



Australian Government

Australian Centre for International Agricultural Research

JUNE - AUGUST 2011

aci-ar.gov.au

partners

IN RESEARCH FOR DEVELOPMENT

**LOCAL PRIORITIES
DELIVER RESULTS**

**AID RECIPIENT
BECOMES DONOR**

**HELPING THE FARMER
FIND A MARKET**

**PEOPLE MAKE OUR
PARTNERSHIPS WORK**

People make partnerships

This edition of *Partners* celebrates some of the people working together within a small group of projects in recognition that without their dedication, enthusiasm and commitment the smallholders who are usually featured in these pages would lead lesser lives.

The success of the projects reported in this edition, as in all our project partnerships, is driven by the commitment of all of the people involved, both within and outside of ACIAR.

Since its inception in 1982 ACIAR has focused its operations on partnerships, linking Australian and developing-country scientists to deliver research to those in need of it. The effectiveness of ACIAR's partnership approach is borne out in the level of impacts generated, both to date and those estimated to occur into the future.

ACIAR's research generates practical solutions to agricultural constraints and works to deliver the resulting knowledge and technologies to smallholder farmers.

A recent independent analysis of 46 impact assessments undertaken for 120 ACIAR projects estimated a stream of benefits totalling \$31.6 billion. Of these benefits, \$29.4 billion flows to developing countries.

There are many reasons why our research approach is effective and successful. Research is targeted, based on the establishment of mutual priorities between partner countries and Australia, as reported on page 4.

The mechanism by which this is achieved is formal consultations with key stakeholders within partner-country research and agricultural institutions. ACIAR recently held a consultation in India, with future research to be focused through four clusters. The outcomes of that consultation inform ACIAR's Annual Operational Plans. How this approach is being deployed and the benefits of that approach are reported on page 6.

A recent independent analysis of 46 impact assessments undertaken for 120 ACIAR projects estimated a stream of benefits totalling \$31.6 billion. Of these benefits, \$29.4 billion flows to developing countries.

There are many reasons why ACIAR's research approach is effective and successful. Research is targeted, based on the establishment of mutual priorities between partner countries and Australia.

ACIAR supports postgraduate studies through a fellowship scheme for eligible developing-country scientists involved in its research projects. Emerging leaders, such as El Sotheary from Cambodia, engaged in ACIAR-supported research are the focus of a second fellowship scheme, delivering management and leadership. El's story, together with that of Delia Catacutan, another dual fellow, is told on page 20.

Adapting knowledge that has been proven in Australian conditions to the needs of smallholders is a constant challenge within ACIAR projects. Often the success of such endeavours is the result of the passion of individuals working within the project. Jeff Esdaile is one such scientist. He devoted his working life to establishing conservation agriculture in Australia. Now he is sparking a similar revolution, albeit on a different scale in a number of developing countries, through adapting machinery to roll out conservation tillage in Bangladesh and elsewhere (see page 12).

Pakistan and India are two countries that have benefited from ACIAR work on conservation tillage, particularly in wheat cropping. Sharing resources such as germplasm is another component of successful work, in joint research between India and Australia, reported on page 9. And it is not germplasm alone that is shared. Australian horticultural and dairy expertise is being shared with Pakistan under an Australian Government initiative.

There are other factors that also influence the effectiveness of ACIAR projects. A common thread to each of these is the people involved. This edition is dedicated to all of them.

This issue...

Local priorities deliver results

4

ACIAR partnerships support Australian researchers to work with their overseas counterparts on issues of common concern. How our processes link Australian and developing-country scientists to smallholder farmers is the result of partnerships that adapt to changing circumstances.

Water works

6

The crucial issue of water management in India is proving how ACIAR's cluster approach to research can tackle social and economic issues along with the science.

Yesterday's aid recipient is today's R&D partner

9

As increasing demand for grain challenges drought- and flood-afflicted farmers worldwide, a partnership between India and Australia is allowing agricultural scientists to share germplasm, funds and breeding expertise to help farmers lift wheat productivity.

Lifelong passion fuels productivity lift

12

Agronomic luminary Jeff Esdaile devoted his working life to establishing conservation agriculture in Australia. In retirement he is applying his ingenuity to revolutionise farming in developing countries.

The farmer needs a market

14

Australian horticultural and livestock expertise is helping disadvantaged Pakistani smallholder farmers achieve higher productivity and profitability through a program that also endows Pakistan with a stronger agricultural research, development and extension sector.

Sharing our citrus success with Bhutan

16

A group of citrus industry personnel from Bhutan recently toured Australian citrus industry operations to help direct improvements in their own industry.



ACIAR
aciar.gov.au

Australian Centre for International Agricultural Research (ACIAR), aciar.gov.au
GPO Box 1571, Canberra ACT 2601, Australia

This work is copyright. Apart from any use as permitted under the *Copyright Act 1968*, no part may be reproduced by any process without prior written permission from ACIAR,

Commonwealth Copyright Administration

Attorney-General's Department

Robert Garran Offices, National Circuit, Barton ACT 2600

or posted at <http://ag.gov.au/cca>

© Commonwealth of Australia 2011

PARTNER COUNTRIES

INDIA, see pages 6–11

PAKISTAN, see page 14

BHUTAN, see page 16

FIJI, see page 18

ASIA / PACIFIC, see page 24

Fijian papaya gets a boost 18

Growth in exports of high-quality papaya from Fiji has the potential to raise the livelihood of smallholder farmers. Helping them achieve the necessary supply-chain innovation is an industry-led ACIAR initiative.



Research grows from the seeds of fellowship 20

Providing postgraduate opportunities to people living outside Australia has seen research knowledge spread and thrive across the developing world.

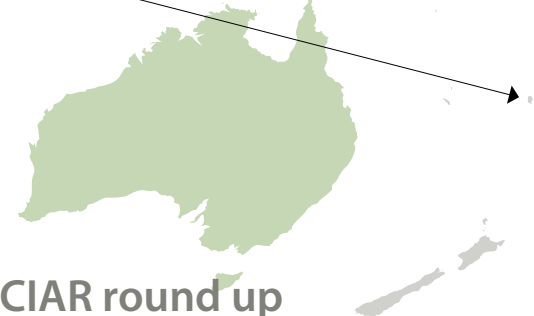
Positive news for world's poor 22

As president of the International Fund for Agricultural Development, Dr Kanayo Nwanze oversees the UN agency working to alleviate poverty and food insecurity among poor rural people. He met up with ACIAR while in Canberra to discuss a new IFAD report on progress to eliminate extreme rural poverty.



Sea ranching shows promise 24

The economic importance of sandfish to poor rural Asian communities triggered a collaborative, multinational research effort to advance breeding and rearing techniques when fish numbers started to decline dangerously.



ACIAR round up

Lao researchers in Wagga Wagga 27

ACIAR Commission appointments 27

Helping Tibetans keep butter tea on the table 28

Farmers happy with increased rice yields in Sulawesi 28

Weather forecasts for Indian farmers 28

Cambodia builds first no-till seeder 28

Congratulations Norah 29

John Dillon Fellows visit Canberra 29

ACIAR what's new

New staff 29

Globetrotters 29

ACIAR Commissioners 30

New publications 30

New projects 31

Events 31

partners
IN RESEARCH FOR DEVELOPMENT



Mixed Sources
Product group from well-managed forests and other controlled sources
www.fsc.org Cert no. SGS-COC-006660
© 1996 Forest Stewardship Council

Partners in Research for Development is the flagship publication of the Australian Centre for International Agricultural Research (ACIAR). Partners presents articles that summarise results from ACIAR-sponsored research projects and puts ACIAR research initiatives into perspective. Technical inquiries 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.

This publication is freely available from ACIAR's website at <aciar.gov.au>. It is also freely available on request from ACIAR. The use of a trade name does not constitute any endorsement of, or discrimination against, any product by ACIAR.

ISSN 1031-1009

For further information contact:
ACIAR Communications and Public Affairs, +61 2 6217 0500

Letters from readers are welcome, and should be addressed to:

The Editor
Partners in Research for Development, ACIAR
GPO Box 1571, Canberra ACT 2601, Australia

Executive editor: **Alex Bagnara**, ACIAR science communicator
Email: comms@aciar.gov.au Photos: All photos ACIAR unless credited

Managing editor: **Brad Collis**, Coretext Pty Ltd, coretext.com.au
Associate editor: **Dr Gio Braidotti**, Coretext Pty Ltd, coretext.com.au
Design and Production: **Coretext Pty Ltd**, +61 3 9670 1168



Local priorities deliver results

ACIAR partnerships support Australian researchers to work with their overseas counterparts on issues of common concern. How our processes link Australian and developing-country scientists to smallholder farmers is the result of partnerships that adapt to changing circumstances.

KEY POINTS:

- **The best approaches to ending poverty are those that understand the issues present within a country or region and design tailored responses.**
- **Flow-on benefits from investment in agriculture include freeing-up labour, generating community growth, ensuring better health and education outcomes, and improving environmental management.**
- **Research priorities need to adapt to changing circumstances.**

BY ALEX BAGNARA

Disaster management, education, gender equality, infrastructure ... such diverse needs all compete for aid funding. So what makes investment in agricultural research and development a priority?

The answer is that half the world's people living in poverty are smallholder farmers.

Dungi Tudu is one of these smallholders. Her life has been one of closed opportunity: her husband Jamiswar was forced to migrate to find work; the land she was left to farm is leased; the income from her work is minimal and the food not enough to keep her children from hunger. Dungi's story of life in Amagara village in India's West Bengal mirrors that lived by families in Papua New Guinea, Tanzania, Lao PDR, Indonesia and elsewhere.

Many of these smallholders struggle to grow enough food for their families. For most, food security is a daily challenge because they do not have the money to buy food they cannot grow.

Often, smallholder land is also marginal—on the sides of hills, far from water, in low-rainfall areas and even on the edge of deserts.

Lack of income also prohibits these farmers from buying fertiliser or pesticides. If they do lose their crop to poor yields or insect attack, often they cannot afford to buy more seed, and what seed they do have in storage may have to be eaten.

This is the harsh reality of life for the world's rural poor. Opportunities taken for granted in developed countries—education, access

to health care, and sufficient daily calorie and protein intake—just do not exist.

Improved agricultural productivity is one way of changing this. Agricultural development research helps to transform smallholder production from subsistence to surplus; small perhaps, but enough to start paying for health care, supplementary nutrition and education.

The return on investment in agricultural aid therefore extends far beyond the immediate on-farm productivity improvements.

ESTABLISHING RESEARCH PRIORITIES

The Australian High Commissioner to India, Peter Varghese, commented on the importance of establishing partnerships during a formal consultation held earlier this year.

"The priorities articulated are both a guide and a touchstone to determine progress in the years ahead," he said. "Meeting these priorities will go a long way to changing lives mired in poverty."

One of those lives is Dungi. Her involvement in an ACIAR project saw her participate in a fertiliser trial, during which she learned about improved agronomic practices for her paddy fields.

The project was the result of previous consultations in India to set a mutual framework of research priorities addressed through projects. For Dungi, the project she became involved in was designed to answer research questions relating to water harvesting and the potential of cropping systems and agronomy to effectively use the harvested water.

ACIAR projects fit into a particular line of research aligned to regional and country priorities. These priorities are often evolving and ACIAR has a role in both responding to and informing the direction they take.

Since ACIAR began operations almost 30 years ago, it has supported Australian researchers and their counterparts in more than 40 developing countries, and the Consultative Group on International Agricultural Research (CGIAR), which oversees global agricultural development research aimed at poverty alleviation.

Much has changed in that time. The CGIAR is undergoing a series of reforms. Some original partner countries are now taking up new roles in ACIAR projects. Where agricultural capacity has been lifted and secured, some traditional recipients of agricultural aid and intervention are now moving into a position to start helping other countries.

ACIAR is adapting to these changes by progressively lifting the assistance it provides in helping to develop not just farmer productivity, but farmer and community agribusinesses.

Research now extends beyond the smallholder farm to areas such as product quality, market access and supply-chain challenges.

A CONSTANTLY EVOLVING PROCESS

Given changing global research directions and the enhanced agricultural capability of some partner countries, ACIAR works to ensure aid continues to be directed to areas of greatest need.

ACIAR commissions independent reviews to determine the economic impacts arising from projects and capacity-building activities.

