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IN RESEARCH FOR DEVELOPMENT

THE MEKONG REGION

Developing aquaculture
Pest and disease control
Building local knowledge

Partnerships in the Mekong region

History weighs heavily on the Mekong countries of Vietnam, Laos and Cambodia, but these countries are gradually shaking off the shadows of the past and looking to the future with confidence.

Part of this confidence comes from economic growth, and agriculture will play a key role in making rural communities more secure economically and socially. Up to 80% of the populations of Cambodia, Laos and Vietnam still live in rural areas where there are high levels of poverty. Building a steady pathway for farmers out of poverty and opening up economic opportunities for rural areas and smallholder farmers will be essential for broad-based economic growth.

ACIAR research projects have covered a range of agricultural services and disciplines, from capacity building among researchers and their institutions to practical farmer support and policy-setting assistance. In Thailand, the Mekong region's economic leader, there is stronger emphasis on co-funding and regionwide projects.

ACIAR's commitment to the region, which dates back more than 20 years, is strong and focused.

The Mekong countries sit among the 'dragon economies' of the region, and particular attention is now paid to the needs of Vietnam, Cambodia, Laos and Burma as the poorest and least integrated in the region.

The strategy in Cambodia, which has a predominantly rice-based farming system, has two thrusts: to support research that underpins diversifying production beyond rice and to increase the productivity of rice-based farming systems.

In Laos, research initiatives have been aimed at crop and livestock farming diversification to improve the productivity of agricultural systems. An important focus in both Cambodia and Laos is on capacity development and training, and also on complementing programs by larger donors.

Vietnam has made some important gains in its development over the past decade. ACIAR's current program of work focuses on biosecurity issues, with concern in the region about avian influenza and the value of surveillance and diagnostic systems for pests and diseases.

The Mekong countries, Laos and Cambodia in particular, are testimony to the value of international cooperation and partnership in agricultural research, and also to the benefits of working with NGOs to spread the outcomes of research to more farmers more effectively. These partnerships and the commitment of our Mekong country partners will help us continue to take agricultural R&D from vision to reality.

partners
IN RESEARCH FOR DEVELOPMENT

Partners in Research for Development presents articles that summarise results from ACIAR-sponsored research projects, and puts ACIAR research initiatives into perspective.

Technical enquiries will be passed on to the appropriate researchers for reply. Reprinting of articles, either whole or in part, is welcomed provided that the source is acknowledged.

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DESCRIPTION: Using molecular genetics to identify independent gene pools, biologists are tracking the size and health of fish populations
CONTACT: Dr Peter Mather, p.mather@qut.edu.au

Tracking fish genes

Urban growth in the Mekong River Basin threatens the fisheries that provide food security. A project aims to identify and strengthen the fish stocks

BY JANET LAWRENCE

Using molecular genetics, researchers are tracking the sustainability of key fish stocks that provide food security to 60 million people across the Mekong River Basin in southern Vietnam.

Rapid urban development in the Basin threatens the fisheries that provide food security, and despite their importance, management of these fisheries is rudimentary at best. Although the Mekong River Commission has initiated studies of a number of important fish species, the task is huge—there are about 1700 species native to the system.

Effective fisheries management requires an understanding of the scale at which fish populations are distinguishable from each other. However, in the first instance discrete breeding units (stocks) need to be identified and information gathered on their individual ecologies and life histories.

This is where researchers, via an ACIAR project, have made a start, using molecular genetics

PAUL DICKENSON

to identify independent gene pools and therefore discrete stocks of two critical species. Armed with this information, biologists can track the size and health of a population over time and detect when it is under threat from overfishing or environmental changes.

Scientists from the School of Natural Resource Sciences at Queensland University of Technology (QUT) have been working with partners associated with the Mekong River Commission Fisheries Program in Cambodia, Thailand, Vietnam and Lao PDR on this project.

Project leader Dr Peter Mather of QUT says that the genetic methodologies for identifying discrete fish stocks have not been used as widely in the region as elsewhere, and the time is right to test their application for the Mekong. Work has begun to determine the patterns of genetic structure in two carp species, *Henicorhynchus siamensis* and *H. lobatus*, that are difficult to tell apart.

Dr Mather says observations of fish gathered in feeding grounds can easily lead to the misconception that all representatives of one species belong to the same population. Yet distinguishing separate groups within a mass of fish is critical in tracking their movements through the Mekong, he says.

"Two carp species were selected as models for the technology because they represent about half the fish caught in the river system," Dr Mather says.

"Fisheries biologists have traditionally gathered information about discrete breeding populations by tagging fish and observing their movements. However, the genetic approach allows us to directly establish population boundaries."

The project is attempting to establish the location, size and distribution of discrete breeding units. Scientists are using mitochondrial-DNA genetic markers—DNA sequences inherited solely from the mother—that can specifically connect a fish with a particular breeding population.

The team has studied populations of the two target species across the natural geographic range in the Mekong River Basin, buying samples from local fishermen and at local riverside markets. Pectoral fin clips taken from both species were prepared for sending to the Ecological Genetics Laboratory at QUT in Brisbane for genetic analysis.

In addition, whole fish were preserved and catalogued for morphometric analysis by collaborators at the Research Institute for Aquaculture No. 2 in Vietnam. This analysis enables the physical features of the fish to be correlated with their genetic make-up.

Dr Mather says that the interaction of the environment with the genotype of the fish can produce individuals with similar characteristics but different genetic make-ups (as had happened with the two species under study). Conversely, environmental differences

Distinguishing separate groups within a mass of fish is critical in tracking their movements through the Mekong

can cause changes within similar genetic make-ups. For example, freshwater prawns can produce different numbers of spines on the rostrum on the head, depending on the level of salinity, he says.

Results for both species reveal population structure to varying degrees. For *H. siamensis* the data suggest that there are two genetic types in the Lower Mekong Basin (below the Khone Falls in Vietnam and Cambodia).

Whether the two genetic types interbreed is still to be determined. However, it is clear that *H. siamensis* individuals do not disperse upstream beyond the Khone Falls, as was thought previously.

In contrast, the Khone Falls do not act as a barrier for upstream dispersal of the other species (*H. lobatus*). The data for this species support recognition of a single stock throughout the main channel of the Mekong River from southern Vietnam to Lao PDR.

A genetically distinct population has been detected, however, in the Mun River. Research has shown that the two *H. lobatus* stocks are separated by the Pak Mun Dam near the confluence of the Mun and Mekong rivers, although the level of genetic divergence between them reflects a much older dispersal than the dam that now acts as a barrier.

Certainly, the genetic differences found there confirm that the scientists are dealing with separate stocks of *H. lobatus*, which therefore need management strategies tailored to their locations above and below the dam. This is the sort of definitive knowledge that scientists were hoping for. The research will help to boost the long-term management of these two Mekong River fish species, and will also be a model for future work on other species. ◀

PARTNER COUNTRIES: Laos, Thailand, Vietnam
PROJECT: Facilitating farmer uptake of ACIAR project results: World Vision collaborative program (PLIA/2000/165)
DESCRIPTION: Producing low-cost fish through community cooperatives is among key economic goals for ACIAR-funded researchers
CONTACT: Jonathan Treagust, jonathan.treagust@worldvision.com.au

THRIVING ON FISH FEEDS RESEARCH

Fish farming in north-east Thailand is strengthening food security and demonstrating the value of community-based research

BY JACINTA CLEARY

What began as research into low-cost fish feed in north-east Thailand has emerged as a shining example of how some simple, well-targeted science can change the economic wellbeing of an entire community.

Six years ago the aid agency World Vision adopted ACIAR's low-cost fish feeds research to improve local aquaculture, on which many families depend for their livelihood. However, the results have broadened far beyond the initial research project and made communities more economically and socially resilient.

World Vision Australia project coordinator Jonathan Treagust says the community-development aspect of the project—such as the establishment of business cooperatives—has become just as important as the initial fisheries component.

World Vision adopted ACIAR's low-cost fish feeds research in 2000, applying it to rural communities in north-east Thailand. With fish feed accounting for 30 to 40% of production costs, inexpensive feed was a household priority—but community production was out of reach because of technical constraints.

Mr Treagust says the collaboration with ACIAR to resolve these obstacles brings out one of World Vision's strengths, in that it looks beyond the technical challenge: "This isn't just about producing low-cost fish feed. It is about community organisation, ownership, management and leadership to enable impacts to continue into the future."

The low-cost fish feeds program has been established in two provinces, Surin and Udon Thani. Community training centres operate in both areas and sell fish feed and fingerlings, allowing farmers to run their own small and medium-scale aquaculture enterprises.

A Thai farmer scoops out a handful of the bagged ACIAR–World Vision low-cost fish feed she uses in her fish and frog ponds.

The training centres operate as cooperatives, which makes feed and fingerling prices cheaper than those sold by commercial manufacturers.

Tilapia and catfish fingerlings are bred under the program, because of their monetary value. However, without proper care survival rates can be as low as 1%. The techniques developed to improve fingerling survival include increasing the water's oxygen levels, nursing fish inside floating baskets covered with a thin sheet for protection, and feeding them egg yolks (from hens) before transfer to earth ponds. Egg yolk increases growth rate and earth ponds contain a natural bacterium that the fish need when they are very young.

Since the program started, hundreds of Thai farmers (about 50% of them women) have been trained in fish-raising, fish-feed production and product processing.

Feeds for catfish and tilapia have also been developed through the community centres. Mr Treagust says some interesting developments have emerged: "One ingredient used in fish feeds is cherry snails, which are a pest in rice crops."

In Prasat district, Surin province, a solar dryer has been built so that feed can continue to be produced in the rainy season. The dryer reduces humidity, allowing the feed to be stored without being ruined by mould.

As a result of the feed and fingerling work, Mr Treagust says families have become more self-sufficient. World Vision estimates that families can earn an extra 15,760 baht (A$600) a year if they raise 800 fish four times a year. Most families also keep fish for their own consumption, boosting their health and finances. Some also now plant crops such as chillies, ginger, lemon grass and mangoes around their ponds, further expanding their farms and incomes.

"So the low-cost fish feeds program has had life-changing impacts," Mr Treagust says. "Technically it is extremely difficult to raise fingerlings and produce fish feed. In the past this has been beyond the reach of rural farmers, but ACIAR's expertise has enabled this to happen.

"Sustainability comes from knowing where to get support and where to get help. The ACIAR project has helped this process by building stronger networks and stronger communities."

Other ACIAR–World Vision collaborations in the Mekong region include low-chill fruit in northern Thailand, reduction of pesticide use in southern Thailand, dissemination of improved rice varieties in Laos, and increased soil fertility and managing rodents in rice in Vietnam. ◀

CLASS LURES ASIA'S FISH FEEDERS

Australian specialists in aquaculture nutrition recently shared their knowledge and experience with their counterparts in South-East Asia, as part of a regional effort to overcome a critical shortage of fish feed

PHOTOS: BRYDON COVERDALE

BY BRYDON COVERDALE

Ten years ago Australian aquacultural scientists predicted a looming shortage of fish meal and a consequent spike in prices. Their predictions have come true, with prices leaping from US$600 a tonne last year to US$1500 a tonne in recent months.

Not surprisingly, with aquaculture a major supplier of protein in South-East Asian diets, this is causing big problems for struggling Asian fish farmers who rely on fish meal to feed their stock. But the Australian organisers of a masterclass on aquaculture nutrition, held in Thailand in August this year, hope their work will help introduce changes to lift the industry's sustainability, efficiency and profitability.

Organised by ACIAR, the Australian Academy of Technological Sciences and Engineering (ATSE) Crawford Fund and other groups, the two-week masterclass invited scientists specialising in aquaculture nutrition in Australia to share their knowledge and research with scientists and aquaculture specialists from Thailand, Laos, Cambodia, Indonesia, Vietnam, India, the Philippines and Papua New Guinea.

