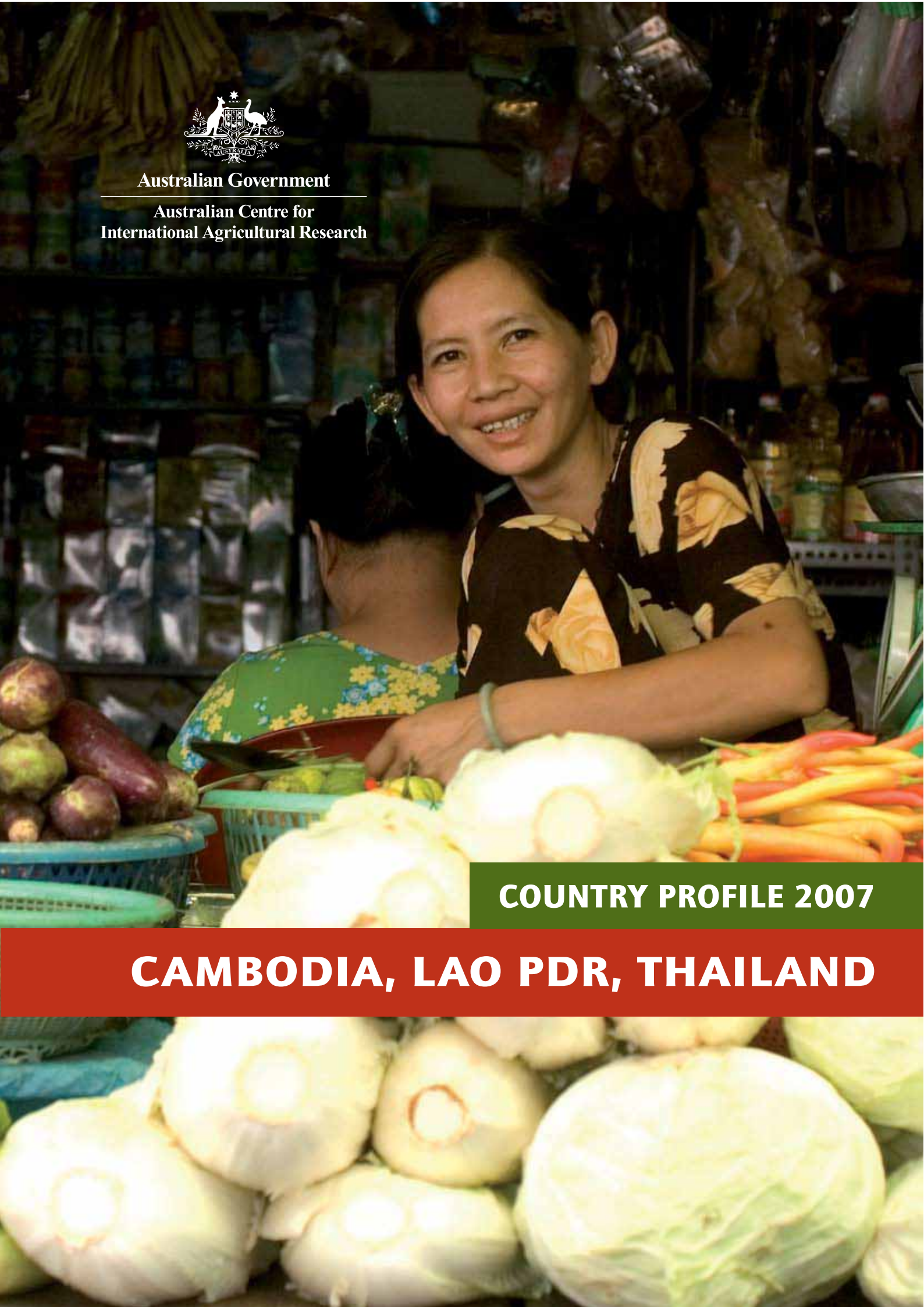




Australian Government

Australian Centre for
International Agricultural Research



COUNTRY PROFILE 2007

CAMBODIA, LAO PDR, THAILAND



Australian Government

**Australian Centre for
International Agricultural Research**

**COUNTRY PROFILE 2007
CAMBODIA, LAO PDR, THAILAND**

The Australian Centre for International Agricultural Research (ACIAR) operates as part of Australia's international development cooperation program, with a mission to achieve more productive and sustainable agricultural systems, for the benefit of developing countries and Australia. ACIAR commissions collaborative research between Australian and developing country researchers in areas where Australia has special research competence. It also administers Australia's contribution to the International Agricultural Research Centres.

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Additional copies of this publication are available from ACIAR offices:

In Thailand:

Ms Chiraporn Sunpakit
Manager Burma, Cambodia, Lao PDR, Thailand
Tel: +66 2 344 6300 ext 483
Fax +66 2 344 6305
Email: chiraporn.sunpakit@dfat.gov.au
Postal address:
Australia Embassy
37 South Sathorn Road
Bangkok 10120
Thailand

In Australia:

Ms Liz Clarke
Manager Communications and Secretariat Unit
Tel: +612 6217 0500
Fax: +612 6217 0501
Email: comms@aciar.gov.au
Postal address:
GPO Box 1571
Canberra ACT 2601

Website: www.aciar.gov.au

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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 bilateral and multilateral projects with Cambodia, Lao PDR and Thailand that were active from 1 July 2006 to 30 June 2007. At that time there were 27 active bilateral projects, and two active multilateral projects, the latter being led by international agricultural research centres. There were another 13 projects under development, many of which are expected to start in 2007–08 financial year.

This publication also sets out the key outputs and outcomes from 12 bilateral projects that have been completed between 1 July 2006 and 30 June 2007.

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

ACIAR updates this profile each year and distributes it to key stakeholders in Cambodia, Lao PDR, Thailand and Australia.

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



Peter Core
Chief Executive Officer

November 2007



Chiraporn Sunpakit
ACIAR Country Manager
Burma, Cambodia, Lao PDR, Thailand

2 Overview

2.1 ACIAR

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

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

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

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

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

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

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

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

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

2.2 Country Portfolio

Cambodia

ACIAR has supported a program of collaborative agricultural research with Cambodia since 1998. 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 Cambodia.

ACIAR's program with Cambodia as at 30 June 2007.

Bilateral Program

Active projects	12 with a value over their lifetime of approximately \$7,484,665
Projects under development	4
Share of South East Asia program	\$1,744,985 which represents 9.0% of the total 2006-2007 South East Asia program.
Completed projects	9

Multilateral Program

Active projects	0 with a value over their lifetime of approximately \$0
Projects under development	0
Completed projects	2

Lao PDR

ACIAR has supported a program of collaborative agricultural research with Lao PDR since 1992. 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 Lao PDR. Lao PDR is also targeted in ACIAR's multilateral program delivered in conjunction with the international agricultural research centres.

ACIAR's program with Lao PDR as at 30 June 2007.

Bilateral Program

Active projects	13 with a value over their lifetime of approximately \$4,061,067
Projects under development	8
Share of South East Asia program	\$1,066,463 which represents 5.5% of the total 2006-2007 South East Asia program.
Completed projects	26

Multilateral Program

Active projects	1 with a value over their lifetime of approximately \$416,226
Projects under development	0
Completed projects	3

Thailand

ACIAR has supported a program of collaborative agricultural research with Thailand 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 Thailand. Thailand is also targeted in ACIAR's multilateral program delivered in conjunction with the international agricultural research centres.

ACIAR's program with Thailand as at 30 June 2007.

Bilateral Program

Active projects	12 with a value over their lifetime of approximately \$1,677,891
Projects under development	5
Share of South East Asia program	\$440,157 which represents 2.3% of the total 2006-2007 South East Asia program.
Completed projects	113

Multilateral Program

Active Projects	2 with a value over their lifetime of approximately \$298,058
Projects under development	0
Completed projects	15

3 ACIAR Contacts

3.1 Country Office

Country Manager	Ms Chiraporn Sunpakit
Email	chiraporn.sunpakit@dfat.gov.au
Phone	+66 2 344 6300 ext 483
Country Assistant Manager	Thanawalai Jaroenjandang
Email	thanawalai.jaroenjandang@dfat.gov.au
Phone	+66 2 344 6300 ext 482

3.2 R&D Program

Regional Coordinator	Dr John Skerritt
Email	skerritt@aciarc.gov.au
Phone	+61 2 6217 0510
Regional Coordinator Assistant	Stephanie Bennett
Email	bennett@aciarc.gov.au
Phone	+61 2 6217 0559
Liz Clarke	Communications and Secretariat
Email	clarke@aciarc.gov.au
Phone	+61 2 6217 0535

Key Program Managers

Dr Caroline Lemerle	Agricultural Systems Economics and Management
Email	lernerle@aciarc.gov.au
Phone	+61 2 6217 0532
Dr Peter Rolfe	Animal Health
Email	rolfe@aciarc.gov.au
Phone	+61 2 6217 0540
Dr Paul Fox	Crop Improvement and Management
Email	fox@aciarc.gov.au
Phone	+61 2 6217 0527
Dr TK Lim	Crop Protection
Email	fox@aciarc.gov.au
Phone	+61 2 6217 0508
Mr Barney Smith	Fisheries
Email	smith@aciarc.gov.au
Phone	+61 2 9527 8462
Dr Russell Haines	Forestry
Email	haines@aciarc.gov.au
Phone	+61 2 6217 0549
Mr Les Baxter	Horticulture
Email	baxter@aciarc.gov.au
Phone	+61 2 6217 0553

4 Training

The ACIAR training program has a budget in 2007-08 of approximately \$5.57 million. It comprises five elements:

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

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

The ACIAR John Allwright Fellowship Scheme accounts for approximately \$4.53 million (this figure includes \$3 million from AusAID) of the training program budget in 2007-08. The objective of the Scheme is to increase the research and development capacity of ACIAR partner country institutions. It provides funding for promising overseas researchers associated with ACIAR projects to undertake postgraduate studies in tertiary institutions in Australia.

Cambodia John Allwright Fellowship Statistics

		PhD	MSc/Other
Active	Male	1	0
	Female	0	0
Concluded	Male	0	1
	Female	0	0

Lao PDR John Allwright Fellowship Statistics

		PhD	MSc/Other
Active	Male	1	2
	Female	0	0
Concluded	Male	0	1
	Female	0	0

Thailand John Allwright Fellowship Statistics

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

Part 1: Cambodia

5 Annual Report 2006-07

5.1 Cambodia

Active projects in 2006-07	17
AOP budgeted expenditure in 2006-07	\$1,513,016
Actual expenditure in 2006-07	\$1,744,985
Expenditure in 2005-06	\$1,435,960
Expenditure in 2004-05	\$1,212,879

Key performance indicators	Performance 2006-07
Linkages maintained and expanded between Cambodian research and extension organisations in ACIAR projects	Two major projects conduct most research is on farmers fields and formally include extension personnel and provincial staff along with researchers. This linkage is also a key criterion for CARF projects.
Cambodian Journal of Agriculture issues published with reports of successful ACIAR-funded research	Two issues funded and published, with several articles based on ACIAR-funded research work.
New animal health and livestock bio-security program developed and implemented	Project implemented to investigate innovative ways to manage and monitor livestock movements and the diseases they carry.
Project activities to enhance beef production designed and commenced	A study to define and test best practice cattle health and husbandry has been developed and implemented, while the full design of a project focussing on forages for beef production will be completed in August.
Disease management strategies for tomatoes assessed in the field	A range of tomato varieties were assessed in the field on a range of agronomic and postharvest characteristics including pre-and post-harvest diseases.
Two Cambodian scientists trained in identification and management of rice diseases	Two scientists trained and a well-equipped laboratory to underpin capacities in plant pathology.
Forty per cent of new projects designed to have significant farmer or policymaker impacts within five years of completion	All four new projects deemed as having most impacts after five years, although in each case some activities will impact in a shorter time frame.

5.2 Position

Australia took a major role in assisting Cambodia on its path to democracy in the early 1990s, and in doing so pledged to provide significant development assistance over the medium term. A major component of the AusAID assistance in Cambodia continues to be in agriculture and rural development, and ACIAR will endeavour to link its research projects to new AusAID programs. Several other donor programs in Cambodia have an agricultural and rural development focus, and where possible linkages with these programs will be established.

Cambodia has a very low per capita GDP and the predominance of rice-based farming systems on infertile soils means that Cambodia has rather low agricultural productivity on both a labour and land area basis. The suite of current, proposed and completed projects is targeted at research to improve rice productivity, assessing land suitability for a second rice crop, and developing options for the production and marketing of non-rice crops.

ACIAR will continue to support selected initiatives in animal health and production as well as fisheries. Considerable progress has been made in developing the scientific expertise of a number of Australian-trained Cambodian researchers who should be able to contribute significantly to the development of Cambodian agriculture.

ACIAR will also maintain an emphasis on short-course training in areas such as R&D priority-setting and management, enhancing research-extension linkages, scientific proposal and report writing in English, and in experimental design and analysis. This will also include training and technical assistance with the production of the Cambodian Journal of Agriculture.

5.3 Relationship to the AusAID Cambodia strategy

The Australia-Cambodia Development Cooperation strategy emphasises poverty reduction and sustainable development in Cambodia, through three objectives: increasing productivity and incomes of the rural poor; to reduce vulnerability of the poor; and strengthening the rule of law.

The ACIAR program through its two emphases (underpinning agricultural diversification, and supporting research that aims to increase the productivity of rice-based farming systems) directly supports the four thrusts of the first objective of AusAID's program, namely improved farming techniques, product processing, access to market information and addressing market policy constraints.

5.4 Achievements

The Cambodian program has focused on field crop improvement and management, horticulture, land and water resources, animal health, and agricultural systems economics and management. Projects are grouped under the following themes:

- Securing productivity of rice-based farming systems.
- Income generation and better nutrition through agricultural diversification.

Cambodia is moving away from growing largely rice as its core cereal crop and diversifying into secondary crops, to improve human and animal nutrition and boost the cash economy. Work at the Cambodian Agricultural Research and Development Institute (CARDI) now focuses strongly on **non-rice crops for the uplands**, and an ACIAR project is providing researchers, extension workers and farmers with training and experience in relation to such crops.

A series of workshops conducted early in the project has helped to identify the constraints to the adoption of diversified farming systems. Farmer meetings and workshops led on to a program of field research, where farmers, provincial agricultural technicians and extensionists plus researchers from CARDI worked in collaboration to set up trials in the farmers' fields.

Between 2004 and 2006 the program undertook around 150 on-farm experiments and demonstrations, comprising studies of plant variety, insect pests and disease, reduced tillage, agronomy and farming systems.

The project team have prepared manuals for growing soybean, maize, mungbean, peanut, cowpea and sesame, and drafted guidelines to help identify weed and insect pests of upland crops. Farmers have learnt the techniques to boost production by lifting the nitrogen content of the soil.

An 'action research' project is aiming to bring about positive socioeconomic change in the Cambodian **maize and soybean marketing** systems. A significant achievement has been the development of a successful soybean marketing association in eastern Cambodia. The project team worked with the Ta Ong Soybean Association (TSA) in Kampong Cham province. At the outset TSA was a non-functioning association with only 14 members; it now has 160 members (with membership capped at this level). It is operating successfully as a microfinance institution, having made low-interest loans to about 1000 farmers, and is now looking to build its own dryer-silo and market its members' produce in Vietnam.

Several diseases—brown spot, rice blast, false smut, bakanae and kernel smut—are commonly found in Cambodian rice crops, but little is known about the distribution, prevalence or impacts of these diseases. A project is training Cambodian researchers in **basic plant pathology techniques**. Surveys of lowland rice crops were carried out in five provinces in August 2006 and February 2007. The results highlighted the importance of laboratory isolations to confirm diagnoses—in many instances diseased tissue did not yield the pathogen tentatively identified on the basis of symptoms. CARDI now houses the first plant disease herbarium in Cambodia. This will curate specimens of correctly identified diseases (initially of rice, but other crops will be included in future) as a record of their occurrence and as training material for plant pathology personnel.

Vegetable production in Cambodia remains low, due largely to unreliable supply of seed, high input costs and a lack of knowledge of postharvest handling. A project designed to **improve vegetable production and postharvest management** has focused initially on tomato and chilli varieties. Tomato lines selected for trial came from AVRDC and previously untested hybrids that commercial seed companies donated to the project. These were performance-tested against existing grower varieties. The trial sites varied in soil type and management system, and therefore the results gave a good indication of suitability of the entries. A tomato grower survey of 50 farmers complemented an earlier ADB survey of market agents, collectors and transporters. Types of information gathered about the chain of sale included the means of selling tomatoes (for instance through street vendors or wet markets), methods of packaging and handling, and levels of spoilage. A chilli survey is scheduled for the near future.

A collaborative study involving Cambodian and Lao veterinary services working with Australian partners has learnt much about what drives the movement of **domestic and transboundary livestock**. The scientists are using this knowledge to prevent the spread of livestock diseases, especially foot-and-mouth disease and classical swine fever. They now have a mechanism to explain the existing movement patterns of livestock in Cambodia, Lao and surrounding countries, and have used this to compile a list of indicators that will allow timely interventions to minimise the risk of disease spread. ACIAR has recognised the significance of this work for the region by commissioning a thorough review of livestock health and vaccine development as a prelude to developing of several new animal health projects.

In a project **to control fasciolosis** (tropical liver fluke infection) in cattle and buffalo, the project team surveyed farmers at the project site and found that farmers who received education and extension on fasciolosis and control measures had retained a greatly enhanced knowledge and understanding. Farmers were convinced of the economic impacts of fasciolosis as they realised that infected cattle demonstrated negative traits such as slower weight gain, lower fertility among reproductive females and weaker draft ability. They are keen to have the work extended.

6 Annual Operational Plan 2007-08

GNI per capita (\$US)	380	Bilateral actual 2005–06	\$ 1.44 m
Population	13.8 m	Bilateral estimate 2006–07*	\$ 1.51 m
Population 2015/2050	17.1/26 m	Bilateral budget 2007–08*	\$ 1.64 m
Active bilateral projects	8	Bilateral + multilateral budget 2007–08	\$ 1.64 m
Active multilateral projects	0		

*Includes AusAID funding of \$0.2 m (estimate 2006–07)

6.1 Key performance indicators (2007–08)

- Linkages developed between Cambodian research and extension organisations in ACIAR projects and the new AusAID Cambodian Agriculture Value Chain Program, and strategies for the institutionalisation and continuation of CARF assessed
- Field crop diversification fostered through commencement of trials on suitability of maize and legumes following rice in lowland farming systems and characterisation of marketing systems for these products. Processes that improve profitability for Cambodian farmers and traders assessed and modified
- Contribution to better vegetable production systems in Cambodia through evidence of farmer adoption of improved tomato and chilli varieties
- Initial analysis of transboundary livestock disease threats completed
- 40% of new projects designed to have significant farmer or policymaker impacts within five years of completion

6.2 Medium-term strategy

ACIAR's strategy in Cambodia has two thrusts: firstly to support applied research that underpins agricultural diversification, particularly into non-rice field and horticultural crops and into ruminant livestock, and secondly to support research that aims to increase and secure the productivity of rice-based farming systems. As markets develop in Cambodia, ACIAR will place greater emphasis on research to underpin the development of suitable supply chains.

Maintaining and increasing rice yields remains critical to improving food security and incomes in Cambodia. Rice security and income from rice enable farmers to invest in higher-value activities such as vegetables, fisheries or livestock. Increasing rice yields can reduce the area under rice cultivation, making more farm land available for higher-value agricultural activities. The ACIAR program has a strong emphasis on building Cambodian research capacity and encourages the development of collaborative linkages between Cambodian organisations.

6.3 Position

The Cambodian agricultural production environment is, in general, much more harsh than the fertile lowlands of other South–East Asian countries. Soils are generally poor, and most of the agriculture (three quarters) is rain-fed.

The predominance of rice-based farming systems on infertile soils means that Cambodia has rather low agricultural productivity on both a labour and land area basis. Many farmers are

able to produce only a single crop per year, and this brings the combined problems of low productivity, volatile yields and strong seasonality. These factors have contributed to poor market linkages with lack of investment in plantations and in contract farming and other arrangements. Average rice yields are only just over 2T per ha (in comparison with a national average of 5T per ha for Vietnam).

The overwhelming driver for most Cambodian smallholder farmers is to secure their household food production (which essentially means rice security) to avoid annual hungry periods.

Before diversification strategies can be investigated and implemented such security is critical. For this reason, the ACIAR research program has pursued the twin objectives of assisting with rice security (managing constraints and threats to rice production) as well as supporting research to foster agricultural diversification.

Agriculture accounts for about 30–40% of the Cambodian GDP—only 3% of exports but 70% of employment. There is significant year-to-year variation in production, highlighting the dependence of Cambodian farming on rain-fed systems.

The suite of current, proposed and completed projects is targeted at research to improve rice productivity, assessing land suitability for a second rice crop, and developing options for the production and marketing of non-rice crops. This includes production and marketing systems for other field crops such as maize and legumes in upland and lowland situations, and of production and marketing options for vegetables in areas with good access to markets.

Cambodia's low population density, particularly in the uplands, should provide potential for increasing ruminant livestock production. Challenges remain in the supply of low cost animal feed and maintaining product quality. Smallholder livestock are important in the Cambodian agricultural economy, and ACIAR will support research to assist in the control of trans-boundary diseases and production, particularly of ruminants.

ACIAR will also provide additional funding for two further Cambodian Agricultural Research Fund (CARF) project rounds commencing in 2007. CARF was established in 2002 with AusAID and ACIAR funding to provide Cambodian scientists with an opportunity to identify priorities, design demand-driven agricultural research projects, compete for agricultural research funds and to lead the selected projects.

Since 2002 over 40 projects, involving the Cambodian Agricultural R&D Institute (CARDI), Ministries, Universities and non-government organisations have been funded. Over the last few years, ACIAR has diversified its R&D provider base in Cambodia. CARDI is expected to continue to be a key research provider in the rice-based farming systems area. However, other partners are important in horticulture, livestock and economics, and in seeking community impacts from research.

Considerable progress has been made in developing the scientific expertise of a number of Australian-trained Cambodian researchers who are poised to contribute significantly to the development of Cambodian agriculture.

ACIAR will also maintain an emphasis on short-course training in areas such as R&D priority-setting and management, enhancing research–extension linkages, scientific proposal and report writing in English, and experimental design and analysis. This will also include training and technical assistance with the production of the Cambodian Journal of Agriculture.