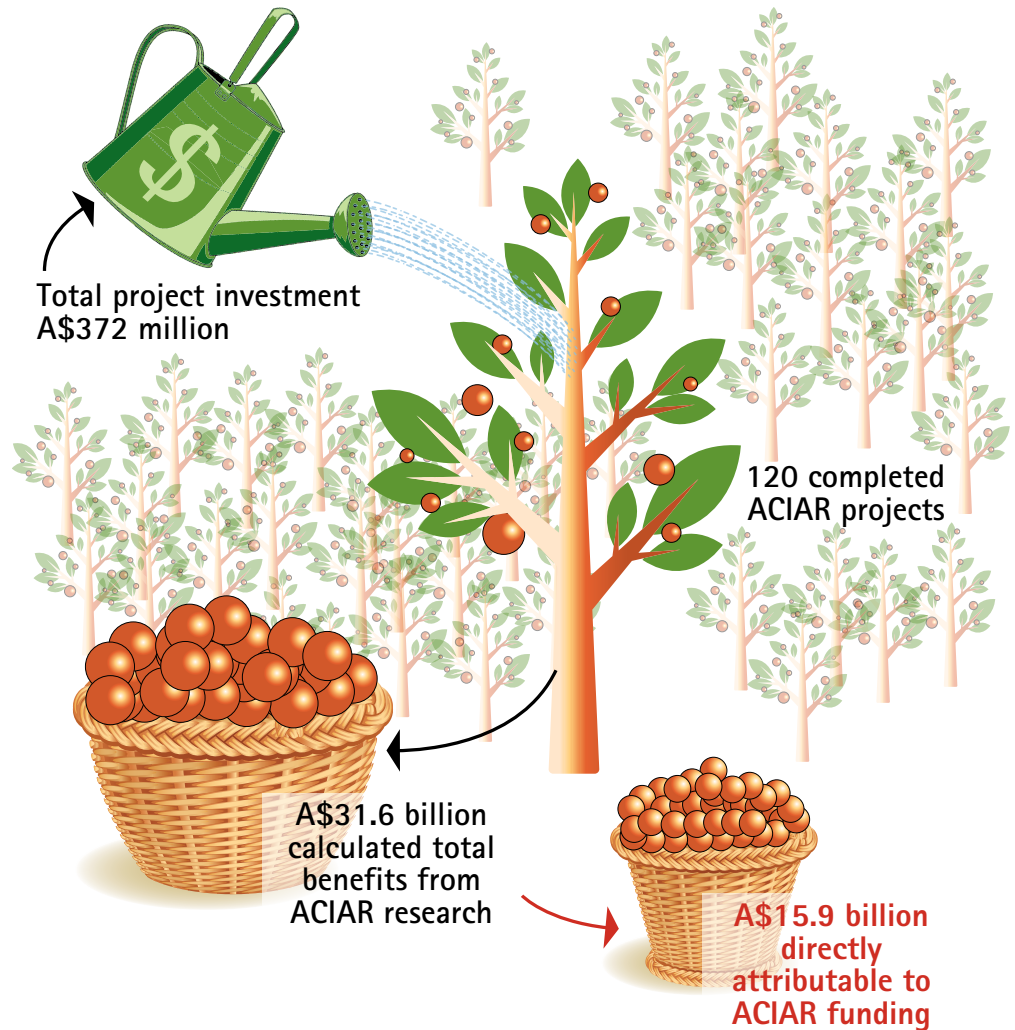
An analysis of 46 impact assessments on 120 completed ACIAR projects, with a total project investment of \$372 million, calculated total benefits from ACIAR research at \$31.6 billion. Of this, \$15.9 billion is directly attributable to ACIAR funding. This is more than three times the total ACIAR expenditure since its inception in 1982.

In 2011–12, the Australian Government

The World Bank's International Development Association suggests that of all the countries it finances, economic growth overall was fastest in those where agriculture projects were a component of their financing.

ACIAR's RETURN ON 120 PROJECTS*

Generates **\$31,6** billion



*An analysis of 46 impact assessments of 120 completed ACIAR projects (total project investment A\$372 million) calculated the total benefits generated from ACIAR research at A\$31.6 billion. Of this, A\$15.9 billion in benefits is directly attributable to ACIAR funding, which is more than three times ACIAR's total expenditure since its inception in 1982.

intends to increase its official development assistance to \$4.8 billion—an increase of 8.4% in real terms. The Budget paper on international development assistance also maintains the timetable for increasing aid towards the target of 0.5% of gross national income (GNI) by 2015–16, as set out in last year's Budget.

That increase is a part of Australia's commitment to the Millennium Development Goals set out by the United Nations to halve global poverty. It is also about the moral dimension of transforming the lives of the poor.

Dungi is today working side-by-side with her husband Jamiswar. By applying what she has learned from her involvement in the ACIAR project Dungi is able to earn a profit. It is enough that Jamiswar no longer needs to migrate for work. He and Dungi profit from the land they lease. Their children benefit through money for an education and the family home is being repaired.

For Dungi it once seemed "unbelievable" that she could today be in this position. The story of how the lives of her family have been transformed is the story of ACIAR. The partnerships that make the unbelievable real for smallholders come about through ACIAR's experience, adaptability and, above all, the commitment of ACIAR's people to partnerships.

This edition of *Partners* tells ACIAR's story through the eyes of some of our partners, our people and the projects that join their lives to those of the smallholders who benefit. ■

THE CGIAR REFORM PROCESS

In 2008, the Consultative Group on International Agricultural Research (CGIAR) set out to identify how best to adapt to and anticipate global changes and challenges, and ensure the continued supply of international 'public-good research' to help address them. This initiative culminated in the CGIAR's decision in December 2008 to adopt a new business model to fight poverty and hunger, while also conserving the environment.

VISION

To reduce poverty and hunger, improve human health and nutrition, and enhance ecosystem resilience through high-quality international agricultural research, partnership and leadership.

STRATEGIC OBJECTIVES

Food for people—create and accelerate sustainable increases in the productivity and production of healthy food by and for the poor.

Environment for people—conserve, enhance and sustainably use natural resources and biodiversity to improve the livelihoods of the poor in response to climate change and other factors.

Policies for people—promote policy and institutional change that will stimulate agricultural growth and equity to benefit the poor, especially rural women and other disadvantaged groups.



(Main photo) Farmers' club meeting in Nemmani village, Bangladesh.

(Inset) Project research fellow Rajender Kulla conducts an interview with a farmer in Gorita village, Andhra Pradesh.

WATER WORKS

The crucial issue of water management in India is illustrating how ACIAR's 'cluster' approach to research can tackle social and economic issues along with the science.

KEY POINTS:

- **Water management in India is inextricably linked to social and economic issues.**
- **ACIAR's 'cluster' approach to water management considers socioeconomic and equity issues alongside technical considerations.**
- **Crop modelling will help vulnerable smallholder farmers mitigate risks from climate variability.**

BY MELISSA MARINO

The combination of rising demand for water, lack of clarity on who owns this resource, and a changing climate altering rainfall patterns are colliding in India, and smallholder farmers are most at risk. And this is only part of the complex environment of water management.

Exacerbating this situation is the need to implement agreed institutional arrangements for water management across Indian states, while still ensuring those farmers at risk have access to water.

Balancing these diverse viewpoints, needs

and rules cannot be done in isolation. The ability to mitigate climate-related risk will not be successful if broader approaches to water resource management do not address associated issues, such as ground water depletion.

ACIAR's approach in India bases its projects around linked clusters: advanced wheat breeding; crop management and cropping systems; land and water resources; and policy.

"This multidisciplinary approach—clusters, if you like—represents a significant improvement by combining research disciplines within projects to create a synergy that allows for real results on the ground," says ACIAR's principal adviser Dr Simon Hearn.

The clustering of ACIAR's water projects in India echoes the systems science approach utilised in Australia. Importantly, it allows for issues of socioeconomic and equity in relation to water to be studied alongside the applied scientific research, including consideration of current and alternative regulatory frameworks.

Perhaps nowhere do these issues intersect to create so many possibilities as in the area of

climate change. The shifting rainfall patterns that have helped shape patterns of life and farming, common across generations, are now uncertain.

PARTNER PRIORITIES

Climate change is already a key issue on the radar of the Indian Government. This is evidenced by its target of reducing its greenhouse gas emissions by 20–25% of 2005 levels by 2020.

That ACIAR is involved in this aspiration is in no small part due to the links between policy settings and farmers' lives. "We don't do projects unless they meet the priorities of our partner countries," Dr Hearn says.

"It's an absolute prerequisite, and one of the reasons for that is you won't achieve adoption of results unless you've got people on board in your partnerships and actively collaborating across the research spectrum."

The approach allows for various issues relevant to a clustered research theme to be examined by several projects and links forged between them. Groundwater depletion, for

example, creates issues of access and social equity; improved watershed development affects users downstream.

Viewed this way, water, Dr Hearn says, is one of the world's biggest challenges in agriculture. This is reflected by the increasing tendency for farmers and researchers to talk about yield per litre or megalitre in addition to the traditional measure of yield per acre.

And with water one of the resources most affected by climate change, farmers' yields per acre and per litre become a focal point beyond the field.

WEATHERING RISK

Managing risk is a major preoccupation of farmers worldwide. As climate change brings increasing variability to farming conditions, those risks become more pronounced.

Often it is those farmers with the least resources who are most at risk. They work in more vulnerable areas. They are at the end of water supply lines. Their food security is tenuous in good times.

A project developing climate-change adaptation strategies aims to modify crop-modelling systems used in Australia to Andhra Pradesh—a state in central India where agriculture is largely centred on small, rainfed, rice-based farms.

The modelling system is based on the online tool Yield Prophet, developed by CSIRO and BCG (formerly the Birchip Cropping Group). Indian partner organisations using the system can generate information that can help farmers adjust their cropping regimes in line with water and nitrogen availability, both before and during the growing season.

"Ultimately we want farmers to be able to track the season as it goes, more or less in real time, to make decisions more tightly linked to how the season is progressing," says project leader Dr Christian Roth, from CSIRO's Climate Adaptation Flagship.

But Dr Roth says perhaps the biggest risk to rainfed farming is brought about by climate variability.

Crop-simulation models such as Yield Prophet—which provide yield predictions based on climate data, soil moisture and nutrient levels—can help mitigate those risks by helping farmers decide if they should invest further in their crop or cut their losses.

"As the season progresses, you can model changed weather conditions to come up with more rigorous predictions and recommendations," Dr Roth says.

Developing a more strategic approach to managing water when it is available becomes more important, says Dr Roth. "So one of the



(Above) CSIRO's Dr Zvi Hochman (right) and G. Srinivas (left) from the Acharya N.G. Ranga Agricultural University using soil augurs for moisture and nitrogen content measurement in a farmer's field.



(Left) Farmers in Nemmani village in Bangladesh study weather forecast information.

questions we will assess in our project is, 'If you had access to a little bit of irrigation, when is the best time to use that water?' And if you don't have access to irrigation water, this is where seasonal forecasting can really make a difference. Farmers can adjust their management according to better knowledge about the season ahead."

Initially the focus is understanding farmers and their livelihoods, and collaboration with farmer groups to discuss climate variability and the resources they have—or need—to deal with it. This will help inform options related to seasonal recommendations. On-farm research experiments in the next season will then be established and monitored.

TAILORED INFORMATION

In India, much work has centred on improving the dissemination of information contained in advisories already being generated in rainfed areas of Andhra Pradesh by the Indian Meteorology Department and distributed by the Agro-Met cell of the Acharya N.G. Ranga Agricultural University.

Understanding farmers' needs and the viability of associated options can ensure the agro-advisories are even better tailored. This will be enhanced by the work of a social anthropologist associated with the project, who spent four months on the ground interviewing farmers about their enterprises and livelihood strategies.

Three villages in Andhra Pradesh's Warangal, Nalgonda and Mahabubnagar districts now receive twice-weekly medium-range forecasts customised to weather scenarios. Farmer groups meet twice a month to discuss the seasonal effects on crops and provide feedback on the advisories and accuracy of the weather forecasts. These activities are facilitated by a collaborating non-government organisation, WASSAN.

Already the information has been used to fine-tune the timing of sowing, paddy harvest and the application of insecticide to control sucking pests.

Dr Zvi Hochman, a CSIRO team member who helped establish Yield Prophet in Australia, plans for the agro-advisories to eventually be underpinned by Yield Prophet-type modelling. That will mean that the impact of a changing weather situation on crop prospects can be modelled to deliver predictions on management options.

"We see an opportunity to value-add to the agro-advisories," he says. "We want to make them more systematic and effective."

THE CLUSTER APPROACH AND POLICY

The linking of advisories to farmers must also operate within the broader policy environment.