CSIRO aquaculture nutritionist Kevin Williams says the world fish-meal shortage is one of the critical issues that needs addressing. "Whether we're talking about wet trash fish or fish being processed into fish meal, there is a finite limit to the availability of that material and we have been at that finite limit for more than 10 years," he says.

And with aquaculture now accounting for about one-third of the world's fisheries production—up from about 10% in the early 1980s—it is no surprise that this fish-meal supply squeeze is getting worse.

"Australia recognised this 10 years ago, and we worked on how we could substitute fish meal in the diets of high-value species such as finfish and shrimp," Dr Williams says. Meat or poultry can be used in some feeds, as well as plant products such as lupins and cereals.

"Australia will benefit because we are a very large producer and exporter of terrestrial protein and carbohydrate sources," he says. "We produce probably 80% of the world's lupin grain production."

But while some South-East Asian fish farmers may be able to afford commercial feeds, most cannot, according to one of the leaders of the masterclass, Dr Geoff Allan of the NSW Department of Primary Industries, Port Stephens. He says that in Thailand, for example, species such as catfish, tilapia and carp might sell at the farm gate for prices ranging from 20 to 50 baht (roughly A$0.70 to A$1.70) a kilogram. However, with catfish and tilapia feeds retailing at about 70 cents a kilogram, profits can be either slim or non-existent.

"You can see that if you're feeding between one and two kilos of feed to produce one kilo of flesh, the economics really don't stack up," Dr Allan says.

It is a similar story across South-East Asia, so making do with other available ingredients is the best option for many farmers.

But for this to happen they need access to information—the reason for the masterclass,

Masterclass participants visited a tilapia farm cooperative where the manager demonstrated his feeding techniques (above), and saw workers at a catfish farm grading young catfish for quality (left).

which built on established relationships between Australian and Asian researchers, some of whom had worked together on ACIAR aquaculture projects.

Topics included combining available feeds as efficiently as possible, physically producing feed pellets, storing feed and minimising wastage when distributing feed.

Dr Allan says that maximising efficiency and minimising waste are crucial for fish farmers, who not only rely on seafood for income but also, in many cases, to feed their families.

"Aquatic protein is the most important source of protein in the world and in this region about 25% of total protein intake comes from fish and aquatic products," he says.

The organisers of the masterclass also hope to truncate the two-week course into a three-day program that masterclass participants can run so the information is more widely delivered. ◀

Brydon Coverdale is a journalist with Rural Press and travelled to the Thailand masterclass courtesy of the ATSE Crawford Fund. This article first appeared in Rural Press newspapers, including Stock & Land*, on 7 September 2006.*

PARTNER COUNTRIES: Indonesia, Laos, Malaysia, Vietnam
PROJECT: Management of rodent pests in rice-based farming systems (AS1/1998/036)
DESCRIPTION: In many South-East Asian countries, rodents can reduce food production by eating crops before the harvest. ACIAR-funded research is helping to develop affordable forms of integrated pest management for rodents CONTACT: Dr Grant Singleton, +63 2 580 5600, g.singleton@cgiar.org

Rat traps break breeding cycles

Where there is rice, there are rats. And that means serious crop losses, especially for smallholder farmers

BY WARREN PAGE

Farmers across South-East Asia who grow lowland irrigated rice lose between 15 and 30% of their crops every year to rats. Sometimes, whole crops are destroyed when rat numbers explode.

Two species of rats are prevalent in most rice-growing areas, the ricefield rat (*Rattus argentiventer*) and the lesser ricefield rat (*R. losea*). Both have adapted their own breeding cycles to rice-crop cycles, and when it comes to numbers, rats are a potent foe.

One to two weeks before the rice matures, female rats enter oestrus. Pregnancy lasts three weeks, with average litters of 11 to 12 pups. The maturing rice crop feeds the growing pups and by six weeks they too start breeding.

Farmers have long known of the link between crop maturity and rat breeding and have devised numerous extermination methods, but ultimately to little avail.

ACIAR and CSIRO Sustainable Ecosystems began working on the problem by seeing if the link between rice maturity and rat breeding could be broken. The key was to find a way to remove female rats before or during the early stages of the breeding cycle, so they failed to produce litters.

Chemicals such as poisons or bioagents are effective, but carry health and environmental risks. Traps can be safe and cheap, but are less effective.

An integrated ecological approach aimed at disrupting rat population dynamics began to emerge in the 1990s, with Lam Yuet Ming, of the Malaysian Agricultural Research and Development Institute, developing the trap barrier system (TBS).

The TBS encloses a crop with a water-filled moat bordered with plastic fencing. Small bunds or causeways cross the moat and lead to traps. However, the system is not cost-effective unless all farmers in an area adopt the practice—something that has proved impractical because of a range of socioeconomic, cultural and agronomic reasons.

So researchers sought to broaden their approach

PHOTOS: BRAD COLLIS

Some farmers have resorted to home-made flame throwers in their desperation to control rats. The idea is to drive a blast of hot air into burrows that have been sealed at the other end with a wire cage.

by developing an Integrated Ecological Rodent Management (IERM) system that combines different approaches to suit different circumstances.

Over the past decade ACIAR and CSIRO Sustainable Ecosystems have refined the concept through nine projects across five countries. Each project has worked towards identifying the types of rat species causing losses and the most appropriate methods of delivering IERM.

A focal point of IERM is still the use of the TBS in farmers' fields, except it is used to surround a small area of early-planted crop. This early crop acts as a lure, allowing farmers to trap the rats before the main crops start to mature—achieving the sought-after break between the rat-breeding and crop-maturing cycles.

A single 'lure crop' enclosed by a TBS can protect surrounding crops in a 200-metre radius. By planting several lure crops that provide overlapping protection, and using other measures such as controlled baiting and trapping near rodent habitats, villages can significantly reduce rat numbers and crop losses. ◀

Tactics can be electrifying

There has been no shortage of imagination in the many ways farmers in South-East Asia have tried to control rats—such as the method of running a wire a few centimetres above the rice paddy water and connecting it to mains electricity.

In some areas natural rodent predators, such as snakes and birds of prey, have been released into or near rice fields. In villages cats are often used to kill rats that threaten grain-storage areas. The use of rodenticides—poisons that target rats and rodents—is also widespread. However, these often harm predators and people.

Baits or poisons placed outside rat burrows or traps are popular but not always effective. Some farmers even avoid planting a crop, creating an extended fallow period to try to starve the rats. Hungry rats do not breed, but they do migrate to more bountiful locations. They return the moment the fallow fields are replanted.

Countries trialling and adapting control systems

INDONESIA

A National Rodent Management Program was developed following ACIAR-supported research in West Java. This research was held over two-and-a-half years across four sites, with two sites established as controls. At the trial sites, yields increased by between 0.1 and 0.9 tonnes a hectare and farmers using chemicals fell to 46%. Yields at the control sites did not rise and chemical usage remained constant at 88% of farmers.

VIETNAM

As Vietnam intensified rice production in the 1990s, the area suffering losses from rodents jumped from 50,000 hectares in 1993 to 310,000 hectares in 1997. World Vision and ACIAR have successfully demonstrated IERM, which is now part of the government's rat control policy.

CAMBODIA

The adoption of IERM has been successful at a community level. Improvements to the system include the use of wax-based baits that non-target species find unpalatable.

LAOS

Refining the IERM approach to upland farming conditions in Laos is underway. Demonstrations in a number of villages have introduced farmers to the TBS concept.

BURMA (MYANMAR)

Rodent biology and taxonomy have been established, and IERM trials have been positive. Training has raised scientific capacity. Several villages involved in trials are now introducing the concept to neighbouring villages.

The 'trap barrier system': a single 'lure crop' enclosed by a TBS can protect surrounding crops in a 200-metre radius.

PARTNER COUNTRY: Laos
PROJECT: Management of CSF and FMD at the village level in Lao PDR (AH/2003/001)
DESCRIPTION: Using minute magnetic beads, scientists from Australia's CSIRO Livestock Industries have developed a rapid diagnostic test for detecting classical swine fever—one of the most problematic diseases for pigs in Laos
CONTACT: Dr Axel Colling, axel.colling@csiro.au

ANIMAL MAGNETISM CHECKS DISEASE

Scientists have developed an important new 'rapid test' for detecting the diseases that can ruin small-livestock farmers in Laos

BY WHITNEY MACDONALD

The answer to improving disease diagnosis in Laotian livestock may lie in tiny magnetic beads smaller than a pinhead.

Scientists from Australia's CSIRO Livestock Industries have developed a rapid diagnostic test for detecting classical swine fever (CSF)—one of the most problematic diseases for pigs in Laos.

The kit uses minute magnetic beads coated with specific antibodies that capture CSF antigen found in fresh samples of CSF-infected pigs. During the subsequent reaction a detector-antibody binds to the captured antigen. A colour change (through an enzyme-substrate reaction) indicates a positive result.

A technique, called the immuno-magnetic bead Enzyme-Linked ImmunoSorbent Assay (IMB-ELISA), was developed as one of five key objectives of an ACIAR-funded project, which aimed to better manage CSF and foot-and-mouth disease (FMD) at the village level in Laos.

The three-year project, scheduled to conclude at the end of 2006, was developed by Dr Laurence Gleeson following an earlier ACIAR-funded project that identified CSF as a major disease concern in livestock production.

The current project, headed by CSIRO Livestock Industries' Dr Axel Colling, involves the University of Melbourne in Australia and the International Centre for Tropical Agriculture and the Department of Livestock and Fisheries, both in Laos.

Dr Colling says establishing a rapid diagnostic test for CSF and FMD is an important advance in the control of these diseases. "There is not an efficient way to test for outbreaks," he says. "Specimens must be transported out of the local villages and to a central laboratory, and then subjected to extensive tests that rely on high-tech equipment before confirming a positive diagnosis.

"This process can take several days, during which time the disease can rapidly spread."

A village pig farm in Laos: rapid diagnosis can help to control disease.

Unlike the traditional ELISA, which requires the use of expensive laboratory-based equipment, the IMB-ELISA can be carried out in small tubes using a hand-held magnet, with a colour change visible to the naked eye.

"The IMB-ELISA is easy to perform and robust, making it an ideal system for rapid diagnostics at the village level," Dr Colling says.

Initial validation results are promising, with the test scoring high for sensitivity and repeatability when performed by different operators within the same laboratory. The test is now being assessed for uniformity when carried out by many testers at different laboratories.

In addition to developing a rapid diagnostic kit, the project set out to establish and validate a vaccine program using a locally produced CSF vaccine and to assess the program's effectiveness.

After identifying logistical problems with vaccine validation, researchers have devoted considerable effort to optimising the quality-control aspects of administering the vaccine and its storage. With the optimal storage and delivery conditions now worked out, scientists are progressing to the next phase of evaluating the effectiveness of the vaccine program.

The project also aimed to track the disease occurrences and outcomes of CSF and FMD within the villages to gain an epidemiological perspective of the effects of these diseases on livestock.

"During the project many samples taken from CSF and FMD cases have been collected, identifying types of outbreaks," Dr Colling says. "The information that we have collected on the number and types of outbreaks is now being used in reports by the Department of Livestock and Fisheries."

As part of the final project objective, the research team has organised a workshop to highlight project findings and assess how best to proceed with the research on CSF and FMD. An integral part of the workshop will be training laboratory staff and field veterinary workers on using the IMB-ELISA and practical aspects of improved pig production.

