Australian Government
Australian Centre for
International Agricultural Research

# Sharing the load in China

# PARTNERS

## IN RESEARCH FOR DEVELOPMENT

**ACIAR and China**

ACIAR has been working on agricultural R&D in China for more than 20 years, and the partnership continues to be of major importance

**Keeping trade free – of pests**

ACIAR is helping developing country partners meet the quarantine requirements of WTO accession and global trade

**After the tsunami**

ACIAR extends a helping hand to Indonesian communities devastated by the tsunami

# Making a genuine difference

Managing change is an essential part of making a difference in the lives of smallholder farmers. Whether the changes are planned or unplanned, caused by nature's upheavals or human interventions, the challenge for ACIAR remains the same: how best can we work with our partner countries to reduce poverty and improve livelihoods of poor farmers?

China has been an ACIAR partner country since 1984. As China has grown and changed, the nature of the collaborative program has changed.

Earlier collaborative research with China covered most areas of agriculture and forestry, and involved institutions across the country.

Today ACIAR's program with China is strongly focused on better management of water, land and forest resources in the poorer regions of north-western and south-western China.

The pattern of investment has changed too, with Chinese institutions now able to contribute more of the total research costs.

Over the years, ACIAR has negotiated similar changes with several partner countries as their economies have grown – first with Malaysia, then more recently with Thailand.

Another change for ACIAR is a greater emphasis on supporting projects aimed at promoting adoption of the results of earlier work (see page 26).

ACIAR recognises that this shift will mean involving new partners – partners such as NGOs and other organisations with special skills in working with communities to help them adapt and adopt new technologies and approaches.

ACIAR also has a unique role to play in helping partner countries deal with the changes that follow conflict and natural disaster.

The tragic Indian Ocean tsunami is the most recent and devastating example. ACIAR will work with Indonesian institutions on specific aspects of restoring agriculture and fisheries productivity in northern Sumatra and Aceh. More information is on page 24.


# 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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# China and ACIAR – a constant in times of change

Terraced crops at Dingxi in western China: growing demand for produce has put stress on water resources as well as on productive lands.

The pace of change in China over the past two decades has been rapid. One constant throughout that period has been the partnership in agricultural R&D between China and ACIAR. When ACIAR first began working with Chinese researchers in 1984, China was isolated from much of the rest of the world. During the late 1980s and 1990s the Middle Kingdom began to engage on a global level, economically and socially. Today China is a full member of the World Trade Organization and economically a global giant.

Over the past 20 years the China–ACIAR partnership has included research on the selection of Australian trees suited to Chinese forestry, studies of livestock production and diseases, and the adoption of new agricultural management practices for land and water resources. Adoption of conservation tillage in some central western provinces has been encouraged to help reduce wind-blown dust in Beijing, as well as to improve crop productivity.

Geographically, the focus of ACIAR's program has now shifted towards western China, including the Tibet Autonomous Region, in line with the poverty-reduction emphasis of Australia's international development cooperation policy. This shift recognises the extensive economic growth that has already taken place in eastern China.

Smallholder farmers in western China are among the poorest in the country. Their incomes can be raised through increases in productivity, derived from improvements to the quality of crops, livestock and forestry. The need for this productivity improvement to be sustainable and to ensure past increases in productivity remain sustainable is central to ACIAR's research in China. Agricultural practices and growing demand for produce have put stress on water resources as well as on productive lands.

Policy and technical interventions are now targeting improved management of these resources and agricultural and forestry environments. This includes more effective allocation and management of irrigation.

ACIAR's past program has played a role in building agricultural research capacity in institutions across the country. In addition to the training opportunities provided within projects, Chinese researchers were amongst the first to benefit from ACIAR's John Allwright Fellowship scheme for postgraduate study in Australia. Today the focus for capacity-building activities has also shifted westwards, with the award of a fellowship to a researcher from the Tibet Autonomous Region.

Australia and China recognise the mutual benefits of continuing close technical cooperation. As the human and financial resources of China's national agricultural research system have improved, Chinese institutions are now able to contribute more of the costs of new research and development activities. And ACIAR can help to build links with other funding sources, both Australian and Chinese.

The nature of the ACIAR–China relationship is changing. The partnership continues to be one of major importance for ACIAR, expected to deliver benefits to both countries for many years to come.

# Getting the best from eucalypt plantations

## It needed some top-quality Australian research to get eucalypt plantations accepted in Asian countries, reports **Janet Lawrence**

It is hard to imagine eucalyptus trees as the cause of widespread outrage. But back in the 1990s communities in south India and north-east Thailand rose in protest at the establishment of eucalypt plantations in their regions. Part of the reason for this protest was their conviction that eucalypts were thirsty trees that sucked all the moisture from the soil, to the detriment of their crops planted nearby.

When such rumours abound, they can circulate quickly. This was so in southern China at that time, where eucalypt plantations had become a major source of hardwood pulp and timber products. About a million hectares had already been planted, and the area continued to grow by about 10 percent a year. But alarm bells were ringing, because the plantations appeared to deplete the groundwater needed for dry-season irrigation of rice and sugar cane, and also to increase soil erosion.

However, the Chinese forest scientists knew little about how much water the trees were using, or even how to ascertain the water balance of eucalypt plantations. Once armed with this knowledge, the scientists still needed to determine the effects of silvicultural choices – including site preparation, tree spacing and rotation length – on plantation water balance.

### Time for action

In this environment an ACIAR-funded project began late in 1996, to address problems of excessive water use. It also focused on plantation growth because, despite the introduction of more suitable tree varieties and selective tree breeding, the productivity of these plantations appeared to fall after two or more successive tree crops. There was also evidence of a decline in soil fertility at the sites.

Practices such as removing litter and understorey vegetation, and harvesting the root systems along with the rest of the tree, were thought to be the main causes of the decline.

The Australian research organisations – the Victorian Government's Centre for Forest Tree Technology, the University of Melbourne's Institute of Land and Food Resources and CSIRO Land and Water in Canberra – teamed up with China's Research Institute for Tropical Forestry, the South China Institute of Botany and the China Eucalypt Research Centre.

The Australian project leader, Dr Jim Morris from the Centre for Forest Tree Technology, brought his 20 years of research experience in the physiology and ecology of forest trees in both natural and plantation environments. He had already collaborated in another ACIAR project that introduced technologies to assess water uptake and to trace water movement through plantations in Pakistan and Thailand.

"When I first began to measure tree water-use early in my career it was a cumbersome and rather inaccurate business," says Dr Morris. "The development of the heat pulse method for measuring water use changed all that. In the course of this project we introduced the method to the Chinese scientists, who now have the skills to carry out the measurements themselves."

### Predicting regional impacts

Modelling is an excellent means of interpolating data collected at a small number of sites over a few years into conclusions for regional impacts of plantations over longer periods.

Chinese and Australian collaborators worked together on a previously published mathematical model (3PG) that enabled prediction of water use in plantations in relation to growth and site management. Their joint efforts led to further development of the model, which they now refer to as ThreePG+. It is now fully functional with user interfaces in both English and Chinese. Dr Morris describes the outcome of this phase of the project as a "raging success".

The project also aimed to develop and apply a large catchment model in the Leizhou Peninsula and also in Victoria. By studying

how water moves through the landscape the effects on water flow of changes such as the introduction of plantations can be assessed.

In practice, the work did not make the progress anticipated across the whole Leizhou region, so the scientists scaled down their efforts and targeted a small sub-catchment of the Upper Nandu River for modelling using Topog, an existing hydrological model.

The project team obtained high-resolution satellite imagery of the central Leizhou Peninsula as a basis for mapping land use and relating the small catchment behaviour to the regional landscape. The experimental area and surrounding plantations comprise a suitable location for future research into management for maintenance of plantation productivity.

In Victoria, the newly developed large catchment model has been successfully applied and the work continues beyond the life of the project. The model is sensitive to the elements of plantation establishment and management and also to the position of a plantation within a catchment. It will provide answers to questions such as: "If I place a plantation in this region, what will be the effects on stream flow in the catchment?" This larger-scale catchment hydrological model, developed in Australia, also has application in the Upper Nandu catchment, to interpolate the small catchment observations of groundwater depth and the distribution of plantations.

## Putting people first

As was the case in India and Thailand, recommendations for changes in forest management may impact on people. Many on the Leizhou Peninsula depend on the plantations for employment or as a source of forest products. Recognising this, the project team gave a high priority to surveying the socio-economic importance of plantations to place the analysis of the modelled results in an economic context. Benefit-cost data collected through surveys and interviews helped ease concerns.

The project teams held workshops where they sought the views of plantation managers, farmers and research workers on their best options for improving productivity and sustainability of plantations. Since the workshops, the scientists have undertaken biophysical and economic modelling that incorporate these options, leading to forest management recommendations that take into account implications for both plantation water-use and productivity.

"Our research provided strong evidence that plantations on the Leizhou Peninsula do not cause excessive lowering of water tables, and have a relatively modest annual water uptake in this humid tropical environment," Dr Morris says. "The modelling work has made it possible to predict how plantation water-use will change in response to management alternatives implemented to improve productivity and sustainability.

"Economic analysis of the model outputs has identified the likely long-term profitability of the alternatives."

The project emphasised the value of technology transfer, and the Australian scientists actively assisted nine of their Chinese colleagues to find short-term placements in suitable Australian research institutes. Back home in southern China, they have built a strong base for policy development, and have greater capacity to identify the actions needed to maintain and improve the productivity of eucalypt plantations.

# Research pays off for China's eucalypt plantations

ACIAR's investment in China's eucalypt plantation industry is reaping a handsome return, according to a recently published independent economic assessment.

The author of the assessment, Martin van Beuren, from the Australian-based Centre for International Economics, concluded that a suite of seven ACIAR-funded projects spanning 20 years had played a central role in creating today's plantation industry.

He believes the A$12 million (A$18m at today's value) investment in ACIAR projects since 1985 played a central role in developing the industry in China. ACIAR's investment accounts for around 78 percent of the total research undertaken, stretching back to the AusAID funded China–Australia Afforestation project of 1981.The total research investment, from all donors including the A$12m from seven ACIAR projects, is expected to generate a net present value of A$1.3 billion over the 30-year period from 1985 to 2015. This is a benefit:cost ratio of 57:1.

China has been working to expand the area under eucalypt plantations since 1981, but the trees used performed poorly. Australian forest scientists realised that, with help, the Chinese could grow much better-yielding eucalypts – by choosing varieties better suited to the conditions and adopting better cultivation techniques.

Thus in 1985 ACIAR funded the first projects to help develop China's eucalypt plantation industry. Since then, ACIAR research has introduced more than 100 eucalypt species (and countless variants of each species) for selection trials, resulting in a valuable genetic base from which the Chinese foresters can now choose varieties suited to specific purposes.

Other ACIAR projects have studied cultivation techniques, how to match tree species to the most suitable sites, tree nutrition (including the introduction of beneficial root fungi that aid nutrition) and water management.

The eucalypt plantation industry in China is now expanding rapidly. Over the past three years about 88,000 hectares have been planted annually, giving an area of 1.5 million hectares under eucalypts – about twice that of Australia. China's trees are yielding on average 20 cubic metres of wood per hectare annually – triple the yield of the species grown in 1985.

All this expansion has coincided with a series of beneficial policy reforms in the forestry sector, along with a booming domestic economy. Other countries are now investing in China's plantations, paper mills and fibreboard factories.

Determining stem weight of a harvested eucalypt as part of a comprehensive tree biomass assessment.

Previous page: plantations on higher ground surrounding agriculture in narrow valleys, may be expected to influence water supply from surface run-off and shallow groundwater.

The research has also brought benefit to rural people in southern China. They are growing eucalypts as a cash crop or participating in the income-generating activities spawned by this thriving industry.

Lucerne is cut and carried back to animals in feedlots. A typical farm may have three to five sheep, three pigs and sometimes cattle or a donkey for draught power. Animal production is important to local farmers for generating cash flow and the government is seeking ways to encourage livestock production. Lucerne can also play a valuable role in protecting soil resources when grown in rotation with crops.

BILL BELLOTTI

# Production, new skills and a sustainable HOPE IN GANSU

## Two projects are helping farmers from one of China's poorest regions get more from their soils, reports **Janet Lawrence**

Farmers in the Loess Plateau in the eastern part of China's Gansu Province grow wheat on tiny farms – only about 1.5 hectares. Their harvest goes into a storeroom, and that room basically feeds the family until the next harvest. There is not much of a surplus of anything, and farm families subsist on the equivalent of A$500 per year, mostly generated by raising a few sheep or pigs.

