI Protein 10DD. Control trials in other crops like guava, jujube, luffa and bitter melon have reduced fruit fly damage from over 70% to less than 5%. The protein bait spot spray technique also provides major health and environmental benefits by utilising extremely low amounts of pesticide and spray volumes in comparison with cover sprays of insecticides. The Ministry of Agriculture and Rural Development now plans to set up more protein production plants in other breweries across the country and extend the benefits of the protein spot spray bait technology to the wider farming community in Vietnam.

The project team successfully implemented an extensive training program on the biology and control of fruit flies for Provincial Plant Protection Department (PPPD) staff as well as for farmers in various provinces around Vietnam. Project staff from Brisbane initially ran a week-long workshop in June 2002 at SOFRI to train a core group of trainers from NIPP, SOFRI, PPD and selected Universities in Vietnam. These trainers from NIPP and SOFRI have subsequently trained 290 PPPD and sub-PPPD staff as well as 4,445 farmers from 16 provinces across Vietnam. The training was accompanied by the distribution of over 5,000 illustrated brochures in the Vietnamese language on the biology and management of fruit flies, incorporating the new protein bait spray technology introduced by the project.

AGB/2007/187: Technical support facility for commercialisation of protein-bait production in northern Vietnam

Vietnam's system of agricultural-research funding has recently moved from a centrally planned system to one where institutions bid for research money out of core funding. Research institutes have been directed to become almost entirely self-funded or face closure. They are therefore moving to commercialise research results and generate income. This small research activity supported a pilot research commercialisation of a new company—a joint venture involving the Plant Protection Research Institute (PPRI), Hoa Binh Agricultural Chemical Company and An Thinh Brewery. The activity focused on building a viable and sustainable market for the commercialised product—a protein bait that attracts and traps fruit flies. A second part of the activity was to take the lessons learnt from this pilot commercialisation and apply them to commercialising pro-poor research results in Vietnam's agricultural area.

Overseas collaborating country

Vietnam

Commissioned organisation

Markets, Development and Investment, Vietnam

Project leader

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Collaborating institutions

Griffith University, Australia
Plant Protection Research Institute, Vietnam

Project budget

\$120,000

Project duration

01/02/2007 to 28/02/2009
(Project extended from 01/05/2008 to 28/02/2009)

ACIAR Research Program Manager

Mr David Shearer

Project outcomes

During 2005–06, advice was provided to PPRI about identifying and setting up protein-bait plants in collaboration with appropriate breweries (investors) and setting up a distribution network for the protein bait in collaboration with plant-protection chemical companies. This has involved the development of a detailed business plan. Negotiations have been undertaken to specify a detailed agreement among partners, including PPRI, An Thinh Brewery and Hoa Binh Agricultural Chemical Company, to establish a joint-venture company. PPRI will be responsible for quality control of the protein bait and will coordinate the transfer of control techniques by providing training and demonstration trials to farmers.

On the basis of this initial assistance, a joint-venture company has been registered and capital subscribed, and preparation of the investment in equipment has begun. The

investment funds all come from the three partners in the joint-venture company.

A major rationale for this project was to assist in the pilot commercialisation of a pro-poor research product (in this case, protein baits) in order to generate information and ideas for researchers to draw on in the quest to commercialise research results. The project partners recognised the reality of an extremely low level of knowledge and expertise in the area of transforming research results into business ideas and then taking the step to full commercialisation. This is hardly surprising when those staffing the institutes are generally scientists and have never had to operate under a system of self-funded research.

The area for fruit production in Vietnam has increased dramatically over the years, reaching 747,000 hectares in 2004. In the northern and central regions, the fruit area increased to more than 300,000 hectares in 2002, accounting for almost 50% of the fruit production area of the whole country. This area is expected to reach 424,000 hectares in 2010. However, the paramount constraint affecting fruit farmers is the damage caused by insect pests, especially fruit flies that have caused serious losses of up to 100% on various fruit crops and in many places.

Controls usually employed by farmers are ineffective, costly, detrimental to the environment and pose food-safety concerns because of chemical residues left on fruit. In an effort to better control fruit flies, the new control measure using low-cost protein baits was developed from research projects funded by ACIAR. The protein bait acts as an attractant to all mature fruit flies and is processed from spent yeast of breweries. It is not only cheap and easy to apply but environmentally friendly as well, reflecting a comprehensive solution for the control against fruit flies. Most importantly, this protein keeps fruit products free from chemical residue, thus ensuring safety for consumers and especially promoting the sustainable export into competitive international markets.

The project determined that currently the demand for the protein bait in Vietnam is not being met. The only bait-processing plant at Fosters in Tien Giang province has a maximum and small annual capacity of about 110–120 tonnes. However, it is currently producing only 50 tonnes per annum and supplies bait to only Tien Giang and adjacent provinces.

Based on the production areas of some typical fruits in 2005, preliminary studies by PPRI estimated that the demand for protein bait in intensive fruit-production areas of provinces in the northern and central regions is about 250 tonnes per annum. If 100% of the export-oriented fruit area were to be treated with this biological-control measure, the demand would be significantly higher, reaching more than 1,000 tonnes per year. Apart from the domestic demand, there is demand for export of protein bait to other neighbouring countries that cannot produce protein bait due to little beer production. The demand for protein bait in 2010 is projected at approximately 5,000 tonnes.

AH/1998/054: Poverty alleviation and food security through improving the sweetpotato–pig systems in Indonesia

In Papua (Indonesia) and Papua New Guinea (the western and eastern components of the island of New Guinea), food shortages and malnutrition continue to be major problems, especially in the mountain areas where sweetpotato is the principal staple food. Sweetpotato is also the main feed source for pigs, which are raised throughout the island. Pigs are an integral part of the culture and political organisation of many New Guinea tribes; pork is a significant protein source for local people and is in high demand as a traded commodity.

Cash income has become increasingly important in the two regions with the penetration of regional and national markets, and pigs offer a good opportunity for income generation. However, the existing sweetpotato–pig systems exhibit several problems, notably low fertility and slow growth in pigs, which may be caused by unbalanced and erratic feeding regimes and health problems. Using an approach that is sensitive to the cultural role of these systems, it is proposed that technical interventions can be made through introduction of novel sweetpotato varieties and improvements to pig-raising management, leading to better food and feed productivity and positive benefits for family nutrition and income.

The project aimed to assess, characterise and analyse the existing human–sweetpotato–pig production systems in Papua within the overall household economy, in order to understand types of systems, their relative importance and their major constraints. Another objective was to improve sweetpotato-based production and staple food and feed supplies for both Papua and Vietnam. A further objective was to improve the efficiency of indigenous, integrated pig-raising systems in Papua.