PARTNER COUNTRIES: Cambodia, Laos
PROJECT: Livestock health and vaccines in Cambodia and Laos: scoping study and economic assessment (PLIA/2006/012)
DESCRIPTION: Australia's Centre for International Economics has completed a three-month study, investigating the vaccine-supply chain and reviewing quality-assurance measures in the government-run Vaccine Production Centre in Vientiane
CONTACT: Dr Robert Warner, bwarner@TheCIE.com.au

NEED FOR VACCINE NETWORK

Disease has been a perennial threat to raising livestock in Asia, with a recent study highlighting the work still needed in developing an effective vaccination program

BY GRAEME O'NEILL

The livestock trade among neighbouring countries such as Laos, Cambodia, Thailand, Vietnam and China is increasing in economic importance, but falling short of potential because of disease.

Endemic diseases such as foot-and-mouth, haemorrhagic septicaemia, cattle blackleg, classical swine fever and avian influenza plague the region's animal industries.

Laos, for example, exports live cattle and buffalo into Vietnam and China—a trade largely based on culled draught animals. Conversely, Laotian pig producers face increasing competition in their own domestic markets from Vietnam and Thailand. The main factor hindering Laotian farmers' competitiveness is disease and the lower production costs of the more intensive Vietnamese and Thai industries.

Dr Peter Rolfe, ACIAR's animal health research program manager, says that even though farmers can buy inexpensive, locally made vaccines, they often fail because of supply-chain problems.

Australia's Centre for International Economics (CIE) recently completed a three-month, ACIAR-funded scoping study in Laos to investigate the vaccine supply chain and to review quality-assurance measures in the government-run Vaccine Production Centre in Vientiane.

The study, by CIE's Dr Robert Warner and AusVet's Dr David Kennedy, used the classical swine fever vaccine to model the vaccine manufacture and supply chain because it is particularly susceptible to heat degradation.

Dr Rolfe says the vaccine must be kept chilled; difficult in remote rural tropical regions that lack a continuous refrigeration chain from manufacturer to farm.

Vaccines commonly have antigenic proteins from the target virus, causing the immune system to raise antibodies that recognise the shape of the viral antigens, and subsequently react to any encounter with the real-world virus. But the antibody response is ineffective if the antigenic proteins in the vaccine are heat-damaged or degraded.

Dr Rolfe says that while the antigens in the classical swine fever vaccine can induce protective immunity, the survey found quality-control issues—but also identified lay-trained village animal workers who could, with more training, deliver vaccines in the field.

"We're still exploring the best way to proceed," Dr Rolfe says. "However, it is imperative that the vaccine supply is sustainable, affordable, delivered effectively and that farmers are aware of the benefits."

He says the issue extends beyond Laos and is a problem throughout the greater Mekong. Disease-control initiatives, coordinated by groups such as the UN's Food and Agriculture Organization and the World Animal Health Organisation, rely on the availability of high-quality vaccines. Disease remains the principal threat to the development of viable livestock industries because until there is widespread control, other production and marketing programs will be undermined.

"For example, producers are not inclined to improve genetics of their feedstocks if viral diseases keep coming through," Dr Rolfe says.

The results of the scoping study are now being analysed with a view to policy changes needed at government level to produce and distribute high-quality vaccines.

BRAD COLLIS

Cattle in Cambodia: endemic diseases plague the region's livestock industries.

Vietnam looks to ACIAR 'short cuts'

Dr Nguyen Van Bo, president of the Vietnamese Academy of Agricultural Sciences and member of the ACIAR Policy Advisory Council, talks to Bill Bainbridge about the key challenges in feeding Vietnam's growing population

Dr Nguyen Van Bo: "We have achieved food security at a national level but not yet at a household level."

Vietnam does not have time to waste. Each child born today is born into a nation of more than 83 million people; by the time they reach old age the population will be closer to 150 million.

Dr Nguyen Van Bo, president of the Vietnamese Academy of Agricultural Sciences (VAAS), says Vietnam, with twice the population density of neighbouring China, faces a key challenge in raising agricultural productivity to feed that growing population now and into the future.

VAAS, established just 12 months ago, amalgamates 10 institutions, rising to 14 by 2008, and is charged with shaping the future of Vietnamese agriculture.

Dr Bo says applying and developing new agricultural methods will be essential for Vietnam to get the most out of its limited resources in the future. "We need to take the high-tech route to save on inputs and to increase productivity," he says. "Rice paddies are decreasing year by year due to industrialisation and urbanisation, and we will never get any more."

For that reason, the Soviet-taught Dr Bo argues Vietnam needs to take a shortcut to agricultural development. He says Vietnam's agricultural scientists have a solid training from their former Eastern Bloc partners, but suffer shortcomings when it comes to the rest of the international sphere.

"In the past our links were all to the Soviet system and not to the rest of the world," he says. "The Soviets gave us a very good theoretical grounding but they didn't have much experience with tropical agriculture, so the theory didn't have immediate implications for our concrete situation in Vietnam."

From his perspective ACIAR is one of the institutions providing vital links to the best of international research. "Vietnam's starting point in science and technology is from a very low level. We suffer from a lack of human resources, of funding and of linkages with international institutions."

Dr Bo explains why the ACIAR presence in Vietnam

is valuable in addressing these fundamental problems. "It is very important for four reasons. First, to improve our research methodology and open our eyes to new directions in applied research.

"Second, to transfer technology directly. This is like a short cut that saves time and money and increases the productivity of Vietnam's agriculture. A domestic forestry program would take at least 20 to 25 years to develop new species but instead we are developing a program with acacias, Australian pine and eucalypts.

"Third, we can access up-to-date information through ACIAR publications.

"And finally, very few of our scientists can speak English, so that is a big barrier to being up to date. The relationship with ACIAR helps us improve our scientists' language skills through international cooperation and workshops, and creates links to organisations such as the state departments of primary industry and so on."

FOOD SECURITY

Not so long ago Vietnam was a net importer of rice. "In the past Vietnam paid most attention to food security and had to import a lot of food before 1988," Dr Bo says. These days the nation exports more than five million tonnes of rice a year, making it second only to Thailand as a rice exporter.

But Dr Bo says the issue of food security is not entirely a thing of the past. "We have achieved food security at a national level but not yet at a household level. So that is still a major target of agricultural policy. But we also need to look at nutritional security; many households have enough food to eat, but not enough of the right food.

"Poverty alleviation is another goal with 17% of Vietnamese still living under the UN's poverty line, and most of that poverty is in the rural areas."

NEW APPROACHES

To this end, Dr Bo says Vietnam needs to take a broader approach to rural development than just focusing on agriculture. "We need to change the face of the rural areas to bridge the gap between the urban and the rural," he says. "In the past we mainly looked at agricultural development and did not concentrate on rural development, so we need to look more to health care, education, social and cultural development—a farmer-centred policy.

"We also need to develop rural industries where the farmers live. In Vietnam we have a saying, 'leaving agriculture without leaving home'."

This means attracting new industries to rural areas and doing more with current crops. "We need to improve the effectiveness and competitiveness of agriculture," he says. "Right now we are an exporter, but mainly of raw and unprocessed produce such as rice, coffee and fish, and our product has very low competitiveness. We also have relatively high production costs and our quality is uneven, so it is difficult to compete with many other countries."

That difficulty is likely to be compounded by Vietnam's expected entry into the World Trade Organization this year. WTO trading rules will lead to rapid adjustments as farmers come to grips with both the opportunities and challenges of international agricultural trade.

Vietnam has already gone some way to diversifying its agricultural production. "In the past we looked always to high-yield varieties of rice; now we need to look at high-quality varieties and we have a program target to produce one million hectares of high-quality rice."

But farmers and policy makers alike are also wary of moving away from traditional crops. "We have encouraged farmers to diversify, but this carries risks. We are asking farmers to grow fruit, flowers, soybeans, maize and so on, but this is market-oriented production and the government cannot guarantee the market; the government is only there to give advice. So a big problem is market projection—what will be the demand in five years?"

'We are asking farmers to grow fruit, flowers, soybeans, maize and so on, but this is market-oriented production and the government cannot guarantee the market'

BRAD COLLIS

Vietnam is looking to research partnerships to diversify its agricultural production, and develop an agricultural economy based on quality as well as volume.

Nonetheless, Vietnam will push toward renovating the agricultural economy over the next 15 years. "Biotechnology will be the main tool for fulfilling our targets, through plant breeding and so on. We also need to restructure our agricultural system. Right now crop production is the major share of agricultural GDP and animal production is worth less than 20%; in the future it should be more like 40%.

"ACIAR can help in a number of these areas, but the most important thing is developing the human resources. We need good, skilled scientists or we won't have a good outcome. Technical transfer will play a key role, especially in the important areas of postharvest technology and new animal and plant breeds."

With those things in place, Dr Bo says Vietnam can work to both eliminate poverty and continue moving its people from subsistence farming to the foundations of a more complex agricultural economy.

One day 150 million people may depend on it. ◀

Economies of size sought in land reforms

The way in which land is used and ownership defined and transferred between generations has profound effects on economic, social and political outcomes in any country. This is particularly true for Vietnam, given its political history and the changes that have taken place in land-use policy

BY SALLY MARSH

Land use has been central to Vietnam's history and development. Since the Doi Moi reforms in 1986, Vietnam has undergone a period of substantial reform, contributing to productivity growth and poverty reduction. For example, economic reforms have helped the country not only attain self-sufficiency in rice but become the world's second-largest rice exporter, as well as being a major player in world markets for coffee, cashew, pepper and rubber.

Much of this growth can been attributed to land reforms that started in 1981, which allowed the move away from centralised cooperative farming under state control by reinstating individual farm households as the main unit of agricultural production.

Land-use rights (LURs) were allocated to households and can be rented or leased, bought or sold and used as collateral. This has allowed both a market for LURs to develop and also the potential consolidation and accumulation of land holdings for more efficient producers.

Today, the long-term development of Vietnam's agriculture still depends on efficient and effective land use. With some 70% of the population still living in rural areas, land consolidation, flexible land use, technology uptake and the impacts of tax and credit policies are significant issues.

A recently completed ACIAR project, a collaboration with Hanoi Agricultural University and the University of Sydney, assessed the impact of land reforms. One of

BRAD COLLIS

PARTNER COUNTRY: Vietnam
PROJECTS: Impacts of alternative policy options on the agricultural sector in Vietnam (ADP/1997/092); Strengthening agricultural market information activities in Vietnam (ADP/2001/066); Scoping study on trade-policy reform in Vietnam (ADP/2005/006)
DESCRIPTION: A number of ACIAR projects in Vietnam have helped or are helping to build skills in market economics and quantitative policy analysis
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credit—is likely to be a powerful tool for transforming agriculture.

The project findings on such land-policy issues have been published in an ACIAR Monograph, *Land Policy and Agricultural Development in Vietnam*, available in hard copy or downloadable from the ACIAR website. This land-reform study complements a number of recently completed and ongoing ACIAR projects in Vietnam that aim to build skills in market economics and quantitative policy analysis.

One such project has focused on building capacity in market-based policy analysis in the Institute of Policy and Strategy for Agricultural and Rural Development (IPSARD), within the Ministry of Agriculture and Rural Development (MARD). This project, now moving into extension phase, has been successful in strengthening economic-modelling and policy-analysis skills.

One outcome was the decision to model IPSARD—restructured during the funding period—on the Chinese Centre for Agricultural Policy (CCAP), following ACIAR-funded trips to China, Australia and Thailand to review the structure and operation of institutions with mandates to supply market information and provide policy advice to government.

As a result, IPSARD now has more independence than its predecessor and is in a better position to give unbiased policy advice.

Vietnam's integration into the global economy has bilateral, regional and multilateral implications, many of which will lie outside agriculture, for example in investment and services.

And while Vietnam has established a definite position for products like coffee, cashew, pepper and rubber, obtaining the imprimatur of the WTO will require it to expose some of its inefficient agricultural sectors, such as sugar and maize, to international competition.