The traditional practices of subsistence farming have not adapted to loess soil, which is very prone to erosion. The Loess Plateau is a unique combination of soil type, slope and rainfall intensity. Practices of deep tillage and leaving the land under bare-fallow for the three months between harvest and crop planting have contributed to some of the worst soil erosion in the world. The high rate of erosion is the major cause of the heavy sedimentation that gives the Yellow River its unique colour, and name.

Believing that changes to these traditional practices could reduce erosion, two Australian research groups independently approached ACIAR in 1999. Each offered skills that could help the Loess Plateau's poor farmers become more productive and profitable, and increase long-term sustainability, by changing farming practices.

The University of Adelaide specialises in dryland (rain-fed) farming rotations between pastures and crops and the implications of soil water and nitrogen; New South Wales Department of Primary Industries has expertise in conservation tillage. The two groups had never worked together, but their complementary skills were ideal for combining into a single ACIAR project to benefit Gansu farmers.

Dr Bill Bellotti, from the University of Adelaide, became leader of the project, which began in 2000. The Chinese collaborators were from the Gansu Grassland Ecological Research Institute (which later merged with Lanzhou University) and the Gansu Agricultural University. The Agricultural Production Systems Research Unit of CSIRO's Sustainable Ecosystems Division also contributed its skills in modelling farming systems and their components.

### Reducing erosion and lifting soil fertility

The project team believed that improved tillage and cropping sys-

Ms Li Lingling, a lecturer from Gansu Agricultural University, and Ms Sharna Nolan, an Australian Youth Ambassador for Development from the University of Adelaide, interview farmers on their attitudes towards adopting new technology.

Far left: Erosion on the Loess Plateau.

tems could reduce erosion, raise fertility and increase economic returns for wheat-based cropping. Two regions in Gansu were selected to test this. Trials were established at Dingxi, with 400 millimetres average annual rainfall and colder winters that permit only spring wheat, and further east, Xifeng with 560mm rainfall and warmer winters, allowing growth of winter wheat.

At the two sites the project team introduced conservation tillage, sowing new crops into the stubble left behind from the previous crop. This proven method of reducing soil erosion, while maintaining or increasing crop productivity, contradicted traditional deep ploughing. And because there is no need to plough, the method also reduces the physical effort need to establish crops and saves on fuel for tractors.

The team also looked to replace the three-month summer fallow with short-season legume crops such as soy beans, and to develop rotations around perennial forage crops such as lucerne. Replacing the fallow with a legume crop retains cover, gives an extra crop to harvest and provides nitrogen for the next crop. The practices had the potential to reduce erosion and increase whole-rotation productivity.

The Australians also established project sites at Wagga Wagga in New South Wales and Roseworthy in South Australia. In NSW, some farmers using conservation tillage complained of poor crop vigour, and the project scientists set out to discover the reason. One contributing factor was thought to be the changed spectrum of disease organisms that can develop in response to changes in tillage and stubble management. Trials to date have not provided any leads to explain the loss in crop vigour.

In South Australia, there was strong interest in the use of lucerne in cropping systems. Developments in system simulation using the Agricultural Production Systems Simulator (APSIM) provided an invaluable tool for analysis and interpretation of rotation experiments and rotations practised on-farm.

## New approach to management

In China new ideas of management – integrating various factors to understand the system as a whole – have been informative for all scientists, extensionists and farmers. The Australian scientists introduced systems simulation modelling, using APSIM to evaluate current and 'novel' cropping systems being proposed to combat soil water erosion in the region.

The application of APSIM is dependent on its ability to accurately predict development and growth of different crops in the regions outside those in which they were developed. For instance, the APSIM lucerne module had been tested in Australia and New Zealand. But it required testing in the conditions of the two project sites before it could be used as a tool to evaluate relevant cropping systems and quantify risk associated with changing from traditional to new farming systems.

Dr Bellotti says: "The project has now completed its first four years, and after a positive review it received an extension to continue until the end of 2006. We have been really impressed with our Chinese partners. Together we have made good progress.

"All collaborators now have a much better understanding of the key processes – rainfall variability and fluctuations in plant-available soil water, and their effects on pasture/crop production and profit – operating in the Dingxi and Xifeng areas.

"APSIM proved itself once more as a valuable tool to integrate data gathered from different sources. The Chinese scientists grasped the usefulness of APSIM when they witnessed it in use, developing a framework to interpret data and predict various courses of action under differing environmental conditions.

"We now understand productivity of lucerne in this environment, its effect on soil water and on the wheat crop following the lucerne. We are addressing the issues of water/nitrogen dynamics and their effects on crop selection.

"We have undertaken an appraisal of conservation tillage, and while the project had not intended to progress so quickly to on-farm trials, the farmers came to us when they saw what we were achieving and wanted to get involved. There are now side-by-side demonstrations of conventional versus new practice on the farms."

## Success with new practices

Some farmers have already shown that they can maintain and even increase crop yield with no tillage and complete retention of stubble. The Chinese farmers traditionally practised several runs of deep ploughing and removal of all stubble (which they completely put to use). So there was an opportunity cost of leaving stubble in the field.

In terms of yield, the conservation tillage compared favourably with traditional practice. Findings from this research will be valuable for local extension agencies as the central Chinese government embarks on an ambitious program to expand the area of crops grown under conservation tillage.

In the final two years of the project, scientists are targeting on-farm research. The project team wants to observe how farmers adapt the new practices to their situation. In December 2004, Australian team members conducted a workshop to discuss the principles of on-farm research with the Chinese scientists, for whom the concept of partnering with the farmers was quite new.

The presence of two Australian Youth Ambassadors for Development (graduates from Adelaide and Melbourne) will boost this on-farm adaptive research. They will work alongside the farmers for nine months in 2005.

Below: The farmer on the right is Mr Feng Jun, who approached the project team after seeing their experimental work and has now conducted on-farm research into conservation tillage. He is convinced that the new system has advantages in terms of less labour and higher yield.

BILL BELLOTTI

# USING FORESTS TO SAVE THE SOIL

## Soil erosion on sloping croplands gives the Yellow River its colour but threatens farmers' livelihoods. **Fiona Perry** reports

Two ACIAR projects under way in the Yellow River Basin in China's north-west are tackling land and water resource degradation that is threatening the social, economic and ecological sustainability of the region.

In the first project, Australian National University Professor Jeff Bennett is working in partnership with the China National Forestry Economics and Development Research Centre to evaluate the effectiveness of the Grain for Green (GFG) program, which encourages farmers to convert steep cropland into forest and perennial grasslands.

The practice of planting annual crops and grazing livestock on deforested lands with a slope of more than 25 degrees has led to accelerated rates of soil erosion in China, particularly in the Yellow River Basin.

The Chinese Government established the GFG program in 1999 on a pilot basis in Shaanxi, Sichuan and Gansu provinces, to help bring soil erosion and consequent problems – such as sandstorms and frequent flooding – under control. When the program was formally launched in 2002, its scope was extended to include 25 provinces and autonomous regions. It has involved more than 100,000 villages, more than 15 million farmer households and more than 60 million people. It is the biggest participatory forestry development program in China.

Under the program, farmers who volunteer to convert existing cropland into grassland or forests are paid in grain and cash. The duration of the payments depends on the type of conversion made: farmers who plant trees for ecological protection purposes (and at a higher density than commercial plantings) receive payments for longer than farmers who convert cropland to grassland, or who turn cropland into forest using commercial species of trees. Farmers are also encouraged to reforest areas that are not currently agriculturally productive but suitable for growing trees.

Disappearing soils: erosion in the Yellow River.

Professor Bennett says that in the first stage of the research – an investigation of the financial impacts of the program on farmers in the Ansai, Binxian, Gonghe and Minhe counties – preliminary data obtained in a household survey of participating farmers showed they were "financially much better off" through the program, both through the subsidies gained for conversion activity and because the new forest crops and grasslands represented long-term, more profitable income streams. In addition, previously barren lands are being brought into productive use, increasing crop yields and farmers' incomes, and tree crops are protecting existing crops, effectively forming buffer zones around them, he says.

Researchers will next undertake a social cost-benefit analysis of the program to investigate its impact on greater social wellbeing. This will involve estimating the 'off-site' environmental and social benefits (such as better air and water quality in 'converted' areas, as well as in distant cities such as Xi'an and Beijing) in an effort to determine the natural resource management outcomes preferred by the broader community and the price it would be willing to pay for them.

Using information obtained in the first two stages of the project, researchers will assess the policy mix and suggest alternative policy strategies, using a technique called Institutional Economics Analysis. For example, Professor Bennett says that at this stage it seems the Chinese Government could have adopted a more strategic approach, with some parts of northern China needing more funding than others.

Professor Bennett says the collaboration with the China National Forestry Economics and Development Research Centre is important on many levels, including providing a good avenue into government decision-making with the aim of making the research a policy reality.

The second ACIAR project is aiming to increase the productivity and sustainability of water use in Yellow River Basin irrigation systems by establishing equitable institutional arrangements, including water trading, that promote more efficient water allocation and management, as well as maintaining social cohesion.

Northern China is an important agricultural region and the site for much of the country's industrial production, but has a much lower per capita water endowment than in the south. There is rapidly increasing demand for water but an increasingly precarious supply, due in part to serious and growing water pollution, water misallocation and deteriorating irrigation systems.

In signing up to the World Trade Organization, China has relinquished trade barriers, putting pressure on farmers to lift productivity. The success of this endeavour demands that water be used most efficiently, on the right crops, in the right amounts and at the right time.

With China's move to a more market-oriented economy, farmers now have more freedom and significant opportunities to cultivate less intensive, horticultural crops that generate higher returns, such as sunflowers and vegetables.

Establishing an integrated water allocation system that is more flexible and responsive to these new developments, as well as being ecologically sustainable, has therefore become a priority.

Dr Stephen Beare, chief economist at the Australian Bureau of Agricultural and Resource Economics (ABARE) in Canberra, is working with the Centre for Chinese Agricultural Policy and the International Water Management Institute to develop a simulation model to evaluate the economic impact of alternative water trading and other allocation policies in the basin. This will enable the research team to provide recommendations on more effective water trading arrangements between villages and sectors, as well as policy tools to aid the sustainable management of water resources.

Dr Beare says the project is progressing well, with two additional resources – the Economic Research Service of the US Department of Agriculture and Professor Scott Rozelle from the University of California – agreeing to collaborate on the project. With their assistance, the first stage of the project has been completed.

Researchers have put together the most comprehensive data ever collected on the hydrological, physical, agronomic and socio-economic conditions existing in the Yellow River Basin. The international research partners have signed two memorandums of understanding with the Chinese Ministry for Water Resources, giving the project important backing at a political level.

Researchers will estimate the economic productivity of water uses by sector for different regions of the basin and a preliminary simulation model will be completed in May. Policy recommendations will follow in June.

Dr Beare says the project will provide the tools to evaluate policy options, and identify practical targets and opportunities to reallocate water with the aim of promoting economic, environmental and social sustainability in the region.

# Time for change at the top

## Tibet is on the highest plateau in the world but its people have some of the lowest incomes. Developing a dairy industry may help narrow the gap, reports **Rebecca Thyer**

Steeped in tradition: a dairy farm among the peaks of Tibet.

On the roof of the world, demand for dairy products such as milk, cheese, yoghurt and butter is increasing at a rate of 20 percent each year. To meet Tibet's growing demand, dairy goods such as butter are being imported. Meeting this demand domestically could not only help Tibet's farming communities increase and diversify their income, but could also lead to significant export opportunities to other parts of China.

At an average of 4875 metres (more than 16,000 feet) above sea level, Tibet is on the highest plateau in the world. However its people survive on the lowest incomes in Asia, with most relying on subsistence farming.

And like many customs in Tibet, agricultural practices are steeped in tradition. Generally, there is little research devoted to agriculture and limited scope to adapt to rapidly changing lifestyle expectations, production goals and market opportunities.

However, by updating farming practices and assisting Tibet's agricultural and animal scientists, three ACIAR-supported projects aim to move the region from a subsistence-based agricultural structure to one where farmers not only meet domestic demands but also have the potential to market their products elsewhere in China.

The projects – increasing milk production, intensifying grain and fodder production and improving rodent control (see facing page) – are different in approach but share the same goal of improving agricultural practices and therefore communities' wealth.

