

# Southeast Asia

Financial year	Regional expenditure	Percentage of total bilateral expenditure	Board target as percentage of expenditure
2003-04	\$11,103,304	43.5	50-60%
2002-03	\$12,713,502	47.8	50-60%
2001-02	\$12,901,088	52.8	50-60%

ACIAR's programs cover five regions, of which Southeast Asia is the largest, with nine countries involved. Of these nine Indonesia is, and will remain, our largest partner. For the region, the Board and Minister have set an expenditure target of between 50 and 60 per cent of our overall bilateral research expenditure.

In 2003-04 expenditure was 43.5 per cent. Security problems in Indonesia, together with those in the southern Philippines and the regional impacts of Avian Influenza (Bird flu) and, to a lesser extent, SARS limited travel by ACIAR and Australian research partners for significant periods during the year, delaying both project development and implementation.

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ACIAR regional team leader for Southeast Asia: Dr John Skerritt





Rat burrows in rice crops

# Burma

Active projects in 2003–04	2
AOP budgeted expenditure in 2003–04	\$536,749
Actual bilateral country expenditure in 2003–04	\$356,093
Bilateral country expenditure in 2002–03	\$153,903
Bilateral country expenditure in 2001–02	\$0

Key performance indicators	Performance 2003–04
<ul style="list-style-type: none"> <li>Field experimentation underway in at least three projects.</li> </ul>	Field experimentation is underway in two projects; a further two projects were put on hold due to concerns regarding Burma's political situation.
<ul style="list-style-type: none"> <li>Surveys of rodent damage to rice crops completed for first season.</li> </ul>	A major evaluation of rodent damage in rice at experimental sites has been completed with pest species identified.



Village chickens

## Position

ACIAR has begun developing a small program with Burma, the first projects commencing in 2003. Despite limited international development cooperation in agriculture with Burma since 1988, some basic facilities have been established and several trained researchers are present to promote effective cooperation. Initial projects are focusing on spillovers from related ACIAR projects. Burma has already indirectly benefited through the Food and Agriculture Organisation (FAO) from the spillover of other ACIAR projects in the region. Training and capacity-building for researchers are being addressed in project development and implementation.

## Achievements

Village chickens are major sources of **high quality dietary protein** and provide supplemental income, but the presence of Newcastle disease, and other factors, threatens major losses. ACIAR-supported research focused on identifying the major constraints to village chicken production—revealed as Newcastle disease epidemics and poor chick rearing. An intervention study, using the ACIAR-developed I-2 vaccine, is now being conducted and demonstrating that losses can be decreased. Burma has some capacity to produce the vaccine, but only enough to cover around 30 per cent of total stocks. ACIAR-supported research is expanding this capacity, including through a one week workshop in diagnosing major poultry diseases. Training to bring Burmese partners up to date on poultry diseases and in molecular diagnostic techniques was also undertaken.

The ecologically based management of rodents in rain-fed cropping systems, also in its first year, identified the major pests in Burma. Surveys identified a variety of pests and resulted in **a draft map of rodent distribution**. Population studies, in part to identify breeding cycles (a key component of ecological management) are under way at three sites. The Trap Barrier System (TBS), used in conjunction with a lure crop planted prior to the main crop, was demonstrated and refinements were trialled then implemented to improve the system's effectiveness in local conditions.



# Cambodia

Active projects in 2003–04	9
AOP budgeted expenditure in 2003–04	\$1,098,618
Actual bilateral country expenditure in 2003–04	\$997,832
Bilateral country expenditure in 2002–03	\$721,584
Bilateral country expenditure in 2001–02	\$489,597



Rice research in Cambodia

Key performance indicators	Performance 2003–04
<ul style="list-style-type: none"> <li>Growth in proportion of budget for Cambodia compared with 2002–03.</li> </ul>	Expenditure grew from 2.5 per cent to 3.9 per cent.
<ul style="list-style-type: none"> <li>Extension activities from ACIAR projects conducted jointly with AusAID’s Cambodia–Australia Agricultural Extension Project (CAAEP2).</li> </ul>	Two projects developed links and worked to support the CAAEP2 project, including undertaking joint activities at field sites in two provinces.
<ul style="list-style-type: none"> <li>Agricultural diversification activities of three ACIAR Cambodia projects coordinated to allow information flow between project teams.</li> </ul>	Coordination between three projects aimed at diversifying agricultural activities regularly undertaken. An additional project is now also involved in the communication network.

## Position

Cambodia is of growing importance as a partner country, although Australia has provided significant development assistance in recent years. A major component of AusAID assistance in Cambodia continues to be in agriculture, and ACIAR has taken the opportunity to link several of its research projects to AusAID-supported extension, industry development and institutional capacity-building initiatives. Cambodian farming is largely based on rain-fed rice systems of relatively low productivity. Projects target improvement in rice production as well as agricultural diversification, and expansion of the country’s animal health research and development capacity. Cambodia has made good recent progress in developing a group of internationally trained researchers and restoring infrastructure, with ACIAR continuing to offer scientific capacity-building opportunities through its projects.



## Achievements

Adapting ACIAR-supported research on rodent management in Southeast Asia to the specific needs of Cambodian farming systems **has led to successful interactions** between farmers, researchers and extension workers. Farmers in selected villages are the main research target and many have already adopted the Trap Barrier System to control rats. Significant benefits in increased yields, reduced losses from rodents and reduction in the use of rodenticides have all been recorded. The project has also delivered social and economic benefits, increasing community interactions to manage rodents and improving livelihoods through more rice. Another research site has been selected to further extend these encouraging results.



Ms Chiraporn Sunpakit is our Country Manager for Cambodia, Laos, Thailand and Burma



Rice threshing

Following a successful project to control fasciolosis (a parasitic disease of livestock) a new ACIAR-supported project is updating risk models. Using geographic information systems project scientists are gathering data that together with the earlier knowledge gained from ACIAR research **will form a package that extension officers can use** for the implementation of a national strategy to control fasciolosis. The new project has started to quantify benefits and costs of control of fasciolosis for farmers. Significant benefits are anticipated, based on results of previous research, through improved income flowing from better growth rates and draught and reproductive performance of cattle and buffaloes, as a result of achieving fasciolosis control.



Selecting rice cultivars suited to Cambodian conditions, where drought is common, continues through a process of drought simulation. Standing water is drained from crops to simulate water stress, allowing researchers to identify cultivars that mature early or adapt well to the effects of drought. This knowledge is now being utilised to develop rice varieties based on early maturity. Double cropping systems significantly **boost rice production** but there are some limitations to the practice. These have been identified and new methods such as earlier planting of rotation crops immediately after rice harvesting and the use of supplementary strategic irrigation will help to improve crop management.

**Crop diversification, from rice** (where Cambodia has reached self-sufficiency) to other higher value crops has the potential to alleviate rural poverty, but is hampered by a lack of knowledge of how to grow non-rice crops, including choice of suitable land for planting. ACIAR is supporting research to help Cambodia establish viable cropping industries beyond rice. Three study sites representing a range of agro-ecological conditions have been chosen, with detailed soil profile descriptions recorded. Also trial crops sown to establish baseline yield data have demonstrated the need to acquire well suited cultivars. This information will be fed into other related projects.