A scoping study is now underway to develop a project to analyse these issues, in preparation for policy approaches likely to be needed for rural adjustment programs. ◀

the issues it explored was the effect of land size. Land allocated to farm households, particularly in the north, often comprises multiple plots of non-contiguous land. This means there are costs as well as benefits associated with having a large number of plots. And as the demand for labour rises elsewhere in the economy, the opportunity cost of agricultural labour also rises, forcing farmers to consider reducing the number of plots they operate by consolidating their land holdings.

In essence, policies that encourage development elsewhere in the economy will in turn raise the efficiency of agriculture.

Also, it became clear from the project that reducing the transaction costs in land exchange and in rural adjustment generally—including the cost of obtaining

Sally Marsh is from the School of Agricultural and Resource Economics at the University of Western Australia

Some of the challenges facing Vietnamese agriculture

- the need to increase the capacity for commercial farm production through land consolidation and land accumulation
- ensuring that, with rising labour costs, there are other employment opportunities and as labour is withdrawn from agriculture, land consolidation and accumulation can raise overall economic efficiency
- maintaining livelihoods in subsistence households whose small farm size is particularly affected by fluctuating prices and increasing input costs
- the need for land-use flexibility to allow farmers to respond to market signals

PARTNER COUNTRIES: Laos, Thailand, Cambodia
PROJECTS: Increased productivity of rice-based cropping systems in Lao PDR, Cambodia and Australia (CIM/1999/048); Plant-breeding strategies for rainfed lowland rice in Northeast Thailand and Laos (CS1/1995/100); Yield improvement of rainfed lowland rice in drought-prone areas of Thailand and Laos (CS1/1990/045)
CONTACT: Professor Shu Fukai, s.fukai@mailbox.uq.edu.au

GRAIN GAIN FROM SKILLS LIFT

By building local research capacity, ACIAR-supported teams aim to boost rice production and improve crop tolerance to drought

BY GRAEME O'NEILL

Images of rural South-East Asia often show terraced paddies with verdant rice crops standing stem-deep in water. But large areas of Laos, Cambodia and Thailand often experience withering drought and low yields.

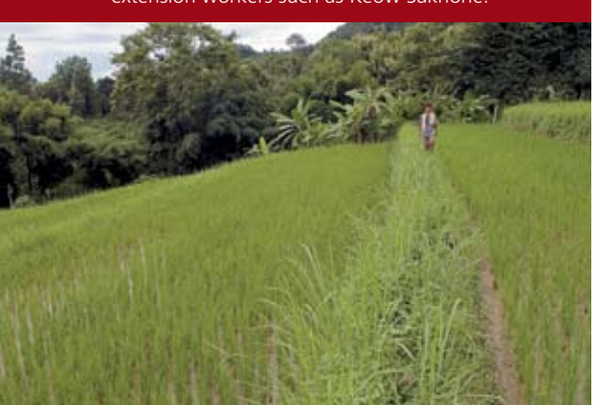
In Laos, for example, 90% of the nation's rice-growing area relies on rain rather than irrigation. The timing and quantity of rain is unpredictable, the soils permeable and leached of nutrients and traditional rice cultivars have low drought tolerance. Consequently, rice shortages are common.

Australian researchers have been working with colleagues and extension officers in the region for 15 years to help local breeders develop systematic breeding programs to make rice growing more reliable.

In 1990, University of Queensland plant scientist Professor Shu Fukai led an ACIAR-funded project with the specific aim of capacity building in Thailand and Laos. "Capacity building rather than research has been our main focus," he says. "We've been successful in many ways, but particularly in postgraduate training. After graduation, young Laotian scientists are now leading rice research in South-East Asia."

PHOTOS: BRAD COLLIS

Digital cameras: the latest tool for Laos agricultural extension workers such as Keow Sakhone.



Upland rice growing in Laos.

Professor Fukai says when the team started its work, there was little infrastructure in Laos: "So for the first three years we did only one simple experiment each year. We tried to build an understanding with local rice breeders and develop their local research capacity."

However, this first project directed only 10% of its funding to Laos; 90% of the money and effort went into Thailand, where local researchers began improving varieties for the country's north-east, their goal being to find a higher-yielding cultivar with the same eating quality as the internationally renowned jasmine rice.

For the second project, starting in 1995, about 40% of the effort went into Laos. Professor Fukai says that by using the expertise developed in the first phase, and with Thai help, the project developed an effective method for screening Laotian rice varieties for drought tolerance.

Professor Fukai says that Laotian breeders have now screened hundreds of rice lines, many collected from local farmers. The breeders use this information to hybridise drought-adapted lines with higher-yielding exotic material, to increase yield and hardiness while maintaining good eating qualities.

Five lines with these characteristics have been identified and Professor Fukai and his team have asked farmers to evaluate them. "Only when they get the thumbs-up from farmers will I know we've been successful," he says.

The second phase of the project in Laos introduced the first experiments in broadcasting seed onto moist soil. Such direct seeding is starting to replace transplanting of rice seedlings elsewhere in Asia as a consequence of labour shortages.

Researchers travelled widely in Laos, demonstrating direct-seeding techniques to farmers. "The idea was new to the Laotian farmers, but we've gradually developed techniques that work," Professor Fukai says. "One is to broadcast the seed by hand, another involves sowing into furrows. Both save on labour."

Based on related research in Cambodia, it was decided not to pursue a separate breeding program to develop direct-seeding varieties. "We concluded it was unnecessary because varieties that were good for transplanting were also successful when direct-seeded."

Professor Fukai predicts that, as in other countries, Laos's shortage of rural labour will inevitably see a large increase in direct seeding. "One of the last things we did in Laos was to develop maps of temperature and rainfall using geographic information systems technology," he says.

Professor Fukai explains that northern Laos is hilly with a lot of rice grown at 500 metres above sea level. Farmers traditionally grow only one rice crop—during the wet season, harvesting in November. About seven years ago, the Laos government developed irrigation schemes to allow farmers to grow a second rice crop during the dry season.

Irrigation delivered good results in central Laos, but in the north, cool temperatures in December and January caused poor germination and slow growth. After 40 days the seedlings were still only a centimetre tall.

The ACIAR-supported researchers used locally available materials to develop a plastic solar dome to warm the seed during germination, promoting seedling growth. When planted out in February, seedlings grew strongly.

Some Laotian farmers are now adopting this new approach, signalling the willingness of many farmers to be innovative when given the opportunity.

PARTNER COUNTRIES: Vietnam, South Africa
PROJECT: Development and evaluation of sterile triploids and polyploid breeding methodologies for commercial species of *Acacia* in Vietnam, South Africa and Australia (FST/2003/002)
DESCRIPTION: Hybrid acacias are being developed not only for the desirable qualities of the parent plants but also to reduce the risk of becoming environmental weeds
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HYBRID FAST-TRACK FOR TIMBER

Research into acacia hybrids is boosting Vietnam's timber industry

BY ROBIN TAYLOR

Smart outdoor furniture made from fast-growing plantation acacias and eucalypts is being exported from Vietnam as part of an expanding wood-products export industry worth about A$2 billion in 2005.

The industry is underpinned by research and development into acacia hybrids, whose growth rates are almost double that of their parents.

On average, hybrids produce an extra 10 cubic metres of wood per hectare a year and the quality is acceptable for furniture, construction, pulp and paper. The faster growth rates mean that hybrids can be harvested two to three years earlier than non-hybrids.

Hybrids developed for Vietnam are also more drought-tolerant than their parent species, meaning the potential range of climatic zones for planting has also been extended.

An ACIAR project is now looking at developing sterile acacia hybrids that combine the desirable qualities of their parents and boost productivity without the risk of becoming environmental weeds.

Australian acacia species were introduced into Vietnam in the 1960s but only a few species were widely planted. In 1991, naturally occurring acacia hybrids were noticed growing at the Ba Vi Experimental Station of the Research Centre for Forest Tree Improvement (RCFTI), 70 kilometres west of Hanoi.

The hybrids were noticeably superior in growth rate to either parent species—identified as *Acacia mangium* and *A. auriculiformis*—because of hybrid vigour.

The following year, Professor Le Dinh Kha, former director of RCFTI, a centre within the Forest Science Institute of Vietnam, became aware of technologies that had been developed through an ACIAR-funded project in Malaysia on acacia hybridisation and propagation.


ROBIN TAYLOR

Dr Sadanandan Nambiar of CSIRO, Duong Thanh Hoa of RCFTI, Dr Ha Huy Tinh, Vu Tan Phuong, director of the Research Centre for Ecology and Environment, and Nguyen Duc Kien inspect a table made from plantation acacia hybrid wood with Dr Chris Harwood of CSIRO/Ensis.

Vietnamese scientists soon started working with CSIRO researchers involved in the ACIAR project and adopted CSIRO-developed clonal selection techniques and propagation methods in their hybrid selection program, which began in 1992 using Ba Vi's hybrid plants.

Hybrid specimens (or clones) must undergo extensive screening before being selected for commercial release. To ensure the selected clones are superior to their parents, they are grown under a range of environmental conditions and their performance is tested. In the case of Vietnam's program, this testing process took four years from the time of first selection in 1992 to commercial release in 1996.

Dr Ha Huy Thinh, RCFTI director and leader of the ACIAR project in Vietnam, says that hybrid acacias are now very important in Vietnam. Their wood is used for woodchips, pulp and increasingly as sawlogs.

Over the past 10 years, significant areas of hybrid acacia plantations have been established in Vietnam. The total area of hybrids planted since their initial release in 1996 is estimated to be 150,000 hectares.

RCFTI has released 12 hybrid clones for commercial production, but will now collaborate with the University of Tasmania to develop sterile hybrids.

Dr Thinh explains that most organisms have two sets of chromosomes (known as diploid), but sometimes organisms can have three sets of chromosomes, making them sterile. "In these triploid plants, all the energy is directed to growing wood rather than producing fruit or flowers (typically needed for reproduction)," he says. "So potentially they can produce more wood and have faster growth rates than conventional hybrids."

Australian project leader Professor Rod Griffin, from the University of Tasmania, developed a tetraploid *A. mangium* (a plant with four sets of chromosomes) under a project supported by Shell International as a first step towards producing a triploid acacia. He produced 40 clones and, when the Shell project finished in 2000, this valuable genetic material remained.

Through Dr Thinh's contacts with the Australian Tree Seed Centre at CSIRO, the material found its way to RCFTI and eventually led to the new ACIAR project.

The clones are being propagated in RCFTI's tissue-culture laboratory to produce plantlets. These tetraploid parent plants are being grown in the field at a number of different sites, with researchers now waiting for them to flower so they can carry out controlled pollination—crossing them with a 'normal' diploid acacia to produce the triploid progeny. Next year the researchers will collect seed and sow it at a number of different sites to develop an experimental trial in the field.

An output of the project will be a reliable technology for producing triploid genotypes of acacias and acacia hybrids, as well as the field trials needed to confirm productivity and sterility. ◀

PARTNER COUNTRIES: Vietnam, Indonesia
PROJECTS: Huanglongbing management for Indonesia, Vietnam and Australia (CP/2000/043); Plant disease diagnostic manual (CP/2005/053)
DESCRIPTION: Farmers are benefiting from a mix of disease controls being researched: ants, oil and guava
COLLABORATING INSTITUTIONS: University of Western Sydney, CSIRO Entomology, Australia, Southern Fruit Research Institute, Vietnam, National Institute of Plant Protection, Vietnam, Gadjah Mada University, Yogyakarta, Indonesia, Research Institute for Citrus and Subtropical Horticulture, Indonesia
CONTACT: HLB management: Professor Andrew Beattie, a.beattie@uws.edu.au; Manual: Professor Lester Burgess, L.Burgess@agec.usyd.edu.au

EASING CITRUS GROWING PAINS

An Asian citrus disease is spreading and threatens the region's production, a setback for the move to diversify from subsistence rice cropping

BRAD COLLIS

Mr Do Hong Tuan, research assistant in the plant protection department of SOFRI, with Mekong Delta citrus grower Mr Le Van Bay, who has been working with ACIAR on disease-control strategies.