In collaboration with the Tibet Academy of Agricultural and Animal Sciences and the Tibet Livestock Research Institute, ACIAR's 'Increasing milk production from cattle' project is looking at cow nutrition.

The project leader, Dr Alan Kaiser from the NSW Department of Primary Industries, says cow nutrition is a key issue to resolve: "Poor cow nutrition is currently the major constraint to increased production.

"So, developing better feed systems (and an annual feed calendar), utilising crop residues, forages and by-products, will substantially improve nutrition and milk production – creating conditions for establishing a specialist dairy sector in Tibet."

In a linked project, 'Intensifying production of grain and fodder in Central Tibet farming systems', Professor David Coventry from the University of Adelaide is exploring ways to improve feed systems for all livestock, not just dairy cows, as this is integral to improving agricultural production.

He says that while cropping in central Tibet's river valleys provides sufficient produce for human needs, there is little excess for use as fodder. But there is scope to intensify production during Tibet's limited, but productive, growing season.

Professor Coventry says improving animal feedstock is important in alleviating poverty, as animals provide a significant income source. "Most farmers produce enough grain for their own needs. If they can produce more, they can improve animal productivity and therefore get a disposable income. This extra money can also be put back into the land, allowing them to purchase things like fertiliser and increasingly improve production rates."

Dr Kaiser agrees: "Feed is the most limiting factor for milk production." As little milk is produced on the hills, his team is looking at developing an industry on the valley floors, where milk production can be integrated with crop production. "Our starting point is to examine the link between feed inputs and milk production on 100 smallholdings spread through the valleys of central Tibet," he says.

Currently farmers undertake a 'cut-and-carry' operation, where cows are mostly tethered and food is brought to them. There is limited grazing. Dr Kaiser's team is looking at making use of more land for dairy production, producing forage crops that can be preserved and examining the use of crop residues and by-products.

"But we are also considering grain," he says. "Grain prices are low relative to milk prices, so it could be economical for dairy farmers to use grain supplements to improve energy intake. Our starting point is to develop a feeding system appropriate for Tibet that can be further refined as a specialist dairy sector develops. It is about developing a milk production system for the future, but also satisfying the immediate need. The project will improve the productivity of the farmer, providing better incomes, and more milk will be available for local markets and for improving human nutrition."

Currently, there are very few specialist Tibetan dairy producers, he Dr Kaiser, and the government is aiming to develop a farming sector that specialises in milk production. To emphasise the clear link between feed and milk production and to encourage the adoption of better feeding practices by farmers, the first part of the three-year project is being conducted on farms.

"This participatory approach will have real benefits for farmers," he says. "They won't only have to rely on research results. Instead, they can see the tangible benefits from better cow nutrition under typical farming conditions. As a result it is more likely that the technology will be adopted by the farming community."

Professor Coventry also believes it is vital to involve local researchers and farmers. "The first phase of our project involves building human capacity. Last year, three young scientists were involved in the project, which helped build their language and research skills, and they created an 'on-farm' research plan. This year two new scientists, who are already in Adelaide, will look at building on this plan."

He says it is important that Australian researchers not only create a dialogue with their Tibetan counterparts, but that they also build up a relationship with the farmers.

"In developing Tibetan research capacity, it can't be in isolation from the farmers, and for that reason we need to train ethnic Tibetans, so they can converse easily with the farmers."

It is also important that Tibetan researchers follow a farming systems approach.

"It's not hard to get the researchers thinking about new things, but taking them beyond that is. Many of them have never done on-farm research with key measurements before," Professor Coventry says.

His visits to Tibet are timed strategically to coincide with winter and spring sowing. "Winter crops of wheat and barley are sown in October, while short-session spring crops of wheat, barley, pulses or corn are sown in April."

Weed management, tillage and varietal choice are areas that have been identified for improvement. "It all sounds simple, but the culture and tradition of farming makes change difficult."

Professor Coventry says making any changes, such as updating varietal choice, needs to be done with consideration for the whole package. "If we update a variety but then do little with weed control, the change will make little difference."

Likewise, both project leaders stress that transferring knowledge to emerging agricultural scientists and working with farmers to show tangible benefits will be essential in further developing Tibetan agriculture.

## Controlling the pika without poison

Scurrying around in the Tibetan grasslands is the native plateau pika, a small, furry mammal related to rabbits and hares that is often blamed for the degradation of the grasslands, the major component in livestock diets. These small creatures compete with livestock for food and can spread disease. Improving their management is vital if Tibet is to improve its rates of agricultural production. Until now, Tibetan farmers used non-specific toxins to control these animals, but these methods can also harm other mammals in the grasslands.

Under the ACIAR project *Improved management of small mammals in Tibetan grasslands*, techniques are being developed to improve the efficiency of rodent control.

The project's leader, Dr Roger Pech from CSIRO Sustainable Ecosystems, says: "Grasslands are used for livestock grazing, and because of the huge increase in the number of livestock between the 1950s and 1970s, grass is now less than one centimetre high in most places."

These changes have resulted in conditions that favour small mammals; pikas are usually found in short grass. "The big increase in livestock numbers has changed the landscape, so problems with small mammals are occurring more often than they used to. And Tibetan reaction has been to treat the symptom and not the cause," he says. "In this case they poison the pikas, but this doesn't address what's changing the landscape.

"Although the project's most direct outcome will be advice on better control, our ultimate aim is to improve the grasslands for production. We want to come up with an ecological way of managing the pest to allow farmers to run productive livestock."

Dr Pech says that Tibetan farmers currently spend a lot of money on control, but research is needed to establish if this is effective.

"We also need to address whether grasslands can be looked after better to stop problems arising as they currently do."

Dr Pech says work carried out with two Tibetan scientists and their colleague from Qinghai showed there was little difference between pika numbers in untreated areas and areas with recent control – so current control programs appear to have limited impact. And current methods for conserving grass for livestock, by fencing areas to let them grow, are benefiting pikas.

"We expected to find that areas that are grazed all year and have shorter grass would have more pikas. But we didn't find this at all. We found that areas that were fenced in the summer to conserve forage for winter had more pikas."

Dr Pech says that farmers may need to move to a system of longer grass and fewer animals before there is a shift in pika numbers. "It may be better to have fewer, but healthier animals."

However, social changes are also having an impact on the region and researchers are mindful of the effects they may have on the agricultural industry. For example, the system of land tenure is changing so that more property is privately owned and therefore fenced. "We want to show people what effects fencing will have – it's important knowledge for them. So we are also looking at fenced versus unfenced areas and whether this can change the management of the land."

Dr Pech says more people are also embracing town life. "Changes in land tenure make people more sedentary and therefore cause changes in the landscape. Nomadic systems have evolved for a reason and fencing, through privatisation, makes a nomadic lifestyle impossible."

# Making melons more marketable

## New technologies are boosting western China's melon industry

The harsh desert environment of western China, where it may rain only once every few years, is the setting for an ACIAR project to help develop the melon industry. With water in short supply, farmers use melted snow to grow melons and other crops. Diseases are a continuing problem, as is the distance to some of the markets in eastern China where the melons are sold.

A project funded by ACIAR is looking at ways to boost post-harvest disease control and improve market quality of melons in western China and the Australian Riverina.

The project, led by Dr Robyn McConchie of the University of Sydney, is building on findings from an earlier ACIAR project which highlighted the need for development of the melon industry in western China. This revealed the scope for disease control and supply-chain technologies to improve melon quality.

So far a number of pre-harvest treatments to control disease and maintain quality have been investigated. In Australia, the researchers are conducting trials in Mildura and Griffith.

Trials with products, known as resistance elicitors, which boost the plant's natural defence mechanisms, have reduced the incidence and severity of the field diseases bacterial spot and powdery mildew infections. The incidences of post-harvest fruit rots caused by Fusarium, Alternaria and Rhizopus have been significantly reduced by using a pre-harvest application of resistance elicitors. The researchers have also applied fungicides to the fruit as sole treatments or in conjunction with the application of pre-harvest resistance elicitors. Combining fungicide dips with fruit heat treatment generally increased the suppression of disease development.

Dr Stephen Morris, from the Sydney Postharvest Laboratory, said the team was making good progress in this area and the project was now focused on a main strategy involving pre-harvest resistance elicitors and post-harvest fungicide treatment. A pilot study demonstrating improved post-harvest technology is planned for later this year, following on from extension workshops held in China in 2004 to introduce farmers to supply-chain management concepts and seek their perceptions about future needs. Researchers are also looking at ways to improve farmers' market power by introducing storage facilities. To this end, a new coolroom/packing system being supplied by Rotary Australia will give them some control.

The project was fortunate in 2004 to have the assistance of an Australian Youth Ambassador, Ms Kim-Yen Phan-Thien, as a volunteer research assistant. Kim took part in the extension workshops. "Considering the Chinese culture, which promotes a respectfully subservient attitude to authority, it was heartening to see how comfortable and uninhibited the farmers became in the small group discussions, despite the presence of 'authorities' such as researchers and government extension officers," she says.

Some of the major issues that emerged from the workshops were temperature management and improved supply-chain relationships.

Kim spent the summer in Xinjiang, where she helped to plan, design, implement and assess the field trial in a government-owned agricultural area where many farmers grow melons as a cash crop, typically intercropped with cotton or sunflower. They tested the effects of pre-harvest sprays of resistance elicitors and fungicides on disease, yield, quality and post-harvest disease development. Sampling leaves for one of the tests involved a weekly three-hour trip by public bus to the trial site in sometimes extremely uncomfortable heat, carrying slabs of ice in a styrofoam esky, much to the curiosity of other passengers.

"The laboratory at XAU (Xinjiang Agricultural University) is the most under-resourced that I have worked in, with a supply of running tapwater only half the day, limited supply of glassware that must be shared by a large number of postgraduate students and equipment that is often malfunctioning or in disrepair," Kim says.

But, she adds, she learned to accept such setbacks with the same calmness as her Chinese coworkers and found that all apparent problems could be overcome one way or another. At harvest, fruit were weighed and assessed on marketability indices and a sample from each treatment was used for testing sugar content and fruit firmness. Two post-harvest workshops were held in Xinjiang to introduce simple and cheap small-scale post-harvest technology to farmers, wholesalers and extension officers. Many of the farmers were enthusiastic about some of the simpler technology and recognised the potential to improve the quality and shelf life of their produce. On the downside, lack of stable land tenure, fragmentation of the supply chain and a lack of trust between industry stakeholders remain strong disincentives to any improvements in management practices, particularly where changes in infrastructure are needed. In their bid to improve supply-chain management, the researchers have conducted transport studies from Gansu to Beijing and from Xinjiang to Shanghai using conventional management practices.

Dr Sherrie Wei, Professor Li Xue Wen and Kim travelled to Shanghai to assess the fruit being transported from Urumqi by train. Much to the amusement of staff at the train depot, they individually evaluated each fruit and recorded the development of disease both photographically and on a computer. Poor conditions during transport, exacerbated by fruit over-maturity, led to rapid development of disease. These conditions cancel out the effect of the earlier treatments to control disease and show the importance of the integrated approach – any recommended disease control strategies must include adequate management practices, as well as the technologies for improving disease resistance.

The project team has completed consumer surveys in Shanghai, Wuhan and Beijing to see what consumers think of the improved quality of melons and whether they are prepared to pay more for them. A cost–benefit study will be carried out on the adoption of techniques such as spray treatments by farmers.

*Kim-Yen Phan-Thien is now working as a volunteer for Australian Volunteers International in Indonesia .*

DR STEPHEN MORRIS

New technologies are improving the quality of melons going to market.

# Extending the shelf-life of leafy vegetables

## Post-harvest improvements are expanding the industry, reports **Robin Taylor**

When the world's sporting elite gather in Beijing in 2008, they will be crunching on vegetables sourced by the Beijing Vegetable Research Centre (BVRC).

The BVRC was one of the partners in an ACIAR project to examine post-harvest management of several key vegetables in China, resulting in improved handling, packaging and transit technology being adopted by the industry. These improvements to extend the shelf-life of vegetables were an important factor in the BVRC being awarded the Olympics contract.

In China, as in Australia, the factor most limiting expansion of the vegetable industry is the short shelf-life of products.

"Many leafy vegetables, such as pak choy and broccoli, tend to perish quickly after harvest," says the leader of the project, Dr Tim O'Hare of the Queensland Department of Primary Industries and Fisheries. "Commodities such as Chinese cabbage and oriental bunching onions are storable but losses during storage can be further reduced."