Dumkor vegetable markets

Scientific capacity in Cambodia continues to grow through the AusAID-funded Cambodian Agricultural Research and Development Institute Assistance Project. The country's scientific capacity diminished greatly during the past two decades, limiting the ability of scientists to deliver effective research. ACIAR is managing a component of the project, **the Cambodian Agricultural Research Fund**, which helps provide the basis of a competitive research sector by support of research projects through a competitive funding scheme. Successful applicants receive training to undertake the research problem identification, preparation of proposals and report writing necessary to interact with the international scientific community and donors.



Aquaculture feeding

# East Timor

Active projects in 2003–04	2
AOP budgeted expenditure in 2003–04	\$483,762
Actual bilateral country expenditure in 2003–04	\$285,402
Bilateral country expenditure in 2002–03	\$681,219
Bilateral country expenditure in 2001–02	\$479,366



President Xanana Gusmao at the Hera Campus of East Timor Agricultural University

Key performance indicators	Performance 2003–04
<ul style="list-style-type: none"> <li>Options for broadening of the program assessed.</li> </ul>	New projects on weed management and cassava production have been developed.
<ul style="list-style-type: none"> <li>Increased yields for introduced varieties of at least three crops demonstrated on farmers' plots as well as project trial sites.</li> </ul>	Around 100 farmers have tried many introduced lines of rice, maize, peanut, sweet potato and cassava with higher yields than local varieties.
<ul style="list-style-type: none"> <li>Completion of at least 10 student thesis research projects at the new University experimental farm.</li> </ul>	More than 20 thesis projects completed at the University farm in 2003–04.

## Achievements

As part of the Seeds of Life project researchers have completed a final year of testing of crop varieties suitable for East Timorese conditions. Many introduced varieties of the **staple crops—maize, peanut, cassava, sweet potato, rice and beans**—have been trialled and continue to show much higher yields than locally grown varieties. The focus of the project has shifted to seed production of varieties identified as suitable for East Timor, and limited farmer demonstration of these varieties has been undertaken. A number of agencies have been approached to help disseminate seed stock of chosen varieties. A follow-on project, focusing on further varietal identification and seed dissemination, is now being developed in association with AusAID. East Timor's Ministry of Agriculture, Forestry and Fisheries will coordinate the new project.

Facilities at the Hera Experimental Station of the National University of East Timor's Agriculture Faculty have now been in operation for two years. The facilities, extensively damaged in the unrest after East Timor's independence vote, are vital for research and teaching agricultural science students. In addition course materials for many aspects of agriculture are now complete, designed to promote a problem-solving approach to **learning that is vital to the on-going development of agriculture**. ACIAR has extended the University Rehabilitation Project until December 2005 to ensure the good base created by the project is consolidated, including allowance for a revision of the agriculture curriculum.



Harvesting sweet potato

## Position

Agriculture provides a livelihood for more than 80 per cent of East Timorese and is also an important source of export income. Much of the country has similarities of climate and production systems to northern Australia, as well as those in neighbouring eastern Indonesia. ACIAR began working with East Timor in late 2000, linking Australia's comparative agricultural research advantage with East Timorese agricultural organisations. Current projects aim to build local agricultural research capacity, both in the field and in the laboratory.



# Indonesia

<b>Active projects in 2003–04</b>	49
<b>AOP budgeted expenditure in 2003–04</b>	\$3,837,577
<b>Actual bilateral country expenditure in 2003–04</b>	\$3,689,481
<b>Bilateral country expenditure in 2002–03</b>	\$4,062,457
<b>Bilateral country expenditure in 2001–02</b>	\$4,784,157

*Restocking experimental net cages*

Key performance indicators	Performance 2003–04
<ul style="list-style-type: none"> <li>• More than two-thirds of projects initiated in 2003–04 have a significant eastern Indonesia component.</li> </ul>	Of 20 projects either commenced or in design in 2003–04, 70 per cent have a significant eastern Indonesia component.
<ul style="list-style-type: none"> <li>• Plan for wider farmer uptake of technologies developed and assessed from ACIAR's suite of Bali cattle nutrition and reproduction projects developed and initiated.</li> </ul>	A suite of three new projects for commencement in 2004–05 is being developed to support expansion of the beef sector in eastern Indonesia.
<ul style="list-style-type: none"> <li>• Development of a new vaccine for the very virulent Indonesian strain of the serious poultry disease, Gumboro.</li> </ul>	A pilot vaccine has been developed for Gumboro Disease of poultry and is in the process of being commercialised.
<ul style="list-style-type: none"> <li>• Initial farmer trials of integrated pest management strategies for the Liriomyza leaf miner pest of vegetable crops.</li> </ul>	Farmer trials comparing local practices with integrated pest management (IPM) showed that insecticide applications offered no advantages over IPM.
<ul style="list-style-type: none"> <li>• Shared fish stock issues between Indonesia and Australia better understood and a mechanism for formal consultation on related management issues established.</li> </ul>	At the March meeting of the Australia-Indonesia Ministerial Forum Working Group on Marine Affairs and Fisheries a Sub-Committee for the Management of Shared Fish Stocks was agreed.

## Position

Indonesia is ACIAR's largest bilateral program. The country's proximity and strategic importance to Australia, and the large proportion of its population relying on agriculture, mean that its prominence in ACIAR's program will continue.

ACIAR's program focuses towards eastern Indonesia, with an emphasis on increasing incomes for farmers and fisher folk. This includes projects to improve cropping, animal health and production, forest production systems, fisheries and building a more sustainable base for agriculture and natural resource management.

Most research capacity is in Java but ACIAR has made good progress to link this expertise with eastern Indonesian institutions and to regional adaptive research agencies and planning authorities.

ACIAR also targets Indonesia in its multilateral program, delivered in conjunction with international agricultural research centres such as the Center for International Forestry Research (CIFOR), the International Potato Centre (CIP) and the World Agroforestry Centre (ICRAF).



*Ms Mirah Nuryati is our acting Country Manager for Indonesia*

## Achievements

Contract arrangements between smallholders and agribusiness do not always deliver benefits to farmers. Surveys of smallholders and communities involved in contract farming have **determined the potential flow of benefits**. Data have been gathered and these are now being used to assess benefits, with an equitable split possible between smallholders and agribusiness. These findings will be incorporated into recommendations for the contracting sector. These include the role of guaranteed prices and lowering input costs as incentives.

A recently commenced project is beginning to build a small-scale model of the economy of north Sulawesi, to demonstrate linkages between the broader economy and the coconut industry, as part of **a project to help revive that industry**. A generic model for microfinance for agricultural producers was produced in a project on this issue in West Nusa Tenggara. Pt Bank has accepted this model and developed operational guidelines for its use in interactions with Micro Finance Institutions (MFI). Linking MFI intermediaries to commercial banks can increase savings and credit facilities at the rural community level. This has resulted in the formation of one women's group and a cooperative.



