

**ACIAR COUNTRY PROFILES 2008–09:  
INDONESIA**



**ACIAR**

Research that works for developing  
countries and Australia

[www.aciar.gov.au](http://www.aciar.gov.au)

**2008**

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# 1 Preface

The ACIAR Country Profiles are designed to give a snapshot of the collaborative research being carried out between Australia and our various partner countries. This publication contains short summaries of 62 projects that are active in 2008-09. There were another 7 projects under development, which are expected to start in 2008–09 financial year.

This publication also sets out the key outputs and outcomes from 22 projects that have been completed in 2007-08.

In addition to these project summaries, the publication includes information on ACIAR's work, including its training program, the Indonesia chapter from the Annual Operational Plan 2008-09 and the 2007–08 Annual Report.

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

We hope you find the publication useful as a record of the progress and achievements between Vietnam and Australia. For information on ACIAR's overall program, we invite you to visit our website at <[www.aciar.gov.au](http://www.aciar.gov.au)>.



Peter Core

Chief Executive Officer

November 2008

## 2 Overview

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### 2.1 About ACIAR

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

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

Australia is in a particularly strong position to provide such assistance because it has a broad range of climates – cool and warm temperate, subtropical and tropical – that are typical of the Asia-Pacific region.

ACIAR-funded research harnesses Australia's outstanding strengths in agricultural research to develop partnerships with developing-country institutions. This research is mutually beneficial as the similar environments allow the results to be used in Australia and developing countries.

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

#### 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 the 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.

## 2.2 ACIAR's program in Indonesia

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

ACIAR's program with Indonesia as at 30 June 2008.

### ***Bilateral Program***

<b>Active projects</b>	54 with a value over their lifetime of approximately \$36.859 million
<b>Projects under development</b>	14
<b>Completed projects</b>	184

### ***Multilateral Program***

<b>Active projects</b>	9 with a value over their lifetime of approximately \$8.334 million
<b>Projects under development</b>	1
<b>Completed projects</b>	26

<b>Total project budget 2008–09</b>	\$10.93 million which represents 23.7% of the total project budget 2008–09
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The research program in Indonesia is focused on the Eastern Indonesia, Java and some parts of Sumatra, looking at the following agricultural priorities:

- Improved policy options to underpin rural enterprise development
- Biosecurity and crop and livestock pest and disease management
- Development of competitive horticultural industries
- Agribusiness development for plantation crops, aquaculture and crop-livestock systems (particularly in Eastern Indonesia)
- Sustainable management of fisheries resources (shared stocks, illegal fishing) and forestry (management policy for climate change mitigation)
- Involvement in major Australia–Indonesia Partnership programs
  - Smallholder agribusiness development in Eastern Indonesia
  - Aquaculture and farming land rehabilitation in Aceh.

Reflecting these priorities, the research program is split into the following subprograms:

### ***Indonesia Subprograms***

*Subprogram 1: Improved policies to underpin agribusiness development*

*Subprogram 2: Biosecurity cooperation and pest and disease management*

*Subprogram 3: Research to underpin the development of competitive horticultural agribusinesses*

*Subprogram 4: Profitable smallholder aquaculture and agroforestry systems*

*Subprogram 5: Sustainable use and management of fisheries and forestry resources*

*Subprogram 6: Profitable agribusiness systems for eastern Indonesia*

*Subprogram 7: Technical cooperation to underpin rehabilitation of agriculture and fisheries in NAD province*

## 2.3 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 2008–09 of approximately \$5.38 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), including support for the Crawford Fund
- On-the-job training.

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 Fellowship**

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.

#### *John Allwright Fellowships in Indonesia*

		PhD	MSc/Other
Active	Male	13	4
	Female	6	7
Concluded	Male	8	4
	Female	1	6

### **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 they are involved in. 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 Fellowship**

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.

## 3 Indonesia chapter from the Annual Operational Plan 2008–09

GDP per capita (PPP <sup>a</sup> US\$)	3,071	Bilateral actual 2006–07	\$2.9 m
Population (millions)	85	Bilateral estimate 2007–08	\$2.4 m
Projected population (millions) 2015	97	Bilateral budget 2008–09	\$2.6 m
Active bilateral projects	27	Bilateral + multilateral budget 2008–09	\$2.9 m
Active multilateral projects	1		

<sup>a</sup>Purchasing power parity (see Appendix 4, Selected world development indicators)

### 3.1 Medium-term strategy

ACIAR's Indonesia program emphasises the application of agricultural policy and technical research and development to support economic growth from agriculture, forestry and fisheries in six provinces of eastern Indonesia and in parts of Java and Sumatra. The program will contribute to increasing farmers' incomes through shifting emphasis from factor-driven production agriculture to the development of integrated agribusinesses. It will do this by focusing on high-value commodities for which there is strong market demand. The Indonesian Government has identified these commodities as priorities because of major constraints that require attention through research and cooperation to improve the policies that underpin agribusiness development.

In addition to supporting research on production and productivity enhancement, ACIAR will also address related pest and disease management (including shared biosecurity concerns), postharvest processing and market development issues. Protection of the resource base for agriculture will be boosted through research collaboration on aspects of crop and livestock biosecurity, and sustainable forestry and fisheries management; and through policy research on effective engagement in markets, particularly with respect to domestic agricultural policy settings. Improved domestic policy by Indonesia should lead to more active engagement in trade liberalisation initiatives. This will be achieved by contributing to the development of well-functioning agricultural commodity markets in which clearer market

signals will enhance farm incomes and enable Indonesia to realise its comparative production and trade advantages. This will also help in directing technical research and extension to areas of higher returns, and inform more efficient private investment in agribusiness, infrastructure and marketing.

ACIAR and Indonesian partners involve end users such as extension groups, the private sector and NGOs during the development and implementation of projects. ACIAR will encourage linkages between research agencies in agriculture, forestry and fisheries and policy/implementation directorate-generals, and will support cooperation between central institutes and provincially based adaptive research agencies and planning authorities.

The emphasis of capacity-building activities is to support the Indonesian Government's efforts to develop a demand-driven agricultural research system. This will be achieved through training on: research management (including research prioritisation, project evaluation and impact assessment); experimental design and analysis; economics/social science for biophysical scientists; participatory agricultural research and extension skills; and agribusiness, including supply-chain management. There is a particular emphasis on capacity building in research management in institutes in eastern Indonesia and Aceh.

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## 3.2 Key performance indicators (2008–09)

- a new R&D strategy for improvement of productivity and competitiveness of the Indonesian tropical fruit industry agreed and implemented
- a joint Indonesian–Australian major agricultural R&D initiative in Papua, Indonesia, designed and implemented
- initial outputs achieved of the adaptive research component of the Smallholder Agribusiness Development Initiative used by participants in the agribusiness value chain to enhance profitability
- development of improved approaches to technology assessment facilitates knowledge exchange between R&D and extension providers in eastern Indonesia
- improvements to Indonesia’s veterinary services system, policy and operations commenced through development, endorsement and piloting of ‘Indovetplan’; and improvements to endemic disease control programs
- redevelopment of Ujung Batee Regional Brackishwater Aquaculture Development Centre providing effective delivery of technical services to Aceh farmers
- aquaculture planning tools adopted by relevant planning agencies in South Sulawesi
- 40% of new projects designed with potential for significant farmer or policymaker impacts within 5 years of completion

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## 3.3 Position

The country’s proximity and strategic importance to Australia, together with concerns for half of its population who live in poverty (on under US\$2 a day), mean that Indonesia’s prominence in ACIAR’s program will continue. Major issues that will be specifically addressed in ACIAR’s program include human capacity constraints in adaptive research and extension in a system with strong regional autonomy, challenges of natural resource governance, and the need to link with major domestic and international markets.

A key challenge for ACIAR and its partner agencies in Indonesia is to secure practical outcomes for farming communities from the considerable research investment. Several current projects focus on the extension of results from ACIAR projects, while the Smallholder Agribusiness Development Initiative provides additional avenues for greater market and community input to the planning and use of research results. Another opportunity for cooperation is through AusAID via the Australia–Nusa Tenggara Assistance for Regional Autonomy (ANTARA) program in eastern Indonesia, in line with increased emphasis on regional economic development in Indonesia across the broader Australian aid program.

The ACIAR program has a strong focus on partnership, using Indonesian systems for the delivery of programs and projects. We will work with our Indonesian partners to: involve end users such as extension groups and the private sector during the development of

projects; more closely integrate project personnel in project activities at the farming community level; and integrate researchers and policymakers where appropriate. In provinces where ACIAR projects are located, we will involve farmer groups and the private sector in consultations on program priorities. We will increase our emphasis on communicating the outcomes of ACIAR projects and linking with major Indonesian government, donor and industry programs. Formal linkages with two major World Bank programs have been established.

The regional balance of investments is influenced by Australian expertise and alignment with the Australian aid program. Continued collaboration with research and development providers and policymakers in Java and western Sumatra is important. This is especially the case for agricultural policy research, biosecurity collaboration, and horticultural and aquaculture research. Indonesia is in a strategic position for Australia with respect to trans-boundary plant and animal diseases, given its close proximity. Eastern Indonesia also remains a high priority for ACIAR. The program includes activities in Nusa Tenggara Timur, Nusa Tenggara Barat, South Sulawesi and Southeast Sulawesi provinces under both SADI–SMAR and the main ACIAR program. In addition, the design of a program in Papua and West Papua will commence in 2008. In response to the December 2004 tsunami, ACIAR

commenced a number of projects in affected communities in Nanggroe Aceh Darussalam. Engagement in Aceh will continue, but will evolve to provide support for increasing farmer incomes from agriculture and fisheries over the medium term.

ACIAR will encourage linkages between the research agencies in agriculture, forestry and fisheries and the policy/ implementation directorate-generals in the same ministries, where appropriate, as well as with other ministries such as the Ministry of Trade. ACIAR will support linkages between the research capacity of institutions in Java and Sumatra and eastern Indonesian adaptive research agencies and planning authorities. In addition, there will be a greater involvement of private sector and other non-government partners in the program.

Animal health projects will value, develop and test surveillance systems that are applicable for all livestock diseases (but with most application to highly infectious viral agents). Assistance in the development of rapid and appropriate responses once diseases are detected will also be a focus. Targeted research will provide the knowledge base to use tools, such as vaccines, most effectively. Increasingly, the impediments to effective disease control are the regulatory and policy environments, particularly development of the cooperation needed to undertake regional initiatives. Opportunities to improve these will be explored. Provincial and central governments will apply the knowledge gained to implement wider control programs. Endemic livestock diseases will also be targeted where there are clear production losses affecting incomes, and a clearly defined pathway to adoption of research results. ACIAR also supports a number of targeted research activities as part of the Australian aid program's commitment to reduce the threat of highly pathogenic avian influenza (HPAI) in Indonesia and elsewhere in the region.

Fisheries projects have had significant impacts, including in the management of shrimp diseases; rehabilitation of degraded or unproductive shrimp ponds on acid sulphate soils; mariculture of high-value fish and crustaceans; restocking of depleted fisheries; management of illegal, unreported and unregulated (IUU) fishing; and monitoring and harmonising management of shared fish stocks. ACIAR will continue to maintain a large fisheries program in Indonesia and seek opportunities for Australia–Indonesia collaboration on efforts to address IUU fishing. In both fisheries and forestry programs there will be an increased emphasis on balancing environmental and employment issues at a regional level.

In forestry, ACIAR will emphasise both community-based agroforestry systems for income generation in eastern Indonesia and improvement of the sustainability and value capture from major plantation species, including acacia and teak. In keeping with the increased emphasis on collaboration on forests and climate change in Indonesia, researchers will build on the previous program that assessed the economic potential of land-use change and forestry for carbon sequestration and poverty reduction, and on policy research to promote sustainable forest management.

Indonesia is an important partner in projects delivered in conjunction with the International Agricultural Research Centres—namely the International Food Policy Research Institute (IFPRI), Centre for International Forestry Research (CIFOR), the World Agroforestry Centre (ICRAF), the International Potato Centre (CIP) and the Asian Vegetable R&D Centre (AVRDC).

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### **3.4 ACIAR's participation in the Australia–Indonesia Partnership**

The partnership, announced in January 2005, supports Indonesia's reconstruction and development efforts, both in and beyond tsunami-affected areas. Assistance will involve long-term sustained cooperation focused on economic and social development projects and Indonesia's programs of reform and democratisation.

ACIAR manages the design and delivery of components of two major regional development programs:

#### ***Smallholder Agribusiness Development Initiative (SADI)***

SADI aims to improve rural sector productivity and growth in four eastern provinces—Nusa Tenggara Timur, Nusa Tenggara Barat, Southeast Sulawesi and

South Sulawesi. It will improve incomes and productivity for farmers and agribusiness in response to market opportunities through a process that is underpinned by improved adaptive R&D capacity. SADI, a 10-year program with an initial funding commitment from the Australian Government of \$38 m for the period to late 2009, comprises three subprograms, each of which also build on existing activities in Indonesia:

- enhanced smallholder production and marketing (implemented by the Kecamatan Development Program Secretariat of the Ministry of Home Affairs, and supported by the World Bank)
- strengthened private sector agribusiness and small- to medium-enterprise development (implemented by the International Finance Corporation)
- support for market-driven adaptive research (SMAR; implemented by ACIAR through project offices in Makassar and Bogor).

The purpose of SADI is to develop strengthened province-based agricultural R&D capacity that is market and client driven, and to effectively transfer knowledge to end users. A feature of this subprogram is its integration with other subprograms on enhanced smallholder production and marketing and strengthened private sector agribusiness development.

There are three delivery components of the SMAR subprogram. The first, *Adaptive Research and Development* funds province-based organisations to implement high-priority demand-driven R&D projects with international technical support. Priorities for these projects

are being identified through workshops of industry, farmer, government and researcher groups, and through institutional and market assessments. A second component improves linkages and more effective knowledge transfer processes between R&D providers and extension providers. New extension media and methods to assist in dissemination of R&D outcomes will be piloted in the field. The third component, on institutional development, assists with the development of optimal R&D planning, policies and procedures for budget allocation, human resources development and upgrade of equipment.

### ***Rural livelihoods components of the Aceh reconstruction program***

ACIAR and the Australia–Indonesia Partnership for Reconstruction and Development (AIPRD) are also cooperating on the rehabilitation of the Regional Brackish-water Aquaculture Development Centre (RBADC) at Ujung Batee, which is the technology development and extension centre for aquaculture in Aceh. The centre suffered extensive damage in the tsunami in 2004. AusAID will manage the physical infrastructure/ construction component and ACIAR will manage training and re-establishment of aquaculture R&D at the site. A second co-funded activity 'Restoration of annual cropping in tsunami-affected areas of Nanggroe Aceh Darussalam province' links closely with other ACIARfunded projects on restoration of cropping systems in Aceh.

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## **3.5 Research priorities**

Priorities for collaborative agricultural research between Australia and Indonesia were discussed in February 2007 during consultations between ACIAR and representatives of relevant government ministries and agencies, universities, the Indonesia Institute of Sciences (LIPI), the private sector and farmer associations. More detailed consultations were also held in four eastern Indonesian provinces in November 2006. Priorities throughout the program were refined through further consultation in 2007–08. A full list of agreed priorities from the meetings is available at <[www.aciar.gov.au](http://www.aciar.gov.au)> under *Partner country priorities / Indonesia*.

In eastern Indonesia there are opportunities to capitalise on linkages between central

research institutions (mainly based in Java) and institutions undertaking location-specific adaptive research that directly addresses farmers' needs. In 2008 a major collaborative R&D initiative will be designed to assist the development of agriculture in Papua. ACIAR made additional investments in Indonesia to assist with fisheries and agriculture rehabilitation in Aceh after the December 2004 tsunami, and the program has evolved from a post-crisis response to one of underpinning selected areas of agricultural research for development.

More follow-up activities that enhance the transfer of technology of earlier ACIAR projects will be pursued, and opportunities

for greater involvement of industry explored. In 2008–09 the collaborative program will emphasise animal health and production, crop protection (especially integrated with horticultural crop production), forestry, fisheries and agricultural policy research.

Agreed thematic areas for cooperation are as follows:

***Subprogram 1: Improved policies to underpin agribusiness development***

- Installation of policy requirements for improved access for smallholders into developing markets including new and competitive trading relationships
- Installation of policy requirements to support structural adjustment (rural transformation); and agricultural diversification to achieve production change and meet market requirements
- Analysis of policy requirements to support fisheries production, postharvest management, processing and marketing of fisheries products
- Understanding of the basis and effects of farmer population movement, including impacts of land tenure, farm size and food pricing policies
- Risk identification, policy and supply chain interventions to underpin improved systems for the safety of poultry, cultured seafood and vegetable products

***Subprogram 2: Biosecurity cooperation and pest and disease management***

*Livestock biosecurity*

- Definition of the economic and social cost of livestock diseases and establishment of effective disease surveillance and control policies and systems, particularly in low-input systems
- Detection and management of risks of disease transfer with movement of livestock
- Improved understanding of avian influenza virus behaviour in ducks and village and commercial poultry, with and without vaccination

- Establishment of the importance of zoonotic diseases, including rabies, anthrax, Japanese encephalitis and cysticercosis

*Crop and forestry biosecurity*

- Introduction of technical and policy requirements for the establishment of pest-free or low-pest areas
- Capacity development in quarantine and disinfestation of plant products
- Improved management of major pests and diseases of bananas
- Pest and disease management for plantation forests

***Subprogram 3: Research to underpin the development of competitive horticultural agribusinesses***

- Quality improvement and value-addition in mangoes, including through the management of fruit flies and fungal diseases
- Improvement in value-addition and marketability for mangosteen through management of physiological disorders, pest control and better shelf life
- Development of clonal rootstocks and postharvest management and packaging systems for avocado
- Improvement in production and pest management systems for shallot
- Development of postharvest handling systems for tropical ornamental horticultural crops
- Development of postharvest handling and value-addition for selected tropical spices and indigenous vegetables

***Subprogram 4: Profitable smallholder aquaculture and agroforestry systems***

*Smallholder aquaculture*

- Review of policy options to guide expansion and intensification of aquaculture, including development and application of decision-support tools and planning frameworks to assist farmers, planners and policymakers, particularly at local levels

- Delivery of more reliable diagnostic services to farmers for viral disease of shrimp through improved application of PCR technology
- Control and management of new or emerging viral threats, including Taura syndrome and marine finfish diseases
- Development of cost-effective formulated feeds for high-value species, with reduced reliance on fish-based protein
- Extension by farmer groups of 'Better Management Practices' production packages enhanced to address product quality, food safety and supply chains to increase market performance

#### *Agroforestry systems*

- Understanding of incentives for small-scale community plantings, including:
  - policies and institutions (regulations, land tenure, models for conflict resolution, effective size of management units) for profitable agroforestry and community forestry
  - analysis of systems and markets that produce intermediate returns
  - models for outgrower schemes to secure market access for smallholders
- Matching of community forestry sites to species in variable environments, including:
  - site classification, and selection of species combinations and improved planting materials, taking markets and cultural preferences into account
  - selection of silvicultural systems adapted for small-scale plantings, including agro-silvopastoral systems
  - development of replicable extension models for small-scale plantations

### ***Subprogram 5: Sustainable use and management of fisheries and forestry resources***

#### *Fisheries resources*

- Use of alternative, innovative assessment and management frameworks which address the problem of resource data limitations and pilot these in selected shared and common-interest fisheries
- Establishment of effective co-management arrangements between fishers and the cage aquaculture industry in inland reservoirs and open water bodies

- Better management of illegal unregulated and unreported (IUU) fishing in seas managed by Indonesia alone, with attention to improving existing reporting and regulation shortcomings; and analysis of institutional and regulatory frameworks and linkages between different levels of government
- Regional cooperation in the monitoring of sharks and rays landed from the Indian Ocean and shark fin export–import data to obtain a better understanding of regional trade flows
- Supply chain economic assessment and policy analysis on optimal use of fisheries industrial processing facilities
- Quality and safety assessment and improvement of fishery products in relation to catching, handling, processing and marketing in order to reduce losses and improve product competitiveness

#### *Forestry resources*

- Review of policy options and economic assessment of smallholder forestry options to address climate change mitigation
- Improvement in post-decentralisation forest governance and administration through action research at provincial and district levels
- Application of improved silvicultural strategies and governance arrangements to appropriately sited plantation species
- Capture of more value from forestry plantation species through improved processing technologies and development of new products matched to appropriate markets

### ***Subprogram 6: Profitable agribusiness systems for eastern Indonesia***

This subprogram integrates key thematic areas for cooperation (including livestock, horticultural crop production, community forestry and aquaculture) with a geographical focus on eastern Indonesia. On-farm water management for the development of competitive agricultural industries, and improvement of the capacity of eastern Indonesian R&D providers to support market-driven adaptive research, are two cross-cutting themes.

Specific areas of emphasis within eastern Indonesia are:

*Crop–ruminant livestock systems*

- Understanding of policies to increase Indonesian sufficiency in beef production, including factors affecting adoption of improved forages, off-take of productive cows, improving reproduction rates and market linkages
- Development of sustainable systems that integrate livestock with crops for the dry tropics of eastern Indonesia and smallholder plantation areas
- Enhancement of Bali cattle and goat productivity to meet market specifications through improved management of feed and reproduction

*Productive and profitable smallholder estate crops*

- Market analysis and development for cashew nut, cocoa, coffee and coconut
- Development of production systems that integrate field crops and livestock into plantation crops
- Management of pests and diseases for cashew nut, cocoa, coconut, coffee and sugarcane
- Market analysis of biofuel production systems, especially of on-farm and small-scale processing of biofuel as an alternative energy source for household needs

*Improvement in productivity and profitability of field crop systems in seasonally dry areas*

- Development of locally adapted postharvest technology for field crops
- Improvement in uptake of existing technologies (nutrient management, plant varieties, integrated pest management, soil conservation) in rainfed rice systems and development of other components of the rotation
- Market development and the fostering of technology uptake in irrigated rice systems
- Development of more water-efficient maize cropping systems that are better linked to input and output markets

***Subprogram 7: Technical cooperation to underpin rehabilitation of agriculture and fisheries in NAD province***

- Redevelopment of human capacity and infrastructure for brackish-water aquaculture of shrimp and finfish in Aceh
- Restoration of tsunami-affected soils, farming systems and seed supply systems to improve field crop and vegetable production

## 4 Active projects in Indonesia

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### 4.1 Subprogram 1: Improved policies to underpin agribusiness development

Policy settings in Indonesia continue to be influenced by a protective and interventionist system which may lack incentives for smallholders to participate effectively in the marketing chain adjustments (ADP/2005/068). In addressing these limiting factors, the policy projects will overlay research investments in other subprograms (e.g. work on fruit markets under ADP/2005/066) by designing sustainable and country-relevant policy options and frameworks in which farmers and investors will have more confidence. The concomitant establishment of clearer market signals will help direct research into areas of high reward.

#### Projects:

Project number	Project title	Page
ADP/2005/066 (multilateral)	Markets for high-value commodities in Indonesia: Promoting competitiveness and inclusiveness	15
ADP/2008/005	Viability of alternative frameworks for agricultural trade negotiations	16
SMAR/2007/100	Support for development of improved approaches to technology assessment and knowledge exchange	17

## **ADP/2005/066: Markets for high-value commodities in Indonesia: Promoting competitiveness and inclusiveness**

### **Summary**

After the Asian currency crisis of 1997 Indonesian policymakers liberalised foreign investment in the retail sector, allowing rapid growth in foreign-invested supermarket chains. As a result, the share of supermarkets and convenience stores in retail food sales rose from 22% in 2000 to 30% in 2004. This study will examine the transformation of selected high-value supply channels in Indonesia and their impact on farmers, wholesalers, and first-stage processors. The commodities are mango, mangosteen, chillies, shallot and prawns. Project researchers will examine the following research and policy areas for each commodity: changes in demand that drive the transformation of food supply chains; patterns in restructuring food supply chains; farmer participation in restructured value chains; and how to maximise the transformation of high-value supply chains.

The studies will lead to an improved understanding of consumer preferences regarding food quality, food safety and related attributes in fruits, vegetables and prawns. Researchers will be better equipped to estimate the future growth of supermarkets based on current preferences for different retail food outlets among poor and rich households. The study will provide a more detailed and realistic view of the pace of transformation of horticulture and aquaculture marketing channels and its likely effect on small farmers.

### **Project information**

**Overseas Collaborating Countries:** Indonesia

**Commissioned Organisation:** International Food Policy Research Institute, USA

#### **Project Leader**

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#### **Collaborating Institutions**

- Indonesian Centre for Agriculture Social Economic and Policy Studies, Indonesia
- Padjadjaran University, Indonesia
- University of Adelaide, Australia

**Project Budget:** \$1,543,248

**Project Duration:** 01/06/2008 to 30/11/2011

**ACIAR Research Program Manager:** Dr Simon Hearn

### **Project progress**

First progress report due in 2009.

## **ADP/2008/005: Viability of alternative frameworks for agricultural trade negotiations**

### **Summary**

The current World Trade Organisation (WTO) framework is designed to reform and liberalise global trade in agriculture, however developing countries and Australia have not been well-served by it. The framework's failure to deliver results has reduced farm incomes, aggravated problems of rural development and had negative spill-over effects on international trade and political cooperation.

This project is looking at these problems and will attempt to develop viable alternative frameworks for agricultural trade liberalisation. It will identify and examine new options for the negotiation of agreements on agriculture within the WTO. It will also analyse the current state of agreement in the Doha Round, comparing the outcome to the opportunity that peer-reviewed economic models show would be available with more ambitious opening of world agricultural markets. In collaboration with the international partner institutions in Indonesia, India, and China the project will identify the reasons for the poor prospects for the Doha Round. The outcomes from this project will depend on the time frame and the strength of adoption of project recommendations.

### **Project information**

**Overseas Collaborating Countries:** China, India, Indonesia

**Commissioned Organisation:** University of Adelaide, Australia

### **Project Leader**

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### **Collaborating Institutions**

- Inquit Communications Pty Ltd, Australia
- Strategic Asia, Indonesia
- Indian Council for Research on International Economic Relations, India
- Center for Chinese Agricultural Policy, China

**Project Budget:** \$150,000

**Project Duration:** 01/05/2008 to 30/04/2009

**ACIAR Research Program Manager:** Dr Simon Hearn

### **Project progress**

First progress report due in 2009.

## SMAR/2007/100: Support for development of improved approaches to technology assessment and knowledge exchange

### Summary

ACIAR, through its Support for Market-Driven Adaptive Research (SMAR) program is supporting Indonesia's Smallholder Agribusiness Development Initiative (SADI) – established to address long-standing issues and constraints relating to agricultural production and rural poverty in Eastern Indonesia. This activity involves the following:

- institutional assessments to determine the nature and effectiveness of current research-extension linkages and methods
- strengthening linkages between R&D and extension providers
- improving extension media and materials to assist in disseminating successful R&D outcomes
- recommending approaches to agricultural technology assessment
- utilising improved linkages, media and approaches for the pilot roll-out of promising technical options resulting from adaptive R&D activities.

### Project information

**Overseas Collaborating Countries:** Indonesia

**Commissioned Organisation:** University of Queensland, School of Journalism and Communication, Australia

#### Project Leader

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**Project Budget:** \$84,136

**Project Duration:** 01/11/2007 to 30/06/2009

**ACIAR Research Program Manager:** Dr Peter Horne

### Project progress

#### Year 1 (01/11/2007-31/05/2008)

Through this SRA project support services are provided to the Technology Assessment and Knowledge Exchange Adviser (TAKEA) and stakeholders of Component 2 of SMAR (ACIAR SADI, Indonesia) in the following areas:

- General capacity building support to TAKEA and partners:

- Intensive guidance has been provided to the TAKEA through almost daily internet communication, input to documents, and discussions during field visits. Support was provided to the establishment and training of the Innovation Team consisting of 3 BBP2TP and 12 BPTP partners. Supervision of one JAF PhD candidate was taken up and input was provided to research proposals of four new JAF applicants.
- To strengthen approaches to agricultural technology assessment:
- Input was provided to methodology guidelines, report outline and initial analysis and reporting of field data conducted by TAKEA, and to guidelines and a report outline for TAKEA approaches case studies to be documented by the provincial Innovation Sub-Teams. Evaluation criteria for technology assessment approaches were defined during the first training workshop.
- To improve linkages between R&D providers and extension providers:
- A study on extension approaches was commissioned to a national consultant. Input was provided to the terms of reference for the consultant and feedback to the first draft report. A session was facilitated in the first Innovation Team workshop to unravel tasks and responsibilities of the various stakeholder organisations in the agricultural research and development spectrum. Possible research-extension linkage models were explored with provincial teams in Sultra and NTT in the context of PRO projects.
- To improve communication/media materials and methods to help disseminate R&D outcomes:
- Terms of reference were developed for consultants from Studio Driya Media (SDM) to run a session at the Innovation Team Workshop I on the use and effectiveness of media in agricultural development. An initial proposal for a training workshop to be delivered by SDM was reviewed and a decision is currently pending. The involvement of an Indonesian UQ

*Subprogram 1: Improved policies to underpin agribusiness development*

graduate in Communication to consult in the area of media effectiveness and possibly conduct a study in the context of a PhD program has been explored and the formulation of a JAF application was supported.

- To develop a model for initial roll-out of promising agricultural technologies emerging from research:

A discussion paper describing the principles and practices of Pilot Roll-Out was written and the PRO concept was introduced to the Innovation team during Training and Planning Workshop I. A set of criteria for the readiness of technologies for Pilot Roll Out was developed and incorporated in guidelines for PRO project development, together with criteria for the appropriateness of a community or farmer group to conduct PRO. Provincial sub-teams were supported in the development of PRO proposals. Initial project ideas were discussed and developed during field visits. Detailed comments were provided to proposals. PRO proposals will be further discussed and finalised during the upcoming training workshop (August 2008).

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## 4.2 Subprogram 2: Livestock biosecurity

Collaborative research activities on, and pest and disease management in, horticultural crops and plantation crops and forests are integrated with production projects in subprograms 3 and 4. There are two focal areas (project clusters) in this subprogram.

### Highly pathogenic avian influenza

Avian influenza (AI) continues to be a major concern for poultry and human health. A cluster of ACIAR projects is providing some of the necessary basic research required to implement effective control programs. The economic impacts of the disease were defined by household and enterprise surveys to inform policy decisions on control approaches. Ducks are considered to be a reservoir host of the virus and therefore important when control programs are being implemented. The patterns of the disease spread and response to vaccination in the duck are being investigated in Indonesia and Vietnam (AH/2004/040).

The virus that causes avian influenza is capable of changing its surface structure over time, which can influence the effectiveness of vaccination. This is being monitored, particularly where vaccination takes place in areas with high levels of exposure to the virus (AH/2006/050). Movement of birds is an important means of virus spread, and knowledge of this spread is critical for implementing regional or island control programs (AH/2006/156).

Other underlying diseases can influence how birds respond to vaccines, especially in the case of avian influenza. A project is commercialising a vaccine for infectious bursal disease—an important disease of itself but which can also cause suppression of immune response to other pathogens and vaccines administered to prevent those diseases (AH/2000/083). Effective quarantine procedures for individual enterprises will be tested in collaboration with the commercial poultry sector in Indonesia (AH/2006/169). These projects are closely aligned to the Government of Indonesia's priorities for control of AI and also those of the major donors supporting control efforts, including AusAID.

### Projects:

Project number	Project title	Page
AH/2004/020	The development of a national surveillance system for classical swine fever, avian influenza and foot-and-mouth disease in Indonesia	21
AH/2004/040	The epidemiology, pathogenesis and control of highly pathogenic avian influenza (HPAI) in ducks in Indonesia and Vietnam	23
AH/2006/050	Control and characterisation of highly pathogenic avian influenza strains in poultry in Indonesia	26
AH/2006/169	Improved biosecurity for small-scale commercial poultry production in Indonesia	28

### Policies and systems for better management of animal disease

The role of government at all levels in animal disease control is important for limiting the effect of diseases and also preventing the introduction of new diseases. Since the decentralisation of government services, the district structure has been responsible for delivery of many services including animal health. This has created difficulty in implementing national policies and approaches, especially for the rapidly spreading viral diseases. A project will examine ways in which agreement can be reached and funding allocated to the control of the high-priority diseases affecting livestock and people (AH/2006/166). These will be captured in an 'Indovetplan' for each disease.

Livestock movement is an important means of spreading disease. The patterns and incentives for these movements will be studied in eastern Indonesia in relation to classical swine fever and avian influenza (AH/2006/156). Effective surveillance in remote locations is often difficult, but it is important in detecting early incursions of disease and managing currently existing diseases. Systems are being examined in the more remote eastern locations (AH/2004/040). Vaccines for Jembrana disease, a common disease of Indonesian cattle, are being commercialised in collaboration with government programs. Diseases affecting humans and animals are common in Indonesia, but their relative importance and the research issues for each are unclear. These will be determined to provide a platform for future investment.

## Projects:

<b>Project number</b>	<b>Project title</b>	<b>Page</b>
AH/2004/074	Large-scale production of a vaccine and diagnostic reagents for Jembrana disease in Indonesia	29
AH/2006/156	Risk assessment of livestock movements for disease transmission in eastern Indonesia and eastern Australia	31
AH/2006/162	Commercialisation of a vaccine for infectious bursal disease	32
AH/2006/166	Improving veterinary service delivery in Indonesia	33

## **AH/2004/020: The development of a national surveillance system for classical swine fever, avian influenza, and foot and mouth disease in Indonesia**

### **Summary**

Indonesia needs an efficient disease surveillance system for the early detection of exotic disease in order to implement an eradication/control program. As well, monitoring the prevalence of endemic (existing) and emerging diseases is a vital part of evaluating the effectiveness of new and established disease control programs.

This project will strengthen the surveillance system for animal diseases in Indonesia, in particular the eastern region of the country. Recent outbreaks of major pandemic livestock diseases in Indonesia have included hyperpathogenic avian influenza (HPAI) and classical swine fever (CSF).

CSF has a significant impact on animal productivity and is now widespread in the Eastern Islands. HPAI has led to the death and destruction of significant numbers of poultry in Indonesia. In conjunction with human infections of H5N1, the impact on the poultry industry has been catastrophic. Risks can be reduced by targeted active surveillance and increased awareness of the disease. The detection and eradication of HPAI requires a surveillance system that is founded on early detection and timely response.

Indonesia has been successful in eradicating foot-and-mouth disease (FMD) regarded by many as the most serious disease threat to livestock in the world and remaining free since the 1990s. Freedom from FMD is important to Indonesia for productivity reasons and for growth in export of livestock and livestock products. However the increased, predominantly illegal, movement of livestock/products into Indonesia has heightened the probability of an incursion of FMD.

There is tremendous potential within the established animal health framework to develop an efficient, effective surveillance network. Such a system would also be of significant benefit to the Australian livestock industries by providing current information to government authorities on the diseases present in our immediate neighbours. This would assist Australian authorities to direct resources in a cost-effective manner, to minimise the risk of disease incursion into Australia.

This project has four main objectives:

- reduce the risk of introduction of FMD and improve early detection of the disease
- enhance disease surveillance systems on Alor Island in NTT, Indonesia
- improve control of CSF on Alor Island
- gain acceptance of new approaches by communicating outcomes to stakeholders.

### **Project information**

**Overseas Collaborating Countries:**  
Indonesia

**Commissioned Organisation:**  
Australian Biosecurity Cooperative Research Centre for Emerging Infectious Disease, School of Veterinary and Biomedical Sciences, Australia

### **Project Leader**

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### **Collaborating Institutions**

- Department of Agriculture and Food, Western Australia, Australia
- CSIRO Livestock Industries, Australia
- Dinas Peternakan Provinsi NTT, Indonesia
- Directorate General of Livestock Services, Indonesia
- University of Western Sydney, Australia
- Dinas Pertanian and Peternakan, Indonesia
- Murdoch University, Australia

**Project Budget:** \$839,408

**Project Duration:** 01/06/2006 to 31/05/2009

**ACIAR Research Program Manager:** Dr Doug Gray

## **Project progress**

### **Year 2 (01/06/2007-31/05/2008)**

A framework for a national surveillance system for foot and mouth disease (FMD) in Indonesia was established at a workshop organised as part of this project and attended by staff from Government, University and Research institutions. Technical guidelines have been drafted for this surveillance. As part of the improved surveillance system a field investigation of a suspect case of FMD was investigated and samples collected and tested by the national FMD laboratory (PUSVETMA). All samples were test-negative and the results highlight the success of having a national integrated surveillance system.

Another important outcome of the work has been in relation to incentives. Villagers were asked what type of incentives would encourage them to report animal diseases and a high percentage stated that more information about diseases was necessary. They also indicated that free vaccinations and free vitamin injections would also encourage them to report to the government officials about diseases. An outcome of this research was the need to explore the decision making processes of villagers. An understanding of how decisions are made about animal disease identification and reporting will be important towards the development of a surveillance program on Alor Island and will form the basis of the upcoming years work.

A pre-trial of the questionnaires for the cross-sectional study, prospective cohort study and vaccination trial for classical swine fever (CSF) was conducted in July 2007. Active surveillance (sampling) for CSF has subsequently commenced. The cross sectional study is complete and in total 690 samples were collected. The cohort study is on-going and to date 529 samples have been collected. A field based vaccination trial of 4 commercially available CSF vaccines has also been instigated and to date 1526 samples have been collected. A valuable component of the cohort and vaccination studies has been collecting data on changes in animal numbers and animal movements over time. Knowledge of movement of animals is essential to understand disease dispersal and to design potential methods of disease control. Questionnaires have been administered to farmers involved in these studies and the results of these will aid in further understanding farmers actions and help in designing effective surveillance systems for remote areas.

The AYAD student, Michael Bragg, was located on Alor Island for 5 months in 2007 and during this time, studied 16 villages across Alor Island. This allowed a better understanding of the importance of livestock in villages on Alor and enabled Michael to successfully complete his Honours degree at the University of Western Sydney with second class honours. This analysis provided valuable insights into the importance of livestock to farmers and the day to day functioning of villages in rural Alor. Although pigs are culturally important to most villagers, it was found that they had little concern for disease in their pigs and were more concerned about their family and crops. Pigs were less important for day to day consumption in comparison to crops, as pigs were mainly eaten at cultural events.

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

### Summary

The avian influenza epidemic has spread through poultry flocks of Asia starting in 2003 and is still continuing. Countries affected include Thailand, Vietnam, Cambodia, Indonesia, China, Laos, Japan, and Republic of Korea and Asiatic and Central Russia. Recent outbreaks have occurred in have occurred in Turkey and Romania. The outbreaks have been characterised by high mortality in bird flocks and reflect the ability of the influenza virus to genetically vary over time to more pathogenic strains, a very unusual feature of this virus strains. The outbreaks were unprecedented in their scale, geographical spread, and devastating economic consequences for the poultry industry, the domestic and international trade in poultry products and the livelihood of rural farmers. Indirect and significant losses have occurred with mass culling of birds in some countries in an attempt to control the spread of the disease in poultry and in humans. Other and unquantified indirect losses have occurred in unrelated sectors such as tourism and business generally with the scare associated contracting the disease. The losses in Asia are estimated at \$US10-15B so far and continuing. Of most concern is the high fatality rate in humans infected from poultry although transmission to humans is apparently quite difficult and therefore limited. Regardless deaths have been reported in most countries where the avian disease is present (total ~ 60 confirmed). A more general concern is that human to human transmission may occur and if the disease is as severe as current cases then a global pandemic is predicted with large number of deaths.

It is not clear whether or not ducks were the initial source of the HPAI H5N1 virus, but it appears very likely that they play a central role in the maintenance and transmission of the virus to chickens and perhaps people. As such, understanding the biology and epidemiology of the HPAI H5N1 virus requires knowledge of the response to infection with the virus, including the length of time that ducks shed the virus, the sites of virus replication and excretion, and the prevalence of both antibodies (indicative of past exposure) and virus (indicative of current infection) in duck populations. It is also not understood how effective current vaccines are in ducks whether virus continues to be shed into the environment.

The project has five major objectives:

- To determine the epidemiological characteristics (e.g. seroprevalence, duration of virus shedding) of HPAI H5N1 virus in small holder duck production systems in Indonesia and Vietnam.
- To understand the role of ducks as maintenance hosts and amplifiers of H5N1 virus during and after infection.
- To understand the pathogenesis of HPAI H5N1 infection in ducks.
- To evaluate the efficacy of current vaccines in ducks and determine the possible role of vaccination in reducing virus load and shedding in ducks.
- To develop recommendations for an epidemiological monitoring system which will enable policy making for effective control strategies against HPAI H5N1 virus.

The objectives will be achieved through a combination of field and experimental activities. A survey will be conducted on ducks in intensive production systems and in small holder farms, and including vaccinated and unvaccinated flocks, to determine the prevalence of past and present infection with the H5N1 virus. Challenge experiments of vaccinated and unvaccinated ducks will be performed using strains of H5N1 virus isolated in Indonesia. These will determine tissue tropism, duration of viral excretion and pathogenicity of the virus for ducks. Collation and analysis of data generated from the field and laboratory studies will allow development of action plans and ongoing monitoring systems, resulting in more effective control strategies.

### Project information

**Overseas Collaborating Countries:**  
Indonesia, Vietnam

**Commissioned Organisation:**  
Australian Biosecurity Cooperative  
Research Centre for Emerging Infectious  
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Australia

### **Project Leader**

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### **Collaborating Institutions**

- 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
- University of Queensland, Australia

**Project Budget:** \$1,400,793

**Project Duration:** 01/03/2006 to 29/06/2009  
(Project extended from 01/03/2009 to 29/06/2009)

**ACIAR Research Program Manager:** Dr Doug Gray

### **Project progress**

#### **Year 2 (01/03/2007-31/05/2008)**

Significant progress was made during this reporting period. The longitudinal studies conducted in Indonesia and Vietnam progressed well. In Indonesia, serological data from four bi-monthly samplings from March 2007 to September 2007 indicated that the seroprevalence of HPAI infection in unvaccinated ducks and in-contact chickens was relatively low, ranging from 0 to 6% in ducks and 0 to 10% in chickens between districts and samplings. This suggests that birds were highly susceptible to infection.

Although the seroprevalence differed between districts, there was no clear temporal pattern apparent over this sampling period. No birds were vaccinated against H5N1 in Indonesia. Positive H5 PCR results were obtained from 28 ducks and 5 chickens during the same sampling period indicating that virus was circulating among these small-holder flocks. This was further reflected in a number of disease outbreaks that occurred in the study villages. H5 virus was isolated from 43 ducks and 52 chickens that died during these outbreaks.

In Vietnam, most of the birds in the longitudinal study were reported to be vaccinated. Although serological results from two samplings in May and July 2007 indicated that only 60% of

vaccinated ducks and 39% of vaccinated chickens had protective titres, no mortality due to HPAI was reported in any of the study villages suggesting that the flock level of protection was adequate. When the antibody response to vaccination over time was analysed, it appeared that chickens responded later than ducks. Chickens had lower antibody titres than ducks at both under 3 weeks and over 15 weeks post vaccination. The sentinel unvaccinated birds in Viet Nam showed higher seroprevalences than the equivalent samples from birds in Indonesia, ranging from 2-26% in ducks and 3-21% in chickens between provinces and samplings.

These results from Viet Nam suggest that despite not achieving protective levels of immunity in all birds, vaccination against HPAI can decrease the likelihood of disease outbreaks and reduce mortality in the presence of active exposure to the virus. Analysis of the case-control study conducted to identify farm-level risk factors associated with the HPAI outbreaks that occurred from December 2006 to January 2007 in the Mekong Delta region was continued during this period. In a preliminary analysis it appeared that vaccination status, other poultry species kept on the farm and the sharing of scavenging areas could be potential risk factors. A descriptive pilot study of nomadic duck farms was also conducted to describe this management system in detail and to evaluate the feasibility of conducting a longitudinal study on nomadic duck flocks.

Using H5N1 virus isolates from Indonesia and Viet Nam, isolated in 2006 and 2004 respectively, domestic Pekin ducks were infected by the mucosal route (oral, nasal, ocular). Viral shedding patterns were determined by virus isolation and titration of oral and cloacal swabs. Virus was shed from both the oral and cloacal routes; it was first detected 24 hours after challenge and continued to day 5 after challenge. Virus shedding was detected in all but two birds challenged with the Vietnamese strain, and in 10 of the 15 challenged with the Indonesian strain. The Vietnamese strain caused severe morbidity with fever and depression, whereas the Indonesian strain caused only transient fever. Both viruses had a predilection for a similar range of tissue types, but the quantity of tissue antigen

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and tissue virus titres appeared to be considerably higher with the Vietnamese strain.

John Allwright Fellowships were awarded to four candidates aligned to the project and they will commence their postgraduate studies in Semester 2, 2008 or in Semester 1, 2009. One project team member from Indonesia received training in molecular diagnostics at the Australian Animal Health Laboratory, Geelong. The project has been represented at a number of scientific meetings during this reporting period and two papers in conference proceedings have been published or accepted. In addition four journal articles are in final stages of preparation. Project meetings were held in Brisbane on 7 January 2008 and in Yogyakarta on 27 March 2008, to discuss progress and present results of the project.

## AH/2006/050: Control and characterisation of highly pathogenic avian influenza strains in poultry in Indonesia

### Summary

In Indonesia outbreaks of highly pathogenic avian influenza (HPAI) in poultry were first notified in August 2003. Initial cases were not contained and HPAI strain H5N1 has since spread throughout the country, with 30 out of 33 provinces now affected. Mortalities due to H5N1 have occurred in layers, broilers, native chickens, quails, pigeons, aquatic, wild and cage birds. Total losses in October 2005 were estimated to be more than 9 million chickens.

Human infections with H5N1 also occurred in Indonesia, with a disturbing 72 confirmed cases (55 of which were fatal – a 76% mortality rate). The source of H5N1 infections for the majority of human cases has been linked to direct contact with poultry.

For this reason, the Indonesian Government has opted for vaccination as a control measure in the hope it will reduce the incidence of H5N1 infection in all poultry and thus allay the threat to human health. But the efficacy of most of vaccines for control of HPAI in Indonesian situations is unclear. And vaccination is to be undertaken in the context of an infection that has become endemic and where a large proportion of poultry are kept under low biosecurity. This project stems from an Indonesian initiative, and addresses some of the issues identified as priorities in the *Government of Indonesia Strategic Plan for Control of HPAI*.

Project work is based around the following objectives:

- to assess the breadth and duration of immunity induced by various inactivated AI vaccines
- to characterise AI isolates from vaccinated poultry, quails and pigeons, at genetic and antigenic levels
- to develop reagents for ELISA-based 'DIVA' testing (differentiation of infected from vaccinated animals) to differentiate between wild infection and vaccinated animals
- to provide specialised training and capacity building for Indonesian scientists
- to develop sustainable protocols for investigating apparent vaccine failures for HPAI
- to develop a simple state-transition model of HPAI infection.

### Project information

**Overseas Collaborating Countries:**  
Indonesia

**Commissioned Organisation:** University of Melbourne, Faculty of Veterinary Science, Australia

#### Project Leader

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#### Collaborating Institutions

- CSIRO Livestock Industries, Australia
- Directorate General of Livestock Services, Indonesia
- Research Institute for Veterinary Science, Indonesia
- AusVet Animal Health Services, Australia

**Project Budget:** \$1,021,840

**Project Duration:** 01/03/2007 to 28/02/2010

**ACIAR Research Program Manager:** Dr Doug Gray

### Project progress

#### Year 1 (01/03/2007-31/05/2008)

In Indonesia outbreaks of highly pathogenic avian influenza (HPAI) in poultry were first reported in August 2003. Initial cases were not contained and HPAI strain H5N1 has since spread throughout the country, with 31 out of 33 provinces now affected. Mortalities due to H5N1 have occurred in layers, broilers, native chickens, quails, pigeons, aquatic, wild and cage birds. Human infections with H5N1 also continue to occur in Indonesia, with the disturbingly high rate of deaths. Indonesian Government has opted for vaccination as a control measure in order to reduce the incidence of H5N1 infection and thereby the threat to human health. Vaccination has been undertaken in the context of an infection that has become endemic, where a large proportion of poultry are kept under low biosecurity and the unique nature of the H5N1, which has a number of properties not previously

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encountered in AI. Therefore vaccination strategies developed in countries with good resources, highly structured poultry industries, geographical compactness, and where infections occurred with less aggressive AI viruses, might need to be adjusted.