The project team examined handling and storage methods in China for pak choy, oriental bunching onions, Chinese cabbage and broccoli. They measured losses for the four vegetables in China by sampling at different points in the handling chain and at different times of year.

Physiological factors that limit the post- harvest life of pak choy and Chinese cabbage were identified and used to develop options to extend shelf-life. Some of these options are simple and low-cost measures that, since their introduction, have reduced post-harvest losses. For example, the project team bought 1000 recyclable plastic crates to replace bags for transporting pak choy, which was being crushed.

"At first the farmers were unwilling to accept the crates, as they found bags easier to handle," says Dr O'Hare. "But after two or three months use they accepted the crates, resulting in improved quality and increased prices."

Another improvement has been the introduction of segregation of cultivars and grading. Tomatoes, for example, were sorted into three grades – big, medium and small – to enable improved returns and more targeted marketing.

After observing the way cabbages were handled at harvest, the scientists were able to recommend that growers remove fewer leaves, resulting in less damage during transport and better returns to the grower.

Since the project, the BVRC has also been involved in the development of handling and cooling systems for suppliers of lettuce to fast-food chain McDonalds in Beijing. Such was the improvement in lettuce quality that McDonalds Shanghai has begun sourcing lettuce from Beijing.

Many of the findings from this project are reported in 'Postharvest handling of fresh vegetables', ACIAR Proceedings 105.

DR SHEN LIN

Buying pak choy at an open-air market: replacing bags with crates has improved the quality.

# Trade benefits throughout China and beyond

## Greater access to world trade is bringing great benefits to China. But making sure these benefits are fairly distributed is a complex task

Above and facing page: For farmers in western China, increasing production is a key strategy to reducing poverty.

World Trade Organization (WTO) accession is designed to free up international markets. Participating countries must comply with WTO rules, often necessitating changes to internal policies, with implications for industry and agriculture. China's WTO accession in December 2001 signalled a range of changes and benefits for the overall economy. But ensuring these benefits reached everyone in the country without compromising food security was, and still is, a complex task.

ACIAR has supported two projects to help manage the transition to WTO accession; the first focused on the implications of this transition on food security, the second addressed the flow of benefits throughout China.

The Chinese Government has pursued a policy of food security for many years, including self-sufficiency in the grains sector. Food security has been a factor helping underpin recent economic growth. Another factor has been increased economic integration with the global economy. With WTO accession has come the deeper integration of the Chinese economy into world markets, an ongoing process.

During the 1990s, price growth for grains and other agricultural industries was strong, with a relatively stable domestic market supported by government interventions. Growth has mainly benefited the country's east, with China's west accounting for more than 70 percent of the country's poor.

Increased agricultural production is a key strategy for reducing poverty. The difficulty for those in western China engaged in agriculture is a lack of comparative advantage, against other regions and global producers. Agricultural sectors without a comparative advantage are the most vulnerable to changes, especially those that face increased competition with other producers, both within and outside China, something the WTO rules are designed to achieve.

To better understand the implications for competition and food security in western China, ACIAR-supported project work has used economic modelling. The underlying methods of analysis developed in an earlier ACIAR project allow identification and quantification of relevant economic parameters, for their incorporation into the model as datasets.

This work has allowed the project team to compile datasets that have formed the foundation for a general equilibrium model of the Chinese economy. The model identifies five agricultural and 39 non-agricultural sectors, and aggregates this information into three regions: eastern, central and western.

Using the model, the implications of WTO accession for each region and the regional disparity of expected benefits have been demonstrated. This revealed a worsening of the income disparity between the wealthier eastern and poorer western regions. If left unaddressed, rural households in western China will suffer the worst effects of China's WTO accession.

Knowing the implications of WTO accession and the effects if left unmanaged is vital to the next stage of research – formulating policy options that the Chinese Government can use to alleviate negative impacts, says Emeritus Professor Ron Duncan of the Australian National University, who is leading the project on food security.

"This knowledge gives us a baseline, and the model a tool to ask the 'what-if' questions on behalf of policy-makers, for comparison of policy effects against the baseline," he says.

Already this work has revealed that although agricultural sectors are adversely affected by WTO accession, the magnitude of these affects is less than anticipated.

Simulations on possible Government policy interventions to maintain grain self-sufficiency have revealed costly programs would be necessary. If transfer payment schemes that target inland regions are used to increase farmer welfare, they would need to be carefully designed to avoid large distortions in resource allocations. (Transfer payment schemes can use public spending to balance income disparities).

Areas with land- or labour-intensive agriculture are likely to gain from trade liberalisation. Those with low availablity of land and labour will suffer a comparative disadvantage. With agriculture expected to shrink in importance due to trade reforms in the lead-up to and since WTO accession, China's ability to achieve self-sufficiency in many agricultural commodities will be reduced.

Ultimately, the lack of reforms in agriculture, due to the policy of self-sufficiency, has reduced potential income growth and competitiveness. Monopolies in many agricultural sectors, such as in input supplies and output markets, mean that WTO accession is likely to increase incomes only where a comparative advantage is tied to market reforms. China's policies to ensure food security will need to adapt to these realities if its agricultural sector is to maintain competitiveness.

For the Chinese Government, the challenge is developing policy options that promote growth while buffering poor smallholders from negative impacts of WTO accession and policy reform.

Past research has shown the value of public investment, both in agricultural growth and poverty alleviation. The key for western China is the effective utilisation of these investments and associated policies to create opportunities for smallholders to gain through WTO accession.

The second ACIAR project is tackling these issues, again using economic analysis and modelling. Policy issues are being examined at the regional, village and household levels.

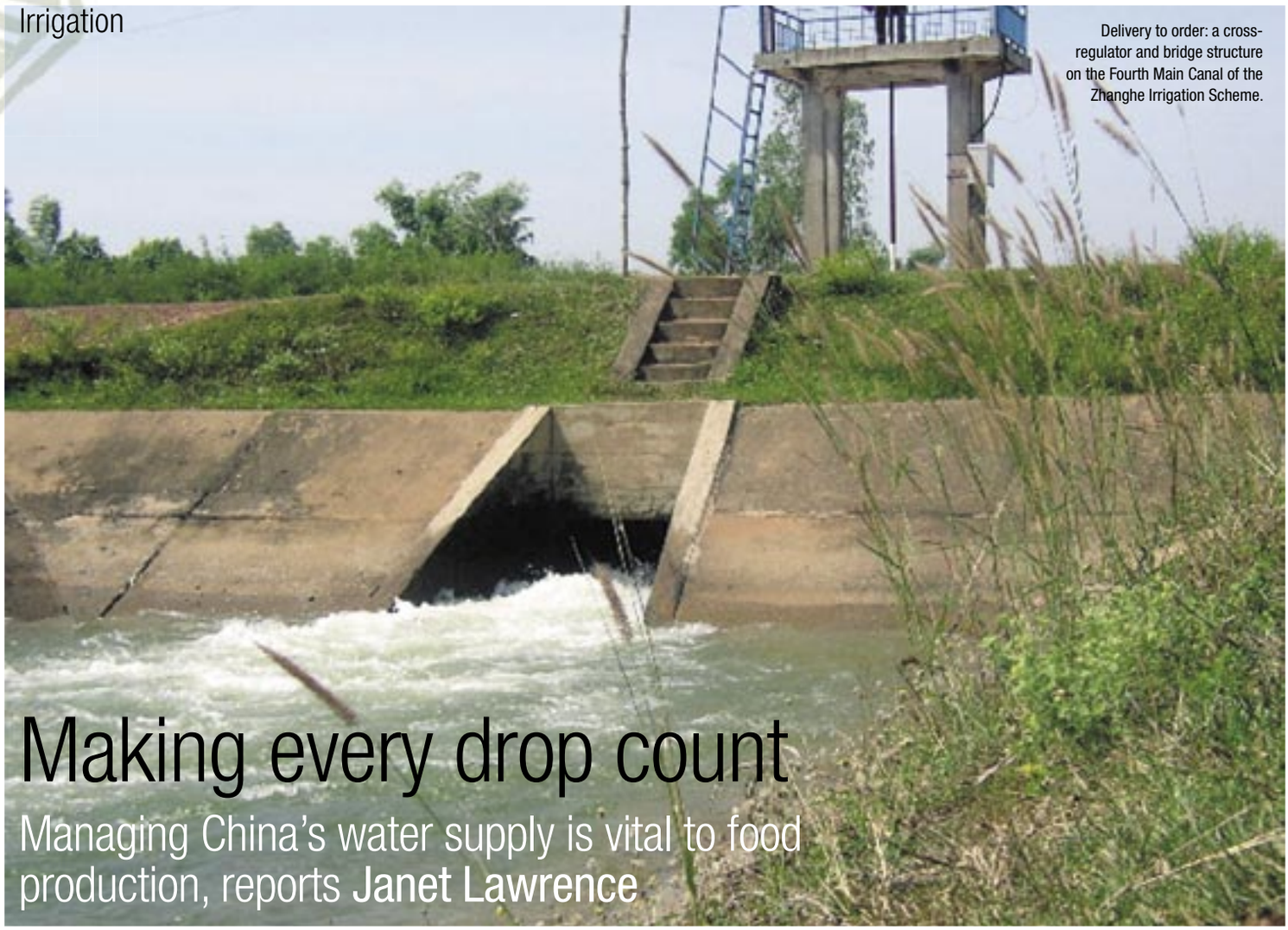
Surveys have been used in the development of datasets, beginning in Gansu Province.

The long-term aim is the development of a series of policy option papers, in Chinese, to advise a range of policy-makers. Past experience has shown that this – along with conferences to disseminate these papers and build networks of policy-makers – is an effective means of creating dialogue on policy options.

Professor Duncan believes smallholder farmers in western China can benefit with appropriate policy interventions, both in the short-term transition to WTO compliance and in the longer-term as markets open up.

"Our work is helping equip Chinese policy makers with information to examine the full range of policy options, for the most effective means of helping smallholders access the benefits of WTO accession," he says.

Given the size of the Chinese economy and population, this would make a real difference in a number of lives, as the benefits flow equitably from east to west.



Delivery to order: a cross-regulator and bridge structure on the Fourth Main Canal of the Zhanghe Irrigation Scheme.

# Making every drop count

## Managing China's water supply is vital to food production, reports **Janet Lawrence**

Irrigation plays a pivotal role in China's plans to meet future food demand. But the volume of water available for irrigation is under threat, largely from the increasing thirst of the country's urban and industrial sectors.

In the Zhanghe River Basin, in China's Hubei province, there is strong interest in widespread introduction of water-saving irrigation (WSI) techniques, that can increase food production using less water. But effective introduction of WSI depends on adequate operation of the water supply system.

Similar problems in Vietnam led Australian scientists from Melbourne University, under the leadership of Professor Hector Malano, to participate in an ACIAR project to study system-wide water management in that country's irrigation schemes. They worked with Vietnamese agencies to adapt a computer model, IMSOP (Irrigation Main System Operation), to analyse and improve operations and develop the infrastructure and institutional arrangements for pricing irrigation supply services. The team also modified and adapted the computer model ASSET MANAGER to speed up collection, retrieval and analysis of asset data.

The project's success caught the attention of the Zhanghe irrigation authorities, who approached the Australians on the team to see if they could undertake a similar study in China. Together they developed a small ACIAR project designed to improve main system water management in China through a demonstration study in the Zhanghe Irrigation Scheme (ZIS). Its main objective was to appraise the situation in Zhanghe and modify the IMSOP and ASSET MANAGER models to include features peculiar to Chinese irrigation schemes.

The focus of the study centred on Zhanghe's Fourth Main Canal that operates under an arranged demand schedule, whereby farmers request water deliveries from the agency as they need them. The canal receives water from the main river system on average four times a year, for five to 15 days each time. Farmers must give three days notice of their need for water to their canal station, which aggregates the farmers' orders. The main canal office then aggregates all canal station demands to determine the total inflow required.

The project team found that farmers tended to delay their water orders on the expectation that rain would reduce their water bill (which is charged on a volumetric basis). This led to a congestion of orders when farmers all realised their crops were in danger of water stress and therefore submitted their requests within a short period of time. At that point the system was unable to deliver sufficient water for all.

The team modified and adapted the IMSOP model to account for this mode of operation, resulting in the addition of a utility for prediction and sequencing of farmer's orders. Other IMSOP modifications came from data collected and processed from the Tuanlin weather station's databases. Through quality checks, the team identified and corrected many inconsistencies.