Rice terraces

## Contract farming is delivering benefits to smallholders in Indonesia

The value of contract farming to smallholder farmers has been uncertain. ACIAR has funded research into the contract broiler chicken industry in Lombok, as well as other agricultural industries elsewhere in Indonesia, to answer this question. Nusantara Unggasjaya (NUJ) is a company that specialises in producing pigs and poultry, using contracts with farmers to ensure supply of broiler chickens. Smallholders must provide a chicken coop before they can enter into a contract. They receive day-old chicks to rear using the company's specifications. NUJ also provides feed, veterinary products and other resources on credit. Live chickens are delivered to the company at around 38 days of age for on-selling. Farmers receive payments by cheque, which they can convert to cash in over-the-counter transactions.

The study of smallholders contracting to NUJ revealed that these farmers are better off than those not engaging in contracts. Participation results in a significant boost to household income, with the support provided by NUJ critical to ensuring the contract is profitable to the smallholder. Contractors on the whole had smaller, but more diversified farms and utilise longer term investments, such as planting trees for timber or as fruit crops. They also had more non-agricultural assets and better household facilities, including sanitation and running water. The main barrier to entry into contracts is still insufficient income, but contractors typically also contributed more to the local community. For those able to enter into contracts with companies like NUJ the benefits can outweigh the costs.



Honey bees

Decentralisation has placed the onus for **effective management policies for forests** (and other sectors) on regional governments. Widespread deforestation requires sustainable policies. ACIAR-supported research has built up five case studies on the impacts of decentralised management, leading to nationally relevant policy recommendations. Researchers have arranged workshops to further develop stakeholder interactions, including accounting for social aspects of policy impacts, with the results being fed into research outputs.

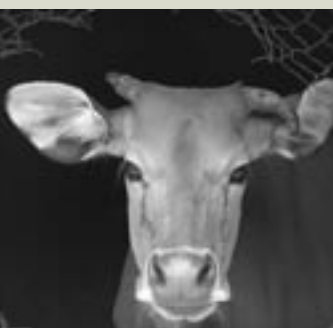
Controls for the parasitic bee mites *Varroa* and *Tropilaelaps* have been developed using formic acid, and design of hives has changed to increase air flow. Honey is an important **medicinal preventative and 'cure-all'** in Indonesia, but the presence of mites reduces production significantly, meaning Indonesia must import honey.



Sheep in Indonesia

Controls for *Fasciola gigantica* and *Haemonchus contortus*, parasites that significantly reduce livestock productivity, have been identified in Indonesian Thin Tailed sheep. These sheep produce a natural defence against both parasites, which has been traced to a set of major genes. DNA markers for these genes have been developed. Several **proteins that kill *F. gigantica* have also been identified**. Results of an earlier project (with components in Cambodia and the Philippines) on developing a fasciolosis control program to reduce poverty have demonstrated that education of animal owners in control techniques has led to increased incomes. This information is now in preparation for wider dissemination.

Research into Jembrana disease continues, with emphasis on boosting Indonesian capacity to detect and manage the disease, especially at the regional level. Jembrana disease has been a barrier to the wider adoption of Bali cattle. Regional Disease Investigation Centres have received training, including use of the ELISA diagnostic **test developed to detect Jembrana antibodies**. Development of vaccines against the disease is in the initial phase, with recombinant protein-based vaccines demonstrating effective immunity in limited trials. Further trials are planned. A DNA-based vaccine is also in development. A second project focusing on a vaccine for infectious bursal virus disease (Gumboro) in chickens has identified one strain for use in vaccine development. Initial tests on the virulence of this strain using tissue culture have shown promise for vaccine development, with virulence reduced. A vaccine based on this strain is now being assessed in further trials.



Bali cattle

Field tests of changes to improve pig growth, in sweet potato–pig farming systems in Papua (in Indonesia's east) have demonstrated significant benefits. The traditional system takes five years for a pig to reach full maturity, but field trials indicated adoption of changes could **reduce this timeframe to two years**. This is achieved through management practices that reduce the impact of diseases, fermentation technologies to convert low-value feeds into quality feeds and introduction of improved sweet potato varieties.

Improving the productivity of Bali cattle through improved management systems presently focuses on implementing research results. An economic model of a new system demonstrated better cash flows and gross margins from adopting changes. A competition to encourage risk-averse farmers to become participants was successful and also helped **identify good bulls for use** in future breeding. An extension package for Indonesian conditions is now being produced.



*Preparing for rice crop*

High quality forages for livestock production in rain-fed farming systems will help smallholders meet the growing demand for cattle products. Using APSIM, which can simulate farming systems under many conditions, existing production modules are being modified to study rice and forage production. Grasses representing those commonly found in farming systems in Sulawesi are also being incorporated. Long-term climatic data are being sourced to help **develop long-term forecasting simulations**. Analysis of cattle growth rates is also being undertaken to develop a full picture of current and future options. This research has added capacity for the newly developed APSIM modules to be used as a base for modelling in other tropical farming systems.

A related project is addressing **ways to optimise crop–livestock systems** in seasonally dry areas. Benchmarking of system performance is under way, including monthly monitoring of animal growth. The data collected have been used in the development of an integrated tool that allows system-wide analysis. Cattle health problems have been resolved using simple cattle management strategies. In West Nusa Tenggara Province the demand for beef has been met mainly through slaughtering of female cattle, reducing an already low reproductive potential. Using the APSIM-derived model developed in the related project, extension workers have gained increased knowledge of how cattle productivity and income can be enhanced without further exacerbating pressure on existing cattle herds.

Another project focused on animal husbandry has identified the impact of cultural and management practices on the fertility and growth of Bali cattle. Comparisons between two sites in eastern Indonesia revealed the management practices at one to be far more effective, providing **a basis for scaling up of extension activities** and emphasising the need to allow for cultural issues when developing these packages.

Through adopting controlled seasonal mating, improvements in feed management and early weaning of calves, conception rates have increased to more than 90 per cent and calf mortality to below 10 per cent. New *Leucaena* varieties to help fatten cattle were also tested, with several promising varieties including Tarramba and the KX2 hybrid showing promise for many parts of Indonesia.



*Bali cattle—capable of producing a 95 per cent weaning rate*



Potato sorting

The potato leaf miner (*Liriomyza huidobrensis*) and other leaf miners are major pests. Scientists have **determined their distribution in vegetable crops** in Indonesia and information on the various species has been compiled into a database. Natural parasitoid wasps (predators) of the various leaf miner species have also been identified. Management practices for potato blight were killing the predatory

wasps. Researchers have modified the practices then conducted trials at field sites that showed lower levels of wasp mortality than in farmers' fields.

Research continues to combat soil-borne fungal diseases, particularly those that cause clove yield decline and vanilla stem and root rot. The factors causing both have been identified and surveys have determined the mode of spread of both fungal pathogens. Insect carriers linked to clove yield decline have been identified and the ability of the vanilla stem and **root rot pathogen to remain dormant in vines** established. This information will be used as the basis of management techniques to limit the spread of both pathogens.



Shrimp ponds

The processes that cause the release of acid from acid sulfate soils (ASS) in aquaculture pond walls and dykes have been described in detail. This knowledge has assisted the development of simple cost-effective remediation techniques and preventative steps using liming in pond preparation. Culture of shrimp in formerly abandoned ponds has seen **shrimp survival rates of 90 per cent achieved**. Production timetables have also been refined to assist farmers better manage risks associated with acidity and toxic metals in soils. Refinements and improvements have also been made to poly- and

monoculture systems, including requirements for stocking of species and the **appropriate use of floating net enclosures** to provide culture opportunities. A new project is examining cage culturing of fish in large reservoirs to determine its impact on wild fish populations, which small-scale fishers rely upon for feed and sale. Management strategies are being developed for optimal harvesting of fish from culture and wild stocks, to achieve an acceptable balance between the interests of both groups.