Australia took a major role in assisting Cambodia on its path to democracy in the early 1990s and, in doing so, pledged to provide significant development assistance over the medium term.

A new \$45m, five-year AusAID-funded Cambodia Agriculture Value Chain Program should commence in 2007/08, and ACIAR will endeavour to link several of its research projects to this program. Several other donor programs in Cambodia have an agricultural and rural development focus. Also, a National Agriculture and Water Strategy was recently developed, with donor input (www.twgaw.org). Where possible, linkages with other donor programs will be established by ACIAR.

6.4 Relationship to the AusAID Cambodia strategy

The Australia–Cambodia Development Cooperation strategy emphasises poverty reduction and sustainable development in Cambodia through three objectives: increasing productivity and incomes of the rural poor, improving health service delivery, and strengthening the rule of law.

The ACIAR program, through its two emphases (underpinning agricultural diversification, and supporting research that aims to increase the productivity of rice-based farming systems), directly supports the four thrusts of the first objective of AusAID's program, namely improved farming techniques, product processing, access to market information and addressing market policy constraints.

6.5 Indicative priorities

Priorities for ACIAR–Cambodia cooperation are established through meetings between ACIAR research program managers and executive staff and Cambodian agricultural R&D institutions, government departments and other organisations active in rural development in Cambodia. Priority development was also facilitated through the July 2006 visit by the ACIAR Board of Management to Cambodia.

New projects will be considered in the areas of field crop improvement and management, horticulture, animal health and production, and agricultural systems economics and management. Projects should fall under the following thematic programs:

Subprogram 1: Securing productivity of rice-based farming systems

- Improving the productivity of rain-fed and irrigated rice-based farming systems through better agronomy and management of pests and diseases
- Development of suitable rotations involving legumes and other crops

Subprogram 2: Income generation and better nutrition through agricultural diversification

- System and technology improvement to support crop diversification (economic analysis of non-rice crops, soil management, assessment of land suitability for different crops)
- Improving the efficiency of production, postharvest and marketing systems for fruits and vegetables
- Improving ruminant livestock health and production of ruminants

- Support for research and extension in other areas of agricultural diversification through the Cambodian Agricultural Research Fund

7 Projects (summary and progress reports)

7.1 Subprogram 1: Securing productivity of rice-based farming systems

Projects:

Active

ASEM/2003/007	CARF — Cambodian Agricultural Research Fund
CIM/2003/030	Improving understanding and management of rice pathogens in Cambodia
CIM/2006/040	Diversification and intensification of rainfed lowland cropping systems in Cambodia
CIM/2007/027	Development of conservation farming implements for two-wheeler tractors (power tillers) in Cambodia and Lao PDR

Concluded

ADP/2000/007	Farmer-based adaptive rodent management, extension and research system in Cambodia
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ASEM/2003/007: CARF – Cambodian Agricultural Research Fund

Bilateral

Overseas Collaborating Countries	Cambodia
Commissioned Organisation	Consultant, Australia
Project Leader	Dr John Schiller Phone: 07 3365 2987 Fax: 07 3365 1188 Email: j.schiller@uq.edu.au
Collaborating Institutions	Large number of Cambodian partners
Project Budget	\$1,279,628
Project Duration	01/03/2002 to 31/12/2009 (Project extended from 01/07/2006 to 31/12/2009)
ACIAR Research Program Manager	Dr John Skerritt

Project background and objectives

The Cambodian Agricultural Research Fund (CARF) was established in 2002 to provide Cambodian scientists with an opportunity to compete for agricultural research funds. It is open to government, university or college and NGO organisations based in Cambodia, which have the clear ability and mandate to implement research within Cambodia.

The aim of the Fund is to provide an environment of competitive tender for agricultural research. In the medium term, it is expected that the CARF will be institutionalised within Cambodia. Other donors will be encouraged to contribute to the trust fund and/or support projects linked to trust fund projects.

Project progress

Year 5 (01/03/2006–28/02/2007)

The CARF review was discussed with AusAID officers who indicated that they were considering inclusion of a major competitive research and extension component within their new Cambodian agricultural program. However, AusAID indicated that significant design work for the program was required so that it was unlikely that a final decision on how to fit a successor funding program into such a scheme would be made until late 2007 (and thus it would be unlikely that any scheme, if approved, would be able to start until mid-2008).

The possibility of interim ACIAR support for CARF was raised by the Cambodian side in discussions with AusAID staff and the Ambassador during the July 2006 ACIAR Board visit to Cambodia. Following this, ACIAR agreed to fund two further rounds of CARF projects, based on applications submitted in late 2006 and late 2007.

The fifth meeting of the CARF project selection committee was held in Phnom Penh on 12 January 2007 with the biggest pool of applications received (50), which shows that interest in CARF remained very strong. CARF was able to fund 14 projects, which all started in the March–June 2006 period.

Projects selected (Round 5) were:

- Assessment of postharvest loss and its economic significance for non-rice crops in upland areas of Cambodia (Som Bunna, CARDI, 3 years)
- Assessing nitrogen management options for rice production in the rainfed lowland systems of Cambodia (Seng Vang, CARDI 3 years)
- Reducing the risk of growing rainfed upland crops in Cambodia (Pin Tara, CARDI, 3 years)
- Assessing soil property changes under cassava production in the upland farming systems of Cambodia (Ngeth Sivutha, CARDI, 3 years)
- Enhancement of farmers' knowledge and skill in pest management on leguminous crops in Cambodian upland condition (Pol Chanthy, CARDI, 3 years)

ACTIVE PROJECTS

- Minimising water use and labour inputs in dry season and early wet season rice production (Khun Leang Hak, CARDI, 3 years)
- An assessment of production potential (production and economics) of seasonal vegetable production (Ing Sina, DAALI, 3 years)
- Continued studies on the potential of improved pastures for improving the productivity of cattle raising in Prey Veng province (Pin Vannaro, MVU, 3 years)
- Occurrence of cashew pests in Cambodia and their control (Sip Pagnasoley, RUA, 3 years)
- The effect of breed difference on growth performance, carcass traits, and consumer preferences, of pigs slaughtered for Phnom Penh consumers (Vathana Sann, RUA 2 years)
- IPM of citrus in Banorn district, Battambang (student project) (Tho Kim Eang, RUA, 6 months)
- Value-adding to rice for enhancement of agro-enterprise development and poverty reduction in Cambodia (Touch Visalsok, RUA, 3 years)
- Improving seed production capacity and promotion of freshwater prawn farming in Cambodia (Chhouk Borin, RUA, 2 years)
- Small-scale hatchery and aquaculture development in Svay Reing province (Mr Khov Kuong, RUA, 1.5 years)

Monitoring of active projects and one-on-one mentoring on the development of proposals continued through three visits to Cambodia by consultant Dr John Schiller. In June 2007, Drs Schiller and Anderson (CSIRO Publishing) visited Cambodia to assist with the *Cambodian Journal of Agriculture*. As of June 2007, three issues of the re-launched journal had been published. A course on experimental design, data management and analysis conducted by the University of Queensland was held in Cambodia in early February 2007. The course took place at the Cambodia Agricultural R&D Institute headquarters and involved 21 attendees.

CIM/2003/030: Improving understanding and management of rice pathogens in Cambodia

Bilateral

Overseas Collaborating Countries	Cambodia
Commissioned Organisation	NSW Department of Primary Industries, Orange Agricultural Institute, Australia
Project Leader	Dr Eric Cother Phone: 02 6391 3886 Fax: 02 6391 3899 Email: ric.cother@agric.nsw.gov.au
Collaborating Institutions	Cambodia Agricultural Research and Development Institute, Cambodia Charles Sturt University, Australia
Project Budget	\$424,725
Project Duration	01/07/2005 to 30/06/2008
ACIAR Research Program Manager	Dr Paul Fox

Project background and objectives

Rice is the main staple crop in Cambodia. Average consumption is about 160 kg per person each year. As a result rice is planted on 90 per cent of the total agricultural area. Rice is also the major agricultural income earner. Diversification of agriculture beyond rice is an important priority for Cambodia's government, but to achieve this several factors must be addressed, including raising rice yields so some land can be freed for other agricultural pursuits.

Average yields for rice in Cambodia vary from wet to dry season. In the wet season yields are around 0.95 tonnes per hectare, almost doubling to 1.8 t/ha in the dry season. One factor constraining wet season yields is disease, which may also limit potential in dry seasons. Current efforts to boost yields include double cropping of rice, a situation that also doubles the opportunities for diseases to spread.

Little is known about the prevalence or spread of important rice diseases in Cambodia. In part this is due to the lack of knowledge and expertise of plant pathology amongst Cambodian researchers. With more than 50 known diseases of rice capable of limiting yields, such knowledge is vital. What is known is the presence of brown spot, rice blast, false smut, kernel smut and bakanae. Building Cambodian capacity in plant pathology, with a focus on rice, is needed to support both increased production and the options for agricultural diversification.

The primary goal of the project is to initiate and develop Cambodian training in general plant pathology (and more specifically in rice plant pathology) to build the country's long-term agricultural research capacity. The secondary aim is for Australian plant pathologists to gain a better understanding of the exotic diseases that have been identified as a threat to the Australian rice industry. It is intended that the knowledge gained from this project will help the Australian industry to maintain its comparative low-disease status and to prepare incursion management strategies.

Project Progress

Year 2 (01/07/2006–30/06/2007)

Surveys of lowland rice crops were carried out in Takeo, Kandal, Svay Rieng, Prey Veng and Kampong Chhnang Provinces in August and February. Crops of upland rice in Ratanakiri and Mondulakiri Provinces that had suffered large losses due to a combination of disease, adverse weather events and insects (termites and stem borers) were inspected in November. Bacterial diseases dominate and many of the diseases listed in various sources as present in Cambodia have not been observed.

ACTIVE PROJECTS

The pathogen causing Blast disease, which is reported to be widespread, was only isolated from one locality. Survey results are highlighting the importance of laboratory isolations to confirm diagnoses based on symptoms. In many instances, diseased tissue has not yielded the pathogen presumed to be the cause based only on symptoms. Leaf lesions similar to those caused by the blast fungus have only produced species of *Bipolaris*, *Drechslera*, *Curvularia* and *Helminthosporium*. Conidia of *Magnaporthe grisea* have not been observed on lesioned tissue.

Bakanae disease was widespread at a low incidence in many crops. Yield loss was estimated as low but this disease poses a great problem for farmers who save their own seed. The first plant disease herbarium in Cambodia has commenced at CARDI. This will curate specimens of correctly identified diseases (initially of rice, but other crops will be included in future) as a record of their occurrence and as potential training material for plant pathology personnel. Authenticated cultures of the pathogens are lodged with the disease reference herbarium (DAR) in Orange NSW. On-site training in plant pathology laboratory methods was a continuing feature of our visits. In addition, a 3-day course on disease recognition in tomatoes and other vegetables, and field sampling protocols was conducted in conjunction with ACIAR project CP/2202/115.

A field experiment was set up at CARDI to assess cultivar and fertiliser interactions with blast disease. There was widespread occurrence of bacterial glume blight, glume lesions and *Cercospora* leaf spot but no blast developed in the trial plots. A glasshouse experiment was conducted to investigate a reported lack of vigour in CARDI-derived rice seed sown in Takeo Province. The condition could not be reproduced in the glasshouse and it was determined that field history was a major influence on the perceived problem.

Several pathogenicity tests were conducted to complete Koch's postulates with bacterial and fungal isolates derived from infected plants sampled in the field. The severity of infection and the widespread occurrence of some bacterial pathogens indicated that considerable yield and/or quality loss is occurring in many areas where the diseases have been observed.

A survey of diseases in wild *Oryza* (rice) species in northern Australia has identified a previously unrecorded smut disease caused by a new species of *Tilletia*. Tests are in progress to determine the pathogenicity of this fungus to a commercial cultivar of rice. Three bacterial diseases were also identified for the first time in wild *Oryza* spp. The Australian survey was augmented by experience gained in Cambodia and it is now known that the three pathogens detected in the Northern Territory are similar to those detected in Cambodia and that they are pathogenic to domestic rice cultivars.

CIM/2006/040: Diversification and intensification of rainfed lowland cropping systems in Cambodia

Bilateral

Overseas Collaborating Countries	Cambodia
Commissioned Organisation	University of Queensland, School of Land and Food Sciences, Australia
Project Leader	Professor Shu Fukai Phone: 07 3365 2340 Fax: 07 3365 1188 Email: s.fukai@uq.edu.au
Collaborating Institutions	Cambodia Agricultural Research and Development Institute, Cambodia Provincial Department of Agriculture of Kampong Cham, Cambodia Provincial Department of Agriculture of Takeo, Cambodia Provincial Department of Agriculture of Kampong Thom, Cambodia NSW Department of Primary Industries, Australia
Project Budget	\$882,407
Project Duration	01/04/2007 to 30/09/2010
ACIAR Research Program Manager	Dr Paul Fox

Project background and objectives

In most seasons Cambodia grows sufficient rice for its population's needs. The country has a priority to diversify some of the rice-based systems to higher-value crops, as a means of increasing family incomes from smallholdings. While efforts have already begun to diversify in the uplands there has so far been little research effort to add non-rice crops to the rainfed lowlands rice systems where over 80% of rice is produced. But a major constraint to change is water supply; there is either too much during the wet season to add non-rice crops into the 'bunded' and anaerobic rice fields, or too little for planting non-rice crops to follow late-maturing rice varieties.

However changes in the rice system now offer opportunities for diversification. Firstly the improved productivity in rice technologies has meant that farmers can meet their family requirements for rice and produce some to spare. They may therefore be prepared to forego some rice production and grow a higher-value crop that increases family income.

Secondly some of the newer rice varieties mature earlier and use less water, thus providing a longer 'window' for growing another crop to follow rice at the end of the wet season.

The aim of the project is to increase the range of crops grown in Cambodia under rainfed lowland conditions, through promoting non-rice crop technologies that are efficient users of water and promise high financial returns to the growers.

Project Progress

Year 1 (01/04/2007–31/03/2008)

First progress report due in 2008.

CIM/2007/027: Development of conservation farming implements for two-wheeler tractors (power tillers) in Cambodia, Lao PDR and Bangladesh

Bilateral

Overseas Collaborating Countries	Bangladesh, Cambodia, Lao PDR
Commissioned Organisation	Mr Ronald J Esdaile Consultant, Australia
Project Leader	Mr R J Esdaile Phone: 02 6760 8572 Email: rjesdaile@bigpond.com
Project Budget	\$46,500
Project Duration	01/06/2007 to 31/03/2009
ACIAR Research Program Manager	Dr Paul Fox

Project background and objectives

Tillage operations by the majority of smallholder farmers in parts of South and Southeast Asia have until recently relied on manual and animal draught power. In the last decade, mechanisation based on the use of two-wheel tractors (power-tillers) has become widespread. The versatility of power-tillers offers significant opportunities to promote conservation tillage in areas of Asia that are transitioning into mechanised agriculture (e.g. Bangladesh, Burma, Cambodia and Lao DPR).

However, with the exception of work carried out by CIMMYT in Bangladesh from 1995 to 2004, to develop conservation tillage implements for power-tillers to establish wheat in rice-wheat systems, little further systematic design, development and testing work has been carried out. This is partly because conservation tillage research has tended to focus on four-wheel tractors (e.g. Pakistan, India, China), or there is limited research capacity to develop agricultural machinery (e.g. Burma, Cambodia and Lao DPR).

A factor compounding the difficulty to develop and promote conservation farming implements for two-wheel tractors is the lack of machinery standardisation between the different power-tiller manufacturers. Consequently, unavailability of suitable conservation farming implements to match prevailing two-wheel tractors in many Asian countries represents a major constraint to the promotion and adoption of conservation farming techniques where mechanisation is primarily at the power-tiller level.

This Small Research Activity aims to bridge this constraint by providing ongoing ACIAR projects in Cambodia, Lao PDR and Bangladesh with a suite of conservation farming implements suitable to use with power-tillers prevalent in the respective countries, and to build these activities into the planning of new projects.

The specific objectives to achieve this are:

1. to develop a universal toolbar complete with a set of conservation farming attachments (including both full tillage and zero tillage seed drills) that can be used on a range of differently configured power-tillers
2. to further modify and alter the existing standard Asian rotary hoe based full tillage power tiller seed drill to convert it to a true zero tillage/strip tillage unit that will operate in an extensive range of soil and environmental conditions.

Project Progress

First progress report due in 2008.

ADP/2000/007: Farmer-based adaptive rodent management, extension and research system in Cambodia

Bilateral

Overseas Collaborating Countries	Cambodia
Commissioned Organisation	University of Queensland, School of Animal Studies, Australia
Project Leader	Mr Luke K-P Leung Phone: 07 5460 1264 Fax: 07 5460 1444 Email: lkl@sas.uq.edu.au
Collaborating Institutions	Cambodian Department of Agricultural Extension, Cambodia Cambodia Agricultural Research and Development Institute, Cambodia
Project Budget	\$515,973
Project Duration	01/07/2001 to 31/03/2007 (Project extended from 01/07/2005 to 31/03/2007)
ACIAR Research Program Manager	Dr Simon Hearn

Project background and objectives

The rat is the most important pest of rice in Cambodia. Rat problems are likely to get worse with increased cropping intensity. Farmers have traditionally managed rats in various ways e.g. using zinc phosphide bait, trapping, digging burrows, hunting, and plastic fences. Sometimes, this has been supported by a bounty on rat tails. There is scope to improve existing practices both by improving the techniques of rat management used by individual farmers and by greater attention to concerted action by communities.

Previous work in Cambodia showed the usefulness of community-based approaches based on the concerted action of individuals pursuing their own practices and on novel technology (such as the active trap barrier system – TBS), and managing the latter as a community resource. TBS technology has been developed elsewhere in the region but the economic and social aspects of this technology are poorly understood.

Management of the TBS as a common property resource (i.e. at a community level) may provide a means to overcome this problem. This also means that the technical aspects of the technology and the social arrangements that support it have to be melded together. An ACIAR-funded rodent project has advanced the knowledge of rodent pest ecology and control in Southeast Asia. This project is building on this large ecological knowledge base.

The project investigated the technical, social and economic aspects of rodent pest management in Cambodia. The researchers identified appropriate social institutions for managing the trap barrier system as a common property resource at a village level; evaluated various technological options for improved rodent management in Cambodia, and promoted a greater familiarity with, and acceptance by the Cambodian Agricultural Research and Development Institute of community-based approaches to technology development.

Project Outcomes

ACIAR funded this project to facilitate the adoption of the community based Trap Barrier System (TBS) and other rice field rodent pest control methods in Kampong Cham Province in Cambodia. A total of 33 community-based TBSs were implemented by 240 farmers during the project. The key findings of this study indicate that the adoption of the technology is limited because the cost of establishing and maintaining the community TBS is justified if rodent damage to crops is high and predictable.

CONCLUDED PROJECTS

The community TBS must be implemented in the rice field at the transplanting stage so that a lure crop to attract rats is planted inside the TBS. Farmers cannot make a decision at the planting stage whether or not to implement a community TBS because it is too early to forecast rodent damage to crops at the transplanting stage.

However, some farmers at the project site have adopted and improved the community TBS in areas where high rodent damage occurs regularly each year. The financial support from the project (e.g., supply of trap and fence materials) for the community TBS was gradually phased out from 40% of total cost in 2003 to 0% in 2004. The number of TBS groups, the number of participating farmers, and the quality of TBS construction and maintenance did not decline over this period, indicating that the community TBS is self sustainable.

The most commonly used method to control rice field rodents in Southeast Asia has been, and will continue to be, the application of rodenticide bait. This is because the bait has been the most affordable technology for rice farmers. Laying rodenticide bait is also the most commonly used method for the control of mouse plagues in Australia. Our project has conducted an experiment to demonstrate that bait uptake and palatability is improved by 65% by replacing maize with rice as the bait base. The farmers also learnt to make wax block bait with technical inputs from the project. They prefer to use wax block bait because they are weather-resistant and not palatable to non-target species such as chickens, dogs and other domestic animals.

The participating farmers have improved both the TBS and zinc phosphide baiting technologies. They played the role as trainers in workshops to teach other farmers to use these technologies. Although the primary aim of these workshops was to field test the extension material developed by the project, the workshops did achieve extension of the technologies to farmers from nearby communes. However, the success of the extension was limited geographically because only farmers near the project site could attend the workshops. The project was not designed to extend the technologies beyond the study site.

Extension material for community TBS developed and used for training workshops and general distribution through the government network included: (1) a 36-page booklet entitled 'TBS for field rat management'; (2) a 4-page pamphlet 'Wax block baiting technique to control rice field rat'; (3) a 95-page book 'Rice field rats: biology, management, and case study in lowland field'; and (4) a 58-page book 'Participatory research and extensions manual for trainers and trainees'. The extension material is in Khmer and has been distributed to a number of researchers and extension workers in Cambodia through the government network.

7.2 Subprogram 2: Income generation and better nutrition through agricultural diversification

Projects

Active

AH/2005/086	Best practice health and husbandry of cattle, Cambodia
AH/2006/025	Understanding livestock movement and the risk of spread of transboundary animal diseases
ASEM/2000/109	Farming systems research for crop diversification in Cambodia and Australia
ASEM/2003/007	CARF—Cambodian Agricultural Research Fund
ASEM/2003/012	Improving the marketing system for maize and soybeans in Cambodia
FIS/2002/068	Improving feeds and feeding for small scale aquaculture in Vietnam and Cambodia
HORT/2003/045	Improvement of vegetable production and postharvest management systems in Cambodia and Australia
SMCN/2001/051	Assessing land suitability for crop diversification in Cambodia and Australia

Concluded

AH/2002/099	Development of a model for the control of fasciolosis in cattle and buffaloes in the Kingdom of Cambodia
AH/2006/078	Assessing and controlling the risks of disease spread in Mekong countries with an initial focus on Cambodia
FIS/2003/003	Stock structure of two important Mekong River carp species (<i>Henicorynchus</i> spp.)
PLIA/2006/012	Livestock health and vaccines in Cambodia and Lao PDR: scoping study and economic assessment

Pipeline

AH/2003/008	Improved feeding systems for more efficient beef and draught cattle production in Cambodia
ASEM/2006/130	Enhancing adoption of new farming systems in Cambodia and Australia
HORT/2006/107	Improved postharvest handling of vegetables in Cambodia

AH/2005/086: Best practice health and husbandry of cattle, Cambodia

Bilateral

Overseas Collaborating Countries	Cambodia
Commissioned Organisation	University of Sydney, Faculty of Veterinary Science, Australia
Project Leader	Dr Peter Windsor Phone: 02 9351 1710 Fax: 02 4655 0618 Email: pwindsor@camden.usyd.edu.au
Collaborating Institutions	Charles Sturt University, Australia International Center for Tropical Agriculture, Lao PDR Department of Animal Health and Production, Cambodia Agricultural Extension Department, Cambodia Tristan Jubb Veterinary Consulting, Australia Royal Academy of Cambodia, Cambodia
Project Budget	\$764,513
Project Duration	01/06/2007 to 31/05/2011
ACIAR Research Program Manager	Dr Peter Rolfe

Project background and objectives

Cambodia has around 3.2 million cattle and 0.7 million buffalo. Almost 80% of the land is lowland and still ploughed by draft animals, which are increasingly paired castrated oxen rather than buffalo. New opportunities for livestock sale are opening up as the market for meat grows rapidly in Southeast Asia, especially from neighbouring countries such as Vietnam.