It emerged that changes in the water pricing policy in recent years had led to reduced water demand from farmers and a shortfall in revenues from water fees in relation to cost of water supply. The ASSET MANAGER analysis allowed the irrigation company to calculate actual operational cost of the Fourth Main Canal and develop a sustainable water fee policy.

Wuhan University scientists translated the modified versions of IMSOP and ASSET MANAGER into Chinese and they are now installed on ZIS's computers. China's National Centre for Irrigation and Drainage intends to promote the work at ZIS to other irrigation areas in China. Such guidelines will be vital as the Chinese Government tackles the massive effort to rehabilitate and modernise ailing structures.

By facilitating more widespread adoption of WSI practices, the project will also help to deal with problems of increasing water shortage and competition that are prevalent in vast areas of China, especially north of the Yangtze River. In several regions, the lack of water may limit future economic development.

# New technologies a winner

## Experts weigh up the best ways to spend $65 billion. By Rebecca Thyer

During the next four years, the world's governments will collectively spend US$50 billion (A$65 billion) on development assistance. But deciding how this money should be spent and how global challenges – from eradicating AIDS to alleviating world hunger – should be prioritised, is daunting.

This difficult task was posed to a gathering of some of the globe's greatest economists last year. The Copenhagen Consensus project aimed to set priorities for confronting 10 serious global challenges: civil conflicts; climate change; communicable diseases; education; financial stability; governance; hunger and malnutrition; migration; trade reform; and water and sanitation.

The expert panel assessed 10 challenge papers written for the Convention answering the question: "What would be the best ways of advancing global welfare, and particularly the welfare of developing countries, if an additional US$50 billion of resources were at governments' disposal?"

During the week-long Convention, experts ranked all proposals (see table). The panel was guided mainly by economic costs and benefits.

Propositions to alleviate malnutrition ranked highly, especially a proposal to increase spending on research into new agricultural technologies, which came in at number five. It stated that investment in agricultural technologies was "the single most effective means of increasing the incomes of those groups in the developing world who suffer from chronic hunger".

Caption in here pleaseCaption in here pleaseDevelopment of new agricultural technologies

The 'Hunger and Malnutrition' challenge paper, by Jere R Behrman (University of Pennsylvania economics professor and Population Studies Center director), Harold Alderman (lead human development economist in the Africa Region of the World Bank, Washington DC) and John Hoddinott (senior research fellow at the International Food Policy Research Institute, Washington DC), proposed investing in technology to develop agriculture.

An opportunity existed, they believed, to focus on developing improved seed varieties and agricultural practices to enable people to grow higher and consistent yields of more nutritious food. However, this was not just to help subsistence farmers grow more to eat.

"Rather it is a question of more productive farming, which gives farmers a better return on their investment, increases demand for the labour of landless people and reduces the price of food to make it more accessible to both rural and urban populations."

The Green Revolution of the 1960s and 70s is a clear example of how modern plant breeding advances can be widely employed for the benefit of the poor, the proposal stated.

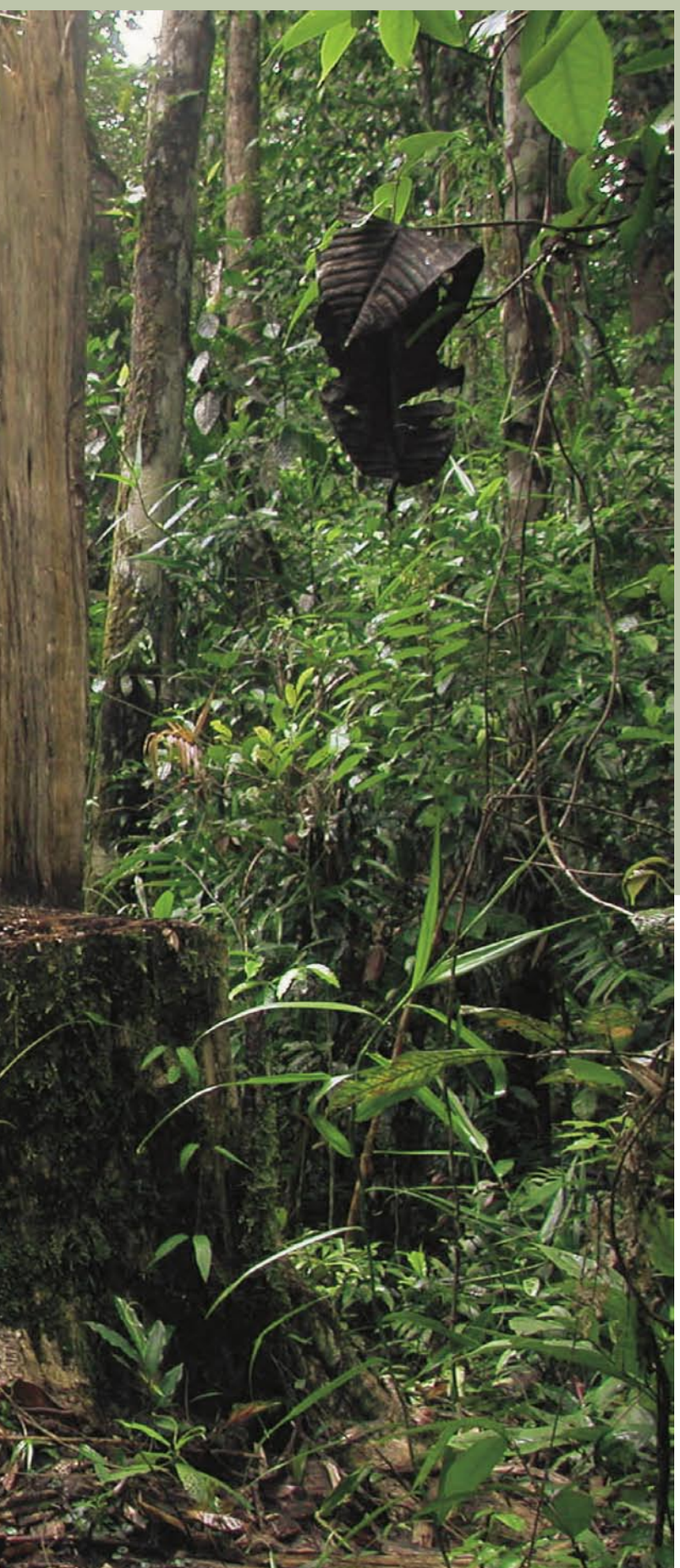
High-yielding dwarf varieties of rice and wheat have vastly increased the supply of staple foods in Asia and South America. Similar advances could be derived using the best technologies available now, including biotechnological advances.

While the 'Hunger and Malnutrition' paper said it was difficult to estimate returns on investment in this area accurately, studies had shown that the relatively modest up-front costs of plant breeding could be quickly recouped.

Additionally, benefits continue to accrue for many years until the seeds are displaced by the use of new varieties with even more benefits.

## Challenges and opportunities

| PROJECT RATING | | CHALLENGE | OPPORTUNITY |
|---|---|---|---|
| Very good | 1 | Diseases | Control of HIV/AIDS |
| Very good | 2 | Malnutrition | Providing micro nutrients |
| Very good | 3 | Subsidies and Trade | Trade liberalisation |
| Very Good | 4 | Diseases | Control of malaria |
| Good | 5 | Malnutrition | Development of new agricultural technologies |
| Good | 6 | Sanitation & Water | Small-scale water technology for livelihoods |
| Good | 7 | Sanitation & Water | Community-managed water supply and sanitation |
| Good | 8 | Sanitation & Water | Research on water productivity in food production |
| Good | 9 | Government | Lowering the cost of starting a new business |
| Fair | 10 | Migration | Lowering barriers to migration for skilled workers |
| Fair | 11 | Malnutrition | Improving infant and child nutrition |
| Fair | 12 | Malnutrition | Reducing the prevalence of low birth weight |
| Fair | 13 | Diseases | Scaled-up basic health services |
| Bad | 14 | Migration | Guest worker programs for the unskilled |
| Bad | 15 | Climate | Optimal carbon tax |
| Bad | 16 | Climate | The Kyoto Protocol |
| Bad | 17 | Climate | Value-at-risk carbon tax |



CSIRO

# The good oil for a better life

## Oils from indigenous trees promise a new source of cash income for Papua New Guinea's remote villages

Papua New Guinea has an abundant and diverse genetic resource in its native flora, but exploiting this has rarely gone beyond the subsistence efforts of smallholder villagers. One such resource is the oil found in some indigenous tree species. These potentially could be sustainably exploited to produce income and other benefits, beyond those of subsistence farming. Essential oils have already been used for health and healing and other practical applications, but production has not been commercial.

An ACIAR project with villagers in remote Western Province who otherwise have few sources of cash income, has begun to change this. Past efforts to foster local, cash-generating industries failed, because they were instigated by external groups without local ownership.

But after word of the success of villagers in Papua (Indonesia) in leaf oil production reached the villages of relatives living in PNG's Western Province, people's interest was revived. A request for help in establishing a village-based production system has now been met through an ACIAR project to help develop a sustainable community-based essential oil industry in Western Province.

The project has focused on the South Fly region of

the province, one of the poorest in PNG. Working with several villages, including Kwiwang, Malam, Bensbach and Rouku, a socio-economic assessment was undertaken. This revealed the need for villagers to work together, and village management committees were subsequently formed.

Local resources were also assessed, revealing that oil of sufficient quality for commercial development was available from nearby tree stands. The source trees of Waria Waria oil and other essential oils were commonly found around villages involved in the project – and oil produced from the Waria Waria tree (*Asteromyrtus symphyocarpa*) was found to have the most commercial potential.

Research plots were established with the aim of identifying silvicultural and best-practice harvesting techniques. Sustainable long-term harvesting strategies based on a light harvesting regime of tree crowns were developed. In 2004, an additional study was established in collaboration with the World Wide Fund for Nature, and this will continue to ensure environmental sustainability in the long term.

Stills for processing oils were upgraded and technical aspects of production were changed.

Also, a marketing consultant was commissioned to study the industry, and this led to a change to the way villagers approach the production and sale of essential oils.

Where previously oil had been bottled in small containers and sold individually, bulk production has become the preferred method. The concept of bulk production and supply to commercial manufacturers was explained to management committees and village groups, who now realise this is far more likely to generate real income.

'Villagers in Western Province are beginning to find that a sustainable, cash-generating local industry is achievable'

The Kwiwang and Malam village committees voted to adopt bulk production, which would be sold to PNG Franchise Pty Ltd. The returns have steadily grown – 7217 Kina (A$2920) for 180 litres in 2001, 11,013 Kina (A$4459) for 275 litres in 2002, and in 2004 the Bensbach and Indoradora villagers received 11,108 Kina (A$4497) for 278 litres.

In an area devoid of all but the most rudimentary infrastructure, the social benefits of these returns have been profound.

A school is now being built in the village and children are attending in increasing numbers. (Schooling is dependent on paying fees, which previously many could not afford).

Essential items, such as hygiene products, are more readily available because of the community's greater buying power. The local Medical Officer, in discussions with the project leaders, has reported an improvement in village health since the project began.

The success of the project has meant increased supplies of Waria Waria oil, with supermarkets and pharmacies in major centres now stocking the product.

Like supply, talk about the benefits of village oil production is increasing too. At a field day in Tabubil (in the North Fly area) in November 2004, information on the possibilities of oil production was presented and distributed through brochures and flyers.

Although it is still early days, villagers in Western Province are beginning to find that a sustainable, cash-generating local industry is achievable, and that through this income a better life is possible.

With the conclusion of the current ACIAR project in Western Province, the Livelihood Programs Department of Ok Tedi Mining Ltd will be providing logistical support and marketing assistance to aid the economic sustainability of this fledgling village-based essential-oil industry.

The strong level of local ownership and value of the returns on offer are promising a flow of benefits as long as the Waria Waria oil continues to flow, and that could be well into the future.

## Building forest management capacity

A key element in the success of projects such as developing Waria Waria oil as an industry is building the capacity of PNG in forestry research and management.

With almost 60 percent of PNG's land covered by forest, and with increasing pressure to clear or exploit forest resources, effective management is vital.

Current logging practices are largely unsustainable, and may well be reducing income options from domesticating trees and sustainably using resources such as essential oils.

Equipping PNG's forest managers to better manage and domesticate trees is the aim of a CSIRO Forestry and Forest Products and PNG National Forest Service project, operating under ACIAR support.