Plant diagnostics

A manual on field and laboratory procedures for fungal diseases of crop plants is being developed by Australian researchers through an ACIAR-funded project.

The manual has been designed to assist plant pathologists and extension staff in Vietnam, especially in provincial plant-protection centres. Plant pathology teachers and students should benefit from the manual's clear style and simple diagrams. Notes on symptoms of disease and laboratory procedures will be illustrated with colour photos. The manual will also include details establishing a basic diagnostic laboratory.

Professor Lester Burgess and Timothy Knight say that accurate diagnosis of a disease is a crucial first step in developing and extending information on control measures.

The manual will collate disease information, illustrations and training notes used in disease diagnostics from both concluded and active ACIAR projects.

BY BRAD COLLIS

Mr Le Van Bay learned the hard way about the pitfalls of trying to establish a new farming venture—in his case oranges. "I lost half my orchard to Huanglongbing disease (HLB) and had to cut down all the trees and start again," he explains.

It was a significant setback for a farmer trying to diversify away from subsistence rice growing, but Mr Van Bay says the disappointment was eased considerably by the support he received from researchers.

Almost a decade later, Mr Van Bay remains part of a University of Western Sydney-led, ACIAR-supported project, working with Vietnam's Southern Fruit Research Institute (SOFRI) to develop controls for the citrus disease.

HLB is the Asian form of 'citrus greening' and is the main constraint to citrus production in Asia. Citrus growing has ceased completely in some areas where the disease has killed all the trees. The disease has spread widely, from Vietnam to Indonesia, and there are concerns that it could reach Australia if it spreads to West Papua and Papua New Guinea.

HLP is spread by an insect vector, the Asiatic citrus psyllid, and this is the target of various controls being developed and tested in a collaboration involving Indonesian, Vietnamese and Australian researchers.

In the project involving Mr Van Bay's orchard, researchers achieved a 70 to 80% control through combined biocontrol and chemicals—weaver ants and white mineral oil. However, the weaver ants are difficult to establish in orange orchards because the leaves of orange trees are too small for the ants to 'weave' into nests.

A 100% control was achieved with white oil and the insecticide Confidor®. However, while effective, it proved too expensive for the average farmer.

Researchers are now looking for other insect predators, and are also trialling inter-cropping orange trees with guava trees. Early trials suggest that the presence of guava suppresses the citrus psylla. However, this leads to a new problem: fruit flies.

"So there is still a lot of work to do," says Mr Do Hong Tuan, a research assistant at SOFRI's plant protection department working directly with farmers like Mr Van Bay who, as research partners, are among the first to benefit from each new piece of knowledge.

So while there is no definitive answer to the disease, Mr Van Bay says his new orchard is benefiting from a mix of controls being researched—ants, oil and guava—which makes him very optimistic about his and his orchard's future.

PARTNER COUNTRIES: Thailand, Vietnam
PROJECT: Integrated control of mango insect pests using green ants as a key element (CP/1997/079)
DESCRIPTION: To keep mango pests under control, old technology is being reintroduced, but with adaptive research to improve it
CONTACT: Associate Professor Keith Christian, +61 8 8946 6706, kchristi@cdu.edu.au

FEISTY ANTS GUARD MANGOES

For some farmers in Vietnam, making the move from growing rice to fruit has depended on keeping forest ants happy

BY BRAD COLLIS

Six years ago, says Huynh Van Lai, life was, quite simply, very, very hard. "We barely existed," he says, reflectively. The reason was that he and his family, like many thousands of others in South Vietnam's Mekong Delta, were among the remnant subsistence rice-growers, just eking out a traditional existence.

Not everyone had become part of the modern new rice-growing regime being developed as a vibrant export industry.

Instead, the plan was for farmers like Mr Van Lai to be assisted out of rice and into a new industry, fruit growing, to break the poverty cycle and to meet the steadily increasing demands for fresh fruit in expanding urban populations.

The transition for Mr Van Lai began 10 years ago, but the first four years were the hardest because rice land had to be set aside for the new fruit trees, which were yet to bear fruit. The first crop—in Mr Van Lai's case, mangoes—was finally harvested six years ago and the change in his circumstances since then has been extraordinary.

"Our income has multiplied by six times, we have built a new house and bought a motorbike," he says. "We are now enjoying modern living."

Mr Van Lai's farm covers just 2000 square metres, which illustrates the difference that a comparatively high-value retail crop makes.

He says he would not have survived the tough years when he was establishing his trees if it was not for the support, encouragement and knowledge being offered by agricultural extension staff from Vietnam's Southern Fruit Research Institute (SOFRI).

His experience of the hard years has made him a keen advocate of new farming systems and his farm has become a model for the use of integrated pest management. Instead of pesticides, Mr Van Lai uses green tree ants (also known as weaver ants)—fierce predators of caterpillars and black ants, which damage mangoes when they are flowering.

This has been part of an ACIAR-supported project run by SOFRI, Charles Darwin University, the Prince of Songkla University in Thailand and the Department of Agricultural Extension of Thailand.

The green tree ants are forest creatures and have to be brought into the orchard. In Mr Van Lai's case, they are fed with chicken and duck offal to encourage them to stay and colonise the mango trees. It is a tricky business because they will return to the forest if they are not kept happy.

Different groups also have to be kept separate, otherwise Mr Van Lai says they fight and excrete formic acid, which leaves black marks on the fruit.

"To start with I hang chicken or duck intestines from the trees and, once the ants seem to be settling in, I gradually reduce this to force them to start hunting for the insects I want them to control," he says. "It takes patience, but if it means I don't have to use pesticides it saves me a lot of money and my fruit will be acceptable to the larger supermarkets."

Across the project generally, yield and fruit quality in orchards that use weaver ants and some environmentally friendly chemicals have proved to be similar or better than orchards using chemical insecticides. In a parallel program in the Northern Territory, profits from orchards that have abundant weaver ants have been increased by more than 70%.

To stabilise weaver ant populations in mango orchards, research has shown it is best to mix mango trees with other tree crops such as citrus. If mango orchards are a monoculture, the ants need to be fed when the trees are dormant and pest insect levels are too low to sustain the ant colonies.

Mr Van Lai has planted oranges to help with the insect mix—a preferable option to draping offal over his trees. ◀

PHOTOS: BRAD COLLIS

Mekong Delta farmer Mr Huynh Van Lai with his income-generating mangoes that he protects with armies of green ants.

(Far left) The green ants use wire bridges to move from tree to tree, reducing territorial conflicts between colonies on the ground.

PARTNER COUNTRIES: Thailand, Vietnam
PROJECT: Management of *Phytophthora* diseases of durian (PHT/1995/134)
DESCRIPTION: The popular tropical fruit durian is prone to fungal diseases, but by developing an integrated disease-management strategy, scientists have come up with ways to limit their impact
CONTACT: Professor David Guest, +61 2 9351 2946, d.guest@usyd.edu.au

The durian market at the ferry crossing at Thuy Tay village, in South Vietnam's Tien Giang province.

BRAD COLLIS

Prosperity ripens on durian rescue

A joint effort between Australia, Vietnam and Thailand is seeking to save the durian industry—and the livelihoods of thousands of small farmers

BY BRAD COLLIS

Life at the ferry crossing in Thuy Tay village in South Vietnam's Tien Giang province has a distinctive rhythm, set by the to-and-fro of the cable-driven ferry and the tide of heavily laden motorbikes that flood the deck for this brief river-crossing break in their rush to market.

On the outward leg the bikes are barely visible beneath large woven baskets filled with freshly picked durian fruit, destined for adjacent villages or for transfer to a river boat that will take the fruit further north to bigger markets at My Tho City or even Ho Chi Minh City.

For anyone not directly involved in this steady flow of commerce, it is a heartening vista from the shade of a streetside coffee house, because the whole scene

is the 'fruit' of agricultural science. The motorbikes, their riders, the industrious ferry, the coffee shop (and its karaoke machine) are the manifestation of an agricultural economy that is the result of the science that saved the fledgling fruit industry and propelled it forwards.

Twenty years ago this was a poor rice-growing district and growing tropical fruit—in this instance, durian—was the Vietnamese government's answer to a better future for traditional villages and, in the longer-term, a possible export fruit industry.

The land-use change needed considerable agronomic assistance from the start, but nothing compared with the research effort required when the mature durian orchards started dying.

As farmer Nguyen Thanh Nhung explains: "When the trees first started showing signs of disease everyone started applying pesticides, which was very expensive … and didn't work because that wasn't the problem."

However, researchers soon realised the attack was coming from the fungus *Phytophthora palmivora*, which thrives in the hot, moist conditions typical of the low-lying Mekong Delta. The challenge was how to manage it: tropical fruit, including durian, had introduced entirely new farming systems to the region so there were no off-the-shelf answers.

Saving the durian industry and the livelihoods of thousands of farmers became the focus of the ACIAR-supported project and broadened into a joint endeavour between Australia, Vietnam and Thailand. Durian is also grown in Queensland and the Northern Territory, so any new knowledge and management protocols had potentially far-reaching benefits.

Dr Nguyen Minh Chau, director of Vietnam's Southern Fruit Research Institute (SOFRI), says the durian farmers were hit hard by the disease because it had become an important crop and was already supplying a significant proportion of farmers' incomes. The disease was also a blow to the country's long-term ambitions for a tropical fruits industry with export potential.

When a tree suffers from *Phytophthora* gummosis, caused by the organism *P. palmivora*, it oozes gum as the sap starts to leak from a spreading wound that gradually moves around the tree, ringbarking and killing it.

Dr Minh Chau says the disease usually strikes when the trees are seven to 10 years old and, if nothing is done, the tree can be dead in 12 months. He says the research project had to initially develop a control for trees already infected, then put in place longer-term strategies to prevent the disease recurring or spreading.

In the first instance researchers found that injecting phosphoric acid into the tree trunk changed the pH environment within the wood, making it hostile to the fungus.

Trees treated in this way recovered quite quickly. Nguyen Thanh Nhung says the first thing he observed after he treated his infected trees with phosphoric acid was they became noticeably greener, and then the scarring started to heal over. He says the availability of this control tool has put his 1.1-hectare enterprise back on track and he hopes to soon be earning enough to buy more land and expand his durian orchards.

The next research focus was to develop improved varieties—rootstock with increased strength and *Phytophthora* resistance, and also varieties producing higher-quality fruit.

Dr Minh Chau says the resistant rootstock that has been developed is producing taller and more productive trees. However, this is only an option for new orchards or where farmers are replacing trees that have been killed. In either case, he says, it is important that farmers are educated about the new varieties and the need to eliminate the conditions that allow the fungus to thrive and spread.

"It starts with good nursery management to ensure all the soil used for growing new stock is sterilised," Dr Minh Chau says. "Then it is about sustaining good practice on farms."

One on-farm practice that has been developed is to build a mound of earth against each tree so that rain runs away from the base of the trunk and does not create the sodden, warm conditions that facilitate fungal growth.

Farmers are also encouraged to keep the ground beneath the trees clean and free of leaf matter, so the soil surface can remain as dry as possible. In the lowlands the mounds are typically 70 centimetres in height, while in the highlands 10 to 20 cm has been shown to be enough. The use of mounds is also now being used in rubber and cocoa plantations.

Dr Minh Chau says the development of a sustainable durian industry is part of a wider program to move subsistence rice farmers into horticulture, because the demand for fresh fruit in large towns and cities is growing. He says fruit can earn a farming family four to five times more than rice, with dramatic consequences for living standards and the establishment of a sustainable agricultural economy.

"It is giving people a chance," he says. "No-one wants to stay in poverty."

During the transition years from rice to fruit growing, farmers planted their trees on raised beds and grew rice in between. Now, in most orchards, the rice is gone.