Small village producers own the majority of large ruminant livestock in Cambodia, and up to 25% of cattle are currently exported. There is an opportunity to increase cattle production and address rural poverty. However production income is limited by common diseases such as haemorrhagic septicaemia, foot-and-mouth disease, blackleg and parasites plus poor nutritional, breeding and general husbandry and livestock management practices.

This project aims to improve profitability of large ruminant production by smallholders, through adoption of well known disease control and husbandry practises.

It has these objectives:

- to confirm current knowledge of disease limitations to large ruminant production
- to implement, test and demonstrate the value of interventions preventing key diseases, preventing introduction of diseases and managing reproduction
- to assess attitudes of farmers in targeted communities to health, husbandry and market issues
- to improve knowledge of the cattle supply chain and key drivers for change in the targeted communities.

Project Progress

Year 1 (01/06/2007–31/05/2008)

First progress report due in 2008.

AH/2006/025: Understanding livestock movement and the risk of spread of transboundary animal diseases

Bilateral

Overseas Collaborating Countries	Cambodia, Lao PDR
Commissioned Organisation	Department of Agriculture and Food, Western Australia, Australia
Project Leader	Dr Chris Hawkins Phone: 08 9651 1302 Fax: 08 9651 1008 Email: chawkins@agric.wa.gov.au
Collaborating Institutions	Murdoch University, Australia AusVet Animal Health Services, Australia Department of Animal Health and Production, Cambodia Department of Livestock and Fisheries, Lao PDR
Project Budget	\$1,257,357
Project Duration	01/05/2007 to 30/04/2012
ACIAR Research Program Manager	Dr Peter Rolfe

Project background and objectives

Transboundary animal diseases in Southeast Asia (including foot-and-mouth disease and classical swine fever) cause significant losses. Such diseases cross national borders and spread primarily to new areas through livestock movements.

A detailed, timely, quantitative understanding of livestock movement patterns and their influence on the spread of disease would quickly pinpoint high-risk areas. This would enable preventative actions to be taken and also aid the development of new strategies to minimise the risk of disease spread.

The veterinary services of Cambodia and Lao PDR and their three Australian partners will undertake research in Cambodia, Lao PDR and Australia in order to understand the drivers of domestic and transboundary livestock movements, then use this understanding to help prevent the spread of livestock diseases.

The project will also involve partnerships with the International Animal Health Organisation (OIE) and the Australian Federal Department of Agriculture, Fisheries and Forestry (DAFF), and maintain close linkages with the Bangkok regional office of the UN Food and Agriculture Organisation (FAO).

The overall aim of the project is to improve control of livestock diseases by: 1) providing information on the predicted spatial risk of disease spread (allowing implementation of pre-emptive measures to limit disease spread in high-risk populations); 2) developing alternative interventions to decrease the risk of disease spread through livestock movements.

Project Progress

Year 1 (01/05/2007–30/04/2008)

First progress report due in 2008.

ASEM/2000/109: Farming systems research for crop diversification in Cambodia and Australia

Bilateral

Overseas Collaborating Countries	Cambodia
Commissioned Organisation	NSW Department of Primary Industries, Australia
Project Leader	Dr Bob Martin Phone: 02 6763 1258 Fax: 02 6763 1258 Email: bob.martin@agric.nsw.gov.au
Collaborating Institutions	Cambodia Agricultural Research and Development Institute, Cambodia
Project Budget	\$1,037,586
Project Duration	01/07/2003 to 31/12/2007 (Project extended from 30/6/2006 to 31/12/2007)
ACIAR Research Program Manager	Dr Caroline Lemerle

Project background and objectives

Rice is the staple crop in Cambodia, with little else grown. More than 90 per cent of agricultural cropping land is sown to rice. Crop diversification is minimal, even in upland agro-ecological systems that do not suit rice. Government policy is designed to encourage diversification with CARDI taking a lead in placing emphasis on diversified cropping. There are, however, still substantial barriers to diversification. The main barrier is a lack of familiarity with upland crops. This includes extension workers and researchers as well as farmers, whose knowledge of non-rice crops is limited, creating a perception of higher risk for planting non-rice crops. A wet monsoonal season does not guarantee predictable rainfall, and this unpredictability adds to the perception of risk. As a result market infrastructure for non-rice crops is lacking.

Crop diversification is also an issue at the centre of a policy push from NSW Agriculture, who want to hasten change from cereal crops production in parts of the state. The adoption of more sustainable tillage practices is a central theme of this push. The overall objective is to help reduce poverty and contribute to food security at household and national levels through the development of techniques and opportunities for the production of non-rice upland crops in Cambodia. In Australia the focus is on overcoming the constraints to crop diversification and adoption of sustainable practice in broad acre cropping enterprises in the sub-tropical slopes and plains of the agro-ecological region of northern Australia.

Project Progress

Year 4 (01/07/2006–30/06/2007)

As per the review recommendation in June 2006, the project was extended from 30 June 2007 to 31 December 2007. This enabled a full field program to be conducted in Cambodia in the wet season in 2007. The project extension included an expansion of the demonstration of Improved Technology Practices (ITPs) to additional districts in collaboration with provincial extension staff as well as non-government organisations (CARE and the Maddox Jolie Pitt Foundation (MJP)).

In February 2007, ASEM/2000/109 provided training to Provincial Department of Agriculture (PDA) staff as well as staff from CARE and MJP. The purpose of the training, held in Kampong Cham and Battambang, was to enable extension collaborators to independently implement on-farm demonstrations for improved technologies for the production of upland crops. Overall, only 27 of the 48 demonstrations in the early wet season were successful, with the failures put down to drought.

It is planned to continue involvement with PDA, CARE and MJP in the roll-out of on-farm demonstrations. They will need more hands-on training for implementing the demonstrations and for the recording of data and analysis of the results. Generally farmers have been happy with the demonstrations and have learned a lot. However, they are not yet ready to abandon their current

techniques. Rhizobium, zero-tillage and new varieties have attracted the most interest. The mungbean variety ATF3944 introduced by the project has attracted a lot of interest with farmers wishing to keep the seed. A very high proportion of women have attended workshops and field days.

A highlight for the year was the publication of the paper 'Contemporary practices, constraints and opportunities for non-rice crops in Cambodia' in the *Cambodian Journal of Agriculture*. The authors were: Robert Farquharson, Chea Sareth, Chapho Somrangchitra, Richard Bell, Seng Vang, Wendy Vance, Robert Martin, Ung Sopheap and Fiona Scott. The results pointed to the need for focused research on new technologies and management as they affect crop yields and profits, and for increased extension to Cambodian farmers of this information. As a follow-up, a pilot village-scale socioeconomic study was conducted in 2007 to determine the potential impacts of adoption of the new technologies developed by the project.

The project has shown that tillage is not necessary for the establishment of upland crops and that mulching or the retention of crop residues can significantly increase crop yields. However, Cambodian farmers are committed to full cultivation and do not have access to no-tillage planters. Many Cambodian farmers have access to power-tillers and Mr Jeff Esdaile has assisted the project by constructing a prototype no-till planter with Chinese units fitted to a Siam Kubota power-tiller. This work will continue under Jeff's new project, CIM/2007/027. In the last two seasons in northern NSW, four experiments have been completed to compare seven crop species – sorghum, sunflower, soybean, maize, mungbean, cowpea and sesame.

Three varieties of each crop type were sown to obtain a range of maturities (quick, medium and long season). Mungbeans and sunflowers were the most profitable alternatives to sorghum. Cowpeas and sesame have small niche markets with strict quality requirements and this limits the current prospects for significant expansion. Experiments were also conducted at three sites to evaluate the interaction between early/late sowing and maturity class for a wider selection of maize and sunflower varieties. In collaboration with Queensland DPIF, a range of peanut lines were evaluated at Tamworth for the second year.

The project has a commitment to the publication of a range of extension material for Cambodia. This includes Field Crop Manuals (FCMs) for maize, soybean, peanut, mungbean and sesame; a gross margin handbook; a manual of Improved Technological Practices (ITP) for Upland Crops; and Field Guides for weeds and insect pests. These publications are to be produced in English and Khmer. The English versions of the Maize FCM, the ITP manual and the weed Field Guide are being published by NSW DPI in time for a National conference on upland crops at CARDI to be held in October 2007.

In collaboration with the Crawford Fund, a scientific writing course was provided at CARDI in June to assist 10 researchers in the preparation of scientific papers arising from the project. It is intended that these papers will be presented at the conference and published in a special issue of the *Cambodian Journal of Agriculture*. In Australia, work has continued on a book of 12 farm family case studies of adoption of no-tillage and conservation farming practices. It is anticipated that the book will go to press by December 2007.

ASEM/2003/012: Improving the marketing system for maize and soybeans in Cambodia

Bilateral

Overseas Collaborating Countries	Cambodia
Commissioned Organisation	University of Canberra, Australian Institute for Sustainable Communities, Australia
Project Leader	Professor John Spriggs Phone: 02 6201 2317 Fax: 02 6201 2263 Email: jspriggs1@gmail.com
Collaborating Institutions	Ministry of Commerce, Cambodia Cambodian Development Resource Institute, Cambodia
Project Budget	\$499,901
Project Duration	01/07/2004 to 30/04/2008 (Project extended from 01/01/2007 to 30/04/2008)
ACIAR Research Program Manager	Dr Caroline Lemerle

Project background and objectives

Agriculture in Cambodia has been dominated by rice, much of it grown by smallholder subsistence farmers. The Royal Government of Cambodia has set poverty reduction and improved rural development as top priorities. To achieve this Government is focusing on the development of commercial, export-oriented agriculture. Diversification in cropping from rice is one component of this work.

Among non-rice crops, maize and soybean are particularly important. Both have (after rubber) the highest export potential, but marketing arrangements for the two crops are largely informal and poorly developed. Constraints include postharvest inefficiency, inadequate information flows, high transport costs and lack of external market linkages, with Thailand and Vietnam representing the main external markets. For export potential to be realised these constraints need to be overcome.

ACIAR is supporting complementary research, both to improve maize and soy production and help in crop diversification. Stronger, better developed marketing systems would ensure that increased productivity delivers the benefits from exporting to nearby markets. Mapping of the marketing system, including supply chains and the institutional environment, will substantially aid key stakeholders trying to identify avenues through which to address constraints to the system's development.

The project aims to improve the well-being of participants of the maize and soybean marketing systems, with particular attention being given to the well-being of rural families and rural development by:

- mapping the existing (formal and informal) marketing systems for maize and soybeans and its institutional environment (governmental and infrastructural), to identify the constraints and capacities for change and to evaluate the potential for improvement
- facilitating a process of change within these marketing systems
- enhancing the capacity of relevant people and institutions in Cambodia.

Project Progress

Year 3 (01/07/2006–30/06/2007)

The original project operated for 2½ years from July 2004 to December 2006 with a broad focus on improving the marketing system for maize and soybeans in Cambodia and thereby improving the well-being of rural households and other participants in the non-rice cropping industry. The project was subsequently extended from January 2007 to April 2008.

General approach

The general approach taken in this project has been participatory action research which includes both a research phase and an action (implementation) phase. In this action research process, participants are taken to

be representatives of the various types of participants in the relevant value chains. These include farmers, village collectors, district traders, inter-provincial traders, exporters, importers, and relevant government officers. As a result of initial research, it was decided to divide the country into two parts: eastern and western Cambodia. This arose because we found substantial differences between these regions in the types of crops grown, the nature of the dominant markets involved (i.e. Vietnam and Thailand), and the quality of the production-marketing systems.

In particular, the production-marketing system in eastern Cambodia was found to be static and fragmented with relatively old marketing infrastructure and less fertile land, while western Cambodia was found to have highly fertile land, with dynamic and well-organised marketing infrastructure through the development of five large grain drying/storage operations throughout the growing area.

Following on from the research phase which included the use of participatory workshops in eastern and western Cambodia, we developed action plans that we believe are well-suited to the differing regions. The action plans involved three major initiatives; two in eastern Cambodia and one in western Cambodia.

Major initiatives (eastern Cambodia)

In eastern Cambodia, we took both a micro and a macro approach. The micro approach was to work with a single farmer association to see what we could do to help this association become more successful in marketing crops on behalf of its members. The macro approach was to explore the potential for developing an Agriculture Marketing Development Zone (AMDZ) for eastern Cambodia.

Major initiative (western Cambodia)

In western Cambodia, our background research and a participatory workshop revealed that the major concerns of value chain participants (along with credit concerns) were: (a) lack of access to markets; and (b) lack of market information. These are the result of poor communications between different levels of the supply chain.

At a Battambang workshop of participants, we proposed to address this issue through the development of an Electronic Marketing Communications System (EMCS) based on the use of SMS technology and mobile phones. The idea of using SMS to communicate is workable in Cambodia where the country enjoys 75 % coverage of mobile phones and 85% coverage of SMS.

There was enthusiastic consensus at the workshop for introduction of a pilot project on the EMCS. As a result, and under the direction of Dr. Rob Fitzgerald, we have undertaken a pilot project involving traders in Western Cambodia as well as the Battambang Chamber of Commerce to receive price information via SMS. To make this work, we purchased and established an SMS server at the Price Office, Ministry of Commerce where it is being maintained by Ms. Mam Many.

We are now at the stage where we have proof of concept and plans are under way to move to a larger-scale implementation of the EMCS. Dr. Fitzgerald held a second workshop in Phnom Penh in August 2007 with traders, producers, government and local university representatives to initiate the design and development of the information structure for the EMCS.

This workshop addressed: (a) identifying basic stakeholder information including regions, supply chain roles, language capabilities and SMS skill levels (self assessed); (b) determining stakeholder needs regarding market information (What price information do you need?; How could this be conveyed via alphanumeric code?; How will we link buyers and sellers?; What farm/production information do you want?); and (c) obtaining stakeholder views on the nature of the training and extension work that should be considered.

A series of EMCS training workshops are tentatively scheduled for November 2007 to help familiarise users with the system and training materials in English and Khmer.

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

Bilateral

Overseas Collaborating Countries	Cambodia, Vietnam
Commissioned Organisation	Department of Fisheries, Western Australia, Fremantle Maritime Centre, Australia
Project Leader	Dr Brett Glencross Phone: 08 9239 8103 Fax: 08 9239 8105 Email: bglencross@fish.wa.gov.au
Collaborating Institutions	Can Tho University, Vietnam Royal University of Agriculture, Cambodia Lake Argyle Industries Pty Ltd, Australia Research Institute for Aquaculture No. 1, Vietnam Aquaservice, Vietnam
Project Budget	\$711,460
Project Duration	01/01/2004 to 31/12/2007 (Project extended from 01/07/2007 to 31/12/2007)
ACIAR Research Program Manager	Dr Geoff Allan

Project background and objectives

Aquaculture, or fish farming, is the fastest growing food production sector in the world. It is being seen as a sustainable solution to the growing pressure that increased fishing activities are placing on wild resources. Advances in culturing fish are reducing the capture of wild juvenile fish which are then grown to size, boosting the value of fish farming. But further advances are needed to ensure aquaculture itself remains a viable and sustainable option for smallholders and the environment alike.

One component where advances could contribute sustainability is in fish diets. Most fish farmers do not buy commercial feeds because their high cost is not adequately returned in the market price of fish. Farmers make their own feeds using available ingredients such as rice bran and trash fish, but often these formulations do not sufficiently meet the nutritional needs of growing juvenile fish. To compensate, some farmers ensure excess food and nutrients are available, eroding profit margins and increasing the likelihood of spoilage in the environment.

In Vietnam and Cambodia smallholder farmers are keen to get involved in aquaculture. The main barrier is a lack of information on the ingredients for diets. This, when assessed against the nutritional needs of fish species farmed, can help in formulating optimal diets.

Differences in feed requirements also extend to the stage of development; high protein and energy required in juvenile fish is not always suitable for maintaining health in fully grown fish. Bio-energetic modelling, using these variables, can define protein and energy requirements and then guide the formulation of diets using local ingredients to match these parameters.

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

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

Project Progress

Year 3 (01/01/2006–31/12/2006)

Develop diets based on locally available ingredients for improved production of catfish and tilapia

Further progress has been made in collecting a range of ingredient samples for a collective ingredient database for Vietnam and Cambodia. The data include the source history, diversity of species involved in some resources (e.g. trash-fish), price variability and nutritional composition. The digestible value to *Pangasius* catfish of eight key ingredients has been determined.

Nutritional requirements of fish species in Vietnam & Cambodia

Growth and temperature data, and samples of tilapia and catfish from commercial farms for development of fish growth models have been collected in both northern and southern Vietnam. Progress with collection of data and/or samples from Cambodia has been limited, but significantly improved after the location of Mr Daniel Wright from Australian Volunteers International (AVI) person with the group. Maintenance energetics trials on tilapia and catfish were successfully re-run in both northern and southern Vietnam. Sample and data analysis from these trials has also been completed. The energy utilisation efficiency trial was completed for catfish, but was not successful for tilapia. A functional factorial bio-energetic model for catfish has now been constructed and has been used to iteratively define nutritional protein and energy requirements for this species. Tilapia model remains to be constructed pending re-evaluation of data limitations.

Nutritional requirements of barramundi in Australia

All growth model studies have been completed and the existing growth and metabolic models developed by Dr Glencross are presently being further refined based on the higher temperature data derived from earlier experiments as new knowledge is gained. Two additional studies have been undertaken, one to validate some outputs of the model and another to examine the nutritional potential of alleviating heat stress in fish.

Diet formulation for catfish, tilapia and barramundi

Iterative diet designs have been derived from the catfish and barramundi models. This has led to the formulation of a series of diets based on the ingredient assessment work and these revised diet specifications. These diets are presently being tested with catfish. Based on outcomes from the barramundi model the use of high-energy diets for large barramundi has been examined and shown to provide a significant advantage to production efficiency.

Demonstrate/evaluate the potential of new improved feeds in on-farm trials

Diets based on the ingredient evaluation and nutritional modelling of protein and energy demands of catfish are presently being tested in laboratory at Can Tho University. This work will be extended to farms and feed mills pending the outcome of the work. Further follow up assessment is required to review the outcomes of this validation trial.

Transfer technology and extend information

A four-day Aquaculture Nutrition Masterclass Shortcourse was held at Can Tho University College of Aquaculture and Fisheries in March 2007. This Shortcourse focused on dissemination of general aquaculture nutrition science and project findings to researchers, farmers and feed manufacturers from southern Vietnam and Cambodia. Course content also included field visits to fish farms, feed mills, laboratories and practical formulation classes.

HORT/2003/045: Improvement of vegetable production and postharvest management systems in Cambodia and Australia

Bilateral

Overseas Collaborating Countries	Cambodia
Commissioned Organisation	NSW Department of Primary Industries, Yanco Agricultural Institute, Australia
Project Leader	Mr Mark Hickey Phone: 02 6951 2523 Fax: 02 6951 2692 Email: mark.hickey@agric.nsw.gov.au
Collaborating Institutions	Cambodia Agricultural Research and Development Institute, Cambodia Department of Agronomy and Agricultural Land Improvement, Cambodia Department of Planning, Statistics and International Co-operation, Cambodia
Project Budget	\$910,726
Project Duration	01/07/2005 to 31/12/2008
ACIAR Research Program Manager	Mr Les Baxter

Project background and objectives

The Cambodian Government has been keen to support a growing trend of crop diversification amongst farmers. Traditionally rice has been the main crop grown, but diversification has increased since the country attained rice self-sufficiency. Despite this, vegetable production remains very low – largely due to unreliable supply of seed, high input costs and a lack of knowledge of postharvest handling. Per capita consumption is amongst the lowest in Asia, so the industry has a large potential for growth. The most urgent requirements for vegetable improvement in Cambodia have been identified as:

- availability of cultivars with resistance to diseases, pests and high temperatures
- enhanced understanding of the deficiencies and options for improvement of vegetable supply chains
- practical and low-cost technologies to improve crop yields and quality
- postharvest handling and pest management to reduce pesticide residues and provide more effective control measures.

The Asian Vegetable Research and Development Centre (AVRDC) has active breeding and crop improvement programs in tomatoes and chilli, and these vegetables were suitable for inclusion as target crops in the project.

The three main project objectives are:

1. to map supply chain constraints, devise improvements and incentives for improving product marketability in the Cambodian vegetable industry
2. to develop and demonstrate improved production and postharvest strategies that will underpin quality improvement and industry development
3. to improve Cambodia's R&D capacity in vegetable research.

Project Progress

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

The project completed its second full year of field and laboratory experiments, conducting cultivar evaluation and postharvest assessment work in chillies and leafy vegetables in addition to the ongoing tomato evaluations. A total of 15 research station, on-farm replicated and demonstration trials were conducted in Cambodia, and three replicated tomato trials completed in Australia.

A series of postharvest experiments and evaluations were also completed at the postharvest laboratory now functioning at the Cambodian Agricultural Research and Development Institute (CARDI).

On-farm commercial testing of the best tomato varieties evaluated in Cambodia so far commenced in the 2006–07 season. Extensive grower and market surveys for tomato and chilli were completed, and these surveys will form a basis for the research and extension components for the second half of the project.

Several training activities were also conducted in the 2006–07 period, with training courses involving CARDI, DAALI and the Royal University of Cambodia – in biometrics, vegetable pest and disease identification and irrigation management. The project team also delivered a three day irrigation management training course to over 30 technicians working with the NGOs CARE and IDE in Prey Veng Province.