The project has developed capacity in domesticating indigenous species, including though provenance and progeny trials. Four species, *Calophyllum euryphyllum*, *Dracontomelon dao* (PNG walnut), *Pometia pinnata* (taun) and *Casuarina oligodon* were all trialled, based on their potential for domestication.

Dr Brian Gunn, of CSIRO Forestry and Forest Products, led the project team that was able to establish effective trials for the first time in many years. "Prior to this project there was only one trial that had been established as a replicated trial in the last 20 years."

A seed production area for *Acacia mangium*, established under the project and comprising improved germplasm, is now available for distribution to commercial growers through FRI. The seed used to establish the production area was developed in Australia as part of the project.

Conservation strategies for sandalwood and eaglewood germplasm were developed. Propagation and seed-handling techniques relevant to several species were also developed.

The project also delivered 27 training courses, engaging 133 participants from throughout the forestry sector in PNG, including research institutes and universities. Seed cleaning and storage facilities and a seed database were all established. This included the publication of a booklet on *Seed handling and propagation of PNG's tree species*.

# Training the trainers in Papua New Guinea

## Courses will open up new fish-farming opportunities, reports **Geoff Wilson**

When fisheries and aquaculture lecturer Ursula Kolkolo returns to Port Moresby in April 2007, she hopes to set up education programs that will help improve Papua New Guinea's food security at village level.

Courses she will help develop at the University of Papua New Guinea (UPNG) will target opportunities for new village-level and commercial fish farming and fisheries in PNG.

Meanwhile, Ms Kolkolo is on study leave in Australia studying for a doctorate degree in aquaculture from James Cook University (JCU) in Townsville, Queensland, as an ACIAR John Allwright Fellow.

She began her PhD topic – Settlement cues in post-larval development of the mud crab – with mud and sand crab culture work at JCU in December 2003.

While also furthering JCU's research, Ms Kolkolo's work will better equip her to teach a spectrum of aquaculture skills when she returns home. The training will also provide the basis to start crab-farming courses if resources at UPNG allow.

She believes that broad training in modern aquaculture is needed so villagers can enjoy higher levels of protein in their diets.

About 90 percent of PNG's population of nearly 5.2 million people live in rural areas and grow their own food. Up until now, the major animal food protein has come from pigs in the highlands and fishing on the coast. Farmed fish, crustaceans and shellfish could become important alternatives for a healthier and more varied diet.

Capture fisheries are already a major industry in PNG, with its large and rich Exclusive Economic Zone (EEZ) recognised for opportunities in tuna fishing and processing, deep-sea and reef fishing, plus rock lobster and prawn capture with on-board processing.

ACIAR recently funded a review of village-based farming using carp and other species, and found that there was a need for training to help develop village-scale aquaculture.

Commercial and village-level opportunities in aquaculture are increasingly being recognised as a means of providing protein from PNG's coastal and inland waterways. As a result, opportunities exist for farming introduced carp and tilapia fin fish; what is lacking is the knowledge of how best to achieve this.

Ms Kolkolo's work will help generate and disseminate knowledge that will allow villages to pursue goals like these. She is already well qualified to teach fisheries and aquaculture. In 1983 she obtained a science degree from UPNG and joined the fisheries research branch of the Department of Primary Industry, working with local reef fishermen in Port Moresby.

Ms Kolkolo was the biologist in charge of Torres Straits fisheries (barramundi, lobster and prawns) in Daru, Western Province, from 1986 to 1989, then in 1989 she obtained a master's degree in aquaculture from Simon Fraser University in Vancouver, Canada.

After returning from Canada, Ms Kolkolo continued working for PNG's National Fisheries Authority from 1993 to 1999, first as the principal scientist for inland fisheries and aquaculture, then as manager for fisheries research and management – before joining UPNG as a lecturer in fisheries biology in 2000.

Her PhD studies at JCU will equip Ms Kolkolo for the new program of fisheries aquaculture undergraduate courses expected to be set up at UPNG in Port Moresby, in response to the demand for aquaculture industries.

GEOFF WILSON



Ursula Kolkolo holding a farmed mud crab at JCU's aquaculture research facility. With her is the head of JCU's School of Marine Biology and Aquaculture, Professor Rocky de Nys.

PHOTOLIBRARY.COM

# Keeping trade free OF PESTS

## ACIAR is helping developing country partners meet the quarantine requirements of WTO accession and global trade. **Paul Ferrar** reports

With the opening of world trade markets increasingly being hastened by World Trade Organization (WTO) accession and the potential benefits on offer, developing countries are keen to find new markets to build wealth and reduce poverty. For many developing countries, horticulture is a promising first field for trade development. The relatively exotic nature of many tropical fruits and vegetables can result in price premiums in developed countries, and there is often little competition except from other developing countries.

Unfortunately, pests and diseases have a similar demand for fresh tropical produce, resulting in quarantine problems that affect trade in these commodities. In the past, restrictions based on such quarantine factors, whether real or imagined, were used as trade barriers. The creation of the WTO provides a solution to such artificial trade barriers, through Sanitary and Phytosanitary (SPS) regulations. These allow quarantine to be used as a barrier only when based on clear and demonstrated scientific evidence. The WTO has set up a system for arbitrating cases where the scientific evidence for and/or against quarantine is disputed.

This system has great potential to help developing countries compete more equitably in international trade, but in practice they have found it hard to use due largely to two particular constraints:

- knowing which pests and diseases are present in the exporting country and which in the importing country. Few developing countries have detailed knowledge of their indigenous pests, and the lack of this information makes it impossible to challange unfair quarantine restrictions on trade; and
- crop protection staff in developing countries lack experience in mounting professional scientific challenges, even when information on pests is available.

Recognising these constraints, the Australian Government convened an interdepartmental committee, led by AusAID, drawing on the expertise of:

- AusAID – to provide capacity-building to developing countries in operation of the SPS provisions;
- ACIAR – to assist developing countries to obtain information on distribution and biological characteristics of their national pests and diseases and practical ways of disinfesting commodities to meet quarantine requirements;
- the Department of Agriculture, Fisheries and Forestry (DAFF) – as operators of Australia's quarantine, to help developing countries meet international quarantine and crop protection requirements and standards; and
- the Department of Foreign Affairs and Trade – to oversee integration of these activities with Australia's trade relations.

This committee also compares notes with AusAID's New Zealand counterpart NZAID, to develop intitatives to help developing countries challenge quarantine decisions.

### What does a developing country need?

To be able to use the SPS provisions effectively, a developing country ideally needs:

- a comprehensive, electronic national plant protection database, with information on all pests and diseases, where they are found in the country, which crops they attack, and what damage is done. NZAID has provided this for four ASEAN nations (Vietnam, Laos, Cambodia and Myanmar), and the software is freely available to other developing countries that wish to use it. ACIAR is contributing survey information to be included in these databases, as noted below; and
- crop-protection personnel trained in the use of plant protection databases and with the skills to prepare information for SPS challenges under WTO rules. Under the World Trade Agreement developed countries are required to help developing countries lift their SPS capacity. Australia's efforts are being led by the AusAID SPS Capacity Building Program for ASEAN, with assistance from ACIAR, DAFF and complementary projects from NZAID.

ACIAR's contributions to SPS capacity enhancement have

included research that addresses pre-harvest protection, post-harvest disinfestation and broader effects of compliance with WTO rules. Work on pre-harvest research includes tackling the widespread need to control pests.

Among the major pests of tropical produce – both fruits and vegetables – are fruit flies. Since 1985 ACIAR has been assisting developing countries in Asia and the South Pacific to determine which fruit flies occur in what fruit species, and to come up with solutions for control and disinfestation. Fruit flies have been surveyed in Malaysia, Thailand, Vietnam, Bhutan, Papua New Guinea and seven South Pacific nations, and work is continuing in Vietnam and Indonesia.

This effort is now building up a comprehensive picture of the distribution of fruit flies in Asia and the Pacific, and has resulted in the formation of an International Centre for Management of Pest Fruit Flies (ICMPFF). The centre is headquartered at Griffith University, Brisbane, and is establishing a South-East Asian node in Kuala Lumpur under an agreement with the Malaysian Government. This follows endorsement of the ICMPFF by a meeting of ASEAN Ministers, and the centre will initially serve all ASEAN nations and Australia.

Other surveys supported by ACIAR have included diseases of various fruits and vegetables in Indonesia and Vietnam, vegetable leaf miners in Indonesia and whiteflies in the South Pacific.

## Survey 'toolbox'

As a direct complement to the AusAID SPS Capacity Building Program, ACIAR has engaged the Office of the Chief Plant Protection Officer in DAFF to compile a 'toolbox' manual on how to conduct national surveys of particular pest and disease problems. This follows similar, well-acclaimed products from ACIAR on animal health and aquaculture health. The toolbox introduces surveillance methodologies suited to developing country contexts. It is aimed at providing comprehensive guidance to users on how to conduct national surveys of pests and diseases, how to incorporate this in an electronic database for rapid access, and how to prepare and maintain national reference collections of pests and pathogens to provide supporting evidence for information in the database.

ACIAR has also been a core member of the consortium that supported CAB International to compile a Global Crop Protection Compendium. This contains a large amount of information on the pests and diseases of all countries, and can provide invaluable inputs to national crop protection databases.

## Pre-harvest management

For export produce to meet quarantine requirements it must be free from live pests or pathogens when it crosses national boundaries. Attacks before disinfestation occurs will leave fruits damaged and unsaleable. ACIAR fruit fly projects have developed methods for reducing infestations in orchards before harvest. These have focused particularly on bait spraying, in which a tiny amount of insecticide is combined with bait that attracts fruit flies but not non-target insects, providing an environmentally friendly means of control. Baits made from processed waste have been found to be excellent attractants for fruit flies – they are cheap and make use of otherwise useless waste materials. Tonga, Vanuatu and Vietnam have all used brewery waste for baiting fruit flies.

## Post-harvest disinfestation

ACIAR's post-harvest research program has focused a number of projects on ways to disinfest fruits and vegetables attacked by fruit flies and other pests, to ensure that no residual live pests are present as the commodity is exported. Current projects include:

- reducing aflatoxin in peanuts through agronomic management and biocontrol strategies in Indonesia;
- post-harvest handling and disease controls against diseases of melons in China; and
- integrating effective phosphine fumigation practices into grain storage systems in China and Vietnam.

Past research has addressed:

- the development and application of simple test kits for use in detecting pesticide residues in plant-derived foods;
- bioremediation technology for insecticide residues in horticulture;
- monitoring mycotoxins and pesticide residues in grain and food production systems for risk management; and
- low-cost disinfestation systems for fruits.

The fruit disinfestation system project developed heat treatment disinfestation conditions suitable for mangosteen in Thailand. This satisfied requirements for the export of mangosteen to Japan, with commercial shipments able to begin.

A set of guidelines for quarantine disinfestation for fresh horticultural produce, outlining heat treatments for fruit flies, was developed and reviewed by Thai, Philippines', Malaysian, Vietnamese, Chinese, Indian, Japanese, Australian and US representatives through a joint workshop.

A second project, monitoring mycotoxins and pesticides in grain and food production, has boosted Vietnamese capacity in detecting contaminants. Cost-effective and rapid tests, using the enzyme-linked ELISA technology, have been developed and are now in use in Vietnam, along with the establishment of a monitoring network for testing agricultural produce.

While many of the projects mentioned above have focused on the phytosanitary part of the SPS rules, the sanitary side has also been a subject of research. Sanitary rules can be used to impose restrictions on imports based on such problems as contaminants.

## Economic impact of SPS regulations

An Agricultural Development Policy project is examining the trade impact of SPS standards. The project is using analysis of the trends and patterns of food imports and surveys of organisations involved in food trade in India and Thailand.

The aim is to gather information to help determine the degree to which the impacts of SPS relate to measures to comply with SPS rules, as opposed to the impacts stemming from limited capacity to comply with these rules at the country level.

This will help distinguish between the two in terms of impacts on trade, and help provide policy options for countries and the WTO dispute settlement arrangements. Technical, scientific and institutional capacity in India and Thailand will be enhanced, underpinning efforts to help comply with and use the SPS rules under WTO.

ACIAR-supported research into all aspects of SPS compliance described above is beginning to build significant capacity in partner countries in Asia and the Pacific. These efforts, combined with those of other Australian Government agencies such as AusAID and DAFF, are helping bring freer trade a step closer throughout the region.