Overseas collaborating countries

Indonesia, Vietnam

Commissioned organisation

International Potato Center, Indonesia

Project leader

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Collaborating institutions

Balai Penelitian Tanaman Kacang-Kacangan dan Umbi-Umbian (Balitkabi), Indonesia
National Institute of Animal Husbandry, Vietnam
South Australian Research and Development Institute, Australia
Food Crop Research Institute, Vietnam
Department of Livestock Services Irian Jaya, Indonesia
Research Institute for Animal Production, Indonesia
Indonesia Legumes and Tuber Roots Institute, Indonesia
Assessment Institute for Agricultural Technology, Papua, Indonesia

Project budget

\$1,481,230

Project duration

01/01/2001 to 31/12/2008
(Project extended from 01/01/2007 to 31/12/2008)

ACIAR Research Program Manager

Dr Doug Gray

Project outcomes

Sociopolitical turmoil in West Papua hampered project activities in the first year. Work was undertaken on sweetpotato selection in Java, Indonesia and in Vietnam. When work finally commenced in West Papua it involved an extensive exercise of data gathering, surveys and field observations, yielding much information about the animal and crop production systems and the sociocultural and belief systems of Bailem Valley communities in West Papua.

Pig diseases and management emerged as a more significant factor than expected, and ACIAR provided extra funds to extend the surveys. The surveys showed that internal parasites were the most important problem for pigs. The project scientists therefore devised a management plan for pig production, incorporating some elements of the traditional 'laleken' system that had previously been used to manage rotational grazing and isolation of dung, but had been abandoned when wood for construction became scarce. A modified design is being considered for trialling in an extension operation.

In northern and central Vietnam, where the sweetpotato–pig raising system is an important component of the domestic economy, the project should increase household incomes through increased starch and protein yields in sweetpotato and improved pig growth. Farmer-to-farmer extension has already started in Vietnam, involving farmer-trainers who have attended workshops and distribution of a manual that arose from the project.

The reviewers recommended that the project be extended in West Papua for a further two years, with an invitation for Papua New Guinea to become involved. Vietnam has already fulfilled its project objectives.

FIS/2001/058: Sustainable tropical spiny lobster aquaculture in Vietnam and Australia

Grow-out of the tropical spiny lobster *Panulirus ornatus* in Vietnam has developed rapidly from a small beginning in 1992 with a few hundred cages, into a large export-oriented, village-based industry worth US\$65 million in 2006 and producing around 1,900 tonnes from 49,000 sea cages—about equal to Vietnam's fishery production of lobsters. This species is very highly valued, among the most valuable lobster species in the world, with a market price of approximately US\$50 per kilogram live into Hong Kong in 2007. The lobster aquaculture industry is based on an abundance of naturally settling late larval stage (puerulus) lobsters, which are collected along the coastline of central Vietnam. Collection rates grew very quickly from 500,000 in 1999 to 2,500,000 in 2003. In 2007 lobster disease had a devastating effect, cutting production to 1,400 tonnes. This was attributed to environmental degradation from inappropriate feeding practices and unmanaged industry development. The supply of seed-stock for the cages and the trash fish used to feed the lobsters are currently still all based on catching from the wild.

The project had two broad objectives: the first was to enhance the sustainable production of tropical spiny lobster in Vietnam (and indirectly more widely throughout South-East Asia) and the second was to develop technology that facilitates commercial establishment of tropical spiny lobster grow-out in Australia.

Overseas collaborating countries

Indonesia, Vietnam

Commissioned organisation

CSIRO Marine and Atmospheric Research, Australia

Project leader

Dr Kevin Williams

Collaborating institutions

Research Institute for Aquaculture No. 3, Vietnam
Queensland Department of Primary Industries and Fisheries, Australia
Institute of Oceanography, Vietnam
University of Fisheries, Vietnam
Directorate General Aquaculture, Indonesia

Project budget

\$1,123,117

Project duration

01/01/2005 to 30/06/2009
(Project extended from 01/07/2008 to 30/06/2009)

ACIAR Research Program Manager

Dr Chris Barlow

Project outcomes

Both project objectives were successfully accomplished. There has been a comprehensive census of lobster seed collection in Vietnam and the technology and techniques developed through the project have been passed on to the Indonesian collaborators for the conduct of their own seed census. To date, there has not yet been an

attempt for assessment of the ecological impact of lobster seed collection based on the data that has been collected. This would require a comparison with the wild catch of lobsters over the past ten or so years, to see if increasing seed catch has resulted in a decrease in the wild catch, with some assessment of the ecological impact and increased production resulting from aquaculture of the species.

There have been several studies conducted that show how to reduce the postcapture losses of lobster pueruli. These results have been extended to industry, through working with the fishers and through publication of literature. Further research and extension is required to benefit the whole of this sector of the fishery, which extends along 700 kilometres of coastline.

There was considerable diet development work within this project which has resulted in a reasonably priced, formulated diet for lobster grow-out at the experimental scale. Work is still required to attract commercial feed companies that can produce this diet for the industry. There are several other aspects of husbandry best practices for lobster grow-out that have been examined, including co-culture with mussels to reduce site pollution and feed costs, feasibility of land-based culture and improving nursery survival of seed lobsters with better shelter materials. However, further work is required, particularly with respect to cage, farm design and feeding practices to reduce nutrient outputs, increase survival and increase ecological sustainability.

Enhancement of capacity building and technology transfer has been a strong point of this project, with all participants reporting successful outcomes from training and staff development. The project has been influential in improving lobster aquaculture practices in Vietnam and supporting a fledgling industry in eastern Indonesia. In Australia, the project achieved all the goals set out at the beginning of the project at an experimental, research level. The participants are now ready to work with Australian businesses and Aboriginal and Torres Strait Islander communities to develop an Australian industry and verify the grow-out technology package that has been developed at the commercial level.

A significant issue that arose during the project (in 2006–07) was the large loss of stock in culture from a condition termed 'milky lobster disease'. This had a significant impact on profitability and production, so much so that prices of postpueruli dropped by 64% from US\$11 per piece in 2006–07 to US\$4 in 2007–08. The Government of Vietnam subsequently funded a lobster disease survey and some research. Lobsters were injected directly with antibiotics and while this reduced mortality it also affected growth. The cause of the disease is presently under investigation by Vietnamese scientists.

FST/2002/112: Domestication of Meliaceae species in South-East Asia and Australia, particularly management of the problem of *Hypsipyla robusta* attack

The domestication of Meliaceae species in South-East Asia and Australia is based on the high-value wood they produce, including mahogany, *Chukrasia* and red cedar. A barrier to plantation development has been attacks by the *Hypsipyla* genus of insects. These shoot borers attack the stem apex, causing deformation that lowers the quality of harvested logs. Previous ACIAR-supported research has advanced domestication prospects and identified *Hypsipyla*-resistant families and provenances. Identification, development and testing of tolerant *Toona ciliata* (red cedar) and *Chukrasia* will be conducted, with silvicultural and management protocols aimed at mitigating attacks also developed. Another aim will be capacity building at partner-country research institutions, through project involvement and results dissemination.