A clearer picture of the socioeconomic importance of artisanal fisheries in eastern Indonesia has emerged from a project that also boosted institutional skills in socioeconomic research related to fisheries

management. An assessment of the sustainability of current levels of fishing elasmobranch (shark and ray) species is in progress for these artisanal fisheries. An analysis of the longline tuna industry catch in the Indian Ocean has **significantly boosted Indonesian capacity** in fishery statistical information collection and analysis, vital to the sustainable management of this and other fisheries in Indonesia. Port sampling programs have also been established at several locations.

Grouper aquaculture has been significantly enhanced with the completion of a project that has improved technology for this industry. Production techniques and optimal requirements for **growing grouper from the egg through larval stages** have been developed. These technologies, using a combination of live foods, have boosted survival rates to the point where commercial hatcheries are adopting them. Scientists have determined nutritional requirements to support the methods and developed grow-out diets to fatten and mature fish in floating net cages and ponds.

Capturing carbon sequestration benefits available from planting new forests could be enhanced through changes to institutional conditions. A recently commenced project is examining ways to reduce transaction costs and overcome other institutional barriers by **developing standard approaches** to designing and managing reforestation projects that could result in carbon-credit payments.

Current and past fire use patterns, including the physical, economic and social characteristics of fire use were described for sites in Indonesia, as part of a project on the impacts of fire. Changes in land cover and land use have also been mapped, and are being used to determine connections between land use and fire history. The ongoing development of **coffee planting as an alternative** to traditional slash-and-burn agriculture is reducing soil erosion. The importance of increasing canopy cover of coffee plants in reducing erosion has been clearly demonstrated, with fertiliser applications and management to achieve canopy growth developed. The work also significantly boosted yields from coffee plants in experimental plots, compared to those in farmers' fields.

Trials of selected silvicultural practices to **reduce the incidence of heartrot** in *Acacia mangium* are underway. *A. mangium* when planted in Indonesia is susceptible to heartrot, limiting timber use and paper production. Glasshouse studies of wood properties and possible natural defences are also under way. Provenance (geographic origin) selection is also being assessed to determine if this plays a role in susceptibility. DNA-based diagnostic tools are also being developed. Guidelines for plantation management based on the project's findings will be produced.

Aflatoxins which are a serious health risk to humans and some livestock can occur in peanuts as a result of contamination risks by the fungus *Aspergillus flavus*. Contamination **risks during production are being assessed** in Indonesian conditions using APSIM. A newly developed



Floating barru cages



Grouper grow-out



Mud-crab fattening pens



Cocoa grafting

simulation module, based on an existing peanut growth module, together with another software tool is revealing aflatoxin risk levels associated with climatic and other causal factors and scenarios in peanut-producing areas across Indonesia.

A collection of Indonesian and international cocoa tree clones has been established in Sulawesi as part of research into improving quality and disease resistance. Grafts of **promising varieties have also been replicated**, and all collections will be examined for improved quality and disease resistance. Researchers have demonstrated farmer management practices, including pruning, to improve the establishment productivity of clonal material grafted onto existing trees.



Chillies growing in vertisol soils

The use of permanent raised beds for cropping in Nusa Tenggara's vertisol soils has demonstrated that growing chillies offers a significant cash bonus (Rp5000 per kilogram against Rp1000 per kilogram for rice) as produce is available a month earlier than from other regions. The use of raised beds also allowed more water for secondary crops (rice is the main crop) to be **collected and used for irrigation**. Finally the use of seasonal climate forecasting for Lombok could substantially enhance planning options for crop choices and irrigation uses. A new project is using climatic modelling and historical data to develop reliable forecasts. These will become part of existing decision-support tools for choosing the most desirable options for crop type, planting times and management practices.



# Laos



Active projects in 2003–04	10
AOP budgeted expenditure in 2003–04	\$759,205
Actual bilateral country expenditure in 2003–04	\$714,519
Bilateral country expenditure in 2002–03	\$545,329
Bilateral country expenditure in 2001–02	\$613,852

Key performance indicators	Performance 2003–04
<ul style="list-style-type: none"> <li>Practical assessment tools and management strategies developed for assessing subsurface salinity.</li> </ul>	A conceptual salinity assessment model of tools and measurements through bores developed.
<ul style="list-style-type: none"> <li>Identification of most suitable rice varieties for cooler districts of Laos.</li> </ul>	Good data obtained on the success of planting particular rice varieties through links to climatic data.
<ul style="list-style-type: none"> <li>Development of a new animal health research project linked with major donor initiatives.</li> </ul>	A new project on the control of FMD and CSF at the village level has started, with support from the European Union.
<ul style="list-style-type: none"> <li>Understanding of rodent taxonomy in upland rice.</li> </ul>	A working taxonomy guide has been compiled and a guide on field methods for rodent identification published.

## Position

ACIAR has had a small, targeted program in Laos operating since 1992, focusing on multi-country projects with Lao components that address special research needs and capacity-building. Projects are designed to complement major donor programs on crops, animal health, forages and forestry, with an emphasis on major policy and technical interactions.

## Achievements

Pasture production on marginal lands is threatened by salinity and waterlogging. Lucerne is a deep-rooted perennial plant that helps arrest soil problems and maintain productivity, and **more than 200 lines of lucerne germplasm** have been sourced for testing in Laos, China and Australia. Training has also been provided for a Lao lucerne breeder, providing exposure to the latest breeding techniques.

The productivity of rice-based cropping systems is being increased by the use of temperature and rainfall maps, combined with trials of different sowing times to determine optimum sowing seasons. This includes for double-cropping of rice in irrigated conditions to avoid low temperature exposure.

Trials of many rice varieties across a range of agro-ecological conditions demonstrated that yields could be substantially boosted by **matching of varieties to conditions**. High-yielding lines were identified. Screening varieties for drought tolerance has determined suitable varieties for further breeding. An improved management system for rice nurseries for irrigated rice in northern Laos was also developed.



Low chill orchard



Hmong mother feeding pigs

Research to further the development of a low-chill temperate fruit industry in Laos, Thailand and Vietnam continues. **Locally derived germplasm with disease resistance** (including resistance to some major leaf diseases) **and good quality characteristics** has been identified for possible incorporation into breeding programs in Laos and Vietnam.



Lao fish market

Non-astringent persimmons have also been identified as a potential new commercial crop for Laos and the other two countries. Key management practices, including how to control some pests and diseases, have been developed and refined and are now in use. Training to extend this knowledge was also conducted. The need for short-term cash crops while trees mature, to supplement income between seasons, is also being addressed. Based on an external review the project is being extended to refine and extend the production technologies developed and to encourage farmer uptake.

Awareness of the problems of salinity in Laos and northern Thailand continues to be raised through ACIAR-supported research. Monitoring of salinity, through surveys of groundwater levels and water movement, meteorological studies, collection of river discharges and other mechanisms, is producing a clearer picture of the extent of salinity. Maps of saline areas have been produced and **data on tree clearing** and regional geology compiled for the development of hydrogeological models and a salinity database. The maps and database are now helping inform government decision-makers on how to manage salinity.