The strategies used in this project aim to identify the most efficacious vaccination strategy to reduce the incidence of HPAI in poultry. Specifically the project aims are to: (i) Assess the breadth and duration of immunity induced by various inactivated AI vaccines; (ii) characterise AI isolates from poultry vaccinated with selected vaccines (iii) develop reagents to differentiate field infections in vaccinated poultry (DIVA); (iv) develop protocols for investigating apparent vaccine failures for HPAI and (v) develop a simple state-transition model of HPAI infection.

The project is a collaboration between Indonesian Research Center for Veterinary Science (Bbalitvet), Bogor, Indonesia and three organisations in Australia: the University of Melbourne School of Veterinary Science (UoM), CSIRO Australian Animal Health Laboratory (AAHL) and AusVet Pty/Ltd.

The project commenced in late September 2007 when the majority of legal agreements were signed and project development process completed. This includes exchange of material of transfer agreements (MTA) related to the transfer and use of Indonesian HPAI strains in Australia. Initially it was ensured that standardized procedure and reagents are in place enabling comparison of results with other studies conducted internationally and in Indonesia. Baseline collection of data on antibody status in selected commercial flocks has commenced, as has the laboratory trail to establish levels and duration of antibody responses in controlled conditions. It was attempted to source reagents for various DIVA tests that have been published in international literature, but none were available. In the view of changing HPAI situation in Indonesia, several approaches for development of DIVA test have been considered and generation of several different reagents has commenced. Protocols and documentation on how to approach and undertake investigations of vaccination failures have been generated. A simple state transition model was developed and tested using standard parameters. This model appears functionally sound and shows promise as the basis of future modelling scenarios if suitable parameters for the Indonesian situation can be developed.

## **AH/2006/169: Cost-effective biosecurity for non-industrial commercial poultry operations in Indonesia**

### **Summary**

The spread of highly pathogenic avian influenza (HPAI) is responsible for significant economic loss in Indonesia, particularly in the non-industrial commercial poultry sector (NICPS) and the village poultry sector. High mortality rates, decreases in demand for poultry and poultry products in affected areas, continuing human deaths and the risk of a global pandemic, ensure that control of HPAI remains a priority for Indonesia.

The Government of Indonesia and donor agencies have allocated considerable resources to control HPAI in the village poultry sector. But there is increasing realisation that more resources should be allocated to control of HPAI in the NICPS. Improving biosecurity in this sector will reduce the likelihood of flocks becoming infected and, therefore, reduce the risk of large numbers of infected birds being dumped into live bird markets.

This project will identify appropriate, efficient and effective poultry biosecurity measures for NICPS farms. Resources will then be devoted to training of farmers and advisors and facilitating the introduction of these biosecurity systems within communities.

### **Project information**

**Overseas Collaborating Countries:** Indonesia

**Commissioned Organisation:** University of New England, Institute for Rural Futures, Australia

### **Project Leader**

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### **Collaborating Institutions**

- Livestock Health Systems Australia, Australia
- Directorate General of Livestock Services, Indonesia
- Indonesian Poultry Industry Forum, Indonesia
- University of Sydney, Australia
- Udayana University, Indonesia

- Indonesian Centre for Agriculture Socio Economic and Policy Studies, Indonesia

- Bogor Agricultural University, Indonesia

**Project Budget:** \$1,099,290

**Project Duration:** 01/06/2008 to 31/05/2012

**ACIAR Research Program Manager:** Dr Doug Gray

### **Project progress**

First progress report due in 2009.

## AH/2004/074: Large scale production of a vaccine and diagnostic reagents for Jembrana disease in Indonesia

### Summary

Jembrana disease of cattle, a problem confined to Indonesia, is an acute disease that produces a 20% fatality rate. It remains one of the most significant threats to the cattle industry in Indonesia, which almost exclusively involves smallholder farmers. Cattle ownership contributes to poverty reduction, with a consequent value-adding effect in rural areas of eastern Indonesia. The utilisation of the cattle as draft power enables smallholder farmers to double food production from their available land.

The disease is severe only in Bali cattle (*Bos javanicus*), which comprise around 27 per cent of the 11 million cattle in Indonesia. The causative lentivirus Jembrana disease virus (JDV) has been detected in Indonesia only, but it is closely related to a non-pathogenic virus (BIV) detected in other countries including Australia.

Control of Jembrana disease is a priority of the Directorate General of Livestock Services in Indonesia and requires the development of sensitive and specific methods of diagnosis and effective vaccines. For many years, a crude tissue-derived (whole virus) Jembrana disease virus vaccine has been used on a small scale in Indonesia and it has been shown to be effective in controlling the disease. Unfortunately, this vaccine is not amenable to large scale production methods it is expensive, with poor quality control and it could pass on to vaccinated cattle other agents inadvertently present in the donor animal.

During a previous project (AS1/2000/029) potential new vaccines based on recombinant DNA technology were produced at Murdoch University. Laboratory trials demonstrated that they induced a protective immunity in cattle. These recombinant protein vaccines have significant advantages, particularly in terms of safety, standardisation and quality control procedures, and can be produced on a large-scale, sustainable basis.

A major objective of this project is to develop within Indonesia methods to produce the recombinant protein vaccine on a medium–large scale. A second objective will be to develop a kit for Jembrana disease immunosurveillance, then market it commercially. A third objective will be to investigate the non-pathogenic lentivirus (BIV) present in Indonesia, to determine what distinguishes this virus from Jembrana disease and any effects it may have on the immune status of cattle against JDV.

### Project information

**Overseas Collaborating Countries:**  
Indonesia

**Commissioned Organisation:** Murdoch University, School of Veterinary and Biomedical Sciences, Australia

#### Project Leader

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#### Collaborating Institutions

- Disease Investigation Center Region VI, Indonesia
- Vaksindo Satwa Nusantara, Indonesia

**Project Budget:** \$512,019

**Project Duration:** 01/04/2006 to 31/03/2009

**ACIAR Research Program Manager:** Dr Doug Gray

### Project progress

#### Year 1 (01/04/2006-31/05/2007)

To enable the production of a commercial recombinant protein vaccine for the control of Jembrana disease in Indonesia, a commercial fermenter was purchased. Methods of utilising this fermenter for producing recombinant proteins for preparation of a Jembrana disease vaccine, on an expanded scale over that we have not been previously able to achieve under laboratory conditions, have been determined. The fermenter has now been shipped to Vaksindo, a commercial vaccine company in Indonesia, and plans have been made to assist them in the technology required to produce the vaccine. Plans for licensing of the vaccine in Indonesia are in place and a memorandum of understanding for the production and supply of vaccine has been agreed to by the DGLS and Vaksindo.

A safety trial of the recombinant protein vaccine in cattle under field conditions in Indonesia has been completed. One hundred cattle were vaccinated with vaccine containing both Capsid and Tat proteins and 100 cattle were given a

*Subprogram 2: Livestock biosecurity  
Policies and systems for better management of animal diseases*

placebo vaccine. All cattle were monitored over the next 12 months for side effects and antibody response. The vaccine induced minimal side effects, even in pregnant cattle, and induced a long lasting antibody response that persisted for the duration of the trial. This information will be used to assist licensing of the vaccine within Indonesia.

There is evidence that cattle in Indonesia are infected not only with Jembrana disease virus but also with a non-pathogenic but genetically and antigenically related virus that we assume is closely related to bovine immunodeficiency virus (BIV) present in other countries. The possibility exists that prior infection with BIV may inhibit subsequent infection with Jembrana disease virus and that it may be possible to utilise this observation to control Jembrana disease. The R-29 American strain of BIV was inoculated into Bali cattle and it did not induce any clinical disease but virus replication, peaking about 15 days after infection, was detected. In the BIV-infected cattle, Jembrana disease virus infection 42 days later was inhibited. This is an important observation and has application not only as a means of controlling Jembrana disease virus infection but also in understanding the epidemiology and pathogenesis of the disease within Indonesia, especially in areas where both viruses are present in cattle.

## **AH/2006/156: Livestock movement and managing disease in eastern Indonesia and eastern Australia**

### **Summary**

Management of animal and animal product movement is an essential component of control programs for trans-boundary animal diseases (TAD). This project, focusing on critical trans-boundary diseases (highly pathogenic avian influenza (HPAI) and classical swine fever (CSF) in eastern Indonesia and foot and mouth disease (FMD) and CSF in eastern Australia), will strengthen capacity for effective disease control by identifying livestock trade patterns that are high risk for disease transmission and by supporting formulation and pilot implementation of policy designed to restrict, manage and/or monitor these livestock movements.

### **Project progress**

First progress report due in 2009.

### **Project information**

**Overseas Collaborating Countries:** Indonesia

**Commissioned Organisation:** University of Sydney, Veterinary Public health Management Program, Australia

#### **Project Leader**

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#### **Collaborating Institutions**

- University of New England, Australia
- Disease Investigation Center Region VI, Indonesia
- Department of Livestock, NTT, Indonesia
- Murdoch University, Australia
- Charles Sturt University, Australia
- NSW Department of Primary Industries, Australia
- University of Mataram, Indonesia
- University of Udayana, Indonesia

**Project Budget:** \$890,511

**Project Duration:** 01/01/2008 to 31/12/2011

**ACIAR Research Program Manager:** Dr Doug Gray

## **AH/2006/162: Commercialisation of infectious bursal disease vaccine**

### **Summary**

ACIAR has supported the development of a vaccine in Indonesia for the poultry disease, Infectious Bursal Disease. This disease suppresses the immune system leading to greater susceptibility to other diseases. The form of the disease in Indonesia is also particularly pathogenic and can cause disease in its own right. This activity will support the Research Institute in Veterinary Science to transfer the technology for vaccine development and manufacture to local vaccine companies in Indonesia for supply to the commercial poultry sector.

### **Project information**

**Overseas Collaborating Countries:** Indonesia

**Commissioned Organisation:** Q-Vax, Australia

#### **Project Leader**

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**Project Budget:** \$34,959

**Project Duration:** 01/12/2006 to 30/11/2008

**ACIAR Research Program Manager:** Dr Doug Gray

### **Project progress**

#### **Year 1 (01/12/2006-31/05/2007)**

A very effective vaccine has been developed by Indonesian and Australian scientists for the control of Gumboro disease in poultry. The vaccine now needs to be commercialised to make it available to the Indonesian poultry industry.

This Small research Activity sets out commercialisation options and make recommendations for a proposed course of action.

Gumboro disease is an important disease of poultry in Indonesia resulting in substantial losses of production in all sectors of the industry. The virus itself can cause disease, but it also attacks the birds immune system, thus preventing vaccines such as Newcastle disease from working effectively.

The effects of Gumboro disease may thus be seen as an increased mortality due to reduced effectiveness of vaccines for Newcastle disease, infectious bronchitis etc.

Vaccines are available in Indonesia for control of Gumboro disease, but these vaccines are not readily available to the small-holder sector. Available vaccines are inactivated, need multiple injections, and are packaged in large dose containers all of which makes them unsuitable for the small-holder sector.

An ACIAR funded Project aimed to develop an attenuated live vaccine based on an Indonesian strain of Gumboro disease. The Project has been very successful in developing a vaccine and its effectiveness has been demonstrated in controlled pen trials and also in pen trials in three different regions of Indonesia.

Recommendations on the commercialisation process were developed by the Australian and Indonesian partners and, as of May 2008, one commercial company is working with Bbalitvet to initially produce the inactivated vaccine. Another is negotiating over the registration arrangements for the production of the live vaccine.

## **AH/2006/166: Improving veterinary service delivery in a decentralised Indonesia**

### **Summary**

Infectious animal diseases, especially those affecting people (zoonoses), have always been difficult to control in Indonesia and continue to cause major economic losses and human morbidity and mortality. Since Indonesia was decentralised, it has become a huge challenge to educate locally elected district and provincial leaders and their people of the importance of animal disease prevention and control, and to introduce animal health systems, policies and operating procedures.

For example, highly pathogenic avian influenza (HPAI) entered Indonesia in 2003, and since then there has been huge international pressure and considerable commitment of money and resources to contain and eradicate it, but success has been limited. Efforts to control HPAI have also diverted scarce resources away from programs to control other serious endemic animal diseases and from preparedness for exotic diseases such as foot-and-mouth disease.

This project aims to assist the Indonesian government to reduce the impacts of serious zoonotic and trans-boundary animal diseases by introducing and eventually institutionalising improved frameworks and strategies for veterinary service delivery in the new decentralised Indonesia.

### **Project information**

**Overseas Collaborating Countries:** Indonesia

**Commissioned Organisation:** NSW  
Department of Primary Industries, Health  
Sciences, Strategic Alliances and Evaluation,  
Australia

#### **Project Leader**

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#### **Collaborating Institutions**

- Directorate General of Livestock Services,  
Indonesia

**Project Budget:** \$1,197,148

**Project Duration:** 01/02/2008 to 31/01/2012

**ACIAR Research Program Manager:** Dr Doug  
Gray

### **Project progress**

First progress report due in 2009.

### 4.3 Subprogram 3: Research to underpin development of competitive horticultural agribusinesses

In the tropical fruits area, the primary emphasis in the 2001–08 period has been on management of crippling diseases of banana and citrus fruits, and in the development of better systems for the management of fruit fly infestation. In 2008 a major new initiative on technical and market development research to support mango and mangosteen industry development is being designed. With vegetables, the primary focus has been on improving returns to smallholder farmers for the major commercial crops of potatoes, brassicas and chillies, particularly through developing a more consistent supply of better quality product and fostering closer linkages to markets.

Two approaches are employed separately in the projects. The first approach is to look at how abiotic and biotic factors like pests and diseases impact on productivity, fruit quality and markets; and to develop an environmentally friendly and sustainable control strategy based on an integrated pest and disease management systems approach at pre- and post-harvest stages. The second approach is to look at the supply chain of the commodities and address constraining components and weak linkages in the supply chain, thereby improving market competitiveness of the industry.

#### Projects

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## **AGB/2005/167: Optimising the productivity of the potato/Brassica cropping system in Central and West Java**

### **Summary**

The two major vegetable crops in the Indonesian provinces of West and Central Java are potatoes and brassicas, which farmers normally grow in rotation. Potato and brassica (crucifer) crop production from these provinces accounts for over 50% of the total Indonesian harvest for both crops (1 million tonnes and 1.2-1.5 millions tonnes respectively). Farmers producing these crops are mostly smallholders who want the produce for cash income rather than home consumption. Demand for potatoes continues to increase - the major processors cannot source sufficient quantities of potatoes from within Indonesia and must import raw materials. This unmet demand plus export opportunities to nearby Asian countries offer excellent opportunities for Indonesian farmers to improve productivity and supply without a negative impact on prices.

The average yields for potato crops grown in these regions are 10-20 tonnes/ha. These are low by international standards and reflect the sub-optimal agronomic management, the unavailability of high quality seed, and problems caused by pests and diseases. This project will build on a significant body of earlier research supported by ACIAR and its Indonesian collaborators, CIP and FAP.

The overall purpose of this project is to assist farmers in Central and West Java to develop best local farming practices and thus increase their returns from the potato and brassica production system, by adapting proven Australian, Indonesian and CIP technologies to conditions in Central and West Java.

### **Project information**

**Overseas Collaborating Countries:** Indonesia

**Commissioned Organisation:** Department of Agriculture and Food, Western Australia, Australia

### **Project Leader**

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### **Collaborating Institutions**

- Department of Primary Industries, Victoria, Australia

- University of Queensland, Australia
- DINAS Pertanian & Tanaman Pangan Jawa Barat, Indonesia
- International Potato Center, Indonesia
- Institute for Rural Technology Development, Indonesia
- Indonesian Vegetable Research Institute, Indonesia
- DINAS Pertanian Jawa Tengah, Indonesia
- PT Indofood Sukses Makmur Tbk, Indonesia
- Assessment Institute for Agricultural Technology (South Sulawesi), Indonesia
- Assessment Institute for Agricultural Technology, NTB, Indonesia
- Agency for Food Crops and Horticulture, Indonesia

**Project Budget:** \$1,850,990

**Project Duration:** 01/05/2006 to 30/06/2010 (Project extended from 01/05/2010 to 30/06/2010)

**ACIAR Research Program Manager:** Mr David Shearer

### **Project progress**

#### **Year 2 (01/05/2007-31/05/2008)**

The project aims to develop potato, Brassica and allium (shallot) production and post harvest systems in the provinces of West Java, Central Java, South Sulawesi and Nusa Tenggara Barat. The temperate highland climate in these provinces enables predominantly small scale growers to grow potatoes, brassicas and alliums as cash crops. Domestic demand for ware and processing potatoes and regional demand primarily for processing potatoes is seeing potatoes becoming an increasingly important crop throughout Indonesia. Accordingly the Indonesian government and donors such as ACIAR are funding research, development and extension work to support the development of potatoes and rotational crops.

The project document was signed in May 2006 and the project initiation workshop was held in September 2006. Delays to the

commencing the baseline survey due to late rains have led to the project running approx. 6-8 months behind schedule.

A project variation was signed in February 2008 to expand the project to include the provinces of South Sulawesi and Nusa Tenggara Barat (NTB). These provinces are small producers of vegetables in comparison to West and Central Java however there are opportunities to increase potato/Brassica/allium production significantly. PT Indofood Fritolay are looking to expand potato production in Lombok and Lombok, if it proven to be free of Potato Cyst Nematode (PCN), has the potential to supply high quality seed to the rest of Indonesia.

Work on the variation commenced in May 2008 when Peter Dawson (DAFWA) and John Marshall (Independent Consultant) visited NTB, South Sulawesi and Central Java to commence the PCN survey. Training was supplied to counterparts and farmers in PCN survey techniques and applied farm biosecurity methods.

The original project design had Training of Trainer (ToT) activities being undertaken over a full production season however the duration was revised down to 12 days, reflecting the available budget. ToT activities, training groups of 20, were undertaken from 29 August – 9 September in West Java and 5 – 16 November 2007 in Central Java. The curriculum taught by trainers is based on the Indonesian version of the CIP/FAO manuals for potato IPM. The material taught to farmers is being improved by team members from Australia and Indonesia drawing on previous research experience and on the results of the baseline survey for potato crop 1 which were available in time to be incorporated into the curriculum. A complete curriculum will only be developed once the results of the baseline survey and follow on trials are available.

Integrated crop management Farmer Field School (FFS) were established in 10 communities in West Java and 10 communities in Central Java. The FFS commenced in November 2007 in West Java and March 2008 in Central Java.

In November 2007 Rini Murtiningsih, Entomologist with IVEGRI commenced a 1 month training period with the University of Queensland. The training focused on increasing her entomological skills and planning entomological activities for the rest of the project

The crop management and economic baseline survey for the first potato crop was completed and analysed. The first potato crop was grown over the 2006/07 wet season from November 2006 to March 2007. Soil and plant nutrient data support the conclusion that micro element toxicity due to soil acidification is contributing to significant yield loss in both provinces.

The economics baseline survey examined the relationship between variables such as yields, scale, pesticide and fertiliser use and gross margin returns for growers. Profitability is sensitive to the cost and performance of seed, fertiliser and pesticides which make up 75% of costs, there is a negative relationship between pesticide expenditure and gross margin, additional expenditure on fertilisers leads to increased yields. There is a need to conduct further work into the financial benefits of additional fertiliser expenditure. There was no significant correlation between seed expenditure and seed source and gross margin. Further work is required in this area.

The second baseline survey was carried out on the cabbage crop grown in 2007 after the harvest of the potatoes in March/April. The collection of data on growing practices and conditions by enumerators and results from laboratory samples of soils and plant material was complete in most cases. Yield was seen to be correlated to soil pH and planting density.

The baseline survey work was supported by Andrew Taylor, Plant Pathologist with DAFWA. Andrew spent 5 months working with IVEGRI in Lembang funded by the AusAID Youth Ambassador Program.

Supply chain systems work in Western Australia has focused on optimising harvesting and post harvest systems. An electronic tuber has been purchased and is being run through farmers' harvesters and grading lines to measure physical impact on tubers.

## **AGB/2006/115: Linking vegetable farmers with markets in West and Central Java, Indonesia**

### **Summary**

The intensive potato/*Brassica* systems of West and Central Java are important sources of cool climate vegetables for consumers in Indonesia, but at present the supply chain is poorly organised. Farmers, processors, wholesalers, retailers and others who play a role within the supply chain have limited trust of each other, which reduces efficiency and increases transaction costs within the chain. This project, which builds on the ACIAR project, *Optimising the productivity of the potato/Brassica cropping system in Central and West Java* (CP/2005/167), seeks to upgrade the flow of market information and encourage technology adoption and innovation. Its objective is to improve incomes and promote sustainable livelihoods among vegetable farming households in West and Central Java by enhancing farmer participation in two key types of supply chain: 1) fresh-products markets involving assemblers/ wholesalers/ retailers/ institutional buyers; 2) processed-product markets involving chips factories and snack-food enterprises.

### **Project progress**

First progress report due in 2009.

### **Project information**

#### **Overseas Collaborating Countries:**

Indonesia

**Commissioned Organisation:** International Potato Center, Impact Enhancement Division, Philippines

#### **Project Leader**

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#### **Collaborating Institutions**

- Department of Agriculture and Food, Western Australia, Australia
- University of Adelaide, Australia
- Indonesian Vegetable Research Institute, Indonesia
- SwissContact Indonesia, Indonesia

**Project Budget:** \$551,114

**Project Duration:** 01/02/2008 to 31/01/2012

**ACIAR Research Program Manager:** Mr David Shearer

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

### Summary

Huanglongbing is a citrus disease caused by the proteobacterium *Candidatus Liberibacter asiaticus* and spread by the Asiatic citrus psyllid *Diaphorina citri*. The disease is a serious impediment to citriculture in Asia because it can destroy orchards within five years of planting. Huanglongbing was first seen in India and Pakistan in the 1800s, but has been gradually moving eastward through tropical and subtropical Asia. Despite the application of hazardous and expensive pesticides, the disease has prevented the establishment of viable citrus industries, seriously affecting the welfare of farmers and national economies. It is also a threat to biodiversity through the loss of citrus species and citrus relatives that are endemic to the region. Vietnam and Indonesia are particularly affected. Complete control of huanglongbing is not possible, but a better understanding of the vector could be used to minimise vector populations and disease transmission, and to optimise the role of natural enemies within sustainable integrated crop management programs.

Huanglongbing and *D. citri* do not occur in Australia, but there is a high risk that they could be introduced by natural and unintentional human-assisted spread through Indonesia and Papua New Guinea on known and possibly alternative hosts.

The aim of the project is to improve citrus productivity in Indonesia and Vietnam by studying the transmission and management of the citrus disease huanglongbing. A further aim is to develop management strategies for the Australian citrus industry in the event that the disease enters Australia.

### Project information

**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, Vietnam
- Research Institute for Citrus and Subtropical Horticulture, Indonesia

**Project Budget:** \$1,089,164

**Project Duration:** 01/01/2003 to 31/05/2009 (Project extended from 01/01/2006 to 31/05/2009)

**ACIAR Research Program Manager:** Mr Les Baxter

### Project progress

#### Year 5 (01/01/2007-31/05/2008)

Studies on huanglongbing and its vector, the Asiatic citrus psyllid (*Diaphorina citri*) continued in Viet Nam and Indonesia. In southern Viet Nam, where applications of mineral oils, pesticides and other management strategies are being compared for control of the psyllid in an orchard at Cai Be in Tien Giang in the Mekong Delta, no differences have been detected between treatments. This outcome is due to the presence of guava trees inter-planted with king orange trees in the orchard. The level of disease in the orchard reached 24% in March 2008, increasing slightly from 20% in early 2007. This level of disease is dramatically lower than in orchards in the absence of guava. The psyllid has not been observed in the orchard, or in similar orchards, by University of Western Sydney personnel, scientists and citrus growers from Florida (April 2007), and scientists from China (May 2008), whereas, psyllids are easily found in orchards where guava trees are not planted. As a result, evaluation of guava interplants has commenced in northern Viet Nam, Indonesia, Florida and China; work in China has shown that guava volatiles repel adult psyllids. Other sources of volatiles are being considered and use of guava and

other plants as groundcovers in inter-row spaces has been contemplated.

At Cao Phong in Hoa Binh near Ha Noi in northern Viet Nam, no psyllids were observed in the project orchard where applications of mineral oils, pesticides and other management strategies are being compared. The absence of the psyllid was most probably due to high pesticide use in adjacent orchards and to climate (Cao Phong is cooler than Cai Be, where the potential for psyllid populations to increase is higher).

In Indonesia, application of foliar fertilisers was shown to reduce disease severity in mandarin trees. Other studies have demonstrated that the psyllid populations and incidence of the disease are related to altitude: higher at low altitudes (10 to 60 m asl), uncommon at medium altitudes (600 m asl) and absent at high altitudes (1,300). Species abundance and diversity of natural enemies also varied with altitude. Studies on the influence of mineral oils on the behaviour *D. citri* continued to show that oil deposits reduce feeding and egg-laying by adult psyllids. Psyllid populations, though increasing, remained too low (due to slow ingress from surrounding orchards) during 2007 and early 2008 to determine differences between treatments in the field experiment where applications of mineral oils, pesticides and other management strategies are being compared.

Ongoing reviews of literature continued as part of the project and for preparation of an incursion management plan, for both the disease and its vectors, for the Australian citrus industry. These reviews indicate that Citrus evolved in Australasia, not Asia, as widely accepted, and that huanglongbing did not, as widely accepted, originate in China. Plans for extension activities from 2009 were considered at an annual workshop in Indonesia in January 2008. The workshop was attended by extension personnel and farmers, and inter-planting of guava in citrus orchards in Java, and more widely in Indonesia, commenced in preparation for these extension activities. Supplies of a mineral oil were also arranged for these activities.

Interest in the project led to the chief investigator (Dr Beattie) being invited to the annual Citrus Expo in Florida in August 2007, where he addressed some 700 people, mostly growers. Interest in the project and Australian expertise also led to Dr Beattie being invited by the United States National Science Academy to participate in a meeting in April 2008 to determine priorities for research on huanglongbing and *D. citri* in Florida.

## **HORT/2003/036: Managing pest fruit flies to enhance quarantine services and upgrade fruit and vegetable production in Indonesia**

### **Summary**

The major pest of horticulture production in tropical and subtropical regions is fruit flies of the Family Tephritidae. Crop losses can range from total to around 40 per cent, depending on what is grown. There is little difference in losses experienced by the scale of operation, with similar patterns reported for both smallholder and commercial operations.

Fruit flies can also result in other losses too, as their presence in a country can have major quarantine implications. Trade partners can impose quarantine restrictions and costly technologies and surveys may be needed to lift such restrictions. Quarantine implications include:

- strict quarantine restrictions to trade are applied by importing market countries
- costly Market Access Technologies are required in order to meet the marketing constraints
- permanent quarantine surveys must be established in production areas in order to guarantee importing countries that the fruit fly pest species are known in the locations from which crops are exported. Quarantine surveys must be established in key locations such as ports of entry, to detect new incursions of exotic fruit fly pest species.

Indonesia has problems relating to fruit flies: economic losses, limited supply of fruit and vegetables resulting in low dietary intake, trade restrictions blocking access to potential export markets and a need to build reputation as a reliable fruit exporter with controls performing to expectations.

The specific objectives of the project are to:

- enable Indonesian quarantine to meet WTO-SPS requirements in relation to fruit flies
- reduce Indonesia's crop losses from fruit flies, through improved pest management including use of protein bait sprays
- raise Indonesia's capacity to independently undertake fruit fly research and pest management in the future.

### **Project information**

**Overseas Collaborating Countries:**  
Indonesia

**Commissioned Organisation:** Griffith University, Faculty of Environmental Sciences, Australia

### **Project Leader**

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### **Collaborating Institutions**

- Agency for Agricultural Quarantine, Indonesia
- Directorate of Horticulture Protection, Indonesia
- Department of Agriculture, Fisheries and Forestry, Australia

**Project Budget:** \$1,282,084

**Project Duration:** 01/11/2004 to 31/12/2009 (Project extended from to 31/12/2009)

**ACIAR Research Program Manager:** Mr Les Baxter

### **Project progress**

#### **Year 4 (01/06/2007-31/05/2008)**

All samples of fruit flies collected during Year 3 of the fruit fly trapping survey conducted in the provinces of Nusa Tenggara, Maluku, Papua and West Irian Jaya and sent to Griffith University have been identified, and a list of species occurring in these provinces has been compiled. Fruit fly damage assessments on fruits of economic importance is still in progress in these provinces.

The second training workshop on "Fruit Flies of Indonesia: Their Identification, Pest Status and Pest Management" was held in Darwin from 10 – 14 March 2008. The workshop provided training to 21 staff members from the Department of Horticulture Protection and the Agency for Agricultural Quarantine in Indonesia, particularly on the identification of fruit flies collected in the nationwide survey of fruit flies. With the aid of an illustrated key that was prepared and provided, trained staff now has the independent capacity to carry out accurate identifications of fruit flies in Indonesia. In addition to the Indonesian staff, the training workshop was also of great benefit to 3 participants from the

Northern Australia Quarantine Strategy, Darwin, Broome and Mareeba, and 3 participants from the Northern Territory Department of Primary Industry and Mines, all of whom were able to obtain the most up to date knowledge on fruit flies of quarantine importance to Australia.

In conjunction with the ACIAR project, a workshop on Fruit Fly Pest Free Areas was conducted in Jakarta from 18-22 June 2007. Invited speakers from Griffith University, Biosecurity Australia, NSW and Victoria Departments of Primary Industries and AQIS, provided in-depth presentations on fruit fly area freedom as practised in Australia. The workshop was attended by 44 senior scientists and quarantine staff from various agencies in Indonesia.

Construction of the protein bait plant at PT MultiBintang Brewery in Tangerang, Java was completed in February 2008 and the plant was commissioned in March 2008. Once registration has been obtained, production of the protein bait will begin in Indonesia.

## HORT/2004/034: Diagnosis and management of wilt diseases of banana in Indonesia

### Summary

Bananas are an important component in many Indonesian diets, reducing the dependence on rice. High in potassium and essential minerals, bananas aid in growth and maintaining good health. Bananas are also profitable to grow. Smallholder farmers often rely on bananas to fill much the same role in farming output as in their diet, to provide additional income that growing rice does not.

The additional income bananas provide to smallholders stems from demand for the fruit rising. Production has fallen in recent years due to disease outbreaks, reducing supply available to meet demand. These outbreaks have in turn reduced the area planted to bananas. The outbreaks and associated consequences have seen export income from bananas fall from a 1996 high of \$22 million to just \$150,000 in 2002.

Two diseases are responsible for this rapid decline, Foc (*Fusarium oxysporium f sp cubensis*) and BDB (Blood disease bacterium). These diseases cause fungal and bacterial wilt diseases that attack plants and reduce productivity. Controls for the diseases are not satisfactory in maintaining or reducing outbreaks from spreading. Bioagents to control the diseases have been trialled but losses continue to mount as both diseases spread. This has left smallholder farmers all but defenceless against the diseases. Commercial smallholder producers and mixed croppers (accounting for 95 per cent of total Indonesian production) along with backyard farmers all face a bleak future unless control over the disease can be achieved.

The overall purpose of this project is to develop systems for the sustainable management of banana wilt diseases and extend these to farmers, through three objectives:

- improve the understanding of the epidemiology and biology of banana wilt diseases
- evaluate management options (biocontrol, soil treatments, elicitors) for wilt diseases
- extend best practice management practices for banana wilt diseases to growers.

### Project information

**Overseas Collaborating Countries:** Indonesia

**Commissioned Organisation:** University of Queensland, Australia

### Project Leader

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### Collaborating Institutions

- Indonesian Tropical Fruit Research Institute, Indonesia
- Gadjah Mada University, Indonesia
- Assessment Institute for Agricultural Technology (West Sumatra), Indonesia
- West Sumatra Provincial Crops and Horticulture Protection Institute, Indonesia
- Pest and Disease Forecasting Centre, Indonesia

**Project Budget:** \$972,624

**Project Duration:** 01/01/2005 to 31/12/2008

**ACIAR Research Program Manager:** Mr Les Baxter

### Project progress

#### Year 3 (01/01/2007-31/05/2008)

Characterisation of strains and variability of BDB is nearing completion. Considerable progress was made in further improving the detection methods for Blood Disease Bacterium (BDB). A PCR method for detecting BDB in dried vascular strand samples was developed. It will enable detection of the bacterium in samples collected originally for the detection of *Fusarium oxysporum f.sp. cubense* (Foc). Studies on the host range of the bacterium showed that some species of *Heliconia* supported survival of BDB. Inoculation experiments showed that BDB, in addition to the well-known mode of infection via male flowers, can infect bananas from soil. Research on the survival of BDB in soil and plant debris showed that it declined to very low levels after 3 months and was not

detectable after 6 months. These results have allowed the development of strategies to rehabilitate areas affected by BDB, including destruction and burial of infected plants, rotation to non-host crops, then re-planting with bananas.

Three field trials on biological control of Foc were established, with 4 banana varieties that had been propagated by tissue culture: Puju, Kepok, Tanduk and Barangan. Two of the trials were in highland and lowland areas of West Sumatra, while the third was established on land owned by the University of Gadjja Mada in Jogjakarta. The West Sumatra trials were on farms with a history of wilt disease, while the trial at UGM was artificially inoculated with Foc. Data on disease incidence and the populations of Foc and the biological control agent *Trichoderma* were collected. Populations of *Trichoderma* after the biocontrol agent was applied rose initially, then declined to very low levels after three months, indicating that repeated applications may be required for efficacy.

When the banana plants flowered it became apparent that some plants in the trials were not of the designated variety. In particular the "Tanduk" plants at UGM were found to be cv Panjang, while in other plots one or several plants of one variety were in the same plot as another. The trials were mapped and individual plant data are being kept to enable separation of varietal effects.

Changes were made to pathways for funds transfer and to personnel, including the appointment of Dr Catur Hermanto as the principal researcher in Indonesia. A meeting of all participants in the project was held in July 2007 to review objectives, activities and progress.

The targeted survey of wilt diseases finally got underway and is in progress. A database has been developed to facilitate reporting and analysis of the data. Provinces surveyed to date are West Sumatra, Yogyakarta, East Kalimantan and East Java. A further five provinces are planned to be surveyed, and access to samples collected during the surveys of Foc in other provinces, carried out by the ACIAR multilateral project CP/2005/136, is being sought so data on the distribution of BDB can be added to the Foc results. Plants have been propagated for use in varietal trials in several provinces.

## **HORT/2004/048: Integrated disease management (IDM) for anthracnose, Phytophthora blight and whitefly transmitted geminiviruses in chilli pepper in Indonesia**

### **Summary**

In Indonesia, chilli pepper (*Capsicum* spp.) is an important crop, providing income and nutritional benefits to smallholder producers. In 2003, over 550,000 t were produced, mostly in Java and Sumatra, with smaller production centres in Bali and Sulawesi. Productivity of chilli pepper is limited by disease pressures from fungi and viruses, which reduce yields and marketability, while increasing economic risks to the farmer.

The two most serious fungal diseases are Phytophthora blight (PB), (caused by *Phytophthora capsici*), which causes wilting, defoliation, fruit drop, and plant death and anthracnose, (caused by *Colletotrichum* spp) which causes fruit lesions on immature green and mature red fruit thus reducing harvestable yield; fruit lesions may even develop several days after harvest, causing substantial post-harvest loss.

On the other hand, Whitefly-transmitted geminiviruses (WTG) induce symptoms such as foliar chlorosis and curling, reduced leaf size, inhibited fruit set and abnormal fruit development. Chemical control measures are frequently ineffective or expensive, and farmers lack knowledge of innovative approaches to disease management. The development of satisfactory control measures is a high priority for AVRDC-the World Vegetable Center (AVRDC) and Indonesian R&D collaboration.

The overall purpose of this project is to identify and demonstrate effective integrated strategies to limit losses to Phytophthora blight, Anthracnose, and Whitefly-transmitted geminiviruses in chilli peppers in Indonesia. The specific objectives of the project are to:

- Assess and address the socioeconomic and horticultural practices affecting adoption of disease control options in Central Java
- Characterise biological factors affecting disease incidence and severity of anthracnose, Phytophthora blight, and whitefly transmitted viruses on chilli pepper
- Assess integrated crop management strategies for sustainable control of anthracnose, Phytophthora blight and whitefly transmitted viruses

- Continue with the development of locally acceptable varieties carrying effective resistance to anthracnose and phytophthora blight, and search for lines resistant to whitefly transmitted viruses.

### **Project information**

**Overseas Collaborating Countries:**  
Indonesia

**Commissioned Organisation:** The World Vegetable Center, Taiwan

### **Project Leader**

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### **Collaborating Institutions**

- Indonesian Vegetable Research Institute, Indonesia
- NSW Department of Primary Industries, Australia
- CSIRO Entomology, Australia
- Assessment Institute for Agricultural Technology (Central Java), Indonesia
- Bogor Agricultural University, Indonesia

**Project Budget:** \$821,822

**Project Duration:** 01/01/2006 to 31/12/2009

**ACIAR Research Program Manager:** Mr Les Baxter

### **Project progress**

**Year 1 (01/01/2006-31/12/2006)**

*Summary Statement:*

Project activities began in May, 2006. Indonesian partners in IVEGRI, AIAT, and IPB were confirmed. An organizing, Inception Workshop was organized and conducted in September, 2006, in Bandungan, Central Java, with all members attending except our Australian partners. Formal workplans and budgets were discussed and settled, as well as basic reporting responsibilities.

During October and November, pathologists and entomologists conducted surveys of the three targeted production

### *Subprogram 3: Research to underpin development of competitive horticultural agribusiness*

regions, gathering plant and insect samples for isolation and evaluation of pathogen strains, primarily of phytophthora and WTG.

#### *Activities:*

##### *Administrative/General:*

- Inception Workshop, Bandungan, Central Java, September 4-8, 2006
- Recruitment and hiring of our project Site coordinator, Dr. Anna Dibyantoro

#### *Objective 1 (Assess socioeconomic and horticultural practices affecting adoption of disease control options in Central Java):*

Planning begun for Rapid Rural Appraisal survey of three target areas. Initially scheduled for January, this activity was postponed to March 5-15, 2007, because of schedule conflicts and the transfer of AVRDC socio-economist Dr. Mubarik Ali to new duties in Pakistan).

A consultant, Mr. Joko Mariyono, was contracted to assist in the RRA activity. He will potentially be hired as a research specialist within AVRDC's socioeconomics unit, upon his completion of a PhD degree at Australia National University (Crawford School of Economics and Government) in Australia.

#### *Objective 2 (Characterize biological factors affecting disease incidence and severity...):*

IVEGRI virologist and entomologist visited the target regions, and collected pepper plant sampled displaying symptoms of geminivirus: Magelang (3), Rembang (4), and Brebes (6). These will be studied further at IVEGRI laboratories. Live plants were also harvested and transferred to IVEGRI-Lembang for further studies. Whitefly samples were also collected, and rearing is underway at Lembang.

Designs were completed for construction of three screened inoculation rooms, to be used in 2007 for transmission studies of the geminiviruses, and for screening germplasm for virus resistance.

Collection surveys for Phytophthora and Colletotrichum pathogens were undertaken in January 2007, and will be reported on in next year's activity report.

#### *Objective 3 (Assess IDM strategies for sustainable disease control):*

Initial crop management trials were established in late 2006, in the Brebes area, on Surjan beds 1.5 meters wide x 25 meters long. Shallots were set in the blocks in December,

and pepper seedlings were germinated in banana-leaf plugs under protective screen netting, to prevent insect and/or virus infection. These seedlings will be inter-planted among the shallot, and will be followed by disease protective treatments.

#### *Objective 4 (Continue development of locally acceptable varieties carrying resistance to target diseases):*

At AVRDC, segregating progenies were advanced and reselected during the fall season, and seed samples are being made available for follow-up testing in Indonesia. These include:

25 F3 progenies of a Kerriting variety crossed with potential sources of WTG resistance. 77 single plant selections were made based on horticultural type and yield potential, and will be shared with IVEGRI and IPB staff for screening with WTG isolates.

21 F4 progenies from crosses between the Phytophthora resistant line PI201238 and several Indonesian varieties (Jatilaba, Kerriting, and Tit Super) were screened a second time for resistance, and 29 single plants were selected for further refinement. Seed bulks of the resistant progenies were also harvested, and these will be sent to Indonesia for additional evaluation, screening, and reselection.

40 F5 and 21 F6 multi-disease resistant progenies based on a Jatilaba background (or Kerriting in some cases) were further reselected on the basis of resistance to anthracnose, yielding 25 F6 and 78 F7 selections. Seed of these will also be shared with Indonesian collaborators for screening against local strains, and potentially used in farmer participatory selection trials.

150 accessions of Capsicum frutescens were established in a seed increase block to provide seed for screening in Indonesia for resistance to WTG

At IVEGRI, numerous Indonesian OP varieties are being increased in anticipation of screening them with locally isolated strains of phytophthora and anthracnose, which tasks are being accomplished by the mycologist. Screening of accessions for resistance to geminivirus awaits establishment of isolates, whitefly vectors, and inoculation chambers by the virology group.

## **HORT/2005/136: Mitigating the threat of banana Fusarium wilt: understanding the agroecological distribution of pathogenic forms and developing disease management strategies**

### **Summary**

Fusarium wilt disease caused by *Fusarium oxysporum* f. sp. *cubense* (*Foc*), one of the most devastating plant diseases, is a major concern for banana-producing countries. The damage potential of the disease is exemplified by the devastating outbreaks that occurred in Latin America in the 1950s, which destroyed whole plantations and led to the disappearance of the Gros Michel cultivar from the commercial dessert banana industry. *Foc* is conventionally classified into four pathogenic forms known as 'Races'. Race 1, which destroyed the Gros Michel plantations, also attacks many local cultivars in Asia; Race 2 affects specific cooking bananas. The particularly virulent 'Tropical' Race 4 affects a wide range of cultivars including Cavendish, and has caused substantial production losses for commercial and subsistence farmers in Indonesia, Taiwan, Malaysia and the Northern Territory of Australia.

*Foc* is also classified into vegetative compatibility groups (VCGs) - 21 clonal lines of VCG are known to exist. Recently, severe infections were reported on Cavendish plantations in China and the Philippines. The variation in pathogenicity within the conventional races highlights the need for more precise characterisation of variability based on VCGs, and a better understanding of the relationship between pathogenicity and *Musa* (banana and plantain) diversity. *Foc* cannot be effectively managed with fungicides and the disease remains over a long period in the soil. The early and accurate diagnosis of the disease, prevention of its spread and the deployment of management strategies are, therefore, of utmost importance. The impact of the disease has prompted the Banana Asia Pacific Network, BAPNET, to call for support for increased research into pathogenic variability, host-resistance and sustainable disease management methods to alleviate the losses caused by this disease.

The objective of this project is to carry out a comprehensive survey and characterisation of *Foc* pathogenic forms and to develop national strategies for disease exclusion, containment and management, identifying a package of management tools through participatory approaches and exploiting existing networks to enable 'fast-track' adoption of effective measures.

### **Project information**

#### **Overseas Collaborating Countries:**

Indonesia, Papua New Guinea

**Commissioned Organisation:** Bioversity International, Philippines

#### **Project Leader**

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#### **Collaborating Institutions**

- Indonesian Fruit Research Institute, Indonesia
- National Agricultural Research Institute, Papua New Guinea
- National Agriculture Quarantine and Inspection Authority, Papua New Guinea
- Agency for Agricultural Quarantine, Indonesia
- Queensland Department of Primary Industries and Fisheries, Australia

**Project Budget:** \$600,566

**Project Duration:** 01/06/2006 to 31/05/2009

**ACIAR Research Program Manager:** Mr Les Baxter

### **Project progress**

#### **Year 2 (01/06/2007-31/05/2008)**

##### *Indonesia*

The survey and collection of samples within the framework of the CP/2005/136 project is complete in eight major Indonesian banana producing provinces. One hundred and eleven *Fusarium oxysporum* f.sp. *cubense* (*Foc*) pure isolates were sent to QDPI&F for VCG (Vegetative Compatibility Group) and DNA characterization. The *Foc* isolates came from 16 different banana varieties. To fully map the *Foc* distribution in Indonesia, provinces under the Indonesian / ACIAR bilateral project (CP 2004/034) are being surveyed to complement surveys under project CP/2005/136. ITFRI is generating pure isolates from the samples collected, to be sent to QDPI&F for VCG and DNA characterization.

VCG analyses at QDPI&F show that 73 out of the 111 isolates gave positive VCG results, belonging to several VCG groups. 44 out of the 73 VCG-positive isolates showed specific results for VCG 01213/16, the VCG that is associated with the virulent Tropical Race 4 (TR4). The remaining 38 isolates were negative in the VCG tests. There was a confirmation of VCG 0126 on a wild banana, *Musa schizocarpa*, collected from Papua Province. Nine new *Musa* accessions were collected from Central Kalimantan, North Sulawesi and Papua.

#### *Papua New Guinea (PNG)*

Survey and collection activities are being conducted in PNG. Six field surveys, yielding 36 samples were completed between September 2007 and February. These were sent to QDPI&F for testing. *Fusarium* wilt-like symptoms were uncommon in these surveys, indicating that *Fusarium* wilt disease is not yet well established in PNG. QDPI&F tests show that none of the 36 samples from PNG was infected with *Fusarium* wilt disease. Survey and collections are scheduled for June 2008 in Sundaun, which borders with Papua, where TR4 has been previously reported.

A huge diversity of local bananas was observed in Manus. Taxonomists from the survey-team collected new banana accessions from Manus (10) and Western province (6). New germplasm accessions are important potential sources of resistance for specific banana diseases, including Foc TR4. The accessions were added to the existing germplasm collection of NARI in Laloki.

#### *Development of rapid molecular diagnostic tool*

A key project objective is to develop an accurate and rapid diagnostic molecular technique test for *Fusarium* wilt. One hundred and two Foc-positive isolates from Indonesia were studied by extracting their DNA, using a commercial DNA plant extraction kit BioSprint Tissue Lyser. Tests showed that 47 samples were found to be positive for TR4, 35 to be negative, and 20 samples gave inconclusive results. The accuracy of the test on the 102 samples was computed at 80.39%, which is relatively low, thus test procedures will yet have to be refined.

#### *Virulence-Host Resistance Test*

Four local banana varieties, Ambon Kuning, Barangan, Kepok, and Raja Sere, have been initially tested for resistance to the six following VCGs: 01213/16, 0123, 0120, 01218, 0126, and 012415. The project will be conducting

virulence tests on a total of 25 selected wild and cultivated banana varieties to eight VCGs. Preliminary results showed *Fusarium* wilt symptoms such as vascular discoloration, chlorosis and wilting were observed on inoculated plants. Other tested local varieties showed common symptoms such as yellowing and wilting of leaves even three months after inoculation. Despite some observed corm infection. VCG01213/16 was noted to be most virulent among the tested VCGs. These results indicate differences in disease resistance/susceptibility of the various test varieties, and possibly differences in virulence of the different VCGs.

#### *On-farm disease management demonstration trials*

The farmer co-operators participatory planning workshop assessed farmers' practices in banana production and disease management, as well as options for management of *Fusarium* wilt disease. From this workshop, the following are the 'best-bet' options for *Fusarium* wilt management: The use of:

- disease-free planting materials obtained from tissue culture (TC) propagation
- varieties tolerant or resistant to *Fusarium* wilt such as FHIA-17, FHIA-21, FHIA-25, GCTCV 119, Ketan-01, and one susceptible variety Ambon Warangan (Cavendish subgroup)
- burning rice-hull on infected mats or spot eradication
- good agronomic practices
- a biological control using *Pseudomonas fluorescens*, adopted from the farmers' field-school program.

Demonstration plots were established in Lampung, Central Java and Malang, East Java in cooperation with farmer-co-operators. The farmers were trained on the use of clean planting materials from banana tissue culture and the management of tissue culture seedlings for field planting. One important aspect of the project is to introduce a sustainable TC delivery system to small-scale farmers sourcing from commercial laboratories. Private tissue culture laboratories producing banana meriplants were identified across Indonesia. A meriplant delivery system and a management protocol for village nurseries is being developed.