Overseas collaborating countries

Lao PDR, Thailand, Vietnam

Commissioned organisation

CSIRO Forest Biosciences, Australia

Project leader

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Collaborating institutions

Queensland Department of Primary Industries and Fisheries, Australia
National University of Laos, Laos
Department of National Parks, Wildlife and Plant Conservation, Thailand
Forest Science Institute of Vietnam, Vietnam

Project budget

\$386,083

Project duration

01/07/2005 to 30/06/2008
(Project extended from 01/07/2008 to 31/03/2009)

ACIAR Research Program Manager

Dr Russell Haines

Project outcomes

Final report not yet submitted by the project leader

FIS/2002/068: Improving feeds and feeding for small-scale aquaculture in Vietnam and Cambodia

Aquaculture, or fish farming, is the fastest-growing food production sector in the world. It is being seen as a sustainable solution to the growing pressure that increased fishing activities are placing on wild resources. Advances in culturing fish are reducing the capture of wild juvenile fish, to then grow to size, boosting the value of fish farming. But further advances are needed to ensure aquaculture itself remains a viable and sustainable option for smallholders and the environment alike. One component where advances could enhance sustainability is in fish diets. Most fish farmers do not buy commercial feeds. The high cost of these is not adequately returned in the market price of fish. Farmers make their own feeds using available ingredients, such as rice bran and trash fish. Often these formulations do not sufficiently meet the nutritional needs of growing juvenile fish. To compensate, some farmers ensure excess food and nutrients are available, eating into profit margins and increasing the likelihood of environmental impacts.

In Vietnam and Cambodia, smallholder farmers are keen to get involved in aquaculture. The main barrier is a lack of information on the ingredients for diets. This, when assessed against the nutritional needs of fish species farmed, can help in formulating optimal diets. Differences in feed requirements also extend to the stage of development; high protein and energy required for juvenile fish are not always suitable for maintaining health in fully grown fish. Bioenergetic modelling, using these variables, can define protein and energy requirements and then guide the formulation of diets using local ingredients to match these parameters.

The overall aim of the project was to enhance the development of sustainable aquaculture using locally (Vietnam/Cambodia) derived ingredients and better formulated feeds to:

- develop diets based on locally available ingredients for improved production of *Pangasius* catfish and tilapia in southern Vietnam, *Pangasius* catfish in northern Vietnam and Cambodia, and barramundi in Australia
- demonstrate/evaluate the potential of new improved feeds in on farm trials
- transfer technology and extend information.

Overseas collaborating countries

Cambodia, Vietnam

Commissioned organisation

Department of Fisheries, Western Australia, Fremantle Maritime Centre, Australia

Project leader

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Collaborating institutions

Can Tho University, Vietnam
Royal University of Agriculture, Cambodia
Lake Argyle Industries Pty Ltd, Australia
Research Institute for Aquaculture No. 1, Vietnam
Aquaservice, Vietnam

Project budget

\$761,460

Project duration

01/01/2004 to 31/12/2008

(Project extended from 01/07/2007 to 31/12/2008)

ACIAR Research Program Manager

Dr Chris Barlow

Project outcomes

The project achieved its primary objectives, with progress being excellent in the Mekong Delta (the main focus of the project). Progress in northern Vietnam was good but delayed by project staff changes. In Cambodia, progress was mainly related to capacity building.

The project sought to develop diets based on locally available ingredients for improved production of *Pangasius* catfish and tilapia in southern Vietnam, *Pangasius* catfish in northern Vietnam and Cambodia, and barramundi in Australia. The project team collected regional and seasonal information on the availability and nutrient composition of local feed ingredients, which included trash fish and commercial grain products. These data are being compiled into a database that will be published, either in print or on the internet, to make it as widely available as possible to potential users.

Formulation of efficient and cost-effective diets for the fish species of interest was through the development of a bioenergetic model for each species, to relate protein and energy requirements to size of fish and water temperature during culture. The model requires data from a complex series of experiments for each species. Together with information on the nutritional value of locally available ingredients, this model can be used to assist in the formulation of feeds and the feeding strategy for the particular feeds. This work progressed extremely well with outstanding results for barramundi and catfish. Good results were also obtained for tilapia, but these will require further refinement.

The principal investigator interacted closely with the Australian barramundi farming industry to pass on the information on the project's barramundi bioenergetic model. New diet formulations for barramundi based on the model have been produced, tested and adopted by commercial feed manufacturers in Australia.

Diets for catfish and tilapia that were formulated and produced at the Research Institute for Aquaculture No. 1 (RIA1) in Vietnam were assessed on a number of small farms. The on-farm trials were used to compare locally prepared (on-farm) feeds with the feeds produced at RIA1.

The economic benefit of these diets is still being assessed. The main constraints to increasing use of formulated feeds to replace low-value fish as feeds for key species in Vietnam (other than *Pangasius* catfish production in the Mekong Delta) are the lack of information to demonstrate the cost-effectiveness of formulated feeds in comparison to trash fish, lack of the information needed to formulate cost-effective feeds, the perceived high price of currently available formulated feeds relative to trash fish, and lack of a compelling argument to encourage the support and commitment of feed companies to manufacture the feed once a formulation is developed.

Future priority research initiatives to address these constraints are associated with the development of cost-effective feeds. Priorities include: understanding the production status and potential demand for feed for target species; current status and use of trash fish and barriers to changing practice; better understanding the nutritional requirements of target species; evaluating the potential of available ingredients for use in formulated feeds; understanding how feeding strategies need to change to adapt to formulated feeds,

and, finally, overcoming the barriers for feed companies to manufacture formulated feeds and for farmers to use these feeds.

FIS/2005/115: Improving capability for shrimp virus PCR testing laboratories in Vietnam

Vietnam is a major producer of farmed shrimp with annual production exceeding 330,000 tonnes. The bulk of production is from smallholder farming systems in the Mekong Delta region and production is almost entirely black tiger shrimp (*Penaeus monodon*). As occurs elsewhere in Asia, viral disease has a major impact on shrimp aquaculture in Vietnam with losses estimated at 20–25% of annual production.

The management of viral disease in shrimp aquaculture is based entirely upon pathogen exclusion and stress minimisation practices. One of the most critical control points for pathogen exclusion is the use of the polymerase chain reaction (PCR) technique to screen brood-stock and/or seed for major pathogens before stocking of ponds. However, there is currently little or no regulation of PCR-screening techniques, which results in poor reproducibility and reliability, causing many farmers to question the value of the screens. The objective of this project is to improve delivery of PCR-screening performance and enhance reliability of shrimp production for smallholder farmers by adapting an approach developed and applied in India and Indonesia under another ACIAR project (FIS/2002/075). This involves targeted training for service laboratory technicians from the government and private sectors with coordinated inter-laboratory calibrations of PCR-testing performance. Increased reliability of PCR testing will ensure improved shrimp seed quality, resulting in improved productivity for smallholder shrimp farmers. There will be a flow-on of benefit to allied industries, local communities and the national economy. There will also be benefit to the Australian shrimp-farming sector by assisting the reduction of exotic disease risks associated with increasing trade in seafood and seafood products.

Overseas collaborating country

Vietnam

Commissioned organisation

CSIRO Livestock Industries, Australian Animal Health Laboratory, Australia

Project leader

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Collaborating institution

Network of Aquaculture Centres in Asia–Pacific, Thailand

Project budget

\$124,982

Project duration

01/04/2008 to 31/12/2008

ACIAR Research Program Manager

Dr Chris Barlow

Project outcomes

Final report not yet submitted by the project leader

FIS/2007/117: Review of sandfish pond-culture progress in Vietnam

Coastal communities in the Asia–Pacific region are facing severe difficulties maintaining livelihoods based on fisheries resources. Attributes of sandfish (*Holothuria scabra*) make it particularly attractive for aquaculture. These include: a high market price; demand from China that currently swamps supply; benefits of farming a low-food-chain species for which expenditure on food may not be needed (sandfish feed on organic material in pond sediments). Recent findings by the Malaysian WorldFish Center working in Vietnam and through an ACIAR–WorldFish project in New Caledonia indicate that sandfish can grow 2–3 times faster in earthen ponds than in the wild, with comparatively high survival. The objective of this project was to document recent progress and bottlenecks in both research and pilot-scale commercial trials in Vietnam. Covering all production phases, these trials presented a unique opportunity to gather data that will shape future research to support industry establishment in the Asia–Pacific region.