It is this type of synergy, Dr Hearn says, that is critical to a project's success. For example, to achieve uptake, the research not only needs to be relevant to growers, but also in step with the regulatory framework and realistic socioeconomic contexts.

"If the policy framework is not conducive to people adapting the science in a practical sense, it may never happen," he says. "And after all, beneficial adoption of the research results is the driving objective of such undertakings."

While this is true for all countries, in India there are specific socioeconomic issues that need to be considered alongside the science to ensure implementation is realistic—for example, the cost of water and electricity.

ACIAR Land and Water Resources (LWR) program

The LWR program is spread across four key areas:

- **Management of soil and water salinity—for example, tsunami-affected soil management, developing baseline data for soil salinity in Iraq**
- **Water management at the farm scale (including improving cropping systems)—for example, laser levelling, permanent raised beds, conservation agriculture, drainage modification**
- **Basin-level water management and water policy—for example, monitoring sediment flows, water security across basins, village groundwater recharge, institutional performance of watersheds**
- **Climate-change adaptation and mitigation—for example, climate change adaptation strategies, assessment of impacts of climate change.**

Activities range from systems modelling at a basin scale and government policy options, to interacting with farmers on water management, salt-tolerant varieties and more efficient cropping systems.

The LWR program has been traditionally active in South Asia, with a particular focus on India (specifically the state of Andhra Pradesh), as well as Pakistan and Bangladesh. ACIAR has recently partnered with AusAID to undertake projects in the Middle East and Africa. There are also LWR projects underway in Laos, Cambodia and China.

Dr Hearn explains that in many parts of India water is almost free and the electricity used to pump it often heavily subsidised for smallholder farmers. While in social terms this serves its purpose, it is also detrimental to environmental conditions because collectively farmers are using electricity to pump groundwater at a rate that is depleting reserves in some provinces.

The sheer scale of this practice is illustrated by the statistic that 40% of energy produced in India is used to pump groundwater. On an environmental level, Dr Hearn says soil degradation is resulting from the rate of groundwater extraction partially driven by subsidised electricity.

But for pumping practices to change, Dr Hearn says social policy has to be considered alongside the scientific research. "If we can provide some policy options alongside the science, you can make better use of the science," he says.

"And this is just a small example of where a discipline cluster can work to bring together the economists and the policy researchers with the scientists, recognising, of course, that the final policy decisions rest with relevant Indian authorities."

SUPPORTING PARTNERS TO MAKE CHANGE

The issue of water ownership has particular relevance in India as there are no formal institutional mechanisms that encourage people to conserve the resource.

Nobody owns the water, so anyone who can dig a well can pump. While this accelerates the rate of environmental degradation, it also means there is less incentive for farmers to adopt new, more efficient water-management practices that researchers may recommend.

The issue is considered so significant that it cannot be left unaddressed. Professor Lin Crase from La Trobe University, Professor Vasant Gandhi from the Indian Institute of Management and Dr Madar Samad from the International Water Management Institute are collaborating on an ACIAR-funded project looking into the institutional arrangements around water. It complements a raft of research done by Indian organisations into the issue.

Another ACIAR project is looking at the equity issues surrounding groundwater access and watershed development in Andhra Pradesh. Led by Professor Geoff Syme from Edith Cowan University, this project addresses the uneven distribution of water access in the region where richer farmers have the resources to dig deeper tubewells to access more water than their poorer counterparts. This inequity is often compounded by the location of wealthier farmers, generally on richer soils with better

access to groundwater in the first place.

Both projects are considering the question of accessing water resources to help create more equitable systems. They will influence policy settings that are needed to help projects implement advances in technical research that can have the desired impact in the region.

Dr Roth says the state of Andhra Pradesh is an ideal place for the water cluster to be centred because it has government supportive of research and development, and also because it is largely a poorer region suffering from depleted groundwater, which affects both its rainfed and irrigated farming systems fed by the Krishna Basin.

POSITIVE FEEDBACK

"We strived to set up a 'water program' rather than a water project or set of water projects," says Dr Kuhu Chatterjee, ACIAR's South Asia country manager.

This is a departure from the usual approach to research in India, where historically research has been confined within strong institutional boundaries, such as rice or livestock. ACIAR has been fortunate in its timing and has worked hard to capitalise on this to further changes heralding a new approach.

The emerging economies of India and China are accelerating towards a multidisciplinary approach to research, particularly at a senior level.

At the same time the linkages between projects ensure that smallholders are central to shaping policy that will affect them.

While the 'big picture' projects provide an insight into broad water-management issues, the climate-adaptation project led by Dr Roth hones in on where potential conflicts could arise around water access in a changing climate in such a way that helps farmers on an individual level improve their capacity to adapt.

"If we help establish systems and processes that enable farmers to access relevant climate information they will be better placed to manage whatever the climate turns out," Dr Roth says. "At the end of the day, you are addressing the key issues of how the individuals are going to cope." ■

PARTNER COUNTRY INDIA

PROJECT: LWR/2010/033 Developing capacity in cropping systems modelling to promote food security and the sustainable use of water resources in South Asia

CONTACT: Dr Christian Roth, christian.roth@csiro.au; Dr Andrew Noble, andrew.noble@aciarc.gov.au

Yesterday's aid recipient is today's R&D partner

As increasing demand for grain challenges drought and flood-afflicted farmers worldwide, a partnership between India and Australia is allowing agricultural scientists to share germplasm, funds and breeding expertise to help farmers lift wheat productivity.

David Deery manning the 15-metre imaging tower of Australia's High Resolution Plant Phenomics Centre, which is used to take infrared thermography images of wheat crops. The imaging technology is used to improve the water productivity of wheat in dryland farming systems.

PHOTO: ANTON WASSON

KEY POINTS:

- **Indian and Australian researchers are exchanging wheat germplasm to raise the resilience and productivity of both countries' wheat crops.**
- **The program targets both breeding and agronomic practices such as conservation agriculture.**
- **Unique germplasm has been identified, with far-reaching implications for improving water productivity in dry farming regions.**

BY GIO BRAIDOTTI

There is a longstanding debt Australia owes India when it comes to its farmers' ability to produce vast surpluses of bread wheat. Pedigrees reveal that crosses made in the 1890s introduced genes from an Indian landrace into Australian wheat that proved so advantageous that they persist in elite varieties to the present day.

Researchers now believe that encoded in the Indian DNA are valuable stress-tolerance genes—to saline soils, for example—that help wheat adapt to the harsh environments of much of the Australian wheatbelt.

To Dr Paul Fox, manager of ACIAR's Crop Improvement and Management program, the Australian success of Indian biodiversity indicates just how similar the agro-climatic

landscapes and cereal-production challenges are in the two countries.

In recognition of this similarity and its food security implications, ACIAR has sponsored agricultural science collaborations between the two countries since 1983. As India developed, however, the relationship matured and it now jointly funds ambitious research projects in key crop-production challenges of the 21st century.

Prime among these are efforts to overcome major wheat-yield constraints arising from water scarcity and poor or hostile soils.

"The relationship with India is a big positive for Australia and consists of 12 projects, worth \$22 million, focusing on four areas: wheat breeding, cropping systems, water management and agricultural policy," Dr Fox says. "It is also a significant evolution in the relationship for both countries."



Dr Michelle Watt

PHOTO: BRAD COLLIS



Dr Howard Eagles

PHOTO: FELICITY PRITCHARD



Dr Paul Fox

PHOTO: EVAN COLLIS

FAMILIARITY BREEDS BETTER WHEAT

Active within the Indo–Australian wheat-breeding research network is Dr Howard Eagles of the University of Adelaide. Dr Eagles' familiarity with the pedigree and provenance of important wheat traits is so extensive that it advances molecular genetics, bioinformatics and commercial breeding.

He has recently finished work on an ACIAR project that provided Indian breeders with Australian germplasm and DNA markers to develop biscuit-quality wheat varieties. India is the second-largest biscuit-consuming country in the world (after the US), but relies on enzyme-treating flour from chapati wheat to make biscuits.

"The intertwining of Australia's gene pool with India's has an interesting history," Dr Eagles says. "It was legendary Australian wheat breeder William Farrer who first acquired Indian wheats and corresponded with Indian breeders."

The parentage of Federation wheat unequivocally includes an Indian landrace, 'Etawah', named after a district in the state of Uttar Pradesh. Genes originating from Etawah are now thought to have contributed a lot of stress tolerance to Farrer's wheat varieties.

"Federation basically created the current Australian wheatbelt because it could grow inland in dry areas," Dr Eagles says. "Farrer essentially figured out Mendelian inheritance and in 1895, during a tremendous drought, he spotted and selected a few lines from his crosses with Indian, Italian and Canadian wheats that coped a fair bit better. That was the start of Federation."

With a long history of growing wheat in low-rainfall seasons, Australia has kept up Farrer's legacy and possesses some of the world's best scientists when it comes to providing wheat with the means to yield in hot, dry conditions.

Prime among them are the CSIRO Plant Industry team headed by Dr Richard Richards. In 2009, Dr Richards' team decided to join the Indo–Australian Program on Marker-Assisted Wheat Breeding and the development of their latest suite of water-productivity traits is now partially funded by ACIAR. Heading the ACIAR-related activities is Dr Michelle Watt.

"CSIRO's philosophy is that to improve productivity in water-limited conditions is to essentially adapt the architecture of the wheat plant—the shoots and roots—to better scavenge and make use of available water," Dr Watt says.

"In significant zones of both Australia and India, wheat has to rely heavily on moisture stored in the soil for growth, supplemented only by low rainfall in Australia and limited irrigation from unsustainable groundwater sources in India."

The CSIRO team has made its most advanced wheat lines available to India as part of a germplasm exchange with breeders at the Directorate of Wheat Research, the Indian Agricultural Research Institute and the Agharkar Research Institute.

In a departure from past funding arrangements, the Indian partners do not receive ACIAR funds but are independently supported by the Indian Council of Agricultural Research.

ADAPTING TO HOTTER, DRIER CLIMATES

The CSIRO wheats are unique, the product of assimilating years of experience on how best to improve wheat yields in water-constrained farming systems.

Dr Watt says the CSIRO wheats have been field-tested in Australia and are especially advantageous in no-till farming systems where stubble from the previous crop is retained to increase water infiltration to the soil and

improve soil structure.

In exchange, CSIRO has received a package of 40 Indian wheat lines, selected for their standout performance in dry areas. Among that material is 'Lok1', a variety developed by an Indian philanthropic organisation.

"Lok1 was first released in the 1970s but is still grown by Indian farmers because it performs so well in the really dry central and peninsular areas," Dr Watt says. "We suspect there might be something special about its roots and we look forward to examining what makes this line perform well with little water. That's just one of the lines the Indian researchers provided for the project."

All the wheat lines are due to be assessed for water productivity side-by-side in India and Australia.

MORE PRODUCTIVE FARMING

Agricultural scientists such as Dr Watt realise that yield gains are not achieved through genetics alone. In Australia over the past 30 years, 70% of wheat yield gains have been attributed to advances in agronomy. Prime among the beneficial new farming techniques are stubble retention and reduced tillage, techniques that fall under the umbrella of conservation farming.

"We do have in mind that the CSIRO wheats are advantageous in no-till, stubble-retained farming systems," Dr Watt says. "Our research showed that was the case in Australia. So it is very likely that we might try to combine water-conserving agriculture with this germplasm in 2012 within the Indian trials."

Conservation farming replaces stubble burning and ploughing, which tend to damage soil structure and aggravate loss of soil moisture and fertility. In India, however, existing farming



Dr Gurjeet Gill



Dr John Dixon

practices add an extra complication. In some parts of India, wheat is planted in rotation with rice. Dr Gurjeet Gill from the University of Adelaide explains that soil degradation is common in rice–wheat systems, caused by excessive tillage and ‘puddling’ of soil (to minimise water infiltration) in flooded fields for paddy rice production.

“This aggressive tillage for rice production creates an inhospitable soil environment for the following wheat crop,” Dr Gill says.

Since 2006, Dr Gill has headed an ACIAR project that developed a no-till rice-production system to complement no-till systems for wheat developed and introduced in past ACIAR research. He collaborated with Chaudhary Charan Singh (CCS) Haryana Agricultural University, Punjab Agricultural University and the International Maize and Wheat Improvement Center (CIMMYT) in India. The project is active in India’s north-western plains zone of Punjab and Haryana, as well as the eastern state of Bihar.

The result is a mechanised double no-till system that produces similar rice yields while using up to 30% less irrigation water and less labour. As a bonus, soil structure is not degraded during the rice rotation, which allows for 10% higher wheat yields.