In addition, a project study tour to the Mekong Delta and Dalat regions of southern Vietnam was conducted in late May, involving 10 Cambodian scientists, one farmer and a representative from both AVRDC World Vegetable Centre and NSW Department of Primary Industries.

One of the major outcomes from the pest and disease identification training activities has been the placement, commencing late September 2007, of an Australian Youth Ambassador for Development (AYAD) to work with the Department of Agronomy Plant Protection Team to establish a comprehensive horticultural pests collection.

One of the key members of the CARDI project team, Nin Charya also commenced study in a Masters program at Sydney University in August 2007. His major project will focus on the tomato field and postharvest evaluation program as part of this project's Australian component.

SMCN/2001/051: Assessing land suitability for crop diversification in Cambodia and Australia

Bilateral

Overseas Collaborating Countries	Cambodia
Commissioned Organisation	Murdoch University, School of Biological and Environmental Sciences, Australia
Project Leader	Associate Professor Richard Bell Phone: 08 9360 2370, 08 9360 6000 Fax: 08 9310 4997 Email: rbell@murdoch.edu.au
Collaborating Institutions	Department of Agriculture and Food, Western Australia, Australia Cambodia Agricultural Research and Development Institute, Cambodia
Project Budget	\$915,463
Project Duration	01/01/2003 to 31/12/2007 (Project extended from 01/07/2007 to 31/12/2007)
ACIAR Research Program Manager	Dr Gamini Keerthisinghe

Project background and objectives

Crop diversification can alleviate poverty by increasing income and improving nutrition for farm households. In the lowlands of Cambodia there is potential to diversify from the traditional wet season rainfed rice system by double cropping (with rice and legumes) using the abundant shallow groundwater for irrigation.

Similarly, in the uplands, relatively large areas of land are available for the expansion of cropping and could be used to grow field crops and fruit and nut trees. To ensure that crop diversification is effective, information is needed on soil and climate constraints, and potential environmental impacts, to assess the suitability of land for particular crops. The land resource studies and soil maps needed for assessing land suitability are generally not available for Cambodia.

This project aims to facilitate crop diversification in Cambodia and Australia by assessing land suitability for growing crops such as legumes and field crops in lowland and upland areas of Cambodia respectively, and pulses in southern Australia.

Project Progress

Year 4 (01/01/2006–31/12/2006)

Complete land capability assessment in two districts to validate earlier work on basaltic and sandy landscapes

Initial field soil surveys in Kong Pisei and Ponhea Krek districts were completed by CARDI in September 2006, and followed up when Noel Schoknecht visited Cambodia in December 2006. Based on soil profiles described and other spatial data sets, soil-landscape maps were prepared for the two districts and selected soil samples sent for a complete suite of chemical tests and texture analysis.

The basaltic soils in Ponhea Krek district were broadly similar to those in Ou Reang Ov district, but the Kompong Siem Soil group is less prevalent. In Kong Pisei district, the geology of the hills is more varied than in Tram Kak district, so that the colluvial deposits at the base of the hill are generally less sandy. Soil profile data have been entered in the Soil Profile Database at CARDI. Soil analysis will be completed in May 2007, after which the district soils reports will be prepared.

Land capability reports have been finalised for sandy terrain (Tram Kak district) and basaltic terrain (Ou Reang Ov district). These will be updated as required when the soil

constraints for Kong Pisei and Ponhea Krek districts are assessed.

Crop suitability information from the project has been written up and provided to ASEM/2000/109, to be included in the crop manuals for maize, mungbean, peanut, sesame and soybean.

Broaden the use of the land resources database as a Khmer resource including Khmer decodes and screens and capture remaining older data

Dr Som Lon, has been seconded from the Department of Agronomy and Agricultural Land Improvement (DAALI) to CARDI since December 2006 on a 4-month contract to translate from the database a list of soils terms and their definitions, as a basis for preparing a Khmer soils lexicon. Attempts to obtain soils data from studies conducted by scientists from Thailand, Vietnam and Belgium have not yet produced any results that can be added to the Cambodia Soil Profile database.

Based on meetings at DAALI and the Department of Geography, it was concluded that the Cambodia Soil Profile database is best retained at CARDI for the foreseeable future.

Scope the implications of including upland soils in the Cambodian Agronomic Soil Classification and propose revisions

It has been agreed that the Rice Soil manual should not be amended to incorporate upland soils. Rather, the preferred approach is to prepare a separate key for upland soils. This would avoid compromising the integrity of the rice soils key, which is in common usage and well understood.

A draft *Key for Upland Soil Groups* has been prepared. Upland soils are defined as those that are not flooded by rivers, rainfall, or run-off (based on the definitions in the Rice Soil Manual). The draft Key is intended to be a first step towards an Upland Soil manual for Cambodia as a companion to the Rice Soil Manual.

Two main groups of upland soils are proposed:

- Soil on low rises and very gently undulating land in the lowlands where the soils are marginal for rainfed rice or unsuited for rice. This would include some Toul Samroung in the plains of Battambang, Prey Khmer on sandy rises, and Kompong Siem/ Labansiek soils on very gently undulating low-lying land in the basaltic terrains. These soils are already identified in the CASC as rice soils, but may occur in locations where they are unsuited to rice. These soils need to be included in an upland soils key since they do not conform to the hydrological or topographical criteria for keying rice soils.
- Soil in hilly landscapes, where it is proposed that geology might be the key factor for further distinction among soil groups and where most of the new soil groups are likely to be placed. Already the 'Ou Reang Ov' soil group has been proposed as a new upland soil group.

Guide the project finalisation and ensure delivery to key planning agencies in Cambodia through a clear communication strategy

The three one-day workshops will be held in May–June 2007. The workshop materials have been drafted in English, but will be translated into Khmer for delivery to provincial and district level staff.

CARDI's Division of Soil and Water will produce Technical Notes of project documents to ensure wider circulation of detailed technical information about upland soils and crop performance. It was concluded that delivering project outputs to senior staff in planning and policy roles in the Ministry of Agriculture, Fisheries and Forestry, Ministry of Environment, and Ministry of Land Management, Urban Construction and Planning would need to be by post.

Information on land suitability for agronomy and extension staff at middle level positions, based in Phnom Penh will be presented at a national workshop to be held at CARDI in October 2007. Technical notes will be distributed to participants during this conference.

CONCLUDED PROJECTS

AH/2002/099: Development of a model for the control of fasciolosis in cattle and buffaloes in the Kingdom of Cambodia

Bilateral

Overseas Collaborating Countries	Cambodia
Commissioned Organisation	James Cook University, School of Biomedical Sciences, Australia
Project Leader	Dr Lee Skerratt Phone: 07 4781 4838 Fax: 07 4779 1526 Email: lee.skerratt@jcu.edu.au
Collaborating Institutions	Department of Animal Health and Production, Cambodia Cambodia Agricultural Research and Development Institute, Cambodia Agricultural Extension Department, Cambodia Office of Animal Health and Production, Cambodia
Project Budget	\$191,406
Project Duration	01/01/2004 to 31/05/2007 (Project extended from 01/07/2006 to 31/05/2007)
ACIAR Research Program Manager	Dr Peter Rolfe

Project background and objectives

Control of fasciolosis (liver fluke) is a high priority in Cambodia. A previous ACIAR project (AS1/1996/160) gathered data on the spread of fasciolosis to produce a risk map, but much of this was out of date. The lack of accurate data also precluded the model from playing a major role in developing a national control strategy. Recent data collection by several national and regional agencies will allow the model to be updated.

The project aims to update, refine and validate the risk model using geographic information systems. Extension officers will be trained with the aim of developing an extension program to control fasciolosis, leading to the development and promotion of a national strategy.

Project Outcomes

Final project not yet submitted by the Commissioned Organisation.

AH/2006/078: Assessing and controlling the risks of disease spread in Mekong countries with an initial focus on Cambodia

Bilateral

Overseas Collaborating Countries	Cambodia
Commissioned Organisation	AusVet Animal Health Services, Australia
Project Leader	Dr Angus Cameron
	Phone: 02 4757 2770
	Fax: 02 4757 2789
	Email: angus@ausvet.com.au
Project Budget	\$88,373
Project Duration	01/08/2006 to 01/12/2006
ACIAR Research Program Manager	Dr Peter Rolfe

Project background and objectives

Transboundary animal diseases (those which cross national borders) in Southeast Asia, including foot-and-mouth disease and classical swine fever, cause significant losses. In the Mekong countries there is a need to identify the drivers that lead to the spread of animal disease both between and within countries, primarily through livestock movement.

In this small research activity involving a workshop and an in-country visit the scientists sought to develop a deeper and broader understanding of the issues relating to national and regional livestock movements in Mekong countries and their impact on the spread of livestock disease.

An exchange of information and experience between the research partners was needed to help scientists address disease control issues in a more effective and coordinated way. The report from this activity was submitted to ACIAR as a basis for further research projects in the area.

Project Outcome

This activity has served to clearly define a mechanism whereby the existing movement patterns of livestock in Cambodia, Lao and surrounding countries can be better understood. As well, by analysing a range of potential indicators, the scientists may be able to be indirectly estimate the situation in near real-time. This information will provide valuable insight into the role of movements in disease spread, and serve as the basis for the development of a number of interventions to limit high-risk movements, and make existing movements safer.

A proposed activity arising from the study will involve collaboration between the Cambodian and Lao veterinary services and Australian partners to undertake research in the Cambodia, Lao PDR and Australia. The researchers will seek to understand more about the drivers of domestic and transboundary livestock movements, and to use this understanding to help prevent the spread of livestock diseases. The overall aim will be to improve control of livestock diseases by 1) providing information on the predicted spatial risk of disease spread (allowing pre-emptive preventative measures to be implemented in high risk populations), and 2) developing alternative interventions to decrease the risk of disease spread through livestock movements.

Specific objectives relate to: describing actual livestock movement patterns; identifying drivers for livestock movement; predicting the risk of disease spread; institutionalising a sustainable system to describe movement patterns; develop novel strategies to minimise risk of disease spread; coordination with other relevant projects; project management; project monitoring and review.

The key output will be up-to-date estimates of livestock movement patterns and disease risk. This information will provide an essential foundation for disease control, including the definition of zones, pre-emptive control activities in identified high-risk areas, and appropriate interventions to either influence livestock movement patterns, or decrease the risk of disease spread through movements. The activity should collaborate with other regional initiatives to ensure that the information generated is used to achieve a maximum impact on disease control.

FIS/2003/003: Stock structure of two important Mekong River carp species (*Henicorynchus* spp.)

Bilateral

Overseas Collaborating Countries	Cambodia, Lao PDR, Thailand, Vietnam
Commissioned Organisation	Queensland University of Technology, School of Natural Resource Sciences, Australia
Project Leader	Dr Peter Mather Phone: 07 3864 1737 Fax: 07 3864 2330 Email: p.mather@qut.edu.au
Collaborating Institutions	Mekong River Commission, Fisheries Programme, Cambodia Living Aquatic Resources Research Centre, Lao PDR Department of Fisheries, Thailand Research Institute for Aquaculture No. 2, Vietnam
Project Budget	\$386,968
Project Duration	01/01/2004 to 31/03/2007 (Project extended from 01/01/2006 to 31/03/2007)
ACIAR Research Program Manager	Mr Barney Smith

Project background and objectives

The Mekong River Basin (MRB) is home to fisheries which provide food security for approximately 60 million people spread across several countries. Despite their importance management of these fisheries is rudimentary at best.

The Mekong River Commission (MRC), formed under the cooperation of the four countries sharing the lower parts of the basin, have begun to focus on achieving sustainable fisheries management to ensure food security is maintained, while also factoring in growing development pressures on the river.

The basin offers a wide range of agricultural and industrial development opportunities. Hydrological power development is one such opportunity that threatens fisheries, while the importance of the river as a trade link between the six riparian countries through which it runs, is also likely to increase. Population increases will continue to put further pressure on the surrounding environment and river system itself, as well as on the capabilities of Mekong fisheries.

Management of these fisheries is complicated by the high level of diversity of fish species. Sustainable management practices can vary between species depending on ecology and life histories. The MRC has initiated extensive studies of the ecology of a number of important

fish species to understand ecology and life histories better.

The use of genetic methodologies for identifying discrete gene pools has not been used in the Mekong. Elsewhere these techniques are being applied to dish stock discrimination to form the basis of fisheries management plans. The application of these techniques is possible for the Mekong and will be trialled.

Project work will determine the pattern of genetic structure of two economically important carp species (*Henicorynchus siamensis* and *H. lobatus*) as models and to develop an appreciation of the conceptual basis, data interpretation and application of molecular population genetic analysis to fisheries management in the MRB.

Project Outcome

The major objective of this project was to demonstrate the utility of a molecular genetics approach to stock identification for Mekong River Basin fish species. As such, two important carp species (*Henicorhynchus* spp.) were targeted for molecular analysis of mtDNA sequences of samples collected from right across the lower Mekong Basin (LMB) with assistance from MRC scientists from the four countries (Vietnam, Thailand, Cambodia and Lao PDR).

CONCLUDED PROJECTS

The study results showed that the two species, while possessing very similar morphologies (often they are confused in the field), had very different demographic histories and most probably will be seen to possess very different ecologies once the studies are conducted. Patterns of genetic diversity were very different in the two species with two discrete stocks identified in the LMB for *H. siamensis* and three discrete stocks identified for *H. lobatus* with quite different distributions.

Additional stocks were detected for both species in adjacent drainages, indicating that evolution of genetic diversity in the region in these fishes has been a complex process and probably is related to changes in the paleogeography and river basin evolution of the MRB. These data can provide the foundation for establishing effective management units for fish stock conservation for both species in the future by the MRC. It is likely that each of these stocks may require independent management practices to be developed to maintain populations into the future.

In parallel with the genetic diversity studies undertaken at Queensland University of Technology (QUT) for the two model species, a series of training workshops and a *Masterclass in microsatellite analysis* were conducted for national scientists attached to the project. These provided a foundation to the theory and practice of molecular diagnosis of fish stocks using this approach.

In addition, a number of regional scientists received short course training at QUT and some have commenced or will shortly commence postgraduate degrees that include significant exposure to the genetic technologies employed in the current project.

This, in parallel with the development of a new 'state of the art' molecular genetic research facility at Research Institute for Aquaculture No. 2, means that in the near future the MRC and member countries will have access to both facilities and trained staff. These additions will enable them to commence routine application of the molecular approaches to fish stock identification demonstrated in the current project.

PLIA/2006/012: Livestock health and vaccines in Cambodia and Lao PDR: scoping study and economic assessment

Bilateral

Overseas Collaborating Countries	Cambodia, Lao PDR
Commissioned Organisation	Centre for International Economics, Australia
Project Leader	Dr Robert Warner Phone: 02 6245 7800 Fax: 02 6245 7888 Email: bwarner@thecie.com.au
Project Budget	\$100,800
Project Duration	01/06/2006 to 29/09/2006
ACIAR Research Program Manager	Dr Jeff Davis

Project background and objectives

ACIAR's Animal Health Program has identified the policy and economic environment as an important aspect of livestock development in Lao PDR and Cambodia. Therefore it was decided that the Policy Impact Linkages and Assessment Program should commission a thorough review of this environment as a prelude to supporting effective development of several Animal Health projects, namely AH/2005/084 (Improved supply and quality of livestock vaccines in Lao PDR), AH/2005/086 (Best practice control of diseases in cattle, Lao PDR and Cambodia) and AH/2006/025 (Improved risk assessment for transboundary disease in Lao PDR and Cambodia).

Project Outcome

Final report not yet submitted by the Commissioned Organisation.

Part 2: Lao PDR

8 Annual Report 2006-07

Active projects in 2006-07	22
AOP budgeted expenditure in 2006-07	\$1,079,788
Actual expenditure in 2006-07	\$1,066,463
Expenditure in 2005-06	\$770,466
Expenditure in 2004-05	\$824,152

Key performance indicators	Performance 2006-07
Through consultation with Lao PDR partners, a new strategy for animal health and livestock biosecurity developed and implemented	Project has been implemented in collaboration with regional disease control initiatives.
Small grants scheme for Lao research institutions implemented and engages returned overseas-trained Lao scientists	This scheme has been implemented as a new ACIAR project following a successful pilot during the previous year.
Improvements in productivity of rice-based farming systems in central Lao PDR reduce seasonal food insecurity	World Vision distributed seed of higher-yielding rice varieties which alleviated food insecurity in several districts. Farmers also increased plantings of vegetables.

8.1 Position

ACIAR has had a program in Lao PDR since 1992, coinciding with the period of expansion of Australia's aid program to the Mekong countries. Distinguishing features of this landlocked country are low population density, high ethnic diversity, poor infrastructure, and geographical dispersion of people. Agriculture employs over 80 per cent of the population and forms 53 per cent of GDP. A major emphasis of past ACIAR work has been the establishment in Vientiane of an animal diseases laboratory to service Lao PDR.

Other successes include the introduction and selection of cold- and drought-tolerant rice varieties, identification of the major rodent pests affecting rice farming, capacity building in forestry research and agricultural extension approaches, management of indigenous fisheries, and provision of training, including in scientific data analysis and scientific writing in English.

ACIAR has recently supported a small grants scheme to enable Lao researchers to develop skills in the design and management of agricultural research projects.

In 2006-07, a number of new projects will commence as ACIAR expands its Lao PDR program where opportunities for research collaboration with a high likelihood of farmer impact exist.

8.2 Relationship to the AusAID Lao PDR strategy

The AusAID program in Lao PDR aims to assist Lao PDR to improve the pre-conditions for poverty reduction and sustainable development. It supports “appropriate recipient government development priorities as well as donor coordination and harmonisation efforts, in order to maximise development impacts...”.

Sectorally the country strategy focuses on building Lao human capital by improving access to education; promoting the growth of the market economy by expanding access to private land titles and strengthening property rights; and reducing the vulnerability of the poor by reducing the impact of natural disasters and unexploded ordnance.

While the ACIAR program, in focusing on agriculture and forestry, differs in its sectoral emphasis, its overall purpose (poverty reduction and sustainable development) and strategic approach is similar.

There is also a strong emphasis on assisting the Lao government’s own development priorities in agricultural research for development, and there is a particular effort in Lao PDR to harmonise with other donor programs through supporting underpinning research. Interventions in horticulture, livestock, forestry and agroforestry specifically target the market economy and the program has a strong emphasis on capacity development training in agricultural research and extension.

8.3 Achievements

ACIAR’s program in Lao PDR has focused on areas of animal health, forestry, fisheries and crop improvement, together with management to encourage and sustain crop diversification and reduce impacts of shifting cultivation. Projects are grouped under the following themes:

- Alternatives to shifting cultivation in upland regions
- Agricultural diversification to improve productivity of lowland farming.

Many of the animal health and cropping initiatives studied in Lao PDR are part of collaborative undertakings with other Mekong countries. ACIAR is investing in a range of studies to determine the best way forward for **animal health research**. One project is supporting the development of best practice cattle and buffalo health and husbandry systems for Cambodia and Lao PDR.

Prior to developing a full project ACIAR funded a small research undertaking to confirm that the key concepts and research issues, including economic drivers for enhancing large ruminant productivity, were captured. This has been helpful in defining the best avenues for ACIAR to develop its suite of current projects and tailor the work for each country. It has also helped to identify the key partners, personnel and preferred locations for undertaking the research. Several new research initiatives have arisen as a result.

Australia and Lao PDR have cooperated since 2003 to strengthen **disease control options for pigs** in a village setting. Of particular concern are foot-and-mouth disease (FMD) and classical swine fever (CSF). The project team has placed particular emphasis on understanding the social conditions that promote transmission of the diseases.

Team members have succeeded in establishing good communication between scientists, veterinary village workers and national institutions. Information such as how piglets are traded at village markets is valuable because here is a perfect opportunity for a disease to spread. The wealth of information gathered should help to break the disease cycle. Since pig farmers in Lao PDR are mostly women, the Lao Women’s Union is playing a critical role in circulating information through their extensive network.

In the northern mountainous regions rearing pigs is a widespread smallholder livelihood activity, but productivity is low due to poor nutrition. A project is seeking to **introduce forage legumes** into the farming system, to improve pig nutrition and also to reduce the time that women spend gathering and preparing feed.

Lao (and Cambodian) agriculture rely heavily on rice production from rainfed lowlands where drought is a frequent occurrence and is the major production constraint. A project has sought to **incorporate drought tolerance** into the country's rice breeding program and thus develop varieties more resilient to drought.

The project was successful in developing a method for reliable and routine screening of relatively large numbers of lines for drought tolerance. It has crossed the best drought-tolerant lines with lines for high quality and high potential yields, generating new lines that are resilient to drought and yet yield well in good years and have quality characters desired by the farmers.

Lao PDR has a small teak plantation estate but the country is expanding its resource of teak smallholdings. Optimally designed and managed agroforestry systems can provide significant income streams to rural Lao families. These plantings have become very popular and good prices are now being paid to farmers. An ACIAR project has provided information on the economic, social and other factors influencing the production and marketing of non-timber forest products and plantation teak in Lao PDR. The study has outlined the prospects for the agroforestry systems; estimated potential economic benefits and identified major constraints.

9 Annual Operational Plan 2007-08

GNI per capita (\$US)	440	Bilateral actual 2005–06	\$ 0.77 m
Population	5.8 m	Bilateral estimate 2006–07	\$ 1.08 m
Population 2015/2050	7.3/11.6 m	Bilateral budget 2007–08	\$ 1.41 m
Active bilateral projects	11	Bilateral + multilateral budget 2007–08	\$ 1.52 m
Active multilateral projects	1		

9.1 Key performance indicators (2007–08)

- New forestry program in Lao PDR implemented, addressing value-addition through processing and improved agroforestry systems
- Validation of community extension processes in two provinces of northern Lao PDR
- Options for optimising animal health vaccine delivery in Lao PDR identified
- Major project on diversification of lowland rice-based cropping systems implemented in three provinces

9.2 Medium-term strategy

ACIAR's growing program in Lao PDR emphasises crop, livestock, fisheries and forestry research to develop viable alternatives to shifting cultivation in the uplands through better crop and forest production and livestock health and production. It also has a focus on agricultural diversification to improve productivity of lowland farming systems.

There is also a strong emphasis on assisting in capacity development for the research and extension systems. Where appropriate, research interventions are designed to complement larger donor programs on improving rice production, forestry and animal health and production.