Overseas collaborating country

Vietnam

Commissioned organisation

WorldFish Center, Malaysia

Project leader

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Collaborating institution

Research Institute for Aquaculture No. 3, Vietnam

Project budget

\$54,226

Project duration

01/11/2007 to 31/10/2008

ACIAR Research Program Manager

Dr Chris Barlow

Project outcomes

The study assessed growth and survival of sandfish through the wet season by direct observation in commercial ponds, and through farmer interviews. Survival of sandfish enclosed in nine pens within three operating commercial ponds was 100% through the 2007–08 wet season, which included nine consecutive days of exceptionally heavy rain. Growth rates in ponds were very high for a month following trial inception (up to 3.5 grams per day) but declined rapidly with reducing water temperature in the wet season. Farmers reported growth rates of 1.0–1.8 grams per day over a 10-month period that included the wet season. The lowest growth rates were from ponds stocked well above (almost twice) the recommended maximum of one sandfish per square metre.

Interviews with farmers revealed that while most had at some stage experienced high mortality rates during periods of heavy rain, this occurred before they were fully aware of pond management requirements for sandfish. Simple interventions, including regular tidal

water changes and limited use of paddlewheels, prevented these mortality events. During significant floods in the 2007–08 wet season, experienced farmers reported no increases in mortality due to the influx of fresh water.

Unpublished research in Vietnam shows that sandfish are tolerant of salinity shocks. These results reinforce the thinking of farmers and researchers in Vietnam that pond stratification (a layer of freshwater forming on top of sea water, reducing oxygen exchange), rather than low salinity alone, was a significant contributor to wet-season mortalities.

A synthesis of farmer and researcher knowledge provided the following list of physical pond characteristics critical for successful sandfish culture:

- regular, direct tidal access to clean sea water via sluice gates positioned directly at the seashore or connected via a short drainage canal
- isolation from potential high-level freshwater inputs
- pond sediments that are not too coarse to permit the regular burying activity of sandfish
- appropriate pond preparation before stocking.

Bioeconomic modelling showed that staff salaries were by far the largest contributor to the cost of production, but that returns were also sensitive to stocking density and size at harvest. Modelling also suggested that rotational culture will substantially improve the returns from farming, and that the development of a late-stage nursery system to promote rotational culture was highly desirable.

Culture of sandfish in Vietnam and elsewhere has considerable potential benefit beyond being a replacement species for struggling shrimp farmers. Reducing the organic loading of pond sediments will enhance water quality, may improve the health and productivity of species grown in co-culture or in rotation with sandfish, and will lengthen the productive life of ponds. It also diversifies aquaculture for smallholders with minimal cost and no additional feed costs.

Five priority research areas to support future smallholder industry development in Southeast Asia were identified:

- *Environmental requirements and interactions:* Most of our experience with pond grow-out systems comes from Vietnam. Due to fairly uniform conditions in Vietnam, there are limited data on correlations between growth/survival and physical and chemical characteristics of ponds. Similarly, environmental shocks in other areas of South-East Asia (typhoons, hypersalinity) will differ from those in Vietnam (hyposalinity, stratification).
- *Commercial hatchery systems:* Juveniles for the culture industry in Vietnam are currently produced at the national hatchery facility. For industry expansion, a modular system for converting existing shrimp hatcheries should be developed.
- *Advanced nursery systems:* Currently, sandfish are seeded to ponds at a size of approximately 2 grams. Developing advanced nursery systems that produce 20–50-gram juveniles would reduce the main grow-out phase in ponds to around 8 months. This reduces vulnerability of farming operations to extreme weather conditions, and allows for rotational culture with other species.
- *Rotational and co-culture systems:* Due to their benthic foraging behaviour, sandfish require fairly large pond areas for fast growth. The efficiency of resource use and financial return may be substantially improved through co-culture systems. While early indications are that shrimp co-culture may not be effective, alternative species (notably finfish) should be investigated.
- *Value-chain analysis:* As a new enterprise, market analysis will be a critical

component of any program to advance industry development. The key objective of such an analysis would be to identify ways to ensure equity and maximum social and fiscal returns to communities engaged in this activity. The potential for the production of increased and predictable volumes of sandfish provides new marketing opportunities that may provide better returns to farmers than existing chains that handle the small volumes of wild catch.

FST/2003/002: Development and evaluation of sterile triploids and polyploid breeding methodologies for commercial species of *Acacia* in Vietnam, South Africa and Australia

Several species of Australian acacias have become commercially important in both tropical and temperate regions. These species have gained widespread acceptance due to their high yields, simple silvicultural regimes, prolific seed production and fast growth rates. These traits, however, also carry a level of risk when introduced into exotic environments, that species will reproduce and spread beyond plantations or planned growth to become invasive weeds. The planting of sterile, but high-yielding, varieties would overcome this risk. Some forms of acacias are sterile, offering protection against becoming invasive weeds in exotic environments. The sterility comes from manipulating chromosome numbers (ploidy) in search of improved productivity.

Some forms of polyploid, such as triploids formed by mating diploid (2n) and tetraploid (4n) parents, are reproductively sterile which confers possible advantages in tree improvement: more harvestable woody biomass may be produced if energy is not invested in maturing fruits and seeds. When genetic modification technology is developed in the future, the availability of sterile genotypes is expected to overcome concern about 'genetic pollution' through uncontrolled outcrossing to non-crop trees. During 2001, Shell International Renewables Ltd donated tetraploid *Acacia mangium* plants to the Forest Science Institute of Vietnam and made available associated technical reports to the Australian partners. This offers potential to grow this species as a sterile but high-yielding variety.

The project is developing and assessing the utility of polyploid breeding methods for commercially important acacia species, to position for production of triploid plants from elite germplasm for operational deployment. This goal will be achieved via activities within six sub-projects, each involving work by partner organisations in two or more countries.

Overseas collaborating countries

South Africa, Vietnam

Commissioned organisation

University of Tasmania, CRC for Sustainable Production Forestry, Australia

Project leader

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Collaborating institutions

CSIRO Forest Biosciences, Australia
Forest Science Institute of Vietnam, Vietnam
CSIR Environmentek, South Africa
Sylvatech Ltd, Australia
University of Adelaide, Australia

Project budget

\$506,054

Project duration

01/01/2004 to 30/06/2009

(Project extended from 01/07/2008 to 30/06/2009)

ACIAR Research Program Manager

Dr Russell Haines

Project outcomes

Final report not yet submitted by the project leader

LPS/2002/079: Utilisation of local ingredients in commercial feeds for pigs

The pig production sector is an important avenue for smallholders to earn additional income. Increasingly, smallholders are entering the commercial arena, responding to the demand for lean pig products; a valued source of human dietary protein. The major constrain to increased smallholder involvement in the commercial sector and to the long-term viability of commercial operations is the cost of feed. Traditional feeds are based on grains and protein-rich components. Prices are being driven up by the increasing global demand for grains. In Vietnam, smallholders utilise a variety of feedstuffs, despite limited knowledge concerning their value. Commercial imperatives, however, require feeds that maximise performance and meat quality.