“With double no-till, farmers can retain stubble and go in with a drill to sow the next crop,” Dr Gill says. “In most cases, crop residues are removed from the fields and used as animal feed in an integrated cropping-livestock system.

“We found that traditional varieties perform well in the double no-till system. Hybrid rice does particularly well, as does Basmati rice.”

Locally made seed drills have been shown to perform well and do away with the need to hand transplant rice seedlings from the nursery to the field—an immensely hard job performed

at above 35°C and 80% humidity. Farmers have also been encouraged to perform laser levelling of their fields before sowing to ensure even water distribution.

These innovations stand to have long-term beneficial effects on food-production resilience and farm profitability by helping to conserve oversubscribed water resources, especially declining groundwater, improve soil fertility and eliminate the need to burn straw. There is an additional and rather surprising economic impact as well.

“As wages rise in India due to industrialisation, farmers’ labour costs have quadrupled in recent years,” Dr Gill says. “Despite India being densely populated, farmers are facing declining access to labour and, with it, a decline in production. Double no-till helps reverse that trend.”

Dr John Dixon, who manages ACIAR’s Cropping Systems and Economics research program, says another important outcome of ACIAR’s involvement in India has been growth in capacity within the Indian agricultural R&D sector.

“We’ve built the capacity in India to roll out conservation farming to interested farmers,” he says. “In so doing, India is now in a position to help other countries, like Pakistan, to adopt no-till and reap the benefits as once Australia helped India.” ■

PARTNER COUNTRY INDIA

PROJECT: Indo–Australian Program on Marker-Assisted Wheat Breeding

CONTACT: Dr Michelle Watt (CSIRO Plant Industry), michelle.watt@csiro.au;

Dr Paul Fox (ACIAR) paul.fox@aciarc.gov.au;

Dr John Dixon (ACIAR), john.dixon@aciarc.gov.au;

Dr Gurjeet Gill, gurjeet.gill@adelaide.edu.au

Deeper roots: the ‘Holy Grail’

Working side-by-side, Australian and Indian wheat researchers are extending the search for improved productivity underground—to the root system.

“With regards to roots and improved water-scavenging traits, researchers worldwide have barely begun to make discoveries,” Dr Watt says. “Almost all the research we are doing is new, so there are many opportunities for making important discoveries and that has created quite a keen atmosphere within the project.”

Critical to these efforts are three field sites in India that provide near-ideal conditions to screen for diversity in root architecture. The trial sites are located in the central and peninsular states, where wheat is grown entirely on soil-stored moisture acquired during the monsoon. Without rainfall to confuse the results, wheat lines whose roots are best suited to scavenging moisture deeper in the soil profile as the season progresses can be identified.

The quest for deeper roots is an ambitious one—something of a ‘Holy Grail’ among wheat breeders. Dr Watt explains that impressive yield gains are thought to be possible with roots that are just 10 centimetres deeper at the time of flowering and seed setting.

“We have calculated that the uptake of an extra 10 millimetres of water can contribute to an extra half tonne of grain per hectare,” she says. “So the deep-root trait has very high water productivity: a high yield per water available to the crop.”

Coring to measure root architecture and soil moisture commenced in 2010 and the preliminary analysis indicates the existence of a lot of genetic variability—both in root depth and distribution—in the pool of Indian and Australian wheats.

“I think we will get that extra root length,” Dr Watt says. “We easily have an extra 10 cm within the genetic variation in root system depth ... in fact, we have up to 40 cm.”

The next major challenge is making the selection process simpler on behalf of breeders, replacing soil coring with simple proxy measurements based on above-ground shoot traits.

“No-one in the world has yet managed to develop a reliable proxy test for deeper roots, but I think we can do it,” she says. “That is the great advantage of working in these Indian environments. We can clearly see the wheat’s ability to access deep soil moisture. So I do feel optimistic this project can eventually help farmers.”



Retired agronomist Jeff Esdaile with the ACIAR-Rogro zero-tillage tined seed drill that is revolutionising farming in developing countries.

Lifelong passion fuels productivity lift

Agronomic luminary Jeff Esdaile devoted his working life to establishing conservation agriculture in Australia. In retirement he is applying his ingenuity to revolutionise farming in developing countries.

BY MELISSA BRANAGH-McCONACHY

To NSW researcher Jeff Esdaile, agronomy is more than a career—it's a vocation. Hailed as the world's foremost authority on zero tillage with two-wheel tractors, the 72-year-old mourns the fact that, in most cases, "a generation of experience walks away when people retire".

Determined to make an ongoing contribution to agriculture since ending a 33-year stint at the University of Sydney in 2000, Jeff has worked in a voluntary capacity with ACIAR to develop more productive and sustainable farming systems in South-East Asia and other developing countries.

The same foresight that underpinned the University of Sydney's evolution as the pioneer of commercial-scale zero-tillage cropping in Australia has seen Jeff develop a 'no-till' seed drill that can be fitted to two-wheel tractors (2WTs).

A step up from animal traction, the 2WT is increasingly the major unit employed in countries such as Bangladesh, Cambodia and Lao PDR, where smallholder farming is common. It is also widely used in Mexico and throughout Africa.

Consistent with global objectives to protect food security in developing countries, zero-tillage cropping enables farmers to plant and harvest crops more quickly. By double cropping, farmers can increase food production.

Jeff was introduced to the concept at the



Bangladeshi farmers test the ACIAR–Rogro seed drill.

University of Sydney's Plant Breeding Institute in Narrabri, where he was appointed farm manager in the late 1960s following 7 years as an agronomist with the then NSW Department of Agriculture in Tamworth.

He was involved in early University of Sydney research that showed by retaining residue and eliminating tillage, 30–50 millimetres of extra water could be stored in cropping soils during the fallow period in comparison with traditional burning and tillage systems.

Jeff subsequently developed zero-tillage farming at the university's 4850-hectare 'Livingston Farm' in Moree, innovatively applying Australian research findings in a large-scale enterprise and demonstrating the technology's capacity to increase crop yields, reduce soil erosion and energy costs, and improve profits.

This paved the way for no-till systems to dominate broad-scale farming in Australia and earned Jeff a prestigious Australian Society of Agronomy Donald Medal in 2001. He was appointed a Member of the Order of Australia in 2006.

Jeff says the heightened opportunity for double cropping is a substantial spin-off in no-till systems that can "transform agriculture in South-East Asia and other countries where farmers face similar soil erosion and water loss issues".

He became involved in ACIAR work overseas

in 2004 when project leaders Professor Bob Martin, from the NSW Department of Primary Industries, and Professor Richard Bell, from Murdoch University, invited Jeff to assist farming mechanisation projects in Cambodia and Bangladesh.

"About 80% of arable land in Bangladesh was farmed with 2WTs, while in Cambodia 2WTs, four-wheel tractors and animal traction were used," Jeff says. "But I observed there was no conservation equipment available for 2WTs."

Work previously undertaken by the International Maize and Wheat Improvement Center (CIMMYT) and the Bangladesh Agricultural Research Institute (BARI) had been terminated, so on his return to Australia Jeff obtained a funding grant from ACIAR and teamed up with Spring Ridge engineer Chris Holland, of Rogro Machinery, to design and fabricate a seed drill for 2WTs.

Two prototypes were developed—a tined unit based on a toolbar concept and a rotary tillage drill. Both were fitted with seed and fertiliser boxes and press wheels, and adjustable for row spacing and seeding depth.

The drills have been successfully tested in Bangladesh, Cambodia and Laos since 2008, generating substantial farmer interest. However, adoption is largely dependent on affordability. The attachments cost about A\$5,000 to produce in Australia, but must be

manufactured under A\$600 to ensure uptake in Asia—where half a million 2WTs are produced every year—and in Africa and Mexico.

Future demand is also expected from Afghanistan following the US Government's subsidised distribution of 6,000 2WTs this year.

He was recently approached by a large Chinese manufacturer and will travel to Beijing for negotiations shortly as a guest of the China Agricultural University's Professor Li Hongwen, an advocate of the ACIAR–Rogro drill.

"No-till drills can vastly improve conservation, particularly in rice-based farming systems that are being rapidly commercialised but often face severe labour and water shortages," Jeff says. "It takes 33 days to plant 1 hectare of rice through transplant methods, but under a day using a machine.

"At the other end of the season, zero tillage and use of a seed drill enable farmers to harvest rice one day, spray weeds the next and plant a dry-season crop on day three, essentially increasing the number of annual crops from one to two or three (including wheat or maize and mungbeans in the rotation). This provides scope for significant productivity gains and economic growth."

As most 2WTs are sold with a rotary hoe or inversion plough attachment—"a step forward in mechanisation but backwards in conservation farming"—Jeff says promotion to convince farmers of the triple-bottom-line benefits is vital.

Training is also a priority. "It has taken 30 years for conservation farming to become the leading practice in Australia and it will take just as long in Asia and Africa, where education is limited and most farmers have never been exposed to mechanised farming systems," Jeff says. "Weeds, residue handling, and safe and effective herbicide application will present new challenges."

Jeff and Chris Holland presented the ACIAR–Rogro zero-tillage tined seed drill on the ABC TV program *The New Inventors* this year. The technology will also be demonstrated at the World Congress of Conservation Agriculture's 5th World Congress in Brisbane in September (www.wcca2011.org). ■

MORE INFORMATION

For more information or to subscribe to the 'Two Wheel Tractor Newsletter', contact Jeff Esdaile (+61 2 6760 8572, rjesdaile@bigpond.com).



ACIAR projects in Pakistan are helping smallholders engaged in the citrus and dairy sectors to become more profitable.

THE FARMER NEEDS A MARKET

Australian horticultural and livestock expertise is helping disadvantaged Pakistani smallholder farmers achieve higher productivity and profitability through a program that also endows Pakistan with a stronger agricultural research, development and extension sector.

KEY POINTS:

- Australia and Pakistan are adapting Australian farming technology to alleviate poverty among Pakistani smallholder farmers.
- The program targets improved productivity and market and employment opportunities.
- Support is also provided to improve economic and natural resource management, and build public and private capacity to service the needs of stakeholders.

BY GIO BRAIDOTTI

There is growing recognition within the aid community that helping smallholder farmers can have far-reaching benefits for alleviating poverty. Farms can function as a catalyst for greater socioeconomic development and environmental sustainability.

The idea is central to ACIAR operations. Across programs, ACIAR's research managers do not just help developing-world farmers better manage their fields, ponds, fisheries or woodland. To realise the benefits of greater on-farm productivity, ACIAR also pays attention to issues beyond the farm gate, such as the supply chain that determines farmers' access to markets and retailers.

The approach can transform disadvantaged subsistence farms into small but dynamic agribusinesses that provide farming families with the means to better access education, health care and to build rural economies.

Rather than pursue solutions across the supply chain in a piecemeal fashion, ACIAR takes an integrated approach, building

into projects support for issues relating to marketing, labour and retailing.

One of the largest such endeavours is the \$6.6-million Australia–Pakistan Agriculture Sector Linkages Program (ASLP), which initially ran from 2005 to 2010 and targeted Pakistan's mango, citrus and dairy sectors.

In each case, ASLP on-farm production projects were augmented with supply-chain and social-science components, each headed by an Australian and a Pakistani project leader. The approach has proven to be one of Pakistan's most successful models for agricultural cooperation and partnership.

As a result, ACIAR and AusAID have agreed to extend ASLP, with AusAID investing A\$12.95 million over four years into ASLP2. Providing oversight of the program is Dr Munawar Kazmi, who formerly headed the mango production project for Pakistan. He is based at the Australian High Commission in Islamabad.

"We are ready to start phase two, which I am excited about," Dr Kazmi says. "The goals are the same and build on the outcomes from phase

one. But we are now more focused on the small farmers.

“In Pakistan the majority of farmers hold less than 5 hectares of land. So our goal is to reach more of the farmers for whom innovation and fine tuning of management practices can alleviate poverty and bring benefits to society.”

One thing Dr Kazmi stresses is that there is no intention to copy Australian farming practices but rather to understand the science behind the technology that makes Australian farms so productive. The aim is to then modify and adapt it for farmers in Pakistan and their local situation.

“One example is the emphasis we have placed on improving nursery practices in both the mango and citrus projects,” Dr Kazmi says. “We are not importing any material or technology from Australia for the nurseries. Pakistani smallholders could not afford it.

“Instead we work with what is available locally. This is an approach that makes innovation and productivity gains affordable while emancipating the local economies of smallholders.”