9.3 Position

Distinguishing features of this landlocked country are low population density, high ethnic diversity, poor infrastructure, and geographical dispersion of people. Agriculture employs over 80% of the population and forms 53% of GDP, but at least one-third of the population remain below the poverty line.

There has been a reasonably good economic recovery since 1999 after serious problems in mid to late 1990s when there was major currency devaluation and triple digit inflation. Part of this was due to the Asian economic crisis which heavily affected the closely linked Thai economy. Major exports are garments, timber and wood products, gold re-exports, hydroelectric power and coffee.

Despite overall national self-sufficiency, seasonal rice (and food) shortages occur regularly in many provinces and districts. Food security is still central to agricultural development in Lao PDR. As the Thai economy develops, Lao PDR is starting to exploit opportunities in specialist agricultural products required by Thailand and to utilise the Lao comparative advantage of low labour costs. Some newer ACIAR projects focus specifically on this issue.

Lao PDR has tended to develop two agricultural economies in recent years—the lowland areas along the Mekong River (where, in many parts, access to markets in Thailand has stimulated agricultural development) and the uplands (where many farmers still practice 'slash-and-burn' shifting cultivation).

The Lao PDR Government is expanding irrigation in lowland areas and working to find alternatives to slash-and-burn cultivation in the uplands. With increasing population pressures in the uplands, fallow periods have become unsustainably short. In both upland and lowland areas, diversification of production and greater integration of both agricultural systems with markets remain priorities but the areas of comparative advantage, market opportunities and research needs, generally differ. Lowland agriculture is remarkably rice-centric—at the national level; about 2.3 million tonnes of rice is produced compared with 120,000 tonnes of maize and 150,000 tonnes of sweet potato and much smaller amounts of legume crops.

Upland systems are often more diverse than lowland ones but are poorly connected to markets. Some simple approaches can be successful in reducing slash-and-burn agriculture, such as the introduction of better cut-and-carry forage production systems and the introduction of income-generating pond aquaculture and agroforestry in these regions.

Forestry provided up to one-third of export revenue in the 1990s, but the government has since moved to limit harvesting of natural forests so income from log extraction has fallen. Lao PDR remains by Asian standards a heavily forested country and long-term conservation of this natural resource is critical. More so than other Asian countries, the harvesting of non-timber forest products for food, fibre and medicine forms an important income and livelihood source for many rural households in Lao PDR.

Smallholder livestock are important in the Lao economy. ACIAR research will assist in the control of infectious disease across and within countries (trans-boundary diseases) in partnership with regional disease control initiatives such as the OIE South-East Asian Foot and Mouth Disease Control Program.

Improved risk assessment of disease transmission that occurs with trading and movement of livestock, disease surveillance systems and application of these to disease control programs will be important priorities. Projects may include cooperation with neighbouring countries that are involved in trade. There are opportunities in each country to improve village-based and small-scale commercial enterprises by limiting important constraints, one of which is disease.

Australia is the only country to have maintained unbroken diplomatic representation at the Ambassador level since Lao independence in 1953, and the significance of the unbroken relationship is appreciated at senior levels in Lao PDR. ACIAR has had a program in Lao PDR since 1992, coinciding with the period of expansion of Australia's aid program to the Mekong countries.

A major emphasis of past ACIAR work has been the establishment in Vientiane of an animal diseases laboratory to service Lao PDR.

Other successes include the introduction and selection of cold- and drought-tolerant rice varieties, identification of the major rodent pests affecting rice farming, capacity building in forestry research and agricultural extension approaches, management of indigenous fisheries, and provision of training, including scientific data analysis and scientific writing in English.

In 2006, in collaboration with the National Agricultural and Forestry Research Institute, ACIAR implemented a small grants scheme to enable Lao researchers to develop skills in the design and management of agricultural research projects. In 2007–08 a number of new projects will be implemented as ACIAR expands its Lao PDR program where opportunities for research collaboration with a high likelihood of farmer impact exist.

9.4 Relationship to the AusAID Lao PDR strategy

The AusAID program in Lao PDR aims to assist the country to improve the pre-conditions for poverty reduction and sustainable development. It supports 'appropriate recipient government development priorities as well as donor coordination and harmonisation efforts, in order to maximise development impacts...'.

Sectorally, the country strategy focuses on building Lao human capital by improving access to education, promoting the growth of the market economy by expanding access to private land titles and strengthening property rights, and reducing the vulnerability of the poor by reducing the impact of natural disasters and unexploded ordnance.

The overall purpose of the ACIAR program (poverty reduction and sustainable development) and strategic approach are similar. It can contribute to reducing the

vulnerability of the poor to the impact of natural disasters and unexploded ordnance through enhanced livelihood opportunities.

There is also a strong emphasis on assisting the Lao Government's own development priorities in agricultural research for development, and there is a particular effort in Lao PDR to harmonise with other donor programs through supporting underpinning research.

ACIAR's work can contribute to the development of the market economy by enhancing the productivity of smallholders who are able to trade some of their increased agricultural and forest product output. The program has a strong emphasis on capacity development and training in agricultural research and extension.

9.5 Indicative priorities

Priorities are determined through discussions, interactions and visits between scientists and senior research managers from Lao PDR, ACIAR and Australian institutions, including a visit in July 2006 by the ACIAR Board of Management. Future collaborations will continue to encourage linkages with other donor-funded programs and aim to extend the impact of previous ACIAR-funded projects in the region.

In addition, ACIAR will continue to explore opportunities for linking Thai R&D providers and collaborators to ACIAR projects in Lao PDR.

It is envisaged that new projects will be considered in the areas of animal health and production, forestry, fisheries and crop improvement and management to sustain crop diversification and reduce impacts of shifting cultivation. These projects are under the following themes:

Subprogram 1: Alternatives to shifting cultivation in upland regions

- Technical interventions to improve the profitability of low-input household farming systems as an alternative to shifting cultivation

- Enhancing the impact of earlier ACIAR project investments in livestock production and health at the farmer level
- Sustainable smallholder forestry, including through better silvicultural management of timber and non-timber forest species and through value-addition

Subprogram 2: Agricultural diversification to improve productivity of lowland farming systems

- Improved productivity of irrigated and rain-fed rice-based farming systems and diversification into other crops
- Increasing production from smallholder riverine fisheries and pond aquaculture
- Analysis of incentives for vaccine use, capacity for delivery and quality of available vaccines for classical swine fever and other diseases of cattle, pigs and poultry
- Improvements to the policy and regulatory environment for regional disease control

10 Projects (summary and progress reports)

10.1 Subprogram 1: Alternatives to shifting cultivation in upland regions

Projects:

Active

AH/2003/001	Management of CSF and FMD at the village level in Lao PDR
AH/2004/046	Forage legumes for supplementing village pigs in Lao PDR
ASEM/2005/008	Lao Agricultural Research Fund (pilot)
ASEM/2005/124	Extension approaches to scaling out livestock production in northern Lao PDR
ASEM/2006/060	Lao Agricultural Research Fund (LARF)
FIS/2005/078	Culture-based fisheries development in Lao PDR
FST/2002/112	Domestication of <i>Meliaceae</i> species in Southeast Asia and Australia, particularly management of the problem of <i>Hypsipyla robusta</i> attack
FST/2005/100	Value-adding to Lao plantation timber products

Concluded

ADP/2004/016	A systems approach to rodent management in upland environments in Lao PDR
AH/2006/057	Scoping Study: Assessment of current and potential animal vaccine use in Lao PDR
AH/2006/077	Identifying research priorities for the development of the beef industry in Cambodia and Lao PDR with special reference to animal health interventions

Pipeline

AH/2006/159	Addressing cattle health system constraints in Lao PDR
AH/2006/161	Management of pig-associated zoonosis in the Lao PDR
FIS/2006/183	Development of fish passage criteria for floodplain species of central Lao PDR
FST/2004/057	Optimising production of timber and non-timber forest products in Lao PDR agroforestry systems

AH/2003/001: Management of CSF and FMD at the village level in Lao PDR

Bilateral

Overseas Collaborating Countries	Lao PDR
Commissioned Organisation	CSIRO Livestock Industries, Australia
Project Leader	Dr Axel Colling Phone: 03 5227 5255 Email: axel.colling@csiro.au
Collaborating Institutions	University of Melbourne, Faculty of Veterinary Science, Australia International Center for Tropical Agriculture, Department of Livestock and Fisheries, Lao PDR
Project Budget	\$549,327
Project Duration	01/07/2003 to 31/12/2008 (Project extended from 01/01/2007 to 31/12/2008)
ACIAR Research Program Manager	Dr Peter Rolfe

Project background and objectives

Smallholder farmers in Lao PDR view livestock production as a means to generating cash income. With more than 85 per cent of the country's population located in rural areas sales of livestock are vital to poverty alleviation. Almost all livestock is raised by smallholders, with pigs the most common in smallholder and village systems. Livestock production and accessing cash from sales are a 'stepping stone' away from poverty, but are limited by the persistent outbreaks of some diseases.

Losses due to disease are a major constraint particularly in pig and poultry systems. Earlier ACIAR-supported research identified Classical Swine Fever (CSF) as the major cause of death in village and smallholder pig systems. Anecdotal evidence supports this finding, suggesting epidemics occurring in some regions on a two to three year cycle. Foot-and-mouth disease (FMD) is another common disease, though it is not endemic in some parts of the country as is CSF.

Control of both diseases is a national priority, but is limited by significant knowledge gaps for each. For FMD this centres on disease surveillance activities, which will also deliver benefits in improving skills and methodology for managing other diseases. For CSF a live virus vaccine does exist, but maintaining its efficacy has been difficult. A more stable vaccine, improved vaccine management and simple diagnostic tests are needed to rebuild farmer confidence in the effectiveness of vaccinations.

The project aims to improve the control of CSF and FMD in village pigs through:

- development, evaluation and implementation of a simple, rapid diagnostic test for CSF
- establishment and validation of a system to apply locally produced CSF vaccine
- evaluation of the impact of the CSF vaccine program in the village pig production system
- monitoring the epidemiology of FMD and CSF
- communication of project findings to extension staff and animal health and production scientists in national, regional and international networks.

Project progress

Year 4 (01/07/2006–30/06/2007)

The project was externally reviewed in November 2006 and a review committee recommended that the project be extended for a further two years. The aim of the extension is to undertake additional activity considered necessary to provide the research base on which to plan and implement CSF control.

The specific objectives that will achieve this are:

- To undertake experiments to further validate the IMB-ELISA and develop a system to introduce the test into the mainstream of CSF diagnosis nationally and regionally.
- To develop and implement a program for the adoption of CSF vaccination as a control strategy in village production systems.
- To develop and distribute an education package for the control of CSF at the village level to complement Objectives 1 and 2.
- To maintain a diagnostic capability for FMD by providing FMD reagents.

Experiments necessary to further develop and validate the IMB antigen ELISA at AAHL

At this stage the IMB Ag ELISA uses spleen tissue samples and can be used only for samples from dead pigs. Control activities will be enhanced if the test can be used to detect infected pigs shortly after infection with CSF virus in blood samples of living pigs. Information about the diagnostic window of such a test will help to diagnose CSF outbreaks at earlier stages of infection and more timely quarantine actions. This will help reduce the spread of a CSF outbreak. A blood test will also allow livestock health officials to identify and monitor chronically infected pigs. For that purpose it is necessary to conduct experiments at AAHL to investigate the potential to detect viral antigen in blood samples rather than spleen tissue samples. The next step is to further assess the sensitivity of the IMB Ag ELISA against suitable gold standards, such as virus isolation and RT PCR from experimentally infected pigs.

Determining the antigenic characteristics of the virus used in the experimental infection available at AAHL.

The field viruses will have an impact on the comparability of the results. Experiments to better assess the specificity of the test are being carried out at AAHL, e.g. samples from pigs experimentally infected with other Pestiviruses such as BVD and BD and also samples from CSF viruses used for vaccine strains are used to better characterise the specificity of the IMB Ag ELISA. The outcome will allow an assessment as to how useful the test is for the early detection of CSF outbreaks and to better understand the importance of chronically infected pigs.

Experiment to determine vaccination schedule of piglets against CSF

To further determine the best timing for the vaccination of piglets against CSF approximately 320 piglet sera were sent to AAHL for testing with the NPLA and if possible also with the CEDI test. Blood samples were taken in weekly intervals from 0-3 months of age. Piglets were born from two sows at NAHC (16 piglets) and three sows from Bolikhamxay province (18 piglets). Sows were vaccinated against CSF prior to mating. The outcome of this experiment will help to determine the most suitable vaccination schedule for piglets.

Production and distribution of test reagents for CSF

The normal shelf life of an IMB Ag ELISA kit is approximately 2 months, the main limitation being the stability of the working stock of conjugate. Colour development in positive samples decreases, conversely, colour intensity in negative samples increases. This has caused problems in the past because samples may not be available for testing in such a short period and the use of old conjugate may lead to the reporting of false negative and false positive results. Commercially available kits normally have a minimum of 12 month shelf life which is much better under the conditions in which these kits are used. Production of crucial test reagents such as coated IMBs, mabs, lyophilised conjugate is carried out at AAHL. AAHL is carrying out experiments to determine whether the conjugation of the HRP to the mab and lyophilisation of conjugate is a viable solution. If successful this will be an important step to increase the shelf life of the kit.

Once produced, sufficient quality controlled reagents these will be sent to NAHC. NAHC will be responsible to do further quality control and include lyophilised internal controls, SOP and eqa sheet. The test reagents then can be sent out as a test kit to other provincial or regional labs. It was suggested to use the SCAHLS validation template to formally assess the validation of the IMB ELISA. That would be useful as a step to more formally certify and register the IMB ELISA.

Adaptation and preliminary validation of IMB-ELISA into a blocking format for the sensitive detection of antibodies to CSF virus

These experiments are carried out at NAHC, who are in the process of adapting the IMB ELISA to a 96 well plate format and the production of reference sera from 5 vaccinated pigs on filter paper and as normal serum has been carried out. The next step is to further develop and test an inhibition ELISA. Once these experiments are completed successfully the use of the test to monitor CSF vaccination programs and for routine serological surveillance will be determined.

Conduct participatory problem diagnosis in upland villages to identify incentives to incorporate CSF vaccination in the village production system.

This activity addresses the question: What are the drivers to incorporate vaccination into a production system in Lao highlands? NAHC staff is involved in a survey design and will conduct a survey.

ACIAR proceedings and CSF resource booklet

A preliminary version of the proceedings, representing a history of the activities and results of the project starting in 2003, has been submitted to ACIAR.

The resource booklet addressing major constraints and possible solutions to control CSF at the village level is in production and will be translated into Lao.

Maintain diagnostic capability at NAHC for FMD

NAHC holds reagents for the diagnosis of FMD serotype (O, A and Asia) specific ab and ag ELISA and FMD specific NSP ELISA. NAHC periodically undertakes quality control testing to assure that reagents are still performing within upper and lower limits. CSIRO/AAHL will assist in QA/QC and troubleshooting activities and can supply necessary reagents.

AH/2004/046: Forage legumes for supplementing village pigs in Lao PDR

Multilateral

Overseas Collaborating Countries	Lao PDR
Commissioned Organisation	International Center for Tropical Agriculture (CIAT), Lao PDR
Project Leader	Dr Werner Stur Phone: +856 21 770 090 Email: w.stur@cgiar.org
Collaborating Institutions	Queensland Department of Primary Industries and Fisheries, Australia International Livestock Research Institute, Lao PDR National Agriculture and Forestry Research Institute, Lao PDR
Project Budget	\$416,226
Project Duration	01/01/2006 to 31/12/2008
ACIAR Research Program Manager	Dr Peter Rolfe

Project background and objectives

The Lao PDR government has given highest priority in its rural development strategy to improving livestock production systems, given the potential of livestock production to alleviate poverty and reduce shifting cultivation. Rearing pigs is a widespread smallholder livelihood activity in the northern mountainous regions, but productivity is low due to poor nutrition.

The introduction of forage legumes into the farming system offers the opportunity to improve pig nutrition and to reduce the time spent by women in gathering and preparing feed. The project will initially document existing pig feeding and production systems to help identify entry points for new practices. It will use the scaling-up of a promising forage with at least 1000 farmers to learn how they adapt and integrate that feed into their farming systems. It will also introduce and evaluate new forages for their suitability as pig feeds.

Broader adoption of these technologies will be achieved through the network of agencies in Lao, the development of guidelines for use by other groups in scaling up this innovation and through pending large development programs that involve CIAT and the Lao partner organisations.

Project progress

Year 1 (01/01/2006–31/12/2006)

Objective 1: The project team developed a sound understanding of the constraints and productivity of village pig production systems in Lao PDR during the first year of the project. Two studies contributed to our better understanding.

The first study explored the impact of feeding *Stylosanthes guianensis* CIAT 184 (Stylo) to village pigs. It showed that feeding of fresh Stylo to pigs had two important benefits. The first was that Stylo supplementation increased the average daily gain of growing pigs from 107 to 207 g per day. The second impact was a saving of time for collecting and cooking naturally-occurring leafy plants as pig feed. For farmers who had plenty of Stylo the time needed to feed pigs was reduced from over 3 hours to 1.5 hours per day as Stylo could be used instead of naturally occurring green feeds.

The collection of feed and preparation of feeds was, in most households, the task of women, and reducing the time needed to carry out this task has been greatly appreciated. The second study was a broader survey of village pig production systems. The survey showed that there are three main pig production systems in the uplands of Lao PDR: (1) free scavenging system; (2) confining pigs in enclosures; and (3) penning. The type of system employed was related to the purpose of raising pigs and ethnicity of the producers.

The two main purposes of raising pigs (all native breeds) were: (1) piglet production and (2) fattening pigs. The main feeds were rice bran, maize, cassava, broken rice and green feed occurring naturally. Almost all producers reported that they fed rice bran and some green feed (fresh leaves) to their pigs.

In Lao-loum villages (lowland rice producers), producers fed mainly rice bran, sometimes mixed with broken rice or brewery waste (rice grain) and green feeds. Maize and cassava were used by most Hmong producers, while Khmu producers used maize and some cassava. Labour requirements for collecting and cooking feed were 3 hours per day and the average daily gain of growing pigs was 110 g per day.

Objective 2: An international workshop was held in Luang Prabang from 12 to 14 June 2006 to review the current state of knowledge of smallholder pig production and identify critical research issues. The workshop concluded that the traditional diet was severely deficient in supplying protein. Thus adding even small amounts of protein through Stylo had big effects.

The main research needs identified were: (i) collection and chemical analysis of traditional feeds; (ii) establishing the growth rate and protein deposition of local pigs; (iii) determining the digestibility of Stylo in a feeding trial; (iv) evaluating other forage legumes in terms of nutritive value (chemical analysis) and suitability for smallholder farming systems; (v) determining the voluntary feed intake and performance of pigs fed fresh or dried Stylo.

The first two of these research activities were started in 2006. A list of common local feeds was assembled and samples were collected and sent for chemical analysis. Results are expected in early 2007. The second activity was an experiment to determine the growth rate and nutritional requirements of Moo lat. Five feed intake levels of a well-balanced diet, ranging from an *ad lib* diet group to a restricted intake diet limiting feed intake to 60% of the *ad lib* group. Although not yet completed, by the end of December average growth rates ranged from 611 g/day for the *ad lib* treatment group to 325 g/day for the 60% restricted intake treatment group. This clearly demonstrates the good growth potential of local pigs and highlights the great potential for improvement.

Objective 3: The project formed an alliance with development practitioners from NGOs, local government and development projects. The rationale was to accept that we are scientists rather than development practitioners and that the only way for us to contribute to significant development outcomes is to work closely with practitioners from the development sector. Clearly, there are benefits for both sides with the development practitioners getting access to research results and we are getting feedback on what is needed by the development practitioners.

The project has established such an alliance and, after more than 6 months of collaboration, we are enthusiastic about the approach and benefits that are emerging. The NGOs, in particular, are very enthusiastic and appreciative of the inputs provided by project staff, and the project is very grateful for feedback on issues encountered by the development practitioners in scaling out Stylo for supplementation of village pigs. By the end of 2006, the project and its partners worked with more than 380 farmers.

ASEM/2005/008: Lao Agricultural Research Fund (LARF) Pilot

Bilateral

Overseas Collaborating Countries	Lao PDR
Commissioned Organisation	Consultant, Australia
Project Leader	Dr John Schiller Phone: 07 3365 2987 Email: j.schiller@uq.edu.au
Collaborating Institutions	Large number of Lao PDR institutes
Project Budget	\$214,500
Project Duration	01/01/2006 to 30/06/2009
ACIAR Research Program Manager	Dr Caroline Lemerle

Project background and objectives

The Lao PDR Agricultural Research Fund has been designed to provide Lao scientist from government, university, college and NGO type organisations based in Lao PDR, to compete for agricultural funds. Project proposals must contain a defined research component, over one to three years in duration and must be led by a Lao scientist. The annual funding limit for individual projects will be US\$5000 with a three-year project limit of US\$12,000 per project.

Project proposals will be considered in the areas of crop production; livestock production and health; natural resource management; integrated agricultural systems research; agricultural economics and socio-economics studies relating to agriculture; and fisheries research. Preference will be given to proposals with clear potential benefits to smallholders or the broader community; collaborate with different agencies; and include complementary inputs from other sources.