"We want fruit growing to follow what we have achieved with rice," Dr Minh Chau says. "In 1975, rice production was dominated by small-plot subsistence farming, but in 25 years this had been replaced by a modern export industry.

"This is what we also hope to achieve with fruit. We started in 1994 and our ambition is to be producing export-quality fruit by 2010–15." ◀

PARTNER COUNTRIES: Laos, Thailand, Vietnam
PROJECT: Adaption of low-chill temperature fruits to Australia, Thailand, Laos and Vietnam (CP/2001/027)
DESCRIPTION: With assistance from Australian researchers, farmers are adopting new varieties, ideas and practices to increase farm productivity. For many farmers this is leading to their first steps out of poverty
CONTACT: Dr Alan George, alan.george@dpi.qld.gov.au

Dr Le Duc Khanh prunes fruit trees in the orchards of the project's research station in Moc Chau, with colleague Dangå Dinh Thang.

FRUIT OF THEIR LABOURS

Over the past decade economic growth in Vietnam has been rapid, with per capita GDP increasing from US$200 to US$550 by 2004. Although poverty levels have halved, about one-third of the population is still classified as poor by international measures

Moc Chau is about four hours drive west of Hanoi. The beautiful, fertile countryside has been home to the minority Hmong people for generations. Many women still wear traditional dress and mud-and-straw houses on stilts provide a link between the past and present.

Farming methods have sustained people here for centuries, but only at a subsistence level. However, change is underway.

With assistance from Australian researchers, farmers are adopting new varieties, ideas and practices to increase farm productivity. By growing new varieties of plums and nectarines that fetch much higher prices than traditional varieties, many farmers are taking the first steps out of poverty.

Dr Le Duc Khanh, from Vietnam's Ministry of Agriculture and Rural Development, says the Moc Chau area is good for growing temperate fruit. "It's 1500 metres above sea level and the winters are very cold," he says. "The problem is that the quality of plums and nectarines that are grown here isn't that high and prices are subsequently low."

For the past few years, through ACIAR support, the Queensland Department of Primary Industries and Fisheries (QDPI&F) and Dr Khanh's team have been working to address quality issues by testing new varieties introduced from Australia on research orchards in Moc Chau, and by introducing new management practices.

Introduced varieties, such as the peach cultivar Tropic Beauty, are proving to be well suited to the red ferralitic soils of Moc Chau. The trees are planted in long rows over a couple of hectares, and are well mulched, pruned and thinned to allow maximum air and sun. The ACIAR team, comprising Dr Alan George and Bob Nissen from QDPI&F, is evaluating new training and orchard-management systems suitable for Vietnamese conditions.

Simple techniques, such as the use of straw mulch to increase soil-moisture status and the application of non-toxic baits to control fruit fly, can greatly improve fruit quality and are relatively inexpensive to implement. The team is also evaluating new packaging and transport systems so that the fruit reaches markets without bruising or breakdown.

Results are promising. The nectarines and plums are larger, more colourful and sweeter than the traditional varieties. For these reasons and the fact that they ripen in April, well ahead of the regular varieties, they sell for much higher prices in the markets of Hanoi. People in the city will pay up to 20,000 dong (about A$1.50) for a kilogram. The traditional varieties fetch a fraction of that, about 1000 dong a kilo.

"When farmers hear about the difference in price they are very interested in growing the new varieties," Dr Khanh says. "We hold demonstration days where we teach them better management, such as pruning and fertilising. When they see the difference these new techniques and varieties make to the quality and volume of fruit growing on trees, they want to try them."

Getting produce quickly and efficiently to markets is also crucial. The recent improvement to the highway from Moc Chau to Hanoi has made a big difference to farmers. They are able to pick their fruit and load it onto trucks, which travel through the evening to the markets in the capital, where the fruit is quickly snapped up by local buyers.

With the fruit-growing season now extended from April through to the end of July and the higher prices being paid, the farmers of Moc Chau are able to increase their incomes and gradually improve their family circumstances.

"One of the first things they do with their extra income is put it towards a motorbike," Dr Khanh says. "Being able to travel around the area opens up a whole set of possibilities for families that weren't there before."

PARTNER COUNTRY: Vietnam
PROJECT: Soybean variety adaptation and improvement in Vietnam and Australia (CIM/1995/130)
DESCRIPTION: Vietnam aims to increase soybean production from 200,000 tonnes to a million tonnes a year by 2010. To help meet this target, Vietnamese and Australian scientists have been working together to breed new varieties with higher yield potential
CONTACT: Professor Bob Lawn, James Cook University, robert.lawn@jcu.edu.au

NEW VARIETIES LIFT SOYBEAN HOPES

Vietnam is aiming to produce a million tonnes of soybeans a year by 2010. An ACIAR project is helping to achieve the target

BY PROFESSOR BOB LAWN

Higher yields from improved varieties are helping Vietnam's soybean growers to start catching up with runaway demand for this highly valued source of cooking oil and livestock feed.

Soybeans are a high-quality source of vegetable oil for human consumption and their protein-rich meal is widely used in livestock feeds, especially pig and poultry production.

In Vietnam, rapidly rising demand for soybean products has outstripped supply in recent years. As local soybean varieties often have low yield, Vietnam can only meet 25% of domestic demand for soybeans, an issue the Vietnamese government is keen to address.

Soybeans rank third in Vietnam's priorities for crop research after rice and maize. The government's target is to increase soybean production from the current level of 200,000 tonnes to a million tonnes a year by 2010.

To help meet this target, Vietnamese and Australian scientists have been working together on an ACIAR project for the past six years, with good results. A new variety with higher yield potential has been made available to farmers and several others are in the breeding pipeline. Good progress has also been made in identifying key climatic constraints to production in Vietnamese environments and developing better production practices.

Key organisations involved in the project have been the Vietnamese Academy of Agricultural Science (VAAS), Hanoi Agricultural University (HAU), Thai Nguyen University (TNU), the Institute of Agricultural Science of South Vietnam (IAS) and, from Australia, James Cook University (JCU) and CSIRO Plant Industry. Collectively, scientists from these agencies tested over several years a wide range of varieties and breeding lines from the Australian breeding program, in different regions and growing seasons in Vietnam.

The project team at Ung Hoa.

While several lines performed well in particular regions or growing seasons, the best variety, line 95839, performed well under a wide range of conditions. Line 95839 has now been released by VAAS for commercial production as DT21 ('the soybean variety for the 21st century').

VAAS's Professor Tran Dinh Long says DT21 has shown excellent yield potential in the Red River Delta region, whether grown as a spring, summer or winter crop.

Although the average yield produced by local varieties is around one tonne a hectare, DT21 can produce 2.5 to 3 tonnes a hectare using 'best agronomic management practice' conditions, he says. "It shows particular promise for the spring season and as a winter variety in place of corn or where land is idle after rice crops."

DT21 has also performed well in the northern highland areas of Thai Nguyen where, according to Mr Tran Van Dien from Thai Nguyen University, soybeans are grown as a spring or summer crop.

"DT21 is slightly later maturing than local varieties, which our studies have shown helps increase yields," he says.

This variety also performed best in the southern Mekong Delta, where soybeans are grown as an irrigated crop in the dry season after rice. Mr Ha Huu Tien, from IAS, is increasing seed supplies in that region for local farmers.

However, even an excellent variety like DT21 has its limits. It was outperformed in the summer-cropped upland areas of the south, where soybean rust is endemic. In that situation another project variety, CM60, performed very well and seed is being multiplied by IAS for release to growers.

CM60, originally from Thailand, has been released by CSIRO for Queensland sugarcane areas as the variety YY, again as a result of the work from the project.

According to CSIRO's Dr Andrew James, DT21's wider adaptation and slightly longer duration is due to a trait that delays flowering under tropical conditions. "We introduced the long-juvenile gene into a large-seeded variety that originated in Vietnam," he says. "The local farmers prefer large-seeded varieties which, combined with the higher yields, explains why DT21 has been warmly welcomed by farmers in the seed-production cooperatives that have multiplied the seed for VAAS."

The ACIAR project formally ended in mid-2006, with a three-day training workshop at VAAS, attended by more than 40 national and provincial soybean experts from all over Vietnam. The focus was on the constraints imposed by weather conditions in the tropics, and how these could be overcome by breeding and by better production practices.

By understanding how weather conditions affect crop growth and yield in different regions and seasons, the Vietnamese scientists are better placed to build on the project and breed the next generation of varieties with even better yields than DT21. ◀

Bob Lawn is Professor of Tropical Crop Science, James Cook University, Townsville

A LESSON IN THE VALUE OF 'PROCESS'

A four-year project in Cambodia has demonstrated that getting the process right is vital to the success of agricultural research

BY CHRIS GREENWOOD

Dr Kep Coughlan knows about agricultural research. As team leader of the AusAID-funded Cambodian Agricultural Research and Development Institute Assistance Project (CARDI-AP) for nearly three years, he understands that getting the process right has been vital to developing the technical aspects of the research itself.

With the completion of the four-year project in August 2006, Dr Coughlan and his Australian and Cambodian team look back on achievements that have helped CARDI become an organisation that is delivering research results to extension staff and farmers, is responsive to national research needs and is proactive in seeking donor funds.

"When CARDI-AP began in 2002, the CARDI research program was shifting from an exclusive focus on rice production to a more diversified crops-research agenda," Dr Coughlan says. "It had a great team of researchers, but little experience in managing a modern research organisation with a diversified agenda.

A team delivering results: Dr Kep Coughlan and Cambodian colleagues.

BRAD COLLIS

"In the second phase of the project, we introduced five key projects: research planning, research extension, information management, business and marketing and on-farm testing of CARDI technologies."

Dr Coughlan points to successes in all project areas. For example, a comprehensive package of business and management tools has been implemented to help research planning and strategy.

The IT infrastructure at CARDI has been improved and a marketing program guides the preparation of targeted research proposals. This enhances its capacity to attract research funds from regional donors.

Gains in extension have also been improved when the process is managed as a project between research and extension staff. "We have got our researchers and extension people talking together, which will improve the potential application of research technologies on the ground," Dr Coughlan says. "We've also developed a series of technology implementation procedures (TIPs) to communicate research results and develop extension programs."

Another success has been the Cambodian Agricultural Research Fund (CARF), which is a sub-component of the CARDI-AP program and managed by ACIAR.

"This project has allowed smaller Cambodian research groups to secure research funds. It has been a capacity builder as well as facilitating grassroots extension activity. It has also helped build linkages between research and extension and NGOs."

The difficulty of implementing a research business model in a developing country such as Cambodia has not gone unrecognised. In August this year, Dr Coughlan and two of his CARDI-AP colleagues, Grahame Hunter and Mike Clarke, were presented with Cambodian Achievement Medals.

PARTNER COUNTRY: Cambodia
PROJECTS: ASEM/2003/007, CIM/199/048, CIM2003/030, ASEM/2000/109, ASEM/2003/012
DESCRIPTION: Cambodia's reliance on rice is being eased as new, more productive varieties are grown, freeing up land for alternative crops that allow farmers and villages to establish commercial enterprises
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Training for a competitive edge

BRAD COLLIS

BY WARREN PAGE

During the turmoil of the 1970s Cambodian scientific capacity was almost destroyed, leaving a void that has not properly been filled. A shortage of funds made it harder to re-establish an effective agricultural research sector.

In the late 1990s, when funding from foreign donors found its way into the Cambodian agricultural science sector, it was assumed that scientists were familiar with the competitive process of applying for grants. But for researchers like Meng Sokhon, applying for funding was a new and difficult experience. There was no shortage of ideas and research needs, but most scientists lacked experience in negotiating funding processes. This also presented a problem for donors trying to manage competitive grants in an environment that was unfamiliar with such systems.