## **HORT/2006/147: Integrated pest management of stem borers and insect vectors of viral diseases of sugarcane in Indonesia**

### **Summary**

In Indonesia sugarcane is grown by over 140,000 farmers, and the industry supports over 1.3 million workers in associated industries. Over three-quarters of the sugarcane production occurs on the island of Java. But over the last 40 years, productivity has been declining. Pests and diseases are major contributors to this production slide, and stem borers particularly are dramatically affecting crop yields on Java – with infestations in commercial Javan sugarcane fields estimated at >10%. Other pests include vectors of sugarcane mosaic and sugarcane streak mosaic viruses, which are widespread through Southeast Asia.

Recent estimates suggest that the species *Chilo auricilius* and *C. sacchariphagus* may lead to yield reductions of up to 50% and cause the Indonesian industry large financial losses. There remains a strong need to implement effective control programs, especially to bring effective Integrated Pest Management (IPM) strategies onto Javan sugarcane farms.

Results from very successful ACIAR-funded studies (CP/1996/140; CS2/1991/680) in other countries (such as PNG where IPM strategies were implemented for the closely related stem borer *Sesamia griseocens*) will be drawn upon in this project.

The project addresses the problems of losses to sugarcane productivity by reducing the infestations of stem-borers and viruses. This will be achieved by accomplishing the following objectives:

1. to determine the distribution and incidence of stem borers, insect vectors and natural enemies in Java
2. to identify known mosaic virus insect vectors and their frequency on Java (the transmission of mosaic by some potential vectors may be assessed)
3. to develop an integrated pest management (IPM) program, particularly for stem borers
4. to transfer new technologies using appropriate extension methods to the farming, scientific, and quarantine community.

### **Project information**

**Overseas Collaborating Countries:** Indonesia

**Commissioned Organisation:** Bureau of Sugar Experiment Stations Limited, Australia

#### **Project Leader**

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#### **Collaborating Institutions**

- Indonesian Sugar Research Institute, Indonesia
- Plant Quarantine Station, Indonesia

**Project Budget:** \$530,200

**Project Duration:** 01/01/2008 to 31/12/2011

**ACIAR Research Program Manager:** Mr Les Baxter

### **Project progress**

First progress report due in 2009.

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## 4.4 Subprogram 4: Productive smallholder aquaculture and agroforestry systems

### Shrimp

Shrimp is the most important export product in Indonesia's fishery sector. This complementary suite of projects aims to improve the productivity and profitability of small shrimp farmers along with associated micro-to-small enterprises involved in the shrimp supply chain. The projects will achieve this by improving planning for aquaculture development, both on-farm and more broadly at district and provincial levels; and by improving the reliability and quality of harvests through on-farm refinement of best-management husbandry packages and their active dissemination using farmer-to-farmer extension pathways. Product quality and market access issues are increasing in prominence.

### Projects

Project number	Project title	Page
FIS/2002/076	Land capability assessment and classification for sustainable pond-based aquaculture systems	50
FIS/2005/169	Improving productivity and profitability of smallholder shrimp aquaculture and related agribusiness in Indonesia	52
FIS/2006/144	Strengthening regional mechanisms to maximise benefits to smallholder shrimp farmer groups adopting better management practices	54

### Culture of finfish and high-value aquaculture and mariculture species

The marine finfish culture industry is growing strongly in Indonesia. This cluster of projects continues a long-term joint effort to establish robust hatchery production systems for key species of interest. This will be achieved by controlling disease threats and improving the productivity of nursery and grow-out operations through the development and promotion of suitable best-practice husbandry packages. Consistent with the rapid growth profile of the industry, researchers are giving increasing attention to sustainability issues. These include the evolution of better planning tools (maps, calculation of environmental carrying capacity), the more effective management of finfish cage culture in inland and coastal water bodies (including co-management approaches), and the development and promotion of cost-effective environmentally friendly formulated feeds.

### Projects

Project number	Project title	Page
FIS/2002/077	Improved hatchery and grow-out technology for marine finfish in the Asia-Pacific region	55
FIS/2002/111	Culture-capture conflicts: sustaining fish production and livelihoods in Indonesian reservoirs	57
FIS/2003/027	Planning tools for environmentally sustainable tropical finfish cage culture in Indonesia and northern Australia	59
FIS/2006/140	Achieving consistent spawning of captive yellowfin tuna ( <i>Thunnus albacares</i> ) broodstock at Gondol Research Institute for Mariculture, Bali, Indonesia	61

## **FIS/2002/076: Land capability assessment and classification for sustainable pond-based aquaculture systems**

### **Summary**

Aquaculture in Indonesia offers the possibility of high returns and the industry has expanded rapidly, including into land-based systems. Frequently, ponds to accommodate these systems are constructed using unsuitable soils and established in areas incapable of sustaining the chosen form of aquaculture. For example, intensive shrimp farming systems are often developed in areas that are more suited to less intensive or alternative aquaculture systems.

Land capability classification would allow better matching of soils to systems, such as in Australia. However, mapping in Australia is conducted at a broad regional scale rather than at the farm level, and limited to basic site factors that in some cases only satisfy screening requirements for development approval. Production problems can, therefore, occur in areas that are mapped as suitable at the regional scale but lack detailed site assessment criteria for farm-level decisions on pond location and management. More robust site selection and land capability assessment would result in land classification schemes for a variety of aquaculture systems in Indonesia, and also refine the methods currently in use in Australia.

The objectives of the study are first, to develop more effective and informative site selection criteria and land capability assessment techniques to produce land classification schemes and maps for a variety of land-based aquaculture systems in Indonesia, and second, to identify environmental constraints and improve existing site selection criteria and land capability assessment and mapping in Australia.

Later in the project, by combining and integrating their findings with those from ACIAR Project FIS/2003/027, titled *Planning for environmentally sustainable tropical finfish culture*, a coastal aquaculture classification scheme for sea-cage and land-based aquaculture will emerge.

### **Project information**

**Overseas Collaborating Countries:**  
Indonesia

**Commissioned Organisation:** University of New South Wales, Faculty of Science, Australia

### **Project Leader**

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### **Collaborating Institutions**

- Research Institute for Coastal Aquaculture, Indonesia
- Gadjah Mada University, Indonesia
- Australian Institute of Marine Science, Australia
- Directorate General Aquaculture, Indonesia

**Project Budget:** \$767,063

**Project Duration:** 01/07/2005 to 30/06/2009

**ACIAR Research Program Manager:** Mr Barney Smith

### **Project progress**

#### **Year 3 (01/07/2007-31/05/2008)**

The project focussed on the completion of fieldwork, data analyses, production of draft site selection criteria and associated draft land capability maps. The project also co-developed mapping models for seacage farming with FIS/2003/027 (seacage project).

Fieldwork was completed at all South Sulawesi-based locations including the ground truthing of draft maps for land- and sea-based aquaculture. Sites on the east and west coast of South Sulawesi were used to compare different soil, geomorphic and hydrological settings and various production systems (shrimp monoculture, polyculture, seaweed culture and fish monoculture). Data from FIS/2005/009 in Aceh were used to include sandy soil environments in the data analyses and subsequent development of the site selection criteria and mapping models. Study sites in Lampung were included under a project variation to enable the land-based and seacage projects to conduct joint research where seacage and land-based farming operate intensively in close vicinity. Environmental, socioeconomic and production data were analysed using multivariate methods to develop site selection criteria for a range of extensive

*Subprogram 4: Productive smallholder aquaculture and agroforestry systems*  
*Shrimp*

farming practices. The draft site selection criteria target farm-level decision making. The criteria are based on low cost technologies to evaluate the physical and human constraints on brackishwater aquaculture development, and decision making processes to identify issues that require technical intervention from government agencies. Draft site selection criteria guidelines are close to completion and will be reviewed by stakeholders in 2008.

Site selection criteria were developed further and translated into GIS-based mapping criteria to underpin the development of mapping models for spatial planning purposes. Field and remote sensed data were combined in the analyses to refine techniques for land evaluation over large areas, and to improve the predictive accuracy of the image classification used in the mapping. The draft GIS models were first tested in Pinrang regency and more recently applied to sites in Lampung and the east coast of South Sulawesi. Ground-truthing was used to test the accuracy of mapping boundaries and land classification. Data from the Australian study sites are currently being analysed to revise existing site selection criteria and provide inputs to policy development in NSW and Queensland. Site selection criteria from the Indonesian component are being revised in the context of the Australian data set and the intensity of the farming systems on the east coast of Australia. The analysis of the Australian data set also involves multivariate approaches.

Mapping models for Indonesia are based on three spatial scales. At 1:100,000 the maps differentiate between suitable and unsuitable classes for regional-scale planning. Selected areas have been mapped at 1:50,000 and the project is currently testing the accuracy of suitability sub-classes at this scale. At the 1:10,000 scale all maps are sufficiently detailed to divide the suitability classes into well-defined sub classes which include specific information on farming methods, the type of culture systems best suited to the location and the maximum intensity of the farming systems. Draft guidelines for map interpretation are being produced and will be reviewed by government agencies in July/August 2008.

The land-based and seacage project have continued to operate under the auspices of the National Steering Committee (NSC) and a Local Advisory Committee (LAC) in South Sulawesi. The two committees have successfully fostered information exchange between the research agencies and stakeholders leading to more effective extension and adoption. The spatial data and mapping outputs of the project have also been adopted by the Agency for Regional Development and Zoning and the Bureau of Rural Settlement to facilitate broader landuse planning and to minimise encroachment of brackishwater areas by other landuse. The two committees have enhanced interagency collaboration and communication between the projects and farmers.

A joint extension workshop, held in November 2007, enabled stakeholders, researchers and the LAC to further develop the dissemination and adoption strategies of the land-based and seacage projects. Stakeholders were also involved in small workshops to identify appropriate extension materials. A print publishing process was also developed to improve in-country production of extension materials for both projects. The land-based team visited farmer groups after the workshop to plan community extension and adoption programs. A farmer workshop was held in Luwu in December 2007 and more district-based workshops are planned for 2008.

The project has also developed stronger links to FIS/2000/061 (disease management project). The land-based project has characterised and mapped soils at the disease project's experimental ponds in Barru and Pinrang, and in 2008 will also undertake a social survey to develop a better understanding of farmer risk perception and how it affects the uptake of technology. The two projects are also integrating information on pond management to minimise the effects of soil and water quality on disease outbreaks.

## **FIS/2005/169: Improving productivity and profitability of smallholder shrimp aquaculture and related agribusiness in Indonesia**

### **Summary**

Shrimp is the most important export product in Indonesia's fishery sector. About 200,000 ha of brackishwater ponds (40% of the total) are used for growing shrimp in Indonesia. Of these, 75% are farmed extensively (using 'traditional' or 'traditional plus' systems, sometimes in polyculture with milkfish), 15% semi-intensively and 10% intensively. There are 35,000 and 104,000 ha of brackishwater ponds, respectively, in the project's two target provinces, Central Java and South Sulawesi.

All levels of government actively promote the three intensification levels of shrimp farming to lift the prosperity of coastal communities and to generate foreign exchange. In 2004, Indonesia produced 239,000 tonnes of farmed and wild-caught shrimp, of which 143,000 t were exported - mainly to Japan, the EU and USA. The exports generated over US\$1 billion, with farmed shrimp contributing 93% of that amount.

Farming at each level can be profitable and sustainable, as long as biosecurity, productivity, environmental and social requirements are properly managed. To remain competitive and to protect export market access, governments and industry supply chains are increasingly recognising the importance of international food safety standards, and of marketing and value-adding as effective competitive strategies.

The project aims to improve productivity and profitability for 'traditional' and 'traditional plus' shrimp producers and associated supply chain micro-to-small enterprises (MSEs) by improving biosecurity and enabling compliance with product quality and food safety standards for export and premium domestic markets.

### **Project information**

**Overseas Collaborating Countries:**  
Indonesia

**Commissioned Organisation:** University of Sydney, Faculty of Veterinary Science, Australia

### **Project Leader**

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### **Collaborating Institutions**

- Directorate General of Fisheries Products Processing and Marketing, Indonesia
- Directorate General Aquaculture, Indonesia
- Fisheries and Marine Affairs, Central Java, Indonesia
- Fisheries and Marine Affairs, South Sulawesi, Indonesia

**Project Budget:** \$1,046,597

**Project Duration:** 01/01/2007 to 31/12/2010

**ACIAR Research Program Manager:** Mr Barney Smith

### **Project progress**

#### **Year 1 (01/01/2007-31/05/2008)**

Following a prolonged contractual dispute, Part H funds were released in June 2007 and remaining Payment 1 funds in October 2007, i.e. 10 months after the formal 1 January 2007 start date. These delays forced us to postpone project inception until June and, during the period up to October, to focus on low-cost preparatory/organising/scoping activities. Most importantly, the delays forced postponement of pond-level implementations and other activities closely linked with cropping calendars.

This report, while retaining (by agreement with ACIAR) the start and milestone dates detailed in the project document, covers activities in the period 1 June 2007- 31 May 2008 only.

Activities to date include:

- Four volunteer farmer groups were selected for BMP implementation - 2 in Demak district, Central Java; 1 in Barru district and 1 in Pinrang district, South Sulawesi
- A 15-point BMP program with full supporting technical information was developed
- New-entrant farmers and project technician-extensionists (TEs) were trained in BMP implementation

*Subprogram 4: Productive smallholder aquaculture and agroforestry systems*  
*Shrimp*

- A Project Officer was appointed, staff roles and responsibilities defined, and data collection, recording and reporting systems established
- Generic and project-related extension training was conducted for university-based 'train the trainer' extensionists, provincial and district extensionists
- Project Epidemiologist (Indonesia) has enrolled in doctoral program at Gadjah Mada University (GMU); risk factor study design completed
- Project Coordinator and senior diagnostician (ex GMU) completed shrimp pathology training at Mahidol University, Bangkok
- 'Shake-down' trial implementations, conducted during the less favourable cropping period (Dec 07-Mar 08), were completed in 2 ponds in Demak using 2nd draft BMPs (1 success, 1 failure)
- Formal, full BMP demonstrations, during the most favourable cropping period (May 08-Sept 08), have begun in 4 ponds (2 Demak; 1 Barru; 1 Pinrang), matching control ponds also monitored
- Planning for a study of socioeconomic determinants for BMP program adoption and compliance, led by a consultant fisheries socioeconomic from Hasanudin University, Makassar, is at an advanced stage.

Observations during the reporting period indicate that the spread of serious shrimp pathogens, notably WSSV, across Indonesia during the past decade has had much more serious long-term consequences for traditional farmers than for better-resourced intensive farmers. In WSSV-endemic areas, implementation of BMPs directed at host/environment/pathogen interactions is the key to successful shrimp farming. Furthermore, project activities to date indicate the need for close interactions in these implementations between shrimp health management, extension, socioeconomic, soil and infrastructure issues. In this context, key emerging issues for the project, with some proposed responses, include the following.

A serious constraint to provision of fisheries extension services in Indonesia has emerged. Because of limited resourcing, district Dinas staff, proposed as key providers under the project's working 'model' for wider dissemination and adoption, are in reality unable to engage with farmers on any significant scale. This unexpected and critical deficiency, together with the lack of any

obvious alternative provider, has been brought to ACIAR's attention. In response, ACIAR has agreed to run a cross-sectoral 'constraints to adoption' workshop during 2008. Meanwhile, we plan to use existing funds to support Dinas extensionists' activities as detailed in the project's crop calendars. This will be done in the expectation that, in a yet to be identified way, Dinas staff will provide extension services under the 'model'.

Serious infrastructure shortcomings combined with unexpected, marked variations in soil type, even within individual farms, will have important implications for BMP implementations, particularly during scale-up to farmer group levels; to address this, we propose working closely with FIS/2002/076. There is limited understanding of environmental conditions and BMP options in traditional, macroalgae-dominated growout ponds; project-funded masters programs for both province-based Senior Technical Officers (STOs) should remedy this deficiency.

Recent suspension of the UPP credit scheme further limits shrimp smallholder access to credit; we expect this will be addressed under ACIAR's proposed 'constraints to adoption' workshop. We expect political will, together with farm-level successes, will strongly influence wider program adoption. Both Central Java province and Pinrang district administrations have signalled they will fund independent, parallel BMP programs provided the project's round 2 demonstration trials succeed;

During 2008, DGA will recruit and train ~300 new graduate field staff to support aquaculture development in targeted areas; some will be deployed to work with smallholder shrimp farmers. DGA's expectation is that Provincial and District governments will subsequently seek funding to expand the scheme within their jurisdictions. Such expanded deployments could provide an important vehicle for wider program dissemination under Subproject 2.

Optimal project progression will require a cross-discipline approach to BMP implementation via linkages with related ACIAR and other projects. This should identify evidence-based, risk-related criteria to assist ACIAR and others in geographically locating projects aimed at benefiting Indonesian smallholder shrimp farmers.

## **FIS/2006/144: Strengthening regional mechanisms to maximise benefits to small-holder shrimp farmer groups adopting better management practices (BMPs)**

### **Summary**

Better Management Practices (BMPs) in the aquaculture context outline norms for responsible farming of aquatic animals. In aquaculture, better management practices have been developed largely for shrimp and salmon aquaculture, although some efforts are presently being made to develop them for other aquatic commodities (e.g. tilapias, catfish, molluscs, eels).

This project is building on the ongoing shrimp BMP programs in the Asia-Pacific region (e.g. in Australia, Indonesia, India, Vietnam and Thailand). It seeks 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 socio-economic sustainability and comply with international principles.

### **Project information**

**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:** Mr Barney Smith

### **Project progress**

Annual report not yet submitted by the project leader.

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

### **Summary**

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

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

With marine finfish playing an important role in the economic well-being of many coastal communities, ensuring the sustainability of aquaculture is important to maintaining wild fisheries. Without such production fishing pressure on wild stocks will increase, fisher folk will increasingly be forced to trawl for trash fish and increasing numbers of wild fry and fingerlings will be removed from wild populations to act as a source of seed stock.

The overall objective of the project is to enhance the sustainability of marine finfish aquaculture in the Asia-Pacific region by improving hatchery production technology and facilitating the uptake of compounded feeds for grow-out.

### **Project information**

#### **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**

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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 31/12/2009 (Project extended from 29/09/2008 to 31/12/2009)

**ACIAR Research Program Manager:** Mr Barney Smith

### **Project progress**

#### **Year 4 (01/06/2007-31/05/2008)**

Larval rearing research continues to focus on improving larval survival and improving the quality of fingerlings produced in hatcheries. While some improvements have been made, progress has been limited due to unreliable egg production at some of the partner institutions. Research into the enzymic capacity of larval groupers is continuing at NFC Cairns, to support the use of inert diets as part of the larval rearing regime. This work has demonstrated that coral trout have lower levels of enzyme activity over the first 12 days post-hatch than tiger grouper (*Epinephelus fuscoguttatus*), which may help explain why *Plectropomus* species are more difficult to rear than other groupers.

Research into developing cultures of small (S-strain) and super-small (SS-strain) rotifer (*Brachionus rotundiformis*) has shown that most techniques to select for smaller rotifers have little or no long-term effects on population size. The most

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promising technique for reducing rotifer population size is isolating and culturing specific strains. Future work will examine whether strain hybridisation can reduce overall rotifer population size.

Collection and cold storage of amictic rotifer eggs was also evaluated. However, cold storage of amictic eggs was found to be effectively limited to 24 hours.

Techniques to culture small copepods – the calanoid copepod *Parvocalanus* – have been developed at NFC Cairns. Cultures of *Parvocalanus* are routinely used in larval rearing in Cairns and have replaced the use of *Acartia* for larval rearing. Two staff from Research Institute for Aquaculture No.1, Cua Hoi and Cat Ba hatcheries, in Vietnam, were trained in live food culture, including copepod culture techniques, at NFC Cairns.

Research into development of grow-out diets has focussed on trialling commercial pellet feeds against research diets or 'trash' fish. Results from commercial diets remain mixed. Coral trout (*Plectropomus leopardus*) fed a commercial pellet feed and a custom-made (RIM-Gondol) feed showed similar survival (46–49%), weight gain (411 and 422%), daily growth rate (1.38 and 1.41 g/day) and FCR (1.55 and 1.45).

However, in another trial RIM Gondol undertook a comparison of pellet diet and 'trash' fish fed to coral trout and coral grouper (*E. corallicola*). 'Trash' fish outperformed the commercial pellet with both species. Coral trout fed 'trash' fish were substantially larger (554 g) after 180 days than those fed the pellet (diet 366 g). Survival rate was similar: 72 – 75%. Growth differences in *E. corallicola* were less marked with fish fed 'trash' fish reaching 316 g compared with pellet fed fish 278 g after 180 days. However, survival of fish fed 'trash' fish was higher (96%) than those fed pellets (82%).

Trials at RICA Maros showed that tiger grouper fed commercial feed (dry pellet), moist pellet, or 'trash' fish have relatively similar whole body content of lipid and protein. Meat quality of fish fed commercial pellet, fed moist pellet, or 'trash' fish was well accepted generally by taste panellists and grouper consumers in Hong Kong.

Three issues of the APMFAN eMagazine (Nos. 9-11) and seven editions of the APMFAN eNews (Nos. 32 – 38) were produced during 2007–08. The Marine Finfish section of the eNACA web site continues to be a popular source of information on marine finfish aquaculture and a valuable mechanism for distributing extension information.

NFC Cairns provided on-farm training to two farmers on culture techniques for grouper with particular reference to methods of cage culture and fish grading. Also, training was provided to a barramundi hatchery operator on the culture of tiger grouper. This training provided the first fingerlings of tiger grouper produced by a commercial operator in Australia.

RICA Maros held a short training course for farmers from Sengata Regency (Kalimantan Timur Province) on feed preparation and feed management, 30 July – 5 August 2007 (in Sengata and Maros).

The APMFAN Grouper Hatchery Production Training Course was held twice during 2007–08: 9–29 July 2007 and 5–25 May 2008, at the Brackishwater Aquaculture Development Centre, Situbondo, East Java, Indonesia. As always, these courses were well attended by trainees from throughout the Asia-Pacific region.

## **FIS/2002/111: Culture, capture conflicts: sustaining fish production and livelihoods in Indonesian reservoirs**

### **Summary**

Inland cultured fish production is a growing industry in Indonesia. This takes two main forms, pond culturing and cage culturing. Inland aquaculture makes a significant contribution to the livelihood of many households, this being a major factor in its rapid expansion. In 1986 the Cirata reservoir held 74 7x7 cage units, by 2000 this number was more than 30,000. Expansion has not been without its problems. Poor fishers relying on capturing wild stocks from reservoirs and other inland water sources have been left behind during this expansion.

The Indonesian Government, which has encouraged cage culturing in reservoirs, has not been able to keep pace with the rate of growth. Regulations and data on wild fish stocks are not yet in place. As cage culturing has expanded pressures on wild stocks have steadily increased, with mounting pressures on wild stocks. Recently this has contributed to a growing number of fish kills, affecting both caged and wild stocks.

Poor fishing families relying on wild stocks have been left without an income source for between four and six months while these stocks regenerate following fish kills. Culture fishers have financial resources and can deal with income losses from fish kills. Poor fishers, without this fallback, often resort to activities such as bamboo harvesting, that impact on reservoir catchments and ecosystems, possibly increasing the speed of cycles causing fish kills.

The primary objective of the project will be to develop suitable implementation plans that will lead to co-management strategies for long-term sustainable utilisation of the reservoir resources, harmonised development of fish culture and the capture fishery, and overall environmental integrity.

### **Project information**

**Overseas Collaborating Countries:**  
Indonesia, Thailand

**Commissioned Organisation:** Deakin University, School of Ecology and Environment, Australia

### **Project Leader**

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### **Collaborating Institutions**

- Network of Aquaculture Centres in Asia Pacific, Thailand
- Directorate General for Aquaculture, Indonesia
- Central Research Institute for Capture Fisheries, Indonesia
- Research Centre for Marine Fisheries Product Processing and Socio-Economics, Indonesia
- Victorian Marine and Freshwater Research Institute, Australia
- Australian National University, Australia

**Project Budget:** \$628,192

**Project Duration:** 01/01/2004 to 31/12/2010 Project extended from 01/10/2007 to 31/12/2010)

**ACIAR Research Program Manager:** Mr Barney Smith

### **Project progress**

#### **Year 4 (01/01/2007-31/05/2008)**

The MoU between NACA and ACIAR was signed on 31 March 2008, and the first payment was received on 28 April 2008. However, the commencement of the project was delayed as a result of introduction of new regulations by the Indonesian Government, and the approval to proceed was obtained by the Ministry of Finance only in August 2008.

The inception meeting of Phase 2 was held at the DGA's Office in Jakarta; attended by all project partners, ACIAR Country Manger, Indonesia, Julien de Meyer, and was co-chaired by **Dr. Reza Shah Pahlevi, Head of Program Division and Fatuchri Sukadi.**

- This project was the first to have obtained registration of the MoF, under the newly introduced regulations (707-777-101)

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- The guidelines for co-management have already been provided to the stakeholders of Jatilnuhur & Cirata for scrutiny at a consultation on 30 June 2008
- DGA of aquaculture has made budgetary provision of A\$47,604 for the local counterpart funding for implementation of aspects of the project

Stocking of the reservoirs commenced in June 2008:

- 2.1 million milkfish fingerlings, 5-7 cm, stocked in Jatilnuhur
- 200,000 in Cirata
- The stocking was attended by the Hon. Minister for Marine Affairs & Fisheries
- Further stocking will continue to meet the target recommendations of 4 million
- Witnessed stocking in J on 20 August 2008
- The Directorate of Human Resources Development have recruited 4 RAs dedicated to aspects of the project; monitoring and implementation of co-management; farmer training; and in addition will provide dissemination material
- Two post-graduate students from University of Bogor will be researching on the success of co-management and the stock enhancement program

*Stocking*

1. Milkfish fry, hatchery produced are bought by the DGA at the cost of Rp20 per tail and transferred to the DGA station in Karawang and reared to fingerling size, and the cost of a fingerling is estimated to be Rp 200/ tail.
2. Jatilnuhur was stocked more intensely because as at current the fishing community is better organised (6 committees), compared to Cirata.
3. A scheme is being introduced that the fishers societies collect Rp1000/kg of milkfish caught and these funds be used for purchase of fingerling in the second-year-around; the DGA wishes to encourage the practice
4. Conflicts: young milkfish enters cage nets and the cage farmers use these catches; the conflict is being resolved by reaching agreement with cage farmers to release such catches into the reservoir

*Stakeholder Meeting (20 August 2008)*

- 50,000 milkfish fingerlings were stocked in Jatilnuhur; discussions with the Chair and Treasurer of the Fishery organization
- Stakeholder Meeting; presentations made by the project team

In spite of the delay the Indonesian counterparts has proceeded with important components of the project. The key areas of progress have been:

- Appointment of research Assistants for monitoring of co-management activities in Cirata and Jatilnuhur reservoirs
- Hiring of four extension workers by the Directorate of Fisheries for monitoring the re-stocking program of the reservoirs
- Preparation of draft co-management strategy document and dissemination of it amongst farmers and fishers in the two reservoirs.

## **FIS/2003/027: Planning tools for environmentally sustainable tropical finfish cage culture in Indonesia and northern Australia**

### **Summary**

Fish farming using cages is a lucrative industry for otherwise poor coastal communities spread throughout the tropics of Asia. Marine finfish are in demand, particularly in the live fish markets of Hong Kong. Recent advances in farming, or culturing fish, have further enhanced the potential of caged fish farming in tropical waters.

The environmental effects of this activity are not year clear, other than in reported economic losses, which can reach more than 10 per cent of the value of production. There is concern about the environmental impacts of fish farming in cages.

Governmental land and coastal habitat managers do not have the necessary tools to address the key environmental issues. The lack of:

- planning tools
- the ability to estimate capacity
- cost effective impact assessment tools all limit environmental assessments. The risk of disease is another associated issue that is difficult to identify without the appropriate tools and framework to assist in planning.

This project aims to develop and apply planning tools to:

- establish sustainable capacity thresholds for tropical finfish cage aquaculture
- establish a database detailing the environmental effects of finfish cages in Indonesian and Australian locations, by data mining and by direct measurement
- adapt/develop an appropriate model to determine carrying capacity of tropical marine coasts for fish cage culture
- develop a coastal aquaculture classification scheme for seacage and land-based aquaculture by combining and integrating the findings from this project and those of ACIAR Project Land capability assessment and classification for sustainable pond-based, aquaculture systems (FIS 2002/076)
- facilitate adoption of project outputs by Indonesian agencies.

### **Project information**

**Overseas Collaborating Countries:**  
Indonesia

**Commissioned Organisation:** Australian Institute of Marine Science, Australia

#### **Project Leader**

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#### **Collaborating Institutions**

- University of New South Wales, Australia
- Research Institute for Coastal Aquaculture, Indonesia
- Marine Harvest, Australia
- Research Institute for Coastal Fisheries, Indonesia
- Hasanuddin University, Indonesia
- Central Research Institute for Aquaculture, Indonesia
- Gondol Research Institute for Mariculture, Indonesia
- Directorate General for Aquaculture, Indonesia
- Balai Budidaya Laut, Lampung, Indonesia

**Project Budget:** \$755,754

**Project Duration:** 01/01/2005 to 31/12/2008

**ACIAR Research Program Manager:** Mr Barney Smith

### **Project progress**

#### **Year 3 (01/01/2007-31/05/2008)**

Project activities during 2007 were aimed toward the completion of field studies in Indonesia and in the finalisation of aquaculture planning tools.

In March AIMS scientists undertook the second of 2 field trips to Indonesia to complete the wet season – dry season comparison, as well as complete work at our study sites in South Sulawesi. A project variation funded in March 2007 allowed us to expand studies to Lampung, where the fish farms are larger and we expected a more significant environmental impact. In

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May AIMS' physical oceanographers conducted studies of currents and circulation in Teluk Lampung, with particular attention to the area around Tanjung Putus, where there is a concentration of sea cages. The emerging picture from our studies in Indonesia is that in these microtidal environments there is little physical dispersal of aquaculture wastes, since the currents are very weak. Consequently, the main mechanisms by which aquaculture wastes are dissipated are by biological assimilation rather than physical dispersal. However, the footprint of the farms we have visited appears to be very small, with noticeable changes in benthic processes limited to sites within 100m of the cages, and little effect on water column processes at all.

In July 2007 the RICA team completed 2 years of water quality sampling in the vicinity of sea cages in Awarange and Labuange Bays, South Sulawesi. Water quality and the occurrence of toxic algal blooms has occasionally been problematic in these areas. These issues are important because of the location of RICA's new hatchery in Awarange Bay and because of the presence of commercial farms in Labuange Bay. RICA has also completed 4 field trips to the Tanjung Putus area of Lampung, towards the project goal of comparing the environmental effects of land-based and seacage aquaculture. In addition, RICA has produced an estimate of waste loading into Hurun Bay, Lampung, and completed a study of uptake of waste grouper feeds by wild fish communities at Awarange Bay.

In order to progress completion of the mapping products in May 2007 Gajah Madah University was engaged as a project partner for this project— they are already partners in the parallel land-based project FIS/2002/076 and will now take primary responsibility for mapping 4 focus areas in South Sulawesi to identify sites suitable for sea cage aquaculture, taking into account adjacent land-based aquaculture. This collaboration was facilitated by a workshop held at Sydney in Sept 2007, in which the site selection criteria were drafted and a strategy developed for delivering the map series needed for the coastal classification scheme.

In conjunction with FIS/2002/076, we have established a National Steering Committee for Aquaculture development in Indonesia, as well as a Local Advisory Committee in South Sulawesi. In November 2007 both projects participated in an LAC meeting in Makassar chaired by Dr Fachuri Sukadi. The meeting was part of an extension workshop to identify and address stakeholder needs to underpin the development of extension materials for 2008. The meeting was attended by 85 participants from South Sulawesi, including land- and sea-based farmers, Regency and Provincial managers, Dinas Perikanan and other stakeholders and interested parties.

A major project deliverable, the model to calculate carrying capacity (entitled CADS\_TOOL) was finalised in the second half of 2007. CADS\_TOOL was developed by Dr Halmar Halide, and is a Decision Support System which includes modules for site classification, site selection, 4 carrying capacity models, as well as an economic calculator. In November 2007 a workshop held in Lampung was jointly convened by ACIAR and NACA to compare carrying capacity models from the region and to identify information gaps and problems. The workshop involved participants from 7 Asian countries. The CADS-TOOL model was previewed at the workshop and subsequently adopted as the working model for aquaculture development in the region. CADS\_TOOL has now been recoded in Java<sup>®</sup> and is available on the AIMS web site.

Dr Halmar Halide, employed as a Post Doc with the project, completed his employment at AIMS in January 2008. During the period of this report, the project has won a John Allwright Fellowship for one team member (Muh Chaidir Undu), supported 5 collaborators in study tours in Australia, completed all field studies, and convened one international workshop.

## **FIS/2006/140: Achieving consistent spawning of captive yellowfin tuna (*Thunnus albacares*) broodstock at Gondol Research Institute for Mariculture, Bali, Indonesia**

### **Summary**

Yellowfin tuna (*Thunnus albacares*) is considered a promising new species and a potentially valuable surrogate species for a range of research activities, e.g. propagation and nutrition, that could contribute to future research on other more valuable tuna species, e.g. southern bluefin tuna (*Thunnus maccoyii*). The Gondol Research Institute for Mariculture in Bali has a collaborative research and development program on the yellowfin tuna, and consultations between Indonesia and Australia have agreed to support and enhance this program. This project will initiate ongoing tuna aquaculture collaboration between Australia and Indonesia, and represents an opportunity to achieve desirable outcomes of significant potential benefit to both countries. It aims to achieve consistent spawning of captive yellowfin tuna broodstock and help to achieve successful rearing of fingerlings.

### **Project information**

**Overseas Collaborating Countries:**  
Indonesia

**Commissioned Organisation:** South Australian Research and Development Institute, Australia

#### **Project Leader**

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#### **Collaborating Institutions**

- Gondol Research Institute for Mariculture, Indonesia

**Project Budget:** \$148,814

**Project Duration:** 01/06/2008 to 31/05/2010

**ACIAR Research Program Manager:** Mr Barney Smith

### **Project progress**

First progress report due in 2009.

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## 4.5 Subprogram 5: Sustainable management and profitable utilisation of fisheries and forestry resources

### Fisheries resource management

#### Projects

Project number	Project title	Page
FIS/2002/074	Capacity development to monitor, analyse and report on Indonesian tuna fisheries	63
FIS/2002/075	Application of PCR for improved shrimp health management in the Asian region	65
FIS/2006/142	New assessment and policy frameworks for Indonesia's marine fisheries, including the control and management of Illegal, unregulated and unreported (IUU) fishing	67

#### Forestry resources

The main project cluster focuses on enhancing the realisation of value from Indonesia's extensive forest plantations and natural forests. This includes improving the management of existing plantations (FST/2003/048, FST/2004/058), introducing new products and technologies, and stimulating the development of more-effective market linkages (FST/2005/177, FST/2006/117, FST/2007/119). Investigation of carbon sequestration by natural forests as a tradable product that provides a commercial return without requiring conversion of forests, is a significant objective (FST/2007/052).

#### Projects

Project number	Project title	Page
FST/2003/048	Management of fungal root rot in plantation acacias in Indonesia	68
FST/2004/058	Realising genetic gains in Indonesian and Australian plantations through water and nutrient management	70
FST/2005/177 (multilateral)	Improving economic outcomes for smallholders growing teak in agroforestry systems in Indonesia (CIFOR)	72
FST/2007/052	Improving governance policy and institutional arrangements to reduce emissions from deforestation and degradation (REDD)	74
FST/2007/119	Mahogany and teak furniture: action research to improve value chain efficiency and enhance livelihoods	75

## **FIS/2002/074: Capacity development to monitor, analyse and report on Indonesian tuna fisheries**

### **Summary**

The tuna fisheries of the Indian Ocean are fished by commercial (long-line) and artisanal (smallholder) sectors. Indonesia and Australia are the two countries with exclusive economic zones (EEZs) in the area. Distant water fishing nations also operate in these EEZs and on the open seas. Indonesia is the single largest tuna fishing country, with commercial and artisanal fishers taking a combined catch of 177,000 tons in 2000. This injected around US\$200 million into the Indonesian economy through export sales alone.

During recent years the fishing industry, particularly in Indonesia, has reported declining catches. This decline is twofold; in total catch numbers, and in the average size of the fish caught. These trends are important indicators of the health of a fishery. The larger the catch numbers and fish sizes the healthier the fishery. Declines in either, and in both at the same time, indicate fishing is unsustainable and that the collapse of a fishery is likely if the downward trends are left unaddressed.

Of great concern to fisheries managers in Indonesia and Australia is the role the Indian Ocean tuna fisheries play in spawning tuna species. These waters are known to be spawning grounds for many tuna species. Southern Blue Fin tuna have no other known spawning grounds. A key to ensuring sustainability of such species, is effective catch monitoring to feed into management plans. Earlier ACIAR research introduced Indonesian fisheries authorities to improved methods of catch monitoring. Furthering this initial activity will be the focus of this project.

This project aims to improve Indonesia's capacity to independently monitor and assess its tuna and billfish fisheries, and the capacity for reporting to international management organisations by:

- improving and extending existing national systems and capabilities for the collection, compilation and analysis of reliable, high quality fisheries data for Indian Ocean tuna long-line fisheries in Indonesia
- conducting a thorough review on Indonesia's tuna fisheries operating in the eastern region, including Banda Sea and Western Pacific Ocean waters review of Eastern Indonesia tuna fisheries

- developing a broader based capacity within MMAF to analyse and interpret fisheries data so as to independently produce and report fisheries assessments in line with international requirements for shared fish stocks.

### **Project information**

**Overseas Collaborating Countries:**  
Indonesia

**Commissioned Organisation:** CSIRO  
Marine Research, Australia

### **Project Leader**

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### **Collaborating Institutions**

- Agency for Marine and Fisheries Research, Indonesia
- Directorate General of Capture Fisheries, Indonesia

**Project Budget:** \$718,548

**Project Duration:** 01/01/2005 to 31/12/2008

**ACIAR Research Program Manager:** Mr Barney Smith

### **Project progress**

#### **Year 3 (01/01/2007-31/05/2008)**

The past 12 months has seen good progress across each of the three main objectives within the project, and, as we enter the final 6 months (project completion at end of Dec'08), we are optimistic that the majority of the project's goals will have been achieved by project's end.

The trial observer program, for the tuna longline fishery based at Benoa in Bali, continued to progress well, with the 6 observers having now completed a total of 44 trips to sea between them (some solo, some in pairs), on vessels from 8 fishing companies. Hook-timers and temperature-depth recorders have been successfully deployed by the observer team on some vessels, and have produced a dataset that is already proving beneficial in our, and industry's, better understanding of what are

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*Fisheries resource management*

key factors that influence catch. Availability of vessels for observer placements remains an ongoing issue, and the recent (May'08) national fuel price rise is likely to further reduce the number of active vessels. Further discussions were held throughout the year (most recently at "Steering Committee Meeting for Monitoring and Assessment of Indonesia's Tuna Fisheries", Jakarta 27 - 28 May) to develop a strategy for the transition of this project's trial observer program into a broader, more formal observer program, and to further progress the implementation of a formal logbook/logsheets system.

The analysis of the data from the observer program is the focus of the research project of Ms Lilis Sadiyah (John Allwright Fellow) at University of Tasmania. Ms Sadiyah was recently successful in her application to convert from MSc to PhD candidature, in recognition of her excellent progress to date. The second of our stock assessment trainees, Ms Setiya Triharyuni, visited CSIRO Marine Laboratories for a month of training in April'08 and a second visit is planned for later this year.

There were several other capacity development highlights linked to project activities during the past year. Indonesia achieved Full Member status of both Indian Ocean Tuna Commission (IOTC) and Commission for the Conservation of Southern Bluefin Tuna (CCSBT) and made a firm commitment to achieve Full Member status of Western and Central Pacific Fisheries Commission (WCPFC) during the coming year. For the first time, Indonesia produced catch estimates for key tuna species caught by the Indian Ocean longline fishery, to submit to IOTC and CCSBT, independent of assistance from external agencies. The plans developed by MMAF, to expand the current Benoa Tuna Monitoring Station into a formal Tuna Research & Monitoring Station by the end of 2008, were recently approved by the Indonesian Government. Also planned by MMAF is the establishment of a similar facility at Bitung in North Sulawesi, to become a centre of tuna fisheries research and monitoring for the fisheries that operate in the

Sulawesi, Seram, and Banda Seas, and adjacent Western Pacific Ocean waters. Linked to establishment of the Bitung Station is the planned establishment of a port-based monitoring program for the eastern sector, a collaboration between Indonesia, WCPFC, and ACIAR. This project's Review of Eastern Indonesia Tuna Fisheries provided the baseline information for decisions on which ports are the most appropriate for initial implementation of the monitoring and trial of newly developed sampling protocols (utilising components of successful programs in Western Indonesia and Philippines). The plan of implementation was progressed at the recent workshop for the Indonesia and Philippines Data Collection Project in Jakarta, 29 May, and monitoring should commence at the Sulawesi ports of Bitung and Kendari by end of 2008, with the likelihood of an expanded program during 2009-2011 (contingent on funding).

Another project highlight of the past year was the Project Coordination Meeting held at Santika Beach Hotel, Bali, on 3 - 4 November. Eighteen participants from among all partner agencies spent two very productive days reviewing progress from the past 3 years of activity, developing strategies to achieve the remaining project goals, and discussing priorities for research activities and capacity development beyond the end of the project. The more recent "Steering Committee Meeting for Monitoring and Assessment of Indonesia's Tuna Fisheries", partially funded by this project, was a valuable opportunity for follow-up to the discussions of Bali and for identifying a clear schedule of action for progress on several fronts. The meeting was particularly notable for bringing together participants from IOTC and WCPFC (i.e. the 'east' meets 'west') to discuss pursuing a coordinated approach with Indonesia to address common issues with respect to the country's pelagic fisheries, across both ocean areas.

## **FIS/2002/075: Application of PCR for improved shrimp health management in the Asian region**

### **Summary**

Shrimp farming, or culturing, is a profitable industry. Successful culturing provides income and employment for smallholder farmers, as well as those working in hatcheries, larger-scale farms, feed mills and processing plants. Most of this has flow-on effects as income is redistributed throughout the usually poor rural communities, many located in coastal regions that practice shrimp culturing.

In addition to these benefits farming of shrimp is sustainable. This relieves the pressure placed on wild populations being harvested at unsustainable catch levels, motivated by reaping the potential income on offer. Thailand leads the world in farmed shrimp production, with Indonesia and India, like many other countries in Asia, both major and growing producers.

For the past decade the Asian industry has been limited by disease outbreaks. Several have been serious enough to cause declines that if continued unabated would threaten the industry. Two diseases in particular, white spot syndrome virus (WSSV) causing white spot disease and yellow head virus (YHV) have caused these declines. Past ACIAR research has developed polymerase chain reaction (PCR) and epidemiological tests to identify the diseases. These are used to detect the viruses in seed stock and live shrimp respectively. Despite these being widely adopted outbreaks continue, and a slow growth syndrome has become more prevalent, prompting further research into PCR use and its role in ongoing farm management.

The project will focus on:

- reducing the risk of White sport disease in shrimp farms through the application of PCR-based detection tests and epidemiological probes
- reducing the risk of yellow head and other shrimp diseases in shrimp farms through application of PCR-based detection tests and epidemiological probes
- improving the effectiveness of PCR-based viral screening in hatcheries and service laboratories in India, Indonesia and other countries in the Asian region.

### **Project information**

**Overseas Collaborating Countries:** India, Indonesia, Thailand

**Commissioned Organisation:** CSIRO Livestock Industries, Australian Animal Health Laboratory, Australia

#### **Project Leader**

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#### **Collaborating Institutions**

- Mahidol University, Thailand
- Directorate General Aquaculture, Indonesia
- Network of Aquaculture Centres in Asia Pacific, Thailand
- Agency for Marine and Fisheries Research, Indonesia

**Project Budget:** \$715,920

**Project Duration:** 01/01/2005 to 31/12/2008 (Project extended from 01/01/2008 to 31/12/2008)

**ACIAR Research Program Manager:** Mr Barney Smith

### **Project progress**

#### **Year 2 (01/01/2006-31/12/2006)**

This project aims to reduce risks of disease outbreaks in small-holder shrimp farms by a combination of strategies involving training of PCR laboratory technicians, the inter-calibration of PCR laboratories test performance and improved health management practices derived from a better understanding of sources of white spot disease on farms. A major aspect of the project is a large field study at a site in Andhra Pradesh, India. The study is the first in a series of investigations that aim to assess the quality of PCR screening available to small holder shrimp farmers and to identify the sources of disease outbreaks in shrimp ponds. The study involved a total of 457 ponds from 28 clusters in 15 villages. The farms were stocked in early 2005 with PCR-screened PLs obtained from local hatcheries. Samples of shrimp post-larvae (PLs) were

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*Fisheries resource management*

collected from farmers at the time of stocking and from juvenile shrimp and wild crustaceans from the ponds during grow-out and at the time of disease outbreaks and planned or emergency harvest. Samples collected from the site were tested by laboratory staff in India and Australia by PCR to identify infected stock and assess the source of infection. Samples from disease outbreaks were also examined by histology to determine the cause of disease. The results indicate that very few of the PL batches used by the farmers in the study were positive by PCR tests conducted in India and Australia by the project team, suggesting that PCR screening conducted by local laboratories was relatively effective. However, PCR testing of samples collected from shrimp at planned or emergency harvest indicated there was a very high prevalence of WSSV infection in the study ponds with a high proportion of moderate-severe infections. There was also evidence that a small number of nursery ponds were the source of seed for a high proportion of disease outbreaks during grow-out. There was also evidence of clustering according to the village under study with 2 villages in particular being major foci of infection and disease. The data suggests that nursery ponds may be a weak link in the current disease management practice.

Work has also continued in the search for infectious agent associated with monodon slow growth syndrome (MSGs), a newly emerging disease that has impacted severely on *P. monodon* production in Thailand. At Centex Shrimp in Bangkok, a new shrimp virus (Laem Singh virus - LSNV) has been investigated. Although LSNV occurs commonly in *P. monodon* in Thailand, it is thought that progression of the infection in the optic nerve may be the cause of slow growth. To determine if LSNV also occurs in India, 205 samples collected in the field study in Andhra Pradesh were screened for the presence of the virus using PCR test developed at Centex Shrimp. Although no evidence of infection was detected, we have concerns about the stability of the LSNV RNA after prolonged storage in ethanol and new set of samples will be collected in early 2007.

To improve the reliability of PCR-based screening, the first of two inter-laboratory

calibrations of WSSV PCR testing was conducted in India in June 2006. Forty-nine service laboratories from the government and private sectors and shrimp hatcheries received equivalent sets of randomly coded positive and negative samples comprising fixed shrimp tissues WSSV DNA for testing. Seventeen laboratories correctly identified all positive and negative samples and 3 laboratories failed to detect only one low positive sample. Six laboratories reported negative results for positive samples indicating problems with test sensitivity. Nine laboratories reported positive results for negative samples indicating problems with test contamination. Two laboratories reported incorrect results for both positive and negative samples. The results were collated returned to all participating laboratories in a form that allowed them to see the results of all laboratories but identify only themselves by code. A second inter-calibration is planned following the second PCR training workshop in early 2007 and it is expected that a national PCR laboratory accreditation program will commence in 2008. A similar inter-calibration commenced in Indonesia in December 2006.

The second in a series of 2 PCR training workshops has been completed in India. The second workshop was conducted in October 2006 for essentially the same group that attended the first workshop in 2005 including 23 from hatcheries and government, private and research laboratories in India and 3 participants from Sri Lanka, Bangladesh and Myanmar. The second workshop provided more focussed training and assessment with each participant required to perform every step in the process at least once during the 4-day program and feedback was given on the basis of individual rather than group performance.

## **FIS/2006/142: Developing new assessment and policy frameworks for Indonesia's marine fisheries, including the control and management of Illegal, Unregulated and Unreported (IUU) fishing**

### **Summary**

Indonesian fisheries managers and scientists face the enormous task of assessing the nation's fisheries resources, delineating manageable units and applying an effective policy framework, which includes dealing with the current high level of scale illegal, unregulated, unreported (IUU) fishing activities. Industrial IUU fishing (for example duplicate fishing licences, unlicensed fishing vessels, illegal fishing gear and trans-shipment of catch) results in estimated lost government revenues of more than US\$1 billion. It also leads to serious underestimation of catches and consequent depletion of major fish stocks. Artisanal and subsistence-scale IUU fishing also leads to local depletions in fish stocks, damage to habitats and impacts on local communities. In order to develop effective assessment and policy frameworks to better manage Indonesian fisheries, particularly IUU fishing activities, this research project will undertake a pilot program within a specific region of Indonesia, with the general aims of better understanding the characteristics of the various fisheries, including the IUU components, and of investigating new innovative assessment and management approaches.