The ability of the animal health services to manage foot and mouth disease and classical swine fever (CSF), already enhanced by past ACIAR-supported research that **established diagnostic and investigative capabilities for both diseases**, is being further strengthened. A new project is developing improved methodologies to deliver and evaluate village-based vaccination and control of CSF, together with the development of a rapid diagnostic test to support this initiative. Epidemiological information on both diseases is being collected to facilitate control strategies.



Foraging—carrying the future

A recently commenced project is examining stock structures of two species of Mekong carp, **important for food security in the Mekong River Basin** (where fisheries help feed up to 60 million people across several countries). Managing fish stock is vital as development increases throughout the Basin and encroaches on the river. Laos, Cambodia, Thailand and Vietnam are all involved in the project.

# Malaysia

Active projects in 2003–04	4
AOP budgeted expenditure in 2003–04	\$36,424
Actual bilateral country expenditure in 2003–04	\$35,424
Bilateral country expenditure in 2002–03	\$296,572
Bilateral country expenditure in 2001–02	\$316,686

ACIAR did not have any Key Performance Indicators for Malaysia in the 2003–04 Annual Operational Plan as no new projects during the financial year were considered. Project results reported below are from previously commissioned, on-going research.

## Position

Malaysia is a longstanding partner country for ACIAR, but in recent years ACIAR's program of work with Malaysia has tapered down, reflecting the country's economic progress. Malaysia now has a strong research infrastructure and capability, and the push for privatisation and commercialisation of agriculture is strong. No bilateral project development has been initiated since 1998, with ongoing projects having a strong regional focus and applications in other countries. Malaysian organisations are welcome to participate in ACIAR projects as non-funded collaborators. On occasions, ACIAR supports Malaysian scientists as specialist advisers to assist in projects in the region, and through multilateral projects that deal with subjects of a regional nature.

## Achievements

The conservation of tropical fruit germplasm has progressed through a project that has developed micro-propagation systems for **a number of fruits**. Techniques established during the project are now being adopted by other countries in Southeast Asia.

Cool weather cultivation and cold storage of pineapples can result in the postharvest defect blackheart, which reduces quality and sale options. A bioassay of leaf browning, a potential **early indicator of blackheart susceptibility**, has been developed. The bioassay is now being tested, along with testing of resistance to the defect in 36 transgenic lines of pineapple.



Rambutan



Pineapple with the postharvest defect blackheart





# Philippines

Active projects in 2003–04	35
AOP budgeted expenditure in 2003–04	\$1,980,195
Actual bilateral country expenditure in 2003–04	\$1,852,285
Bilateral country expenditure in 2002–03	\$2,948,986
Bilateral country expenditure in 2001–02	\$2,471,426

Key performance indicators	Performance 2003–04
<ul style="list-style-type: none"> <li>New research projects underpinned by design processes that include endusers of the research and address their needs.</li> </ul>	Strong end-user involvement in new Landcare, weed management, groundwater management and mango supply chain projects.
<ul style="list-style-type: none"> <li>At least 400 farmer groups adopting Landcare principles in Mindanao and the Visayas.</li> </ul>	More than 400 Landcare groups, with participation between 25 and 35 per cent of farming households and conservation adoption between 35 and 65 per cent.
<ul style="list-style-type: none"> <li>Diagnostic screening tests for tick-borne diseases applied to screening cattle in at least two provinces.</li> </ul>	Surveys have been conducted in Luzon and in Mindanao.
<ul style="list-style-type: none"> <li>Evidence of community group involvement in watershed management on Bohol Island.</li> </ul>	Local catchment stakeholders and community groups are actively engaged with the project.

## Position

ACIAR's program in the Philippines, which commenced in 1983, has a broad aim of supporting improvements in agricultural productivity to increase market access for poorer farmers. A shift in project location, to emphasise poorer areas of Mindanao and the Visayas, reflects this broad aim. Increasingly ACIAR underpins new research projects with design processes that include the end users of the research. Project activities that enhance the impact of earlier ACIAR projects are now a particular focus, as is increasing the sustainability of agriculture and development of the natural resource base.

## Achievements

Small ruminant production in the tropics is constrained by parasites, including nematode worms. Chemicals (anthelmintics) have been used to control nematode parasites, but there are concerns over levels of anthelmintic resistance. Surveys revealed **low rates of resistant parasites** and highlighted the need to maintain random surveys as a measure of resistance. Collection of genetic data has been undertaken and a database developed. Guidelines for worm control and husbandry techniques are being disseminated in the Philippines and beyond, in part through a CD-ROM and the Internet.

Surra (trypanosomiasis) caused by *Trypanosoma evansi* is endemic throughout livestock in Southeast Asia. Molecular techniques to improve the diagnosis of *T. evansi* have resulted in a sample test kit for diagnosis being distributed in Mindanao. This will significantly enhance the mobility of surveillance. Evaluation of existing drugs against Surra has determined **which suit large animals**. Investigations into the epidemiology in the Philippines revealed that the combination of buffalo and goats is likely to increase infection. Another project is helping equip the Bureau of Animal Industry with expertise in diagnosing and controlling bovine babesiosis and anaplasmosis. Past project work in Zimbabwe developed ELISA diagnostic tests which are being adapted in a more user-friendly form. Training in the use of the kit and in disease control has also been undertaken.

A database is being compiled for breeding and performance records for ruminant species to **identify elite breeds** for incorporation into a customised version of the Breedplan software, which enables selection of elite genetic lines. It is hoped to emulate the success achieved in Thailand,

where the use of Breedplan has led to improvements in the quality of Thai cattle breeds.

The contribution of livestock to the smallholder farming sector is limited, due to poor uptake of research outputs that could boost productivity. The Leyte Livestock Improvement and Innovation Network established under an ACIAR-supported project continues to build smallholder capacity through contacts with local teams of farmers and **linking these, through participatory research, to R&D providers**. Profits of members farming pigs and chickens have increased, and improved environmental management has been achieved. A combined knowledge system— Selection of Forages for the Tropics (SoFT)—for forages suitable for smallholder farming and livestock systems is being developed for several countries. Database specifications have been drawn up and more than 100 forage species reviewed.

Researchers have conducted a survey of smallholder duck and chicken producers to reveal constraints to **improved performance**, with preliminary analysis revealing that marketing systems limit farmer opportunities.

The Landcare program, working in conjunction with a Spanish aid agency on implementing and testing the applicability of the approach in upland farming communities in Mindanao, has had significant impact at its three project sites. More than 400 Landcare groups have been formed with participation by up to 35 per cent of households, **adoption of conservation measures by up to 65 per cent of farmers**, and protection of up to 25 per cent of farmland. The project also had significant impact on both social capital through membership of Landcare groups and farmer knowledge and skills through training provided. Since proving that Landcare is successful in an upland context 45 Local Government Units and Non-Government Agencies and Organisations have now become actively involved, re-shaping institutional approaches to agricultural development. Questions remain on the long-term sustainability of Landcare and how best to extend it beyond the initial pilot sites.