Project progress

Year 1 (01/01/2006–31/12/2006)

LARF-14: Maize Variety Development for the Lao PDR
Agency: National Agriculture and Forestry Research Institute (NAFRI)
Project Leader: Mr Singkham Nephantala
Project Duration: 3 years commencing May 2007

LARF-15: Development of Gall Midge (GM) Resistant Lowland Rice Varieties
Agency: Provincial Agriculture and Forestry Services Office (PAF0) – Savannakhet Province
Project Leader: Dr Soulaphone Inthavong
Project Duration: 3 years commencing April 2007

LARF-16: Improvement of Frog Strains for Improving Frog Production in Lao PDR
Agency: Living Aquatic Resources Center (LARReC)
Project Leader: Mr Bounsong Vongvichit
Project Duration: 3 years commencing March 2007

LARF-17: Study of fish diseases in fish culture in the Vientiane Capital
Agency: NAFRI - Living Aquatic Resources Center (LARReC)
Project Leader: Mr Saloumphone Changhavong
Project Duration: 2 years commencing May 2007

LARF-18: Study of the growth response of native pigs to Leucaena leaf meal supplements to basal diets of rice bran and maize
Agency: NAFRI–Livestock Research Center (LRC)
Project Leader: Mr Phonepaseuth Phengsavanh
Project Duration: 2 years commencing May 2007

LARF-19: Effects of Erythrina leaf and cassava leaf hay as supplementary feeds on the voluntary intake and growth performance of native cattle
Agency: National University of Lao PDR (NUOL) – Faculty of Agriculture
Project Leader: Mr Viengsakoun Napisirth
Project Duration: 1 year commencing March 2007

ASEM/2005/124: Extension approaches to scaling out livestock production in northern Lao PDR

Bilateral

Overseas Collaborating Countries	Lao PDR
Commissioned Organisation	Charles Sturt University, School of Environmental and Information Sciences, Australia
Project Leader	Dr Joanne Millar Phone: 02 6051 9859 Fax: 02 6051 9897 Email: jmillar@csu.edu.au
Collaborating Institutions	International Center for Tropical Agriculture, Lao PDR National Agriculture and Forestry Extension Service, Lao PDR University of Sydney, Australia Department of Livestock and Fisheries, Lao PDR National Agriculture and Forestry Research Institute, Lao PDR
Project Budget	\$399,732
Project Duration	01/04/2007 to 31/03/2011
ACIAR Research Program Manager	Dr Caroline Lemerle

Project background and objectives

Shifting cultivation of livestock practiced in northern Lao PDR limits both the numbers of animals grazed and their growth rates. A past ACIAR project, in conjunction with CIAT and AusAID, introduced poor farmers to forage and livestock technologies and approaches that accelerated animal growth, while minimising the reliance on shifting cultivation.

The success of these technologies, in concert with extension methods that enhanced farmer learning, resulted in farmer number doubling within two years, with the time until impact halving. Two major initiatives, by the EU and ADB, intend to broaden the geographic focus of this work, while ACIAR will evaluate existing extension approaches with an aim to modify these for greatest uptake and impact.

Project progress

First progress report due in 2008.

ASEM/2006/060: Lao Agricultural Research Fund (LARF)

Bilateral

Overseas Collaborating Countries	Lao PDR
Commissioned Organisation	Uniquest, Australia
Project Leader	Dr John Schiller Phone: 07 3365 2987 Fax: 07 3365 1188 Email: j.schiller@uq.edu.au
Collaborating Institutions	National Agriculture and Forestry Research Institute, Lao PDR
Project Budget	\$399,560
Project Duration	01/01/2007 to 31/12/2009
ACIAR Research Program Manager	Dr Caroline Lemerle

Project background and objectives

Agriculture in Lao PDR contributes more than 52 per cent of GDP and employs more than 80 per cent of the labour force. Rice is the dominant crop of a sector that is still largely subsistence farmed. Modernising the country is a government priority outlined in the Vision 2020 Statement, including advances in agriculture.

Strengthening research in agriculture is an important component of this planned advance. Most funding for agricultural research is external and directed to large projects. There remains a funding gap for smaller projects, particularly for recently graduated agricultural scientists and those returning from study overseas. The LARF will fill this gap by funding small research grants aimed at building and maintaining career momentum for scientists.

Project progress

First progress report due in 2008.

FIS/2005/078: Culture-based fisheries development in Lao PDR

Bilateral

Overseas Collaborating Countries	Lao PDR, Thailand
Commissioned Organisation	Deakin University, School of Ecology and Environment, Australia
Project Leader	Professor Sena De Silva
Collaborating Institutions	Department of Livestock and Fisheries, Lao PDR Department of Primary Industries, Victoria, Australia Network of Aquaculture Centres in Asia Pacific, Thailand
Project Budget	\$398,801
Project Duration	01/04/2007 to 31/03/2010
ACIAR Research Program Manager	Mr Barney Smith

Project background and objectives

Fish is the main animal protein source of Lao people. Current fish production, almost entirely based on the seasonal riverine and reservoir capture fisheries, approximates 30,000 tonnes per annum. There remains a gap between supply and demand that the Government of Lao PDR is endeavouring to close through aquaculture-related developments. But the industry is still in its infancy, and currently accounts for less than 250 tonnes annually.

The primary objective of this project is to develop one or more technological packages that can, with village community participation, optimise yields from culture-based fisheries practices in flood plain depressions and reservoir coves in two provinces of Lao PDR.

Project progress

First progress report due in 2008.

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

Bilateral

Overseas Collaborating Countries	Lao PDR, Thailand, Vietnam
Commissioned Organisation	CSIRO Forestry and Forest Products, Australia
Project Leader	Mr Khongsak Pinyopusarerk Phone: 02 6281 8247 Fax: 02 6281 8266 Email: khongsak.pinyopusarerk@csiro.au
Collaborating Institutions	Queensland Department of Primary Industries and Fisheries, Australia National University of Lao PDR, Lao PDR Department of National Parks, Wildlife and Plant Conservation, Thailand Forest Science Institute of Vietnam, Vietnam
Project Budget	\$386,083
Project Duration	01/07/2005 to 30/06/2008
ACIAR Research Program Manager	Dr Russell Haines

Project background and objectives

Many species of the Family Meliaceae native to Southeast Asia and Australia, including mahogany, *Chukrasia* and *Toona ciliata* (red cedar), produce high-value wood. Forest scientists have identified wild species suitable for domestication, but a barrier to plantation development has been their susceptibility to attacks by insects of the *Hypsipyla* genus. The larvae of these tip moths attack the stem apex, causing deformation that lowers the quality of harvested logs.

Previous ACIAR-supported research has advanced domestication prospects and identified *Hypsipyla*-resistant families and provenances. This project seeks to further test tolerant red cedar and *Chukrasia*, and to develop silvicultural and management protocols aimed at mitigating attacks. The research team is also undertaking capacity building at partner-country research institutions.

The research objectives of this project are: to identify, develop and test tolerant genotypes of *Chukrasia* species and *Toona ciliata*; to establish silvicultural and management protocols mitigating *Hypsipyla robusta* damage; to undertake capacity building, communication and dissemination of project results.

Project progress

Year 1 (01/07/2006–30/06/2007)

Vietnam

Two adjoining clonal trials of *Chukrasia* were established at Cam Qui (Ba Vi) on the same site that the provenance was established under ACIAR Project FST1996/005. Both trials contain the same genetic material. However, the one trial does not have any tree canopy while the second trial was initially planted with *A. mangium* hybrid then several months later planted with *Chukrasia*.

The Ba Vi nursery carried out a decapitation trial of 30 clones across the three categories of recovery from hypsipyla attack. The results of this trial showed no difference between the ability of *Chukrasia* to recover. They all produced a clear single leader.

The Ba Vi nursery has been preparing cuttings of selected clones of *Chukrasia* for shipment to Thailand in order to complement the clones in that country.

Thailand

A *Chukrasia* companion trial was established in May 2007 under an *Acacia mangium* planting in May 2006. The trial will look at the effects of *Hypsipyla* attack on *Chukrasia* grown under/companion to *A. mangium*.

Grafting was undertaken to establish a hedge garden representing 20 selected trees from the *Chukrasia* field trials at Kanchanaburi nursery. Cuttingtaking from the hedge garden has commenced. Additional plant material is being sourced from Vietnam selections.

Lao PDR

The *Chukrasia* trial at the Agroforestry Research Station at Thongkhang, Luang Prabang was weeded during the course of the year. A one-week training course in trial design, establishment and analysis was undertaken at Luang Prabang in October 2006.

FST/2005/100: Value adding to Lao PDR plantation timber products

Bilateral

Overseas Collaborating Countries	Lao PDR
Commissioned Organisation	University of Melbourne, Australia
Project Leader	Dr Barbara Ozarska Phone: 03 8344 7188 Fax: 03 9349 4172 Email: bo@unimelb.edu.au
Collaborating Institutions	National University of Lao PDR, Lao PDR Burapha Agroforestry Co Ltd, Lao PDR Lao Furniture Industry Association, Lao PDR Ministry of Industry and Handicrafts, Lao PDR Pakpasak Technical School, Lao PDR
Project Budget	\$889,241
Project Duration	01/01/2007 to 31/12/2010
ACIAR Research Program Manager	Dr Russell Haines

Project background and objectives

Plantations of eucalypts and teak are grown in parts of Lao PDR. Some of this timber is processed locally for furniture manufacture, with most timber is sold for export. Few products are made, as the Lao timber processing industry is relatively new. Most timber is cut down in local sawmills then exported to Vietnam and Thailand.

Opportunities exist to expand Lao timber processing and manufacturing so more value-adding can be carried out and the returns captured locally. Enhancing the range, quality and value of products produced from locally-grown timber will take place through the development of appropriate timber processing, the introduction of new technologies and application of quality controls.

Project progress

First progress report due in 2008.

ADP/2004/016: A systems approach to rodent management in upland environments in Lao PDR

Bilateral

Overseas Collaborating Countries	Lao PDR
Commissioned Organisation	CSIRO Sustainable Ecosystems, Australia
Project Leader	Mr Peter Brown Phone: 02 6242 1562 Fax: 02 6242 1505 Email: peter.brown@csiro.au
Collaborating Institutions	National Agriculture and Forestry Research Institute, Lao PDR World Vision in Lao PDR, Lao PDR
Project Budget	\$215,939
Project Duration	01/01/2005 to 31/12/2006
ACIAR Research Program Manager	Dr Simon Hearn

Project background and objectives

Shifting cultivation remains one of the dominant production systems in many upland areas throughout Southeast Asia. Many of the rural communities practising this traditional agriculture are very poor. In the uplands of Lao PDR this pattern holds true, with smallholders amongst the poorest in Asia. Lao farmers practicing shifting cultivation in upland areas grow rice, maize, sorghum and other crops. Rodent pests are a major production constraint. Farmers cite this as the problem they have the least control over. Past ACIAR research has developed a population-based control, the community trap barrier system (TBS). The TBS uses a lure crop, planted ahead of the main crop and traps strategically placed around a barrier encasing this lure crop, to trap sufficient quantities of rodents to break population cycles, which coincide with crop cycles.

Past project work in Lao PDR introduced the TBS concept, established for lowland irrigated rice, into an upland, shifting cultivation setting. Farmers adapted this to protect stored grain but found it had limited impact in the field. Rodent population data, together with data on past rodent outbreaks, were also collected. This will now be used to test rodent management practices amongst farmers.

Existing knowledge, attitudes and practices will be evaluated to help adapt and adopt a rodent management system suitable for upland shifting cultivation settings by:

- developing robust management solutions for rodent management in upland shifting cultivation systems based on understanding of population dynamics of the key rodent pests and to prepare a manual on rodent control,
- determining the sociological and cultural factors that influence farmers' decisions on the adoption of rodent management through conducting pre- and post-survey of knowledge, attitudes and practices in Lao PDR, and
- developing the capacity and involvement of government and NGO extension for establishing adoption pathways of ecologically-based rodent management.

Project outcomes

The key impact was a strong ownership of the recommended rodent management strategies by the farmers, extension staff and the NGO.

Farmers on treatment sites in Luang Prabang spent significantly more time in trapping rats, but overall spent less money applying rodent management practices compared to reference sites. In contrast, farmers on treatment sites in Luang Namtha spent less time controlling rats but spent more money (one site applied rodenticides which were expensive) compared to reference sites.

CONCLUDED PROJECTS

The project team drew up a list of final recommended rodent management strategies for Lao PDR.

Upland: Employ traps continuously, use pitfall traps (1 m deep, 0.5 m wide at opening), set up the bait trap-barrier system (TBS). Work together to hunt rats in field stores, and again to hunt rats after harvest.

Lowland/garden: Employ traps continuously, work together to hunt rats after harvest, set up pitfall traps, dig burrows and hunt with dogs.

Village: Establish rules/regulations for sustainable management of rodents (stop use of rodenticides, stop eating predators of the rat, promote village campaign and work together). Raise cats and dogs, conduct sanitation throughout village, set up a grain store trap barrier system (TBS), get school children working together to trap rats, and conduct village campaign at key times.

As compared to farmers in reference sites, treatment farmers maintained a rice store TBS, pitfall traps, sanitation, bait TBS and TBS in the field. There was an 80% reduction in use of rodenticides on treatment sites (some villages banned the use of rodenticides).

Rodent damage to upland and lowland rice was relatively low to crops throughout the project, while damage increased from booting to flowering to harvesting stages. There was no significant difference between treatment and reference sites, with crop damage for corn 7% (range 0–26%), for lowland rainfed rice 3% (0–16%), for lowland dry season rice 1% (1–2%) and for upland rainfed rice 1% (0–7%).

Moderate levels of breeding of the black rat, the main pest species, was evident throughout the year (15–25% adult females pregnant each month). Therefore, management of villages and neighbouring areas needs to be continuous.

A manual on the rodents of Lao PDR was completed with a description and photos of 12 pest and 24 non-pest species, identification keys and recommended rodent management strategies. The publication contains English and Lao information. Four Lao brochures were developed covering the main pest species and the rodent control strategies.

The project researchers determined the sociological and cultural factors that influence farmers' decisions on the adoption of rodent management through conducting a pre- and post-survey of knowledge, attitudes and practices (KAP). They found the key impact was the reduction in reliance of rodenticides (from 34% of farmers applying rodenticides to 21%, which is a 39% reduction) with reliance on trapping remaining high. For successful rodent management, it was important to have a rodent 'champion' in the village, strong support from the village head, and for the village to work together to manage rodents.

The capacity of government and NGOs for establishing extension and adoption pathways for ecologically-based rodent management was enhanced through regular involvement of extension staff in the project workshops, training courses on rodent biology and taxonomy and through cross-visits by farmers and extension staff to different provinces.

AH/2006/057: Scoping Study: Assessment of current and potential animal vaccine use in Lao PDR

Bilateral

Overseas Collaborating Countries	Lao PDR
Commissioned Organisation	Ausvet Animal Health Services, Australia
Project Leader	Dr David Kennedy Phone: 02 6365 6016 Fax: 02 6365 6088 Email: david@ausvet.com.au
Project Budget	\$21,500
Project Duration	10/07/2006 to 21/08/2006
ACIAR Research Program Manager	Dr Peter Rolfe

Project background and objectives

This review of animal vaccine supply and demand in the Lao PDR was undertaken in late July 2006 as background to a proposed ACIAR project (Improved supply and quality of livestock vaccines in Lao PDR, AH 2005/084) to improve the technical aspects of the production and distribution of the products of the Lao Government's Vaccine Production Centre (VPC) near Vientiane.

It involved in-country consultations with stakeholders – from those involved in vaccine production and distribution through to the end-users and the coordinators of regional transboundary disease programs.

Project outcomes

From their findings, the reviewers reported that the demand for vaccines by commercial livestock producers will increase steadily as the number and size of such enterprises increases. Commercial producers can access vaccines from a number of sources and do not need to rely on the VPC. They will use vaccines of high quality, conveniently sourced, promptly supplied and appropriately priced for their production systems. International distributors are already supplying an unknown quantity of vaccine in relatively small consignments and appear interested in supplying a larger market as it develops over the next 10 years.

Current imports have tacit government support at the national level and some provincial governments may be actively importing vaccines. When proposed regional transboundary animal disease (TAD) programs become active they will increase demand for specific vaccines, of which classical swine fever and haemorrhagic septicaemia vaccines are manufactured in Lao PDR but FMD vaccine would still need to be imported.

Smallholders can buy a vaccine or have their animals vaccinated on a fee-for-service basis through village veterinary workers who get their supplies through the government vaccine distribution network. Although smallholder access to vaccines and good animal health advice in remote areas is poor at this stage it should improve with rural development.

The current demand for vaccine from VPC by smallholders and the vaccination coverage of their livestock by VPC vaccines is low compared with the potential for their use. Smallholders' vaccine use will probably increase slowly, driven by rising incomes as they supply cash markets and their growing awareness and understanding of infectious animal diseases and the role of vaccination in protecting their investment in their livestock and the income derived from them. Moreover, smallholders' awareness and understanding would be increased if there were more educated and active advisors.

CONCLUDED PROJECTS

Reviewers found that inadequate government funding and poor cost recovery through underpriced sales and variable compliance with ASEAN standards of production compromised quality control, both in manufacturing at VPC and in distribution by the Veterinary Supply Unit (VSU). There is significant potential to improve the quality and effectiveness of VPC vaccines through better quality control in production and distribution (as proposed by the CSIRO/NAHC proposal to ACIAR).

The government policy of maintaining artificially low vaccine prices to encourage smallholder vaccination is not increasing demand and should be reviewed. There were no major donors committed to funding the operations of the VPC/VSU in the future, and a new business model for the VPC and VSU was needed to ensure financial and operational sustainability.

The reviewers recommended that the current research proposal to ACIAR be improved by including an initial 'go/no go' milestone of developing a **new business plan** with the Government of the Lao PDR for animal vaccine supply and distribution. Before the technical aspects of the proposed AH/2005/084 project proceed, this plan should be used to review the Lao government's commitment to local manufacturing of major animal vaccines at the VPC under the new business plan or an alternative sustainable model.

In addition to the project centred on the VPC they recommended that a **complementary field-based project** investigate more closely the factors affecting smallholders' management of animal health, including vaccine use.

AH/2006/077: Identifying research priorities for the development of the beef industry in Cambodia and Lao PDR with special reference to animal health interventions

Bilateral

Overseas Collaborating Countries	Cambodia, Lao PDR
Commissioned Organisation	University of Sydney, Faculty of Veterinary Science, Australia
Project Leader	Dr Peter Windsor Phone: 02 9351 1710 Fax: 02 4655 0618 Email: pwindsor@camden.usyd.edu.au
Project Budget	\$60,000
Project Duration	01/09/2006 to 30/01/2007
ACIAR Research Program Manager	Dr Peter Rolfe

Project background and objectives

A preliminary project proposal, *AH/2005/086 Developing best practice cattle and buffalo health and husbandry systems for Cambodia and Lao PDR*, is in preparation at ACIAR, but elements of the proposed research need resolution. Before proceeding to a full proposal the following steps are required: confirm that the key concepts and research issues including economic drivers for enhancing large ruminant productivity are captured; define the role for ACIAR within the suite of current projects occurring in each country; identify the key partners, personnel and preferred locations, and gain details for budgeting; document ongoing research needs.

This small research activity will enable two accompanied visits by the project leader to Cambodia and Lao PDR and, if possible, a preliminary attitudinal survey in target communities.

Project outcomes

Final report not yet submitted by the Commissioned Organisation.

10.2 Subprogram 2: Agricultural diversification to improve productivity of lowland farming systems

Projects

Active

AH/2006/025	Understanding livestock movement and the risk of spread of transboundary animal diseases
AH/2006/155	Vaccine Business Development—Lao PDR
ASEM/2005/008	Lao Agricultural Research Fund (pilot)
ASEM/2006/060	Lao Agricultural Research Fund (LARF)
CIM/2007/027	Development of conservation farming implements for two-wheeler tractors (power tillers) in Cambodia, Lao PDR and Bangladesh
PLIA/2000/165	Facilitating farmer uptake of ACIAR project results: World Vision collaborative program

Concluded

CP/2001/027	Adaptation of low-chill temperate fruits to Australia, Thailand, Lao PDR and Vietnam
FIS/2003/003	Stock structure of two important Mekong River carp species (<i>Henicorynchus</i> spp.)
PLIA/2006/012	Livestock health and vaccines in Cambodia and Lao PDR: scoping study and economic assessment

Pipeline

AH/2005/084	Improved supply and quality of livestock vaccines in Lao PDR
AH/2006/159	Addressing cattle health system constraints in Lao PDR
CIM/2006/041	Increased productivity and profitability of rice-based lowland cropping systems in Lao PDR
FIS/2006/137	Analysis of the Dai and trap fishery in Lao PDR

AH/2006/155: Vaccine business development in Lao PDR

Bilateral

Overseas Collaborating Countries	Lao PDR
Commissioned Organisation	AusVet Animal Health Services, Australia
Project Leader	Dr David Kennedy Phone: 02 6365 6016 Fax: 02 6365 6088 Email: david@ausvet.com.au
Collaborating Institutions	Agronomists and Veterinarians without Frontiers, Lao PDR
Project Budget	\$149,968
Project Duration	15/01/2007 to 17/12/2007
ACIAR Research Program Manager	Dr Peter Rolfe

Project background and objectives

Vaccines for animal diseases in Lao PDR have been produced locally, however the sustainability is limited under present arrangements. This activity will investigate, in cooperation with the Lao PDR government, the options for the future management, marketing and supply of vaccine and provide a preferred option that can be implemented by government over time.

Project progress

First progress report due in 2008.

CIM/2007/027: Development of conservation farming implements for two-wheeler tractors (power tillers) in Cambodia, Lao PDR and Bangladesh

Bilateral

Overseas Collaborating Countries	Bangladesh, Cambodia, Lao PDR
Commissioned Organisation	Australia
Project Leader	Mr R J Esdaile
	Phone: 02 6760 8572
	Email: rjesdaile@bigpond.com
Project Budget	\$46,500
Project Duration	01/06/2007 to 31/03/2009
ACIAR Research Program Manager	Dr Paul Fox

Project background and objectives

Tillage operations by the majority of smallholder farmers in parts of South and Southeast Asia have until recently relied on manual and animal draught power. In the last decade, mechanisation based on the use of two-wheel tractors (power-tillers) has become widespread. The versatility of power-tillers offers significant opportunities to promote conservation tillage in areas of Asia that are transitioning into mechanised agriculture (e.g. Bangladesh, Burma, Cambodia and Lao DPR).

However, with the exception of work carried out by CIMMYT in Bangladesh from 1995 to 2004, to develop conservation tillage implements for power-tillers to establish wheat in rice-wheat systems, little further systematic design, development and testing work has been carried out. This is partly because conservation tillage research has tended to focus on four-wheel tractors (e.g. Pakistan, India, China), or there is limited research capacity to develop agricultural machinery (e.g. Burma, Cambodia and Lao DPR).

A factor compounding the difficulty to develop and promote conservation farming implements for two-wheel tractors is the lack of machinery standardisation between the different power-tiller manufacturers. Consequently, unavailability of suitable conservation farming implements to match prevailing two-wheel tractors in many Asian countries represents a major constraint to the promotion and adoption of conservation farming techniques where mechanisation is primarily at the power-tiller level.

This Small Research Activity aims to bridge this constraint by providing ongoing ACIAR projects in Cambodia, Lao PDR and Bangladesh with a suite of conservation farming implements suitable to use with power-tillers prevalent in the respective countries, and to build these activities into the planning of new projects.