### **Project information**

#### **Overseas Collaborating Countries:**

Indonesia

**Commissioned Organisation:** University of Wollongong, Australia

#### **Project Leader**

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#### **Collaborating Institutions**

- CSIRO Marine and Atmospheric Research, Australia
- Research Centre for Capture Fisheries, Indonesia
- Directorate Fisheries Resources Management, Indonesia
- Centre of Fisheries Extension Development, Indonesia

**Project Budget:** \$1,492,219

**Project Duration:** 01/06/2008 to 28/02/2012

**ACIAR Research Program Manager:** Mr Barney Smith

### **Project progress**

First progress report due in 2009.

## **FST/2003/048: Management of fungal root rot in plantation acacias in Indonesia**

### **Summary**

In Indonesia, plantations of *Acacia mangium* now occupy 1.4 million hectares. Stumps and woody debris left after harvesting may harbour root-rot fungi, containing levels of spores that act as an inoculum to spread the fungi. Tree mortality is rising in successive rotations as a consequence, and root-rot disease is now considered the most economically damaging disease of *A. mangium*. In recent surveys of second-rotation commercial plantations in Sumatra and Kalimantan, the incidence of root rot was as high as 28% in trees aged 3-5 years.

Tree companies with large plantation estates of *A. mangium* in Indonesia are partnering this project. Root rot is difficult to control and cost-effective management tools for *A. mangium* are not yet developed. Scientists have reduced root-rot incidence in other tree crops by developing a thorough understanding of the biology of the pathogens involved and the causal agent(s) responsible for the observed distribution of root-rot disease. The research team will try a similar approach to this particular problem, drawing on Australian work with decision-support tools that incorporate factors associated with disease severity. This approach will facilitate resource allocation and target preventative and remedial interventions.

The research program has the following objectives:

- identification of the causal agent(s) of root-rot disease and characterisation of their field biology;
- investigation of factors that influence root-disease distribution;
- development and application of cost-effective root rot control options for outgrowers (who participate in a scheme to establish and manage acacia plantations and share in the profits at harvest).

### **Project information**

**Overseas Collaborating Countries:** Indonesia

**Commissioned Organisation:** University of Tasmania, School of Agricultural Science, Australia

### **Project Leader**

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### **Collaborating Institutions**

- Forest Research and Development Agency, Indonesia
- PT Musi Hutan Persada, Indonesia
- PT Riau Andalan Pulp and Paper, Indonesia
- PT Arara Abadi, Indonesia
- CSIRO Forest Biosciences, Australia
- Queensland Department of Primary Industries and Fisheries, Australia
- Gadjah Mada University, Indonesia

**Project Budget:** \$710,140

**Project Duration:** 01/06/2006 to 31/05/2009

**ACIAR Research Program Manager:** Dr Russell Haines

### **Project progress**

**Year 2 (01/06/2007-31/05/2008)**

Project advances are presented in line with the project's four overarching objectives:

#### *Pathogen identity, biology and dispersal*

A number of other species have been identified fruiting or associated with root rot disease in *Acacia mangium* including three *Phellinus* / *Inonotus* species and five *Ganoderma* species. Thus there is a diversity of potentially pathogenic species present on all areas surveyed. This has enabled us to alert industry to the need to test proposed management solutions against as wide a range of potential pathogens as possible.

Somatic incompatibility testing has been commenced in Yogyakarta, Indonesia. These tests show if fungal isolates collected from different trees or sites belong to the same individual allowing us to draw conclusions about the dispersal mechanism and management of the fungi in question. The project culture collection to be used for these experiments is now in

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excess of 2800 databased, spatially referenced isolates.

Pathogen spread is being monitored on a system of 24 semi-permanent plots on six sites across Indonesia and Northern Australia representing a broad range of site conditions and vegetation histories. All Indonesian sites have now been monitored at least twice and 4 of the 5 Indonesian sites have now been monitored three times. This is providing information on disease progression in *Acacia mangium* at an unprecedented level of detail which will underpin disease modelling for the remainder of the project.

*Risk assessment*

*The value of various above-ground variables for detecting the below-ground presence of root rot on a tree has been assessed.*

For individual trees, though there is a tendency for living trees with root rot to show poorer crown condition, if an individual tree has good crown condition this does not mean that root rot is not present on its roots. In fact, most living trees with root rot have healthy crowns.

Our ability to predict the disease status of a tree is markedly improved by the use of a new index developed to integrate not only the health of the individual tree but also the health of its nearest neighbours

Preliminary models have been developed (using the index mentioned above) to link the number of dead trees in root rot infected areas to the total, underlying level of infection / inoculum potential on a range of sites.

Collaboration with the ACIAR project (FST/2004/058: Realising genetic gains in Indonesian and Australian plantations through water and nutrient management) will underpin the parameterisation, validation and delivery of the model developed.

*Management options*

Experiments have been set up on one of the 5 Indonesian sites mapped for root rot disease to examine effectiveness of inter-rotation stump removal and remediation burns on the spatial and temporal development of root rot disease in the subsequent crop.

Biological controls are being investigated:

The putative biological control targeted by one of our industry partners has been identified molecularly to genus and morphological identification to species is now underway.

Indigenous Indonesian fungi with antifungal and wood decomposing activity have been discovered through the project and are currently being laboratory tested to discern if these abilities could allow them to inhibit or out-compete the pathogens on dead wood.

*Training, cooperation, extension and adoption*

Preparations are underway for two Indonesian collaborating scientists to visit Australia to develop their skills in risk assessment and biological control.

Collaboration and cooperation in data management has been enhanced through the development of a project website including members only online-access to project data and planning tools.

Molecular training in Hobart and Yogyakarta has meant that routine molecular identification of fungal isolates can be undertaken in the Yogyakarta FORDA laboratory.

We have recommended that Industry partners integrate mechanised planting-hole preparation and biological control application and higher cost management solutions including stem injection of systemic fungicides or plant growth promoters (such as phosphite or Biosil) on high value assets such as seed orchards.

We are also investigating the relationship between root rot in *Acacia mangium* and the performance of *Eucalyptus pellita* planted on ex *A. mangium* lands, as the use of *E. pellita* as an alternative crop has been proposed as one possible management solution to the root rot problems in *A. mangium*. Our research into pathogens and pathogenicity is helping to assess the feasibility of this.

## **FST/2004/058: Realising genetic gains in Indonesian and Australian plantations through water and nutrient management**

### **Summary**

Acacias are a preferred species for wood fibre production in many countries. They can achieve high growth rates under a range of soil conditions and produce high-quality wood for pulp and timber products in short-rotation crop cycles. The expanding (now more than 700,000 ha) acacia plantations are already a major contributor to the Indonesian economy and will increasingly supply fibre for a series of massive pulp mills that currently rely on non-sustainable logging of native forest. In Australia, the first 13,000 ha of a potential 75,000 ha estate have been established on the Tiwi Islands. Acacia plantations are also rapidly expanding in other countries, including China and Vietnam.

There are two industry partners in this project: PT Musi Hutan Persada (MHP, Sumatra, Indonesia), and Great Southern Plantations (Australia). MHP manages about 200,000 ha of acacia plantations in Indonesia, and its mills are exclusively run on plantation-grown wood. They are leading in community development schemes, and they have an active outgrower scheme that pays smallholder farmers to establish and manage acacia plantations and share in the profits at harvest. Great Southern Plantations, in close association with the Tiwi Land Council, manages an expanding *A. mangium* plantation on the Tiwi Islands north of Darwin, which is supporting economic growth, employment and social and educational benefits for the Tiwi people.

This project aims to improve the profitability and sustainability of acacia plantations in Indonesia and Australia, expanding the involvement of and benefits to the smallholder farmers and communities who are using wood production as a new source of income. Underpinning objectives are:

- to quantify the role of site edaphic properties (those pertaining to or conditioned by soil) and phosphorus in realising gains from deployment of genetic gain across sites, and to develop appropriate management strategies for maximising productivity and economic value
- to develop a capacity to predict potential productivity of *A. mangium* in relation to site factors in Indonesia and Australia

- to evaluate economic benefits of improved management in outgrower schemes
- to develop practical tools to support improved management.

### **Project information**

**Overseas Collaborating Countries:** Indonesia

**Commissioned Organisation:** CSIRO Sustainable Ecosystems, Australia

### **Project Leader**

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### **Collaborating Institutions**

- Great Southern Plantations, Australia
- Gadjah Mada University, Indonesia
- PT Musi Hutan Persada, Indonesia
- University of Sriwijaya, Indonesia
- Forest Research and Development Agency, Indonesia

**Project Budget:** \$703,283

**Project Duration:** 01/06/2006 to 31/05/2010

**ACIAR Research Program Manager:** Dr Russell Haines

### **Project progress**

#### **Year 2 (01/06/2007-31/05/2008)**

This year we made significant progress on several fronts. We established the remaining field sites, developed an understanding of key physiological responses and incorporated these into a draft parameter set for CABALATM, improved our understanding of the socio-economic basis for decision making by small farmers, hosted training visits by four Indonesian scientists to Australia, including commencement of 2 postgraduate candidates. We also developed a simple methodology for site classification to assist with predicting potential productivity based on soil characteristics.

This year we established 6 new field experiments in each of Sumatra and

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Australia bringing the total number of sites to 12 in each location and 24 in total. Initial productivity measurements at the sites established in 2007 showed significant growth responses to application of P at all satellite sites. At all sites there was a growth response to at least 10 kg P/ha, and some sites responded further to 50 and 150 kg P/ha. The shape of the response curves indicate that higher rates may yield even higher productivities. Application of basal fertilisers (micronutrients and cations) did not increase early growth in Sumatra, but a response was observed at most sites in Australia. The Australian sites also responded to application of phosphorus at rates up to 100 kg P/ha. Early results from the core experiment have shown that responses to phosphorus are genotype specific, with the best genetic material more responsive to higher rate of phosphorus than the unimproved and moderately improved material. These results will be important in building decision support tools, and for validating the upper productivity envelope for model predictions.

We have been exploring simple measures of potential productivity to allow growers to objectively characterise their sites to assist in making decisions about suitability and profitability of acacias. In this regard, Mr Makruf Nurudin completed a UNESCO international research course in August 2007, for which he studied soil physical and chemical characteristics in relation to productivity across the 12 sites which were part of the initial screening of prospective experimental sites. His report, entitled "Application of soil colour to assess productivity of *Acacia mangium* plantation in Indonesia," demonstrated that low productivity sites were characterised by soil profiles with shallow plinthite layers, indicating tendency for waterlogging, and conversely, that soils with deep haematite were generally better drained and were more productive. These minerals can potentially be identified via soil colour, thus allowing for the development of a simple tool to allow farmers to characterise site productive potential.

Physiological characterisation of *A. mangium* continued, with an end-of-dry season

campaign completed in September 2007 on Melville Island, and 2 shorter measurement campaigns in Sumatra studying photosynthesis rates, stomatal response, and water potential under different phosphorus treatments. Based on the results of these studies and a literature review, we developed a draft CABALA parameter set for *A. mangium*. This parameter set will be tested against *A. mangium* growth data over the next 12 months.

Socio-economic studies have continued, with a national paper being published arising from the first survey of small holder farmers and the factors that are important in their decision making about establishment of *Acacia mangium* or alternative land use. Activities this year have included an analysis of the economics of previous *Acacia* rotations, and comparison with alternative land uses, the results of which are currently being written up.

Another key progress point during the year was commencement of 2 new John Allwright fellows, both of whom started in July 2007 at the University of Western Australia. Mr Gunawan Wibisono is studying for his PhD, and Mr Daryono Prehaten has enrolled in a Masters degree. Both of these student projects are tightly aligned to the overall ACIAR project, with Wibisono studying nitrogen cycling in *A. mangium* plantations, and Prehaten is exploring the impact of genotype and nutrition on photosynthesis, water relations and physiological response to drought. Both of these studies are contributing to the overall understanding and capacity to model *A. mangium*.

In summary, the project is proceeding according to plan, and is additionally achieving a deeper understanding of the system than originally envisaged through the activities of the two John Allwright fellows.

## **FST/2005/177: Improving economic outcomes for smallholders growing teak in agroforestry systems in Indonesia**

### **Summary**

Teak production and furniture manufacture is a major industry in Java, Indonesia. Logs and sawn timber sales accounted for more than 680,000 m<sup>3</sup> valued at nearly \$A115 million in 2001. In just one district (Jepara) more than 15,000 factories depend on teak to survive. Production from the parastatal plantations is in decline. There are already approximately 1.5 million households in Java growing teak, mostly on degraded land.

Despite the major potential for smallholders to feed the timber demand in Indonesia, there are significant impediments to profitable smallholder teak plantations. Some of these are poor silvicultural techniques, limited market knowledge and restrictive timber regulation policies. Poor silvicultural techniques lead to low quality timber but it can be difficult for smallholders to make improvements because they lack of capital to invest in teak planting and have limited ability to wait the duration of a teak rotation before requiring returns.

Smallholders also tend to take prices that are often well below market rates because of their limited access to markets, limited market information and inability to overcome transaction costs faced by timber buyers. Further, government policies restrict smallholder involvement in timber production, as regulations designed for large-scale timber production (e.g. cutting and transportation permits, registration procedures) are applied to smallholders.

This project aims to improve livelihoods of smallholders growing teak in Indonesia. It will focus on all aspects of the management of smallholder teak production.

The major objectives are to introduce and adapt silvicultural technologies that improve returns for smallholder teak producers, to identify and design financing schemes providing incentives for smallholder participation in profitable teak production, and to enhance market access by smallholder teak producers.

### **Project information**

**Overseas Collaborating Countries:** Indonesia

**Commissioned Organisation:** Center for International Forestry Research, Forests and Livelihoods Program, Indonesia

### **Project Leader**

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### **Collaborating Institutions**

- World Agroforestry Centre, Indonesia
- Australian National University, Australia
- Forest Research and Development Agency, Indonesia
- Farm Forestry Consortium, Indonesia
- Bogor Agricultural University, Indonesia

**Project Budget:** \$810,111

**Project Duration:** 01/01/2007 to 31/12/2010

**ACIAR Research Program Manager:** Dr Russell Haines

### **Project progress**

#### **Year 1 (01/01/2007-31/05/2008)**

The ACIAR Project No. FST/2005/177 “*Improving economic outcomes for smallholders growing teak in agroforestry systems in Indonesia*” has been implemented effectively since March 2007 by the Centre for International Forestry Research (CIFOR) and the collaborative institutions, which consist of the World Agroforestry Centre/International Centre for Research in Agroforestry (ICRAF), Winrock International; International Centre for Applied Finance and Economics Institut Pertanian Bogor (Inter-CAFÉ IPB); Forestry Research and Development Agency (FORDA), the Ministry of Forestry of Indonesia; Farm Forestry Consortium (FFC) or Pokja Hutan Lestari of the district of Gunungkidul and the Australian National University (ANU).

The project has three main objectives, i.e. (1) to introduce and adapt silvicultural technologies that improve returns for smallholder teak producers; (2) to identify and design financing schemes providing incentives for smallholder participation in profitable teak production and (3) to enhance market access by smallholder teak producers. The project site was located in the district of Gunungkidul, the province of Yogyakarta at seven selected

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villages which represent three different geographical areas (northern, middle and southern parts of the district).

During the first year of project period, most of the planned activities have been completed and the project implementation is progressing well. Following up to the inception meeting held in May 2007, a series of discussions among the project team members was conducted to finalize research approaches and methodologies. Integrated questionnaire was constructed for data collection during the household surveys. The household surveys were conducted during August and September 2007, following project launching in July 2007 at the Bupati office in Gunungkidul district. More than 275 farmer respondents were interviewed during the surveys. Exchange visits (study tours) to several places on two occasions in late November and early December 2007 were completed. Places visited included teak processing factories, a private teak plantation (Perum Perhutani), nursery centres and neighbouring teak producing communities.

The first study tour was attended by project scientists to review the current teak management practices and identifying possible improvements that could be applied on smallholders' teak production systems. The second study tour was attended by farmer representatives to provide farmers with some experiences and knowledge of best practices of teak plantation management.

A one day Focus Group Discussion (FGD) was conducted in December 2007 to cross-check collected data derived from the household surveys as well as farmers' feedback from the study tour. Simultaneously with the household surveys, in depth interviews with relevant key stakeholders at each project site were conducted. An inventory of smallholder teak plantations was conducted in March 2008 to document the existing condition of farmers' teak systems and to cross-check the collected data from the household surveys.

In February 2008, a three-day training program for farmer representatives focussed on Verification of Legal Origin (VLO), Wood Tracking System and collective action to develop microfinance institutions was conducted. The first year project activities were summed up at an annual project meeting recently conducted (April 2008) in Yogyakarta.

Under objective 1, survey results have provided detailed documentation of smallholders' current silvicultural practices, attitudes and systems, which confirm many of the pre-project assumptions and provide direction for future actions. Generally smallholder teak producers use poor silvicultural practices leading to low productivity and poor timber quality. Limited knowledge, information and capital have restricted smallholders' application of "best practice" teak farming system. Data analysis from this activity is being progressed and the results are being compiled in a project working report.

Under objective 2, preliminary results show that almost all of the respondents require loan funds to fulfil their daily needs but only a limited portion (12%) of them have used loan funds for productive activities, such as for purchasing fertilizers and farming equipments. Most of the loans are obtained from informal sources, which are very common in each surveyed village. These preliminary findings are being compiled in a project working report.

Activities under objective 3 identified some key marketing problems faced by farmers when dealing with local traders. The problems faced by local traders when dealing with local farmers were also identified.

While scientific publications of project activities are in progress, the project has published one project newsletters in English and in bahasa Indonesia version. (see Annexes 1 and 2). The project also produced 2 articles in ICRAF' published newsletters (see Annex 3 and 4). In early May, the project produced a documentary film on teak farm forestry in the project area including details on project activities supporting its development. Copies of the film on compact disk (CD) will soon be distributed to community organizations and local stakeholders.

## **FST/2007/052: Improving governance, policy and institutional arrangements to reduce emissions from deforestation and degradation (REDD)**

### **Summary**

Reducing deforestation and forest degradation (REDD) has an important role in global responses to the threat of climate change. Indonesia, with annual deforestation at about 1.5 million hectares (amounting to about 14% of global deforestation), can play a central role in REDD. The country attaches a high priority to rapidly building its capacity to deal with REDD and the emergent forestry carbon market, because during the next four years it will have to negotiate the framework for the inclusion of REDD in the post-Kyoto protocol. It will also need to design the national policies and institutional arrangements needed to implement REDD activities.

This project will provide support to assist development of policy and institutional arrangements at the provincial and district level to facilitate the implementation of REDD and the capture and equitable distribution of financial benefits from an international carbon market. The project work will be augmented by partnerships with the Forestry Research and Development Agency of the Ministry of Forestry and the Center for International Forestry Research.

### **Project information**

**Overseas Collaborating Countries:**  
Indonesia

**Commissioned Organisation:** Australian National University, Crawford School of Economics and Government, Australia

### **Project Leader**

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### **Collaborating Institutions**

- Forest Research and Development Agency, Indonesia
- Center for International Forestry Research, Indonesia
- University of New England, Australia
- Forestry Service of Riau Province, Indonesia
- Forestry Service of Papua Province, Indonesia

**Project Budget:** \$1,450,175

**Project Duration:** 01/04/2008 to 31/03/2012

**ACIAR Research Program Manager:** Dr Russell Haines

### **Project progress**

First progress report due in 2009.

## **FST/2007/119: Mahogany and teak furniture: action research to improve value chain efficiency and enhance livelihoods**

### **Summary**

Jepara in Java has a long tradition of high-quality furniture making, coupled with ready access to high quality teak. With the adoption of environmentally and socially sound practices Jepara could be a strong competitor in international markets. But inefficiencies throughout the value chain currently result in plantation over-harvesting, leading to poor incentives for producers and misuse of resources.

This project aims to improve the value chain for mahogany and teak furniture enterprises in Jepara, specifically by enhancing the structure and function of the furniture industry to benefit small-scale furniture producers, helping them and their organisations to make improvements to marketing, and monitoring changes regarding the effects and early acceptance of project innovations. Producers will benefit from project findings that identify inefficiencies of supply and define the value chains that improve efficiency and strengthen the furniture industry.

The project team will also devise strategies and actions to strengthen market engagement and position, leading to enhanced value addition and capture of higher prices. Positive impacts will arise from improved value-chain efficiency, security for over 15,000 furniture enterprises (177,000 jobs) and enhanced incomes for these producers while giving them and their organisations a greater role in the value chains. The project will work in close coordination with another ACIAR-CIFOR project that focuses on improving the livelihoods of tree growers.

### **Project information**

**Overseas Collaborating Countries:**  
Indonesia

**Commissioned Organisation:** Center for International Forestry Research, Indonesia

### **Project Leader**

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### **Collaborating Institutions**

- University of Melbourne, Australia
- Forest Research and Development Agency, Indonesia
- Bogor Agricultural University, Indonesia
- Forum Rembug Klaster, Indonesia
- District Planning and Development Agency, Indonesia

**Project Budget:** \$1,012,090

**Project Duration:** 01/06/2008 to 31/05/2013

**ACIAR Research Program Manager:** Dr Russell Haines

### **Project progress**

First progress report due in 2009.

## 4.6 Subprogram 6: Profitable agribusiness systems for eastern Indonesia

Projects funded through the Smallholder Agribusiness Development Initiative (SADI) are shown as 'SMAR'.

### Crop–livestock systems

The major cluster of projects concerns beef research with an emphasis on eastern Indonesia. The cluster includes several projects emphasising technology development for on-farm application by smallholders, including improvements for better managed and timed reproduction and calf weaning (LPS/2006/025) and use of nutrients (planted fodders and crop by-products) (SMAR/2006/003, SMAR 2007/013). Factors affecting wider adoption of technical interventions are being assessed in South Sulawesi (SMAR/2006/061) and Nusa Tenggara Barat (SMAR/2006/096). The on-farm work is integrated with projects assessing broader characteristics of the beef supply chain (SMAR/2007/202). In 2008–09 there will be greater emphasis on understanding the broader economic and social context in which beef production is taking place.

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## Aquaculture and mariculture

### Projects

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## AH/1998/054: Poverty alleviation and food security through improving the sweet potato-pig systems in Indonesia

### Summary

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 sweet potato (SP) is the principal staple food. Sweet potato 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 SP-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 SP varieties and improvements to pig-raising management, leading to better food and feed productivity and positive benefits on family nutrition and income.

The project aims to assess, characterise and analyse the existing human-sweet potato-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 sweet potato-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.

### Project information

**Overseas Collaborating Countries:** Indonesia, Vietnam

**Commissioned Organisation:** International Potato Center, Indonesia

### Project Leader

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### Collaborating Institutions

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- 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 progress

#### Year 7 (01/01/2007-31/05/2008)

Baseline data of the sweet potato seed system and sweet potato cultivation practices in the Baliem valley have been collected and analysed, as well as the way farmers manage sweetpotato planting material.

A trial has been established to demonstrate to farmers the advantages of using positive selection for selecting planting material, rather than the current practices used.

Six sustainable pig diets that were formulated during the life of the project have been costed and ranked in terms of growth rate potential and the economic impact evaluated. Using the improved pig husbandry and management system developed during the first 5 years of the project, and feeding cost-effective diets, will reduce the time taken for pigs to reach sale weight by 30 to 50%. Based on the cost of diet alone, the increased profit from feeding these diets from weaning to 60 kg for 324

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days is approximately 0.7 to 1.0 million rupiah/pig. The figure for a 40kg is 0.4 to 0.6 million rupiah.

Training materials have been written, reviewed and translated into Bahasa Indonesia and 100 copies printed along with 10 copies in English. The materials will form the basis of a training document that can be adapted and used in other parts of eastern Indonesia. The manual contains sections on SP cultivation and seed production, identification of pests and diseases of SP, developing SP products post harvest for human nutrition, building and managing lalekens (small paddocks) and dunging areas, developing and managing pastures for rotational foraging for pigs, building and managing pig houses, prevention and control of parasites, examining pigs post-mortem, feed and feeding management, growing Dadap (*Erythrina* sp) cuttings, and sow and boar management. Manuals have also been developed for the positive selection process of sweetpotato planting material, a rapid multiplication technique of sweetpotato planting material, how to make sweet potato silage for pig feed, a post mortem manual and a manual on the kinds of crops and foods that can be used to feed for pigs

The next step was to conduct a series of farmer training programs, to which all of the project farmer collaborators were invited, and a group selected as Farmer Trainers to train other farmers.

Assistance was sort from the Director of the Baliem Valley Co-operative Farmer Groups (KTNA), the Head of the Regency Livestock Office, and the Leader of World Vision Indonesia Papua, to select farmers in 7 key villages for training in the project outcomes and methodology.

To date only one training program has been completed, but a further 6 are planned before the end of October 2008. The initial training session was attended by 20 males and 9 females, who were wives of participating males. The program runs over 3 days with a one day field trip and practical sessions on making silage, processing SP, and cultivating tree cuttings. Training programs will be run in a further 6 villages prior to October 2008.

## LPS/2004/023: Strategies to increase growth of the weaned Bali calf

### Summary

The Indonesian Government has placed high priority on increasing beef production, with emphasis on smallholder farmers in the eastern islands, recognising the comparative advantage for beef production. Local species are well suited to crop-livestock farming practised in this region. Beef consumption is growing at 7% per annum in Indonesia, but imports filled 20% of demand. The gap between local supply and demand is projected to widen over the next decade. A suite of integrated projects, which aim to boost cattle production from the smallholder crop-livestock sector has been initiated. This project will focus on feeding systems to accelerate calf growth after weaning, including whole-farm resource use and herd management.

### Project information

**Overseas Collaborating Countries:**  
Indonesia

**Commissioned Organisation:** University of Queensland, Schools of Animal Studies and Veterinary Science, Australia

### Project Leader

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### Collaborating Institutions

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- Beef Cattle Research Institute, Indonesia
- University of Nusa Cendana, Indonesia
- University of Tadulako, Indonesia
- Indonesian Centre for Animal Research and Development, Indonesia
- Assessment Institute for Agricultural Technology (NTT), Indonesia
- University of Haluoleo, Indonesia
- Assessment Institute for Agricultural Technology, Southeast Sulawesi, Indonesia

**Project Budget:** \$466,682

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

**ACIAR Research Program Manager:** Dr Peter Horne

### Project progress

#### Year 3 (01/07/2007-31/05/2008)

The period between June 2007 and June 2008 saw the completion of the on-station feeding studies and the continued implementation, demonstration and monitoring of best-bet feeding strategies in villages. A total of 14 on-station feeding studies were successfully completed at West Nusa Tenggara, East Java, Central Sulawesi and East Nusa Tenggara. Each experiment used a similar design and experimental protocol to evaluate the growth response and feed intake of early weaned, 6 month old Bali cattle to a range of locally available feed resources.

A total of 52 different feeding strategies (treatments) were evaluated, with a live weight gain response measured for each strategy, and associated measurements of feed and water intake, nutrient composition of the feedstuffs and digestibility conducted. The laboratory and statistical analysis of this component of the project are in progress.

The results suggest that feedstuffs commonly fed to young Bali calves in villages may not provide sufficient protein to maximise growth of the early weaned, 6 month old Bali calf. The range in live weight gain in response to the various treatments was from less than 0.1 kg/day, for local cut and carry grasses, to over 0.6 kg/day for leucaena fed with a small amount of rice bran. It has been demonstrated that the inclusion of tree legumes (e.g. *Leucaena* spp, *Sesbania* spp) or other protein sources (copra meal), at low levels will promote growth of early weaned, 6 month old Bali calves. Further, in situations where a high protein diet is available, such as leucaena *ad libitum*, the provision of an energy source, such as rice bran or maize grain, will further enhance growth rates.

At each site, best-bet feeding strategies from the on-station feeding studies have been implemented in villages and monitoring is in progress. To date the results indicate that the targeted use of locally available protein supplements, such as a copra meal/rice bran mixture in Central Sulawesi or leucaena in East Java (both fed at 1% of live weight on a dry matter basis), increased growth rates of early weaned, 6 month old Bali calves from

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0.29 to 0.42 kg/day and 0.18 to 0.42 kg/day, respectively, over a 6 month period. The increased live weight gain evident from the introduced feeding strategies resulted in Bali cattle, weaned at 6 months of age, being 27.6 and 43.2 kg heavier, after 6 months of feeding, at Central Sulawesi and East Java, respectively. Similar activities are in progress in West Nusa Tenggara and East Nusa Tenggara. These results demonstrate that it is possible to extend, implement, adapt and monitor on-station research findings in a village management system in eastern Indonesia.

Attitudes of farmers to the feeding strategies have been evaluated at farmer visits during the on-station experiments and during the demonstration and monitoring activities conducted in the villages and are currently being collated. In addition, cost-benefit analysis of the feeding strategies is also in progress.

A joint, two day project workshop was held with partners from LPS 2004 023 and SMAR 2007 013 at the University of Mataram, West Nusa Tenggara, in December 2007 to present and discuss project results to date. One session during the workshop was dedicated to the development of researchable issues to further develop and improve the productivity of the Indonesian beef cattle industry. The meeting also incorporated a visit to Tandek and Kelebu villages, demonstrating the integrated village management system for Bali cattle in West Nusa Tenggara. The project has continued to support the development of young scientists, through the involvement of undergraduate students in on-station feeding studies and the appointment of junior scientists at each site. Further, the careers of senior scientists continue to be supported through attendance at international conferences and training workshops. In addition, an Indonesian scientist studying strategies to increase microbial protein production in cattle for his PhD at the University of Queensland (John Allwright Fellow) will submit his thesis in June 2008.

## LPS/2006/005: Evaluating strategies to improve calf survival in West Timor villages

### Summary

Cattle production is one of the few income generating activities available to farmers in West Timor. Offtake rates from the herds are low, but interventions to raise production are limited by the practice of communal grazing. Reducing calf mortality rates from current levels of over 30% by confinement and supplementation during the day is a strategy that appears to fit into the current management modality. This project will test the strategy on-farm to assess the impact on calf mortality and to ascertain whether the practice is acceptable to the farmer families. If successful, information will be packaged in a form suitable for broader extension by government agencies and NGOs.

### Project information

**Overseas Collaborating Countries:**  
Indonesia

**Commissioned Organisation:** University of Queensland, School of Animal Studies, Australia

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#### Collaborating Institutions

- University of Nusa Cendana, Indonesia

**Project Budget:** \$149,988

**Project Duration:** 01/01/2007 to 31/12/2008

**ACIAR Research Program Manager:** Dr Peter Horne

### Project progress

#### Year 1 (01/01/2007-31/05/2008)

This project is being conducted entirely on farm, with the overall objective of developing methods of reducing calf mortality. The main annual period of activity is from the beginning of the calving season (June) until the commencement of the rainy season (November). Treatments cease when sufficient grass is available for animal feed, although monitoring of liveweight continues. Results reported here are for phase 1 (2007), and preparatory activities for phase 2 (2008).

Phase 1 (2007) involved 59 farmers from eight villages in the Kupang district, East Nusa

Tenggara (NTT) Province of Indonesia.

These farmers provided a total of 258 cow-calf pairs which were randomly allotted into the following treatment groups:

1. 19 farmers with 62 calves, the control group, receiving no supplement,
2. 12 farmers with 98 calves, receiving 1% of body weight supplement,
3. 16 farmers with 56 calves, receiving 2% of body weight supplement and
4. 12 farmers with 42 calves, receiving 3% of body weight supplement.

The supplement consisted of grass hay and concentrate (rice bran, corn meal, leucaena legume leaf, and fish meal), and was formulated to contain 18% crude protein. This supplement was introduced to calves in the morning while confined to calf pens and their dams were out grazing. Calves were reunited with the cows during the night for normal suckling. Parameters measured were calf mortality, calf and cow daily weight change (calves weighted every 14 days), and milk production. Supplementation tended to reduce calf mortality ( $P=0.094$ ) from 6.4% in control to 0% in calves received 2% and 3% supplement. Supplementation at 2% of calf body weight significantly ( $P<0.001$ ) improved calf daily weight gain. Body weight changes and milk production of cows was unaffected by calf supplementation.

As the project progressed, participating farmers gained skills in handling their cattle and feeding the calves. Participants in the project were involved in the construction of the calf pens, constraining their calves and frequent weighing of animals. The motivation of some farmers increased as the project progressed. This outcome was achieved through close supervision of participating farmers by project staff who visited every 2 weeks and built up a close rapport with them.

This project started January 2007, with the focus of observing calf mortality and growth during the "calving season" (June to September). However, funds were not received until the end of May. Nevertheless, the project was successfully implemented and conducted according to the project plan. One side effect of this rapid startup was that some farmers may

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not have been as well trained and briefed as they should have been. This could be the reason that a number of farmers withdraw from the project. Lessons learnt from 2007 will be applied to the project implementation during 2008.

Cows and calves became quieter as the project progressed, making animal handling easier, and reducing the time needed to make observations on the animals.

Implementation of the project increased the involvement women in the cattle husbandry as most of the preparing of feeds and feeding of the calves was carried out by women.

The calf mortality in the supplemented groups was, as expected, low (3% overall, 0% in groups supplemented at the 2% or 3% rate). However, the calf mortality amongst the control group was lower than expected (6.45%). It was felt that the control farmers selected for the project by the State Animal Husbandry Department may have been better informed than the average, and thus have a higher standard of husbandry. Therefore, a complementary study of calf mortality was conducted across 4 districts. This study revealed an average calf mortality of 17.90%, but ranging up to 60% in some villages.

During the period December 2007 to May 2008, the research team carried out the following tasks:

1. Collecting feed for the 2008 calving season. 10 tons of grass hay have been made, as well as 3.2 tonnes of corn have been purchased. Farmers have also been engaged in collecting leucaena leaves. The process of obtaining raw materials and formulating the supplement is continuing.
2. Monitoring weight changes of calves born during 2007.
3. Recruiting farmers for phase 2. The team have recruited 119 farmers owning 474 Bali cows in 3 districts (Kupang district, 35 farmers owning 248 cows; Timor Tengah Selatan district, 68 farmers owning 105 cows, and Timor Tengah Utara, 16 farmers owning 121 cows). The control groups are yet to be recruited.

Results of the project will be reported to the Conference of the Australian Society of Animal Production, to be held in June 2008.

## SMAR/2006/003: Integrating forage legumes into the maize cropping systems of West Timor

### Summary

In West Timor, Indonesia, maize is a major component of the traditional food resource. But yields are poor due to inadequate crop nutrition and crop husbandry, and variable climate. Relay cropping of high-biomass forage legumes during the late wet season, when water and nutrient use by maize is declining, has potential to improve soil nutrient availability for maize crops grown in the following wet season and to supply quality forage for animal production during the subsequent dry season.

This project will evaluate forage legumes for integration into maize cropping and assess their potential as dry season fodder to lift animal production. Socio-economic information gathered from participating farmers will assist in determining technology acceptability, potential broader impacts and extension strategies associated with the use of forage legumes.

### Project information

**Overseas Collaborating Countries:**  
Indonesia

**Commissioned Organisation:** CSIRO  
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### Collaborating Institutions

- Assessment Institute for Agricultural Technology (NTT), Indonesia

**Project Budget:** \$398,191

**Project Duration:** 01/10/2006 to 30/09/2009

**ACIAR Research Program Manager:** Dr Bill Winter

### Project progress

#### Year 2 (01/06/2007-31/05/2008)

The identification of underutilised soil water remaining at maize harvest, supplemented by late wet season rainfall, as resources for forage legumes production during the dry season has major implications for both animal and cereal crop production in the semi-arid cropping systems of West Timor. Research to date indicates that the forages have the

potential to provide high quality supplementary feeding to livestock, particularly in the late dry season and supplement nitrogen supply to subsequent maize crops through fixation.

The first objective has been to identify and trial appropriate legumes within the farming system. Six legumes (*Centrosema pascuorum*, *Clitoria ternatea*, *Lablab purpureus*, *Macroptilium bracteatum*, *Stylosanthes guianensis* and *Stylosanthes seabrana*) were selected during the 2006/07 season on their biophysical attributes and the ability to fit within the existing farming system. It was shown that substantial quantities of forage could be produced over the dry season. At Biloto village (Timor Tengah Selatan regency) maximum biomass production for the annual species, *Centrosema pascuorum* (3.6 t DM/ha) and *Lablab purpureus* (4.3 t DM/ha) was achieved in 94 days (February sowing) whilst *Clitoria ternatea* continued to grow through the dry season producing 3.8 t DM/ha in 197 days. The perennial species *Stylosanthes guianensis* and *Stylosanthes seabrana* were slow to establish but produced 6.4 t and 9.7 t DM/ha in 197 days (3rd September).

These data support the hypotheses that legumes can be grown in the dry season on stored soil water. Characterisation of soil water holding capacity at trial locations found that the clays (Vertisols and Inceptisols) stored between 160 and 180 mm of water for crop use, whilst the clay loams (Alfisols), 140 mm. At the time of legume sowing in February the soil at Biloto was at field capacity (180 mm plant available water), 72 days later, by which time the legume *Clitoria ternatea* had produced 1.7 t DM/ha of biomass, there was still 145 mm of water remaining. During the following 130 days (from early May to early September) this water contributed to the production of an additional 2.1 t DM/ha.

During the 2007/08 wet season research has concentrated on integration of the legumes into the cropping system, either as relay crops after maize or as part of a longer term rotational sequence. Whilst this study will continue into the 08/09 season early results are encouraging. Relay cropped legumes have established well under the maize, and rotation trials have

been established using both annual and perennial species. Results from a rotation trial established on the 06/07 legume evaluation site at Kakaniuk (Belu regency) during the 07/08 season are providing support to the idea that legumes can contribute to maize nitrogen supply. Whilst other legumes contributed sufficient nitrogen in one dry season to increase maize grain yield by around 1 t/ha, *Clitoria ternatea* fixed sufficient to increase grain yield by 2.6 t/ha and stover by 4.1 t DM/ha when compared to the maize control.

Seed production has been increased during the 2007/08 season with over 4.5 ha of a range of species being produced by farmers in three regencies. The aim is to develop self sufficiency in seed supply and to develop a group of farmers and extension personnel experienced in seed production. The increase in production area and the recent agreement by the extension agency DINAS to purchase and distribute seed in Belu regency are positive steps towards achieving these goals.

Preliminary results from on-station animal studies indicate that feeding 6 month old weaned Bali calves conserved annual forage legumes would result in live weight gains greater than those reported in recent dry season village studies where crop residues were fed alone. While the growth rates were not as high as for calves fed *Leucaena leucocephala*, they do demonstrate a role for forage legumes in the cattle production system. The conservation and utilisation of stored forage legumes for late dry season feeding to growing calves or bulls is expected to be a viable option to supplement the current feed gap. This will be tested during village feeding trials planned for the late dry season (September 2008) in which forage legumes will be fed in conjunction with low quality crop residues including corn stover.

Socioeconomic benchmarking and longitudinal evaluation of farmer and researcher attitudes to the research and proposed interventions continues. Survey of participants in a project sponsored forage workshop (Kupang, November 2007) showed strong interest from farmers in the legumes, *Clitoria ternatea* and *Lablab purpureus*, and in future involvement in legume seed production. Labour availability and technical support for seed production and legume management were cited as the main constraints to future expansion. The next round of longitudinal evaluation will commence in July 2008 and will include the first attempt at recording the impact of ad-hoc extension on the wider adoption of the technologies in the West Timorese farming community.

## **SMAR/2006/061: Building capacity in the knowledge and adoption of Bali cattle improvement technology in South Sulawesi**

### **Summary**

The demand for beef cattle in Indonesia (for meat and transmigration programs) is strong and growing. Smallholder farmers in South Sulawesi (Sulsel) are major suppliers into that market, and in the short- to medium-term increased beef production is considered the best option for raising the welfare of smallholder crop-livestock households in that region.

However, beef production is constrained by the quantity, quality and continuity of forage supply, and inappropriate herd management practices. These constraints can be redressed at the farm level by establishing annual feed-plans based on crop residues, perennial or annual forages, tree legumes, or diet supplements in association with appropriate herd management strategies. However, all of these options must be taken in the context of a better understanding of the interactions between components within the crop-livestock systems and consideration of the important social and cultural constraints to altering farming systems practices.

Previous ACIAR projects have successfully developed research and extension capacity in eastern Indonesia. Two of those projects brought farmers and scientists together to develop a research and extension capacity to simulate and explore new crop-forage-livestock scenarios and trade-offs in a smallholder household context and to evaluate their impact on household economic and social welfare.

For the first time this approach brought together all elements of the farming systems. It also recognised the subtle and significant variations between family enterprises within and between regions. The 'one solution fits all' which applied previously was not appropriate and (understandably) was ignored by most farmers.

A current project (*LPS/2004/005: Improving smallholder crop-livestock systems in eastern Indonesia*) is applying these tools and approaches to identify (in partnership with groups of smallholder households in several case study villages in Sulsel, Lombok and Sumbawa) a range of 'best-bet' cattle management and forage improvement options (scenarios). This project is building on that project's experience, and will increase the scope to cover a wider range of agro-ecological zones and socio-economic systems.

It represents a significant scaling out of the activities to an additional 12 communities in Sulsel. Project activities are also closely integrated with another project, *SMAR/2006/096: Scaling-up herd management strategies in crop-livestock systems in Lombok*.

The objectives of the project are to initiate and support the adoption of better feeding and herd management of Bali cattle in mixed crop livestock systems in Sulsel and thus significantly improve household welfare and security, and to build local (R,D&E) institutional and community capacity to support the accelerated uptake of feed and herd management technologies in the mixed crop-livestock farming communities of Sulsel.

### **Project information**

**Overseas Collaborating Countries:**  
Indonesia

**Commissioned Organisation:** CSIRO  
Sustainable Ecosystems, Australia

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#### **Collaborating Institutions**

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- Assessment Institute for Agricultural Technology (South Sulawesi), Indonesia
- Livestock Services of South Sulawesi Province, Indonesia

**Project Budget:** \$999,454

**Project Duration:** 01/06/2007 to  
31/05/2010

**ACIAR Research Program Manager:** Dr  
Bill Winter

### **Project progress**

#### **Year 1 (01/06/2007-31/05/2008)**

Activities in the first year of the project were focused on establishing teams and facilities, selecting and engaging with communities in the three study regions, developing protocols and beginning the 'best bet' process with communities and farmers.

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The project employed 14 On Ground Team (OGT) members and one Project Officer in November 07 after an intensive recruitment process in August and September. The team is an impressive group of recent graduates and recruits with experience in smallholder farming systems and comprises skills in socio-economics, animal management, forage monitoring and smallholder farming – all with abilities in regional languages.

The OGTs have received theoretical and practical training from SulSel and Australian specialists on an array of topics including forage analysis and monitoring, nursery establishment and maintenance, animal nutrition and health, farming systems and modelling and engagement and social survey techniques. Most OGT training is also attended by local agricultural extension staff from the project's study villages.

To ensure effective project coordination, a multi-level team structure was established. The Project Management Team is responsible for operations & coordination; the Project Specialist Team is responsible for technical expertise & training and the On Ground Team is responsible for implementation & extension. A start-up meeting attended by all teams was held in Makassar in November 07. In addition, a Steering Committee was established in November 07, comprising representatives from Dinas Peternakan at provincial and regency levels, BPTP, UNHAS and CSIRO. The Committee's role is to provide overall guidance and advice on the direction and relevance of the project.

Farming systems data were collected from all villages in the three study regencies – Barru, Gowa and Bone. Criteria for village selection included size and relative importance of cattle population, access to study sites, willingness of the community to participate and scope and willingness for adopting improved technology and recommendation of regional and local agricultural extension officers. Twelve study villages were selected in January. Village benchmarking (social, economic and cultural information) and mapping is due to be completed in May.

In January, OGTs were placed in Barru, Gowa and Bone regencies. Introductions were made to local farmers, heads of village and local government officials. Accommodation, office space and facilities were sought in each region.

This project builds on cattle and forage improvement tools and technologies developed by precursor ACIAR projects, and successfully

tested and implemented by ACIAR project AS2/2004/005 (*Improving smallholder crop-livestock systems in eastern Indonesia*). In essence, the improvement technologies (Best Bets) are:

- Making better use of existing forages in a farming system
- Introducing new forages
- Seasonal (controlled) mating to match feed supply and labour needs
- Preferentially feeding particular animals
- Feed budgeting and planning to meet forecast feed demands.

Best Bet activities in the first field season will be predominantly focused on managing forage resources. Other options will be negotiated incrementally.

Due to the late start of the project, the project team was not able to launch the Best Bet process (village workshop to identify constraints and options for increased cattle production; negotiation of Best Bet options with individual farmers; design and establishment of on-farm trials and monitoring) during the main 07-08 wet season. However, the project team is taking advantage of Bone's bimodal wet season ('small wet' from December to March and 'big wet' from April to July) to launch Best Bet activities in that regency's four study villages.

A priority for the project team over the next six months is to finalise the model, methods and monitoring for scale-out activities for years 2 and 3. These will be largely be informed by the results and findings of the AS2/2004/005 project. Activities to date supporting scale-out include farmer-to-farmer visits, extension worker joint training, village and farmer group meetings and use of farmer and OGT diaries.

Communication and engagement activities in year one include: organising or facilitating participating farmer visits to established Best Bet farmers, producing the first edition of a project newsletter which will be distributed to relevant institutions in South Sulawesi, Lombok and Australia; and engaging proactively with key regional stakeholders, including Dinas Peternakan at provincial and local levels, and heads of participating and interested villages in the study region.

## SMAR/2006/096: Scaling-up herd management strategies in crop-livestock systems in Lombok, Indonesia

### Summary

ACIAR's Indonesia program has for some time emphasised the application of agricultural technical research and development to increase farmer incomes, especially in eastern Indonesia. This emphasis has been strengthened through participation in the AusAID-funded Smallholder Agribusiness Development Initiative (SADI) which, over 10 years from 2006, aims to achieve a sustained increase in rural growth and household incomes through productivity gains, better access to markets, and on- and off-farm value-added activities in four target provinces of eastern Indonesia: South Sulawesi (Sulsel), South-East Sulawesi, Nusa Tenggara Timur (NTT) and Nusa Tenggara Barat (NTB). ACIAR's role in SADI is to implement the research subcomponent *Support for Market Driven Adaptive Research (SMAR)*, which aims to improve access for farmers and agribusiness/SMEs to new knowledge underpinning the production and marketing of agricultural outputs at higher levels of productivity and quality.

The Bali cattle industry is vitally important to the Indonesian Government's high-priority policies of increasing self-sufficiency in beef production while concurrently boosting economic development in its poorest regions i.e. the eastern islands. At a regional and community scale, Bali cattle production is the most encouraging prospect for increasing income levels for a large number of resource-poor smallholder households in eastern Indonesia.

A previous ACIAR project (AS2/2000/103: *Developing an integrated production system for Bali cattle in the eastern islands of Indonesia*) addressed the problem of the long intercalving intervals of Bali cattle typical of the generally seasonally dry environment of NTB. Communal housing of cattle in kandangs (village communities) provided the opportunity to introduce bull management and seasonal mating to match the whole farming system, early weaning and tactical feeding of weaners and cows. Inter-calving intervals were reduced by an average of 10 months, and there were significant improvements in household income and other social benefits. Other ACIAR projects have identified options to improve feed supply in a manner sympathetic to the changes in herd and whole-farm management.

The specific objectives of the project are to improve household welfare and security by initiating and supporting the adoption of better husbandry and feed management of Bali cattle in mixed crop-livestock systems in Lombok.