MANGOES, CITRUS AND DAIRY

The agricultural sector in Pakistan contributes 21.8% to the country's gross domestic product. Of particular importance are the mango, citrus and dairy sectors.

ASLP2 assistant coordinator Dr Greg Johnson says dairy is by far the country's largest agricultural industry. It ranks fourth in the world, with production worth an estimated US\$5.77 billion in 2008.

About eight million farm families are responsible for 95% of this milk production. Most are smallholders with two to five animals raised on farms that often also produce wheat, maize and cotton. About 66% of Pakistan's milk is actually produced by buffaloes; the remainder comes from cattle.

Dr Johnson says that given the informal and traditional structure of the industry, most of the milk produced is used for family consumption or traded locally.

“Of particular note for poverty reduction is the economic scope that dairy offers people with no secure land tenure, as a significant proportion of the land-less raise dairy cattle as a major source of income,” he says.

Analysis by ASLP scientists found a dairy sector in which production levels are below genetic potential and smallholders too far removed from market considerations. The situation proved similar in the fruit sector.

Pakistan harvested about 1.75 million tonnes of mangoes in 2008 from the Punjab and Sindh regions and 2.5 million tonnes of citrus, most of it mandarins. This production level makes Pakistan the world's fifth-largest mango producer and the

fifth-largest exporter of mandarins.

Farmer income, however, is constrained by high postharvest losses, low export levels (less than 5% for mangoes and 10% for citrus) and low export prices due to poor quality, handling and marketing.

With the government of Pakistan eager for incomes to increase among smallholders, the ASLP partners agreed on two main strategies: improving production and streamlining marketing.

Dr Johnson says that the benefit of this approach is illustrated in the mango sector where, despite export volume remaining relatively constant (as a percentage of total production), export value has risen from US\$32 million in 2007 to US\$61 million in 2009, which amounts to a 33% increase in price.

The process, however, places added pressure on producers to improve quality and meet international standards, issues that ASLP is helping farmers address. The Australians on the team also evaluated where Australian expertise could be brought in to the greatest effect and focused on adding value to existing production systems.

For horticulture these included the introduction and evaluation of new types of citrus and new varieties, the improvement of nursery production systems for virus-free stock, and the provision of improved management packages.

“For citrus, the focus was on improving orchard management practices,” Dr Johnson says. “The season was very short, so the program is helping to expand that window and reduce ‘seediness’, which is unpopular in some markets.”

Besides working with farmers on production issues, ASLP teams also distributed surveys in international markets, all the way through to retailers, to collect information about what buyers look for in Pakistani fruit. Feedback is then provided to growers and exporters who can use the information to target different markets.

“Through the ASLP we established demonstration sites where we can showcase the results of all the agricultural practices being made available to smallholders,” Dr Kazmi says. “The value-chain team members then market the fruit from these sites as a trial shipment and that allows them to go to the growers and tell them what the returns are from adopting certain farming practices.”

Dr Chrys Akem from the Queensland Department of Employment, Economic Development and Innovation (DEEDI) explains that a system-wide approach is one of the strengths of Australian horticulture in general and mangoes in particular.

“The systems approach and integration of end users in the planning, execution and

evaluation of research are unique attributes that could be brought to bear in Pakistan,” Dr Akem says. “It promises significant opportunities for impacts on productivity and more efficient supply-chain systems.”

From Dr Kazmi's perspective on the ground in Pakistan, the approach has earned the respect of Pakistani farmers. “Advice provided by Australian scientists is often considered convincing and is followed more diligently than advice offered in the past from extension services,” he says. “If the Pakistani project teams know that somebody from the Australian team is coming to discuss the project, they are more enthusiastic. It is a morale builder.”

However, travel to Pakistan has sometimes been restricted due to security concerns. Nonetheless, links and friendships have been forged as partners found alternative means to connect.

“As part of building research, development and extension capacity within Pakistan, the ASLP has provided the means for the Pakistani participants to travel to third-party countries that import Pakistani fruit or to Australia,” Dr Kazmi says.

“When we launched ASLP, we brought a group of growers to Australia who developed good links with the Australian Mango Industry Association. We are trying to develop the same kind of linkages with the Australian citrus industry. Some of the more enterprising farmers have even made contact with Australian scientists by email and Skype.”

Among the more frequent Australian visitors to Pakistan are Professor Peter Wynn's livestock team from Charles Sturt University (CSU), who identified poor nutrition as the main limitation to milk production and are helping farmers make up the shortfall. He places special emphasis on communication between farmers and extension officers.

“There is a major opportunity for Australian technical support to help develop the dairy sector by enhancing extension services provided to farmers,” Professor Wynn says.

“This includes improving the style of communications with farmers, the information available to extension staff to address farmer problems, the skills and number of extension staff, and the capacity to consider problems and solutions in a whole-farm systems context.” ■

PARTNER COUNTRY PAKISTAN

PROJECT: Australia–Pakistan Agriculture Sector Linkages Program (ASLP)

CONTACT: Dr Munawar R. Kazmi,
munawar.kazmi@dfat.gov.au



I&I NSW irrigation officer Jeremy Giddings runs a soils and irrigation workshop for Bhutanese extension staff in Bhutan.



Sharing our citrus success with Bhutan

A group of citrus industry personnel from Bhutan recently toured Australian citrus industry operations to help direct improvements in their own industry.

KEY POINTS:

- Citrus is the most important cash crop to the 670,000 people who live in Bhutan.
- More than 22,000 households in Bhutan's central and southern districts grow mandarins.
- Prior to engagement with Australian scientists, average yields were less than half that of Australian trees.

BY MANDY GYLES

The citrus industry in the small Himalayan country of Bhutan is adopting new strategies to boost production of their biggest export crop, thanks to the assistance of Australian citrus industry experts.

Mandarins are grown by more than 22,000 households in Bhutan, mostly in the central and southern districts of the country, which is on the eastern end of the Himalayas and home to some 670,000 people. Citrus is Bhutan's most valuable export crop, with Bangladesh and India the main market destinations.

Traditional Bhutanese mandarin producers

rarely prune their trees, use few inputs and are faced with pests and diseases such as Chinese citrus fruit fly, powdery mildew and the insect-borne bacterial disease Huanglongbing (HLB). As a result the fruit can be of poor quality, with average yields less than half that of Australian trees.

INTRODUCING NEW TECHNOLOGY

In the past 3 years, the foundations have been laid for the Bhutanese citrus industry to adopt new technologies. This has been achieved with input from citrus personnel at Industry & Investment NSW (I&I NSW) and visits to Australia by Bhutanese research and extension officers for training and exposure to Australian citrus technology and production practices.

The work has been led by Sandra Hardy, citrus industry leader with I&I NSW, in collaboration with Mr Dorjee, national citrus coordinator with the Bhutan Department of Agriculture.

Ms Hardy says the project has exposed the Bhutanese to several management practices

they can use to improve their citrus production. "Early surveys of Bhutanese growers identified opportunities to improve yields through tree pruning, better-timed fertiliser and irrigation applications, and more targeted pest and disease-management strategies.

"Following on from our training and exposure to Australian citrus industry practices, the Bhutanese research and extension staff have been running farmer field days to demonstrate best management practices."

Two demonstration orchards have also been established in Bhutan to show the benefits of canopy management, weed removal and creating basins around the trees for the targeted application of water and fertilisers.

WELCOME CONTRIBUTION

Mr Dorjee says the project's contributions to developing Bhutan's citrus industry are numerous and welcome. "Unlike other projects in our country, the visits by eminent Australian citrus scientists and researchers to Bhutan will have a direct impact on our citrus industry both



Paul Holford, a pathologist from the University of Western Sydney, demonstrates the use of the iodine-starch test to Bhutanese district extension officers on a citrus pest and disease study trip to Bhutan in 2009. The iodine-starch test can be a useful field test for helping to select suspect HLB leaves for further laboratory testing.



(From left) Mr Dorjee, national citrus coordinator with the Bhutan Department of Agriculture, Sandra Hardy, I&I NSW, and Eyles Citrus nursery owner Gary Eyles inspect a citrus tree ready for dispatch.

in terms of technology generation and capacity building of our extension and research officials," he says.

As a result of the technical input provided by I&I NSW, improvements have been made to citrus management, with the project identifying pests and diseases that are affecting crops such as HLB.

"We are also taking steps to improve our citrus nursery practices and tree production techniques," Mr Dorjee says.

RECENT AUSTRALIAN VISIT

A group of senior citrus industry personnel from Bhutan recently toured Australian citrus industry operations on a three-state visit to help direct improvements in their own industry.

In Mildura they visited the Murray Valley Citrus Board, Citrus Australia Ltd, Auscitrus, the Mildura Co-operative Fruit Company and Dareton Agricultural Research and Advisory Station, along with local citrus producers, including an organic producer.

In the Sydney Basin they visited the Elizabeth Macarthur Agricultural Institute, the University of Western Sydney, Sydney Markets and a wholesale citrus nursery. While in Queensland the visitors were hosted by owners of a number of orchards, nurseries and packing sheds in the Mundubbera–Gayndah area.

Mr Dorjee says the group was very interested to see how Australian citrus growers prune their trees because it is one of the main ways they are improving production in Bhutan.

"Traditionally seedling trees are used and growers don't prune their trees at all, so the Australian approach is very different," he says.

AUSCITRUS FOCUS

Members of the Bhutanese group benefited from seeing the operations of Auscitrus—the industry organisation that supplies high-health-status budwood and seeds to the Australian industry—including at Eyles Citrus nursery at Kenthurst, Sydney.

"As well as looking at nursery practices we tried to reinforce how important a scheme like Auscitrus is to the citrus industry in any country," says owner Gary Eyles. "If you are not propagating from clean, true-to-type material then you are starting with a huge disadvantage."

The Bhutanese group could see the potential for introducing this approach. Mr Dorjee says Bhutan wants to introduce the use of clean-grafted citrus trees because they can fruit in 3–4 years. "This is significantly earlier than the seedling trees currently used, which take, on average, 7–8 years to fruit, and sometimes up to 12 years."

A selection of citrus rootstock has been introduced as seed into Bhutan to provide a source of rootstock material for the Bhutanese citrus industry. These rootstocks are being further trialled in Bhutan to assess their performance under the local mandarin variety on a range of soil types.

EXOTIC DISEASE THREATS

An important aspect of the ACIAR project has been research on exotic diseases such as HLB, which is a key threat to Australia's citrus industry.

Through the project, Australian scientists completed a pest and disease survey, collected psyllids (the insect vector of HLB) and diseased

citrus samples. As a result, they identified the agent responsible for the devastating powdery mildew disease that causes mandarin tree dieback and crop loss in Bhutan. Spray trials are assessing the use of sulfur and horticultural mineral oils for the control of powdery mildew in citrus orchards.

"One of the benefits of the project to Australia has been the experience of learning firsthand about these exotic pests and diseases, and the impact they have on commercial citrus orchards," says Graeme Sanderson, an I&I NSW officer who has visited Bhutan several times to pass on his knowledge of the Australian citrus industry.

"These diseases, already present in neighbouring countries like Papua New Guinea and East Timor, are a severe biosecurity risk to Australia."

To assist in the transfer of new knowledge to Bhutanese extension officers and farmers, a simple production guide for mandarin orchards has been developed. It provides guidance on canopy management, nutrition, irrigation, pest and disease management, and harvesting practices. A similar guide is being produced for Australian mandarin growers as part of the project. ■

PARTNER COUNTRY BHUTAN

PROJECT: HORT/2005/142 Improving mandarin production in Bhutan and Australia through the implementation of on-farm best management practices

CONTACT: Sandra Hardy, sandra.hardy@industry.nsw.gov.au; Les Baxter (ACIAR), les.baxter@aciarc.gov.au

FIJIAN PAPAYA GETS A BOOST

Growth in exports of high quality papaya from Fiji has the potential to raise the livelihood of smallholder farmers. Helping them achieve the necessary supply-chain innovation is an industry-led ACIAR initiative.

KEY POINTS:

- A sea-freight option is being researched for Fijian papaya farmers and exporters to New Zealand markets.
- A successful trial in 2011 found freight costs can be nearly halved, while doubling papaya exports.
- The project is an example of an effective private–public partnership.

BY GIO BRAIDOTTI

Farmers cultivating cash crops for export face a make-or-break issue: finding the means to economically move produce to markets. The problem is especially acute for Pacific Island farmers located thousands of kilometres from target markets.