The specific objectives to achieve this are:

1. to develop a universal toolbar complete with a set of conservation farming attachments (including both full tillage and zero tillage seed drills) that can be used on a range of differently configured power-tillers
2. to further modify and alter the existing standard Asian rotary hoe based full tillage power tiller seed drill to convert it to a true zero tillage/strip tillage unit that will operate in an extensive range of soil and environmental conditions.

Project Progress

First progress report due in 2008.

PLIA/2000/165: Facilitating farmer uptake of ACIAR project results: World Vision collaborative program

Bilateral

Overseas Collaborating Countries	Lao PDR, Thailand, Vietnam
Commissioned Organisation	World Vision Australia, Australia
Project Leader	Mr Jonathon Treagust Phone: 03-9287 2509 Email: jonathan.treagust@worldvision.com.au
Collaborating Institutions	World Vision of Vietnam, Vietnam Lao PDR World Vision Foundation, Lao PDR World Vision Foundation of Thailand, Thailand Queensland Department of Primary Industries and Fisheries, Australia
Project Budget	\$1,452,769
Project Duration	01/01/2001 to 31/12/2007 (Project extended from 01/01/2004 to 31/12/2007)
ACIAR Research Program Manager	Dr John Skerritt

Project background and objectives

Increasing the impact of ACIAR project results has been furthered through a partnership with World Vision (WV) projects where provision of technologies arising from ACIAR projects can further agricultural productivity. ACIAR entered into a Memorandum of Understanding (MoU) with World Vision for this purpose in February 2000, and this project comprises some of the major collaborative activities in Southeast Asia under this MoU.

This project consists of a set of six collaborative sub-projects between ACIAR and WV in Lao PDR, Thailand and Vietnam. Results arising from a mature or completed ACIAR project activity which are suitable for farmer-level extension are integrated into an active WV project in particular provinces of the three countries. The single Lao PDR sub-project is seeking to introduce improved crop options by boosting wet season rice production and utilising other crops in the dry season.

Project progress

Year 6 (01/01/2006-31/12/2006)

This report describes the progress of the Improving Crop Yields project in 3 districts of Savannakhet including of seven villages of Phalanxai, 10 villages of Outhoumphone and five villages of Atsaphangthong.

During the beginning of January 2006, 49 farmers from 27 villages of Outhoumphone, Atsaphangthong and Phalanxai districts participated in a study tour to the Thasano Rice Multiplication Centre and Kanthachan village in Saiphouthong district to learn about rice seed and exchange lessons learnt about growing peanuts. In the dry season, vegetables were planted by 70 farmers from 20 villages. They grew vegetables for family consumption and to reduce expenditure.

At the end of January 06, Siddhartha Sahu, World Vision Savannakhet Team leader, and Soda Souvannaphong, ICY project manager, participated in an ACIAR-funded workshop on social impact and community science, attended by up to 20 project leaders and key researchers from ACIAR projects in Lao PDR. Ten tonnes of rice seeds were distributed to farmers in Outhoumphone, Atsaphangthong and Phalanxai districts.

ACTIVE PROJECTS

Activities implemented during the reporting period are summarised as follows:

- Study tour of farmers to Thasano Rice Research and Seed Multiplication Center
- Monitoring of dry season crop planting.
- Participation in social and community science training workshop
- Bio and compost fertiliser training
- Selection of farmers for rice demonstration
- Training of farmers on rice demonstration
- Distribution of 10 tonnes of rice seeds.

CP/2001/027: Adaptation of low-chill temperate fruits to Australia, Thailand, Lao PDR and Vietnam

Bilateral

Overseas Collaborating Countries	Lao PDR, Thailand, Vietnam
Commissioned Organisation	Queensland Department of Primary Industries and Fisheries, Maroochy Horticultural Research Station, Australia
Project Leader	Dr Alan George Phone: 07 5441 2211 Email: alan.george@dpi.qld.gov.au
Collaborating Institutions	Research Institute of Fruit and Vegetables, Vietnam National Institute of Plant Protection, Vietnam National Agriculture and Forestry Research Institute, Lao PDR Southern Fruit Research Institute, Vietnam Department of Agriculture, Thailand
Project Budget	\$687,393
Project Duration	01/07/2001 to 30/06/2007 (Project extended from 01/07/2004 to 30/06/2007)
ACIAR Research Program Manager	Dr T K Lim

Project background and objectives

This project extends previous research investigating the development of a sustainable temperate fruit industry in Thailand. Temperate fruit industries in Thailand are in the early stages of development, but high prices are paid for temperate fruits in Thai domestic markets. The production of high-value temperate fruits would raise living standards of hill tribe people and encourage them to use sustainable cropping systems. There is also an export market window into other Asian countries from March to May.

Vietnam already grows many fruit crops and the average revenue from fruit production is two to three times higher than that of rice. It is estimated that many more areas are suitable for temperate fruit production. Lao PDR only grows poor-quality local varieties but has other suitable areas to grow low-chill temperate fruit.

The problems for growing temperate fruits in Vietnam and Lao PDR are similar to those that have been identified in Thailand: development of insect pests and diseases during high humidity, lack of knowledge on how to select the best varieties and manage the crops, lack of nurseries, and lack of marketing studies or plans.

The project aims to establish and develop sustainable low-chill temperate fruit industries (stone, pomegranate fruit and persimmon) in Thailand, Lao PDR and Vietnam through the identification of appropriate sites and varieties

and through the implementation of best management practices at the farm level.

Project outcomes

The overall objective of the project was to develop sustainable temperate fruit industries in Thailand and Lao PDR. Because of the excellent market opportunities for stonefruit and persimmon in Asia, the project focused on introducing new varieties of these species and adapting advanced technologies developed in Australia for Thai and Lao farmers.

The second extension of the project has demonstrated that with new varieties and management systems that high returns can be achieved from temperate fruits in warm subtropical regions of Asia. For example, in Lao PDR, farmers achieved incomes of about \$A6000–8000 per hectare from low-chill peach and nectarine production, about 20–30 times greater than their usual annual income of \$A300 from growing upland rice and corn.

At Ang Kang in northern Thailand, trees of peach cv. Tropic Beauty produced 120–150 fruit per tree with an estimated yield of 8–10 tonnes per hectare. Fruit quality was excellent with average fruit weights of 150 g and high sugar content. Using an average price of 80 baht per kg, we demonstrated that farmers could achieve gross returns of \$A25,000 per hectare even in very steep, marginal country.

CONCLUDED PROJECTS

In Lao PDR, the project successfully extended temperate fruit production systems to four new districts in Xiengkhouang Province and the nearby province of Huaphan. A small nursery, near the Regional Agricultural Office in Ponsavan, has been established to propagate temperate fruit and other subtropical fruit species. Due to the success of the project, the Lao Ministry of Agriculture is now actively promoting temperate fruit production in cooler regions of the country.

In Thailand, the Thai DOA has established stonefruit demonstration orchards at 20 farmer sites in Khun Wang, Ang Kang and Chiang Rai Provinces. Tree age varies from 3 to 5 years of age. Older trees have commenced cropping. Peach cv. Tropic Beauty has produced high quality fruit. For example, one farmer has achieved yields on 4-year-old peach trees of about 120 fruit (18–20 kg per tree). Because the quality of fruit was high, with about 30% of the fruit extra grade, this farmer received on average 80 baht/kg (\$A3 per kg).

Although the temperate fruit growing regions of both Thailand and Lao PDR have a plentiful supply of water, which is held in small dams, farmers lack expertise and funding in designing and installing suitable irrigation systems. In Lao PDR, the project successfully installed a minisprinkler irrigation system, the first of its type in this country, at one commercial farmer's orchard.

Extension, farmer training and communication channels

At the commencement of the project extension, an extension methodology workshop was held in Chiang Mai Thailand to examine ways of improving delivery of temperate fruit methodologies to farmers. As a consequence, an improved understanding on the best extension methodologies was developed.

Excellent communication links have now been established between Australian, Thai and Lao researcher and extension officers. Mr Pichit Sripinta, Thai DOA, conducts monthly visits to the World Vision Centre at Ban Kon village near Chiang Rai to train local farmers and World Vision extension officers in temperate fruit technologies. Since this training has commenced, there has been a significant improvement in the quality of stonefruit marketed from this region.

Thai DOA researchers are now transferring the technologies developed in this project to other Asian countries such as China through formalised projects. They are also continuing their training of Lao research and extension officers.

Marketing

In Thailand, sensory evaluation studies were conducted at both Royal Ang Kang and Khun Wang Research Stations. Our analyses showed that four of the newly introduced stonefruit varieties are well accepted by Thai consumers. Our studies showed that both Thai and Lao PDR consumers prefer large, highly coloured fruit with high sugar concentrations and low acid.

Conclusions

It will take at least a further 10 years for the new temperate fruit technologies to be transferred and successfully adopted by Thai and Lao farmers. The rate of adoption will be slow because farmers in these countries are unfamiliar with fruit tree technologies in general and because they associate a greater degree of financial risk with growing temperate fruits compared with short-term crops such as vegetables and corn. Additionally, extension officers need to become more confident in training farmers in these technologies. However, those farmers who have adopted the new technologies to date have reaped the financial rewards and this should provide the catalyst for further growth.

FIS/2003/003: Stock structure of two important Mekong River carp species (Hemicorynchus spp.)

Bilateral

Overseas Collaborating Countries	Cambodia, Lao PDR, Thailand, Vietnam
Commissioned Organisation	Queensland University of Technology, School of Natural Resource Sciences, Australia
Project Leader	Dr Peter Mather Phone: 07 3864 1737 Email: p.mather@qut.edu.au
Collaborating Institutions	Mekong River Commission, Fisheries Programme, Cambodia Living Aquatic Resources Research Centre, Lao PDR Department of Fisheries, Thailand Research Institute for Aquaculture No. 2, Vietnam
Project Budget	\$386,968
Project Duration	01/01/2004 to 31/03/2007 (Project extended from 01/01/2006 to 31/03/2007)
ACIAR Research Program Manager	Mr Barney Smith

Project background and objectives

The Mekong River Basin (MRB) is home to fisheries which provide food security for approximately 60 million people spread across several countries. Despite their importance management of these fisheries is rudimentary at best. The Mekong River Commission (MRC), formed under the cooperation of the four countries sharing the lower parts of the basin, have begun to focus on achieving sustainable fisheries management to ensure food security is maintained, while also factoring in growing development pressures on the river.

The basin offers a wide range of agricultural and industrial development opportunities. Hydrological power development is one such opportunity that threatens fisheries, while the importance of the river as a trade link between the six riparian countries through which it runs, is also likely to increase. Population increases will continue to put further pressure on the surrounding environment and river system itself, as well as on the capabilities of Mekong fisheries.

Management of these fisheries is complicated by the high level of diversity of fish species. Sustainable management practices can vary between species, depending on ecology and life histories. The MRC has initiated extensive studies of the ecology of a number of important fish species to understand ecology and life histories better. The use of genetic methodologies for identifying discrete gene pools has not been used in the Mekong.

Elsewhere these techniques are being applied to fish stock discrimination to form the basis of fisheries management plans. The application of these techniques is possible for the Mekong and will be trialled. Project work will determine the pattern of genetic structure of two economically important carp species (*Hemicorynchus siamensis* and *H. lobatus*) as models and to develop an appreciation of the conceptual basis, data interpretation and application of molecular population genetic analysis to fisheries management in the MRB.

Project outcomes

The major objective of this project was to demonstrate the utility of a molecular genetics approach to stock identification for Mekong River Basin fish species. As such, two important carp species (*Hemicorhynchus* spp.) were targeted for molecular analysis of mtDNA sequences of samples collected from right across the lower Mekong Basin (LMB) with assistance from MRC scientists from the four countries (Vietnam, Thailand, Cambodia and Lao PDR). The study results showed that the two species, while possessing very similar morphologies (often they are confused in the field), had very different demographic histories and most probably will be seen to possess very different ecologies once the studies are conducted. Patterns of genetic diversity were very different in the two species with two discrete stocks identified in the LMB for *H. siamensis* and three discrete stocks identified for *H. lobatus* with quite different distributions.

Part 3: Thailand

11 Annual Report 2006-07

Active projects in 2006-07	16
AOP budgeted expenditure in 2006-07	\$238,237
Actual expenditure in 2006-07	\$440,157
Expenditure in 2005-06	\$501,180
Expenditure in 2004-05	\$522,291

Key performance indicators	Performance 2006-07
All new projects under development are focusing on implementation of results of earlier ACIAR projects	Fisheries project commenced to complement results of earlier project on shrimp virus testing including field validation. Thai involvement in Lao PDR rice based systems project builds on earlier ACIAR work in Thailand.
NGOs and farmer groups continuing to build upon ACIAR-funded pilot projects using their own resources	World Vision expanding "clean vegetable production" to at least 4 other provinces. Communities also scaling out work on low-cost fish feed production using own resources.

11.1 Position

Thailand was an early and large collaborator with many projects successfully undertaken. However, as Thailand's own economic and research capacity has increased, its involvement in ACIAR projects has diminished. Successful outcomes include techniques to ensure longer shelf life that have enabled the expansion of tropical fruit exports, the development of cooler climate fruits for the hilly regions of northern Thailand, and fruit fly identification and control. New fish feed made from cheap, locally available ingredients has helped thousands of Thai fish farmers.

A substantial investment in diagnosis and control of foot-and-mouth disease has made Thailand the accepted regional centre of expertise in Southeast Asia. The use of software

(developed under ACIAR support) to assist in selection in cattle breeding programs has been recognised through national awards. Over 10,000 hectares of suitable fast-growing Australian trees are planted each year as a result of ACIAR research.

It is expected that Australian investment in projects will continue to decrease in line with the increasing ability of Thai partners to co-invest in projects of strong mutual importance. In some cases, there are spillovers to less developed countries from drawing on the development experiences of Thailand. ACIAR's project investment will be very highly selective and will focus only on implementation of the results of earlier ACIAR projects.

11.2 Achievements

The program with Thailand continues to capitalise on the benefits arising from technical and policy research to underpin trade of agricultural products. It emphasises the importance of policy research and market chain incentives in underpinning agricultural developments. Opportunities to promote the application of technology, using both conventional extension methodologies and new approaches, are sought for the benefit of farmers in upland northern Thailand and northeast Thailand.

A project to extend earlier work in Thailand with **low-chill fruits** has tested a wide range of species (plum, peach, nectarine, pear, and persimmon) in Thailand, and varieties are now being tested in Vietnam and Lao PDR to replace poor quality, locally-grown cultivars. Work in all three countries has produced promising outcomes.

In Thailand, the Department of Agriculture has established stonefruit demonstration orchards at four farmer sites in Khun Wang Province and at four sites in Ang Kang Province. At an ACIAR demonstration block on Royal Ang Kang Research Station, crops from trees of peach cv. Tropic Beauty carried about 120–150 fruit per tree, with an average fruit weight of 150 grams (18–22 kg per tree). At a conservative price of 80 baht (\$3) per kg, returns should equal \$23,000 per hectare.

At the World Vision demonstration plots at Ban Kon Pan Village near Chiang Rai in northern Thailand significant **improvements in orchard management** have lifted fruit quality, and newly introduced varieties such Tropic Beauty are performing well. Surveys have revealed that Thai consumers prefer large, highly coloured fruit with high sugar concentrations and low acid. Studies continue to determine how best to raise the understanding of marketing and supply chain management, which should help to implement quality assurance systems and give better access to export markets.

Earlier ACIAR work helped Thailand to establish a national system of recording and evaluating the breeding and performance of beef cattle and buffalo. This system which has been run by the Department of Livestock Development uses a PC software system, 'Herd Magic' to record the data for genetic evaluations to rank animals for genetic merit and monitor genetic progress within and across herds. A new ACIAR initiative has helped to translate the HerdMASTER program (the latest tool on a Microsoft platform) into the Thai language, to enable more efficient data collection.

Two socioeconomic studies are helping Thailand to deal with the intricacies of trade liberalisation and technical change. One study is examining the impact of sanitary and phytosanitary (SPS) measures (important quarantine considerations) on the ability of agricultural-exporting developing countries to achieve the full benefits of trade liberalisation. The study is designed to provide policy recommendations for further improvement of the current WTO procedure for SPS dispute settlement, and for enhancing technical, scientific and institutional understanding of SPS measures in India and Thailand.

Thailand is also keen to understand the socioeconomic impacts of recent technology developments. A project is seeking to identify agricultural industries that have shown productivity growth and determine why they have grown—is it biotechnical change such as improved crop varieties and cultivation methods, mechanisation, management improvements, or other reasons? Researchers are compiling a large data set encompassing eight major agricultural sectors and undertaking statistical analyses of the rate and factor-saving biases of technical progress in each sector.

12 Annual Operational Plan 2007-08

GNI per capita (\$US)	2,720
Population	63.7 m
Population 2015/2050	69.1/74.6 m
Active bilateral projects	6
Active multilateral projects	1

Bilateral actual 2005–06	\$ 0.50 m
Bilateral estimate 2006–07	\$ 0.24 m
Bilateral budget 2007–08	\$ 0.59 m
Bilateral + multilateral budget 2007–08	\$ 0.62 m

12.1 Key performance indicators (2007–08)

- New collaborative project developed with an NGO to enhance adoption of results of earlier ACIAR-funded research
- At least one new project developed on the basis of co-investment from Thai institutes and/or regional agricultural consortia
- New linkages between Thai and Lao partners in two ACIAR projects
- New collaborative biosecurity research program established in conjunction with relevant Thailand and Australian agencies

12.2 Medium-term strategy

The key influence in the ACIAR Thailand country program continues to be the transition of Thailand to an emerging economy status. As Thailand's own economic and research capacities have increased, the relationship will be less aid-driven and more of a co-investment partnership involving a wider spread of Australian agencies.

ACIAR's medium-term strategy will focus on three issues: implementation of the results of earlier projects, with relevance to the poorest farming communities; enhanced scientific and policy exchanges on bio-security research and systems implementation; and research to build

onto joint endeavours to reduce and eliminate international agricultural protection and subsidisation.

In addressing this strategy ACIAR will work closely with Thailand partners to review joint funding on agreed projects. Opportunities for partnering with Thailand on a regional basis will be explored, particularly with respect to Lao PDR. Active consideration will be given to enhanced private and public sector partnerships (including NGOs) to secure the adoption and implementation of collaborative projects.

12.3 Position

ACIAR has had a long-standing and fruitful collaborative research partnership with Thailand. As Thailand's own research capacity is growing and its role is changing from a donor recipient to a regional leader, a joint high-level forum was held in November 2006 (with funding from the Australia–Thailand Institute) to re-examine the broader agricultural research relationship.

Eight themes were identified:

- R&D to support common interests in natural resource management and sustainable agriculture
- research to build onto joint endeavours to reduce and eliminate international agricultural protection and subsidisation
- enhanced scientific and policy exchanges on biosecurity research and implementation
- added attention to value-chain research and agribusiness development
- sharing experiences and systems knowledge in the application of biotechnology sciences and regulatory services
- continued engagement on agricultural research capacity building and education
- consideration of bio-energy prospects and scope for improved partnerships in a bilateral or wider context

- collaboration in the dissemination of research outputs, evaluation and assessments.

New areas for ACIAR cooperation in Thailand in 2007/08, based on further discussions, include:

- plant biosecurity, including molecular identification of quarantine pests
- development of fish passage technology
- avian influenza research with an emphasis on improving laboratory facilities, field diagnosis and small farmer management systems
- biosecurity and market development in the livestock sector
- working with poor communities to improve rice production on poor soils in north-east Thailand (NGO collaboration).

ACIAR funding on bilateral projects with Thailand will not change significantly in line with the increasing ability of Thai partners to co-invest in projects of mutual importance. Overall funding will increase moderately to accommodate joint funding of regional and trans-boundary projects with third countries.

12.4 Indicative priorities

ACIAR will continue to address the effective implementation of the results from earlier research projects with added attention to the involvement of NGOs. We will selectively focus on the current themes on a basis of co-investment. Bilateral and regional collaboration will be emphasised.

Issues for attention will cover trade policy and farm adjustment research; biosecurity challenges at national and international levels; and application of results from earlier ACIAR projects to benefit poorer farmers, particularly in north and north-eastern Thailand.

13 Projects (summary and progress reports)

Projects:

Active

ADP/2000/004	International food safety regulation and processed food exports from developing countries: A comparative study of India and Thailand
AGB/2002/012	Technical change in Thai and Indonesian agriculture: measurement and socioeconomic impact and policy implications
CIM/2006/041	Crop intensification and yield improvement in lowland rice cropping areas in Lao PDR
FIS/2002/075	Application of PCR for improved shrimp health management in the Asian region
FIS/2002/077	Improved hatchery and grow-out technology for marine finfish in the Asia–Pacific region
FIS/2005/078	Culture-based fisheries development in Lao PDR
FIS/2006/144	Strengthening regional mechanisms to maximise benefits to small-holder shrimp farmer groups adopting better management practices (BMP's)
FST/2002/112	Domestication of Meliaceae species in Southeast Asia and Australia, particularly management of the problem of <i>Hypsipyla robusta</i> attack
PLIA/2000/039	Impact of migration and/or off-farm employment on roles of women and appropriate technologies in Asian and Australian mixed farming systems (IRRI)
PLIA/2000/165	Facilitating farmer uptake of ACIAR project results: World Vision collaborative program

Concluded

CP/2001/027	Adaptation of low-chill temperate fruits to Australia, Thailand, Lao PDR and Vietnam
FIS/2003/003	Stock structure of two important Mekong River carp species (<i>Henicorynchus</i> spp.)
FIS/2006/086	Field validation of an ELISA for gill-associated virus and construction of a Farmer's Decision Tree for Harvest
FST/1999/035	The impact of changing agroforestry mosaics on catchment water yield and quality in Southeast Asia
LPS/2005/052	The development of cattle and buffalo breeding strategies and activities based on BREEDPLAN in Thailand

Pipeline

ADP/2007/230	Fostering Thailand – Lao PDR - Australian regional cooperation in agricultural research for development
CIM/2007/215	Improving field crop productivity in north-east Thailand: partnerships for implementation of the results of earlier ACIAR projects
CP/2006/170	Plant biosecurity: improved molecular identification tools for Thailand and Australia
FIS/2006/183	Development of fish passage criteria for floodplain species of central Lao PDR

ADP/2000/004: International food safety regulation and processed food exports from developing countries: A comparative study of India and Thailand

Bilateral

Overseas Collaborating Countries	India, Thailand
Commissioned Organisation	Australian National University, Australia
Project Leader	Professor Prema-Chandra Athukorala Phone: 02 6125 8259 Fax: 02 6125 3700 Email: prema-chandra.athukorala@anu.edu.au
Project website	http://rspas.anu.edu.au/economics/aciar/
Collaborating Institutions	Research Information Systems for the Non-aligned and Other Developing Countries, India University of Melbourne, Australia International Food Policy Research Institute, USA Thammasat University, Thailand
Project Budget	\$621,895
Project Duration	01/01/2002 to 31/12/2007 (Project extended from 01/01/2006 to 31/12/2007)
ACIAR Research Program Manager	Dr Simon Hearn

Project background and objectives

India and Thailand, like a number of other agricultural resource rich developing nations, have experienced significant expansion of processed food exports. In recent years Thailand has exported over US\$10 billion worth of processed food (4 per cent of GDP) and India over US\$3 billion worth (2 per cent of GDP).