'Using baits combined with processed brewery waste has been found to be an excellent attractant for fruit flies'

# Helping Indonesia to rebuild after the TSUNAMI

## International agricultural research – a quiet contributor to rebuilding lives and livelihoods

In the aftermath of the tragic Indian Ocean tsunami, agricultural scientists are working quickly and quietly in the background to plan and initiate activities aimed at restoring agriculture and food security in the devastated areas.

Led by the United Nations Food and Agriculture Organisation (FAO), its regional body the Asia-Pacific Fishery Commission, the Network of Aquaculture Centres in Asia-Pacific, and representatives of the Consultative Group on International Agricultural Research (CGIAR), expert teams have made rapid assessments of the most urgent needs and longer term requirements. Humanitarian aid organisations and defence personnel have been at the forefront of restoring essential services and providing short-term food and shelter in the immediate aftermath of the disaster. Now, national and international attention is turning to the long-term rebuilding effort.

Restoring agriculture and food security is an essential first step in helping the affected communities recover. Many of the coastal communities relied heavily on fishing for their livelihoods. They have lost their boats and nets, and the fish populations they relied on have also been devastated.

In India, Indonesia and other affected countries, the tsunami washed many kilometres inland, destroying or damaging crops and leaving thick residues of salt-laden silt. Salinity levels in the land and sub-soil water have increased substantially. Farmers will need long-term help to adapt and adopt management practices and salt-tolerant crop varieties to restore productivity to their land.

## ACIAR's role

As part of the Australian government's efforts, ACIAR is committing additional funds to its Indonesia program.

Our role in Australia's international development cooperation is as a facilitator and funder of agricultural research and extension. Therefore our resources and partnerships will be used to help re-establish food production and restore the livelihoods of farmers and fishers in affected areas, particularly Aceh. This assistance is commencing immediately, and will continue for several years.

Over the past few months, our staff have met with Indonesian agricultural, forestry and fisheries research institutes in Java and Sumatra to assess where Australian expertise is most needed.

Indonesia's tsunami-affected agriculture and fisheries R&D and exten-

sion staff in Aceh and other parts of northern Sumatra need help to re-focus their efforts on the immediate needs of local people. Training of these staff, using Australian and Indonesian expertise and intact facilities in other parts of Indonesia, was identified as a priority to bolster local contributions to the long-term relief effort. The training workshops will focus on fisheries management and issues associated with soil salinity and crop production in lands inundated by sea water.

The next stage will be the commissioning of collaborative research aimed at providing technical information to underpin longer term reconstruction of agriculture and fisheries in these areas.

Research needs in the following areas are being assessed:

- the degree of salinisation and siltation of farmland and demonstration of strategies to allow re-use of this land for farming
- the likely impacts on fish stocks because of tsunami damage to reef systems and coastal habitats
- re-establishment of coastal shrimp aquaculture and mariculture
- possibly in re-establishment of appropriate crop planting stock, cropping systems, small ruminant production and perhaps chicken production

During the rebuilding of agricultural industries and infrastructure, we will continue to work closely with AusAID, our Indonesian counterparts, FAO, the CGIAR and other regional bodies on the long-term reconstruction efforts.

As the Indian Ocean region starts to rebuild its coastal life, scientists from Australian and international agricultural research institutes have committed to join with their counterparts in the affected countries to bring their collective expertise to the massive rebuilding task.

For more information: www.aciar.gov.au/web.nsf/doc/ACIA-69L3Z3

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AMI

## EXTENDING SYMPATHY AND A HELPING HAND TO OUR FRIENDS AND PARTNERS

All ACIAR staff were saddened and shocked by the extent of the Indian Ocean tsunami and feel privileged to be able to play a very small role in the task of rebuilding lives and livelihoods. ACIAR expresses its deepest sympathy to research and development institutions in affected countries that have lost staff in the tragedy.

# Building on the past for a better future

## How ACIAR is working to increase the delivery of research results to farmers

The success of ACIAR's projects is built through effective partnerships. These create answers to agricultural problems, for dissemination to the farmers and other end-users confronting those problems head-on.

Linking the expertise of Australian agricultural scientists with their counterparts in developing countries has been and remains the foundation of successful projects. Some address problems previously not researched, others take past research and aim to deliver the results directly to end-users.

To help deliver research to the relevant farmers, natural resource managers and policy makers, ACIAR has worked with a variety of organisations over the past two decades.

Organisations such as Australian Volunteers International (formerly the Overseas Service Bureau), World Vision and Catholic Relief Services have all been involved in ACIAR projects. A variety of agricultural extension agencies, scientific research organisations and private businesses have also played a role in getting solutions to those who need them.

To help end-users further capitalise on the science and technology emerging from ACIAR-supported research, some changes have been made to project development. These will help define the timeframe from project commencement to dissemination of results and benefits to end-users. There are three categories, or timeframes, for the delivery of results:

- **Category 1: likely to achieve impact within five years of project completion (near-term)**
  – 40 percent of ACIAR's project expenditure will be aimed at near-term projects;
- **Category 2: likely to achieve impacts in five to 10 years of project completion (medium-term)**
  – 40 percent of ACIAR's project expenditure;
- **Category 3: likely that benefits will take more than 10 years from project completion to be seen on the ground (long-term)**
  – 20 percent of ACIAR's project expenditure.

Details on these changes can be found in the 'Guidelines for the Development of Project Proposals' (under Project Guidelines on the ACIAR website), and in relevant Country priorities, to be detailed in the Country chapters of ACIAR's 2005–06 Annual Operational Plan.

A key element of this change is increased opportunities for funding of projects likely to deliver benefits to end users within five years of project completion. These Category 1, or near-term, projects are expected to have strong linkages and partnerships with community-based organisations who work directly with end users.

With 60 percent of investment aimed at medium- to longer-term projects there is still a major emphasis on research that addresses real problems but does not necessarily deliver results on the ground. The useful results and technologies emerging from longer-term projects may be developed into near-term projects in later years.

A range of organisations, from NGOs to industry representative bodies to research institutions, may be involved in disseminating research results. The main advantage these organisations have is the ability to reach target communities and end-users directly.

So what type of projects is ACIAR expecting to fund to deliver community-level impacts in the shorter term?

In the June 2004 issue of *Partners* Robin Taylor reported on ACIAR's engagement with World Vision and how this has disseminated research results to farmer communities in Thailand, Laos and Vietnam – an example of one type of near-term project.

One facet of this project was work led by World Vision to change horticultural practices in Thailand's Songkla Basin region. Farmers growing vegetables were relying on chemical fertilisers, but chemical run-off was contaminating water. Some of this was used for

Thai farmers show the practical results of the ACIAR–World Vision project. In Thailand, and elsewhere in the developing world, women often lead smallholder farming enterprises.

drinking. By adopting the use of diluted chicken manure, soaked overnight in a tank of water, chemical use was reduced. The liquid manure/fertiliser was run through drip irrigation, leading to an increase in income from reduced chemical input costs. Marketing the produce as chemical-free attracted a price premium, also boosting income.

A second example of a project delivering impacts to end-users was the introduction of ectomycorrhizal fungi to eucalyptus plantations in China.

fungi play a beneficial role in improving the growth and establishment of eucalypt species. By matching the fungi to plantation sites in three provinces, root stocks and seedlings were able to be inoculated in nurseries before planting. This significantly expanded the potential area of eucalypt plantings, both to generate income and to rehabilitate degraded land.

As a result of the project's training activities, and its dissemination of information, mainly in Chinese, a total of about 25 percent of new plantings are of inoculated stocks. The majority of private forestry companies, now taking over the plantation sector following the withdrawal of government resources, use local people to prepare and maintain plantation lands. These companies have indicated that more than 50 percent of new plantings will use inoculated seedlings by 2007.

In South Africa, the involvement of the Agricultural Research Council and several other organisations in a CSIRO-led project is helping smallholder farmers gain access to the commercial beef sector.

Smallholder cattle farmers use cross-bred and non-commercial varieties. This difference from commercially accepted varieties has been a barrier to selling to the commercial sector.

By proving that the smallholder farmers who adopted appropriate management and feeding strategies for non-commercial varieties could meet the specifications of the commercial sector, the door has been opened to increased income.

Disseminating this information has been undertaken by several groups. The National African Farmers Union is working on a new feedlot system for smallholders. Members of the South African Feedlot Association, a commercial supplier, have established buyers in regional areas to take advantage of the new source of cattle.

A Beef Improvement Network has also been established to link farmer groups.

In Laos, the emphasis of the World Vision work has been on training rice farmers in techniques to grow dry season crops. As a result of this training, farmers are now able to grow dry season crops for consumption and for sale. In total, according to government counterpart reports, 1663 kilograms of crops were grown in the January to March dry season. Peanuts, green beans and wheat had also been planted and total crops harvested totalled 567kg. Following the wet season training and seed distribution, it was noticed that the farmers were working hard to use the lessons learnt in their training. By the end of June, all the farmers who received seeds from the project had completed sowing using the new methods.

While each of the three projects above has unique characteristics, all have successfully delivered project results to end-users and catalysed new approaches.

Fostering technology change is one avenue through which NGOs, private and public research and other organisations can become involved. Utilising the expertise of such agencies as a part of a project, for their communication activities or ability to involve volunteers in projects, are other avenues.

ACIAR will focus on projects that pilot new and existing technologies emerging from projects supported by the Centre. This will position partner organisations to 'scale-up' these technologies to the district and provincial levels and, where appropriate, beyond.

# John Dillon Fellows visit

ACIAR's John Dillon Fellows for 2005, selected for their potential as future R&D leaders in their countries, visited the ACIAR's Canberra office in March. The six fellows were in Australia visiting Australian organisations and events designed to boost their experience in their relevant fields of expertise.

Prior to visiting ACIAR, the fellows received training at the Melbourne Business School's Mt Eliza Centre for Executive Education, one of the leading management training institutions in Australia. Each fellow also visits one or more research, policy or extension organisations, these acting as host organisations (see list of the fellows and their programs).

Fellows are selected on a range of criteria. Each has been involved in a recent or current ACIAR project, is from a developing country and has demonstrated outstanding potential as a future research manager and leader.

By supporting a five-week visit to Australia, the fellowship provides an opportunity to gain insights into how leading organisations operate, management techniques and relevant processes that can be applied in the fellow's home organisation. The visits to host organisations are built around the specific interests of the fellows, such as examining priority-setting mechanisms or visiting state of the art laboratories.Visiting ACIAR strengthens the networks that project involvement has already established.

During their week at ACIAR, the fellows gave presentations on their home institutions, outlining the challenges ahead. They also attended a training course in research management in agriculture.

The course, run by Associate Professors Geoff Hinch and Brian Sindel of the University of New England, is designed to assist with the transition from hands-on research to management.

For many of the fellows this transition presents a challenge and shift in mindset, moving away from a single research area or series of experiments.

A highlight of the week was a meeting with the Minister for Foreign Affairs, the Hon. Alexander Downer. The Minister presented the fellows with a plaque for advanced training in agricultural research management.

The fellows ended their week by attending ACIAR's In House Review, the forum where projects are evaluated and recommended for approval, followed by a visit to the Australian Department of Agriculture, Fisheries and Forestry.

## ABOUT JOHN DILLON

Professor John Dillon was a leading agricultural economist who served as Chairman of ACIAR's Board of Management from 1985 to 1994. A long-time champion of agricultural research, Professor Dillon made an enormous contribution both to ACIAR and the wider

Hosts and guests: the 2005 John Dillon Fellows with their University of New England course leaders. From left, Associate Professor Brian Sindel, Dr Eric Omuru, Associate Professor Geoff Hinch, Dr Larry Digal, Dr Harminder Singh Sidhu, Ms Rahmini, Dr Changyong Zhou and Ms Norah Omot.

international research community.

This included serving on the Boards of five consultative groups on international agricultural research centres, including chairing three. He was also a lecturer and later Professor of Rural Economics at the University of New England.

### THE 2005 JOHN DILLON FELLOWS

**Dr Larry Digal** – Associate Professor 1, School of Management, University of the Philippines.
Program – AARES 2005 Conference, ABARE Outlook 2005 Conference, University of Sydney and Rural Industries Research and Development Corporation.

**Dr Eric Omuru** – Head of Economics and Planning, Cocoa Institute of Papua New Guinea.
Program – AARES 2005 Conference, ABARE Outlook 2005 Conference, NSW Department of Primary Industries, and Rural Industries Research and Development Corporation.