### Project information

**Overseas Collaborating Countries:** Indonesia

**Commissioned Organisation:** CSIRO Sustainable Ecosystems, Australia

### Project Leader

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### Collaborating Institutions

- Assessment Institute for Agricultural Technology (NTB), Indonesia
- University of Mataram, Indonesia
- Livestock Services of Nusa Tenggara Barat Province, Indonesia

**Project Budget:** \$995,876

**Project Duration:** 01/06/2007 to 31/05/2010

**ACIAR Research Program Manager:** Dr Bill Winter

### Project progress

#### Year 1 (01/06/2007-31/05/2008)

The project is progressing well and is ahead of its proposed schedule. Activities in the first year focused on establishing teams and methodologies, selecting and working with communities in the study region, and creating opportunities for engagement with key farming and institutional stakeholders.

The project employed 12 On Ground Team (OGT) members and one Project Officer in November 07 after an intensive recruitment process in August and September. The team is an impressive group of recent graduates and recruits with experience in smallholder farming systems and comprises skills in socio-economics, animal management, forage monitoring and smallholder farming, and all have ability in Sasak language.

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The OGT has received theoretical and practical training from Lombok and Australian specialists on an array of topics such as forage assessment, management and monitoring, nursery establishment and maintenance, animal nutrition and health, farming systems and modelling, data management, socio-economics and extension practices. Most OGT training is also attended by local agricultural extension staff from the project's study villages.

Two students also joined the project in 2008. One is undertaking a Masters degree in forage agronomy and diversity. The other is completing a PhD on the impacts of improving the availability of introduced and local forages on cattle productivity under smallholder conditions, covering aspects of forage composition and quality, preferential feeding and the impact of forage legumes on livestock performance and farmer adoption.

To ensure effective project coordination, a multi-level team structure was established. The Project Management Team is responsible for operations & coordination; the Project Specialist Team is responsible for technical expertise & training and the On Ground Team is responsible for implementation & extension. A start-up meeting attended by all teams was held in Lombok in November 07.

In addition, an Advisory Committee was established in November 07, comprising representatives from the local government, BPTP, University of Mataram, Dinas Peternakan, NGOs, CSIRO and the farming community. The Committee's role is to provide overall guidance and advice on the direction and relevance of the project.

Despite a late start to the project, 12 kandang communities were selected by January 08, in addition to two demonstration or 'training' kandangs. Criteria for selection included cattle population, ownership status and security of the kandang, willingness of the community to participate and scope for adopting improved technology, particularly in terms of labour and land. The OGT completed the compilation of socio-economic and cultural data from the kandang communities in February 08, after developing and trialling a benchmarking survey.

Ten new kandangs have now been selected for the second year of the project and a similar benchmarking process is underway.

The project team is using a three-step approach to adoption of livestock technologies, based on farmer perceptions of need and potential for improvement. Step one is improvement of existing kandang facilities and provision of a communal bull (thereby ensuring controlled mating). Community negotiation about renovations was facilitated by the OGT and other team members and renovations were completed by the community in May 08. Renovations commonly include construction of bull and calf pens and improved kandang drainage. Bulls will be purchased and introduced to the kandangs in early June 08.

The second step is improving the forage resource and to this end, small demonstration nurseries have been established by OGT and farmers at each participating kandang to demonstrate new forages, management techniques and aspects of animal nutrition. The third step is the introduction of other breeding management strategies shown to be successful in previous ACIAR projects (eg early weaning and preferential feeding of calves).

Communication and engagement activities in year one include: hosting international visitors interested in the design and progress of the project; featuring in print media articles in key regional newspapers; producing the first edition of a project newsletter which was distributed to relevant institutions in Lombok, South Sulawesi and Australia; organising or facilitating participating farmer visits to demonstration sites, the university forage nursery and other participating kandangs; and engaging regularly with key regional stakeholders, including the Bupati of Central Lombok, Dinas Peternakan at regional and local levels, Bappeda in Central Lombok and heads of participating and interested villages in the study region.

## SMAR/2007/013: Opportunities to use cocoa pods and forages to address feed gaps in the dry season in Southeast Sulawesi

### Summary

In southeast Sulawesi a background problem in the beef sector is poor growth and reproduction, primarily ascribed to low quality and at times low availability of feed. Consultations held in Sultra, SE Sulawesi placed a high priority on the utilisation of residues from the cocoa industry for beef cattle production. This initiative will expand the scope of project LPS/2004/023 (*Strategies to increase growth of the weaned Bali calf*) to include the BPTP Sultra and the University of Haluoleo in work that addresses the cocoa residue issue, broadens the range of higher quality feeds available to farmers and builds local capacity through the conduct of on-station and on-farm research.

### Project information

**Overseas Collaborating Countries:**  
Indonesia

**Commissioned Organisation:** University of Queensland, Schools of Animal Studies and Veterinary Science, Australia

### Project Leader

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### Collaborating Institutions

- Assessment Institute for Agricultural Technology (Southeast Sulawesi), Indonesia
- University of Haluoleo, Indonesia
- University of Tadulako, Indonesia
- University of Mataram, Indonesia
- Assessment Institute for Agricultural Technology (NTT), Indonesia

**Project Budget:** \$129,536

**Project Duration:** 01/01/2007 to 31/12/2008

**ACIAR Research Program Manager:** Dr Bill Winter

### Project progress

#### Year 1 (01/01/2007-31/12/2007)

The project commenced in July 2007 with a project planning meeting with partners from BPTP South East Sulawesi (South East Sulawesi; Sultra), the University of Haluoleo

(Sultra) and the University of Tadulako (Central Sulawesi). Activities to address the two researchable issues of the project, namely the utilisation of cocoa-pods as a feed resource and the use of new forages to address dry season feed shortages, were developed. Development of a simple cocoa-pod processing method, activities to evaluate forages in the dry season and a series of on-station and village based feeding studies were planned.

The research activities commenced at the end of the main cocoa harvest, in August 2007. Cocoa-pods were collected and processed, either with or without fermentation with *Aspergillus niger* and stored for future use in on-station and village feeding studies. A village feeding experiment was conducted between September and December, 2007, to determine the effect of fermentation of cocoa-pods with *Aspergillus niger* on growth of Bali cattle, compared with unfermented cocoa-pods. Bali cattle fed fermented cocoa-pods, at 1.5% of LW on a dry matter basis, grew at 0.33 kg/day compared with cattle fed unfermented cocoa-pods, at the same level, which grew at 0.27 kg/day. A separate study, conducted by the University of Tadulako, demonstrated that fermentation of cocoa-pods with *Aspergillus niger* increased the crude protein content and decreased the neutral detergent fibre content, compared with unfermented cocoa-pods. A simple cocoa-pod chopper has been sourced and will be utilised in villages during the upcoming cocoa harvest. The new cocoa-pod chopper is manually operated, with an option to add a small motor if desired, and is inexpensive and simple to operate and maintain.

Forage legume evaluation plots were established in dry land and low land rice field areas in Ladongi district, in November 2007 and biomass production of a range of legumes was determined. Biomass production was greatest for *Lab lab purpureus*, followed by *Clitoria ternatea*, *Macroptilium bracteatum*, *Centrosema pasuorum*, *Stylosanthes hamata* and *Desmanthus pernambucanus*, 100 to 140 days after sowing. Best-bet forage legumes (*Lab lab*, *Clitoria* and *Macroptilium*) will be scaled out on paddy fields after the rice harvest, utilising sub-soil moisture to

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provide a forage resource available for the tethering and grazing of growing calves during the dry-season. It is expected that this will increase soil fertility, through nitrogen fixation of legumes and manure from the tethered calves.

A long term growth path study conducted at the University of Mataram revealed no difference in live weight gain between male and female cattle between 6 and 18 months of age. This work also demonstrated that Bali cattle can be fed diets comprised solely of tree legumes and will grow at 0.35 to 0.40 kg/day; however large variation in daily live weight gain exists between individual animals.

Staff from BPTP Sultra and the University of Haluoleo have been involved in all activities associated with LPS 2004 023 and have also participated in other training and workshops on experimental design and statistical analysis and laboratory methods for the analysis of soils and plant materials.

## **SMAR/2007/195: Smallholder commercial pig production in Nusa Tenggara Timur - opportunities for better market integration (AGB)**

### ***Summary***

Pigs are the most important livestock for smallholders in Nusa Tenggara Timur (NTT), playing a role in traditional religious and social activities and providing a critical source of protein. Currently the major reason for pig ownership is to have pigs available for ceremonies and to fulfil social and family obligations. However, a changing market in NTT has led to increasing smallholder investment in production units orientated at supplying a growing domestic market. This project aims to understand the changing market dynamics and determine ways that smallholders will be able to gain benefit from these changes without losing the important cultural component pigs play.

### ***Project information***

**Overseas Collaborating Countries:**  
Indonesia

**Commissioned Organisation:** Rural Solutions SA, The Food Export Centre, Australia

#### **Project Leader**

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#### **Collaborating Institutions**

- South Australian Research and Development Institute, Australia
- University of New England, Australia
- Department of Livestock, NTT, Indonesia
- University of Nusa Cendana, Indonesia
- Assessment Institute for Agricultural Technology (NTT), Indonesia

**Project Budget:** \$149,790

**Project Duration:** 01/05/2008 to 30/04/2009

**ACIAR Research Program Manager:** Mr David Shearer

### ***Project progress***

First progress report due in 2009.

## **SMAR/2007/201: Improving goat production in integrated estate cropping systems in South Sulawesi (AGB)**

### **Summary**

In Indonesia the local and export demand for goats is high. They are often integrated with vegetable and estate crops through three operation systems; scavenging; daytime foraging with evening cut and carry; and intensive cut and carry of feeds. However, in South Sulawesi there are a number of constraints that limit industry development and market improvements. Developing a more integrated supply chain, with improved production, management, markets and access to markets, could help both the local and export market. This project is investigating constraints on this industry, as well as options for improving production systems. It will also analyse some of the socio-economic constraints that limit the adoption of new technologies.

### **Project information**

**Overseas Collaborating Countries:**  
Indonesia

**Commissioned Organisation:** University of Queensland, Australia

#### **Project Leader**

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#### **Collaborating Institutions**

- Curtin University of Technology, Australia
- Hasanuddin University, Indonesia
- Assessment Institute for Agricultural Technology (South Sulawesi), Indonesia

**Project Budget:** \$149,100

**Project Duration:** 01/06/2008 to 30/11/2009

**ACIAR Research Program Manager:** Mr David Shearer

### **Project progress**

First progress report due in 2009.

## **SMAR/2007/202: Benchmarking the beef supply chain in eastern Indonesia (AGB)**

### **Summary**

Benchmarking is a tool for assessing and comparing different businesses and organisations within a particular sector. Understanding the supply chain of beef products in Eastern Indonesia and being able to make a comparative analysis through effective benchmarking are positive steps to ensure more effective engagement of future activities.

This project will assess and compare the beef sector of Eastern Indonesia in relation to global benchmarks in the beef cattle sector, that have been developed through a global 'agri benchmark'. The outcomes will help to advance the industry through 'better practice models', focusing initially on beef marketing channels across Eastern Indonesia and thus contributing to the development of a cost:benefit analysis of better feeding and watering of cattle during inter-island transport.

### **Project information**

**Overseas Collaborating Countries:**  
Indonesia

**Commissioned Organisation:** Charles Sturt University, Asian Agribusiness Research Centre, Australia

### **Project Leader**

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### **Collaborating Institutions**

- Indonesian Centre for Agriculture Socio Economic and Policy Studies, Indonesia
- Assessment Institute for Agricultural Technology, NTT, Indonesia
- Assessment Institute for Agricultural Technology, South Sulawesi, Indonesia
- Assessment Institute for Agricultural Technology, NTB, Indonesia

**Project Budget:** \$491,920

**Project Duration:** 01/05/2008 to 31/10/2010

**ACIAR Research Program Manager:** Mr David Shearer

### **Project progress**

First progress report due in 2009.

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

### **Summary**

In irrigated rice crops, rodents are the number one pre-harvest pest in Indonesia and amongst the top three pests in Vietnam. Rodent pests affect directly the lives of poor farmers in these countries through damage to growing crops, incurring postharvest losses, transmitting diseases to people and livestock, contaminating food and water, and damaging buildings and other possessions. Rodent impacts are greatest among the poorer communities, who have no capacity to absorb either the chronic losses or the occasional acute losses associated with periodic rodent population eruptions.

Two previous ACIAR projects in Indonesia and Vietnam, together with an ACIAR/World Vision project and an AusAID CARD project in Vietnam, have made substantial advances in ecologically-based rodent management. Four detailed reviews of these projects have been very positive and there has been strong recommendation for extending the village focus to a broader geographic scale.

The major objective of this project is to develop effective pathways for delivery and uptake of integrated ecologically-based methods for rodent management in poor farmer communities in the Red River delta and central coastal zone of Vietnam, and in South Sulawesi in Indonesia.

### **Project information**

**Overseas Collaborating Countries:**  
Indonesia, Vietnam

**Commissioned Organisation:** CSIRO  
Sustainable Ecosystems, Australia

#### **Project Leader**

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#### **Collaborating Institutions**

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

**Project Budget:** \$78,781

**Project Duration:** 01/04/2006 to 30/09/2009

**ACIAR Research Program Manager:** Dr Simon Hearn

### **Project progress**

#### **Year 2 (01/04/2007-31/05/2008)**

The project is progressing according to plan and is on track to meet all milestones.

The main emphasis of the project over the last 12 months has been training of farmers and regional extension staff to consolidate activities on project sites, and also to encourage adoption of sustainable integrated ecological rodent management in neighbouring villages and districts. There were approximately 40 training activities conducted in Vietnam and Indonesia and an estimated 4000 farmers trained. The capacity of core project staff (10 staff) and technical extension staff (approximately 140) has been increased through on-the-job training and formal training courses and workshops.

Project activities in Vietnam (Ha Nam province in the Red River Delta and An Giang province in the Mekong Delta) and Indonesia (Karawang district West Java and Pinrang district in South Sulawesi) have concentrated on establishing community actions (CA includes synchronised cropping, field sanitation, community campaigns at key times), and setting up community trap barrier systems (CTBS), training of farmers, cross visits, and demonstration sites. Farmer activities are monitored through farmer diaries (collected every 2 weeks), damage is assessed at 3 key stages of crop growth, and rice yields are collected at the end of each season. Results so far indicate that yields on treatment sites are 1-2% higher than on reference sites and the cost of rodent management actions conducted are less expensive on treatment sites than on reference sites at a village scale.

The key impacts resulting from project activities over the last 12 months include:

- Community impacts: increase participation of farmers and desire to involve community members to manage rats at a community/village level. Carry-over benefit of mutual management for rodents and brown plant hoppers in the Mekong Delta because of synchronised cropping.
- Economic impacts: less damage observed on treatment sites and slightly higher rice crop yields, leading to benefits for households.
- Social impacts: increased involvement within the farming community to bring a common benefit to the whole community through the rodent management, and involvement in communal rodent management with neighbouring villages.
- Environmental impacts: reduction in the use of rodenticides and plastic sheeting used for constructing barriers around individual rice fields.

Another key focus of the project is to implement and promote sustainable integrated rodent management at a large scale, achieved through communication and training activities:

- Training activities: Core project staff have undertaken important on-the-job training and structured and formal training courses/workshops, and postgraduate training for 2 ACIAR John Allwright Fellowships for Masters and PhD students to study in Australia.
- Communication and dissemination activities: Review workshops involving farmers, extension staff and project staff were conducted to evaluate results from each season and plan activities for the forthcoming season. There have been many training courses with farmers at different times of crop growth to encourage appropriate use and timing of rodent management to achieve desired outcomes. Thousands of rodent management booklets, leaflets and brochures have been distributed to farmers and extension staff in Vietnam and Indonesia.
- Project planning: Involving all project partners to generate strong commitment and engagement from key staff and key institutions participating in the project. Planning workshops incorporated discussions and actions for communication planning and scaling out strategies.

The adoption of sustainable integrated ecological rodent management strategies has been promoted through a variety of communication and extension activities to farmers in the target provinces in both Vietnam and Indonesia, but also into neighbouring areas. An important strategy has been to utilise existing extension networks, such as the Primatani system in Indonesia and the “3-reductions and 3-gains” system in the Mekong Delta in Vietnam.

Other key activities include:

- Training with knowledge attitudes and practices and socio-economic farmer survey (KAP&SE) and data entry and preliminary analysis.
- Project site visits to monitor activities conducted by farmers, conduct focus group discussions and key informant interviews, attend project planning workshops and assist with training activities.
- Preliminary analysis of KAP&SE data.
- Key informant interviews in West Java and South Sulawesi with extension agencies, community leaders, credit managers and farmer group leaders to understand the governance arrangements for agricultural extension that condition adoption of the ecological rat control technologies, to understand the structural, financial and cultural barriers to effective extension, and to evaluate the effectiveness of the technologies and extension strategies to date.
- Development of a rodent population dynamics model to link with a farm household model to explore farmer management decisions, which will be linked with a rice crop model to examine resulting changes in damage and yield loss to rice crops.
- Development of household economic models to account for farmer decisions and examine cost-effectiveness of individual and community-based rodent management decisions and specific management scenarios.

## **SMAR/2007/068: Productivity and profitability enhancement of tropical pulses in Indonesia and Australia (AGB)**

### **Summary**

Peanut and mungbean are important food and cash crops in the eastern Indonesian provinces of Nusa Tenggara Barat (NTB) and Nusa Tenggara Timur (NTT) but average productivity and profitability are low. Significant productivity and profitability improvements are possible from adaptive research addressing: (1) new varieties and cost-effective management practices using farmer-participatory adaptive research approaches; (2) efficient and sustainable seed system strategies; and (3) functional partnerships between the national and provincial government agencies and industry stake holders in NTB and NTT.

In Australia, the project will conduct on-farm research and extension on effectiveness of rhizobium inoculants and delivery systems in soybean and peanut and on developing management practices, especially optimum row configurations and irrigation strategies to maximise yields in mungbean. The outputs of the research in Australia are expected to have an impact on the on-farm adaptive research conducted in Indonesia, especially through the supply chains linked to Garuda Foods.

### **Project information**

**Overseas Collaborating Countries:**  
Indonesia

**Commissioned Organisation:** Queensland  
Department of Primary Industries and  
Fisheries, Australia

### **Project Leader**

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### **Collaborating Institutions**

- Indonesia Legumes and Tuber Roots Institute, Indonesia
- Assessment Institute for Agricultural Technology, NTB, Indonesia
- Assessment Institute for Agricultural Technology, NTT, Indonesia
- University of Mataram, Indonesia
- University of Nusa Cendana, Indonesia

**Project Budget:** \$523,500

**Project Duration:** 01/06/2008 to  
31/05/2010

**ACIAR Research Program Manager:** Dr  
Peter Horne

### **Project progress**

First progress report due in 2009.

## **SMAR/2007/193: Quality management to enhance effective supply chains for mangoes and rambutans in Nusa Tenggara Barat (NTB), Indonesia and Australia (AGB)**

### ***Summary***

The successful development of export-capable fruit industries relies on a range of different factors. This project aims to develop effective, competitive supply chains that deliver high quality mango and rambutan fruit from Nusa Tenggara Barat (NTB) into profitable markets in Indonesia and internationally. This will be achieved through the improvement of pre- and postharvest quality management strategies, linked to the development of effective supply chains to penetrate markets. Researchers will establish the likely causes of mango and rambutan fruit degradation through the supply chain, and implement appropriate solutions. This in turn will lead to further optimisation of the ASEAN GAP (Good Agricultural Practices) protocols for both the pre- and postharvest handling of these fruit.

The key outcome of the project will be improved supply chain management that delivers product to market specification.

### ***Project information***

**Overseas Collaborating Countries:**  
Indonesia

**Commissioned Organisation:** Department of Primary Industries, Fisheries and Mines, Diagnostic Services Division, Australia

#### **Project Leader**

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#### **Collaborating Institutions**

- Assessment Institute for Agricultural Technology, NTB, Indonesia
- University of Mataram, Indonesia
- Provincial Agricultural Agency, NTB, Indonesia

**Project Budget:** \$795,963

**Project Duration:** 01/05/2008 to 30/04/2011

**ACIAR Research Program Manager:** Mr David Shearer

### ***Project progress***

First progress report due in 2009.

## **SMAR/2007/196: Market development for citrus from eastern Indonesia (AGB)**

### **Summary**

An earlier ACIAR-funded analysis of the Indonesian citrus market and eastern Indonesian supply chain identified a highly competitive market with opportunity to improve supply chain management and market penetration on products with identified comparative advantage, particularly keprok (mandarins) from regionally specific locations.

The general aim of this project is to improve grower returns through the adoption of improved production and post handling techniques and by increasing the understanding of and cooperation among the different segments of the citrus supply chain.

The specific objective is to use keprok as a model for developing awareness of 'quality' parameters, product differentiation and the importance of careful postharvest handling, also to introduce and foster market-driven business practices in the keprok supply chain, forging stronger links between farmers and the marketplace.

### **Project information**

**Overseas Collaborating Countries:**  
Indonesia

**Commissioned Organisation:** South Australian Research and Development Institute, Australia

### **Project Leader**

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### **Collaborating Institutions**

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- Indonesian Citrus and Subtropical Fruits Research Institute, Indonesia
- South Australia Citrus Industry Development Board, Australia
- Assessment Institute for Agricultural Technology, NTT, Indonesia
- Assessment Institute for Agricultural Technology, South Sulawesi, Indonesia
- Assessment Institute for Agricultural Technology, Southeast Sulawesi, Indonesia

- Assessment Institute for Agricultural Technology, East Java, Indonesia
- Food Crop and Horticulture Services, Indonesia

**Project Budget:** \$582,066

**Project Duration:** 01/03/2008 to 28/02/2011

**ACIAR Research Program Manager:** Mr David Shearer

### **Project progress**

First progress report due in 2009.

## **SMAR/2007/203: Integrated tropical passionfruit production systems in South Sulawesi (AGB)**

### **Summary**

The excellent market for passionfruit in South Sulawesi is being eroded, due primarily to a fall in production and supply capability. Production is currently limited to the highland areas, and in this region is under intense land-use pressure, with plantings being replaced by higher-value temperate vegetable crops. Passionfruit vine life is often limited, with the likely cause being root disease. This project will address these major constraints to the development of the industry in South Sulawesi by:

- improving passionfruit vine longevity, through the introduction and uptake of root disease management strategies in highland production areas
- introducing new elite lines of passionfruit germplasm (scion varieties and rootstocks) that meet market demands at both lowland and highland sites
- establishing appropriate mechanisms to manage passionfruit supply to meet long-term market demand and opportunities, thus allowing the industry to remain focused on the demands of the market.

### **Project information**

**Overseas Collaborating Countries:**  
Indonesia

**Commissioned Organisation:** Department of Primary Industries, Fisheries and Mines, Australia

### **Project Leader**

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### **Collaborating Institutions**

- Indonesian Fruit Juice Producers Association, Indonesia
- Agency for Food Crops and Horticulture, Indonesia
- Hasanuddin University, Indonesia
- Assessment Institute for Agricultural Technology, Makassar, Indonesia

**Project Budget:** \$259,225

**Project Duration:** 01/04/2008 to 31/03/2011

**ACIAR Research Program Manager:** Mr David Shearer

### **Project progress**

First progress report due in 2009.

## **SMAR/2007/216: Improving rice productivity in South and Southeast Sulawesi**

### **Summary**

With international rice prices at a 10-year high there is strong pressure on rice-importing countries like Indonesia to lift domestic production. This project focuses on generating sustainable, profitable productivity improvements in the irrigated rice-based farming systems of South and Southeast Sulawesi, working with smallholder farmers in four target villages with the aim of increasing rice production by an average of 10% or more. The project teams will conduct an agronomic benchmarking to identify crop management practices that have the potential to address the main limitations to productivity in each village. Then smallholder farmers chosen for their active engagement in the market and their potential to improve rice productivity will test and locally adapt the selected management practices.

### **Project information**

**Overseas Collaborating Countries:**  
Indonesia

**Commissioned Organisation:** International Rice Research Institute, Philippines

### **Project Leader**

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### **Collaborating Institutions**

Assessment Institute for Agricultural Technology (South Sulawesi), Indonesia

Assessment Institute for Agricultural Technology (Southeast Sulawesi), Indonesia

Indonesian Centre for Rice Research, Indonesia

### **Project Budget**

\$622,695

### **Project Duration**

01/03/2008 to 28/02/2011

### **ACIAR Research Program Manager**

Dr Peter Horne

### **Project progress**

First progress report due in 2009.

## **PC/2007/111: Incursion prevention and management of coffee berry borer (CBB) in Papua New Guinea (PNG) and Indonesia (South Sulawesi and Papua)**

### **Summary**

Coffee production in PNG and Indonesia is threatened by the most serious pest, *Hypothenemus hampei* known as coffee berry borer (CBB). In Indonesia, where 96% of coffee is planted by smallholders, CBB has infested 920,000 ha and has led to an annual production loss of 15–20%. PNG production is under threat of incursion from the Papua Province in Indonesia because the pest is present in Wamena and Oksibil districts – respectively 200 and 50 km from the PNG border.

This project aims to prepare stakeholders in Sulawesi, Papua and PNG to manage and prevent incursion of CBB and thus ensure continued productivity of coffee plantings. This will come from enhanced stakeholder knowledge/awareness of CBB, strengthening surveillance/monitoring efforts for CBB management and incursion detection, and building up the capacity and institutional framework for CBB biosecurity management. Coffee is the major agricultural export commodity for PNG and a major source of cash to smallholders, thus any success in delaying the invasion of new zones by CBB will have a great economic impact.

### **Project information**

**Overseas Collaborating Countries:**  
Indonesia, Papua New Guinea

**Commissioned Organisation:** CABI South East and East Asia, Malaysia

### **Project Leader**

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### **Collaborating Institutions**

- PNG Coffee Industry Corporation, Papua New Guinea
- Ministry of Agriculture Indonesia, Indonesia
- National Agriculture Quarantine and Inspection Authority, Papua New Guinea
- Indonesian Coffee and Cocoa Research Institute, Indonesia

- Provincial Agricultural Services (Estates) Papua, Papua New Guinea
- Provincial Agricultural Services (Estates) Sulawesi Selatan, Indonesia

**Project Budget:** \$1,014,062

**Project Duration:** 01/06/2008 to 31/05/2013

**ACIAR Research Program Manager:** Dr T K Lim

### **Project progress**

First progress report due in 2009.

## **SMAR/2005/074: Improving cocoa production through farmer involvement in demonstration trials of potentially superior and pest/disease resistant genotypes and integrated management practices (AGB)**

### **Summary**

Over the last 25 years cocoa production has expanded greatly in the outer provinces of Indonesia, especially in Sulawesi, driven by the initiative of about 400,000 smallholders. This has brought substantial development, even during times of low world prices for cocoa and economic crises. Sulawesi now produces 350,000 tonnes of dry beans per annum (over 80% of Indonesia's total), making it globally the third largest producer of cocoa.

Following a period of relatively trouble-free expansion, cocoa production is now facing serious losses due to the build-up of cocoa pod borer (CPB, the moth *Conopomorpha cramerella*), *Phytophthora* pod rot (PPR) and stem canker caused by *Phytophthora palmivora*, and vascular-streak dieback (VSD, caused by the basidiomycete fungus *Oncobasidium theobromae*). From initial outbreaks in Central Sulawesi, CPB has spread throughout the island and to other parts of Indonesia, causing yield losses of 20-50%. It has spread to West Papua and, very recently, to Papua New Guinea.

PPR caused yield losses exceeding 50% on many farms in Sulawesi in the wet season of 2005. VSD has been in the plantings since the earliest expansion but continues to cause branch death. CPB and PPR contribute to the poor quality of Sulawesi cocoa, which is a major concern for cocoa processors in Makassar, including PT Effem (Mars Inc.) which is associated with this project.

A current ACIAR cocoa project (CP/2000/102) has involved farmers in selecting, from among the great genetic diversity of cocoa on their farms, types with possible resistance to pests/diseases and improved quality. These have been tested in field trials and several clones with resistance have been identified. It was shown that local selection of improved cocoa on smallholdings is possible, and farmer participation in the testing and dissemination of technologies was demonstrated.

The aim of the project is to promote the approach more widely of selecting for superior genotypes, to initiate crossing between selected clones and to test the progeny.

### **Project information**

**Overseas Collaborating Countries:**  
Indonesia

**Commissioned Organisation:** La Trobe University, Department of Botany, Australia

#### **Project Leader**

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#### **Collaborating Institutions**

- University of Sydney, Australia
- Provincial Agricultural Services (Estates), Indonesia
- Indonesian Coffee and Cocoa Research Institute, Indonesia
- Masterfoods Australia/New Zealand, Australia
- Biotechnology Research Institute for Estate Crops, Indonesia
- Assessment Institute for Agricultural Technology (South Sulawesi), Indonesia
- Assessment Institute for Agricultural Technology (Southeast Sulawesi), Indonesia
- Provincial Agricultural Services (Estates and Horticulture), Indonesia

**Project Budget:** \$720,895

**Project Duration:** 01/01/2007 to 30/06/2010

**ACIAR Research Program Manager:** Mr David Shearer

### **Project progress**

#### **Year 1 (01/01/2007-31/05/2008)**

The opening workshop for the project was held in July 2007 and was attended by staff from Dinas Perkebunan, University of Hasanuddin and Mars Inc., farmer leaders and the project partners. The meeting provided an opportunity for presentations and group discussions addressing the key problems faced by cocoa smallholders.

Visits made to farmer groups in South, South-East and West Sulawesi provinces

during the year allowed project staff to explain the process of selecting and testing clones and its potential value in farm rehabilitation to farmers. Since many farmers wish to rehabilitate parts of their farms from seedling cocoa, trials were planned (under Objective 1) as part of a rehabilitation process on land cleared of unproductive trees by farmers. Six trials testing twelve clones in four replicate blocks have been established in the three provinces in the districts of Pinrang, North Luwu (Bone-bone), Polmas, North Kolaka and Kolaka (Lambandia, including one trial established by sidegrafting onto mature trees).

One further trial is planned. Clones for testing were top-grafted onto rootstock seedlings in 2007 and, in early 2008, planted in trials at sites selected with the guidance of project staff from Mars Inc. Clones selected for the trials include genotypes with promising high-yielding or resistance characteristics identified by Mars Inc., a previous ACIAR project and local farmers. Two clones will be common to all the trials and act as standards.

The project has initiated the establishment of a field facility for cocoa research in Soppeng, South Sulawesi on 5 hectares provided for field research by Dinas Perkebunan Selatan. This will form part of a cooperative effort under the Cocoa Sustainability Partnership (CSP), a forum of private and government agencies concerned with cocoa research and development in Sulawesi.

A nursery and well with a pump have been constructed. The well will provide only some of the water needed for the ACIAR project trials. A further well will be required to provide sufficient water for the two trials planned at the site (Objective 2): to test hybrid progeny and selected clones against pests and diseases. Staff management, infra-structure requirements and organisational matters for the field centre were discussed in detail and responsibilities allocated.

Hybrid crosses for the Soppeng trial site have already been made and seeds of some of these crosses produced. Also, trial sites have been marked out and temporary shade planted. But the establishment of the hybrid testing trial has been delayed by the higher-than-expected costs for preparing the site for planting. Approximately fifty genotypes for the clone testing trial at the Soppeng site have been grafted onto rootstock seedlings.

A project staff member has commenced a PhD study at Gadjah Mada University (also part of Objective 2). The study will focus on forms of resistance in cocoa pods to cocoa pod borer. Meetings with farmer groups and extension officers established some priorities for research on options for pest/disease management (Objective 3).

Feedback indicated that the major pest/disease concerns of farmers were *Phytophthora* pod rot and vascular-streak dieback. Demonstrations of cultural management methods (pruning, sanitation and fertiliser application) and phosphonate application were conducted in South-East Sulawesi. The phosphonate, to be tested against *Phytophthora palmivora*, is applied using slow-release implants placed in the stem and major branches. Further trials are planned for the coming year.

In visits to farmer groups made by ICCRI, BRIEC and Australian project staff, feedback sessions were conducted in conjunction with practical training demonstrations. The basic design of a proposed cocoa management handbook relevant to Sulawesi farmers was discussed. However, to avoid confusing or conflicting advice it was decided that such educational material should be prepared in collaboration with other members of the CSP.

The aims and methodology of a socio-economic study (for Objective 4) were discussed and farmer surveys were commenced in West and South Sulawesi. This study will be continued with surveys conducted at six monthly intervals in three provinces.

## **SMAR/2006/011: Enterprise development, value chains and evaluation of non-timber forest products for agroforestry systems in West Timor, Flores, Sumba and Savu, eastern Indonesia**

### **Summary**

Many subsistence households in Indonesia's poorest province, Nusa Tenggara Timur (NTT) rely on the availability of two categories of natural resources: near-shore marine resources and products from forests, woodlands and agroforestry systems. The resources derived from the latter (many of which are harvested for daily subsistence needs of shelter, fuelwood for the household, and traditional medicine for health care) are often referred to as non-timber forest products (NTFPs).

The aim of this project is to identify and evaluate any NTFPs that may have potential for incorporation into agroforestry systems and thus enhance the incomes of farming communities in pilot-study sites of West Timor, Flores, Sumba and Savu in NTT.

### **Project information**

**Overseas Collaborating Countries:**  
Indonesia

**Commissioned Organisation:** Charles Darwin University, School for Environmental Research, Australia

#### **Project Leader**

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#### **Collaborating Institutions**

- University of Nusa Cendana, Indonesia
- Threads of Life: Indonesia Textile Arts Centre, Indonesia
- Yayasan Pecinta Budaya Bedbali, Indonesia
- Forest Research and Development Agency, Indonesia

**Project Budget:** \$273,449

**Project Duration:** 01/06/2007 to 31/05/2009

**ACIAR Research Program Manager:** Dr Russell Haines

### **Project progress**

#### **Year 1 (01/6/2007-31/05/2008)**

Although this project had a delayed start due to a delayed sign-off on the project by one partner organization and consequent delays with dissemination of funds, significant impacts have now been achieved. Prior to this project, the only systematic survey of forest and agroforestry products sold in local marketplaces that we are aware of was done in Kalimantan in 1996 Arman, S. 1996. *Diversity and trade of market fruits in West Kalimantan*. Pp. 308-317 in: Padoch, C and N Peluso. Eds. *Borneo in transition: people, forests, conservation, and development*. Oxford University Press, Kuala Lumpur. This study, aimed at identifying NTFP species whose economic and production (growth, silvicultural) characteristics make them suitable for incorporation into agroforestry systems, is the most detailed ethnobotanical survey of local marketplaces and trade. It has generated a huge data set based on surveys in West Timor (Kupang, Soe, Kefamenanu, Atambua, Camplong, Kapan), Flores (Mauwere, Ende, Bajawa and small weekly markets located near Mauwere), Sumba (Waingapu, Waikabubak, Kabunduk and Melolo) and on Savu.

Training and capacity building have been essential to success for without the support of Indonesian partners familiar with ethnobotanical survey methods, this phase of the project would not have been possible. Literature reviews have been completed and peer reviewed research papers and resource manuals shared with Indonesian partners. The quantitative surveys of local marketplaces will enable market characterisation (from an economic geography perspective) into four main categories:

1. Local marketplaces and markets (comprising permanent and periodic marketplaces and decentralized marketing (specialist products (honey, textiles, seasonal higher value fruits)) and low value products (fuelwood);

## 2. Inter-island regional trade

Complex inter-island supply chains are identifiable from marketplace surveys (eg: *Areca catechu* and *Canarium* seed trade from Flores to markets in West Timor, *Arenga pinnata* stem fibre trade for ritually important thatch, with Bali as the major market in eastern Indonesia and even sago palm starch from Ambon to West Timor. Seasonal trade in ritually important products is a notable part of this trade. There also is potential for FairTrade marketing to “high-end” tourist hotels and lodges in Bali, as a market for plant products that give a “sense of place” (cosmetic oils, soaps;

## 3. Exports from NTT for national markets

(comprising visible” market chains (*Aleurites* (kemiri), *Canarium*) and “hidden” market chains for high value products (*Aquilaria* (gaharu), sandalwood, bird’s nests);

## 4. Exports for international markets

The most promising export products, currently sold at low value in NTT as food supplements, are (i) cosmetic oils; (ii) flavours and fragrances; (iii) functional foods and (iv) **culturally-valued products in the art and hand-woven textile sector**. The size of these market sectors and likely species through which project impacts are likely to be reached is discussed in Section 3.3.1 below (Economic impacts).

## **SMAR/2007/063: Enhancing farmer engagement with specialty coffee chains in eastern Indonesia (AGB)**

### **Summary**

The rapid growth in the international specialty coffee market is an opportunity for smallholders to improve economic returns in a number of developing countries, including Indonesia. Global consumers and specialty coffee buyers are demanding greater product quality, traceability and compliance with environmental and social standards, however smallholder producers are unable to meet these requirements and government agencies do not have the capability to support smallholders meeting these greater demands.

This project will improve the capacity of the smallholder based coffee industry in South Sulawesi and West Timor (NTT) to successfully participate in the international specialty coffee market and improve the capability of Indonesian agencies to support this engagement. Through this improved engagement the livelihood of smallholder coffee farmers in eastern Indonesia will be improved.

### **Project information**

**Overseas Collaborating Countries:**  
Indonesia

**Commissioned Organisation:** University of Sydney, School of Geosciences, Australia

#### **Project Leader**

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#### **Collaborating Institutions**

- Assessment Institute for Agricultural Technology, NTT, Indonesia
- Indonesian Coffee and Cocoa Research Institute, Indonesia
- Assessment Institute for Agricultural Technology, South Sulawesi, Indonesia

**Project Budget:** \$332,862

**Project Duration:** 01/06/2008 to 31/05/2011

**ACIAR Research Program Manager:** Mr David Shearer

### **Project progress**

First progress report due in 2009.

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

### Summary

Marine lobsters attract premium prices, selling for an average of A\$50 per kilogram (Vietnam figures 2001-02), reflecting the high level of demand. Supply, however, has reached its maximum sustainable levels in many fisheries and in some cases has breached these levels. If increasing demand is to be met, it must be sustainably – aquaculture offering the only way of achieving this. In Vietnam the production of cultured lobster is estimated as being worth A\$100m a year. An abundance of lobster seed is the main driving force behind the industry's recent expansion. But mortality rates in rearing lobster form seed remain high. Rearing is based on a diet of fresh fishery by-catch, which is seen as a source of increasing environmental pollution. Both wild collection of seed stock and the trawling and use of bycatch are threatening the industry's long term sustainability, as coastal environments begin to degrade and pressure grows on lobster populations.

The Vietnamese grow-out industry has a low-technology base, predominately using sea cages to fatten the ornate tropical lobster (*Panulirus ornatus*). Improvements in post-capture survival rates when rearing, including through pellet diets that reduce environmental impacts, will substantially boost production, benefiting the industry in Vietnam and Australia.

The project is working to enhance the sustainable production of tropical spiny lobster in Vietnam (and indirectly more widely throughout Southeast Asia) and to develop technology that facilitates commercial establishment of tropical spiny lobster grow-out aquaculture in Australia.

### Project information

**Overseas Collaborating Countries:**  
Indonesia, Vietnam

**Commissioned Organisation:** CSIRO Marine Research, Australia

### Project Leader

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### 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:** Mr Barney Smith

### Project progress

**Year 3 (01/01/2007-31/05/2008)**

*Ecological impact of lobster seed collection in Viet Nam*

Comparison of the catch data for years 05/06 and 06/07 shows some interesting differences: total catch of *P. ornatus* seed in 06/07 was only half that of the 05/06 season (999k vs 1,918k respectively); whereas *P. homarus* was only a minor catch in 05/06, more of this species was caught in 06/07 than *P. ornatus* (1,329k vs 999k, respectively); and the highest monthly catch was delayed by one month in 06/07, being highest between October and February. The 07/08 census of lobster seed collection in Vietnam is awaiting collation and analysis of the May 08 survey data. The number of seed lobsters caught in 07/08 is expected to be low because demand for the seed has fallen as a result of the current severe lobster disease problems in Vietnam. Farmers are unwilling to take the risk of huge disease losses and are choosing to culture marine finfish instead of lobsters. It is reliably estimated that the number of fishing boats catching lobster seed this year is only 60% of that for the previous season. Consequently, the price of *P. ornatus* seed has dropped compared to prices in 05/06 and 06/07.

*Reducing post-capture losses of seed lobsters*

RIA3 has continued studies to examine the role of transport and nursery cage practices on the growth and survival of seed lobsters. Additional work on optimizing husbandry practices during nursery culture has commenced. The first experiment is examining the effects of different types of shelters in the cages with all treatments being fed the same mixture of trash fish and shellfish. Subsequent experiments will examine different feed types and feed timing and frequency.

*Husbandry best-practices for lobster grow-out*

Improved and less-polluting methods for seacage grow-out of lobsters

An 18-month experiment comparing traditional lobster culture methods (trash fish feeding) with one in which green mussels (*Perna viridis*) and lobsters are being co-cultured has been completed. Losses were highest (25-35%) at cage sites where only trash fish was fed and generally lower (2-10%) at the off-shore sites. For the whole experiment, lobster survival was only 43.5%. Although firm conclusions can not be drawn because of the low treatment replication and disease, there was some indication that lobsters fed trash fish with mussels grew and survived better than those fed only trash fish. Effects of season, river inflow and other land and cage pollutants are thought to be having as great, if not greater, effect on the environmental conditions at the cage sites. Again there was some indication that culturing mussels alongside the lobster cages improved the environmental conditions adjacent to the cages. Widespread adoption of this practice could help ameliorate the poor water quality in Van Phong Bay.

*Improving lobster grow-out feeds*

During the year, work at NTU focused on examining the extent to which fish meal in a compounded diet can be replaced using soybean meal. Inclusion of soybean meal in the diet brought about an almost linear decline in growth rate of the lobsters and a concomitant worsening of food conversion ratio. By comparison, lobsters fed the trash fish control diet grew the best at an economical DM food conversion of 1.4. Clearly, replacement of fish meal with soybean meal was not well utilised by the lobsters. In further work, the lobster's requirement for the highly unsaturated omega-3 essential fatty acids is being investigated in a 10-week growth assay experiment with juvenile lobsters.

An 8-week experiment at CSIRO has examined optimal tank water depth for

nutritional studies with sub-adult lobsters. There was a very clear advantage with lobsters held in the 2-tonne tank growing faster than the other two tank types. The lobsters were fed a dry TG-bound diet and the recorded growth rate for lobsters in the 2-tonne tank was as good as that achieved by lobsters cultured in sea cages in Vietnam and fed trash fish.

Also at CSIRO, a 12-week sub-adult lobster experiment is examining the essentiality of including fresh constituents (fish fillet) in diets presented either as moist or dry pellets. The experiment was delayed on account of the purchased lobsters being of poor quality because of sub-optimal water quality in the supplier's holding tanks. The experiment is now in progress with lobsters stocked in sand-bottom 2.5 tonne tanks (4/tank)

*Land-based systems for lobster culture*

At QDPIF, the low settlement of seed lobsters limited juvenile lobster work to a 12-week tank study examining the suitability of a moist diet. The growth of the lobsters was good, survival was high and the vitality and coloration were excellent. The moist diet was expensive and further work is being done to source cheaper ingredients. Additionally a 4-month pond trial with sub-adult lobsters confined in cages in the intake channel of a prawn farm was carried out and compared with lobsters held in a land-based tank. All lobsters were fed the newly developed moist diet with excellent growth and survival. The coloration of the lobsters was similar to wild-caught lobsters and achieved high prices when marketed.

*SMAR Variation to include Nusa Tenggara Barat (Lombok) and Nusa Tenggara Timur (Flores, East Timor), Indonesia*

In November 2006, representatives of the Smallholder Agribusiness Development Initiative (SADI) convened a workshop with Indonesian participants to identify priorities for market chain work in eastern Indonesia. One such priority was to improve lobster grow-out and nutrition in NTB (Lombok and Sumbawa). Subsequently, a priority for lobster aquaculture development has been identified for NTT (Flores, Sumba and West Timor). Because similar work on lobster aquaculture was already being carried out in Vietnam and Australia in the ACIAR Fisheries project FIS/2001/058, one of the Project's Australian scientific team (Dr Clive Jones, QDPIF) was commissioned in April

2007 to carry out a feasibility study of the lobster aquaculture industry in NTB. The prime objectives of the study were to identify opportunities and constraints for lobster aquaculture development in NTB and to consider whether synergies might exist between the needs of the Vietnam and NTB lobster aquaculture industries and the work being done in the existing ACIAR lobster project. The feasibility study was undertaken as a Support for Market-driven Adaptive Research (SMAR) initiative and administered as a variation to FIS/2001/058. The feasibility study noted the fledgling state of lobster aquaculture development in NTB, which was paralleling the development that occurred 10 years earlier in Vietnam, and commented on the significant opportunity that existed to expand smallholder industry development, partially through lobster aquaculture technology transfer from Vietnam and through targeted market driven adaptive research at NTB.

The results and recommendations arising from the feasibility study resulted in the development of an expanded joint ACIAR Fisheries and SMAR Variation so that lobster aquaculture development in NTB and NTT could be fast-tracked. The following sections outline the proposed work to be done in the Variation. The variation also sought to slightly increase the budget being provided to the Vietnamese agencies to address the increased cost of purchasing lobster seed for research and the higher than budgeted cost of carrying out the annual census of lobster seed being taken from the wild for aquaculture.

- Carry out a market chain assessment of lobster supply and demand in Indonesia and Vietnam
- Facilitate development of lobster aquaculture at NTB and NTT
- Training of NTB and NTT staff in lobster aquaculture husbandry – lobster feeds, nursery and grow out
- Assess the ecological impact of lobster seed collection at NTB and NTT
- Survey lobster settlement sites at NTB and NTT
- Annual census of lobster seed collection at NTB and NTT.

## **SMAR/2007/225: Assessing mariculture market constraints and potential in Southeast Sulawesi - Stage 1: Stakeholder engagement and situation analysis (AGB)**

### **Summary**

ACIAR has identified as a major priority in South East Sulawesi the development of the mariculture industry, with a focus on various high-value species. While there is significant potential for development of this industry, there are presently constraints in both production and marketing that hamper commercial growth, and all these need to be resolved before a viable industry can emerge. A critical element in addressing these constraints is appropriate stakeholder engagement within each sector of the chain. This Stage 1 project will facilitate the development of such linkages, by working with commercial enterprises, government (provincial and central) institutions, universities and other parties to build an effective group to lead future industry development.

### **Project information**

**Overseas Collaborating Countries:**  
Indonesia

**Commissioned Organisation:** Department of Primary Industries, Victoria, Sustainable Fisheries and Aquaculture, Australia

#### **Project Leader**

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#### **Collaborating Institutions**

- Network of Aquaculture Centres of Asia, Indonesia
- University of Haluoleo, Indonesia
- Hasanuddin University, Indonesia
- Centre for Marine and Socio Economic Research, Indonesia

**Project Budget:** \$149,000

**Project Duration:** 01/11/2007 to 31/12/2008

**ACIAR Research Program Manager:** Mr David Shearer

### **Project progress**

**Year 1 (01/11/2007 12:00:00 AM-31/05/2008)**

This project was formally and operationally commissioned in January, 2008 for a 14 month period. The project team is lead by the Department of Primary Industries (DPI)

Victoria, and involves collaboration with Haluoleo University (Univ. Halu.), Kendari, Se Sulawesi, and the Network of Aquaculture Centres in Asia-Pacific (Bangkok, Thailand). The primary objectives of the project are:

1. To facilitate local leadership and support for mariculture industry development through establishment of a functional stakeholder network and strategic implementation framework.
2. To identify opportunities to adopt a more agribusiness, market driven approach to industry development of the smallholder mariculture market sector in SE Sulawesi.
3. In close consultation with the stakeholder network, prepare an industry development strategy.

#### **Key activities to date:**

- two project visits (June 2007 and January 2008) have been completed to SE Sulawesi collectively by DPI and NACA.
- project inception and planning workshop completed by project team and key local stakeholders (Kendari, Jan. '08; workshop program and local media publicity attached to this report as Attachment A).
- project work plans developed and commissioned by project team (Jan-April '08).
- mariculture market chain baseline survey (socio-economic/technical/chain dynamics) in Se Sulawesi designed, developed and implemented; incorporating collaboration with Indonesian Centre for Marine & Fisheries Socio-Economic Research (ICM&FS-ER)(May, '08; in progress).
- mariculture market chain post-harvest characterisation/logistics case study completed; incorporating both commercial consultancy input and in-house, project team investigations, data collation and analysis (Jan.-May '08).
- preliminary mariculture market chain risk assessment, opportunity/needs analysis and strategic industry development conceptualisation completed.