A past project which delivered improved pig genotypes also examined dietary feeds. Many hundreds of components are available but their value in terms of maximising performance and meat quality is unknown.

The project is assessing the suitability of some locally available protein and energy sources as components of commercial pig diets. Adoption of these outputs is intended to lead to reduced prices of commercial complete and concentrated diets and to reduce reliance upon imported dietary components.

Overseas collaborating country

Vietnam

Commissioned organisation

Department of Employment, Economic Development and Innovation, Australia

Project leader

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Collaborating institutions

Institute of Agricultural Sciences of Southern Vietnam, Vietnam
Southern Sub-Institute of Agricultural Engineering and Post-Harvest Technology, Vietnam

Project budget

\$400,001

Project duration

01/04/2004 to 31/03/2009
(Project extended from 01/04/2007 to 31/03/2009)

ACIAR Research Program Manager

Dr Peter Horne

Project outcomes

Final report not yet submitted by the project leader

SMCN/2002/015: Managing groundwater access in Tay Nguyen (central highlands), Vietnam

The Tay Nguyen (central highlands) region is Vietnam's leading coffee producer. It also supplies agricultural and forestry products for domestic markets and export. The region covers approximately 17% of Vietnam's land area, including 16% of total arable land and 22% of forested land. In recent years, drought has struck, reducing coffee production in 2003 by an estimated 25%. Domestic water supplies were also threatened. Drought, however, was not the only factor in production declines and water shortages. Government of Vietnam policies have encouraged the intensification of agricultural and agroforestry practices over the past three decades. Population growth has since resulted during the same period, intensifying resource use, including water. Much of the increased agricultural production has been based on cropping, with deforestation providing cropping land and increasing water use.

Current groundwater extraction practices to support and underpin much of this agricultural expansion are unsustainable. Recent droughts have exacerbated the threat to groundwater and agricultural production but are not the main cause of concern. If left unaddressed, sustainable farming will collapse and the economic, social and environmental impacts could be severe—both to the region and Vietnam as a whole. Salinity and nutrient depletion are becoming evident and have the potential to be widespread. This will cause production to decline in key industries and unemployment will rise as a consequence.

The project aimed to:

- understand the dynamics of groundwater flows in the Tay Nguyen region and to employ these data to analyse the physical impacts of alternative use regimes over the forecast period
- determine the use allocation of groundwater resources that provide for social improvements on the basis of economic, social and environmental criteria using extended benefit–cost analysis
- consider alternative policy options for securing improved groundwater-use practices and determine the most practical and cost-effective institutional framework to provide incentives for the improved use of the resource using the new institutional economics framework
- facilitate the use of the research findings in the development of policy initiatives and institutional frameworks
- build the capacity of Vietnamese scientists and organisations involved in resource and environmental management.

Overseas collaborating country

Vietnam

Commissioned organisation

Australian National University, National Centre for Development Studies, Australia

Project leader

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Collaborating institutions

Taj Nguyen University, Vietnam
Ho Chi Minh City University of Economics, Vietnam
Department of Water Resources Management, Vietnam

Project budget

\$402,912

Project duration

01/01/2005 to 31/12/2008
(Project extended from 01/07/2008 to 31/12/2008)

ACIAR Research Program Manager

Dr Gamini Keerthisinghe

Project outcomes

The development of a sustainable water management regime in Dak Lak province in the central highlands of Vietnam is one of 18 high national priority projects in the Implementation of the National Water Resources Strategy for 2006–10.

Vietnam is the second-largest coffee producer in the world, and approximately 40% of national coffee output originates from Dak Lak province. In recent years, coffee production in Dak Lak has been significantly constrained by dry-season water shortages, and the sustainability of smallholder coffee production in the region has been questioned.

Increasing irrigation water-use efficiency on coffee smallholdings in Dak Lak would generate sizable social welfare increases to inhabitants. Coffee smallholders were found to be inefficient irrigators, applying more than twice the amount of water required to maximise coffee yields.

By adopting a technically efficient irrigation schedule, water input could be reduced from the current average application of around 1,050 litres per tree per irrigation to 550 litres per tree per irrigation. Achieving this water input would increase output per hectare by around half a tonne to five tonnes on average, and would also reduce variable irrigation costs by around 10% on average.

Developing effective institutions that can bring about greater irrigation water-use efficiency on coffee smallholdings in the Dak Lak Plateau is therefore strongly recommended. While pricing or some other form of supply constraint is one feasible component of a program to increase irrigation water-use efficiency in the coffee smallholder sector, such institutions cannot be implemented on a stand-alone basis because they will not by themselves reveal the marginal economic value of water to coffee smallholders.

A feasible and realistic approach to increasing irrigation water-use efficiency on coffee smallholdings in the short term is therefore through farmer education. Hence, a key recommendation from this research is to establish pilot programs training coffee smallholders in irrigation water management. Because the project research showed that coffee smallholders also overfertilise, a comprehensive coffee smallholder training program that includes good irrigation and fertiliser and other farm management practices is recommended. Further, because households in Dak Lak have shown they are willing to pay for programs that increase irrigation water-use efficiency on coffee smallholdings, some form of funding arrangement based on direct contributions could be considered.

It is also recommended that water policy and planning in Vietnam should continue to be strengthened by encouraging work that effectively drives formal water laws, policies, and institutions into on-the-ground application.

7 Impact Assessment Program

ACIAR has a long history of assessing the impact of its research and development (R&D) investments. These assessments have provided valuable lessons in improving the selection, design and delivery of R&D projects. They have also been useful for demonstrating the value of ACIAR as part of Australia's international development assistance program. The two main types of finished project assessments are adoption studies and impact assessments.

Adoption studies became part of ACIAR's evaluation strategy in 2003–04. They are undertaken by project leaders on completed projects where ACIAR expenditure was greater than \$400,000, and for which there is no follow-on project. The primary purpose of these evaluations is to provide information on the uptake of the project results, three years after a project's completion. In addition, where there has been no adoption, information on the reasons for the lack of uptake is sought. Information from adoption studies, of which over 50 have been completed to date, is used to support ACIAR's investment decision-making process, in project development and design and in the selection of projects for impact assessment.

Impact assessments involve extensive analysis of the adoption and impact of the project results, both in the partner country or countries and in Australia. Over the last six years, there has been an increased focus on undertaking thematic impact assessments, rather than assessing the impact of individual projects. The credibility of ACIAR impact assessments has been enhanced by several meta evaluations and the use of independent consultants to undertake the studies. In addition, stratified random-sampling techniques are used, where practical, to select projects for impact assessments. ACIAR has also published guidelines for assessing the impacts of its research activities to ensure rigour and consistency in all future assessments.