A new project, co-funded by AusAID, has been formulated to address these questions by establishing an independent network of Landcare coordinators and site support personnel at five sites across the southern Philippines. The project will analyse the most appropriate processes for the network to **effectively sustain and grow Landcare** throughout the region. The ultimate aim is to integrate the network into a larger independent and self-sufficient non-government Landcare agency, and to evaluate its performance in sustaining the approach.

Another project is examining the agribusiness supply chain for smallholders in Mindanao. Information to provide a complete picture of the chain has been collected, leading to the development of a farm-household model to determine activities that will optimise profits. Discussions have begun with stakeholders to **foster links of farmers with supermarkets**, including cooperation to meet quality standards.



*Landcare project*



*Cecilia Honrado is our Philippines Manager*



Landcare seedlings



Marcelino Patindol, Landcare participant

Researchers are also examining the role of government policy in supporting such linkages.

Extensive land clearing leading to environmental degradation has resulted in the need for reforestation. A project focused on Leyte has developed a demonstration seedling farm for forest species, and the **seedlings are now available** for extension activities. This has resulted in increased interest in re-establishing forest areas. Research capacity has improved, with added assistance from a training manual in socioeconomic research methods. Researchers examining the extension services for agriculture in the Philippines have begun gathering information, initially through meetings with key stakeholders.

Incorporation of genes **resistant to papaya ringspot virus** into papaya breeding lines has led to plants that remain free of disease symptoms in field trials alongside infected plants. Glasshouse trials of backcrossed varieties continue to demonstrate resistance, including some crosses with elite Philippine papaya varieties. A separate project is developing papaya varieties with delayed ripening as a means of extending shelf life and marketability.

Two fisheries projects involving the Philippines and Indonesia began during the year. The first is assessing the genetic diversity of wild stocks of the giant freshwater prawn, to help in preserving wild resources and to provide a sounder scientific basis to improve aquaculture breeds. A second project is helping both countries implement Plans of Action to **manage Illegal, Unreported and Unregulated fishing** (IUU), and to work cooperatively to develop a regional IUU Plan of Action in the shared Sulawesi Sea fishing grounds.

The **use of Australian tree species for wood** and other forest products is being supported through seed collection, allowing trials of relevant species in several countries. Advice on silvicultural practices, provenance

## Philippines Landcare: a farmer's perspective

With the success of Landcare in Mindanao, now involving more than 4,200 households, it can be easy to overlook the benefits to individual farmers. Landcare began in Australia in the 1980s as a way for farmer groups to work together to restore degraded land. The experience in the Philippines mirrors this, with ACIAR becoming involved after work by IRRI and ICRAF to help Mindanao's farmers manage erosion on steep farming land by establishing Native Vegetative Strips (NVS) on contours.

The driving force behind this growth is the benefit individual farmers get from involvement, benefits that begin by changing attitudes. Marcelino Patindol, a farmer at Claveria, was, like many farmers in Mindanao,

sceptical about Landcare. "I am not a person who is easily convinced without proof. I ploughed one side of my farm with NVS and the other side I left as it was without contours. When I compared the two areas after two years, at harvest I found that NVS improved my production of corn by 20 to 30 per cent." Another benefit Marcelino describes is a greater sense of community, with more people willing to work together. "... there is a spirit of unity, which we call bayanihan. For example, it might take one person a week to plough a field, whereas when other farmers are invited to help it can be done in a day. The groups work together to construct nurseries, meeting places or beautify a sitio (small village)."

selection and seed production was disseminated to relevant project partners. Seed orchards of Australian species in nine countries were surveyed, providing information on yields and the impact of climatic, soil and management factors. In the Philippines **over-exploitation of natural bamboo stands** has seen many lose productivity. Researchers have developed and trialled management practices to improve productivity—including better irrigation, mulching and fertiliser use—with positive results.

Offsite impacts of pesticides applied to field crops have been assessed, leading to the development of risk-based approaches to preserving water quality. Potential risks in a range of catchments and land uses have been assessed, and monitoring programs established. A separate project on **pesticide residues in horticultural produce** is developing protocols on how to apply enzyme bioremediation technology to remove the residues from several crops.

Watershed monitoring in Bohol continues, with assessment of soil erosion from cropping land and measurement of its impacts on the watershed and water quality. These impacts and options for water resource uses have been discussed with stakeholders for **incorporation into planning activities** for sustainable agriculture. Distribution and water capture from major storage facilities on the Inabanga River have also commenced.

**A diagnostic key for sweet potato disorders** has been produced on CD and a related field guide for diagnosing common problems developed. By specifying symptoms based on the field guide non-related problems are filtered out. The field guide has been distributed, and after further refinement the CD will follow.

For rice a diagnostic key based on all available information on rice disorders has been packaged in both **a web-based and CD-ROM format**. The key allows users to diagnose specific problems based on observed symptoms. Users systematically filter through a variety of possible causal agents until the problem is identified. Information is available for insect pests, plant diseases, nutrient disorders and other causes of rice crop problems.

A project on biofumigation of soils to eradicate soil-borne pathogens is developing management practices to increase the efficacy of the process. These include the use of green manures in combination with specific treatments. **Best bet strategies for biofumigation** have been developed for pest organisms and are being trialled at the commercial farm level.



*Landcare meeting*



*Crop regeneration*



*Tending crop*



Ms Chiraporn Sunpakit is our Country Manager for Cambodia, Laos, Thailand and Burma

# Thailand

<b>Active projects in 2003–04</b>	23
<b>AOP budgeted expenditure in 2003–04</b>	\$1,125,711
<b>Actual bilateral country expenditure in 2003–04</b>	\$1,102,630
<b>Bilateral country expenditure in 2002–03</b>	\$1,090,643
<b>Bilateral country expenditure in 2001–02</b>	\$1,148,593

Key performance indicators	Performance 2003–04
<ul style="list-style-type: none"> <li>All new projects under development are focusing on implementation of results of earlier ACIAR projects.</li> </ul>	All pipeline bilateral projects emphasise implementation of earlier projects. A pipeline multilateral project is regional, with some research applicable in Thailand.
<ul style="list-style-type: none"> <li>Farmer groups in two provinces establishing fish farming based on manufacture of low-cost feeds using local ingredients.</li> </ul>	An external review of an ACIAR–World Vision project visited four low-cost-feed producing centres supporting over 550 families.
<ul style="list-style-type: none"> <li>Establishment of the OIE Regional foot-and-mouth disease (FMD) laboratory using diagnostic tests developed by ACIAR projects.</li> </ul>	The Regional FMD laboratory in Thailand has passed all biosecurity checks and is now receiving diagnostic specimens from other countries and using ACIAR-developed diagnostic tests.

## Position

Thailand's research capacity has increased with the country's economic development over the past two decades. As a result its need for ACIAR projects has diminished. ACIAR's investment in projects has decreased 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, particularly neighbouring Mekong countries, from drawing on the development experiences of Thailand. Project investment with Thailand is highly selective, focusing only on implementation of the results of earlier ACIAR projects, with emphasis on delivering these benefits to poor farmers and rural areas.