For years papaya growers in Fiji relied on the aeroplanes that brought tourists to the islands to freight produce to buyers. Air-freight helped to open markets in New Zealand, Australia and Japan for 'Fiji Red' papayas, but it also imposed high freight costs and limits on the industry's growth.

In good years—when cyclones and floods leave orchards relatively unscathed—production can exceed available air-freight capacity.

2011 was just such a year but, unlike previous good years, papaya growers were able to tap ACIAR support to trial a system to sea-freight Fijian papaya to Auckland retailers.

Dr Richard Markham, research program manager for ACIAR's Pacific Crops program, says the project's starting point was questionable quality at point of sale, which was undermining the reputation of Fiji Red papayas.

"To improve standards requires action all the way from planting material through to crop nutrition, grading and postharvest handling," Dr Markham says. "The sea-freight trial component of the project provides opportunities to compare freight alternatives that can increase the competitiveness of Fijian papaya in export markets by reducing costs and creating opportunities for growth."

The impetus for the papaya project came from an industry service company that is owned by Fijian papaya growers and exporters. Nature's Way Cooperative is located near Nadi International Airport and provides high-temperature forced-air (HTFA) treatment to eliminate the risk of fruit fly from fresh produce destined for export.

The cooperative has more than 300 members, all located in the Western Division of the main island in the Fijian archipelago, Viti Levu. Nature's Way Cooperative established the Fiji Papaya Project to improve the industry's competitiveness for the benefit of its members.

For the shipping trial, the project accessed Australian and international expertise through

PHOTOS: KOKO SIGA FIJI



Papaya is harvested over three days at Produce Specialties Ltd farms at Sigatoka, Fiji.

relationships with research organisations brokered by ACIAR. Prime issues were how best to stall ripening during the longer sea route and the need for cartons that protect the fruit while promoting cooling.

Technical partners participating in the project include the Secretariat of the Pacific Community, the Queensland Department of Employment, Economic Development and Innovation (DEEDI) and Fiji-based agribusiness firm Koko Siga Fiji.

Within Fiji, the Nature's Way Cooperative and Fiji's largest grower and exporter of papaya, Produce Specialities Ltd, were leading participants, while Koko Siga Fiji's Kyle Stice coordinated the project's various activities.

"While research and extension is not the core business of Nature's Way, they have an interest in ensuring a good supply of high-quality fruit," Mr Stice says. "So the company works with farmers and exporters to solve production and marketing issues.

"They approached ACIAR with a proposal to use applied research to solve some of the technical aspects Fiji faces accessing international markets, from the farm through to postharvest handling and freighting."

The papaya industry, while small in scale, is starting to play an increasingly important role in Fiji's economy. High-value crops are increasingly pursued to diversify agriculture following the loss of preferential sugarcane prices from the European Union. Papaya has been identified as one such crop.

"Traditionally the type of work undertaken by the ACIAR project would be done through the Ministry of Agriculture Research and Extension divisions," Mr Stice says. "But because the Ministry is required to serve a whole range of producers, spread across the country, the industry-based partners have the opportunity to be commodity-specific and work directly with industry champions."

Prime among these industry collaborators is Produce Specialities Ltd. It is the largest exporter and producer of Sunrise Solo Papayas, which are grown at its Sigatoka farm on the island of Viti Levu. Its produce is sold in New Zealand, Australia, Japan and, more recently, Hong Kong.

Produce Specialities Ltd was selected as the exporter for the sea-freight trial to Auckland in early 2011 and contributed fruit, cartons and packing material for the 6.5-tonne trial shipment. The Fiji Papaya Project covered freight costs and provided technical support and monitoring equipment, including assessments in New Zealand.

"Aside from the technical treatments, the trial also let us test market uptake of Fijian papaya," Mr Stice says. "Up to this stage, Fiji air-freighted about 700 cartons per week to New Zealand.



Preliminary observations in the carton performance trial indicate that papaya in the cartons with holes (right) did not ripen in transit, while those in the standard cartons (left) did.



Papayas packed in foam and stickered, ready to go.



After two-and-a-half days in the ripening room, the fruit is almost full colour and ready for distribution.

But with sea-freight it was 1300 cartons in a single week. So we got the chance to look at how much Fiji Red papaya the market can take in any given week."

The trial proved a commercial success. A cooling treatment was identified to arrest the ripening process in transit, a major project aim. In New Zealand, the project worked closely with the importer, Fresh Direct, which ran

in-store promotions for Fijian papayas and sold the entire trial container in one week.

Comparisons found that the transport cost per carton was FJD\$3.25 by sea, compared with FJD\$5.98 for air-freight.

"The trial also identified several issues requiring further research, including the strength of the cartons," Mr Stice says. "When used in air-freight, the cartons are stacked seven or eight high, but that was raised to 12 high in the sea-freight and some crushing occurred."

The Fiji Papaya Project is now working with local carton manufacturers in the design of a more appropriate sea-freight carton that allows for cooling in transit and ripening once the fruit is at its destination.

"We believe once we have overcome the issue of an appropriate carton and a few other minor logistical constraints at the packing facility, the exporter will commence with regular sea freighting into New Zealand," Mr Stice says.

At ACIAR, Dr Markham thinks that sea freight can make a major contribution to keeping Fiji's papaya industry competitive in international markets.

Analysis indicates that increasing exports from the 2008 level of 600 tonnes to 4000 tonnes could result in an increase of about FJD\$7 million in export earning and FJD\$3.5 million in direct farm income. A larger production base is also expected to benefit local markets, increase employment, and create opportunities to develop value-added processing industries.

"Whether this specific target is achieved or not, the biggest contribution of the project may be to show how one of Fiji's key export industries can raise standards and compete successfully in international markets," Dr Markham says.

"This successful private-public partnership could serve as a model for other fruits and vegetables and help to raise standards and expectations across the board."

In Australia, the papaya industry has not achieved its full potential due to high losses in the supermarket system and inconsistency of product flavour and fruit-ripening behaviour. Results from the supply-chain components of the Fiji Papaya Project and parallel research funded by ACIAR in Queensland are also expected to benefit Australian farmers. ■

PARTNER COUNTRY FIJI

PROJECT: PC/2008/003 Strengthening the Fiji papaya industry through applied research and information dissemination

CONTACT: Kyle Stice, kyle@kokosiga.com;

Dr Richard Markham, richard.markham@aciar.gov.au

MORE: www.fijipapayaproject.com

RESEARCH GROWS FROM THE SEEDS OF FELLOWSHIP

Providing postgraduate opportunities to people living outside Australia has seen research knowledge spread and thrive across the developing world.



ACIAR John Allwright Fellow Dr Bhagirath Singh Chauhan (left), pictured with colleagues from the International Rice Research Institute, is investigating the effect of flooding depth and duration on rice and weed emergence and growth.

KEY POINTS:

- ACIAR has a strong commitment to helping partner countries build their R&D capacity.
- Improved capacity ensures ongoing services to farmers seeking to innovate production, marketing and retail systems.
- In addition to running farmer field and business schools, ACIAR offers training within Australia through the John Dillon and John Allwright Fellowships.
- Strong diplomatic bonds have been forged as a result of relationships built through ACIAR's capacity-building initiatives.

BY PENNY FANNIN

Although born into a middle-class family and raised in the Cambodian capital of Phnom Penh, Dr El Sotheary is acutely aware of the challenges facing many of the country's farmers.

As the deputy head of the Cambodian Agricultural Research and Development Institute's (CARDI) socioeconomics division, Dr Sotheary seeks to understand the social and economic circumstances that prevent farmers from adopting improved technologies and production practices.

Her position has other responsibilities, but they all come down to making life better for the 8.3 million Cambodians the World Bank estimates rely on agriculture for their livelihoods.

Dr Sotheary joined CARDI in 2000. She had a background in business administration and embraced the move into the agricultural sector.

"Living in a country where agriculture is the leading sector of the country's economy, I have always been enthusiastic to work as an agricultural socioeconomist with the ultimate goal of helping to improve the living conditions

of Cambodian farmers who have suffered in poverty for decades," Dr Sotheary says.

In the early 2000s Dr Sotheary, keen to move into a senior position at CARDI, applied to ACIAR for a John Allwright Fellowship (JAF). The fellowship took her to the University of Queensland (UQ) where, in 2009, she completed a PhD through the School of Natural and Rural Systems Management (now the School of Integrative Systems). Dr Sotheary says she regularly applies the knowledge and skills she gained to her work at CARDI.

This is largely why, in 1986, ACIAR established the JAF scheme. Through the scheme ACIAR is building the capacity of agricultural research institutions in partner countries.

The program benefits research capacity in ACIAR's partner-country institutions, linking their scientists to Australian scientists. This approach has been proven to ensure development and research outcomes are more sustainable.

ACIAR, with co-funding from AusAID, provided 138 John Allwright Fellowships in 2010–11 to allow researchers from partner countries who are actively involved in ACIAR projects to undertake postgraduate studies at Australian universities. 154 people had obtained Masters or PhD qualifications.

A survey in 2008 of JAF alumni showed the aims of the fellowship scheme were being met. Major findings were:

- A high (74%) return rate of fellows to their home country following completion of studies, maximising the opportunities for capacity building to occur within alumni home-country institutes.
- Almost all (99%) fellows indicated that they were facilitating the transfer of

knowledge and skills within their institute or current workplace.

- The majority (93%) of institute directors and fellows agreed that the skills and knowledge acquired during postgraduate studies were highly relevant to their current positions.
- The majority (81%) of fellows have been promoted since returning to their home country, with directors (78%) and fellows (85%) agreeing that the promotion was directly attributed to successful completion of postgraduate qualifications.
- Almost all (95%) fellows indicated that the fellowship was a positive experience, with both fellows and directors identifying research and writing skills, increased flexibility and openness to new ideas, and the network of professional contacts as major benefits resulting from participation in the scheme.

Dr Sotheary is representative of all these findings. "Most of the knowledge and skills I gained from my postgraduate degree in Australia are now regularly applied in my work at CARDI," she says. "For example, I've developed a research project on the adoption and impact of CARDI's released rice varieties 'Phka Rumduol' and 'Sen Pidao'."

The project has been funded by the Cambodian Agricultural Research Fund and aims to understand why some of CARDI's released rice varieties are well known among some farmers but unfamiliar to others. "Although CARDI has released 32 rice varieties to suit rainfed lowland and dry-season conditions, not all of them are well adopted," Dr Sotheary says. "So, in order to understand the current level of adoption of both rice varieties and how the adoption can be increased in the future, I am using a research tool that I used in my PhD."

Dr Sotheary is also involved in two ACIAR research projects. One is seeking to enhance the



ACIAR John Allwright Fellow Dr El Sotheary (second from right), facilitates a workshop for agricultural extension staff and farmers at CARE Pailin, Cambodia.

adoption in Cambodia of improved technologies and practices for the production of upland crops such as maize and soybean. The other is focused on improving vegetable production and postharvest management systems.

Across the South China Sea another John Allwright Fellow, Dr Bhagirath Singh Chauhan, is also seeking to improve the livelihoods of people living below the poverty line.

His fellowship took him out of one ACIAR partner country—India—and led to him taking up a postdoctoral position in another—the Philippines—although his research has significance for the entire region. Dr Chauhan is now based at the International Rice Research Institute (IRRI), where he is studying the ecology and management of rice weeds. He left his native India to take up his John Allwright Fellowship at the University of Adelaide, where he completed a PhD in weed science in 2006.

“My PhD work was on weed ecology and here at IRRI I am engaged in similar work,” he says. “The knowledge I gained in weed ecology in Australia is helping me to develop new ideas on the ecology of rice weeds. I pass on this knowledge to my staff very often and train them also.”

This transfer of knowledge ensures the JAF scheme has reached beyond the people who are awarded the fellowships.

The long-term benefits of providing postgraduate scholarships through the JAF scheme to partners from developing countries is highlighted by the number who are now playing key roles and passing on their valuable knowledge and skills.

One John Allwright Fellow who has been disseminating knowledge to not only her home country of the Philippines but also throughout East Africa and Vietnam is Dr Delia Catacutan.

When in the Philippines, Dr Catacutan, a

World Agroforestry Centre (ICRAF) research manager, works from her home town of Lantapan in a remote area of the north-central region of Mindanao. For the moment, though, she is living in the United States, having been awarded the Giorgio Ruffolo postdoctoral fellowship by Harvard University, where she is researching the links between knowledge generation and policy practice.

“Before coming to Harvard, I was a collaborating scientist on the ACIAR-funded Landcare project in the Philippines,” Dr Catacutan says. “At the same time, I was leading the AusAID-funded Landcare project in East Africa.”