As part of the evaluations, areas for practical methodology innovations were identified and some advances in impact assessment methods were made. In recent years, the focus has been on developing and implementing frameworks to measure the returns to ACIAR's investment in capacity building. Over 50 full benefit–cost assessments have been published in ACIAR's impact assessment series.

ACIAR has developed a database for systematically recording all the adoption studies and impact assessments and providing important summary information to support decision-making. This continues to be developed, expanded and refined to ensure maximum use is made of the results of these impact assessment efforts.

ACIAR has begun the process of linking its impact assessment work to the activities of the Australian Government's Office of Development Effectiveness and will strengthen this link during 2009–10.

7.1 Impact assessments undertaken in 2008–09

This year, five impact assessment studies were undertaken, with details reported below. The ACIAR Database for Impact Assessments became operational, with a report describing the framework and functionality of the database published in the Impact Assessment Series. The database allows a comprehensive update of previous analysis of returns to ACIAR's investments in R&D. Based on an analysis of the quantitative information obtained from 37 ACIAR impact assessment studies, the total cost of the investment in these projects is around \$234 million in net present value terms (2008 dollar equivalents). Of these costs, \$128 million are direct ACIAR costs. In total, these projects generated an estimated total benefit of \$12.6 billion, with the benefits attributable to ACIAR being \$6.8 billion. The benefit:cost ratio for all the projects evaluated is around 54:1.

This study also contained a significant qualitative element, which involved drawing evidence on the appropriateness, effectiveness and efficiency of ACIAR's activities within the broad context of Australia's aid delivery system. There is a particular emphasis on whole-of-government and public good issues, which demonstrates that ACIAR is an effective and efficient funding agency. Despite its relatively small size on the international aid and research for development arena, ACIAR performs well, ensuring that the research it invests in meets the needs of its stakeholders, makes a difference to the livelihoods of the poor and aligns within the broader Australian aid program.

Two-stage grain drying in the Philippines

Grain drying is a major issue in all grain-producing countries, presenting particular problems in humid, tropical climates. ACIAR and the Philippine Council for Agriculture, Forestry and Natural Resources Research and Development, in association with other Philippine research organisations, supported a major effort in this area dating back to the early days of ACIAR's activities. The assessment indicated that the grain-drying technologies had not been adopted in the Philippines despite evidence of adoption in other collaborating countries in the Asian region and in Australia. This lack of adoption and impact was due to the structure of the grain industry in the Philippines, with the grain-trading industry dominated by small-scale operators. As a consequence, economies of scale do not exist in grain trading, and the grain-drying technologies developed are therefore currently not profitable. These lessons will help guide future investments in research, in particular the interactions between local industry and policy conditions and research activities. The analysis undertaken suggests that, if the structure of the grain industry in the Philippines changes, application of the grain-drying technologies developed could yield returns as high as those gained in other countries.

ACIAR Database for Impact Assessments (ADIA): an outline of the database structure and a guide to its operation

This report describes the development of a database established as the repository of information from impact assessments. The database provides a mechanism to choose a stratified random sample of completed projects for impact assessment. As well, on the basis of the data entered, the database can be used to manipulate information and present it in various forms for reporting and analytical purposes.

Salinity reduction in tannery effluents in India and Australia

The tanning industry is an important contributor to economic output in India, particularly in the state of Tamil Nadu, which produces around 60% of India's total leather production. Tannery effluent, however, is high in salinity and has caused significant environmental damage, including increased salinity in groundwater and river systems, contaminating productive agricultural land and drinking water. Reducing the salinity of effluent was a common challenge for both Indian and Australian tanners. ACIAR provided funding of \$0.8 million in nominal terms out of a total budget of \$1.9 million for a project to reduce the salinity of tannery effluent by developing technologies that reduced salt inputs. The project was undertaken by the Commonwealth Scientific and Industrial Research Organisation (CSIRO) Textile and Fibre Technology in partnership with the Central Leather Research Institute in India. It is estimated that, in constant 2008–09 dollars, the project will deliver benefits to Indian tanners of around \$62.0 million in present value terms, using a discount rate of 5%. Of these total benefits, \$28.1 million can be attributed to ACIAR on a cost-share basis, resulting in a net benefit of \$59.9 million; a benefit of \$29.60 for every dollar spent. The internal rate of return on the project is estimated to be 35.1%.

Integrated management of insect pests of stored grain in the Philippines

Protecting stored grain in tropical areas relies on the use of pesticides. ACIAR supported a series of four research projects to develop effective alternative control options for major

pests of stored grains in the tropical areas of Australia, the Philippines, Malaysia, Thailand and China. The combined research involved the Bureau of Postharvest Research and Extension and two research groups in Australia—the Queensland Department of Primary Industries and CSIRO. This assessment focused on the impact in the Philippines and, through surveys of members of the grain sector, found that there has been significant adoption of the outcomes. This has been primarily by the larger storage and handling sectors of the rice and other grain industries. The study found that the return on this significant investment by all parties was substantial, with a net present value of research gains to the Philippines of \$1,696 million. This provides a benefit:cost ratio of approximately 174:1 and an internal rate of return of 46.6%.

Analysis of ACIAR's returns on investment: appropriateness, efficiency and effectiveness

Following the development of an impact assessment database, a study was commissioned to analyse the results of 37 quantitative impact assessments. In total, the benefits to ACIAR research calculated in these impact assessments are estimated at \$12.6 billion for a total investment of approximately \$234 million in 2008 dollar present value terms. Of the total benefits, \$11.4 billion accrued to developing countries, with \$1.2 billion in benefits to Australia. The average benefit:cost ratio across all assessed projects is 54. Of the \$12.6 billion, the benefits directly attributable to ACIAR funding are estimated at \$6.8 billion for an investment of \$128 million across the assessed projects. Given that total ACIAR expenditure since inception is estimated at \$2.1 billion, the returns from assessed research effectively pay for total expenditure more than three times over.

This impact assessment demonstrates the appropriateness, effectiveness and efficiency of ACIAR-funded research over a long period of time. A key finding is the importance of partner-country scientific, research and extension capacity. ACIAR's research tends to be more successful in countries with strong capacity in these areas, while countries where uptake of ACIAR research has been low tend to have lesser in-country capacity. Alignment of priorities agreed by partner countries and ACIAR is also an important factor in uptake of research.

7.2 Impact assessments planned for 2009–10

Key performance indicators

- at least five impact assessment studies of completed projects published
- impact assessment review of at least one thematic area in Indonesia
- impact assessment of at least one thematic area in Papua New Guinea (PNG)
- assessment of the impact of international agricultural research centre (IARC) activities in ACIAR's mandate region
- 2009–10 project leader adoption studies published for selected projects completed in 2005–06
- links established with partner-country, IARC and Australian impact assessment groups.

Key priorities

Project-specific

- Publish five assessments in 2009–10 of the impacts of completed projects (this year, with an emphasis on increasing the number of impact assessments undertaken in ACIAR's two largest partner countries, Indonesia and PNG)

- Where possible and appropriate, increase emphasis on the type and quantity of data used in the impact assessments, in an effort to further strengthen their rigour and credibility
- Review and publish the 2009–10 project leader adoption studies for the set of large projects concluded in 2005–06.