However, both India and Thailand, and other developing countries, have experienced significant problems in exporting processed food to lucrative markets in developed countries. These trade conflicts often relate to food safety standards and their inability to meet the WTO Sanitary and Phytosanitary (SPS) Agreement. For example in 1999–2000 there were 860 shipments of fishery, vegetables and fruit products from India placed in detention in the US and 684 cases of products from Thailand.

SPS issues have become a significant source of international trade friction and dispute. While the development of food processing export industries offers enormous potential for rural development and economic growth in developing countries, problems with meeting these standards are considered a major constraint to achieving this growth. There is a lack of adequate information on the problems that constrain firms' ability to meet international standards.

This study aims to examine the policy, institutional and technical problems faced by processed food exporters in developing countries in meeting SPS requirements, and to identify appropriate policy measures that will minimise their negative impacts on exports and enhance their capacity to meet SPS standards, while recognising the legitimate concerns in importing countries about safety and quality.

Project progress

Year 5 (01/01/2006–31/12/2006)

Annual Report not submitted by the Commissioned Organisation.

AGB/2002/012: Technical change in Thai and Indonesian agriculture: measurement, socio-economic impact and policy implications

Bilateral

Overseas Collaborating Countries	Indonesia, Thailand
Commissioned Organisation	Australian National University, Research School of Pacific and Asian Studies, Australia
Project Leader	Professor Peter Warr Phone: 02 6125 2682 Fax: 02 6125 3700 Email: peter.warr@anu.edu.au
Collaborating Institutions	National Center for Genetic Engineering and Biotechnology, Thailand Chulalongkorn University, Thailand Bogor Agricultural University, Indonesia 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 background and objectives

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
- the economic structure of the agricultural sectors of Thailand and Indonesia.

Capacity building: To develop the capability within BIOTEC, Chulalongkorn University, Institut Pertanian Bogor and Center for Agro Social Economic Research and Development to sustain research of this kind after the project is successfully completed.

Project progress

Year 3 (01/01/2006–31/12/2006)

1. Statistical analysis identifying rates and factor biases of technical change in Thai and Indonesian agriculture.

Problems were encountered with official data on agricultural production and input use for both Thailand and Indonesia. Official data assigning inputs to particular commodity outputs have proven less satisfactory than was hoped.

In the case of Thailand, the data from the Office of Agricultural Economics on allocated input use by commodity output have not been continued beyond 1989. In the case of Indonesia, the data that CASERD had intended to provide, and which was to be the basis of their main input into the project, have been found to be unusable. The reason is that the computer tape which contained these data has deteriorated to the point where the data cannot be read. There is no known copy of the data set.

New data sets were required for both countries. Three such data sets were identified and obtained. First is a data set for Thai and Indonesian agriculture from Yair Mundlak and Donald Larson from the World Bank and the International Food Policy Research Institute.

Second, there is a data set for Indonesian agriculture assembled by Keith Fuglie at the International Potato Center (CIP) in Bogor, Indonesia.

Third, there is a data set on Thai agriculture from Masahiro Shintani from Japan. None of these data sets are fully satisfactory in that they either do not allocate factor use to agricultural commodities at all (each of the above except Fuglie) or do so incompletely (Fuglie).

Nevertheless, they do make aggregate level analysis feasible. All three data sets were acquired during 2006 and they will be analysed during 2007. The Indonesian project personnel also assisted CASERD to do econometric analysis and to write a report on technical change in Indonesian agriculture.

2. General equilibrium analysis of the social and economic effects of technical change in Thai and Indonesian agriculture.

Progress was good for the Indonesian modelling. This included completion of the updated data base to 2000, including consumer demand system and updated database to 2003 for Wayang. In the case of the Thailand modelling, technical problems were encountered with the model structure.

A robust test of simulation results is whether the measures of GDP on the income and expenditure sides are equal. The Thai model did not pass this test. The decision was made to overhaul the structure of the model to make it consistent with the ORANI–G structure, as was done with the Indonesia model. This work was scheduled for the first half of 2007.

3. Development of capacity for general equilibrium analysis of technical change issues in Thai and Indonesian agriculture through training and hands-on experience.

This objective of the project was achieved well during 2006 and the modelling problems described above proved to be helpful in training project participants in the rigorous testing of general equilibrium models for consistency.

CIM/2006/041: Increased productivity and profitability of rice-based lowland cropping systems in Lao PDR

Bilateral

Overseas Collaborating Countries	Lao PDR, Thailand
Commissioned Organisation	University of Queensland, School of Land and Food Sciences, Australia
Project Leader	Professor Shu Fukai Phone: 07 3365 2340 Fax: 07 3365 1188 Email: s.fukai@uq.edu.au
Collaborating Institutions	National Agriculture and Forestry Research Institute, Lao PDR National Agriculture and Forestry Extension Service, Lao PDR NSW Department of Primary Industries, Australia Ministry of Agriculture and Cooperatives, Thailand
Project Budget	\$1,068,933
Project Duration	01/04/2007 to 31/03/2011
ACIAR Research Program Manager	Dr Paul Fox

Project background and objectives

More than 70% of the rice produced in Lao PDR is grown during the wet-season in the rainfed lowland rice ecosystem which covers approximately 600,000 hectares. Yields and productivity are low, partly as a result of variable rainfall distribution and the occurrence of periodic droughts. This project is targeting three provinces in Lao PDR where approximately 50% of the total lowland rice is located.

The potential benefit of growing non-rice crops in the irrigated dry season is estimated at about \$4 million per year. And if direct seeding of rice could be introduced on 35,000 ha of dry-season, irrigated cultivation, it would save up to 55 days per ha in labour which, in turn, represents a potential saving of \$3.85 million per year. The benefits of introducing these new varieties and cultivation practices can also be expected to spill over to lowland rice farmers in the other provinces in the Mekong River Valley of Lao PDR.

This project is designed to improve the productivity and profitability of the dominant lowland rice-based system in Lao PDR, and to pursue diversification in suitable locations by adding non-rice crops under irrigation in the dry season.

Project progress

First progress report due in 2008.

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

Bilateral

Overseas Collaborating Countries	India, Indonesia, Thailand
Commissioned Organisation	CSIRO Livestock Industries, Australian Animal Health Laboratory, Australia
Project Leader	Dr Peter Walker Phone: 03 5227 5165 Fax: 03 5227 5555 Email: peter.walker@csiro.au
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 31/12/2007
ACIAR Research Program Manager	Mr Barney Smith

Project background and objectives

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 progress

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

A large field study commenced 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 shrimp post-larvae (PLs) obtained from local hatcheries. Samples of PLs were 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 two villages in particular being major foci of infection and disease. The data suggest 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 three 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 and 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 of two PCR training workshops has been completed in India. It was conducted in October 2006 for essentially the same group that attended the first workshop in 2005. It provided more focused training and assessment with each participant required to perform every step in the process at least once during the 4-day program and feedback given on the basis of individual rather than group performance.

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

Bilateral

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

Project background and objectives

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

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

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

Project progress

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

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

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

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

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

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

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

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

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

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

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

The electronic dissemination of information continues to be popular with users. APMFAN eMagazine (four issues/year) averaged 1575 downloads; while the APMFAN eNews (monthly) averaged 600 downloads. Training news and reports downloads were >600–1370. Around 30–40% of traffic on the NACA website discussion forums is related to marine finfish aquaculture.

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

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

ACTIVE PROJECTS

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

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

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

Bilateral

Overseas Collaborating Countries	India, Indonesia, Thailand, Vietnam
Commissioned Organisation	Network of Aquaculture Centres in Asia Pacific, Thailand
Project Leader	Dr C V Mohan Phone: 66 2 5611728 ext 115 Fax: 66 2 5611727 Email: mohan@enaca.org
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 background and objectives

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 BMPs 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.

The project has the following objectives:

1. *Communications and networking* – To strengthen regional networking mechanisms between stakeholders for exchange of knowledge on BMPs, based on the International principles, to enable adoption to maximise benefits to smallholder shrimp farmers

2. *Development and dissemination of contextualised BMPs* – To promote development and dissemination of contextualised BMPs for country/location/farming system/species
3. *Forward integration* – To explore strategies that maximise market opportunities for BMP-compliant farmer groups
4. *Farmer group certification* – To develop a methodology for enabling certification of BMP-compliant smallholder farmer groups.

Project Progress

First progress report due in 2008.

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

Multilateral

Overseas Collaborating Countries	Philippines, Thailand, Vietnam
Commissioned Organisation	International Rice Research Institute, Philippines
Project Leader	Dr Thelma Paris Phone: +63 2 845 0563, 844 3351 ext 312 Fax: +63 2 891 1292 Email: t.paris@cgiar.org
Collaborating Institutions	Curtin University of Technology, Australia Khon Kaen University, Thailand Cuu Long Rice Research Institute, Vietnam
Project Budget	\$496,764
Project Duration	01/01/2004 to 31/12/2007 (Project extended from 01/07/2007 to 31/12/2007)
ACIAR Research Program Manager	Dr Jeff Davis

Project background and objectives

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

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

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

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

Project Progress

Year 3 (01/01/2006-31/12/2006)

For this year, extensive surveys of 800 farming households (with and without migrants) in Thailand, Vietnam and Philippines, and 635 households in Australia, were conducted to assess the effects and impacts of family migration/off farm employment on agricultural productivity, farm efficiency, welfare, and the changing roles of women at the household, farm and local level.

Data collection, editing, entry in the computer and preliminary tables were completed in Vietnam and the Philippines. Data editing and data entry are partially completed in Thailand and Australia (75% completed). In-depth surveys of 240 households in Philippines, Thailand, Vietnam and Australia were also conducted to examine perceptions on migration, decision-making, changes in gender roles, source of information in rice farming, training attended, participation in rice farming, possible interventions, and constraints and opportunities. Focus group discussions (FGDs) were also conducted with women farmers in the Philippines, Thailand, Vietnam and Australia to identify the factors that constrain or support the adoption and diffusion of technologies they face in agriculture due to male out-migration.

In north-east Thailand, the work burden of female family members in rice production increased. They complained of high expenditures on herbicides due to high density of weeds, especially in direct seeded plots. They also have problems with snails which damage the young rice seedlings; low yields due to drought and reduction in paddy areas due to increasing area cultivated to other crops (sugar cane, eucalyptus, cassava). Based on these constraints, the women want to be trained on pest control (e.g. insects, snails and weeds) and integrated pest management, production of healthy rice seeds and high yielding rice varieties which can tolerate drought.

In Vietnam, women took over the responsibilities and work load of men in rice operations such as water management, land preparation, dredging field canals, pest management, pest identification, pesticide spraying, fertiliser application and hauling of paddy sacks. The women complained of lack of capital to pay for hired labourers and cash to buy material inputs since the remittances were small.

FGDs in the Philippines, Thailand and Vietnam revealed that women who are left to manage their farms are faced with increasing expenditures in rice production. Thus they want to be trained in increasing input efficiency and reducing costs of inputs. For example in Vietnam, women want to be trained on '3 Rs' (reduce seeds, pesticides, fertiliser) and to better manage/conservate water. In the Philippines, women want to learn more on estimating the costs and returns of rice production. They also want to have access to seeds for short-duration and drought-tolerant crops which they can grow after rice or between two rice crops.

In Australia, FGDs revealed that most farming families have at least one member who works off-farm. Both men and women work off-farm, but there is a higher percentage of women working off-farm. Men mostly do the farm work while women work off-farm to supplement household income. But women also work on the farm. The driving forces for off-farm work and/or work-related migration are to: supplement household income, social reasons and isolation issues.

The effects of off-farm and non-farm work on agricultural production are: a) additional (higher) household income, women feel they are contributing to household finances and leading to empowerment (i.e., increased participation in decision-making in the household and in the farm). As more and more women are getting off farm work (where there is employment) the men, who weren't that way inclined before are slowly being trained in the traditional female dominated roles. Men are beginning to realise that women are sometimes the ones saving their livelihood and the significant contribution they make, so farming is definitely becoming more and more a joint effort, with roles constantly being re-evaluated.

ACTIVE PROJECTS

The major constraints women and their families face when looking for/undertaking off-farm work are: lack of employment opportunities, tyranny of distance, low wages, high travel cost, lack of services (e.g., health, child care, education) and isolation. The opportunities are: harnessing women's skills, revitalising communities by providing opportunities for off-farm work, opportunities for value-adding, attracting youth back to the countryside, and stimulating business in rural communities. During the FGDs, women identified training in leadership programs as an area of capacity building for women in farms.

To monitor the progress of the project activities, two meetings were conducted. During the first meeting, training on statistical and multivariate analysis was conducted in Social Sciences Division, March 30–June 3. Training on data analysis (econometric analysis) of 800 household surveys was conducted during the 2nd meeting held this year at Curtin University of Technology. Econometric analysis focused on measuring technical efficiency, production analysis and determinants of migration.

FIS/2006/086: Field validation of an ELISA for gill-associated virus and construction of a Farmer's Decision Tree for Harvest

Bilateral

Overseas Collaborating Countries	Thailand
Commissioned Organisation	James Cook University, Australia
Project Leader	Dr Leigh Owens
Project Budget	\$20,948
Project Duration	01/10/2006 to 31/03/2007
ACIAR Research Program Manager	Mr Barney Smith

Project background and objectives

Midcrop Mortality Syndrome (MCMS) cost the Australian prawn farming industry \$32.5 million dollars. One of the viruses involved was Lymphoid Organ Virus, known more commonly as Gill Associated Virus (GAV), a strain of the overseas, widespread Yellowhead Virus (YHV). Researchers Munro, Callinan and Owens chose GAV as an indicator virus by for the suite of viruses within MCMS. But the only means of testing for its presence was an expensive RT-PCR test requiring highly skilled staff and well equipped laboratories.

This small research activity sought a cheaper alternative test to gauge the prevalence and intensity of GAV on *Penaeus monodon* farms. An ELISA test had been developed but had not been field-validated on prawns from production crops. Furthermore a decision tree, based on viral load on whether to harvest or not, was desired for use in Australia or overseas. This project activity undertook the requisite testing to elucidate these issues, using samples from a previous investigation.

Project Outcome

Eleven earthen ponds located on a northern Queensland farm were chosen and 30 juvenile *Penaeus monodon* per pond were captured and sampled weekly until normal or emergency harvest. Water temperature, salinity, pH, dissolved oxygen levels and bloom depth were measured twice daily (am and pm). Four pleopods per animal were removed, homogenised and analysed using ELISA for the detection of stress protein 70 (sp70) an indicator of cellular stress, ubiquitin (Ub) an indicator of protein degradation and GAV an indicator of disease.

Correlation analysis of environmental factors and bio-indicators for individual ponds was conducted. There were significant correlations (positive and negative) between stress indicators and environmental factors and between the stress indicators themselves. The highest number of significant correlations was associated with sp70 followed by GAV and then Ub. In general, the correlations between stress indicators were positive and the environmental factors showed mostly negative correlations with the stress indicators.

To determine the biological significance of these interactions, correlation analysis was conducted for each stress indicator and environmental factor from 6 days prior to sampling up to and including the day of sampling (DOS). Morning pH (am) was negatively correlated to sp70 at DOS and 4 days prior to sampling with a dramatic correlation coefficient increase at 5 days and 6 days prior to sampling. A similar pattern was noted with Ub. This pattern is most likely related to the farm's liming regime of the ponds. Salinity (am) was negatively correlated to sp70, Ub and GAV at all days. The highest correlation coefficients for sp70 were at 1–2 days prior to sampling, for Ub at 4 days prior to sampling.

This pattern is consistent with the fact that the stress protein response is a relatively quick response. However if the stress persists, the Ub response is activated as protein is degraded. GAV presented a different pattern with a decrease in correlation coefficients 3–4 days prior to sampling.

CONCLUDED PROJECTS

The decrease in the correlation coefficient for GAV seen at 3 and 4 days prior to sampling is pertinent as studies have indicated that moderately infected prawn ponds show a pattern of initial increase in average GAV load followed by a period of low GAV load after mortalities. This pattern repeats until mass mortalities or harvest.

Discriminate Analysis (DA) was performed in an attempt to simplify the data and determine what stress indicators and environmental factors could be used to predict specified production outcomes. From this analysis it is possible to correctly classify 87.5% of ponds into one of two groups with an overall survival of > or < 70%, 63.6% of ponds with an average body weight of > or < 25gm and 68.2% of ponds with a total yield (T/Ha) of > or < 7T. Due to the complexity of the data and high number of correlations across all environmental factors, no dominant factor could be deduced.

A further DA was performed for each production factor as described above from 1 week before harvest to 11 weeks before harvest where possible. The results indicate that at 3 weeks before harvest the DA model was able to correctly predict 92.9% of the ponds that would have either > or < 70% survival and 80.4% of ponds that would have a total yield (T/Ha) of > or < 7T. This information enables the farmer to decide whether to harvest or continue culture will provide the best production outcome. Unfortunately, the necessary data matrix needed to make decisions has not been simplified, so while a complex set of data can be used to make decisions, a simple decision tree cannot be constructed.

The foundation investigation described here is the first to use ELISA to illustrate the response of sp70, ubiquitin and GAV in *P. monodon* in a commercial setting. The information gained provides the basis of a management tool enabling farmers to predict when to harvest for maximum production outcome on the basis of percentage survival and yield (tonnes/ha).

FST/1999/035: The impact of changing agroforestry mosaics on catchment water yield and quality in Southeast Asia

Bilateral

Overseas Collaborating Countries	Indonesia, Thailand
Commissioned Organisation	World Agroforestry Centre, South East Asian Regional Research Program, Indonesia
Project Leader	Dr Meine van Noordwijk Phone: +62 254 162 5415 Fax: +62 254 162 5416 Email: m.van-noordwijk@cgiar.org
Collaborating Institutions	Bogor Agricultural University, Indonesia CSIRO Land and Water, Australia Chiang Mai University, Thailand Lampung University, Indonesia Forest and Nature Conservation Research and Development Centre, Indonesia Australian National University, Australia Center for Soil and Agroclimate Research, Indonesia Brawijaya University, Indonesia National University of Singapore, Singapore
Project Budget	\$1,142,952
Project Duration	01/07/2002 to 30/06/2007 (Project extended from 01/07/2006 to 30/06/2007)
ACIAR Research Program Manager	Dr Russell Haines

Project background and objectives

Forest conversion in much of the uplands of Southeast Asia has resulted in a gradual loss of forest functions as the landscapes evolve into mosaics of agriculture, agroforestry and forest remnants. Inappropriate policies have frequently fuelled disputes about use of land for forest or agriculture, leading to unnecessary conflict between upland and lowland farmers. Thousands of poor communities inhabiting upland watersheds are blamed for the destruction of forests and associated hydrological functions that affect communities downstream. This has led to restrictions on land use, and there is little chance of secure land tenure for such communities.

Research is needed to gain greater understanding of the watershed hydrology in these agroforestry landscape mosaics and to use the knowledge to develop more equitable policies and practices for upland farmers. This project is testing the hypothesis that some farmer-developed agroforestry mosaics are as effective as the original forest cover in protecting water yield and water quality.

This project is studying selected watersheds to characterise current land use and ongoing trends in land-use change, and determine their effects on filter functions and overall impacts on water quantity, seasonal effects and sediment loads. Studies are also testing soil and water movement in landscape mosaics at catchment scale; quantifying the trade-off between watershed functions and profitability of land use for current and possible future land-use mosaics, and exploring alternative practices through farmer participation.

Project Outcome

Final report not yet submitted by the Commissioned Organisation.

LPS/2005/052: The development of cattle and buffalo breeding strategies and activities based on BREEDPLAN in Thailand

Bilateral

Overseas Collaborating Countries	Thailand
Commissioned Organisation	Agricultural Business Research Institute, Australia
Project Leader	Mr Jamie Allen Phone: +61 2 6773 3023 Fax: +61 2 6772 5376 Email: jack.allen@abri.une.edu.au
Project Budget	\$50,000
Project Duration	01/05/2006 to 31/12/2006
ACIAR Research Program Manager	TBA

Project background and objectives

A previous ACIAR's project has helped Thailand to establish a national system of recording and evaluating the breeding and performance of beef cattle and buffalo. This system which has been run by the Department of Livestock Development (DLD) uses a PC software system — Herd Magic to record the data for genetic evaluations to rank animals for genetic merit and monitor genetic progress within and across herds.

This new ACIAR's project proposes to develop the HerdMASTER program — the latest tool of Microsoft, to have Thai language capability to collect data more efficiently. This work will specifically alter HerdMASTER screens to have Thai language labels, convert online help documentation and develop basic help into Thai language and convert existing Thailand Herd Magic systems to HerdMASTER. This proposal will include the training of a Thai officer from DLD in the use of the package.

Project outcomes

The HerdMaster PC based on farm herd recording system was developed with a Thai language switch allowing screen labels, online help and output report headings to be in Thai. A Thai data recording specialist was trained in Australia to become the trainer for Thailand where 31 DLD station personnel were trained in the use of the new system. The system has been installed on 33 DLD Livestock and Breeding stations and 54 databases have been converted into the new format.

14 ACIAR Publications

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

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

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

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

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

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

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

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

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

ACIAR • GPO Box 1571, Canberra ACT 2617
Tel: +61 2 6217 0500 • Fax: +61 2 6217 0501
Email: aciarc@aciarc.gov.au