## Achievements

Thailand's **accession to the World Trade Organisation** has demanded new sanitary and phytosanitary measures for its produce. A project under way in Thailand and India is examining existing mechanisms to manage risks. Trends in food exports have been mapped and case studies of organisations in selected food industries undertaken. More than 40 organisations in both countries have been involved to date. The results will be fed back to governments in each country to help shape policy recommendations for improvements to current procedures.

Increased agricultural productivity has resulted in a loss of vegetation cover, necessitating improved water resource management. Integrated Water Resources Assessment and Management **models have been devised and tested** across a range of catchments. Hydrology, erosion, crop and economic models have also been developed, with Thai capacity in this area growing substantially.

Careful management is needed for the water catchments downstream from former forest areas that have been settled and are now being farmed. Current land-use trends and changes in selected catchments have been characterised, and impacts on water yields and soil properties determined. A database on the impacts on salinity of water use by trees is being compiled for Thailand and Australia. Socioeconomic and cultural surveys have been undertaken **for incorporation into a salinity model**. A risk assessment map of soil acidification has also been developed to predict pH levels for future years, based on accumulated knowledge. Sixteen farmer networks are now using deep-rooted species to rehabilitate degraded soils.

A project that has introduced the Breedplan software, to identify superior genetic traits in cattle, has established a database of pedigree and performance information for the past 20 years. Desired genetic characteristics can now be evaluated and estimated breeding **values calculated for economically important traits**. As a result, the Government of Thailand is using Breedplan to determine a national breeding strategy for native Thai, Brahman and crossbred cattle. This is a major payoff for the Livestock Department, which has been able to revolutionise the direction and operation of the major breeding stations in Thailand, replacing much of the traditional breeding practices of the Thai government and now the private sector. The involvement of village breeding programs has spread the benefits of the project across all types and sizes of cattle-raising enterprises. Thailand now considers itself as the leader in Breedplan and its use in Asian cattle herds.

The Thai component of the low-chill fruit project has concentrated on training and extension. Training courses have been conducted in pest management, with work also assessing the value of **small-mesh netting to protect fruit**. This has demonstrated that pesticide-free, high-quality fruit can be produced under netting. Links to supply chains and entry to retail markets are helping smallholders begin to see profits from selling peaches at \$A4.00 per kilogram in local markets.

Through collaboration **with World Vision in Thailand** the results of a variety of ACIAR projects are being disseminated to smallholder farmers. Changes to horticulture practices have reduced chemical inputs, replacing these with organic alternatives. This is creating a niche market for growers who market their pesticide-free produce in local supermarkets in the Songkla Basin. Environmental impacts from run-off have also been reduced. Another initiative is helping increase smallholder fish production, to tap into local demand for freshwater fish. A third component is extending the low-chill fruit project to other groups of farmers in the northern Thai uplands. This is focusing on cash crops such as vegetables intercropped with fruit trees.

Transferring technology from a project on shrimp viruses has been undertaken, with farmers being shown positive and negative results from various technologies to **encourage them to adopt the improved methods**. High-quality shrimp production clusters are being linked to government and industry programs that emphasise quality. A cheap ELISA test for gill-associated virus has also been developed and is being field tested. As a result of this work the smallholder shrimp industry in Thailand is well placed to capitalise on market opportunities previously constrained by disease outbreaks.

Green ant predation is proving valuable as **a key element of integrated control** of mango insect pests. One type of green ant, the weaver, has proven to be the best species to use, with measures to control its aggressiveness (a major problem in harvesting) now developed and in practice. Integrated pest management (IPM) models have also been established for Thailand and Vietnam.



*Breedplan producing results*



*Benefit from low chill orchard*





# Vietnam

Active projects in 2003–04	38
AOP budgeted expenditure in 2003–04	\$2,685,982
Actual bilateral country expenditure in 2003–04	\$2,069,638
Bilateral country expenditure in 2002–03	\$2,212,809
Bilateral country expenditure in 2001–02	\$2,597,411

*Paddy field at Tam Dao*

Key performance indicators	Performance 2003–04
<ul style="list-style-type: none"> <li>• Training in research management and evaluation provided in 2003 has been applied in at least four projects.</li> </ul>	Strong Vietnamese input has been provided into two project reviews and the development of five new projects.
<ul style="list-style-type: none"> <li>• Collaborative research addressing agricultural markets and information systems commenced.</li> </ul>	A project comparing markets and information systems commenced with a focus on institutionalising tools for use in market information systems.
<ul style="list-style-type: none"> <li>• Adoption of improved phosphine fumigation practices by grain handling authorities.</li> </ul>	Discussions about improved practice held with grain handling authorities, and agency and fumigation company personnel trained.
<ul style="list-style-type: none"> <li>• Protein baits for fruit fly control produced by industry and distributed to farmers.</li> </ul>	A new production plant for baits opened in April 2004, with baits now available to farmers.
<ul style="list-style-type: none"> <li>• Evidence of improved profitability of farmer-managed stocked reservoirs through adoption of project-derived husbandry strategies in two provinces.</li> </ul>	Productivity improvements achieved in on-farm trials in Yen Bai and Thai Nguyen provinces. Marketing is to be addressed as fish harvests increase.

## Position

ACIAR's Vietnam program focuses on forestry, land and water resources, animal sciences, crop sciences, fisheries and postharvest technology. There is an emphasis on delivering practical farmer and policy impacts, particularly in poorer regional areas. A number of recent projects focus on extension or adaptation of outputs from earlier ACIAR projects in Vietnam and elsewhere in the region. Appropriate technologies arising from these projects are also being applied and capacity developed in R&D through the AusAID Collaboration for Agriculture and Rural Development (CARD) program. ACIAR is also seeking greater involvement of the private sector and NGOs in projects, linkages with other donors and development of closer linkages between Vietnamese research and extension organisations.

## Achievements

A model to assess the economic viability of different cultured fish systems in Vietnamese reservoirs is in development. The model combines economic and biological inputs, including growth of selected species. Surveys are also under way to assess current markets and **market arrangements for cultured fish produced in reservoirs** and to identify constraints to smallholder participation, with reservoir fisheries being a potentially valuable income source. A second project is examining stock densities through practical trials using species in demand in local markets.



*Misha Coleman is our Country Manager for Vietnam*

Digitised catchment data are being used to determine the relationships between land-use patterns and fish productivity.

Agricultural markets are being studied to **describe supply chains** for stone fruit marketing in northern provinces. The study has revealed that increases in production are not based on market signals and opportunities, highlighting the need for more market information when producers are making choices relating to crops and produce levels.

Improvements in the varieties of sweet potato used in traditional pig-sweet potato farming systems are boosting production. Many **traditional varieties offered limited nutritional value** to pigs, restricting their growth and potential marketability. Sweet potato varieties with higher starch and protein yields that increase growth rates of pigs have been identified and are now being distributed through farmer networks.

The destruction caused by rats in rice crops is also being successfully controlled, with integrated rat management being introduced in Binh Thuan province, through the ACIAR–World Vision collaborative project. By **encouraging village-level participation and using appropriate technologies**, including the Trap Barrier System with a lure crop, significant reductions in rat numbers have been achieved. This success has also seen the Vietnamese Government implement a policy to support widespread adoption, and provincial governments are budgeting for its introduction.