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## 4.7 Subprogram 7: Technical cooperation to underpin medium-term rehabilitation and development of agriculture and fisheries in Aceh

In 2005 ACIAR commenced a range of training and technical projects to assist in fisheries and agricultural rehabilitation of the provinces of North Sumatra and Aceh, which were affected by the December 2004 tsunami. There was a research focus on the technical issues that needed to be addressed following the changed physical environment caused by deposition of silt in cropping fields and destruction of brackishwater ponds (Tambak) after the tsunami. There was also a strong emphasis on rebuilding human resources in these areas. During 2008, longer term initiatives in the areas of aquaculture and sustainable crop management and crop marketing will be designed in close collaboration with Aceh-based and central agencies.

### Projects

Project number	Project title	Page
FIS/2002/075	Application of PCR for improved shrimp health management in the Asian region	113
FIS/2005/009	Technical capacity building and research support for the reconstruction of tsunami-affected brackishwater ponds in Aceh	115
FIS/2006/002	Aceh Aquaculture Rehabilitation Project	117
SMCN/2002/033	Seasonal climate forecasting for better irrigation system management in Lombok	119
SMCN/2005/075 (multilateral)	Integrated soil and crop management for rehabilitation of vegetable production in the tsunami-affected areas of Nanggroe Aceh Darussalam province, Indonesia (TWVC)	122
SMCN/2005/118	Restoration of annual cropping in tsunamiaffected areas of Nanggroe Aceh Darussalam province, Indonesia	124

## **FIS/2002/075: Application of PCR for improved shrimp health management in the Asian region**

### **Summary**

Shrimp farming, or culturing, is a profitable industry. Successful culturing provides income and employment for smallholder farmers, as well as those working in hatcheries, larger-scale farms, feed mills and processing plants. Most of this has flow-on effects as income is redistributed throughout the usually poor rural communities, many located in coastal regions that practice shrimp culturing.

In addition to these benefits farming of shrimp is sustainable. This relieves the pressure placed on wild populations being harvested at unsustainable catch levels, motivated by reaping the potential income on offer. Thailand leads the world in farmed shrimp production, with Indonesia and India, like many other countries in Asia, both major and growing producers.

For the past decade the Asian industry has been limited by disease outbreaks. Several have been serious enough to cause declines that if continued unabated would threaten the industry. Two diseases in particular, white spot syndrome virus (WSSV) causing white spot disease and yellow head virus (YHV) have caused these declines. Past ACIAR research has developed polymerase chain reaction (PCR) and epidemiological tests to identify the diseases. These are used to detect the viruses in seed stock and live shrimp respectively. Despite these being widely adopted outbreaks continue, and a slow growth syndrome has become more prevalent, prompting further research into PCR use and its role in ongoing farm management.

The project will focus on:

- reducing the risk of White spot disease in shrimp farms through the application of PCR-based detection tests and epidemiological probes
- reducing the risk of yellow head and other shrimp diseases in shrimp farms through application of PCR-based detection tests and epidemiological probes
- improving the effectiveness of PCR-based viral screening in hatcheries and service laboratories in India, Indonesia and other countries in the Asian region.

### **Project information**

**Overseas Collaborating Countries:** India, Indonesia, Thailand

**Commissioned Organisation:** CSIRO Livestock Industries, Australian Animal Health Laboratory, Australia

#### **Project Leader**

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#### **Collaborating Institutions**

- Mahidol University, Thailand
- Directorate General Aquaculture, Indonesia
- Network of Aquaculture Centres in Asia Pacific, Thailand
- Agency for Marine and Fisheries Research, Indonesia

**Project Budget:** \$715,920

**Project Duration:** 01/01/2005 to 31/12/2008 (Project extended from 01/01/2008 to 31/12/2008)

**ACIAR Research Program Manager:** Mr Barney Smith

### **Project progress**

#### **Year 2 (01/01/2006-31/12/2006)**

This project aims to reduce risks of disease outbreaks in small-holder shrimp farms by a combination of strategies involving training of PCR laboratory technicians, the inter-calibration of PCR laboratories test performance and improved health management practices derived from a better understanding of sources of white spot disease on farms. A major aspect of the project is a large field study at a site in Andhra Pradesh, India. The study is the first in a series of investigations that aim to assess the quality of PCR screening available to small holder shrimp farmers and to identify the sources of disease outbreaks in shrimp ponds. The study involved a total of 457 ponds from 28 clusters in 15 villages. The farms were stocked in early 2005 with PCR-screened PLs obtained from local hatcheries. Samples of shrimp post-larvae (PLs) were

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collected from farmers at the time of stocking and from juvenile shrimp and wild crustaceans from the ponds during grow-out and at the time of disease outbreaks and planned or emergency harvest. Samples collected from the site were tested by laboratory staff in India and Australia by PCR to identify infected stock and assess the source of infection. Samples from disease outbreaks were also examined by histology to determine the cause of disease. The results indicate that very few of the PL batches used by the farmers in the study were positive by PCR tests conducted in India and Australia by the project team, suggesting that PCR screening conducted by local laboratories was relatively effective. However, PCR testing of samples collected from shrimp at planned or emergency harvest indicated there was a very high prevalence of WSSV infection in the study ponds with a high proportion of moderate-severe infections. There was also evidence that a small number of nursery ponds were the source of seed for a high proportion of disease outbreaks during grow-out. There was also evidence of clustering according to the village under study with 2 villages in particular being major foci of infection and disease. The data suggests that nursery ponds may be a weak link in the current disease management practice.

Work has also continued in the search for infectious agent associated with monodon slow growth syndrome (MSGs), a newly emerging disease that has impacted severely on *P. monodon* production in Thailand. At Centex Shrimp in Bangkok, a new shrimp virus (Laem Singh virus - LSNV) has been investigated. Although LSNV occurs commonly in *P. monodon* in Thailand, it is thought that progression of the infection in the optic nerve may be the cause of slow growth. To determine if LSNV also occurs in India, 205 samples collected in the field study in Andhra Pradesh were screened for the presence of the virus using PCR test developed at Centex Shrimp. Although no evidence of infection was detected, we have concerns about the stability of the LSNV RNA after prolonged storage in ethanol and new set of samples will be collected in early 2007.

To improve the reliability of PCR-based screening, the first of two inter-laboratory calibrations of WSSV PCR testing was conducted in India in June 2006. Forty-nine service laboratories from the government and private sectors and shrimp hatcheries received equivalent sets of randomly coded positive and negative samples comprising fixed shrimp tissues WSSV DNA for testing. Seventeen laboratories correctly identified all positive and negative samples and 3 laboratories failed to detect only one low positive sample. Six laboratories reported negative results for positive samples indicating problems with test sensitivity. Nine laboratories reported positive results for negative samples indicating problems with test contamination. Two laboratories reported incorrect results for both positive and negative samples.

The results were collated returned to all participating laboratories in a form that allowed them to see the results of all laboratories but identify only themselves by code. A second inter-calibration is planned following the second PCR training workshop in early 2007 and it is expected that a national PCR laboratory accreditation program will commence in 2008. A similar inter-calibration commenced in Indonesia in December 2006.

The second in a series of 2 PCR training workshops has been completed in India. The second workshop was conducted in October 2006 for essentially the same group that attended the first workshop in 2005 including 23 from hatcheries and government, private and research laboratories in India and 3 participants from Sri Lanka, Bangladesh and Myanmar. The second workshop provided more focussed training and assessment with each participant required to perform every step in the process at least once during the 4-day program and feedback was given on the basis of individual rather than group performance.

## **FIS/2005/009: Technical capacity building and research support for the reconstruction of tsunami-affected, brackishwater aquaculture ponds in Aceh**

### **Summary**

The 26 December tsunami caused widespread devastation of tambak-based aquaculture on the west and north east coast of Aceh, Indonesia. 'Tambak' is the commonly used Indonesian term for brackishwater aquaculture ponds used for fish and shrimp production. More than 20,000 ha of tambaks were put out of production and since the disaster there has been insignificant redevelopment of the industry. Over 40,000 people were thought to be directly employed in the aquaculture industry before the tsunami and most have no alternative sources of income.

Thus restoration of the industry is a high priority but efforts at redevelopment have been thwarted by a lack of local expertise to tackle the scale of the reconstruction effort and address environmental and engineering limitations on redevelopment. In particular, technical expertise is desperately needed to address soil problems and to ensure that the reconstruction of tambaks, dykes and canals follow sound engineering and environmental principles. Acid sulfate soils, sandy soils, disease risk, poor water quality and contaminated sediments all pose significant risk to the industry.

The main objective of this project is to provide immediate and ongoing technical support to the tambak redevelopment activities with a particular emphasis on building technical capacity within the Regional Brackishwater Aquaculture Development Centre (RBADC) at Ujung Batee in partnership with the Aceh Aquaculture Rehabilitation Project (AARP), developing technical expertise within District Dinas Perikanan (Bureau of Fisheries) to implement district-level technical extension teams, and to provide direct technical support to NGOs and farmers involved in the reconstruction effort. District-level technical extension teams will be trained and resourced to undertake work on soil assessment and remediation, the redesign of tambaks and canals, spatial planning of the redevelopment and promotion of best management practices and alternative farming systems for severely degraded environments unsuitable for intensive monoculture.

### **Project information**

**Overseas Collaborating Countries:**  
Indonesia

**Commissioned Organisation:** University of New South Wales, Faculty of Science, Australia

#### **Project Leader**

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#### **Collaborating Institutions**

- Gadjah Mada University, Indonesia
- Regional Brackishwater Aquaculture Development Centre, Indonesia
- Research Institute for Coastal Aquaculture, Indonesia

**Project Budget:** \$557,584

**Project Duration:** 01/06/2006 to 30/06/2009 (Project extended from 01/12/2008 to 30/06/2009)

**ACIAR Research Program Manager:** Mr Barney Smith

### **Project progress**

#### **Year 2 (01/06/2007-31/05/2008)**

The project has continued to deliver a program of technical capacity building-based workshops at the Centre for Brackishwater Aquaculture Development (known as Balai Budidaya Air Payau). BBAP staff are now skilled in soil assessment, soil remediation, pond engineering and pond management, and have applied these skills to collaborative French Red Cross, GTZ, FAO and ADB-funded projects. Training in alternative farming practices for severely degraded ponds has also been provided. The training program is based on the principles of a 'train the trainer' approach to enable BBAP staff to train staff from other MMAF agencies and international programs operating in Aceh. Trained staff who have passed competency tests have participated in extension roadshows to train district Dinas Perikanan (Bureau of Fisheries), NGO staff and farmers. The community

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and agency-based training activities have been undertaken in collaboration with Component 2 of the Aceh Aquaculture Rehabilitation Project (AARP) funded by AusAid and ACIAR (FIS/2006/002).

During 2007/2008 the project conducted two 4-day training workshops at BBAP as well as two 1-day refresher workshops on soil assessment, soil remediation and pond engineering. Workshop participants also developed their skills in hydrological measurements, surveying, farm planning and dyke and pond design. BBAP staff have also participated in one-on-one training during soil mapping activities conducted by the Research Institute for Coastal Aquaculture (RICA) and Gadjah Mada University (GMU). The field-based training focuses on soil assessment, surveying, tidal measurements, the redesign of canals, ponds and dykes, and the collection of geospatial data for map production.

The project team at BBAP was revised to include new staff. The team is now divided into core field and laboratory team members and supporting staff. Core team members are also responsible for community extension activities. The AARP-funded laboratories are now close to completion; the environmental laboratory will be equipped for soil analyses in 2008. BBAP laboratory staff will undertake further training at RICA in Maros, and will complete their analytical training program at BBAP once the laboratories are fully equipped. The environmental laboratory will provide a soil assessment service for farmers and agencies involved in the rehabilitation programs. Basic soil assessment will be provided at farms using the AARP-funded mobile laboratory. The BBAP team is developing a workplan to assess soils and provide technical and management advice to farmers at selected areas on the north east coast. Field-based training of farmers will be conducted at two AARP-funded pond demonstration sites.

A recent impact assessment of ACIAR's fisheries program in Indonesia recommended the expansion of the training program to deliver similar skill building workshops to other Technical Implementation Units (TIUs). A project variation to deliver technical training to 4 other TIUs was approved in May 2008 and the training program will commence in August.

The research support component of the project has continued to characterise and map soils and aquaculture ponds in the rehabilitation areas. The project has mapped over 470,000 ha of acid sulfate soils and has provided more accurate data on the extent of brackishwater aquaculture in Aceh. A soil texture model, based on fuzzy logic, was developed to map the distribution of sandy soils; these sediments cause significant pond engineering problems. A hydrological model was developed to predict tides and describe wave properties at selected locations. These models have provided important data for pond, dyke and canal design, and to identify appropriate soil remediation and pond management strategies.

## **FIS/2006/002: Aceh aquaculture rehabilitation project**

### **Summary**

Prior to the December 2004 tsunami, aquaculture was an important source of income, employment and livelihood for many communities in Aceh. The tsunami destroyed or severely damaged more than half of the province's brackishwater aquaculture ponds ('tambaks'). The aquaculture industry in Aceh is complex with multiple stakeholders. Production activities include: managing broodstock which spawn eggs; growing the seed in commercial hatcheries or at an aquaculture development centre such as the Regional Brackishwater Aquaculture Development Centre (RBADC); growing out shrimp and fish in tambaks managed by farmers; market and transport of product to local and export markets.

The current needs in Aceh are enormous. Around 20,000 hectares (more than half) of the tambaks in Aceh have been damaged - around 9000 ha totally destroyed. Another 5000 ha were taken out of production due to damage to water canals and infrastructure. Almost all shrimp hatcheries were destroyed. At least 40,000 people directly employed in aquaculture were directly affected through loss of livelihood, and there are significant flow-on effects to households engaged in aquaculture as a primary income-generating activity.

Under the Australia–Indonesia Partnership for Reconstruction and Development (AIPRD) AusAID has undertaken to design a project in support of aquaculture rehabilitation in Aceh up to \$A4 million. AusAID invited ACIAR to prepare a feasibility/design study, and a study team (FDST) visited Indonesia in November 2005 to hold discussions with all the main stakeholders and develop a project outline.

The objectives of the project are to rehabilitate the RBADC and improve the quality of its services, and to re-establish coastal aquaculture as a key source of income and employment in Aceh.

### **Project information**

**Overseas Collaborating Countries:**  
Indonesia

**Commissioned Organisation:** James Cook University, Department of Marine Biology and Aquaculture, Australia

### **Project Leader**

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### **Collaborating Institutions**

- Regional Brackishwater Aquaculture Development Centre, Indonesia
- Directorate General Aquaculture, Indonesia

**Project Budget:** \$949,972

**Project Duration:** 01/07/2006 to 30/06/2009 (Project extended from 01/07/2008 to 30/06/2009)

**ACIAR Research Program Manager:** Mr Barney Smith

### **Project progress**

#### **Year 2 (01/06/2007-31/05/2008)**

Training of BBAP Ujung Batee staff has been undertaken in a range of topics supporting implementation of Better Management Practices (BMPs) for tambak farming in Aceh. Two demonstration sites have been developed in Bireuen and in Aceh Utara districts. The demonstration sites are primarily used to train BBAP Ujung Batee staff in implementation of BMPs for shrimp farming, but also serve to:

- Provide a focal point for implementation of training outcomes, including technical activities and extension and dissemination activities
- Identify gaps in the training program, with additional or revision training undertaken in response
- Provide training for collaborating farmers who will undertake the day-to-day activities of pond management
- Provide sites where other farmers can visit and learn about BMPs not only from BBAP staff, but from other farmers
- Enable local Dinas staff to participate in 'hands-on' training in implementation of BMPs (as they have requested)
- Support the development of effective linkages between BBAP Ujung Batee and District Dinas through collaborative activities.

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The layouts for both pond sites has been developed in cooperation with FIS/2005/169 and are designed to improve biosecurity by reducing as much as possible potential introduction of viral diseases (particularly WSSV) from other ponds with shrimp populations. Shrimp production ponds are limited to those ponds which can be isolated from adjacent ponds which are likely to act as sources of infection (particularly from WSSV). Adjacent ponds are stocked with finfish (milkfish, tilapia, barramundi) to control plankton and algal growth and to predate any wild shrimp that enter the 'biofilter' ponds.

During the pond preparation phase, BBAP Ujung Batee laboratory staff sampled pond soil to provide input on soil remediation requirements and liming rates for the demonstration ponds. This sampling implements training provided by ACIAR project FIS/2005/009 'Technical capacity building and research support for the reconstruction of tsunami-affected brackishwater aquaculture ponds in Aceh'.

The Bireuen demonstration ponds were stocked in March 2008, and the Aceh Utara ponds in May 2008. The demonstration ponds have generated considerable interest in the local farming communities. Many farmers are adopting a 'wait and see' approach and have indicated that in the event that the demonstration ponds are successful, they would like to implement a similar approach on their own farms, with technical support from BBAP Ujung Batee.

*Improved fish health services*

BBAP Ujung Batee laboratory staff have been trained in PCR analytical techniques, histopathology, microbiology and epidemiological techniques. Due to delays in construction of the new laboratory facilities at BBAP Ujung Batee, much of this training has not been able to be implemented. However, a temporary PCR laboratory was established to support testing for shrimp viral diseases in support of BMPs implementation.

The BBAP Ujung Batee laboratory undertook 250 PCR tests during the reporting period (July 2007 – May 2008). Most of these tests were for the ACIAR project sampling for the WSSV

epidemiological survey. However, a number of PL samples were tested to ensure that only WSSV-negative PLs were being stocked in ponds implementing shrimp BMPs through aid agencies / NGOs, including ADB, Caritas, FAO, IFC and NACA–WWF. The laboratory also tested batches of PLs produced in the BBAP Ujung Batee hatchery (Neuheun site) under the 'double screening' program to ensure they were free from WSSV.

An epidemiological study of *Penaeus monodon* broodstock and hatcheries in Aceh, undertaken in collaboration with Sydney University School of Veterinary Science, indicated that out of 225 broodstock sampled from Aceh Besar and Aceh Timur, only five were positive for WSSV. Of the 68 hatchery tanks sampled, only one was positive for WSSV. This is a remarkably low prevalence and suggests that shrimp broodstock and PLs from Aceh are relatively free of this major viral disease.

*Seedstock production*

Training of BBAP Ujung Batee hatchery staff has been undertaken in:

- Grouper hatchery production
- Live feeds (microalgae and rotifer) production
- Shrimp hatchery production to produce high-quality, high-health seedstock.

The shrimp hatchery training has been implemented at the Neuheun site of BBAP Ujung Batee (renovated by JICS). However, implementation of the grouper hatchery training has not been possible because of delays in the construction of hatchery and related facilities for seed production at the Durung site of BBAP Ujung Batee (which is being renovated under AIPRD funding).

## **SMCN/2002/033: Seasonal climate forecasting for better irrigation system management in Lombok**

### **Summary**

A quarter of Indonesia's total cropping land is irrigated, used mainly for paddy rice production. Reliance on irrigation compounds the affect of drought, which tends to be linked to El Nino events. Using El Nino Southern Oscillation, a measure of ocean temperature changes, accurate seasonal climate forecasts (SCF) are possible.

A past ACIAR project (LWR2/1996/215) demonstrated that rainfall prediction for Lombok, an island in eastern Indonesia, is possible for most of the year, with only the wet season months of January to April being unpredictable.

Irrigation on Lombok is derived mainly from diverting streams, rather than from rainfall. Preliminary modelling of stream flows and irrigated cropping areas has demonstrated that the use of SCF in planning cropping ahead of the wet season is possible. This is likely to result in productivity gains and fewer crop losses. The productivity gains extend from managing the irrigation systems for effective water use, this in turn creating greater certainty for cropping choices and reducing the risk of losses.

The overall aim of the project is to use climate forecasts to improve the management of irrigation system water resources in Lombok in order to achieve greater and more secure crop production.

The specific objectives of this project are to:

- refine the decision support systems already developed for optimizing choice of crop, crop area and irrigation water allocation
- use the decision support system and multiple historic climate scenarios to simulate the benefit of SCF in terms of economic output and income distribution
- promote SCF-based planning amongst government officials, community leaders and farmers
- build local capacity in the development and operational use of DSS tools through targeted workshops and training in Australia and Indonesia.

### **Project information**

**Overseas Collaborating Countries:**  
Indonesia

### **Commissioned Organisation:**

Environmental Protection Agency, Australia

### **Project Leader**

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### **Collaborating Institutions**

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- Department of Natural Resources and Mines, Queensland, Australia
- Regional Infrastructures and Settlement Agency, Indonesia
- Bureau of Meteorology and Geophysics, Indonesia
- Badan Meteorologi dan Geofisika, Indonesia
- Agriculture and Field Crops Department, NTB, Indonesia
- La Trobe University, Australia

**Project Budget:** \$863,203

**Project Duration:** 01/01/2004 to 31/12/2008 (Project extended from 01/07/2008 to 31/12/2008)

**ACIAR Research Program Manager:** Dr Gamini Keerthisinghe

### **Project progress**

**Year 4 (01/01/2007-31/05/2008)**

The scientific components of the project are now mostly complete. However, collation and dissemination of results and outputs remain ongoing, with few tangible impacts observable at the community level. This reflects the complexity and the "systems" nature of the project, which relies on the integration of many completed components to produce useful information for dissemination to stakeholders. Progress in this reporting period has mainly focused on finalisation of the scientific components, and dissemination of the project outputs to the government and provincial agencies with several workshops and training activities conducted both in Australia and Indonesia.

### Decision support development

Significant work was undertaken in the previous reporting periods in data collection (meteorological, hydrologic and agronomic), patching and synthesis for input and calibration of the hydrologic model (*IQQM*). Modelling outputs include simulated catchment-scale river flows (50-year daily streamflow), flow-diversions, and water allocations and usage at fifty-seven irrigation weirs in southern Lombok. The hydrological model has now been configured to simulate “historical” water allocation for two demand scenarios (existing cropping pattern and maximum planted area). Three stochastic realisations of streamflow were used in each analysis to capture model uncertainty.

These data are now available for input into the *FlowCast* and *CropOptimiser* decision support software for tactical decision-making. *FlowCast* was developed to generate probabilistic forecasts of rainfall, streamflow and water allocation based on key climate predictors. *CropOptimiser* (a linear programming (LP) model) uses probabilistic forecast distributions from *FlowCast* to optimise choice of crop and planted-area for different seasons and climate types. Prototype versions of these software packages were developed in previous reporting periods. However, continued development over this period has now seen operational versions of both software packages released.

*FlowCast* was significantly modified during the reporting period to simplify its operation, and to enhance its station and spatial analysis capabilities. Powerful forecast analysis tools were added, and the graphical user interface was redesigned to minimise the operational requirements of the software, and to hide the complexity inherent in a state-of-the-art technology. *FlowCast* was formally released to the Indonesian collaborators at a national meeting of the Indonesian National Agency for Meteorology and Geophysics (BMG) in Jakarta in April 2008.

*CropOptimiser* was also extensively modified to produce the first fully functional version. The algorithms used in *FlowCast* to calculate forecast distributions have now been directly incorporated into *CropOptimiser* to minimise the operations required to generate output. This now facilitates direct integration of *IQQM* outputs into *CropOptimiser* allowing for testing of different scenarios based on alternative *IQQM* simulations. Data management algorithms have been developed to aggregate *IQQM* node outputs based on defined irrigation

sub-area configurations, and to average different climate realisations. New reporting capabilities have also been added and the software debugged and tested.

Another accomplishment of the project was the creation of an internet-based database system to manage and store the vast amounts of collected input data. This is potentially one of the most important outputs of this project that can be used for current and future research dealing with climate and water resources management in Lombok. It was envisaged that a similar database would also be generated containing simulation results covering a range of climate scenarios, allocation decisions and planting options. This task has been delayed due to organisational changes in Australia and difficulties in recruitment of staff which ensued. Nevertheless, modifications made to the decision support tools during 2007 will greatly facilitate this task. We will be seeking approval to undertake this work after the final reporting period using unspent project funds.

A further objective of this project negotiated with ACIAR in July 2006, in collaboration with the La Trobe University (SMCN/1999/005), was to conduct a water balance modelling study to assess the potential of water harvesting from the raised-bed systems in southern Lombok, using the *HowLeaky* software package. Earlier work involved modifying the *HowLeaky* simulation code and creating parameter-files for conditions in Lombok. In this reporting period, *HowLeaky* was rewritten to simplify its operation and to directly simulate multiple cropping cycles, and run batch simulations for a detailed sensitivity analysis of different parameters. Outputs from *HowLeaky* were used in *FlowCast* to assess the impact of seasonal climatic variability on field-runoff in the southern Lombok region. This study is ongoing and will be completed by the final project review, with an additional site studied.

Another requirement of the project is to assess the feasibility of using groundwater as a supplementary source of irrigation in the drier areas of southern Lombok. A survey of 197 wells and multiple pumping tests have been carried out, to determine safe groundwater yield and water quality in the region. This data was reanalysed in this reporting period to better quantify the results. Results showed that shallow

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groundwater resources are suitable for agriculture but are limited in capacity and can only be used as a supplementary source using "hand-watering" methods.

*Consultation, information dissemination and capacity building*

Information exchanges continued throughout this period in both Australia and Indonesia. There now appears to be a good understanding of project functionality and responsibilities between key partners, with relative success in scientific capacity building. Unfortunately, at this stage in the project, information dissemination to key stakeholders is still limited, focusing on promoting the theory and advantages of the technology, rather than introducing effective changes into the local communities. It is unlikely that any practical outcomes of this research were implemented at the farm level to influence decision-making, despite attempts to do so.

These issues were addressed in August 2007 through a workshop involving the Australian team and key Indonesian scientists in Toowoomba (Australia). A communication strategy and detailed plan of local capacity building were developed for disseminating project outputs to farmer groups, field officers and government agencies.

In Indonesia, efforts in dissemination of information focused on three different levels including: scientific academics and government officials; field extension and water gate managers; and village leaders and farmers. National workshops were held in Jakarta (PERHIMPI) and Bali (related to United Nations Framework Convention on Climate Change (UNFCCC)) where papers were presented on the impacts of climate variability on agriculture and the use of *FlowCast* as a tool for seasonal climate forecasting in Lombok. At the regional level, workshops and training programs were conducted to increase officer understanding on climate variability to introduce the concepts of decision support systems. Informal meetings and consultations took place with the head of Bappeda Provincial Office and the head of Department of Agriculture at District of Central Lombok, on adopting the decision support tools for strategic cropping management. Officers from Dinas Pertanian (Department of Agriculture) conducted field days and workshops for local farmers on climate, while the Indonesian project team also visited some farmers' group associations to lecture on the local impacts of climate variability and climate change.

## **SMCN/2005/075: Integrated soil and crop management for rehabilitation of vegetable production in the tsunami-affected areas of NAD Province, Indonesia**

### **Summary**

Since the December 2004 tsunami hit Indonesia, rebuilding has been underway, including in Nanggroe Aceh Darussalam Province. In some eastern coastal areas land was only lightly to moderately damaged and farmers are returning to cropping.

The tsunami damaged, and in many cases deposited mud, salt, soils and debris on top of, 40,000 hectares of farming land, presenting constraints to restarting cropping. Vegetable production was halted but with appropriate integrated crop management approaches can be restarted.

Doing so will require assessments of existing constraints and remediation options, with farmers and researchers to be involved in the process of developing these.

### **Project information**

**Overseas Collaborating Countries:** Indonesia

**Commissioned Organisation:** The World Vegetable Center, Taiwan

#### **Project Leader**

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#### **Collaborating Institutions**

- NSW Department of Primary Industries, Australia
- Indonesian Vegetable Research Institute, Indonesia
- Syiah Kuala University, Indonesia
- Food Crops Agricultural Service, Indonesia
- AUSTCARE, Indonesia
- Assessment Institute for Agricultural Technology (Aceh), Indonesia
- Yayasan KEUMANG, Indonesia

**Project Budget:** \$500,007

**Project Duration:** 01/12/2006 to 30/11/2009

**ACIAR Research Program Manager:** Dr Gamini Keerthisinghe

### **Project progress**

#### **Year 2 (01/06/2007-31/05/2008)**

During this reporting period, good progress has been made against the stated objectives, activities and milestones. Key outcomes since the last reporting period include: completion of the soil analyses associated with the Soil Assessments (Activity 1.1), completion of two farmer-participatory research trials and initiation of three others (Activity 1.2), completion of the Regional Training Course in Thailand by one project team member from Aceh (Activity 2.2), and initiation of the baseline survey (Activity 3.1). A "Short Course on Chilli Pepper Integrated Crop Management" (Activity 2.1) was held in Banda Aceh. Preparations for the Vegetable ICM Workshop (Activity 2.2) and Training of Trainers (Activity 2.3), which are planned for October 2008 have also commenced.

Analyses of soil test results for the Soil Assessment were completed for all 21 sites across five Districts: Aceh Besar, Pidie, Pidie Jaya, Bireuen and Aceh Utara. Micronutrient analyses were conducted at the Indonesian Soil Research Laboratory in Bogor, while macronutrient analyses were conducted at the Assessment Institute for Agricultural Technology (BPTP) NAD soil laboratory. The results are currently being analysed and used to prepare a short scientific communication for publication in a relevant scientific journal.

Several soil amendments have been identified for overcoming soil constraints, including manures, compost and lime. These are being evaluated in current research trials. One pepper and one cucumber trial were completed during this reporting period. The farmer-participatory chili pepper trial in Bireuen produced an excellent crop and was harvested 8 times. The farmer-participatory cucumber trial in Pidie Jaya also proceeded very well and was harvested 6 times. A cucumber trial was recently planted in Lhoknga, Aceh Besar. Two trial sites were abandoned due to neglect by our farmer cooperators; these have been replaced with more dedicated farmers. Preparations are now being made to plant a cucumber trial in Bireuen, pepper

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and amaranth trials in Pidie Jaya, and cucumber and pepper trials in Pidie.

The Short Course on Chilli Pepper Integrated Crop Management (ICM), held on 17 January 2008, had 23 attendees from BPTP NAD, the Food and Horticultural Crops Agricultural Service NAD and Non Governmental Organizations (NGOs).

The project continues to facilitate linkages with research and NGOs in Indonesia and internationally, and build the technical capacity of Partner Country project team members. An example of this is the participation of Saufan Daud (BPTP NAD) in the Center's Regional Training Course (RTC) on Vegetable Production and Marketing in Thailand from November 2007 to January 2008. Project team members Peter Ooi, Chris Dorahy and Manuel Palada presented material to RTC participants, and Ooi coordinated the entire RTC.

Planning for the Vegetable ICM Workshop and Training of Trainers commenced in January 2008. Fifteen Resource Persons are already committed to present materials at these events.

Subhan has sent various IVEGRI germplasm to BPTP NAD – tomato, chili pepper, cucumber, eggplant, yard-long bean, *caisim* and kangkong. A demonstration plot at BPTP NAD was recently planted with chili pepper, tomato and cauliflower.

The baseline survey was initiated in January 2008, when Madhusudan Bhattarai trained the coordinator and six enumerators in various survey techniques. Data collection was conducted from January to May 2008, primarily through interview processes with questionnaires. There are 30 - 35 respondents per village, in 8 villages across five Districts. The survey focuses on chili pepper and other vegetables, with comparisons to rice. Data is now being entered for subsequent analysis.

An update on the project was published in the May 2008 edition of "Pertanian Pasca Tsunami – Agriculture after the Tsunami" newsletter.

## SMCN/2005/118: Restoration of annual cropping in tsunami-affected areas of Nanggroe Aceh Darussalam Province, Indonesia

### Summary

The earthquake and tsunami damage in western Nanggroe Aceh Darussalam (NAD) Province on 26 December 2004 resulted in great loss of the farming population, destruction of agricultural and other infrastructure, deposition of marine sediments and inundation of saline water on formerly productive fields. In a number of locations changes to landforms and elevation resulted in major changes to drainage patterns.

Basic infrastructure and accessibility have improved in the western coast districts, which were the most severely affected. There has been shift from disaster recovery and emergency aid to the re-establishment of livelihoods. Current food aid to people displaced by the tsunami now needs to be replaced with locally produced food.

The main field crops affected by the tsunami in NAD were wet-season rice grown in rotation with cash crops such as peanuts, soybeans, maize and vegetables (*palawija* crops). This project is assisting the re-establishment of rural livelihoods based on annual cropping, to reduce the reliance on food aid in tsunami-affected areas of NAD and in particular extend existing agricultural RD&E to food-cropping areas of western coastal districts.

The specific objectives of the project are to:

- strengthen and rebuild the technical capacity of extension services at provincial (NAD-BPTP), district (*kabupaten*) and subdistrict (*kecamatan*) levels to manage tsunami-affected soils and restore crop production
- develop and demonstrate soil management practices to restore the productivity of annual crops in tsunami-affected production areas
- develop and implement a communication strategy for information exchange between government, non-government and community interest groups working to restore agriculture to tsunami-affected land.

### Project information

**Overseas Collaborating Countries:**  
Indonesia

**Commissioned Organisation:** NSW  
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### Project Web Site:

<http://www.dpi.nsw.gov.au/research/projects/06P302>

### Collaborating Institutions

- Assessment Institute for Agricultural Technology (Aceh), Indonesia
- Indonesian Soil Research Institute, Indonesia
- Indonesian Institute for Rice Research, Indonesia
- Assessment Institute for Agricultural Technology (North Sumatra), Indonesia

**Project Budget:** \$858,059

**Project Duration:** 01/09/2006 to 31/10/2008 (Project extended from 01/09/2008 to 31/10/2008)

**ACIAR Research Program Manager:** Dr Gamini Keerthisinghe

### Project progress

**Year 1 (01/09/2006 12:00:00 AM-31/05/2007)**

OBJECTIVE 1. Strengthen and rebuild the technical capacity of extension services at provincial (NAD BPTP), district (*Kabupaten*) and subdistrict (*Kecamatan*) levels to manage tsunami-affected soils to restore crop production.

OBJECTIVE 2. Develop and demonstrate soil management practices to restore the productivity of annual crops in tsunami-affected production areas.

OBJECTIVE 3. Develop and implement a communication strategy to facilitate information exchange between government, non-government and community interest groups working on restoring agriculture to tsunami-affected land.

The project has field activities which focus on monitoring changes in soil salinity during the post- tsunami period as well as introducing improved agronomic and nutrient management practices for rice, peanuts and soybeans.

*Subprogram 7: Technical cooperation to underpin medium-term rehabilitation and development of agriculture and fisheries in Aceh*

Soils have been monitored for salinity at 20 sites across the districts of Aceh Barat, Aceh Besar, Pidie and Bireuen. The monitoring shows soil salinity is declining and is now a less significant limitation to crop production than during the first year after the tsunami. Leaching by rainfall and floods has reduced soil salinity levels. Flooding and poor drainage have caused production losses from waterlogging. Rates of leaching vary with length of inundation of seawater, soil type and amount of rainfall and access to drainage systems. Tidal affected croplands remain saline.

The laboratory at BPTP has been repaired and upgraded, including training of BPTP NAD staff at ISRI, Bogor.

Ten research and demonstration trials have been completed for soybean, rice and peanut crops focussing on soil and crop issues, demonstration of cropping techniques to manage tsunami-related problems, varieties (especially salt-tolerance in rice), and Integrated Crop Management systems.

The capacity of staff at the provincial and district levels has been improved in the area of soils using Soils Training Workshops and Train the Trainer activities to allow District staff to train a wider pool of extension staff.

Information about the progress of research and extension on tsunami-affected agriculture is presented in a regular newsletter, the placement of project outputs on the project web page -

<<http://www.agric.nsw.gov.au/reader/wollongbar/aceh.htm>> - communications workshops in districts for farmers and extension staff and an annual communications forum bringing together extension staff, researchers, leading farmers and NGOs to present and discuss issues relating to farming on tsunami-affected land in Aceh.

Feedback collected from workshops and forums has assisted the development of a soil biology booklet (Appendix 1) and highlighted the need for accessible pest identification materials for farmers and extension staff. Whilst there is valuable information available on the internet, extension staff and farmers have limited access to this material and require a format more appropriate to their needs.

## 5 Projects expected to start in 2008–09

Project number	Project title
ADP/2005/068	The impacts and policy implication of plausible futures for Indonesia and Australia, including for economic development and structural adjustment
AH/2007/106	Improvement and diversification of Sweetpotato-Pig Production Systems to support livelihoods in Highland Papua and West Papua, Indonesia
FIS/2005/137	Control of VNN virus in finfish
FIS/2006/126	Sandfish pond-culture in Indonesia, Philippines, Vietnam
FST/2006/117	Capturing more value from Indonesian forest plantations through enhanced timber processing and manufacturing options
HORT/2006/146	Management of fruit quality and pest infestation on mango and mangosteen to meet technical market access requirements
SMCN/2007/040	Building more profitable and resilient farming systems in Nanggroe Aceh Darussalam and New South Wales

## 6 Indonesia chapter from the Annual Report 2007–08

AOP budgeted expenditure in 2006-07	\$11,909,632
Actual expenditure in 2006-07	\$11,877,511
Expenditure in 2005-06	\$9,673,583
Expenditure in 2004-05	\$6,245,959

Key performance indicators	Performance 2007–08
Evidence of contribution of ACIAR projects designed to the Australian–Indonesian collaborative effort on improved fisheries management and illegal fishing	Research findings and policy networks on shared fish stocks continue to support constructive dialogue between Indonesia and Australia aimed at establishing agreed joint management arrangements for key fishery resources. Red snapper is the first stock selected for consideration. A new project is consolidating the earlier effort and exploring innovative frameworks for the management of Indonesia's complex domestic fisheries, including the reduction of IUU fishing.
Enhanced 'best-management' practices developed and implemented across several aquaculture production systems	Best Management practice (BMP) husbandry packages have been developed and validated for several different shrimp production systems. A regional project is now in place with the Network of Aquaculture Centres in Asia to foster the timely exchange of information between countries. BMPs for freshwater and marine fish cage aquaculture are under development.
Better soil management methods for tsunami-affected soils recommended by BPTP and Dinas groups and in use by farmer groups in Aceh	Promising management practices such as application of manures, use of salt-tolerant crop species and improved crop rotations have been identified to reclaim and increase productivity of tsunami-affected soils. Field demonstrations have been conducted in close collaboration with the Assessment Institute for Agricultural Technology, provincial and local government and farmers.
Evidence of information flow from animal health projects into Indonesian Government policy-making on avian influenza	Strong participation from Indonesian researchers and government animal health system in a large ACIAR–Indonesia avian influenza program, including components aimed at institutionalising incident response. Staff turnover at senior levels delayed policy making.
Successful implementation of the adaptive research component of the Smallholder Agribusiness Development Initiative (SADI).	Fourteen new adaptive research projects commenced in Eastern Indonesia under SADI in 2007–08, representing completion of design and implementation of the research component in the first phase of SADI.
Improved seed systems assessed by the Indonesian potato industry	Discussions were held with the Indonesian potato industry on proposed ways to improve seed systems. Training workshops on seed potato care, handling and seed certification undertaken in early 2008 included, at industry request, additional information on ways to manage potato cyst nematode.
At least 40 per cent of new projects designed with potential for significant farmer or policymaker impacts within five years of completion	Fourteen of the 17 new projects commissioned in 2007–08 fell into this category.

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## 6.1 Position

In 2007–08, the Indonesia program applied research to support economic growth from agriculture, forestry and fisheries in Java and parts of Sumatra and eastern Indonesia. It maintained a focus on high-value commodities (for which there is strong market demand) that are identified as priorities by the Indonesian Government and for which major constraints require attention through research, although under ACIAR-SADI projects were initiated to tackle staple crops such as rice and legumes as these are critical for food security in Eastern Indonesia.

ACIAR also addressed related pest and disease management, including shared biosecurity concerns, postharvest processing and market

development issues. Protection of the resource base for agriculture will be assisted by research collaboration on aspects of crop and livestock bio-security and sustainable forestry and fisheries management and through policy research on effective engagement in markets. A range of training and technical projects continued to assist in fisheries and agricultural rehabilitation in Aceh, affected by the December 2004 tsunami. The program built linkages between research agencies in agriculture, forestry and fisheries and policy/ implementation directorate–generals, and supported cooperation between central institutes and provincially based agencies.

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## 6.2 Achievements

### ***Subprogram 1: Improved policies to underpin agribusiness development***

Public and private sectors in Indonesia commonly use farmer groups as a structure through which they invest resources and implement development programs. A recent study aimed to understand how the behaviour of a group and the group leader can influence the group's provision of marketing support and its choice of selling method. Researchers used modelling to evaluate **the role that social capital plays in facilitating cattle smallholders' access to market opportunities**. They identified what specific characteristics of cattle groups and their leaders enable group members to successfully access cattle market opportunities in the important cattle-producing regions of Bali and Lombok. The study found that most farmer groups preferred to sell on-farm, and that those that preferred to sell at the market tended to focus more on cattle price and productivity and used group and leader strengths to sell cattle this way. The study also found great similarities between farmer groups in Bali and Lombok even though they were culturally and economically different.

The costs of the recent outbreaks of avian influenza (AI) in Indonesia have not only been in lives lost and birds culled and also economic disruptions and wider potential flow-on to tourism. A project to **quantify the full economic costs of bird flu** through socio-economic research is well underway with findings and information keenly sought by agencies dealing with AI control. The research benefits funding

decisions and policy responses and helps guide the national efforts to manage AI with a focus on integrating human health, bird management and indirect consequences to industries such as tourism. Four household surveys have been undertaken involving Balinese and Lombok medium-size producers of broilers and layers and Balinese and Lombok smallholder producers of kampung chickens. The survey work has been supplemented by interviews with upstream and downstream agents and government officials and a computable general equilibrium model capturing the indirect economic effects of the avian influenza epidemic based on secondary data has been developed. Workshops have further disseminated the project results.

Another policy project is **assessing technical change in Indonesian agriculture** to identify agricultural industries that have shown productivity growth and determine why they have grown. The project, also underway in Thailand, is also looking at the economic and social effects of the technological change, including effects on agricultural trade, income distribution and poverty. The Indonesia team made substantial progress with assembly of the data set on agricultural inputs and outputs which will be used for statistical analysis of the nature of technical change and with the general equilibrium analysis of the social and economic effects of technical change

in Indonesian agriculture. Modelling problems encountered have proved to be helpful in training project participants in the rigorous testing of national general equilibrium models for consistency.

### ***Subprogram 2: Biosecurity cooperation and pest and disease management in agriculture and plantation forests***

#### *A. Animal diseases*

The **ACIAR–Indonesia avian influenza and zoonotic disease research and development program** was implemented during this period. The program of targeted initiatives aims to provide necessary underlying research required to implement effective control programs for HPAI. The \$8 million program is closely aligned to Indonesian Government, AusAID and other donor priorities for control of the disease and include underpinning research on:

- **economic impacts** of the disease – which are being defined by household and enterprise survey to inform policy decisions on disease control approaches.
- **ducks** – which are considered to be a reservoir host of the virus and therefore important when control programs are being implemented. The patterns of the disease spread and response to vaccination in the duck are being investigated.
- the virus that causes avian influenza – which is capable of changing its surface structure over time and the influence of this on the effectiveness of **vaccination** is being monitored.
- the **movement of birds** – which is an important means of virus spread and knowledge of this spread is critical for implementing regional or island control programs.
- effective **quarantine procedures** for individual enterprises – which will be tested in collaboration with the commercial poultry sector in Indonesia. While the Indonesian Government has initiated significant control programs, to be effective they must be implemented by the community. ACIAR helped to address this through a scoping study to define the non-integrated commercial poultry sector and identify the factors influencing its economic and social sustainability. A new project has now commenced to foster adoption of least-cost biosecurity measures throughout the entire Indonesian poultry industry. It involves case study areas in Bali, South Sulawesi and West Java where project

participants will record the levels of within-community adoption of project outcomes. The project will also study the market chain to ensure that the biosecurity measures suit the cultural and institutional characteristics of the market.

Problems encountered in national programs to control avian influenza prompted the Indonesian Government to approach ACIAR for assistance in **strengthening veterinary services**. In light of the recent increased decentralisation of government services, ACIAR sponsored an investigation into possible future directions for animal health services, both systemically and with specific disease entities. The study addressed five diseases of primary concern – avian influenza, anthrax, brucellosis, rabies and the transboundary disease of pigs and classical swine fever. The integration of activities and resources of stakeholders was the likely key to strengthening government veterinary services. Strategies to be developed and tested were pilot projects on priority diseases using integrating task force structures, activities to enhance the coordination role of provinces, strengthening capability at district and sub-district level, and more clearly defined roles of all stakeholders.

**Diseases transferred from animal to humans** (zoonoses) are an ongoing concern in Indonesia. A study identified the important zoonotic diseases, attempted to quantify their costs to the nation and then recommended research to address issues presently limiting effective responses and control. The team identified the highest priority diseases as brucellosis and cysticercosis followed by toxoplasmosis and avian influenza, and lastly anthrax and rabies. Many of the suggested disease-specific research involved recurring themes – disease surveillance, effective control programs and training of animal health staff at different levels in principles of epidemiology and surveillance.

ACIAR has made a significant investment in the **study and control of Jembrana disease**, an acute viral infection of the Bali cattle species dominant in Eastern Indonesia. One major outcome is the development of a recombinant protein subunit vaccine for which it is anticipated that a vaccine company in Indonesia will

manufacture and distribute under licence. Work continues towards the development of specific serological tests to aid in Jembrana disease diagnosis and control.

#### *B. Crop and forest pests and diseases*

As a result of a **study of fruit flies** in 16 provinces of Indonesia, scientists and policymakers now have access to a list of species occurring in these regions. Staff at the collaborating institutions received training in fruit fly surveillance techniques. This training helped members of the Food Crops and Horticulture Protection Centre to establish a fruit fly trapping network in six provinces. A controlled environment fruit fly rearing facility at the Pest Forecasting Centre in Jatisari now supplies flies for attractancy testing of protein baits, and a protein bait plant is now functioning at the PT MultiBintang Brewery in Tangerang. A workshop held in mid-2007 has provided Indonesian quarantine and crop protection staff with knowledge of **how to define a fruit-fly-free area**, how to maintain it and the costs involved in dealing with the eight major fruit fly pest species in Indonesia.

The banana industry in Indonesia has been hard hit by two diseases – **Fusarium wilt and blood disease**. Two projects are in progress, focusing on Indonesia but also Papua New Guinea where there is a potential problem. The projects have improved the understanding of the diseases and the diagnostic tests for detecting them. Extension agencies and the Indonesian Banana Wilt Task Force have been instrumental in sharing the best practice management options for wilt diseases with farmers. Scientists in the first project have developed improved diagnostic tests to detect the diseases, and have established a best-practice management regime which they are demonstrating to farmers. The second project is working to learn more about Fusarium wilt disease and aims to map the geographic spread of the wilt in its various forms. Help is at hand through resistant plant varieties, biocontrol, and use of low-cost tissue culture for planting disease-free bananas and undertaking routine surveillance. The recipe for success is going to be the participatory approach by involving farmers right from the start in the development and validation of disease-management strategies.

Another key project has investigated the **integrated disease management of the Chilli pepper** (*Capsicum* spp.) for *Phytophthora*, anthracnose and gemini viruses. Three important chilli production regions in Central Java were selected for baseline survey and evaluation work of this important cash crop. A

site coordinator's office has been established in Tegal and Rapid Rural Appraisals were conducted and several trials were carried out in farmers' fields, including crop management trials to evaluate a combination of plastic mulch, bio-fungicide, or synthetic fungicide and also physical barriers to reduce whitefly movement. Total yields of plots with the high barrier and insecticidal sprays were more than double that of untreated plots that simulated conventional farmer practice. Unfortunately, losses to anthracnose in this trial exceed 50 per cent of the harvested crop, regardless of treatment. Researchers are already seeing local growers imitating this treatment by erecting barrier walls of various sorts around their chilli gardens. Some 225 farmers have been included in the baseline survey work and household surveys are also being completed. Pathologists at The World Vegetable Center in Taiwan have collected isolates of *Geminivirus* pathogens, which are being used in focused studies of virulence and symptom expression.