She took up the latter position after completing a PhD at UQ in 2005, supported by an ACIAR John Allwright Fellowship. In her research, she developed criteria for selecting the best sites for promoting Landcare in the Philippines.

Dr Catacutan’s study did not stop with her PhD. Also awarded a six-week ACIAR John Dillon Fellowship, she bolstered her management and leadership skills and built closer links with Australian research agencies, including CSIRO, the Queensland Department of Primary Industries and Fisheries, and UQ.

Immediately after completing both fellowships Dr Catacutan took on a broader role at ICRAF, which included leading a team of African researchers for the Landcare project in East Africa.

“Both the research and management skills I acquired from the John Allwright and John Dillon fellowships prepared me for this expanded role,” she says. “I remain grateful to ACIAR, especially to the people behind the fellowships. It has helped and changed so many lives positively. I hope it will have more resources to support more researchers in the developing world.” ■

Fellowships support knowledge generation

Australia has invested in training to build the capacity of developing countries since the 1950s, when it was one of seven nations that established the Colombo Plan. The plan aims to strengthen the economic and social development of member countries, including many in the Asia-Pacific region, through collective inter-governmental efforts.

A key component of the plan, which today involves 26 nations, is training and capacity building. The Australian Government also supports training directly through the overseas aid program to increase access to and the quality of education and training for people in partner countries.

Since 1986 ACIAR has offered opportunities to young agricultural scientists from developing countries for postgraduate training at Australian universities. This began with the John Allwright Fellowships (JAF), which are awarded to partner-country scientists involved in ACIAR-supported collaborative research projects. Training undertaken is usually at the masters or doctoral level. The studies add value to the topic or theme of the ACIAR project in which the fellow is engaged, but do not directly form part of the project. Fellows spend up to 50% of their project period on fieldwork in their home country.

A second ACIAR fellowship scheme targets emerging leaders in agricultural research. John Dillon Fellowships provide a career-development opportunity in Australia for outstanding mid-career agricultural scientists and economists from ACIAR partner countries. They aim to develop leadership skills in agricultural research management, agricultural policy and/or extension technologies through exposure to a range of best-practice Australian agricultural organisations involved in research, extension and/or policy-making.

PARTNER COUNTRIES WORLDWIDE

PROJECT: John Dillon and John Allwright fellowships

CONTACT: Sharon Harvey,
ACIAR education and training project officer,
sharon.harvey@aciarc.gov.au

MORE: <aciarc.gov.au/training>

Positive news for world's poor

As president of the International Fund for Agricultural Development, Dr Kanayo Nwanze oversees the UN agency working to alleviate poverty and food insecurity among poor rural people. He met up with ACIAR while in Canberra to discuss a new IFAD report on progress to eliminate extreme rural poverty.

BY KANAYO F. NWANZE

What would your life be like if you were one of the 1.4 billion women, men and children who live in extreme poverty? Chances are you would live in a rural area, as do 70% of the world's extremely poor people.

Like Li Guimin from China, you would worry about the exodus of young people from your community as they seek opportunities but likely face worse poverty in distant cities.

Like Shazia Bibi from Pakistan, you might wonder if your garlic can compete at the market with lower-priced imports and whether you will earn enough to pay your children's school fees and buy your heart medicine.

And like Ribita lobete, a farmer in Kiribati, you would be concerned about the shrinking size of your coconuts due to intrusions of sea water—an ominous repercussion of climate change in a country where 'high ground' is just 2 metres above sea level.

But there is good news, which was discussed at meetings in Canberra in April 2011. A new report issued by the International Fund for Agricultural Development (IFAD) reveals that more than 350 million rural people have pulled themselves out of extreme poverty over the past 10 years. The percentage of the world's rural inhabitants living on less than \$1.20 a day has dropped from nearly half to about one-third.

But poverty remains pervasive, especially in Sub-Saharan Africa. Although its rate of rural poverty has fallen slightly in the past decade, it is still above 60%. And not far from Australia's own shores, South Asia is home to half of the world's one billion extremely poor rural people.

East Asia has accounted for much of the progress. Standouts are China and other emerging economies such as Vietnam, where the number of extremely poor people in rural areas fell by two-thirds, from 365 million to 117 million. So did the rate of extreme poverty, which declined from 44% to 15%.

But poverty remains pervasive, especially in

Sub-Saharan Africa. Although its rate of rural poverty has fallen slightly in the past decade, it is still above 60%. And not far from Australia's own shores, South Asia is home to half of the world's one billion extremely poor rural people.

Yet change is underway in rural areas, giving rise to hope while also exposing challenges.

These include increasingly volatile food

Kanayo F. Nwanze meets with Jane Ngaguara, a member of the Busara Dairy Goat Self-Help Group, while visiting some of IFAD's projects in Kenya. Jane inherited her land from her parents and has run her goat business since 2003.



prices, which complicate life for rural people as both producers and buyers of food. Other emerging threats include deterioration of natural resources, growing competition for land and water, and as Australians know only too well, increasingly severe weather events worsened by climate change.

But good things are happening too. As cities expand and the world becomes more urbanised, the demand for high-value food is growing, expanding markets for farmers.

And while agriculture continues to drive rural growth, engaging four-fifths of rural households worldwide at some level, technological advancements and changes in the global economy are also creating jobs off the farm. The accelerating search for renewable energy sources around the world only increases the potential for growth.

All of this creates opportunities for poor

rural women and men to lift themselves out of poverty and create a future for their children. But making the most of it requires policies and investments that are both market-oriented and environmentally sustainable.

For a start, governments and the international community need to reverse the long-standing neglect of rural development. We need to improve governance in rural areas and create an economic environment that will allow smallholder farmers to grow both food and their businesses.

We need to invest in rural infrastructure and in building the skills of rural people, so they can exploit new opportunities in agricultural markets or find jobs in non-farm industries. If we help them strengthen their collective capabilities, they will be able to support each other in managing risks, learning new techniques to improve productivity and marketing their products.

And we need to invest in youth. In developing countries, young people aged 15 to 24 make up 20% of the population. In rural areas, many of them are growing up on smallholder farms. We must invest in those young, creative minds so they can develop the skills to run their farms like small businesses.

Anyone who has spent any time with farmers in developing countries knows that they are dynamic, innovative people whose hard work will ultimately lead the way to development and prosperity.

At stake is the security of the global food supply. Agricultural production must increase 70% by 2050, and output in developing countries will have to double, if we are to keep food on the table for the nine billion people expected on Earth by then.

I have no doubt that Li, Shazia and Ribita are up to the challenge. Are the rest of us? ■

PHOTO: GEORGINA GOODWIN



Dr Kanayo F. Nwanze

As the fifth IFAD president, Dr Kanayo F. Nwanze brought to the role more than 30 years experience in poverty reduction through agriculture, rural development and research.

Under Dr Nwanze's leadership, IFAD stepped up its advocacy efforts to ensure that agriculture is a central part of the international development agenda, and that the concerns and needs of smallholders and other poor rural people are recognised by governments around the world.

He also increased the number of outposted country program managers and expanded the number of country offices. This increased country presence, and the direct supervision by IFAD of its projects, helps make them more effective.

In recognition of Nwanze's intellectual leadership on issues of food security, he was asked to chair the World Economic Forum's Global Agenda Council on Food Security in 2010.

His background is in agricultural science, earning degrees from the University of Ibadan in Nigeria and Kansas State University in the US. As Director-General of the Africa Rice Center, Dr Nwanze was instrumental in introducing and promoting New Rice for Africa (NERICA), a high-yielding, drought and pest-resistant variety developed specifically for the African landscape. He also transformed the Africa Rice Center from a West African to an Africa-wide organisation with an international reputation for excellence.

Dr Nwanze has held senior positions at several research centres affiliated with the Consultative Group on International Agricultural Research (CGIAR) in Africa and Asia, and he was instrumental in the establishment of the Alliance of CGIAR Centers.

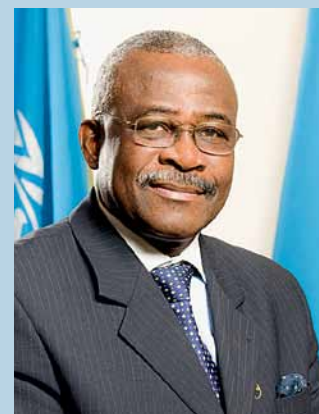
During a visit to Canberra in April, Dr Nwanze visited ACIAR to discuss food security issues, especially in relation to African smallholder farmers. The talks dealt with the need for strategies that better allow smallholder farmers to contribute to the 70% increase in food production required by 2050.

This increase must come from existing agricultural land—largely through environmentally sustainable intensification—creating a need for innovative agricultural R&D and extension services to smallholders within projects that integrate production systems and the value chain, including market access.

This approach squares with ACIAR research programs where productivity, profitability and sustainability are components that are routinely integrated into the design of projects across research programs.

Dr Kanayo Nwanze, president of the International Fund for Agricultural Development.

PHOTO: GUIDO FUK





Sea ranching shows promise

The economic importance of sandfish to poor rural Asian communities triggered a collaborative, multinational research effort to advance breeding and rearing techniques when fish numbers started to decline.

Hapa nets used to grow juvenile sandfish in ponds at the National Seed Production Center, Van Ninh, Vietnam.

KEY POINTS:

- Recent symposium highlights advances in sea cucumber cultivation.
- Hatchery advances simplify breeding technology.
- Sea ranching can assist livelihoods in remote communities.

BY CATHERINE NORWOOD

Sea cucumbers are highly regarded in China for their medicinal properties, including as an aphrodisiac, and demand for the product is almost insatiable. While wild stocks of sea cucumbers are diminishing, there is growing excitement about the prospect of commercially cultivating one of the most desirable tropical species, *Holothuria scabra*, also known as sandfish.

Close to 100 researchers, government and community development representatives gathered for the Asia-Pacific Tropical Sea

Cucumber Aquaculture Symposium in New Caledonia in February to share information about the state of sandfish aquaculture research and development.

The symposium was jointly sponsored by ACIAR and the Secretariat for the Pacific Community. Attendees came from Central America, Madagascar, Tanzania, Maldives, India, Vietnam, the Philippines, Papua New Guinea, Australia, Japan, China and various Pacific nations.

ACIAR and the WorldFish Center have been investing in sea cucumber cultivation research in Vietnam, the Philippines, Solomon Islands, New Caledonia, Fiji and Australia since the mid 1990s. Current projects are focused on hatchery culture, techniques for releasing sandfish into the wild, and sea ranching and pond culture. These projects are based in the Philippines, Vietnam and northern Australia.

ACIAR's Fisheries research program manager Dr Chris Barlow says the aim of the symposium was to discuss the status of research and future

directions, and to harmonise research efforts. This is especially important given that interest in sandfish cultivation is strong right across the tropical region, from East Africa through the Pacific region to Central America.

"All sea cucumbers have different qualities, just like fish—different texture, colour, flavour, size and eating qualities," Dr Barlow says. "*Holothuria scabra* happens to be the most sought after of the tropical species."

Cultivation of *H. scabra* is not as straightforward as other temperate species of sea cucumber, which are more amenable to aquaculture and already widely cultivated commercially in Japan and China. But Dr Barlow says there was good exchange of information during the symposium, which was somewhat facilitated by the fact that most of the research is still in the pre-commercial phase.

Among the speakers at the symposium was Professor Annette Meñez from the University of the Philippines Marine Science Institute



PHOTOS: DAVID MILLS

research program to improve the management of sea cucumber fisheries and develop a sustainable industry. The national program is supported by the Department of Science and Technology and the Department of Agriculture's Bureau of Agricultural Research.

Professor Meñez says increasing juvenile production to supply the sea-ranching project has been difficult because of limited hatchery space at the UPMSI laboratory and lack of access to suitable ponds for juvenile rearing. In response, she and her team have developed ocean nursery systems to culture juveniles to a release size.

They have been able to demonstrate that viable spawning populations can be established in sea-ranching areas. This technique can also be used to help rebuild depleted stocks, as larvae settle in the ranching sites and adjacent areas.

Professor Meñez says poaching from the sea ranches has been an ongoing issue. Sharing information, consultation with adjacent villages and regular guarding of the sea-ranching areas have helped to reduce poaching in some villages. Guarding is undertaken 24 hours a day, seven days a week, although it has been difficult for some community partners to maintain the commitment required to do this for the 12 months or more it takes sandfish to reach harvestable size.