Since then, Meng Sokhon and 41 colleagues have been the beneficiary of a unique training scheme that is lifting scientific capacity by helping local researchers access international funds.

To help local agricultural scientists develop the skills needed to secure funding and transform ideas into projects, AusAID and ACIAR launched the Cambodian Agricultural Research Fund (CARF) in 2002. The fund was established as a component of the AusAID-funded Cambodian Agricultural Research and Development Institute (CARDI) Assistance Project.

Open to government, university, college and NGO organisations based in Cambodia, CARF introduced a competitive research-funding environment and the training and support to go with it. Small research grants of up to US$30,000 were made available.

The difference between this and other funding schemes was that CARF was purposely designed to ▶

Researchers and staff work on crop trials at CARDI.

Developing new skills

Scientists from the following organisations have received funding:

- Cambodian Agricultural Research and Development Institute
- University of Tropical Agriculture
- Prek Leap School of Agriculture
- Royal University of Agriculture
- Maharishi Vedic University
- Kampong Cham National School of Agriculture
- Department of Animal Health and Production
- Department of Agronomy and Agricultural Land Improvement, Ministry of Agriculture, Fisheries and Forestry
- World Vision Cambodia
- University of Tropical Agriculture Foundation
- Union Aid Abroad – Australian People for Health, Education and Development Abroad

develop scientists' skills in negotiating the competitive research environment required by donors.

Initial training focused on writing scientific papers in English, followed by a second course on writing research proposals. Five single-day courses and one-on-one training introduced these concepts to more than 100 Cambodian scientists from a range of institutions, including CARDI, the Kampong Cham National School of Agriculture, the Royal College of Agriculture and the Prek Leap School of Agriculture.

Meng Sokhon from the Prek Leap School was one of the 23 applicants for funding in the first round, in July 2002. His application, along with the others, was judged by a panel of Cambodian and international agricultural development experts.

Proposals that addressed existing problems by emphasising agricultural diversification and involving multidisciplinary teams, particularly with socioeconomic, extension or farmer linkages, were ranked highest.

Meng Sokhon was successful with his proposal on the 'Improvement of maize management and production through farmer participatory research'. This focused on improving dry-season maize production by applying cultivation techniques that were new to farmers.

Traditional techniques did not produce sufficient yields to provide income, except in the best of seasons. Farmers were involved in the project, selecting, evaluating and adapting improved maize varieties and applying new cultivation techniques.

Since that first round of grants, 42 projects have been funded. Fourteen have involved CARDI scientists, with a further 19 projects shared across four educational institutions. Two government departments and four NGOs have shared nine projects between them.

Areas of research have included cattle and pig production, Newcastle disease, aquaculture and a range of crops and vegetables. Watermelon, banana, cassava, tomato, mango, dragon fruit, maize, soy and mungbeanhave all been subjects of funded projects, along with biological controls for diamondback moths and coconut beetles.

ACIAR will fund a further two rounds of applicants and projects, late in 2006 and again in 2007, along with funding for the completion of exisiting projects.

CAMBODIA BUILDS ON DIVERSIFIED EXPERTISE

BRAD COLLIS

Chilli has become a significant crop for many Cambodian farmers, who have diversified away from rice.

ACIAR's work is supporting Cambodia's efforts to reduce its dependence on rice

BY WARREN PAGE

After decades of upheaval, Cambodia is today building a new economy strengthened by an increasingly more diverse agriculture. The change is significant in a country where rice has been the centre of rural culture, not just its staple crop. Rice-banana cakes have been served at wedding ceremonies and special events for centuries. It was this relationship with rice that led to 90% of agricultural land (more than two million hectares) being devoted to the crop.

The almost total reliance on rice is being eased as new, more productive varieties are grown, freeing up land for alternative crops that allow farmers and villages to establish commercial enterprises.

In the late 1960s Cambodia's rice production was comparatively advanced and it was the first country in the region to achieve an export surplus. However, the civil war and complete economic collapse in the 1970s had a devastating impact on agricultural infrastructure and scientific expertise, cementing the dependence on rice even further. Impacts from that period are still being felt, with Cambodia one of the least developed countries in East Asia. By contrast, Thailand, Cambodia's neighbour, has seen rapid economic growth in the past decade. Cambodia's per capita GDP is estimated at US$300 a year, one-tenth of Thailand's.

Poverty is still endemic, especially in rural areas where 40% of people live below the poverty line, compared with 13% of urban residents.

Change, however, is happening. Cambodia has attained World Trade Organization (WTO) accession and it is reforming its economy. A key component of this change is diversifying agriculture to tap into non-rice markets, and this is where ACIAR-supported research has been playing an important role. ACIAR's work in Cambodia focuses on diversifying agriculture and improving rice yields. This includes boosting Cambodia's agricultural research capabilities.

PARTNER COUNTRY: Laos
PROJECT: Accelerating the impacts of participatory research and extension on shifting cultivation farming systems in Laos (ASEM/2001/107)
DESCRIPTION: Stepping away from the traditional role of government 'experts' and instead focusing on helping staff to facilitate farmer-to-farmer learning has boosted efforts to change livestock production from the traditional 'shifting cultivation' to a more fixed system of farming
CONTACT: Dr Joanne Millar, jmillar@csu.edu.au

LEARNING BY EXAMPLE

Farmers in Laos find learning from each other the best way to fast-track livestock production benefits

BY FIONA CONROY

Farmers in Laos are improving the profitability and sustainability of their farming systems by learning from other farmers who have already adopted new or innovative methods for livestock raising.

This was one of the key objectives of an ACIAR-funded project that stepped away from the traditional role of government 'experts' and instead focused on helping staff to facilitate farmer-to-farmer learning.

The ACIAR project team worked with the National Agriculture and Forestry Extension Service (NAFES) and the Forage and Livestock Systems Project (funded by AusAID and managed by CIAT Asia) over three years, assisting local extension staff develop ways to help farmers benefit from more intensive livestock production.

The project involved six Laotian national staff, two Australian staff from Charles Sturt University, one New Zealand researcher from Massey University, two Australians working with CIAT Asia and a total of four provincial and 26 district staff from the northern provinces of Xieng Khouang and Luang Prabang.

In just two years the number of farmers growing forage crops has more than doubled, from 600 farmers in 54 villages to 1400 farmers in 120 villages. The time taken for benefits to flow to farmers was halved. The key to this rapid increase in farmers changing their enterprise was a new approach to delivering information, known formally as 'decentralised participatory research and extension' (see right).

Researchers and extension staff with the Forage and Livestock Systems Project (FLSP) trialled and evaluated three extension methods—case studies, cross visits and 'champion farmer' visits—in 53 villages in 2004.

After several months, farmers and district staff were interviewed to gauge the effectiveness of each extension approach to farmer learning and early adoption. Visits to successful farmers in other villages (cross visits) proved to be the most popular and effective way of stimulating farmer interest in changing their practices.

Farmers could see first-hand how forages were being used; they could talk to the host farmer about livestock management and learn exactly what to do in a practical sense. This approach led to fewer mistakes in forage establishment and feeding methods, as well as livestock disease prevention.

The project coordinator in Laos, Viengxay Photakoun from NAFES, says: "I heard from a group of women from the village of Nong Kouay that went on a cross visit in Xieng Nguen in December 2006 that they had never gone to visit another village like this before, because in the past only the men went. When the men came back home they never talked to the women, or if they did talk about that, they saw it was not as clear as if women went to see for themselves."

While case studies improved overall awareness, farmers wanted more technical and practical information. Visits by a 'champion farmer' were more popular with farmers who could not or did not like to travel or did not like being in a group.

Through working with farmers in their districts, extension staff have developed a better understanding of how and why some farmers are able to modify their upland farming systems away from their reliance on shifting cultivation.

Project leader Dr Joanne Millar, a social scientist from Charles Sturt University, says extension staff are now more aware of the complex factors that either drive or hinder moves by upland farmers to change their production systems. "District staff were able to identify the pros and cons of each extension method and how each method could be useful at different times and in different situations," she says.

Dr Millar says the Laotian staff can now plan and monitor extension programs according to the preferences and circumstances of individual villages and farmer groups. ◀

JOANNE MILLAR

Extension officer Somvan Phommali discusses forage growth with farmers from Xieng Ngeun District.

Learning together: an extension officer makes a point to a Hmong upland farmer.

Village women hear from a farmer who went on a cross visit.

'Decentralised participatory research and extension' involves:

- establishing groups of interested farmers in each village
- trialling and evaluating forages and feeding methods
- developing case studies of innovative farmers in each district
- taking farmer groups to visit successful farmers in neighbouring villages, districts and provinces (cross visits) or vice versa (champion farmer visits)

ROUNDUP

BOARD TOUCHES BASE WITH MEKONG PARTNERS

During a recent visit to Thailand, Laos and Cambodia in late July, ACIAR's Board of Management met key research partners, senior government and Australian Embassy officials, NGOs and farmers. This was a valuable opportunity to discuss policy and also to examine the progress of field research in each country and to see farm-level adoption in action.

Each year the Board holds one meeting in a partner country. This allows the Board to promote ACIAR and its key relationships and also obtain a first-hand understanding of the agricultural research and development framework, policy directions and priorities of key partner countries. This was the Board's first visit to Laos and Cambodia and its second to Thailand.

The Board visited the ACIAR–World Vision project on low-cost aquaculture in north-east Thailand and was warmly welcomed by the Governor of Udon Thani province, government officials and local farmers. The project has introduced low-cost fish feeds based on locally available ingredients to aquaculture farmers in Udon Thani and Surin provinces. The Board saw first-hand the project's impact on food security and incomes of smallholder farmers and the strength of World Vision as a facilitator of community development.

In Laos the Board met with the Minister for Agriculture and Forestry and a range of senior officials and research providers. It was clear from discussions that ACIAR's strategic priorities (as outlined in the Annual Operating Plan) are regarded as well targeted: alternatives to shifting cultivation in upland areas and agricultural diversification to improve productivity of lowland farming systems.

The Cambodian leg of the program included discussions with high-level officials and research institutions and provided the opportunity to learn more about the Cambodian government's strategy for national development and agricultural priorities. Visits to research institutions highlighted the success of projects with partners including the Vegetable Research Station, the Cambodian Development Resource Institute, the Royal University of Agriculture and the Cambodian Agricultural Research and Development Institute (CARDI). The visit covered much of the Cambodian Agricultural Research Fund (CARF) project work and highlighted the capacity-building value of the recently expanded John Allwright Fellowship program.

The chair of ACIAR's Board of Management, Dr Meryl Williams, plants a tree outside the research facilities at the National Agricultural Research Centre (part of the National Agriculture and Forestry Research Institute) to mark the Board's visit to Laos.

Board members also met with two Australian Volunteers International (AVI) staff working at the Animal Health Laboratory in Vientiane, Laos, and at the small-scale fish-farming project at the Royal University of Agriculture in Cambodia. They saw the added benefits to project teams and often long-term commitment by AVI to the development program in the region.

Given the close operational links between ACIAR and the Crawford Fund, the Board was accompanied by the chair of the fund, the Hon. Neil Andrew. The Crawford Fund was able to identify a range of opportunities for establishing and enhancing extension work, and targeted areas for training and masterclasses.

Board members noted the importance of linking ACIAR work with donor project work in the Mekong region and complementing other larger donor programs. The visit will help future programs meet the needs and priorities of Mekong partner countries, in which agriculture is a significant proportion of both GDP and employment. ◀

(Below, left to right) ACIAR Board of Management chair Dr Meryl Williams and the Governor of Udon Thani province, Thailand, inspect the frogs reared by the ACIAR–World Vision aquaculture project.

EXPANSION OF THE JOHN ALLWRIGHT FELLOWSHIP SCHEME

In 2006–07 ACIAR, with co-investment from AusAID, will significantly increase the size of the John Allwright Fellowship scheme, with the aim of maintaining more than 60 active fellowships during the year. In the 2005–06 financial year, A$1.54 million was spent on the JAF scheme, with 57 active fellowships representing 14 countries.