As the Asian **citrus disease, Huanglongbing** (HLB), is spreading and threatening the region's production, an ACIAR-supported project is helping to develop control strategies for the disease. While white oil and insecticide were effective, they proved to be too expensive for the small farmers. So researchers turned to insect predators and are also trialling intercropping orange trees with guava trees. While trials have suggested that the presence of guava suppress citrus psyllids that carry the bacterial disease, guava leads to another problem of fruit flies. While work continues, a mix of controls (weaver ants, oil and guava) has shown to be benefitting growers in their orchards.

Indonesia is one of a number of South-East Asian countries trialling and adapting the Integrated Ecological Rodent Management system. The concept has been refined over a decade by ACIAR and CSIRO Sustainable Ecosystems through nine projects and across five countries. The National Rodent Management Program in Indonesia has now been developed following the ACIAR-supported research in West Java, **allowing villages to reduce rat numbers and crop losses**. At trial sites, yields increased by between 0.1 and 0.9

tonnes a hectare and farmers using chemicals fell to 46 per cent. Yields at control sites did not rise and chemical usage remained constant at 88 per cent.

### ***Subprogram 3: Research to underpin development of competitive horticultural agribusinesses***

Research, development and extension work to support the **development of potatoes and rotational crops** has made significant progress with two projects focussing on growing potatoes as cash crop. Integrated crop management Farmer Field Schools have been established in 10 communities in West Java and 10 communities in Central Java as part of a project to develop potato, Brassica and shallot production and postharvest systems in the provinces of West and Central Java, South Sulawesi and Nusa Tenggara Barat. The crop management and economic baseline survey for the first potato crop was completed and analysed with key findings on soil and nutrient data providing information to enhance yields. A second project focuses on improving the **organisation and efficiency of the supply chain** and finding new ways for horticulture crop farmers to access the supply chain and markets. The project will use a participatory market chain approach. In earlier applications by the International Potato Center, the approach has built trust between stakeholders, promoted collective action and stimulated market-driven innovation. The project will ultimately see farmers participating in two specific types of supply chain: fresh-product markets involving assemblers/wholesalers/retailers/institutional buyers and processed-product markets including chip factories and snack food enterprises.

### ***Subprogram 4: Productive smallholder aquaculture and agroforestry systems***

Developing carbon markets to help lower **greenhouse gas emissions** is a concept gathering momentum around the world. An ACIAR-funded economic study in Indonesia has explored the potential for smallholder agroforestry to gain multiple benefits – reduce deforestation, lower CO<sub>2</sub> emissions, and reduce smoke-induced health and pollution problems from slash-and-burn agriculture. The study found that smallholders lacked the credit to plant trees and wait the considerable time before income is generated. Often they had no security of tenure on the land they farmed. Researchers recommended that carbon credits be sought to provide funding and that farmers gain economies of scale for their agroforestry

enterprise by grouping together and pooling land resources.

Research supported by ACIAR has developed **best-practice health management practices for shrimp farmers** including polymerase chain reaction (PCR) and epidemiological tests to identify white spot and other diseases which can be devastating for small farmers. Building on important partnerships and experiences from a predecessor project, this project has taken a two-pronged approach with laboratory work and field work. At field level, the researchers delivered training to farmers using demonstration ponds operated by leading farmers. Groups of farmers have successfully produced several crops of high-quality shrimps and researchers know more about best management practices suited to traditional farmers. Laboratory work has expanded understanding of yellowhead virus and detected Laem Singh virus, a possible causal agent for Monodon slow growth syndrome in black tiger shrimp from Indonesia, Malaysia and Vietnam.

Another key aquaculture project has targeted the improvement of returns and expansion of the aquaculture industry into land-based systems by studying **site selection and environmental suitability of aquaculture ponds**. Solid progress has been made with the completion of fieldwork, data analyses, production of draft site selection criteria and associated draft land capability maps. The work forms the basis for production of informative land classification schemes and maps for a variety of land-based aquaculture systems in Indonesia. Farmer- and district-based workshops have been held to plan community extension programs. The project also co-developed mapping models for another seacage farming project and has also developed links with another disease management project with the integration of information on pond management to minimise the effects of soil and water quality on disease outbreaks.

Shrimp farming can be profitable and sustainable and access opened to export and premium domestic markets through the **proper management of biosecurity and compliance with product quality and food safety standards**. A linked project has developed and validated model programs combining better

management practices and participatory extension methodologies. Extension and health management services will work at district and provincial levels to facilitate BMP adoption among four selected farmer groups: two in Central Java and two in South Sulawesi and complementary programs for broodstock suppliers, hatcheries and 'middlemen'.

A study of **hatchery and growout technology for marine finfish** in the Asia–Pacific region has a major component underway at the Research Institute for Mariculture in Gondol. Results include the finding that additional vitamin C helps to reduce deformities in larval and juvenile grouper. As well, researchers have isolated and evaluated different rotifer strains, determining that the smallest strain was best suited for first feeding of grouper larvae. At Maros in Sulawesi, scientists evaluating feed ingredients found that tiger grouper could efficiently digest animal feed ingredients, holding promise of their potential to replace fish meal. At Labuange Bay in southern Sulawesi three treatments of fish feed (trash fish, moist pellet and commercial pellet) are being evaluated and compared on five commercial farms growing tiger grouper.

Suitable **diets for cultured mud crabs** have been studied in Indonesia, as well as Vietnam and Australia. As with the marine finfish, scientists wanted to determine the potential of poultry meal and soybean meal to replace fishmeal in diets of juvenile mud crabs. Crabs were able to readily digest a broad range of plant- and animal-based feed meals. In trials, up to 40 per cent of fishmeal could be replaced by high-protein plant- or animal-based meals without significantly reducing growth performance.

A feasibility study undertaken on the island of Lombok investigated how to improve **growout and nutrition in lobster aquaculture**. The industry has developed as a by-product of grouper and seaweed culture which both involve floating rafts to which the juvenile lobster are attracted. The study team concluded that there was an opportunity to expand the industry in Lombok, guided by research for the industry in Vietnam that has taken place through other ACIAR projects.

#### **Subprogram 5: Sustainable utilisation and management of fisheries and forestry resources**

For more than 400 years teak has grown in intercropping systems as a common part of local farming systems in South East Sulawesi. Emerging community involvement in forest management in line with changes in Indonesian

Government policies will help to **increase the planted areas of teak**. A recent study will guide ACIAR and Indonesian counterparts in planning its assistance for smallholder teak growers. Opportunities include establishing reliable inventory systems, improving cultivation options and intercropping alternatives, primary processing of timber and use of log off-cuts, and in testing the suitability of alternative plantation species to grow in association with teak.

In a project designed to optimise the gains possible from **genetically superior tree species**, scientists are determining nutrient and water needs for best performance. Target species are *Acacia mangium* and *A. crassicarpa*, and trial plantation sites have now been successfully established in Indonesia and Australia. In both countries, only limited information exists on soils, and outcomes from this project will contribute knowledge on soil chemistry from the focus areas. Performance of the best available genetic material is being assessed across a range of phosphorus (P) supply treatments (which also include basal nutrients), and in a high P treatment without basal nutrients. In another part of the project, a sociological study has surveyed small farmers to determine the factors limiting adoption of *A. mangium* plantations.

#### **Subprogram 6: Profitable agribusiness systems for eastern Indonesia**

As a partner in the **Smallholder Agribusiness Development Initiative (SADI)**, ACIAR is supporting the development of more-profitable agribusiness systems in eastern Indonesia through better access to new knowledge underpinning improved production and marketing of agricultural products. Responding to priorities of the four target provinces, ACIAR's component of SADI (Support for Market-driven Adaptive Research: SMAR) completed 11 new scoping studies and commenced 14 market-oriented adaptive research projects in 2007–08. The 20 active projects under SMAR, with a total committed value of \$8.7 million, involve research on livestock, horticulture, forestry, aquaculture and field crop systems as well as agribusiness development. In support of these

activities, over 400 training opportunities were provided to Indonesian R&D staff in research management, research skills and specific technical skills, aimed at building individual and institutional capacity to conduct adaptive research and communicate the outcomes to next users.

Active SMAR projects, involving partners from national, provincial and local institutions and a number of different private sector organisations, are addressing key constraints within the supply chains to improve **supply chain competitiveness and smallholder profitability**. While covering several commodity sectors, the projects capture key globally relevant themes for smallholder agribusiness systems including:

- supplying increasing demand for animal proteins, such as scaling out appropriate livestock productivity technologies
- smallholders benefiting from high value products, such as improved supply of aquacultured lobsters
- using regionality as a competitive position, such as capitalising on South Sulawesi passionfruit being recognised as unique throughout Indonesia
- more efficient input management for improved terms of trade, such as the use of alternative feed options for cattle production and improved capacity for changing practice.

**Linkages with specific agribusiness supply chains** are being developed with the assistance of another partner in SADI, the International Finance Corporation (IFC). Working with provincial governments, IFC is identifying lead firms linked to high-priority agribusiness supply chains in eastern Indonesia and partnering with those firms to improve supply chain efficiency. At the same time as IFC identifies lead firms, ACIAR is developing research activities to address significant productivity and profitability issues in those supply chains. **Peanuts**, for example, are a significant cash crop for farmers in Lombok, grown on 37,000 ha following the main rainfed grain crop. IFC has partnered with a major peanut buyer and processor in eastern Indonesia, GarudaFood, to improve farmers' access to markets, finance and technical support. GarudaFood currently sources peanut from 3,500 farmers but, through the partnership with SADI, plans to expand to 18,000 farmers. An ACIAR project is supporting this work by working with the farmers linked to GarudaFood to address the significant technical issues affecting productivity and profitability, including access to good quality seed, new varieties, poor management practices and water management.

Another sector, **cocoa**, is the main source of income and livelihood for over 500,000 smallholder households and contributes significant foreign exchange earnings. However, the quality and productivity of cocoa is in decline due primarily to pest and disease pressure, aging tree stock and declining soil fertility. Farmers are experiencing total losses of up to 50 per cent of their potential production. ACIAR is supporting research to address these key technical issues in partnership with IFC who are supporting an industry forum (the Cocoa Sustainability Partnership) and identifying lead cocoa agribusinesses with which they can work.

ACIAR is also directly funding research aimed at **strengthening agribusiness supply chains** by improving both productivity and supply chain efficiency. One of the 20 new projects under SMAR is developing strategies for making the eastern Indonesian **smallholder beef sector** more competitive and profitable by benchmarking beef supply chains. The project is specifically targeting the benchmarking to areas of eastern Indonesia where ACIAR is also funding research to improve the productivity of Bali cattle (through improvements in feeding, mating, cow-calf management and husbandry). In particular two large projects are focusing on improving management approaches and effective linkages to markets so that smallholder Bali cattle producers can move from being opportunistic keepers of livestock to market-oriented producers. In West Timor, studies are in progress to **integrate forage legumes into the maize cropping system**. A major aim is to augment supply of quality fodder for livestock and ensure availability towards the end of the dry season. Project scientists have already identified some suitable forage species which are now undergoing on-farm assessment. It is critical to ensure that forage production becomes self-sufficient in supply of seed, and this milestone was reached in the first year of the project. Efforts are now underway to produce seed commercially.

As well as funding research projects to help improve the profitability of agribusiness systems in eastern Indonesia, ACIAR is **building the capacity of the Indonesian R&D system to conduct research oriented towards more profitable agribusiness**

**systems.** ACIAR's main partner agency in SADI (the Indonesian Centre for Agricultural Technology Assessment and Development: BBP2TP) is beginning to implement best practices from the partnership with ACIAR to an additional 14 provinces outside of the SADI target provinces, using their own resources. ACIAR will assist the piloting of this scale-out.

A project has examined how **seasonal climate forecasting** could lead to better irrigation system management in Lombok. The scientists modelled water availability throughout the system, taking into account different climate, water, land and institutional constraints. They determined that significant economic gains could be realised through water allocation and cropping decisions at a scale suited to Lombok's small farms (0.25 ha on average). But a major issue encountered was that farmers growing crops on farms of this size are risk-averse, leaving them reluctant to adjust cropping patterns on their farms on the basis of the available climate information.

### ***Subprogram 7: Technical cooperation to underpin post-tsunami rehabilitation of agriculture and fisheries***

Efforts to **restore annual cropping in tsunami-affected areas** of Nanggroe Aceh Darussalam Province continued. Field activities focused on monitoring changes in soil salinity during the post-tsunami period. At 20 sites across the districts of Aceh Barat, Aceh Besar, Pidie and Bireuen soil salinity is declining and is now a less significant limitation to crop production than during the first year after the tsunami. As part of the need to introduce improved agronomic and nutrient management practices, the scientists have established 10 research and demonstration trials for soybean, rice and peanut crops. These have examined soil and crop issues, especially cropping techniques to manage tsunami-related problems, and have led to selection of best-suited varieties (especially for salt tolerance in rice) and promotion of integrated crop management.

A key multilateral project is conducting a **vegetable research and development project in the tsunami-affected areas** of Indonesia. The vegetable production technologies will be shared with thousands of Indonesian farmers to enable sustainable, long-term development in tsunami-affected areas. Vegetables with medium to high salt tolerance likely to have an

advantage in affected soils—tomato, cucumber and cauliflower—have been identified and the soil analyses completed. Two farmer-participatory research trials have been completed and another three initiated. Work has also begun on analysis of the baseline survey (focused on chilli pepper and other vegetables, with comparisons to rice) conducted in eight villages across five Districts. A Short Course was run in Banda Aceh and preparations are underway for a Vegetable Integrated Crop Management Workshop and training of trainers. The project is having a positive impact on the rural communities and farmers are interested in being involved.

Another major sector affected by the Tsunami was aquaculture. The Food and Agriculture Organisation (FAO) estimates that about 20,000 hectares of coastal aquaculture ponds were damaged or destroyed. The Australian Government is rebuilding the Brackish-water Aquaculture Development Centre at Ujung Batee as part of the Australia–Indonesia partnership and has funded a program to build the capacity of staff. The ACIAR-delivered capacity building project will support **the reconstruction of coastal aquaculture** and also the longer term development of sustainable aquaculture. Staff have been trained in laboratory techniques, including polymerase chain reaction (PCR) techniques to test for shrimp and fish viral diseases. A joint ACIAR–ATSE Crawford Fund training activity has assisted in the development of improved disease monitoring and diagnostic practices for aquaculture in Aceh. An extension to the project will allow facility- and field-based training to be completed as planned, and will support a staged transfer of full management responsibility for ongoing project activities to staff. The Australian Prime Minister, Hon. Kevin Rudd, MP, visited and officially opened the reconstructed facilities of BBAP Ujung Batee in June 2008. This event was very successful in showcasing this part of the Australian aid program in Aceh not only to the Australian Prime Minister, but also to the local community and senior government representatives.

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## 6.3 Restoration of annual cropping in tsunami-affected areas of Nanggroe Aceh Darussalam Province, Indonesia

Agricultural soils affected by the 2004 tsunami in Aceh are now more productive thanks to a joint project between ACIAR, NSW Department of Primary Industries, Aceh's agricultural extension service (BPTP), the Indonesian Soil Research Institute (ISRI) and the Indonesian Centre for Rice Research (ICRR). The project rebuilt and strengthened the technical capacity of Aceh's agricultural extension staff, and developed and demonstrated soil management practices to restore farm productivity.

The project established 21 monitoring sites in four districts—Aceh Barat, Aceh Besar, Pidie and Bireuen—to monitor soil salinity and nutrients and their impact on crop production. The laboratory at BPTP was repaired and upgraded to enable on-site soil and water testing. The project provided EM38 instruments and soil test kits, and trained BPTP staff to enable rapid on-site assessment of salinity levels and soil and crop problems, so that farmers did not waste time and resources growing crops in unsuitable soils. Train-the-trainer workshops extended this training to extension staff and NGOs from tsunami-affected districts. Field trials were established to investigate techniques to reduce tsunami-related soil and agronomic constraints and field plots demonstrated technologies and practices that improved yields of rice and palawija crops such as soybeans and maize. ISRI provided soil sampling, analysis and mapping expertise and ICRR assisted with trial design, seed supply and biometric analysis, and conducted pot trials. In most areas, salinity levels dropped relatively quickly because Aceh's high rainfall leached the salt through the soil profile. However, many crops continued to have lower yields than before the tsunami, possibly due to removal of organic matter by the tsunami, and reaction of seawater and soil minerals.

The death toll from the tsunami destroyed many social networks, so building communication networks between farmers and government and NGO agricultural groups was

also a high priority for this project. Annual communication forums established networks between researchers, extension staff, NGOs and farm leaders. Participants presented and discussed issues relating to farming on tsunami-affected land in Aceh. NSW DPI introduced techniques to encourage debate and discussion among all participants at these sessions. Project staff met with farmers in the field to find out what agricultural information and assistance they needed. West coast farmers travelled to other districts to learn techniques from farmers growing crops in peat soils, as peat soils are prevalent in Aceh Barat. This exercise was greatly appreciated by the farmers. Women's farm groups were identified as a very important aspect of tsunami recovery, providing important social networks, occupation and income for the women who otherwise had few outlets in their traumatised communities. The local and Australian project team members have all reported that working with committee and enthusiastic partners and extension workers is one of the reasons that this ACIAR project in Aceh is so enjoyable and so successful.

The project also linked with an Asian Vegetable Research and Development Corporation project to restore vegetable cropping in Aceh's tsunami-affected soils. Printed information about the progress of research and extension on tsunami-affected agriculture was presented in a regular newsletter, a project brochure, and a web page:

<<http://www.agric.nsw.gov.au/reader/wollongbar/aceh.htm>>. Feedback from workshops and forums assisted the development of accessible materials for farmers and extension staff. A major output of the project will be an online manual to help people restore agricultural land after future tsunamis.

## 6.4 Projects concluded in 2007–08

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## **ADP/2007/044: Scoping study on impacts and policy implication of plausible futures for Indonesia and Australia**

### **Summary**

This scoping study is a collaboration between IFPRI and ACIAR to look at the agricultural system - from farm to market - in Indonesia.

### **Project information**

#### **Overseas Collaborating Countries:**

Indonesia

**Commissioned Organisation:** International Food Policy Research Institute, USA

#### **Project Leader**

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#### **Collaborating Institutions**

- Australian National University, Crawford School of Economics and Government, Australia

**Project Budget:** \$21,785

**Project Duration:** 01/07/2007 to 30/09/2007

**ACIAR Research Program Manager:** Dr Simon Hearn

### **Project outcomes**

Indonesian researchers need better information and adaptive capacity on the appropriate policies for natural resource management, strengthening of agricultural production and processing systems, agricultural market activities and trade, investment in research and development, and other skills essential for building the Indonesian economy. This brief mission to Indonesia by IFPRI and ACIAR conducted in August 2007 aimed to revisit and reconfirm the commitment of both organisations to the Indonesia government in providing expertise to strengthen the capacity of national partners. Two objective of the mission were to develop a full research proposal and to identify potential partners in Indonesia, Australia, and the wider research community.

## **AGB/2002/012: Technical change in Thai and Indonesian agriculture: measurement, socio-economic impact and policy implications**

### **Summary**

Productivity growth in the Thai and Indonesian agricultural sectors is an important driver of poverty alleviation. In Thailand more than 90 per cent of poor people reside in rural areas; in Indonesia this figure is more than 80 per cent. In both countries the majority of these poor people are engaged in agricultural production. Raising productivity levels in both cases would help reduce poverty. Growth in productivity in Thailand's agricultural sector has been significant, but the source of this growth is uncertain. Technical changes to improve agricultural productivity, such as improved crop varieties and management practices have been undertaken but the extent to which these have contributed to overall growth is not clear. Indonesia's experience has been different, with more rapid growth than Thailand until the early 1990s, followed by a decade of stagnating growth rates. Information about what types of technical change are most likely to reduce poverty is limited.

The role of public investment and extension services in productivity growth is also unclear. Since the economic crisis of 1997-98, both the Thai and Indonesian economies have experienced lower overall growth, and rising public debt. This has placed pressure the role of public investment, including in the use of investment in agricultural technology and its interactions with the broader economy and impacts on poverty alleviation. Answering these questions will help create an improved understanding of the role of technical change in agricultural productivity. The objectives of the project are:

- Statistical analysis identifying rates and factor biases of technical change in Thai and Indonesian agriculture.
- Dissemination of the results of above through workshops and publications.
- General equilibrium analysis of the social and economic effects of technical change in Thai and Indonesian agriculture.
- Dissemination of the results of above through workshops and publications.
- Development of capacity for general equilibrium analysis of technical change issues in Thai and Indonesian agriculture through training and hands-on experience.

**Research:** To analyse the effects that technological change in Thai and Indonesian agriculture has had on key economic variables which are important for public policy, including: poverty incidence, economic inequality, export performance, public finance, rural-urban migration, and the economic structure of the agricultural sectors of Thailand and Indonesia.

**Capacity building:** To develop the capability within BIOTEC, Chulalongkorn University, Institut Pertanian Bogor (IPB) and Center for Agro Social Economic Research and Development (CASERD) to sustain research of this kind after the project is successfully completed.

### **Project information**

**Overseas Collaborating Countries:** Indonesia, Thailand

**Commissioned Organisation:** Australian National University, Research School of Pacific and Asian Studies, Australia

### **Project Leader**

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### **Collaborating Institutions**

- National Center for Genetic Engineering and Biotechnology, Thailand
- Chulalongkorn University, Thailand
- Bogor Agricultural University, Indonesia
- Indonesian Centre for Agriculture Socio Economic and Policy Studies, Indonesia

**Project Budget:** \$399,799

**Project Duration:** 01/01/2004 to 31/12/2007 (Project extended from 01/01/2007 to 31/12/2007)

**ACIAR Research Program Manager:** Mr David Shearer

### **Project outcomes**

Final report not yet submitted by the project leader.

## **AGB/2004/028: Social capital and rural development in eastern Indonesia**

### **Summary**

Smallholders require improved access to agribusiness including through social organisations that improve efficiency by facilitating coordination - social capital. In Indonesia, smallholder empowerment in agribusiness is an agreed priority. The aim is to evaluate the role that community characteristics, in particular social capital, play in alleviating poverty through improving the ability of smallholders to link with agribusiness. Specific objectives are to understand the nature of, and differences between, community and agribusiness links in Bali/Lombok, to define the role of social capital in, and assist the development of, these linkages. A case study approach contextualises and interprets findings that will be published and presented at various fora before developing policies aimed at reducing transaction costs in these linkages. Capacity building will result in better accounting for social capital, leading to more efficient development programs in the medium-term.

### **Project information**

**Overseas Collaborating Countries:**  
Indonesia

**Commissioned Organisation:** University of New England, Institute for Rural Futures, Australia

#### **Project Leader**

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#### **Collaborating Institutions**

- NSW Department of Primary Industries, Australia
- University of Mataram, Indonesia
- Udayana University, Indonesia
- Assessment Institute for Agricultural Technology (NTB), Indonesia
- Assessment Institute for Agricultural Technology (Bali), Indonesia

**Project Budget:** \$149,334

**Project Duration:** 15/06/2006 to 31/08/2007  
Project extended from 15/06/2007 to 31/08/2007)

**ACIAR Research Program Manager:** Mr David Shearer

### **Project outcomes**

Public and private sectors in Indonesia commonly use farmer groups as a structure through which they invest resources and implement development programs. This has, however, met with varying success – sometimes specific programs have successfully provided welfare and productivity improvements while in other instances with seemingly similar groups these programs have proved unsuccessful. The contribution of this study was to build on this work and evaluate the role that social capital plays in facilitating cattle smallholders' access to market opportunities. It identified the characteristics of cattle groups and the leadership that predisposes them to be of more help to their members in accessing cattle market opportunities.

Bali and Lombok were selected as case study areas as they are important cattle-producing regions that have different social and cultural characteristics. Preliminary results and information from a qualitative analysis were used as a basis for a survey of group leaders (30 in Bali and 30 in Lombok) which aimed to gain a better understanding of the factors that influence a groups' ability to participate in the market. It was found that a group is more likely to provide marketing support (potentially giving group members greater ability to select and use their preferred selling technique) if:

- cattle are the most important source of income to the group members
- the group's main activity relates to cattle production and productivity
- the group has access to a greater number of government assistance programs
- the group has a more formal structure
- there are greater levels of trust between group members
- group members are more likely to address their cattle-related problems through self-reliant collective action
- the leader is more educated and owns more land

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- the leader has fewer personal linkages with other government, political and industry stakeholders
- the leader has confidence in his/her ability to lead, is trusted by group members, and is strongly motivated by success and finding solutions to problems.

After establishing the key qualitative finding that farmers preferred selling their cattle on-farm, a second model was estimated to identify the social capital, leadership and other characteristics of cattle groups predisposing members to sell their cattle on-farm rather than at public cattle markets. Estimation of this model was also a means of examining whether the stated preferences of farmers at the focus groups to sell on-farm were consistent with their revealed preferences as identified through econometric analysis. It was concluded that a group is more likely to sell at the market if:

- cattle are the major source of income to group members
- the main activity of a group is to improve cattle production
- groups are located close to cattle markets
- farming is the main occupation of the group leader.

Based on the qualitative and quantitative analysis the following conclusions can be made;

- Social capital matters and can be modelled; specific characteristics of the group and the group leader will influence a group's provision of marketing support and the choice of selling method.
- Under current institutional and cultural norms, farmer groups have a stated preference to sell on-farm (45 out of 60 in the last 12 months). Those that prefer to sell at the market tend to have more of a focus on cattle price and productivity and are using group and leader strengths to sell cattle this way.
- All stakeholders see cattle groups as important factors in integrating smallholders into the cattle market.
- Within most groups, cattle are not primarily managed and marketed to maximise profit, therefore, selling decisions are influenced by other social and economic demands.

- Groups successfully accessing cattle market opportunities tend to have high levels of member trust and ability to interact as a group with other stakeholders. They tend also to have leaders who are focused on group dynamics and trust and who have the ability and desire to lead the group in meeting its aims.
- Even though farmer groups in Bali and Lombok appear to be culturally and economically different the group and group leader characteristics that influence market selection are the same.

Findings from the study are being published and presented at various fora before developing policies aimed at reducing transaction costs in these linkages. Capacity building will result in better accounting for social capital, leading to more efficient development programs in the medium-term.

## **AH/2000/083: Development of a vaccine for the control of Gumboro in village and small poultry holdings in Indonesia**

### **Summary**

Infectious bursal disease, or Gumboro, is the second most serious viral disease of poultry (after Newcastle disease) in Indonesia. Infection with the virus suppresses the animal's normal immune response, with the result that other infections can readily take hold. The economic impact of IBD in Indonesia has been worsened by the appearance in 1991 of very virulent strains of the virus (referred to as vvIBDV). These variants caused up to 30% mortality in broilers and 60% in layers. Surviving birds perform poorly because of severe immunosuppression by the virus.

Chicken meat is the main source of dietary protein in Indonesia. But since the economic crisis of 1997, there has been a decline in availability of poultry meat and eggs. The traditional backyard farming of kampung (native) chickens continues, with more households adopting ways of intensive growing in response to the high demand for kampung chicken meat.

Unfortunately, most smallholders and backyard chicken farmers do not vaccinate against vvIBDV in spite of frequent heavy losses, because of the vaccine price and the packaging sizes available. As well, many kampung chicken owners are not aware of the importance of the disease. Consequently, subclinical disease, causing poor growth and non-specific deaths, is often not recognised.

Australia is one of the few countries free of vvIBDV, but Indonesia is a potential source for its introduction. Earlier collaboration between Australian and Indonesian researchers led to an approach from Indonesia's BALITVET to ACIAR for help in developing a local vaccine. Locally produced vaccines would be cheaper, and packaging could be tailored for use by smallholders.

### **Project information**

**Overseas Collaborating Countries:**  
Indonesia

**Commissioned Organisation:** University of Melbourne, Australia

### **Project Leader**

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### **Collaborating Institutions**

- Research Institute for Veterinary Science, Indonesia

**Project Budget:** \$575,704

**Project Duration:** 01/01/2001 to 31/12/2007 (Project extended from 01/01/2004 to 31/12/2007)

**ACIAR Research Program Manager:** Dr Peter Rolfe

### **Project outcomes**

All vaccinated flocks had good vaccination response, showed no mortality from Gumboro during the entire growing period, showed no signs of immunosuppression and growth performance at the end of growing period, as expected. Comparison of Ind4BV and Ind18BV with two commercial vaccines in broiler and village chickens indicated that both were as safe and as efficacious as the two commercial vaccines. Since in all field trials two of the vaccines performed well, they were consequently offered to local veterinary vaccine manufacturers for commercialisation in Indonesia. From three companies that expressed interest, two commercial partners were selected (Vaksindo and Caprifarmindo) and agreements made for transfer of vaccine seeds.

## **AH/2004/032: Identification of policy responses to minimise negative socio-economic impacts of an avian influenza epidemic in Indonesia**

### **Summary**

The costs of the recent outbreaks of avian influenza in Indonesia have been in lives lost, birds culled and economic disruptions. Quantifying the full economic costs through socio-economic research has not been undertaken. This is despite the need for such costings to be included in decisions on allocating funds. Such policy responses will be substantially aided by this research, targeting areas of uncertainty in relation to the direct and flow-on effects of a future outbreak and the intersection of policy initiatives relating to human health, bird management and indirect consequences to industries such as tourism.

### **Project information**

#### **Overseas Collaborating Countries:**

Indonesia

**Commissioned Organisation:** University of New England, School of Economics, Australia

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#### **Collaborating Institutions**

- Assessment Institute for Agricultural Technology (NTB), Indonesia
- Disease Investigation Center Region VI, Indonesia
- Assessment Institute for Agricultural Technology (Bali), Indonesia
- Bogor Agricultural University, Indonesia

**Project Budget:** \$399,641

**Project Duration:** 01/04/2006 to 30/06/2008  
(Project extended from 01/04/2008 to 30/06/2008)

**ACIAR Research Program Manager:** Dr Doug Gray

### **Project outcomes**

Final report not yet submitted by the project leader.

## AH/2006/038: Feeding papaya fruits and betel nuts to reduce parasite burdens and increase growth rate in pigs

### Summary

Internal parasites have been identified as the major health problem impacting on the growth and viability of pigs in the Jayawijaya Regency of Papua Province Indonesia. One of the major outcomes from the ACIAR funded project AS1/1998/054, Poverty alleviation and food security through improving the sweet potato–pig systems in Papua Indonesia, has been the development of a pig flow and management system that involves the use of dunging areas and rotational foraging of high-protein pasture grasses. However, even in this modified system, pigs develop significant parasite burdens within 3–5 months. The range of parasites provides a challenge in developing husbandry and control programs, and means that at least two different classes of parasiticides are needed for effective control.

The Jayawijaya Regency of Papua is one of the few areas in the world where local farmers do not have ready access to parasiticides. In the absence of regular treatment, researchers have investigated the prospects of using medicinal plants to reduce or limit the build-up of parasite burdens. Preliminary trials feeding pigs with papaya fruit (*Carica papaya*) and betel nut (Pinang or Areca nut) produced encouraging results. This project conducted further trials to assess the value of feeding pigs either papaya fruit, betel nuts or pineapple leaves to reduce parasite burdens, then monitored and quantified production effects in terms of growth rate and mortalities.

### Project information

**Overseas Collaborating Countries:**  
Indonesia

**Commissioned Organisation:** South Australian Research and Development Institute, Australia

### Project Leader

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### Collaborating Institutions

- University of Udayana, CSAD - Veterinary School, Indonesia

**Project Budget:** \$23,500

**Project Duration:** 01/07/2006 to 31/12/2007 (Project extended from 01/07/2007 to 31/12/2007)

**ACIAR Research Program Manager:** Dr Peter Rolfe

### Project outcomes

The results from preliminary experiments feeding pigs with either papaya fruit or betel nut were encouraging, but pigs would neither eat the pineapple leaves nor drink an infusion produced by boiling them. Dose response experiments were then designed to determine the optimum quantities of fruit and nut that should be fed to pigs to control endoparasitism. The data from these experiments were then used to design field trials using native pigs collected in the Baliem Valley.

Pigs with significant faecal egg counts of *Trichuris* and *Ascarid* parasites, and weighing approximately 10 kg, were allocated to one of three groups. All groups were fed the same diet (33% cooked sweet potato (SP) vines + 22% cooked SP roots + 34% ensilaged SP tubers and vines + 11% cooked banana trunk). In one group this was supplemented with 533 g papaya fruit/10 kg bodyweight/day for 5 consecutive days over 4 weeks, a second group received 4 g ground betel nut/10 kg body weight once, and a third group received no supplementation.

Following dietary supplementation, faecal egg counts in pigs fed either papaya fruit or betel nut were reduced to zero over a 2–3 week period, whereas faecal egg counts increased weekly in untreated pigs. *Trichuris* eggs increased from around 200 to above 500 eggs per gram (EpG) of faeces and *Ascarid* eggs increased from approximately 1,000 to between 6,000 and 7,000 EpG over the 8-week period. The control group was disbanded in the 8th week on welfare grounds and pigs treated with an anthelmintic. Pigs in the treatment groups were maintained until the end of 12th week when faecal egg counts were still zero.

While pigs in the control group lost weight. ( $-27 \pm 13.2$  g/day) over the 8-week period, pigs supplemented with either betel nut or papaya fruit recorded positive growth rates

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( $82 \pm 5.40$  and  $71 \pm 9.46$  g/day respectively over the 8-week period). Growth rates over the 12-week period were  $92 \pm 6.34$  and  $82 \pm 6.34$  g/day respectively.

The reduction in mortality and increased growth rates recorded for treated pigs was valued at more than \$A120/pig; thus farmers grossed \$A160–190 per treated pig compared with \$A40 per untreated pig. The results validate the feeding of either papaya fruit or betel nut to reduce and control parasite burdens in growing pigs in the short to medium term, and, while both had similar efficacies, betel nut proved to be more sustainable due to availability and ease of administration.

## **AH/2007/060: Scoping opportunities for improving bio-security in commercial poultry in Indonesia**

### **Summary**

Highly pathogenic avian influenza (HPAI) is now endemic in 31 of the 33 Indonesian provinces and is responsible for more than 100 human deaths. While the Indonesian Government is initiating significant control programs with regulatory support, it is believed that unless there is community ownership of control; through improved biosecurity on both the farm and the community, HPAI and other poultry diseases will continue to reduce profitability, increase poverty and cause human mortalities.

This scoping study aimed to:

1. Provide a definition and overview of the non-integrated commercial poultry sector
2. Identify the main factors influencing the economic and social sustainability of the non-integrated commercial poultry sector
3. Provide an overview of research needs for this non-integrated commercial poultry sector, with particular reference to appropriate technologies and management practices that could be implemented to improve biosecurity
4. Identify the key private and public stakeholders involved in the research and technology adoption process
5. Evaluate the possibility of a research delivery approach that includes all poultry industry stakeholders.

### **Project information**

**Overseas Collaborating Countries:**  
Indonesia

**Commissioned Organisation:** University of New England, Institute for Rural Futures, Australia

#### **Project Leader**

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**Project Budget:** \$80,240

**Project Duration:** 01/09/2007 to 30/11/2007

**ACIAR Research Program Manager:** Dr Peter Rolfe

### **Project outcomes**

The project team visited Indonesia from September 2 to 16 2007 to consult with stakeholders. This scoping study resulted in the drafting of a project proposal which was presented to ACIAR at the conclusion of the field visit. Results of the ACIAR in-house review and comments from Indonesian partners resulted in team member Dr Ian Patrick returning to Indonesia for further consultation and presentation of a project plan. A Phase II proposal was completed and submitted to ACIAR in January 2008. The key elements of the proposed project are;

- A whole of industry approach. For HPAI control there needs to be an economic imperative for the private sector and the farmers to invest in biosecurity. This project will place a special and unique emphasis on integrating the project into the private sector. Successful adoption of least-cost biosecurity measures in the NICPS depends on the support and input of the entire poultry industry.
- A community approach will be used to implement project outcomes in three case-study areas. The project will not just provide policy advice and recommendations but will learn about adoption successes and failures through actual within-community adoption. The project will target three locations (one each in Bali, South Sulawesi and West Java).
- A whole market-chain approach will ensure that the adoption of cost-effective biosecurity measures is appropriate, given the cultural and institutional characteristics of the poultry market. The project will work with all stakeholders in the industry to define and implement improvements to particular institutional constraints such as post farm-gate marketing systems.

## **CIM/2003/066: Enhancing the adoption of improved cassava production and utilisation systems in Indonesia and East Timor**

### **Summary**

In both Indonesia and East Timor, cassava (*Manihot esculenta* Crantz) is the third most important food crop, after rice and maize in Indonesia and after maize and rice in East Timor. The general objective of this project was to increase the productivity of cassava-based cropping systems through the widespread adoption of higher yielding cassava varieties and improved cultural practices that increase yields and protect the soil from erosion and nutrient depletion.

The specific objectives were: 1) to support national institutions in conducting strategic and applied research on cassava; 2) to develop, with farmers, high yielding varieties and improved crop management, as well as better utilisation through on-farm processing and animal feeding; 3) to disseminate new technologies; and 4) to strengthen inter-institutional collaboration and capacity for farmer participatory research (FPR). This was achieved by conducting collaborative experiments on varietal evaluation and some agronomic aspects in experiment stations and on-farm; by conducting a total of 135 FPR trials with farmers, mainly testing varieties or fertilisation treatments; the organisation of farmer field days often coupled with half-day training courses on cassava production practices and animal feeding; and by conducting two one-week training courses for researchers and extension staff in national programs on 'Cassava production technologies, animal feeding and FPR methodologies' – one in Batu, East Java, Indonesia, and one in Dare, East Timor. In addition there were several exchanges of cassava researchers between Indonesia and East Timor.

### **Project information**

**Overseas Collaborating Countries:** East Timor, Indonesia

**Commissioned Organisation:** International Center for Tropical Agriculture, Thailand

### **Project Leader**

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### **Collaborating Institutions**

- Brawijaya University, Indonesia
- Research Institute for Legumes and Tuber Crops, Indonesia
- Assessment Institute for Agricultural Technology (East Java), Indonesia
- Indonesian Center for Food Crops Research and Development, Indonesia
- Ministry of Agriculture, Forestry and Fisheries, East Timor
- Center for Soil and Agroclimate Research, Indonesia
- National University of Timor, East Timor

**Project Budget:** \$397,912

**Project Duration:** 02/09/2004 to 31/03/2008 (Project extended from 02/09/2007 to 31/03/2008)

**ACIAR Research Program Manager:** Dr Paul Fox

### **Project outcomes**

The main achievement of this project was the identification of several high-yielding, high-starch and/or tasty cassava varieties, that are suitable for industrial processing, animal feeding and for human consumption, respectively. The Universidad Nacional de Timor Leste (UNTL) collected, characterised and evaluated 73 accessions of local cassava varieties in many districts in East Timor. Of these, there are about 18–20 with distinctly different morphological characteristics. In both Indonesia and East Timor photo books were prepared showing the morphological characteristics of the different varieties. In Indonesia both on-station and on-farm trials were conducted on appropriate and economic fertiliser and manure inputs, on cassava leaf production, and on the effect of supplementing the diet of sheep and dairy cattle with cassava leaf silage.

In Malang district of East Java, three farmers' groups were set up and helped in developing simple tools and methods for on-farm processing of fresh cassava roots into a variety of products, such as *kripik*, *krupuk*, wafers and cakes. These groups visited similar processing groups in Kediri, Guning Kidul and Pati districts to learn to

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make more cassava-based dishes and products for sale. They have now produced a recipe book for 32 different products.

While many new varieties and improved technologies were tested in FPR trials by farmers, it is still too early to have achieved widespread adoption and impact. The adoption is still limited mainly to those farmers that actively collaborated in the project and some of their neighbours in the village. The next step is to multiply planting material of the selected varieties, continue the FPR testing of these varieties and new production practices in more and more villages in order to enhance more widespread adoption and achieve real impact.

With the current interest in using cassava roots for processing into bio-ethanol, cassava production will need to increase rapidly to meet this increasing demand. Cassava prices have already increased dramatically over the past few years, giving farmers new opportunities to increase their incomes and improve their livelihoods.

## CP/2007/002: Establishment of fruit fly pest free areas

### Summary

Eight major fruit fly pest species cause enormous crop losses of most edible fruits and fruiting vegetables in Indonesia. Of greater economic impact are the associated quarantine requirements on international trade and the costs to national quarantine agencies in the applications of fruit fly quarantine surveys necessary to detect new incursions of major exotic pest species. The Ministry of Agriculture in Indonesia has placed high priority on the establishment of applied research projects and training that will lead to solutions for their fruit fly problem and expand export of horticultural commodities from Indonesia. Consequently, the Ministry of Agriculture in collaboration with Griffith University is currently conducting a 4.5-year ACIAR-funded project (CP/2003/036) entitled *Managing pest fruit flies to enhance quarantine services and upgrade fruit and vegetable production in Indonesia*.

In association with this research the Directors-General of the Indonesian Quarantine Agency and the Horticulture Directorate recently requested assistance to determine the feasibility and practicality of setting up pest-free areas for fruit flies. To this end a workshop on fruit fly pest-free areas was convened in Jakarta from 19 to 22 June, 2007.

### Project information

**Overseas Collaborating Countries:** Indonesia

**Commissioned Organisation:** Griffith University, International Centre for Management of Pest Fruit Flies, Australia

### Project Leader

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### Collaborating Institutions

- NSW Department of Primary Industries, Australia
- Victorian Department of Primary Industries, Australia
- Directorate of Horticulture Protection, Indonesia
- Agency for Agricultural Quarantine, Indonesia
- Dr Brian Tucker, Australia

**Project Budget:** \$49,910

**Project Duration:** 01/05/2007 to 31/12/2007

**ACIAR Research Program Manager:** Dr T K Lim

### Project outcomes

The Australian model of pest free areas for fruit flies around the Murray River area covering three states has been touted as an exemplary case that has complied to WTO ISPM standards (ISPM No. 04 (1995) *Requirements for the establishment of Pest Free Areas* and ISPM No. 26 (2006) *Establishment of pest free areas for fruit flies (Tephritidae)* and has helped Australia to access many overseas markets. The workshop drew on this work to achieve its aim of imparting knowledge and information on the requirements for the establishment of a pest-free area. Indonesian quarantine and crop protection staff now know far more about the definition of a fruit-fly-free area, how it should be maintained, the complexities of doing so and what it costs to run.

## **FIS/2000/065: Assessing the potential for low cost formulated diets for mud crab aquaculture in Australia, Indonesia and Vietnam**

### **Summary**

Global demand for mud crabs has risen over the past decade, led by expanding wealthier markets such as those in Hong Kong, Singapore and elsewhere in Asia. This demand has largely been met by exploitation of wild stocks, causing many to go into decline. Current trends in these fisheries suggest this exploitation is unsustainable. This situation continues to be exacerbated by rising demand for seafood.

Mud crabs (*Scylla* species) are widely distributed across the Indo-Pacific region, mainly in coastal and estuarine areas, making them ideal for fishing. This does also make them highly suitable for aquaculture, providing some barriers to production can be overcome. Past ACIAR-supported research has developed laboratory-scale technologies for hatching crabs from larvae, a first step in aquaculture development. Large-scale hatchery production is now under way in Vietnam where a leading centre for crab aquaculture has been established, along with others in Indonesia, the Philippines and Australia.

Until diets suitable for crab grow-out can be formulated, based on meeting their nutritional needs, further advances will be limited. Most aquaculture of crabs uses 'trash-fish' collected from marine inshore areas or mussel meat from intertidal areas. This can damage these environments and not all feed is likely to be consumed, fouling hatchery ponds. Growing exploitation of trash-fish is also leading to declining numbers, threatening the viability of aquaculture. A cost-effective replacement diet is needed to ensure the benefits gained to date are not lost.

The aim of this project was to:

- evaluate potential for formulated feeds to replace trash fish
- determine critical nutritional requirements and evaluate key ingredients
- determine the protein/energy requirements of mud crabs during grow-out phases
- formulate and evaluate improved diets.

### **Project information**

**Overseas Collaborating Countries:**  
Indonesia, Vietnam

### **Commissioned Organisation:**

Queensland University of Technology,  
School of Natural Resource Sciences,  
Australia

### **Project Leader**

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### **Collaborating Institutions**

- Gondol Research Institute for Mariculture, Indonesia
- Queensland Department of Primary Industries and Fisheries, Australia
- Research Institute for Aquaculture No. 3, Vietnam

**Project Budget:** \$390,521

**Project Duration:** 01/07/2004 to 30/06/2008 (Project extended from 01/07/2006 to 30/06/2008)

**ACIAR Research Program Manager:** Dr Geoff Allan

### **Project outcomes**

This project built on earlier progress by aquaculture research teams in Australia (Bribie Island Aquaculture Research Centre; BIARC), Indonesia (Gondol Research Institute for Mariculture: GRIM) and Vietnam (Research Institute for Aquaculture No. 3; RIA3). An improved dietary formulation based on a lobster diet was developed in collaboration with nutrition experts Dr Kevin Williams and Dr David Smith (CSIRO Marine Research, Cleveland, Australia). Feeding trials were conducted at BIARC using this improved formulation and resulted in crab growth rates that were approximately 90% of those obtained using a fresh diet (fish, squid and mussel). Small-scale feasibility studies conducted in earth ponds at RIA3 also revealed that mud crabs fed artificial diets could grow at rates that were equivalent to those fed a traditional diet of trash fish.

Nutrient digestibility coefficients were obtained for a broad range of animal- and plant-based ingredients that were equivalent (or superior) to those obtained for fishmeal, which is traditionally the major source of protein in formulated aquaculture

diets. A significant finding was that defatted soybean meal was readily digested when incorporated into diets for local mud crab species in Australia, Indonesia or Vietnam. On the basis of its' high digestibility, the research team recommends that soybean meal be further investigated for its potential to replace fishmeal in formulated mud crab diets.

In laboratory-based culture systems, juvenile crabs demonstrated best growth performance when fed artificial diets containing 45–55% crude protein and 9–15% lipid. This is significantly less protein and more lipid, respectively, than contained in many artificial prawn diets used to support mud crab aquaculture. Such findings are encouraging and suggest it may be possible to: 1) reduce diet cost by lowering the amount of expensive, marine animal-based protein (i.e. fishmeal) required for mud crab diets; 2) increase the energy density of mud crab diets by incorporating higher levels of lipid.

Despite these encouraging results, growth rates of individual crabs in laboratory-based culture systems used for the current project were less than those typically reported for mud crabs grown communally in earth ponds. As a consequence, the research team suggests that alternatives to laboratory-based culture systems be developed for future studies that attempt to optimise nutrient profiles in mud crab diets.

## **FIS/2007/029: Support for antibiotic residue testing in fisheries products**

### **Summary**

This small R&D activity is providing support to scientists at the Indonesian National Centre for Quality Control. An Australian analyst is providing general advisory support, training and troubleshooting advice as needed to help build the organisation's expertise in the analysis of antibiotic residues in shrimp and other seafood for export. The Australian analyst who has experience in using Waters LC-MS/MS analytical equipment will work in-house. This will be followed by two weeks of on-the-job training for three Indonesian analysts in Australia, giving them the opportunity to experience the workings of a modern residue analytical laboratory. An Australian expert will then conduct a follow-on course in Indonesia for a wider audience, assisted by the analysts who took part in the Australian training.

### **Project information**

#### **Overseas Collaborating Countries:**

Indonesia

#### **Commissioned Organisation:**

Leeder Consulting Pty Ltd, Australia

#### **Project Leader**

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**Project Budget:** \$120,000

**Project Duration:** 01/06/2007 to 30/06/2008

**ACIAR Research Program Manager:** Mr

Barney Smith

### **Project outcomes**

Final report not yet submitted by the project leader.

## **FST/2001/105: Can decentralisation work for forests and the poor? Policy research to promote sustainable forest management, equitable economic development, and secure local livelihoods in Indonesia**

### **Summary**

Laws enacted in Indonesia in 1999 aimed to decentralise administrative and regulatory authority over large segments of the country's economy, including the forestry sector. But poor coordination between the different levels of government, lack of clarity of new regulations, inadequate preparation and little institutional capacity to deal with the new responsibilities in district agencies have all impeded the decentralisation process.

This project assisted Indonesia to assess and monitor progress in decentralisation and to implement, where necessary, corrective measures to meet the decentralisation objectives. Researchers documented the impacts of decentralisation on forests and forest communities and provided policy makers with timely analyses of these impacts. They identified strategic interventions to promote sustainable forest management, equitable development and secure local livelihoods. They also sought to strengthen policy dialogues and build Indonesia's capacity to carry out policy-responsive research.