Capacity building

- Develop collaboration with Consultative Group on International Agricultural Research (CGIAR) centres in impact assessment activities, particularly of projects jointly funded through ACIAR
- Provide feedback on the implications of impact assessment studies for research project development and management within ACIAR, through ‘lessons learnt’ style meetings with all staff
- Enhance clarification and estimation of the outcomes of new projects, by assisting project research groups during peer review of their proposals and by including impact analysis in the project design; in particular, provide summaries of the implications of impact studies to meetings of these groups.

Thematic studies

- Review the application and impact of ACIAR natural resource management research activities in the Philippines
- Undertake an assessment of ACIAR’s animal health and/or forestry research in Indonesia
- Commission a comprehensive review of all ACIAR impact assessment studies. This will expand its focus to include issues such as the public good basis for funding this type of collaborative research. It will also disaggregate the benefits to more accurately identify those attributed to other funders of the research and, especially, the development; and will look particularly for whole-of-government and between-government interactions; for example, the shares of benefits to other aid donors such as the Australian Agency for International Development (AusAID)
- Commission two studies to assess the impact of IARC activities in ACIAR’s mandate region—the first, review of past CGIAR impact assessment studies and development of an overview of the impact on the Asia–Pacific region and individual countries within this region; and the second, an assessment of the impact of at least one centre’s genetic improvement program in ACIAR’s mandate countries
- Work closely with the Office of Development Effectiveness (ODE) to ensure ACIAR’s impact assessment work maintains close links with the ODE’s activities.

8 Appendix 1: ACIAR contacts

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9 Appendix 2: ACIAR publications

This is a list of ACIAR publications produced in 2008–09. Print copies are available by emailing <comms@aciar.gov.au>, or electronic versions may be downloaded from ACIAR's website <www.aciar.gov.au>.

Monographs	
120c	<i>Better-practice approaches for culture-based fisheries development in Asia</i> [Tamil translation], Sena S. De Silva, Upali S. Amarasinghe and Thuy T.T. Nguyen (eds), 2009, 117 pp.
120d	<i>Better-practice approaches for culture-based fisheries development in Asia</i> [Sinhalese translation], Sena S. De Silva, Upali S. Amarasinghe and Thuy T.T. Nguyen (eds), 2009, 115 pp.
129a	<i>Diagnostic manual for plant diseases caused by fungi and fungal-like pathogens</i> [Vietnamese translation], Lester W. Burgess, Timothy E. Knight, Len Tesoriero and Phan Thuy Hien, 2009, 210 pp.
134	<i>Growing peanuts in Papua New Guinea: a best management practice manual</i> , Michael Hughes, Rao C.N. Rachaputi, Lastus Kuniata and A. Ramakrishna, 2008, 77 pp.
135	<i>Sea cucumber fisheries: a manager's toolbox</i> , K. Friedman, S. Purcell, J. Bell and C. Hair, 2008, 34 pp.
136	<i>Measuring plant-associated nitrogen fixation in agricultural systems: theory and practice</i> , Murray Unkovich, David Herridge, Mark Peoples, Georg Cadisch, Bob Boddey, Ken Giller, Gruno Alves and Phillip Chalk, 2008, 258 pp.
137	<i>Jorani and the green vegetable bugs</i> [in English], Bob Martin and Deb White, 2009, 48 pp.
137a	<i>Jorani and the green vegetable bugs</i> [Khmer translation], Bob Martin and Deb White, 2009, 48 pp.
138	<i>Landcare in the Philippines: a practical guide to getting it started and keeping it going</i> , Landcare Foundation of the Philippines, Inc., 2009, 144 pp.

Proceedings	
128	<i>Management of classical swine fever and foot-and-mouth disease in Lao PDR</i> , J.V. Conlan, S.D. Blacksell, C.J. Morrissy and A. Colling (eds), 2008, 100 pp.
129	<i>Silvicultural management of bamboo in the Philippines and Australia for shoots and timber</i> , David J. Midmore (ed.), 139 pp.
130	<i>Efficient nutrient use in rice production in Vietnam achieved using inoculant biofertilisers</i> , I.R. Kennedy, A.T.M.A. Chudhury, M.L. Kecskés and M. Rose (eds), 2008, 136 pp.

Impact Assessment Series Reports	
59	<i>Two-stage grain drying in the Philippines</i> , Agnes Chupungco, Elvira Dumayas and John Mullen, 2008, 50 pp.
60	<i>ACIAR Database for Impact Assessments (ADIA): an outline of the database structure and a guide to its operation</i> , Centre for International Economics, 2009, 38 pp.
61	<i>Salinity reduction in tannery effluents in India and Australia</i> , Hayden Fisher and David Pearce, 2009, 53 pp.
62	<i>Integrated management of insect pests of stored grain in the Philippines</i> , S.R. Francisco, M.C. Mangabat, A.B. Mataia, M.A. Acda, C.V. Kagaoan, J.P. Laguna, M. Ramos, K.A. Garabiag, F.L. Paguaia and J.D. Mullen, 2009, 45 pp.
63	<i>Analysis of ACIAR's returns on investment: appropriateness, efficiency and effectiveness</i> , Matthew Harding, Tingsong Jiang and David Pearce, 2009, 37 pp.

Final reports	
2008-19a	<i>Development of an embryo culture manual and an embryo transplantation technique for coconut germplasm movement and seedling production of elite coconut types [HORT/2006/006] [Vietnamese translation]</i> , Stephen W. Adkins, Erlinda Rillo and Osmundo Orense, 2008, 29 pp. < http://www.aciar.gov.au/publication/FR2008-19a >
2008-19b	<i>Development of an embryo culture manual and an embryo transplantation technique for coconut germplasm movement and seedling production of elite coconut types [HORT/2006/006] [Indonesian translation]</i> , Stephen W. Adkins, Erlinda Rillo and Osmundo Orense, 2008, 29 pp. < http://www.aciar.gov.au/publication/FR2008-19b >
2008-35a	<i>Agricultural water-use efficiency in north-western China [LWR/2002006/076] [Mandarin translation]</i> , Philip Young, David Marston, Wang Jinxia and Li Xiande, 2008, 100 pp. < http://www.aciar.gov.au/publication/FR2008-35a >
2008-36	<i>Facilitating farmer uptake of ACIAR project results: World Vision collaborative program [PLIA/2000/165]</i> , Soda Souvannaphong, Jonathan Treagust, John Schiller, Siddhartha Sahu, Monthathip Chanphengxay, Phoudalay Lathvilayvong and Phoumi Inthapanya, 2008, 42 pp. < http://www.aciar.gov.au/publication/FR2008-36 >
2008-37	<i>Increasing milk production from cattle in Tibet [LPS/2002/104]</i> , John Wilkins, John Piltz, Kristy Bailes, Colin Griffiths, Se Zhu, Tsamyu Osman and Nyima Tashi, 2008, 54 pp. < http://www.aciar.gov.au/publication/FR2008-37 >
2008-38	<i>A sea cucumber fisheries management project in Papua New Guinea: a project feasibility review to ACIAR [FIS/2006/133]</i> , Alistair McIlgorm, Bob Lindner and Jeff Kinch, 2008, 32 pp. < http://www.aciar.gov.au/publication/FR2008-38 >