### ACIAR and World Vision—helping to improve rodent management

Rats are a major source of pre-harvest rice losses. Young rats particularly feed on maturing grain for nutrition, their breeding cycle coinciding with the planting and growth of rice crops. As Vietnam has intensified rice production, moving from two to three crops a year, the platform for rat populations to rapidly expand has been laid. Australian scientists from CSIRO, supported by ACIAR funding, developed an Integrated Rat Management (IRM) approach to interrupt the population cycle of rats. A lure crop planted before the main rice crop is surrounded by a Trap Barrier System. This attracts rats to the maturing crop, trapping them before they begin breeding, breaking the population cycle. The IRM system also encourages farmers to synchronise cropping and adopt other practices that work best when implemented by a whole community.

World Vision, as part of a collaborative program with ACIAR to extend the results of this and other projects, has been helping to extend IRM in Bac Binh. For Liem, a farmer from Phan Ri Thanh commune, the benefit of the TBS method goes beyond the obvious economic benefits that are community-wide recognised. “Myself and my wife no longer argue over cost and the use of poisons because of this [TBS method].” Ngoc, another

farmer also sees benefits. “We have seen working among farmers can make the best out of this [technique]. Our cooperative will adopt it [TBS method] next season and we believe rat will be no longer a pest.”

The success of this, and other demonstration sites, has resulted in the Vietnamese Government using IRM as the basis of both national and provincial policies. The national policy directs farmers to practice IRM, with support at the provincial level, including budgetary allocations, to extend adoption of IRM and use of the Trap Barrier System.



*Rat trap barrier*



Soybean is grown between rice crops, usually in a compressed growing season that sees beans harvested before full maturity. Introducing varieties with accelerated growth characteristics to advance **maturity has doubled yields** from 1 tonne up to 2 tonnes per hectare. Better matching of these varieties to local growing conditions and introduction of

drought tolerance has further increased yields. Management practices to increase yields, such as through saturated soil cultures, have been refined and introduced.

Houseboat on Vietnam's Red River



Protein bait against fruit fly

The low-chill fruit project, operating in Laos and Thailand as well as Vietnam, has identified rootstocks with disease resistance and improved quality characteristics, making them better adapted to Vietnamese conditions. Bait programs to help control the serious pest, fruit fly, have also been introduced. Fosters Brewery at Tien Giang, with support from BASF (formerly Aventis), AusAID and the ATSE Crawford Fund, opened a plant in April 2004 to **manufacture a protein bait against fruit fly**. The bait, based on ACIAR research, and comprising brewery waste mixed with tiny amounts of insecticide, is applied to trees to attract then kill the flies. Farmers involved in trials have recorded significant reductions in lost produce, with more than 1,600 farmers in 16 provinces now involved. Additionally, the spot spraying technology has facilitated a 250 to 500-fold decrease in the amount of insecticide required, which will have immense positive public health impacts.

Fungi that have the potential to act as **bioherbicides against weeds** have shown promise in a range of tests over several years. A bioherbicide for barnyard grass (*Echinochloa crusgalli*) was successful in shadehouse trials but was not successful in replicated field experiments in the Red River Delta. This may have been due to water management limitations or insufficient virulence. A second fungus for the weed red spangle top (*Lepochloa chinensis*) in southern Vietnam has been proven under field conditions, with no problems from its use alongside herbicides against other weeds. Simple methods for mass production of this fungus have been developed and a product suitable for farmer application is likely.



Grass carp cages on the Red River

Vietnamese scientists are receiving project training in disease management for fruit and vegetable crops. Regional networks of scientists have been established and more than **100 scientists trained in pathogen identification** techniques. A manual on laboratory techniques has also been published. Huanglongbing disease (citrus greening) has reduced citrus productivity in several Asian countries. Management strategies have tended to ignore past research, resulting in the need to develop a sound scientific approach. A project is examining both the

disease pathogen and the insect that transmits it, beginning with information-gathering in Vietnam and Indonesia that includes discussions with stakeholders to design experimental protocols.

Reforestation is being promoted in many areas of Vietnam, with some smallholders opting for mixed-species timber plantations. The combination of species used is often determined by availability alone. Surveys of smallholders and saw mills were undertaken to determine which species are considered high value compared to actual market rates. More than 60 species have also been surveyed at 29 plantation sites, as a basis for trials designed to determine how monoculture and mixed-species plantations compare in growth and quality. Seedlot trials of the tree species *Toona*, *Chukrasia* and *Khaya*, held across several countries including Vietnam, have identified **some resistance to attack by *Hypsipyla robusta***, a damaging forest pest. Silvicultural practices have also been shown to play a part in protection. Leaves in full sun are more attractive to pests than those from trees grown in shade, producing a chemical difference that may account for this preference. A related project has demonstrated that *Chukrasia* may have a role as a domesticated tree in agroforestry settings, because it is less susceptible than other species to attack by *Hypsipyla* and has the ability to recover from damage by forming a vigorous new terminal shoot.

A tissue culture protocol for the mangrove species *Avicennia marina* has been developed and is in refinement. Several barriers to this technique such as bacterial infections have been overcome. Tissue culturing of shoots of *A. marina* grown in glasshouses has been successful in producing lateral growth, **a further step towards propagation of seeds and trees**. Genotyping data are being processed in preparation for software analysis of genotypes.

Metal contamination of cropping lands in peri-urban areas is a constant risk, with health implications and the **potential loss of market access** or exclusion as Vietnam enters bilateral and multilateral trade agreements. A project investigating such contamination has established baseline data for toxic levels of metals, with eight field sites in operation and testing under way for metals in cropping inputs and outputs. Criteria for suitable waste materials to use as inputs are being determined for Thai and Vietnamese conditions.

In another project the APSIM Manure and SoilP (phosphorus) modules have been modified to incorporate information allowing **the management of soil fertility** for low-input systems in the tropics. The SoilN (nitrogen) module has also been modified to specify added organic matter and its interactions. A project on the management of water



Transporting feed for grass carp



ACIAR Board of Management visiting an *Acacia* hybrid site



Project site for assessing impact of heavy metals on fertilisation and waste recycling in Vietnam



Dried fish at markets

distribution in publicly managed irrigation schemes revealed that improvements can be made to distribute water to farms more efficiently, but farmers must also make changes to the ways they use this water or these efficiencies will be lost.

ELISA tests for the presence of mycotoxins and pesticides in stored grain and other food products have been developed, and are now being implemented in

Vietnam. Mycotoxins and pesticides contaminate food and grain during crop growth and during postharvest storage. Vietnamese scientists have received training in developing and using the ELISA protocols and tests in the laboratory and field. **A national monitoring network has been established and programs are being implemented.** A second project to integrate phosphine fumigation practices for grain storages has completed a national survey of phosphine-resistant pests. These pests are now being characterised. Pest management systems for farmers who store grain have been developed, with trials demonstrating a gross income saving of 8 per cent, achieved without using chemicals.

Innovative approaches to the **control of root, trunk and fruit diseases** caused by *Phytophthora* have been developed for the durian industries in Vietnam and Thailand. These include trunk injection of phosphonate and the use of non-chemical treatments such as manures and mulches. More than 1000 farmers in Vietnam and 2000 in Thailand have been provided with information on these findings and their implementation.



Transport on the Red River