**Ms Norah Omot** – Agricultural Economist, National Agricultural Research Institute, Papua New Guinea.
Program – AARES 2005 Conference, ABARE Outlook 2005 Conference, NSW Department of Primary Industries, and Rural Industries Research and Development Corporation.

**Dr Harminder Singh Sidhu** – Research Engineer, Punjab Agricultural University, Ludhiana, India.
Program – CSIRO Sustainable Ecosystems, Agricultural Institute and Charles Sturt University, CSIRO Land and Water.

**Ms Rahmini** – Researcher (in rodent pests), Indonesian Institute of Rice Research, Indonesia.
Program – CSIRO Sustainable Ecosystems, Cooperative Research Centre for Pest Animal Control, Grains Research and Development Corporation, Agricultural Institute and Charles Sturt University.

**Dr Changyong Zhou** – Director of Citrus Institute, Chinese Academy of Agricultural Sciences, China.
Program – Horticulture Australia, University of Sydney, AusCitrus, CSIRO Plant Industry, NSW Agriculture, South Australian Research and Development Institute.

# NEW APPOINTMENTS

## POLICY ADVISORY COUNCIL
### MR BROWN BAI

Mr Brown Bai, Chairman of the Rural Industries Council of Papua New Guinea, has been appointed to ACIAR's Policy Advisory Council.

Mr Bai, a former Secretary of the Prime Minister's Department, has been involved in agriculture and community development, both in PNG and internationally throughout his career. This includes working in a variety of capacities in the PNG Government's Departments of Agriculture, Livestock and Fisheries, Primary Industries, Finance and Treasury and the National Planning Office.

Mr Bai has also been involved in a number of industry groups in agriculture, chairing the Livestock Development Corporation and the PNG Oil Palm Management Board, and was founding chair of Ramu Sugar. He has also served on the Coffee and Cocoa Industry Boards and the Copra Marketing Board.

The Rural Industries Council promotes the agricultural industry in PNG. The council's membership is made up of regional or national associations that represent growers or primary producers of agricultural crops and livestock.

Dissemination of relevant information of interest relating to rural industries is a main priority of the council, achieved in part through radio programs, publications and grower conferences.

Mr Bai's three-year appointment to the Policy Advisory Council began on 7 March 2005.

The Policy Advisory Council provide advice to the Minister for Foreign Affairs regarding:

- agricultural problems of developing countries and
- programs and policies with respect to agricultural research.

The council includes the members of the ACIAR Board, the Director, the Director

# ROUNDUP

General of AusAID (or his or her nominee) with the remainder (no fewer than nine nor more than 11) appointed by the Minister based on their experience in agricultural research and their knowledge of agricultural problems in developing countries.

### DR T.K. LIM

Dr T.K. Lim is Research Program Manager for Crop Protection. The Crop Sciences Program is divided into two parts, with crop protection focusing on the protection of horticultural crops, cereals, food legumes, forages and oilseeds, with an increasing focus on biosecurity.

Dr Lim was most recently a senior manager at the Department of Agriculture, Fisheries and Forestry in Canberra, working on market access and crop protection issues for horticultural crops. In this role, he gained strong international experience and international and Australian networks, and carried out regular high-level representational work for the Australian Government.

Prior to this he was deputy director for horticulture with the Northern Territory Government, leading a large team of researchers and extension workers on horticulture and crop protection issues.

Dr Lim and his family migrated to Australia almost 15 years ago. He was born and brought up in Malaysia and gained a PhD in the US. Prior to coming to Australia, he was a researcher and associate professor at the major Agricultural University in Malaysia.

### IRRI BOARD OF TRUSTEES

The International Rice Research Institute (IRRI) has announced the appointments of former ACIAR Chair Dr Beth Woods and ACIAR South Asia Adviser Dr Tony Fischer as new Board of Trustees members.

The 15-member Board of Trustees (BoT) meets twice a year as IRRI's most important policy-making body. It is made up of eminent scientists and world leaders in a range of scientific and other disciplines.

Dr Woods, who stepped down as Chair of ACIAR in 2004 to take up the position of Executive Director of Research and Development Strategy at the Queensland Department of Primary Industries and Fisheries, is also the Foundation Professor of Agribusiness at the University of Queensland.

Dr Fischer, aside from his role advising ACIAR, is on the Board of the Grains Research and Development Corporation and has been Director of the CIMMYT Wheat Program.

IRRI is the world's leading rice research and training centre, based in the Philippines. It is

## NEW PROJECTS

ADP/2002/089 Agricultural trade liberalisation and domestic market reforms in Indian agriculture
ASEM/2002/051 Sustaining and growing Landcare systems in the Philippines and Australia
ASEM/2002/103 Enhancing project impact and science capability through ongoing evaluation
ASEM/2003/009 Bridging the gap between seasonal climate forecasts and decision makers in agriculture
AS2/2001/094 Sustainable development of grasslands in western China
CP/2003/028 Biological control of two major weeds affecting crop and livestock production in East Timor
CP/2003/029 Management of potato late blight in Papua New Guinea
FIS/2000/065 Assessing the potential for low-cost formulated diets for mud crab aquaculture in Australia, Indonesia and Vietnam

## PROJECT VARIATIONS

ADP/1997/092 Impacts of alternative policy options on the agricultural sector in Vietnam
ASEM/2000/107 Future prospects for smallholder poultry producers in the Philippines: ducks and native chickens
AS2/1998/035 Ruminant production in the red soils region of southern China and in northern Australia
CP/1996/091 Biological control of *Chromolaena odorata* in Indonesia, Papua New Guinea and the Philippines
CP/2001/032 Impact and management of Oribius weevils in Papua New Guinea
CTE/2000/165 Facilitating farmer uptake of ACIAR project results: World Vision collaborative program
FIS/1997/031 Pearl oyster resource development in the Western Pacific
FST1998/096 Domestication of Australian trees for reforestation and agroforestry systems in developing countries
FST/1998/118 Planning methods for sustainable management of timber stocks in Papua New Guinea's forests
FST/2000/123 Heart rots in plantation hardwoods in Indonesia and southeast Australia
PHT/1997/017 Reducing aflatoxin in peanuts using agronomic management and bio-control strategies in Indonesia and Australia
SMCN/1999/005 Improved soil management on rain-fed vertisols in Nusa Tenggara
SMCN/2001/048 Legumes and reduced tillage for rice- and maize-based cropping in the Democratic Peoples Republic of Korea (DPRK)

## NEW PUBLICATIONS
## MONOGRAPHS

### WORM CONTROL FOR SMALL RUMINANTS IN TROPICAL ASIA

This book and the accompanying CD draw together information from a number of sources to describe the state of research and development on worm control in Asia and the Pacific.
R.A. Sani, G.D. Gray and R.L. Baker (eds).
ACIAR Monograph 113, 264pp, price $32.00 (plus postage and handling).

### DIVERSITY AND MANAGEMENT OF PHYTOPHTHORA IN SOUTH-EAST ASIA

Phytophthora is one of the most important plant pathogens in the world and many economically important crop species in South-East Asia are susceptible. By bringing together information on the identification of phytophthora diseases based on symptoms, their occurrence, economic impact and development of integrated disease management practices, the authors of this volume provide practical information on how to limit the damage caused by phytophthora. A. Drenth and D.I. Guest (eds).
ACIAR Monograph 114, 238pp, price $32.00 (plus postage and handling).

# TECHNICAL REPORTS

## USING SEASONAL CLIMATE FORECASTING IN AGRICULTURE: A PARTICIPATORY DECISION-MAKING APPROACH

The challenge in using seasonal climate forecasts in agriculture is to assess and capture the potential benefits so that peoples' well-being is improved in terms of increased food security, protection of the resource base, lower costs or better economic outcomes within the community. This report arises from an ACIAR project involving Indonesia, Zimbabwe, India and Australia. A.K.S. Huda and R.G. Packham (eds).

ACIAR Technical Report 59, 52pp, price $13 (plus postage and handling).

# IMPACT ASSESSMENT SERIES

## EUCALYPT TREE IMPROVEMENT IN CHINA ACIAR IMPACT ASSESSMENT SERIES 30, AUTHOR: MARTIN VAN BUEREN

The impact assessment series reports are freely available as pdf files at www.aciar.gov.au. ACIAR's distribution policy is to provide complimentary copies of its publications to libraries, institutions, researchers and administrators in developing countries with an involvement in agriculture and to any scientist involved in an ACIAR project.

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# BOOK REVIEW

## HIGH-YIELDING ANTHRACNOSE-RESISTANT *STYLOSANTHES* FOR AGRICULTURAL SYSTEMS BY S. CHAKROBORTY (ED)

Review by J. CLEMENTS, Executive Director, The ATSE Crawford Fund

This is the most recent of a number of reviews of the state of scientific knowledge of *Stylosanthes* (stylo) and its use in farming and livestock production systems around the world. It comes at the end of an ACIAR-funded project aimed at developing new, high-yielding, anthracnose-resistant stylo cultivars for China, India, Brazil and Australia. While the results of this work are reported in detail and are the main focus of the book, the authors have taken the opportunity to review more broadly the recent literature on *Stylosanthes* (approximately 1000 publications since 1990) and to place it in perspective. There is a degree of repetition in the chapters, and there is much information in the earlier reviews that is not covered here but, on the whole, the book is a considerable success and will be a welcome addition to the shelves of all tropical forage legume researchers. It is likely to be too data-intensive for most farmers and graziers.

The book is arranged in three sections. The first contains reviews of aspects of scientific research on *Stylosanthes* – species relationships, genetic diversity, potential forage productivity, constraints to production, and the use of stylo in a wide range of livestock and crop-livestock production systems. The second contains the results of the ACIAR project, in journal paper format. The third contains chapters on aspects of the commercialisation of *Stylosanthes*, with emphasis on seed production and the emerging use of stylo leaf meal for livestock in China and India.

The book is notable for the excellence of the figures and illustrations, many of which are in full colour. Another strength is the abundance of information on the history of cultivar development and seed production in Latin America, Thailand, China, India and, to a lesser extent, Africa. Some of this information has been published before, but some has not. By adding this new information, the historically-minded reader can now piece together a well-documented story of determined efforts to bring stylo technology to farmers around the tropical world.

One of the particular achievements of the past 10 to 20 years is the increased adoption of stylo in farming systems in developing countries. Scaling up of stylo technology commenced in India and Thailand during the 1970s and in China during the 1980s. Estimates of sown areas are hard to come by, but from this book and other sources we estimate that the total sown area in these three countries has risen to about 750,000 hectares. There are other significant areas in Brazil and parts of Africa, and the total sown area in developing countries is now approaching the area sown in Australia. Worldwide, the economic benefits of stylo technology are now very significant.

The book highlights the significance of anthracnose disease caused by the fungus *Colletotrichum gloeosporoides*. During the past decade much of the research agenda has been driven by (or has arisen from) the urgent need to control this disease in order to enhance the sustainability of stylo-based agricultural systems. Reviewing the achievements of the last decade, particularly the increased level of adoption of stylo by farmers, one is struck yet again by the small number of cultivars that make up the bulk of the area now sown worldwide to stylo, and the vulnerability of these cultivars to anthracnose. This is well documented in the book, as are the advances in our scientific understanding of the host, the pathogen and their interaction.

Another lesson from the book is the diversity and complexity of the farming systems to which stylo can contribute. The provision of robust technology is vital; for example, in Brazil there have been hard-learned lessons about the difficulty of promoting cultivars that do not readily produce seeds or possess lasting anthracnose resistance. However, robust technology is not in itself sufficient to ensure widespread adoption. A particular challenge is to provide a farm operating environment – a suitable business and policy context – that will enable farmers to adopt stylo technology in an economically sustainable manner. Some of the factors that we take for granted in Australia (for example security of land tenure, and reliable access to markets for farm produce) do not exist in other countries. In India, Thailand and China, successful adoption has required long-term support by governments and aid agencies.

We have come a long way, and farmers have enjoyed many years of sustained economic benefits from stylo technology. Adoption is now increasing very rapidly. Sadly, (as Chakraborty states in this book) although stylo anthracnose disease has become one of the best-studied diseases of forage plants, it continues to hang over the heads of countless farmers and graziers. While researchers have lessened some of this threat, the potential for trouble persists, even as the research investments falter.


High-yielding anthracnose resistant *Stylosanthes* for agricultural systems. S. Chakroborty (ed). 2004. ACIAR Monograph 111, 264pp, price $45.00 (plus postage and handling).

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