### **Project information**

**Overseas Collaborating Countries:**  
Indonesia

**Commissioned Organisation:** Center for International Forestry Research, Indonesia

#### **Project Leader**

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#### **Collaborating Institutions**

- Murdoch University, Australia
- Center for the Study of Law and Regional Autonomy, Indonesia
- Tanjungpura University, Indonesia
- University of Hassanudin, Indonesia
- University of Papua, Indonesia
- Yayasan Pioner, Indonesia
- Australian National University, Australia

**Project Budget:** \$640,794

**Project Duration:** 01/01/2003 to 31/08/2007 (Project extended from 01/07/2007 to 31/08/2007)

**ACIAR Research Program Manager:** Dr Russell Haines

### **Project outcomes**

The project employed action research methods (PAR, policy dialogues, focus group discussions and interactive workshops). The work was divided into three main parts: observation on changes in forestry policy at district level and consequences at village level with consultations at provincial level; observation on changes in the fiscal governance system at district and province; and observations and interviews at national level on changes in forest and land related policies. In South Sulawesi, information was gathered mainly through several focus group discussions (one at the province, four at the district and six at the villages). In addition the team conducted numerous informal discussions and interviews and studied various official planning documents, mainly those from the forestry sector.

At one case study site, Luwu Utara, the researchers analysed the consequences of the shift in decentralisation policies. They found that: Law 32, 2004 which replaced the earlier regional autonomy law of 1999 was an attempt to improve performance and accountability. The role of the province was re-instated and includes, among others, the authority to evaluate the districts budgets and spatial planning. The province also has the authority to recommend cancelling policies deemed contradictory to the public interest and higher level regulations. Forest policy at provincial level, however, is barely affected by the new law. Law 32 does not specify explicitly how authority over forest is arranged and Law 41, 1999 is accepted as regulating forestry affairs. A new regulation issued in January 2007 reaffirms central government control over forests and leaves little decision-making power to districts. Even the coordination role of the province (according to Law 32) is still kept in the hands of the Ministry of Forestry's implementation units placed in the provinces.

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At district level, no real progress is seen with regard to better forest and resource management. In Luwu Utara the fragmentation of the district has reduced the forest area drastically and left the district mainly with protection forest and almost no production forest. As a result, forestry has become a cost centre with an annual deficit of almost 4 billion rupiah. While expressing continued commitment to sustain forests, the government of Luwu Utara is incapable of combating illegal logging and encroachment by local people, and managing rehabilitation efforts within its mandate. With no incentives from the central government, it will be more and more difficult for the districts to maintain their forests.

It was hoped to improve forest management through better coordination of spatial planning among districts. While provincial and district planning is now better coordinated, substantively it is still weak. Spatial plans often ignore the earlier forest designation. In Luwu Utara, for example, the spatial plan assigns use categories without real consideration to land suitability or actual use in the field. Spatial plans are seldom used for development planning and are still largely paper exercises. There is no real incentive to do it right.

In the mean time, customary rights remain an issue. The government of Luwu Utara does recognise the existence of customary communities but hesitates to recognise customary rights to land. Discussions continue on whether communal rights exist or not and what customary rights actually mean.

To improve the general performance of the district, the national government introduced a performance-based budget system. This system would allow better long-term planning and would provide incentives for a more efficient running of government activities. However, people are too rooted in working by project. As well, the different teams in charge of supervision and monitoring have no clear job description and tend to overlap with each other.

The project team continued to enhance the capacity of local people to get better access to forest resources (particularly, non timber forest products such as rattan) and market, and to improve their bargaining power vis-a-vis external actors. This included a film on rattan and smallholder's access to market, as part of attempts to increase stakeholders' awareness of the need to achieve equitable market and sustainable management of resources.

## **FST/2003/025: Community partnerships for plantation forestry: enhancing rural incomes from forestry in eastern Indonesia and Australia**

### **Summary**

Timber plantations are seen as a positive mechanism for combining reforestation with sustainable production. The plantation sector in eastern Indonesia is largely commercial, with the bulk of benefits going to the commercial processing companies and other commercial stakeholders. Smallholder farmers are often left out of the flow of benefits.

Sustainability arising from plantation growth is most effective when benefits flow to forest companies and smallholders. Government also has a part to play in creating the environment in which successful tripartite partnerships can operate, creating sustainability. Cost efficiency and social equity need to be balanced, providing opportunities for all stakeholders.

Indonesia's recent experience in this area has been disappointing, thus failing to reach the targets for timber plantations, especially in the country's east. One means of increasing plantings and linking companies to smallholders is to develop forestry out-growers schemes. Companies enter into agreements with smallholders to ensure supply of timber, utilising additional lands they do not control as a source of timber. The key to making this a workable option for mutual benefit is establishing effective partnerships that deliver results to both smallholders and companies.

Project objectives were to understand the nature and effectiveness of existing forestry partnerships and agreements in Indonesia and Australia through a scoping review, then to assess the strengths and limitations of specific forestry partnerships and agreements in the three case study regions, and provide clear recommendations to improve existing partnerships. Other objectives were to build capacity in a range of stakeholders to improve existing forestry partnerships and agreements, or initiate preferred partnerships, in these regions, and to communicate the key research findings to project partners and other relevant stakeholders to ensure the forestry partnerships achieve favourable outcomes for smallholders, communities and companies.

### **Project information**

**Overseas Collaborating Countries:**  
Indonesia

**Commissioned Organisation:** Charles Sturt University, Institute for Land Water and Society, Australia

### **Project Leader**

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### **Collaborating Institutions**

- Forest Research and Development Agency, Indonesia
- Centre for International Forestry Research, Indonesia
- CRC Sustainable Production Forestry, Australia
- World Wildlife Fund Indonesia, Indonesia
- Australian National University, Australia

**Project Budget:** \$399,893

**Project Duration:** 01/01/2005 to 31/12/2007

**ACIAR Research Program Manager:** Dr Russell Haines

### **Project outcomes**

The project identified important findings about the relationship between farmers and forestry companies, and in particular how this relationship can be expressed in contractual partnership that is mutually beneficial, fair and secure. The project worked closely with a wide range of partners in its three case study locations – Bulukumba and Sumbawa (in Indonesia) and the Green Triangle (south-east Australia).

The project team found many different types of partnerships used in forestry in Indonesia and Australia. The 'success' of a partnership is best determined by different partners using their own criteria. However, broadly successful partnerships in commercial forestry are those where all the partners have had their expectations met.

They found that smallholders often lack an understanding of the value (costs and benefits) of different components of commercial forestry, have a poor knowledge of market prices, and have weak links to competitive markets – meaning that they are unable to negotiate

## *Concluded projects*

fair and beneficial agreements. This research identified the important prerequisites needed for developing contractual partnerships in commercial forestry that could bring improvements to the livelihoods of rural communities. They included:

- increased knowledge by farmers of the operations and components of commercial forestry (e.g. awareness of forestry's value-chain)
- improved understanding of the direct and indirect costs and returns of commercial forestry (e.g. rigorous cost:benefit analysis to identify net returns and opportunity costs)
- improved access for forest growers to competitive markets (e.g. potential for growers to use market brokers or form cooperatives)
- increased knowledge by growers of market dynamics (e.g. drivers of market fluctuations, awareness of market prices)
- improved capacity of farmer forest groups at the district level to share experiences and information, and create new knowledge of commercial forestry (eg. build the social capital of farmer groups)
- reduced administrative and financial burden of governments faced by small-scale growers (e.g. simplify regulations and streamline the processes for permits).

To help summarise a wide range of experiences, theoretical concepts, and research results, the project team developed a 'checklist' of the key attributes of partnerships expected to be beneficial, fair and enduring in the forestry sector. The checklist had many generic elements that could potentially be applied to forestry in other regions or countries, and possibly to other sectors.

Project findings emphasise that failure to develop contractual partnerships that are mutually beneficial, fair and sustainable can have profound impacts – with flawed partnerships in commercial forestry a contributor to illegal forestry, undesirable tropical deforestation, rural poverty and community conflict. For example, poor farmers who are locked into contracts that do not deliver fair prices are vulnerable to being tempted by the financial returns of short-term and exploitive forestry, even if their activities are illegal.

In conclusion, developing long-term, effective partnerships will develop a more productive and sustainable forestry sector – with benefits for industry, government and rural communities. However, further research is required to reveal how the principles for forestry partnerships translate to the highly varied commercial, biophysical, social and governance characteristics that exist in Indonesia and other countries.

## **FST/2005/054: Seed distribution of Australian Trees**

### **Summary**

Many developing countries face shortages of wood products due to reduced access to forest resources. Demand for forest products expands continuously as a result of population growth and rising consumption per capita. Australian trees play a key economic role in developing countries as many species grow fast over a whole range of soils and climatic conditions. However, the use of poor genetic quality seeds provides less productive and lower-value planted forests.

The objective of this ACIAR's projects is to supply certified lots of high quality seeds of eucalypts, acacias, melaleucas and casuarinas to country partners for research studies on species suitability, species-site matching and establishment of seed orchards, seed production areas and genetic gains trials. Project information

### **Overseas Collaborating Countries:**

Indonesia

### **Commissioned Organisation:** Ensis,

Australia

### **Project Leader**

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**Project Budget:** \$50,000

**Project Duration:** 01/01/2006 to 31/12/2007

**ACIAR Research Program Manager:** Dr

Russell Haines

### **Project outcomes**

As specified in the project objectives, the project team ensured supply of certified lots of high quality seeds of eucalypts, acacias, melaleucas and casuarinas to country partners for research studies on species suitability, species-site matching and establishment of seed orchards, seed production areas and genetic gains trials.

## **LPS/2004/005: Improving smallholder crop-livestock systems in eastern Indonesia**

### **Summary**

Beef consumption in Indonesia is rising, in part due to the adoption of more western-style diets. The demand for beef cattle has thus been increasing strongly in Indonesia. This provides a potential opportunity for smallholder farmers who are the main producers of Bali cattle in Indonesia to improve their economic welfare. However, figures indicate that Bali cattle numbers have actually been declining across most regions of Indonesia over the past decade, leading to a supply deficit that is largely being serviced by imports of beef and live cattle from Australia. There is an opportunity to develop and implement strategies at the smallholder level to increase the number and quality of Bali cattle.

Earlier ACIAR research built an integrated crop-livestock systems model, based on conditions in eastern Indonesia, and also developed improved herd management practices. This project sought to apply the earlier technologies to help increase production, focusing on three factors: forage supply and quality; effective herd management; and a better understanding of the trade-offs necessary to increase production.

The major objective was to develop, test and apply tools, information and knowledge-sharing techniques appropriate for use at both farmer and extension levels, in order to evaluate the impacts of management interventions into tropical rainfed crop-livestock systems. A second objective was to communicate the outputs of the project to smallholder farmers in the immediate vicinity of the case study sites and more broadly across eastern Indonesia, but also to other providers of research and extension services.

### **Project information**

**Overseas Collaborating Countries:**  
Indonesia

**Commissioned Organisation:** CSIRO Sustainable Ecosystems, Tasmanian Institute of Agricultural Research, Australia

### **Project Leader**

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### **Collaborating Institutions**

- Hasanuddin University, Indonesia
- Assessment Institute for Agricultural Technology (NTB), Indonesia
- Department of Agriculture and Livestock, Central Lombok District, Indonesia
- Assessment Institute for Agricultural Technology (South Sulawesi), Indonesia
- University of Mataram, Indonesia

**Project Budget:** \$878,642

**Project Duration:** 01/01/2005 to 30/06/2008

**ACIAR Research Program Manager:** Dr Peter Horne

### **Project outcomes**

This project explored the merits of an approach for improving livestock production that combines the principles and tools of farming systems analysis and farmer participation. The process began with an extensive benchmarking process to understand and quantify how the current system functions and the constraints to livestock production. Potential strategies for addressing these constraints were identified and their economic, social and environmental viability assessed using a customised whole farm model. These simulated results were then 'workshopped' with farmers to come up with a shortlist of feasible, best-bet strategies for subsequent on-farm trialling. The on-farm trials thus became an important extension platform for subsequent extension and communication to other farmers within and beyond the target village.

This project identified a range of factors constraining livestock production in the smallholder farming systems of eastern Indonesia including: availability and quality of forages, especially during the dry season; poor knowledge and/or capacity to implement optimum feed management practices; limited supplies of readily accessible stock water; bull availability; inadequate cattle housing; labour availability; extended and sub-optimal breeding cycles; diseases; marketing constraints and limited access of smallholders to the formal credit sector for acquiring cattle and livestock handling

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materials. Most of the technologies needed to address these constraints have already been developed in Indonesia or elsewhere, but have yet to be adopted by local farmers.

The feedback from farmers and the results from monitoring the on-farm trials indicate that the participatory, farming systems approach was successful. There is a range of evidence to support this including: quantifiable gains in forage and livestock production, labour savings and gains in household income; the intention of most farmers to continue successful strategies; and evidence of significant adoption/adaption of the livestock improvement technologies by other (non-project) farmers.

The pathways to adoption of livestock improvement strategies varied with the region and the technology concerned. Strategies requiring more skill and knowledge to implement, and for which the implications are more complex and less predictable (e.g. changing feed availability or breeding cycle) required greater input from the project team and benefited most from the modelling analysis.

At two of the focus sites, the involvement of village 'champions' was imperative in fostering uptake. Typically, an incremental approach was taken to the rollout of best-bet strategies. The initial focus was to address forage supply and quality constraints through modest plantings of selected forages. The confidence and trust arising from successful adoption of these comparatively simple technologies was then used as an entry point for more complex animal management strategies which require long-term planning and investment.

The Integrated Analysis Tool (IAT) was found to be exceptionally useful in a number of ways:

- as a communication tool to inform/underpin the dialogue between the project team and the farmers
  - enabling rapid analysis of the financial, resource and production impacts of livestock improvement strategies and their sensitivity to key climate, soil, management and farm design variables
  - screening out less desirable strategies and identifying a shortlist of best-bet options for subsequent on-farm testing, thus ensuring a more efficient and targeted use of limited project resources
- providing a degree of confidence to both project staff and farmers that the strategies to be tested on-farm are likely to have a beneficial effect
  - providing for some farmers the motivation to consider the potential impacts of proposed livestock improvement strategies.
  - The apparent success of the approaches developed and tested in this project provides support for wider adoption in other regions of Indonesia.

## **LWR/2005/059: Modelling water and solute processes and scenarios for optimisation of permanent raised bed systems in China, India, Pakistan and Indonesia**

### **Summary**

Permanent raised beds have been promoted to minimise the effects of waterlogging, reduce irrigation water and improve the biological and physical health of the soils – all for the purpose of increasing productivity of crops. But design criteria for permanent beds, in terms of infiltration and drainage, are not well developed and have frequently come about in relation to machinery specifications. Other concerns are correct fertiliser placement for nutrient and solute management and to minimise risk of build-up of salts.

This project underpinned existing ACIAR projects by helping develop criteria for optimising bed design from analytical and numerical modelling of water and solute transport, and designing fertiliser placement strategies to maximise fertiliser usage and minimise leaching into ground water. Researchers also determined the likelihood of salinisation over time in different scenarios.

### **Project information**

**Overseas Collaborating Countries:** China, India, Indonesia, Pakistan

**Commissioned Organisation:** CSIRO Land and Water, Australia

#### **Project Leader**

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**Project Budget:** \$84,816

**Project Duration:** 01/04/2006 to 30/09/2007  
(Project extended from 01/07/2007 to 30/09/2007)

**ACIAR Research Program Manager:** Dr Christian Roth

### **Project outcomes**

This report presented the results of simulations of water and solute transport in permanent

raised beds (PRBs). As well as a generic research on modelling of raised beds the team undertook four case studies – one each in China, India, Pakistan and Indonesia – related to projects already funded by ACIAR. The work also included assimilation of data, estimation of soil properties, collation of climate data and estimation of crop rooting patterns. Simple models were developed for estimating optimal bed width for wetting by furrow irrigation, and drainage of beds when low permeability soils occur at the base of the beds.

The work highlighted some potential advantages and disadvantages of permanent raised beds and the need for further modelling and experimental work. The main advantages determined for permanent raised beds in this work were:

- Good utilisation of water and fertilizers are possible if bed configuration is correct
- Beds can provide much better aeration for all soils following irrigation, and especially clay soils.

The main disadvantages for permanent raised beds that need further scrutiny were:

- Bed width and wetting of the bed
- Salt build up in the centre of beds
- Leaching of salts and agro-chemicals to the groundwater.

The research team recommended that a combined effort of modelling and experimental work was the best way to move forward with future research on permanent raised beds.

## **SMAR/2006/080: West Timor integrated timber-forage-livestock agroforestry (scoping study)**

### **Summary**

In eastern Indonesia 80% of the population lives below the poverty line, subsisting on cropping, livestock and forestry activities. Agroforestry, with the potential to improve dry-season fodder availability and to provide tree-based incomes during drought, offers smallholders a significant opportunity to increase their incomes. This could be further improved by integration of high-value timber species along with more productive forage trees and grasses.

This scoping study reviewed previous agroforestry, forage and livestock projects in eastern Indonesia. It then identified strategies for developing more acceptable systems, proposed methods for their implementation, and provided an assessment and analysis of the constraints to adoption of research results.

### **Project information**

**Overseas Collaborating Countries:**  
Indonesia

**Commissioned Organisation:** Southern Cross University, School of Environmental Science and Management, Australia

#### **Project Leader**

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#### **Collaborating Institutions**

- Department of Primary Industries, Fisheries and Mines, Australia
- Assessment Institute for Agricultural Technology (NTT), Indonesia
- Forest Research and Development Agency, Indonesia

**Project Budget:** \$83,000

**Project Duration:** 01/03/2007 to 31/07/2007

**ACIAR Research Program Manager:** Dr Russell Haines

### **Project outcomes**

The research team undertook a literature review and also made a visit to West Timor. They drew up the following recommendations for further research.

1. Conduct a socioeconomic survey to define the most suitable Timber-Forage-Livestock Agroforestry (TFLA) combinations for particular types of farmers. This survey should establish farmer typologies and identify the key decision drivers for each category of farmer. This approach will improve efficiency and target scaling-up efforts. This survey should also identify the communities' social capital and identify its role in partnerships/collaborations.
2. Conduct an impartial evaluation of major TFLA systems, including morphological information of the species within those systems.
3. Establish and conduct trials on candidate agroforestry species appropriate to farmers' needs and capable of yielding a commercial product.
4. Conduct Rapid Market Appraisals (RMAs) to provide an overview of market strengths and weaknesses and identify potential opportunities;
5. Conduct participatory mapping activities to define boundaries based on the acceptable land tenure system. This activity should include all the stakeholders, government, non-government and farmer communities.
6. Conduct a management audit of the farming sphere to determine the lines of authority and the strengths and weaknesses of the relationships. The audit will establish who and where the power brokers are, identify outstanding challenges arising from the current decentralisation process in government departments. The audit should also establish intraorganisational strengths and weakness that pertain to the TFLA process.
7. Combine the findings of the RMAs, socio-economic analysis and evaluation of the major systems to formulate a training needs analysis. The analysis should furnish the project with information on farmers' needs as well as government needs so that appropriate training and awareness can be instigated.

The team also noted that strengthening Indonesian–Australian partnerships would

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lead to an improved capacity to develop and implement targeted research and extension programs. Researchers would develop a better understanding of how smallholder groups and agribusinesses are run. Focus group discussions, workshops and publications of research findings would enhance public recognition and professional standing of researchers and the institutions involved. These activities would assist the Indonesian collaborating organisations and their staff in developing project design, management, and facilitation skills.

## **SMAR/2007/042: A feasibility study to understand the vegetable value chains in Eastern Indonesia to enhance future collaboration (AGB)**

### **Summary**

The development of the vegetable industry in Eastern Indonesia emerged as a priority during the initial phase of ACIAR's *Support for Market-Driven Adaptive Research (SMAR)* initiative. In SE Sulawesi the priority vegetable crop is chilli, whilst in South Sulawesi potato, chilli and red onions were identified as important industry sectors. In NTB, the vegetable crops of importance included potato, sweet corn, cucumber and chilli. The NTT vegetable crops of importance included long beans, beans, chilli, cucumber, carrot, cabbage, red onions and garlic.

Independently of SMAR, the Australian Department of Agriculture, Fisheries and Forestry (DAFF) commissioned the Department of Primary Industries, Victoria to carry out a feasibility study of to assess future collaboration in food and agriculture value chains, focused on the Indonesian vegetable industry.

Thus ACIAR and DAFF have embarked on a joint feasibility study to consider appropriate ways to improve the vegetable value chains in Eastern Indonesia, with a focus on the key industries identified during the priority-setting phase of SMAR. The study will be used independently by both agencies to guide strategy development and could also be used jointly for publication and communication purposes.

### **Project information**

**Overseas Collaborating Countries:**  
Indonesia

**Commissioned Organisation:** Department of Primary Industries, Victoria, Market Development (South East Asia), Australia

#### **Project Leader**

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#### **Collaborating Institutions**

- Padjadjaran University, Bandung, Indonesia

**Project Budget:** \$15,000

**Project Duration:** 11/05/2007 to 15/09/2007

**ACIAR Research Program Manager:** Mr David Shearer

### **Project outcomes**

Indonesia, the fourth largest market in the world with a population of 220 million in 2005, is forecast to reach almost 250 million people by 2015, making it a large food market. Consumption of fresh food is increasing and urban based consumers are becoming more health and convenience conscious. This has opened up opportunities for the modern retail sector to expand further into fresh foods, such as the offer of hydroponic and organic vegetables. Indonesia has over 17,000 islands and this provides a major challenge to distribute fresh products nationally. Most of Indonesia's locally produced fresh vegetables (cabbage, potato and chilli) are distributed throughout Indonesia in non refrigerated transport. However, there is increased use of airfreight for select high value fresh vegetables for inter-island trading where there is shortage of local supplies.

The traditional wet markets still dominate fresh food trade however there is an increasing trend of food purchases at modern retail outlets. Most supermarkets and hypermarkets in Indonesia have expanded their share of the retail market with the opening of new stores throughout major cities in Indonesia and with an increased emphasis on fresh food and higher value lines, such as hydroponic and organic vegetables. Both Matahari Hypermart and Hero supermarkets are now offering a full range of ingredient vegetables and other food items essential for Indonesian cooking. In the vegetable section, there is now a full range of chilli (five varieties), ginger, onions, garlic, pepper etc.

Indonesia's vegetable production has increased by an average of 8% per year since 2001 from 6.9 million tons to reach more than 9 million tons (excluding almost 31 million tons of mushrooms) in 2005, from almost one million hectares of land; an average yield of 9.6 tons per hectare. The main vegetables grown in Indonesia (besides mushrooms) are cabbages, chilli, potato, shallots/onions and tomato. There are 33 provinces in Indonesia that produce over 20 types of vegetables; however 85% of all vegetables are grown on the islands of Java and Sumatra. The major vegetable

## Concluded projects

producing provinces are: West Java (35.6%), Central Java (13.3%), East Java (11.9%) and North Sumatra (10.3%); these four provinces account for over 70% of all vegetable production. Imported vegetables accounted for only 4% of total consumption in Indonesia in 2005.

East Indonesia accounted for only 11.6% of the volume of all vegetables produced in Indonesia in 2005 yet has 16.0% of the population; this represented an average of 28.7 kg per capita compared to an average across Indonesia of 39.8 kg per capita. Therefore Eastern Indonesia is a net importer of vegetables, with supply mainly from Java. North Sulawesi (274,134 tons) and South Sulawesi (256,153 tons) are the main vegetable producing provinces in Eastern Indonesia in 2005 with 52% share of all vegetables from the 13 provinces in Eastern Indonesia.

The province of South Sulawesi has a topography and climate that is suitable for vegetable production and hence grows a wide range of vegetables for local consumption and inter-island trading. South Sulawesi produces about 256,000 tons of vegetables from almost 55,000 hectares of land; an average yield of 4.7 tons per hectare. The main vegetables grown in South Sulawesi are: cabbage (25.4%), chilli (15.3%), yardlong bean (7.9%), leek (6.5%) and tomato (6.3%).

The main issues, related to vegetable supply, for retailers in Makassar, the capital of South Sulawesi are:

- Consistency in quantity with a lack of local vegetable supply from Sulawesi, especially in the rainy season with retailers requiring to source supply from Java.
- Lower quality of local fresh produce compared to product sourced from Java.
- Large price fluctuations for some vegetables like chilli.

Production of chilli in Indonesia has been increasing by an average of 20% per year since 2001 to reach over 1 million tons in 2005 from about 190,000 hectares; accounting for about 12% of vegetable production. Over 60% of chilli is produced in Java with west Java (198,000 tons) being the major source of large chilli and east Java (143,000 tons) being the major source of small chilli.

There is a wide variation in yields of large and small chilli. The chilli sauce manufacturing industry is based on Java (which has over 60% of all chilli production for fresh and processing) with 10 major companies and 12 manufacturing plants. A value chain analysis of four supply chains of chilli found that supply to supermarket gives the highest return to farmers. The lowest value chain is a channel to traditional markets.

The major issues facing the chilli industry in South Sulawesi are:

1. Low productivity
2. Benefiting from opportunities for value adding on the farm
3. No post harvest or cold chain management
4. Market development opportunities
5. Weak farmer bargaining power.

It is recommended that there is a need to link smallholders to more dynamic markets such as channels to modern retailers and the food processing industry. Technical assistant to farmers is also needed on more efficient cultivation technology to increase productivity and the application of post harvest handling.

## **SMAR/2007/218: Transformation of peanut and mungbean production to address market requirements in NTB and NTT**

### **Summary**

In November 2006, research priority setting workshops in both provinces, involving a wide range of stakeholders, gave a high priority to implementing research activities aimed at overcoming production and profitability constraints in peanut and mungbean systems.

In February 2007, during ACIAR consultations to establish new priorities for collaborative agricultural research between Australia and Indonesia, participants agreed that one thematic area for future collaboration was 'Profitable agribusiness systems for eastern Indonesia' including 'Improving productivity and profitability of field crop systems in seasonally dry areas'. Thus ACIAR funded this technical and market analysis of peanut and mungbean systems in Nusa Tenggara Barat (NTB) and Nusa Tenggara Timor (NTT).

### **Project information**

**Overseas Collaborating Countries:**  
Indonesia

**Commissioned Organisation:** Queensland Department of Primary Industries and Fisheries, Australia

#### **Project Leader**

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**Project Budget:** \$15,400

**Project Duration:** 20/06/2007 to 31/08/2007

**ACIAR Research Program Manager:** Dr Peter Horne

### **Project outcomes**

The team of QDPI&F and Indonesian researchers that conducted the survey in July 2007 found that the productivity and profitability of both crops were severely constrained by a number of issues including access to good quality seed, new improved varieties, awareness about seed quality, poor management practices, and lack of access to crop loans or irrigation water.

The study highlighted the potential for adaptive research to deliver impacts within these systems, leading to the development of a project proposal, *SMAR/2007/068 Productivity and profitability enhancement of tropical pulses in Indonesia and Australia (AGB)*. In late March 2008, five partners in the proposed project (one from ILETRI, one from BPTP NTB, two from Garuda Foods and one from IFC) visited Kingaroy, Queensland to see Australian peanut and mungbean industry R&D activities and finalise the project proposal.

The proposal aligns closely with the goal of SADI (Smallholder Agribusiness Development Initiative), which is to 'achieve a sustained increase in rural growth and household incomes through productivity gains, better access to markets, and on and off-farm value-added activities in four target provinces of Eastern Indonesia: South Sulawesi, South-East Sulawesi, NTT and NTB'. It also aligns closely with the goal of ACIAR's SMAR program, which is to 'improve access for farmers and agribusiness/SMEs to new knowledge underpinning the production and marketing of agricultural outputs at higher levels of productivity and quality'. SADI (and the subprogram SMAR) has strong Indonesian government support. In particular, this project has a strong underpinning collaboration with Garuda Foods and IFC-SADI.

## **SMAR/2007/219: Identifying economic and social constraints for water management in vegetable production in Nusa Tenggara Timur (NTT) and Nusa Tenggara Barat (NTB) (AGB)**

### **Summary**

New cropping models and water management systems have been developed in Nusa Tenggara Timur (NTT) and Nusa Tenggara Barat (NTB) to support the higher-value vegetable production industries. Significant investment has been made to develop robust systems suitable for adoption and scale-out within the provincial environment. Despite these activities, there are very few significant changes of practice being observed, and it is felt that farmers in these areas could be making much better use of the techniques and the infrastructure available for using the water resources.

While considerable understanding exists about the technical factors that may constrain farmer's water management and use practices, very little is known about the economic and social factors that may be constraining farmer behaviour. This project sought to identify the key factors relevant to the use of water storages ('embungs') used in NTT for vegetable growing, cattle raising and human consumption, and of raised bed cropping used for higher-value crops in NTB. It also considered the constraints to the adoption of the new technologies, with particular emphasis on factors that may impact on the sustainability of both systems.

### **Project information**

**Overseas Collaborating Countries:**  
Indonesia

**Commissioned Organisation:** University of Sydney, Agricultural and Resource Economics, Australia

#### **Project Leader**

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#### **Collaborating Institutions**

- Assessment Institute for Agricultural Technology (NTT), Indonesia
- University of Mataram, Indonesia
- World Education, Indonesia, Indonesia

**Project Budget:** \$145,524

**Project Duration:** 01/11/2007 to 31/07/2008

**ACIAR Research Program Manager:** Mr David Shearer

### **Project outcomes**

The main aim of this scoping study was to identify a broad set of economic and social constraints that influence farmer behaviour in relation to agricultural water management for high-value vegetable crops in the two provinces (NTT and NTB) in Eastern Indonesia. More specifically, the study aimed to pinpoint several of these factors that were likely to be most influential in constraining farmer's behaviour, and for which more in-depth understanding is necessary. Consequently, the study offered several strategic research directions on the key socio-economic issues for agricultural water management in Eastern Indonesia. It is felt that addressing these issues will provide essential knowledge and understanding of the underlying problems, which can then inform government policy and international donor activities.

Formulated aims were pursued through a range of research activities. These included: thorough review of previous published work, primary data collection through semi-structured field interviews and surveys of farmers in the research area utilising a formal survey instrument (a questionnaire); analysis of the primary data; and collecting expert input through a stakeholder workshop.

The findings from these research activities enabled the research team to identify a broad set of factors that constrain agricultural water management in high-value vegetable production in the research area. These are: capital constraint and access to credit, market price risk, production risks, inadequate incentives for maintenance of water infrastructure capital assets, social attitude and gender factors, marketing problems including transportation and logistics, problems with extension and diffusion of knowledge, inadequate property rights structures in water management, institutional problems in water management, labour constraints, and land constraints.

The analysis of the data indicated that some of these factors are more important, some less so, in constraining farmer

behaviour. In addition, the analysis uncovered some interesting relationships among these factors, which enabled the team to postulate some implications for current activities of governments and donor agencies directed towards improving agricultural water management. For example, it seems that extension efforts should be focused on smaller farms and on female members of the households, as these two categories seem to have greater interest in using water for high-value vegetable production. Conversely it seems that current extension efforts are presently targeted towards larger farms and male household members.

The team was able to pinpoint four key areas for which more in-depth understanding is needed, and where further research efforts will produce the insights necessary for managing change in agricultural water use in this part of Indonesia. These were:

1. maintenance and operation of water infrastructure assets – instruments and institutions for empowering local communities
2. understanding and managing risk and uncertainty on the farm and in the market related to producing and marketing irrigated high-value vegetable crops
3. determining market price responses to changing supply conditions for high-value vegetable crops
4. understanding the role of social attitudes and perceptions in relation to market engagement and technology adoption in NTB and NTT, and identifying possibilities for change.

## **SMAR/2007/226: Investigation of contract farming options for shrimp production (AGB)**

### **Summary**

The Indonesian shrimp industry makes a significant contribution to the export revenue for Indonesian economy. Several government policies have been developed and implemented to improve the competitiveness of the industry. One option is contract farming, which was developed through the 'Inti-Plasma' or NESS (Nucleus Estate Smallholders Scheme). Most applications of the NESS were not successful due to a range of influencing factors.

This review will assess contract farming in the Indonesian shrimp industry then advise on potentially better options. The study will use several methods – such as the statistics descriptive, supply chain, SWOT and Analytical Hierarchy Process (AHP) – to revive the contract farming system and prioritise best options for the industry.

### **Project information**

**Overseas Collaborating Countries:**  
Indonesia

**Commissioned Organisation:** Bogor Agricultural University, Faculty of Economics and Management, Indonesia

#### **Project Leader**

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#### **Collaborating Institutions**

- Assessment Institute for Agricultural Technology, South Sulawesi, Indonesia
- Hasanuddin University, Indonesia

**Project Budget:** \$36,908

**Project Duration:** 01/06/2007 to 30/11/2007

**ACIAR Research Program Manager:** Mr David Shearer

### **Project outcomes**

Shrimp is one of the most popular export commodities in the Indonesian fisheries sector. According to the Ministry of Marine and Fishery, Indonesia exported 143,550 ton or

US\$1,086 billion in 2004. To encourage this valuable industry the Ministry have set a target of 540,000 tons of exported shrimp by 2009. While South Sulawesi is a major production province (contributing 7.2 percent of Indonesia's shrimp production), in recent years it has fallen significantly because of disease, poor shrimp-pond design and effluent management problems. To reach the 2009 target, revitalisation of the provinces fishponds and improving management practices is required.

Shrimp survival rates, related to shrimp disease, is the most crucial factor concerning shrimp farmers and the industry, in terms of supply. With low farmer capacity in South Sulawesi, government policy is necessary to improve their skills in shrimp management. However to implement this policy the industry needs to be more self-sustainable. The best strategy to develop the Indonesian shrimp industry is based on developing a more competitive supply chain, with improved relationships and communications between the farmers and intermediary sellers in order to avoid the scarcity of resource and the lack of production technology. Government intervention is needed to encourage better partnerships among agents in the supply chain in order to gain more equitable trade and risk sharing. A formal contract farming system, could be introduced, to share the risk of failure that is currently taken by the shrimp farmer. The process could also increase the productivity, quality and resulting profit of the supply chain through:

- improved access to high paying export markets
- innovative capital investment
- access to more advanced/productive technologies; access to farmer groups to share skills
- guaranteed and fixed pricing structures
- better management of risks, shared by all in the chain; improved farm family employment.

## **SMAR/2007/229: Options for teak industry development in Southeast Sulawesi**

### **Summary**

Indonesia is one of the world's largest growers of teak (*Tectona grandis*), with an estimated 1.7 M ha of teak plantations accounting for about 31% of the global plantation resource of teak, 5.7 M ha. This national teak resource supports an export furniture industry worth over US\$1.8 billion annually. Up to 3.1 million households are involved in teak growing through farm forestry operations.

Teak has a long history as an exotic plantation species in Indonesia, where it is believed to have been introduced some 800 years ago. For over 400 years, teak has been grown in intercropping systems in South-East Sulawesi where it is a common part of local farming systems.

Teak is important in South-East Sulawesi and 'Muna teak' (from the island of Muna) enjoys considerable market credibility. Emerging community involvement in forest management, consistent with evolving Government of Indonesia policies, will see increasing areas of teak planted in South-East Sulawesi. Supporting this expansion in the Konawe Selatan District is the Tropical Forest Trust, which seeks to link furniture retailers in the markets of Europe and North America with growers of FSC-certified wood. TFT has successfully supported a forestry cooperative to gain FSC certification for their planted teak resource.

### **Project information**

**Overseas Collaborating Countries:**  
Indonesia

**Commissioned Organisation:** Salwood Asia Pacific, Australia

#### **Project Leader**

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#### **Collaborating Institutions**

- Forest Research and Development Agency, Centre for Plantation Forest Research and Development, Indonesia

**Project Budget:** \$32,380

**Project Duration:** 01/03/2007 to 31/07/2007

**ACIAR Research Program Manager:** Dr Russell Haines

### **Project outcomes**

It is unlikely that there will be an expansion of secondary teak processing in South-East Sulawesi because of a lack of skills, poor export-orientated infrastructure and lack of scale. The expanding teak resource from South-East Sulawesi will be essential, however, to the maintenance of established and sophisticated processing facilities in Java. There are opportunities to improve primary log processing in South-East Sulawesi and to consider export of rough-sawn, kiln-dried lumber rather than squared logs.

There is a strong rationale for ACIAR to become involved with the expansion of the teak resource in Sulawesi. Teak grows well in eastern Indonesia and there are few technical constraints; it fits with long-established local traditions and conditions and with local industry and land use patterns; people from all walks of life can participate as most people in rural areas have access to land; the teak industry is mature and future prospects are bright; and teak enjoys strong support from the communities and the local governments.

ACIAR is in a position to offer considerable assistance to the smallholder teak growers in South-East Sulawesi through support for existing social forestry initiatives in the province and for ensuring that initiatives in growing teak are linked with the markets. A broad suite of opportunities has been identified including socio-economic studies and assistance in the establishment of reliable inventory systems, in improving cultivation options and intercropping alternatives, in improving primary processing and the use of log off-cuts, and in demonstration plantings of alternative plantation species.

## 7 Impact assessment program

ACIAR has always had a significant investment in impact assessment (IA), which is part of the Policy Linkage and Impact Assessment program (PLIA). The purpose is to provide an important after-the-event dimension to the comprehensive monitoring and evaluation processes ACIAR has had in place for many years. These processes are used to ensure that ACIAR's funds are used to support priority issues and are undertaken so that objectives are achieved efficiently and effective impacts result.

The IA functions include an important accountability role in providing key stakeholders with a clear measure of the returns on the funds ACIAR invests. ACIAR continues to expand the measures of these returns to include quantification of all 'economic' impacts, that is, financial, environmental, social and capacity building/stock of knowledge. In addition the assessments are increasingly providing a basis for improving the research selection process by identifying lessons learnt from past activities and feeding them into the project development and selection process.

Emphasis is also placed on developing collaborative links with partner countries, Australian and international groups undertaking similar activities to enhance ACIAR's effectiveness in this area. These collaborative links help improve the accuracy of the information used in assessing the impacts of the research and also the effectiveness of the methodology used to quantify the returns on investment.

ACIAR currently undertakes two types of impact assessment; adoption studies and detailed full benefit-cost impact assessment studies. Adoption studies are undertaken three to four years after a project has been completed and they involve the project leader reviewing the level of adoption of project outcomes, as well as the impact on the communities. Impact assessment studies are done by external reviews and they measure economic growth and environmental, social and capacity-building impacts. They are usually done on a suite of related projects to look at the full impact of ACIAR-funded research.

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### 7.1 Impact assessments undertaken in 2007-08

In 2007-08 nine impact assessment studies were undertaken. Seven were finalised and reports published. The other two are being finalised and will be published in early 2008-09. These results demonstrate that the returns on ACIAR and its partners investments are very high. In total the programs and projects assessed have been shown to have returned a net present value of \$2.3 billion in welfare gains from the investments. Some of the investments have shown extremely high rates of return with benefit to cost ratios of up to 250:1 and internal rates of return up to 210 per cent.

We have continued to focus on quantification of capacity building impacts. The study on pig improvement in Vietnam specifically focused on this and continued to demonstrate that this is an important aspect of ACIAR's partnership modality. Two dimensions were again identified. The first is the contribution the capacity building makes to enhancing the impact of the technology specifically developed by the research. The second is the longer term impact the enhanced capacity has on future activities and investments; this was again shown to be a significant source of welfare

gains from the R&D. Several other studies considered the capacity building impacts but it was found that if the elapsed time since completion of the project had not been long enough, it was too early to reliably identify the subsequent impacts.

#### ***Breeding and feeding pigs in Vietnam: assessment of capacity building and an update on impacts***

The impact assessment (IA) found that the net present value of the benefits to all funding is \$1,988.3 million with \$1,105.5 million attributable to the original ACIAR and partner funding and the balance to the other funders of subsequent development activities. The rates of return to this ACIAR activity were estimated as a benefit to cost ratio of 257:1 and an internal rate of return of 74 per cent. The study also shows that \$422.7 million of the total \$1,988.3 million benefits are attributable to the capacity building activities developed in the ACIAR- and partner-funded activities.

#### ***The impact of increasing efficiency and productivity of ruminants in***

### **India by use of protected-nutrient technology**

The dairy sector is an important part of agriculture in India. Productivity of dairy cows is recognised as being relatively low by international standards and feed quality and availability was identified as an important contributor. The adaptation of known protected nutrient technology from Australia to different feeds available in India was the focus of the ruminants research. The assessment estimates that the net present value of the welfare gains from the impact is \$232.1 million. The returns on the R&D investment are estimated as a benefit to cost ratio of 123:1 and an internal rate of return of 44 per cent.

### **ACIAR fisheries projects in Indonesia: review and impact assessment**

This study provides a review of all ACIAR-funded fisheries research in Indonesia and two detailed impact assessment studies – tuna capture fisheries and shrimp aquaculture. For captured fisheries management, the assessment shows that the capacity developed in early projects contributed significantly to Indonesia becoming a member of a regional fisheries management group and to the associated access to high value markets for southern blue fin tuna caught in Indonesian waters. The estimated net present value of the welfare gains from the investments required to achieve Indonesian membership of this regional group is \$1,100 million. The share of these returns attributable to the ACIAR

supported component is assessed to be \$168 million, indicating a return on ACIAR- and partner-invested funds of a benefit to cost ratio of 179:1 and an internal rate of return of 210 per cent.

For shrimp aquaculture the research developed effective technologies for pond remediation. The net present value of the welfare gains from the impact is estimated to be \$547 million with a benefit to cost ratio of 52:1 and internal rate of return of 26 per cent.

### **A review and impact assessment of ACIAR's fruit-fly research partnerships, 1984–2007**

Fruit flies are a major pest in Australia and most of ACIAR's partner countries. ACIAR has invested in several areas of fruit fly research for over 20 years. The review and impact assessment of this major research program found a complex story with a diversity of potential impacts and strong demands on institutional and policy systems to be able to capitalise on research results. The return from the substantial investment by ACIAR and its partner countries is significant with a net present value of \$208.1 million, a benefit to cost ratio of 5:1 and an internal rate of return of 33 per cent. However, these benefits are distributed in a complex manner between the 15 partner countries and Australia.

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## **7.2 Planned impact assessments in 2008–09**

At least five impact assessment studies (IASs) of completed projects will be published. Measurement of economic growth, environmental, social and capacity-building impacts will be incorporated where identified as important and possible.

Review and publish the 2008–09 project leader adoption studies for the set of large projects concluded in 2003–04.

Review the application and impact of ACIAR forages research activities and determine the implications of the impacts for future research in this area.

Undertake an assessment of at least one program of research for at least one significant partner country.

Collaborate with the Standing Panel on Impact Assessment (SPIA) of the Consultative Group for International Agricultural Research (CGIAR)

to undertake a detailed study of the impact of CGIAR research on ACIAR's mandate regions. This study will make use of past CG Centre impact assessment studies and/or undertake some new impact assessments.

Continue to add to a small database of all past impact assessment studies and start a process of Project Impact Assessment Summaries (PIAS) studies to provide a basis for and complement to the Adoption and Impact Assessment Studies.

### **Project-specific**

Publish five assessments of the impacts of completed projects in 2008–09. Measurement of economic growth, environmental, social and capacity-building impacts will be incorporated where identified as important and possible. This

year we will continue the process of selecting some projects for assessment using a stratified sampling process. The stratification of projects will be based on a range of considerations such as program area, geographic location, types of research and sector of the economy.

Review and publish the 2008–09 project leader adoption studies for the set of large projects concluded in 2003–04.

### **Capacity building**

Develop closer links with partner-country impact assessment groups to enhance estimation of technology adoption levels in future assessments. Training for partner-country impact assessment groups will also be included where appropriate. This training will include collaboration with the ATSE Crawford Fund.

Develop collaboration with international CG 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 the 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, summaries of the implications of impact studies will be provided to meetings of these groups.

### **Thematic studies**

Review the application and impact of ACIAR forages research activities and determine implications of the impacts for future research in this area.

Undertake an assessment of at least one program of research for at least one significant partner country.

Continue to develop a database of all past impact assessment studies and start a process of project impact assessment summaries (PIAS) studies, to provide a basis for and complement adoption and impact assessment studies.

Work closely with the Office of Development Effectiveness (ODE) to ensure ACIAR's impact assessment work maintains close links with 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 2007–08. Print copies are available by emailing [comms@aciarc.gov.au](mailto:comms@aciarc.gov.au), or electronic versions may be downloaded from ACIAR's website [www.aciarc.gov.au](http://www.aciarc.gov.au).

Monographs	
119b	<i>Guidelines for surveillance for plant pests in Asia and the Pacific [Vietnamese translation]</i> . Teresa McMaugh, Vietnamese translation by Phan Thuy Hien, 2008, 192 pp.
119c	<i>Guidelines for surveillance for plant pests in Asia and the Pacific [Thai translation]</i> . Teresa McMaugh, Thai translation by Yupa Hanboonsong, 2008, 199 pp.
120a	<i>Better-practice approaches for culture-based fisheries development in Asia [Lao translation]</i> . Sena S. Silva, Upali S. Amarasinghe and Thuy T.T. Nguyen, 2008, 105 pp.
120b	<i>Better-practice approaches for culture-based fisheries development in Asia [Vietnamese translation]</i> . Sena S. Silva, Upali S. Amarasinghe and Thuy T.T. Nguyen, 2008, 96 pp.
128	<i>Quality management of fresh produce from the highlands of Papua New Guinea: a postharvest manual</i> . Vincent Haguluha and Ernest Natera, ed. by John Spriggs, 2007, 86 pp.
129	<i>Diagnostic manual for plant diseases in Vietnam</i> . Lester W. Burgess, Timothy E. Knight, Len Tesoriero and Hien Thuy Phan, 2008, 210 pp.
130	<i>Soil Constraints and Management Package (SCAMP): guidelines for sustainable management of tropical upland soils</i> . P.W. Moody and P.T. Cong, 2008, 85 pp.
131	<i>Integrated pest and disease management for sustainable cocoa production: a training manual for farmers and extension workers</i> . John Konam, Yak Namaliu, Rosalie Daniel and David Guest, 2008, 36 pp.
132	<i>TaroPest: an illustrated guide to pests and diseases of taro in the South Pacific</i> . Amy Carmichael, Rob Harding, Grahame Jackson, Sarlesh Kumar, Sada Lal, Roy Masamdu, Jacqui Wright and Anthony Clarke, 2008, 76 pp.
133	<i>Overcoming liver fluke as a constraint to ruminant production in South-East Asia</i> . G.D. Gray, R.S. Copland and D.B. Copeman (eds), 2008, 155 pp.

Proceedings	
126	Integrated rural development in East Nusa Tenggara, Indonesia. S. Djoeroemana, B. Myers, J. Russell-Smith, M. Blyth and E.I.T. Salean (eds), 2007, 196 pp.
127	Permanent beds and rice-residue management for rice–wheat systems in the Indo-Gangetic Plain. E. Humphreys and C.H. Roth (eds), 2008, 192 pp.

Technical Reports	
67	Grassland degradation on the Tibetan Plateau: the role of small mammals and methods of control. Anthony D. Arthur, Roger P. Pech, Jiebu, Zhang Yanming and Lin Hui, 2007, 35 pp.
68	Economic potential of land-use change and forestry for carbon sequestration and poverty reduction. Oscar Cacho, Robyn Hean, Kirsfianti Ginoga, Russell Wise, Deden Djaenudin, Mega Lugina, Yuliana Wulan, Subarudi, Betha Lusiana, Meine van Noordwijk and Ni'matul Khasanah, 2008, 98 pp.
69	Achieving food security in China: implications of World Trade Organization accession. Chunlai Chen and Ron Duncan, 2008, 67 pp.

Working Papers	
59a	A survey of the mineral status of livestock in the Tibet Autonomous Region of China [Mandarin translation]. Nyima Tashi, Luo Xugang, Yu Shunxiang and Geoff Judson, 2008, 36 pp.

Impact Assessment Series Reports	
52	Breeding and feeding pigs in Vietnam: assessment of capacity building and an update on impacts. Hayden Fisher and Jenny Gordon, 2008, 56 pp.
53	The impact of increasing efficiency and productivity of ruminants in India by the use of protected-nutrient technology. Michael Monck and David Pearce, 2008, 32 pp.
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