2008-39	<i>Genetic and morphological relationships of mud crabs, genus Scylla, from throughout the Indo–Pacific [FIS/1992/017]</i> , C.P. Keenan, D. Mann, S. Lavery and P. Davie, 2008, 74 pp. < http://www.aciar.gov.au/publication/FR2008-39 >
2008-40	<i>Improving smallholder crop–livestock systems in eastern Indonesia [LPS/2004/005]</i> , Shaun Lisson, Neil MacLeod, Cam McDonald, Jeff Corfield, Lalu Wirajaswadi, Rahmat Rahman, Syamsu Bahar, Nasruddin Razak, Ketut Puspadi, Dahlanuddin, Yusuf Sutaryono, Rusnadi Padjung, Sania Saenong, Lia Hadiawati, Sahardi Mashur and Dwi Proptomo, 2008, 212 pp. < http://www.aciar.gov.au/publication/FR2008-40 >
2008-41	<i>Establishment of beef industries in additional red soils provinces in China [PLIA/2006/151]</i> , R.A. Hunter, J.V. Nolan, N.D. MacLeod, Xu Minggang and Wen Shilin, 2008, 14 pp. < http://www.aciar.gov.au/publication/FR2008-41 >
2008-42	<i>Impact of migration and off-farm employment on roles of women and appropriate technologies in Asian and Australian mixed farming systems [PLIA/2000/039]</i> , Thelma R. Paris, Fay Rola-Rubzen, Truong Thi Ngoc Chi, Chaicharn Wongsamun and Joyce S. Luis, 2008, 56 pp. < http://www.aciar.gov.au/publication/FR2008-42 >
2008-43	<i>Horticulture industry development for market-remote communities: Cape York and Samoa [HORT/2001/023]</i> , Rowland Holmes, Roger Boebel, Philip Tuivavalagi, Jeff Daniells and Mafutaga Tinifu, 2008, 82 pp. < http://www.aciar.gov.au/publication/FR2008-43 >
2008-44	<i>Developing profitable beef business systems for previously disadvantaged farmers in South Africa [LPS/1999/036]</i> , Heather Burrow, Ephraim Matjuda, Phillip Strydom, Baldwin Nkhane Nengovhela, Percy Madzivhandila, Dan Motiang, Garry Griffith and Richard Clark, 2008, 45 pp. < http://www.aciar.gov.au/publication/FR2008-44 >
2009-12	<i>Improving sustainability and profitability of village sea cucumber fisheries in Solomon Islands [FIS/2003/051]</i> , A. Schwarz, D. Boso, C. Ramofafia, N. Andrew and W. Nash, 2009, 69 pp. < http://www.aciar.gov.au/publication/FR2009-12 >
2009-13	<i>Increasing the productivity of cattle in India and Australia with rumen fungal treatments [AH/1997/058]</i> , C.S. McSweeney, K.T. Sampath, C.S. Prasad and S.E. Denman, 2009, 55 pp. < http://www.aciar.gov.au/publication/FR2009-13 >
2009-14	<i>Salinity reduction in tannery effluents in India and Australia [AH/2001/005]</i> , Catherine A. Money, T. Ramasami, N.K. Chandra Babu, C. Muralidharan, J. Ragava Rao, P. Saravanan, A. Amudswari, A.B. Mandal, Ken Montgomery, Mark Hickey, Cameron Simpson, Chi Huynh and Rita Siekris, 2009, 51 pp. < http://www.aciar.gov.au/publication/FR2009-14 >
2009-15	<i>Evaluating domestic tuna fisheries projects [ASEM/2004/011]</i> , Harry Campbell, Ronald Kuk, Margaret Ame, Len Rodwell and Linda Kaua, 2009, 38 pp. < http://www.aciar.gov.au/publication/FR2009-15 >

2009-16	<i>Development of a vaccine for the control of Gumboro in village and small-poultry holdings in Indonesia [AH/2000/083]</i> , Jagoda Ignjatovic and Lies Parede, 22 pp. < http://www.aciar.gov.au/publication/FR2009-16 >
2009-17	<i>Farming systems research for crop diversification in Cambodia and Australia [ASEM/2000/109]</i> , Bob Martin, Bob Farquharson, Fiona Scott, Stephanie Belfield and Chan Phaloeun, 2009, 27 pp. < http://www.aciar.gov.au/publication/FR2009-17 >
2009-18	<i>Microbial contaminants associated with sago processing and storage in Papua New Guinea [ASEM/2001/016]</i> , Jeffrey Warner, Andrew Greenhill and Mary Fletcher, 2009, 74 pp. < http://www.aciar.gov.au/publication/FR2009-18 >
2009-19	<i>Economic performance and management of the Gulf of Papua prawn fishery [ASEM/2002/005]</i> , Tom Kompas and Ronald Kuk, 2009, 16 pp. < http://www.aciar.gov.au/publication/FR2009-19 >
2009-20	<i>Inland pond aquaculture in Papua New Guinea: assessment of the industry and evaluation of smallholder research and development needs [FIS/2001/034]</i> , Paul T. Smith, Augustine Mobiha, Jacob Wani, Kine Mufuape, Kaupa Kia, Micah Aranka, Wally Solato and Hopa Simon, 2009, 11 pp. < http://www.aciar.gov.au/publication/FR2009-20 >

Fact Sheets	
Impact assessment fact sheets	
1	<i>Fruit-fly research yields impacts in the Asia–Pacific region</i> , 2008, 2 pp.
2	<i>Sustaining Indonesia’s fisheries</i> , 2009, 4 pp.
2a	<i>Sustaining Indonesia’s fisheries</i> [Indonesian translation], 2009, 4 pp.
Program fact sheets	
1	<i>ACIAR–SADI [Smallholder Agribusiness Development Initiative] program updates</i> , 2009, 17 facts sheets, total 39 pp.
2	<i>Growing livelihoods from farming</i> , 2009, 2 pp.

Corporate publications	
	<i>Annual Operational Plan 2008–09</i> , 2008, 116 pp.
	<i>Annual Operational Plan 2008–09: Indonesian, Vietnamese, Cambodian and Lao extracts</i> , 2008.
	<i>ACIAR Annual Report 2007–08</i> , 2008, 250 pp.

	<i>ACIAR Annual Report and Publications 2007–08</i> CD-Rom, 2008.
	<i>ACIAR Country Profiles 2008–09</i> : China (71 pp.), Cambodia, Lao PDR, Thailand (132 pp.), Indonesia (178 pp.), Pacific islands (95 pp.), Papua New Guinea (111 pp.), Philippines (73 pp.), South Asia (135 pp.), Vietnam (94 pp.), 2008.
	<i>ACIAR Corporate Plan 2008–2012</i> , 2008, 26 pp. < http://www.aciar.gov.au/publication/CP14 >
	<i>The John Allwright Fellowship scheme: survey report 2008</i> , Felicity Muller and Jessica Morton, 2008, 48 pp.
	<i>Partners in Research for Development</i> magazine: November 2008 – February 2009, March–June 2009, July–October 2009
	<i>Adoption of ACIAR project outputs: studies of projects completed in 2004–05</i> , D. Pearce and D. Templeton (eds), 2009.



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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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