During this time 13 fellows successfully completed their studies and 15 new candidates—from Fiji, India, Indonesia, Laos, Papua New Guinea, the Philippines, Samoa, Solomon Islands, Vanuatu and Vietnam—commenced at eight universities in Australia.

Fellowships in 2006–07 will be open to scientists and economists from Papua New Guinea, ACIAR's six Pacific island partners, East Timor, Indonesia, Vietnam, Cambodia, Laos, the Philippines, India, Bangladesh, Pakistan, western China and the Republic of South Africa. For information regarding the selection and application information visit www.aciar.gov.au.

ACIAR John Allwright postgraduate students visiting the then Parliamentary Secretary to the Minister for Foreign Affairs, the Hon. Bruce Billson MP, at Parliament House, Canberra, in December 2005.

John Allwright Fellowships are awarded to developing-country project scientists actively involved in an ACIAR project. The fellowships are undertaken at Australian universities for postgraduate diplomas, Masters or PhD training, and research topics are related to, but not part of, the existing ACIAR project. The fellowship scheme is designed to benefit both the individual awarded a place and the partner country institution involved in the ACIAR project.

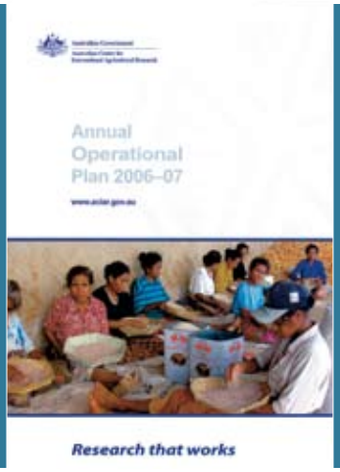
A meeting of new fellows held annually at ACIAR headquarters provides training in science communication, writing research papers and an opportunity for networking, while the John Allwright Alumni Association works to ensure fellows remain an important part of the ACIAR network. ◀

New Annual Operational Plan

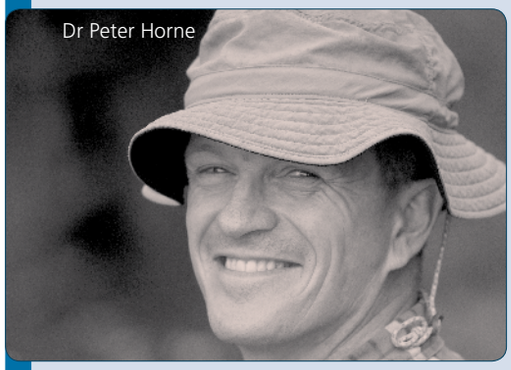
ACIAR's 2006–07 Annual Operational Plan (AOP) has been released and is now available on the ACIAR website. The AOP is our key communication document on operational issues with Australian and overseas partners and stakeholders. It provides transparency about our program and priorities at the country level, along with detailed project listings.

The AOP is a result of detailed consultations with partner countries; we like to think of it as the hard-copy 'roadmap' with all the nitty-gritty detail provided at www.aciar.gov.au. Hard copies can also be obtained from the ACIAR Communications Unit (email: comms@aciar.gov.au).

Two new appendixes have been added to the document this year: 'ACIAR's sectoral/industry strategies for 2006–07' and 'Cross-cutting issues to be addressed in 2006–07'. These new features were added in response to valuable feedback from our Australian stakeholders on the need to identify a clear statement of ACIAR's priorities in individual industry sectors (for example, tropical fruits) or cross-cutting issues (for example, biosecurity or agricultural policy).



ROUNDUP


Dr Peter Horne


Dr Rob Caudwell


Georgina Hickey


Catriona Murray

NEW APPOINTMENTS

Dr Peter Horne

Dr Peter Horne, an Australian citizen, has worked for 10 years as a team leader with the International Center for Tropical Agriculture and CSIRO, leading adaptive research for smallholder crop-livestock systems in South-East Asia. For most of this time he was working as an AusAID team leader, with significant experience in management and reporting roles. Prior to this he worked on a US Department of Agriculture field agricultural project in North Sumatra, and before that on an ACIAR project with the University of New England in southern China for four years. He has also worked recently as a consultant on animal health to the United Nations Food and Agriculture Organization (FAO) and to World Vision Australia. Peter will take up the position of manager of the Support for Market-Driven Adaptive Research (SMAR) subprogram of the Indonesian Smallholder Agribusiness Development Initiative, which is a major joint initiative of AusAID, the World Bank, International Finance Corporation and ACIAR. Peter will be based in Makassar, Sulawesi, where ACIAR will also establish a subprogram office.

Dr Rob Caudwell

Dr Rob Caudwell is a British national with a first-class honours degree in agriculture, a PhD in tropical agriculture and an MBA from the UK's Open University. He is currently agriculture sector senior adviser with the Danish International Development Agency (DANIDA) in Bangladesh, managing a US$7 million annual program encompassing research, institutional development and extension across a range of areas of crops, agribusiness and aquaculture. He has worked as a consultant in Sumatra and Java on estate crop and agribusiness research, development and extension involving private–public sector partnerships. He was also officer in charge of research stations for the Oil Palm Research Association in Papua New Guinea (establishing their pest-management programs), which involved managing three research stations and establishing workable management systems. Rob takes up the position of international institutional development adviser for the Support for Market-Driven Adaptive Research (SMAR) subprogram, and will be located within the Agency for Agricultural Research and Development facilities based in Bogor, West Java.

Georgina Hickey

Georgina Hickey joins ACIAR from the Australian Museum Publishing Unit where she was editor of *Nature Australia* magazine. Georgie holds a Bachelor of Science (Zoology and Mathematics) from the University of New South Wales. During her 22 years as editor, *Nature Australia* won 13 Whitley Awards for best zoological periodical and two Australian Heritage Awards for excellence in scientific publications. Georgie was awarded a Special Commendation from the Royal Zoological Society of NSW in recognition of outstanding services to the promotion of Australasian zoology. Georgie has edited a number of books, and developed and edited websites. She has taken up the position of publications manager at ACIAR.

Catriona Murray

Catriona Murray joins ACIAR as country manager for China, based in Beijing. Cat has a Bachelor of Environmental Design from the University of South Australia and a Diploma of Events Management from Flinders University. She has worked as industry liaison officer for the Agri-Food Industry Skills Council, as a senior project officer for the Queensland Department of Primary Industries and Fisheries and as managing director of Australian Certified Organic Pty Ltd. During the past 12 months Cat was a participant in the Australian Rural Leadership Program, sponsored by the Department of Agriculture, Fisheries and Forestry. She has a wide range of experience in international liaison with government and NGOs, project management, planning and administration.

NEW PROJECTS

ADP/2004/028	Social capital and rural development in eastern Indonesia
ADP/2004/032	Identification of policy responses to minimise negative socioeconomic impacts of an avian influenza epidemic in Indonesia
AH/2004/020	The development of a national surveillance system for classical swine fever, avian influenza and foot-and-mouth disease in Indonesia
AH/2004/040	The epidemiology, pathogenesis and control of highly pathogenic avian influenza in ducks in Indonesia and Vietnam
AH/2004/074	Large-scale production of a vaccine and diagnostic reagents for Jembrana disease in Indonesia
ASEM/2004/017	Assessment and improvement of quality management during postharvest processing and storage of coffee in Papua New Guinea
ASEM/2004/047	Sustainable management of coffee green scales in PNG
CP/2003/042	Fruit fly management in Papua New Guinea
CP/2004/048	Integrated disease management (IDM) for anthracnose, *Phytophthora* blight and whitefly transmitted geminiviruses in chilli pepper in Indonesia
CP/2004/064	Biological control of 'mile-a-minute' (*Mikania micrantha*) in Papua New Guinea and Fiji
CP/2004/071	Reducing pest and disease impact on yield in selected Papua New Guinea sweet potato production systems
CP/2005/136	Mitigating the threat of banana Fusarium wilt: understanding the agro-ecological distribution of pathogenic forms and developing disease management strategies
FIS/2004/065	Culture of promising indigenous fish species and bioremediation for barramundi aquaculture in northern Australia and Papua New Guinea
FIS/2005/096	Assessment of the impact of the Papua New Guinea purse seine fishery on tuna stocks, with special focus on the impact of fish aggregation devices (FADs)
FIS/2006/001	Increasing capacity for regional fish feed manufacture in Papua New Guinea
FST/2003/048	Management of fungal root rot in plantation acacias in Indonesia
FST/2004/055	Domestication and commercialisation of *Canarium indicum* in Papua New Guinea
FST/2004/058	Realising genetic gains in Indonesian and Australian plantations through water and nutrient management
HORT/2004/049	Improved farming systems for managing soil-borne pathogens of ginger in Fiji and Australia
HORT/2006/006	Development of an embryo culture manual and an embryo transplantation technique for coconut germplasm movement and seedling production of elite coconut types
LPS/2005/052	The development of cattle and buffalo breeding strategies and activities based on BREEDPLAN in Thailand
LWR/2004/069	Minimising agricultural pollution to enhance water quality in Laguna de Bay (the Philippines) and Mt Lofty Ranges (Australia)
SFS/2003/060	Implementation of rodent management in intensive irrigated rice production systems in Indonesia and Vietnam
SMCN/2006/045	Modelling minimum residue thresholds for soil conservation benefits in tropical, semi-arid cropping systems

NEW PUBLICATIONS

Monographs

AGRICULTURAL DEVELOPMENT AND LAND POLICY IN VIETNAM

Until 1980 most agricultural land in Vietnam was cooperatively used, with farm decisions being made by the central government. This system resulted in a fall in rice production below that needed to sustain the population, leading to serious food shortages. Since 1981, new policies to decollectivise agriculture have had considerable effect, with Vietnam now self-sufficient in rice and a large exporter. However, the impacts of these policies at the farm level have been little investigated. This monograph synthesises the results of an ACIAR-funded project that assessed the impact of Vietnam's new government policies on agricultural land use during the transformation to a market-based economy. In the process, the project also provided opportunities for Vietnamese researchers to develop their skills in agricultural policy research, formulation and analysis.

Sally P. Marsh, T. Gordon MacAulay and Pham Van Hung (eds). ACIAR Monograph 123, $24.00 GST inclusive (plus postage and handling).

Proceedings

AGRICULTURAL WATER MANAGEMENT IN CHINA

The papers in these proceedings bring together the results of research on agricultural water use arising from ACIAR-supported projects over the past decade. The research ranges in scale from studies made in farmers' fields through to consideration of water allocation in the entire Yellow River Basin, northern China. Originally presented at a workshop in Beijing in September 2005, the papers reinforce the need for improvement in agricultural water use in China. Studies have shown that reduced water use by agriculture is possible while simultaneously maintaining crop yields and maintaining farmers' incomes. However, adoption and implementation of research findings are still limited and require fundamental reform in terms of legislation, institutions and regulatory frameworks. Future research needs to steadily build the case for reforms, while equipping farmers and water resource managers with the means to respond to the reforms.

Ian R. Willett and Zhanyi Gao (eds). ACIAR Proceedings 123, $24.00 GST inclusive (plus postage and handling).

ACIAR'S VISION

ACIAR looks to a world where poverty has been reduced and the livelihoods of many improved through more productive and sustainable agriculture emerging from collaborative international research.

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.

(Front cover) A Cambodian villager threshes mungbeans in a seed multiplication project, associated with ACIAR-supported crop diversification work under Dr Bob Martin from the NSW Department of Primary Industries. (Back cover) A pineapple grower prepares to drop anchor at the floating market in My Tho City, an illustration of the flourishing agricultural diversity in South Vietnam's Mekong Delta.

PHOTOS BY BRAD COLLIS