Natural disturbances, particularly typhoons, have also reduced harvestable yields at the trial sites. At the Victory site the sandfish biomass almost halved following a succession of typhoons that changed sediment quality

and reduced the area of suitable substrate for feeding in the seagrass beds.

"We cannot do anything about this but we can learn much from the results to improve future efforts," Professor Meñez says. "This might include better site selection or changes to the timing of release of juveniles."

She says in addition to supplementary income from sandfish harvesting, the participating communities have benefited from new knowledge and skills, the opportunity to share what has been learned, and the use of sea ranching to improve the management of fisheries for future generations.

"The commitment of our community participants has varied, but we have a core group of very active partners. Perception surveys we conducted after 3 years indicate that, despite the challenges, the majority are willing to continue with the sea ranching. They would like to see it institutionalised by their local government body, even when the project ends."

Research based in Vietnam is focused on pond aquaculture, using ponds previously used for shrimp farming. Dr David Mills of the WorldFish Center oversees the ACIAR sea cucumber research. He says the Vietnam research has simplified hatchery and breeding techniques, making the breeding system more easily adopted in developing countries.

This research is ongoing at the National Seed Production Center of the Research Institute for Aquaculture No.3 at Van Ninh, in Vietnam's central coastal region.

"The aim is to ensure all levels of sea cucumber

(UPMSI). The Philippines is the second-largest exporter of sea cucumber products but the resource has been overfished and unmanaged.

Professor Meñez has pioneered community-based sea ranching as a cultivation strategy that can help local fishers supplement their income and help rebuild wild sea cucumber populations. Sea ranching involves stocking hatchery-reared juvenile sandfish into wild marine habitats to grow out.

She leads the ACIAR sandfish research project in the Philippines that was responsible for establishing three 5 hectare trial sites at Anda, Masinloc and Victory. A critical aspect of the project is liaison between local government authorities and community partners to establish exclusive harvesting rights for communities participating in sea-ranch trials. She also oversees juvenile production in the hatchery and monitoring of released juveniles in the field.

ACIAR's sea cucumber sea-ranching project in the Philippines is part of a broader national



Gutting sea cucumbers harvested from a commercial pond prior to drying for export in Van Ninh, Vietnam.



PHOTO: DAVID MILLS

Setting up experimental cages within a shrimp pond for sea cucumber growth trials at Nha Trang, Vietnam.

cultivation can be undertaken at a community level, maximising the benefit to communities,” Dr Mills says. “Key achievements have been the adoption of simple algal paste coatings to promote settlement of larvae on plastic plates, and a refinement of algae food sources for the larvae and juvenile sea cucumbers.”

Research is also continuing to evaluate the benefits of sea cucumbers as an alternative to shrimp and when grown in rotation with shrimp. Dr Mills says sea cucumbers actually clean the ponds, which can become sludgy and toxic if used consistently for shrimp production.

“They have a positive environmental benefit,” he says. “Disease can also cause two out of

three shrimp crops to be lost, but growing alternate crops of shrimp and sea cucumbers may be able to help reduce the disease risk.”

Both benefits have the potential to extend the lifespan of ponds, which are otherwise rebuilt every 10 years or so. This is important because often sensitive coastal habitats, including mangrove areas, are cleared for the construction of new ponds.

Dr Mills says one of the key issues to emerge from the symposium was the need for an assessment of genetic risk. Some sea cucumber fisheries have been almost entirely fished out and non-indigenous brood-stock is being imported into these areas.

Chemically induced spawning, while effective, also has the potential to reduce genetic diversity. He says work in the Philippines has the most precautionary approach, with brood-stock not only endemic to the country, but locally native—taken from within 50 kilometres of the sea-ranched sites where the juveniles are to be raised.

ACIAR has two smaller sea cucumber projects within the larger Pacific Agricultural Research and Development Initiative that complement the aquaculture research and development. One is evaluating the whole value chain for sea cucumbers. The other is developing training and processing, handling and marketing skills to produce more consistent and higher-grade sandfish products, known variously as bêche-de-mer, trepang or balate.

ACIAR is also supporting research at the Darwin Aquaculture Centre to improve the release methods for juvenile sandfish into sea ranches. Tasmanian Seafoods is an industry partner in this project, holding all commercial sea cucumber harvesting licences in the Northern Territory.

Productivity of wild-caught sea cucumbers along Australia’s northern coast is estimated to have declined to less than 10% of pre-colonial yields. Sea ranching provides an opportunity to rebuild the fishery population. Tasmanian Seafoods research manager Grant Leeworthy says ACIAR sea cucumber projects in Solomon Islands provided a guide for further research, which the company has undertaken independently to enhance local stocks and improve processing.

Tasmanian Seafoods assists with some of the logistical requirements of the research. “We see the ACIAR project as a tool to help build relationships with researchers and with local Indigenous communities,” he says.

Mr Leeworthy says the company is working with Indigenous communities to develop employment opportunities and joint ventures managing sea ranches and harvesting sea cucumbers. Tasmanian Seafoods has already established agreements with the Umbakumba community on Groote Eylandt and the Northern Territory Fisheries Department to assist with sea ranching and the re-establishment of the sea cucumber fishery. ■

PARTNER COUNTRIES PACIFIC REGION

PROJECT: FIS/2003/059 Sea ranching and restocking sandfish (*Holothuria scabra*) in the Asia-Pacific region

CONTACT: Dr David Mills, david.mills1@jcu.edu.au; Dr Chris Barlow (ACIAR), chris.barlow@aci.gov.au



The Director-General of the Laos National Agriculture and Forestry Research Institute (NAFRI), Dr Bounthong Bouahom, discusses with John Lacy, rice production practices.

NAFRI delegate Vanthong Phengvichith discusses production practices with researcher Brian Dunn.



Professor Len Wade (third from left) with the NAFRI delegation at Yanco Agricultural College, NSW.



The NAFRI delegation inspects crops in the heat shelters.

LAO RESEARCHERS IN WAGGA WAGGA

Charles Sturt University (CSU) in Wagga Wagga hosted a delegation from Lao PDR as part of a large research project aimed at finding ways to alleviate the poverty of farming families in rainfed areas in southern

provinces. The \$5.1 million project, 'Developing improved farming and marketing systems in rainfed regions of southern Lao PDR', involves researchers from institutions in Laos and Australia and is funded by ACIAR and led by

CSU Professor Len Wade.

Heading the delegation was Dr Bounthong Bouahom, the Director-General of the National Agriculture and Forestry Research Institute (NAFRI) in Laos. They visited research facilities

at CSU, including the new \$2.4 million underground field research laboratory known as a rhizolysimeter. They also visited rice farms and fisheries while in the NSW Riverina.

ACIAR Commission appointments

A Chair and two members were appointed to the ACIAR Commission by the Executive Council of the Australian Government on 7 April 2011. The Chair and Commissioners of ACIAR provide advice to the Minister in relation to the formulation and funding of agricultural research and development programs. The new appointees are Ms Joanna Hewitt AO (Chair), Professor Kym Anderson and Dr Conall O'Connell. They will join reappointed Commissioner Mr David Crombie and current Commission members Mr Peter Baxter

(Director-General of AusAID), Dr Joanne Daly (member of the CSIRO Executive Management Council) and Dr Nick Austin (chief executive officer of ACIAR).

ACIAR thanks retiring Commissioners the Hon. Neil Andrew AO and Mr Barry Buffier. We also thank former Chair Dr Meryl Williams for her commitment to the Commission since her appointment in 2007 and in her previous role on the ACIAR Board of Management.

Helping Tibetans keep butter tea on the table

A team of scientists from the Tibet Autonomous Region of China visited Australia in late March 2011 to meet with their Australian partners on ACIAR projects that are helping to boost milk production in Tibet through better integrated livestock cropping systems and overcoming mineral deficiencies.



Madam Sezhu, Vice Director of the Tibet Livestock Research Institute, Dr Nyima Tashi, Vice President of the Tibet Academy of Agricultural and Animal Science, and masters graduate Ms Pubu Drolma in Canberra, April 2011.



Researchers inspect field sites of an ACIAR-funded research project in Tibet aiming to boost milk production. Intercropping wheat with vetch and lucerne crops offers the opportunity to increase food for both humans and livestock.

Weather forecasts for Indian farmers

Three villages in the Warangal, Nalgonda and Mahabubnagar districts of Andhra Pradesh are receiving twice-weekly medium-range forecasts customised to weather scenarios. Farmer groups meet twice a month to discuss the seasonal effects on crops and provide feedback on the advisories and the accuracy of weather forecasts.

CSIRO researchers Zvi Hochman and Christian Roth, and their Indian colleagues Raji Reddy, Sreenivas (Acharya N.G. Ranga Agricultural University) and Kosaraju Suresh

(from the non-government Watershed Support Services and Activities Network) recently attended meetings in the villages in India to assess how farmers are adapting to climate challenges and how they are using the weather information.

Farmers have started adopting the weather advisories to fine-tune field operations such as land preparation and sowing, and deciding when to harvest paddy or to apply insecticides to control sucking pests.



Farmer group in Nemmani village, Andhra Pradesh, discussing results of previous wet-season cotton.

Farmers happy with increased rice yields in Sulawesi

Rice farmer Mr Andi Caco from South-East Sulawesi is a project champion who is now promoting the use of natural resource management options in rice production.



PHOTO: DONNA CASARETO, IRI

Rice farmers in South and South-East Sulawesi, who have significantly boosted their rice yields, have given positive feedback on an ACIAR-funded research program that is working towards a 10% increase in irrigated rice production.

The farmers involved in the project are now 'champion' farmers promoting the use of natural resource management options, such as alternate wetting and drying for water management, using the International Rice

Research Institute drum seeder for direct seeding, coupled with better herbicides for effective weed control and using more efficient fertiliser management.

They are also using more ecologically based rodent management and integrated insect pest management by monitoring and harnessing natural enemies, use of cultural management practices and minimal use of insecticides (if needed) for stem borer control and rice bug.



PHOTO: BOB MARTIN

Mr Larano (right) gives some advice to planter operator Mr Seang Chenda on adjusting the depth of planting.

Cambodia builds first no-till seeder

The first no-tillage seed drill built by a local Cambodian equipment manufacturer successfully passed its field test at the Cambodian Agricultural Research and Development Institute (CARDI) at Prateah Lang Commune, Dangkor, outside Phnom Penh in May 2011. The seed drill is one of 11 being

built by agricultural equipment manufacturer Mr Ouchhoeun Larano at Russeykeo, Phnom Penh. Six of the machines were commissioned by ACIAR as part of a project that is helping Cambodia to diversify and intensify cropping in rainfed lowland areas.

Congratulations Norah

Sweetpotato farmers in Papua New Guinea will be pleased to learn of the recent graduation of Dr Norah Omot, who received a PhD from the University of Canberra.

Her studies, sponsored by ACIAR through a John Allwright Fellowship, identified weaknesses in the process of bringing the vegetables from production to market in PNG.

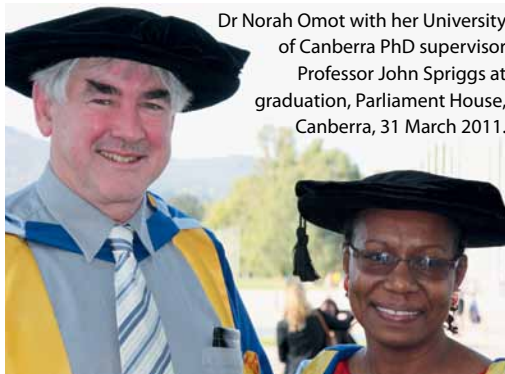
"In particular, I looked at what consumers want and whether suppliers are meeting their needs," Dr Omot said of her thesis, *Long-distance marketing of sweetpotato from the highlands of Papua New Guinea: an analysis of consumer preferences and supplier responsiveness*.

Dr Caroline Lemerle, ACIAR's research program manager for Agricultural Systems Management, recognised Dr Omot's

PhD as a valuable contribution to agricultural development in PNG.

"By identifying market orientation, Norah's thesis can assist sweetpotato smallholders with growing to demand and generating income for their families," she said. "Certainly it has the potential to form the basis for future research."

Dr Omot is now running the NARI program 'Enabling environment', which is identifying the socioeconomic barriers to sustainable agricultural development in PNG.



Dr Norah Omot with her University of Canberra PhD supervisor Professor John Spriggs at graduation, Parliament House, Canberra, 31 March 2011.

John Dillon Fellows visit Canberra

The Hon. Richard Marles MP, Parliamentary Secretary for Pacific Island Affairs, welcomed ACIAR's John Dillon Fellows to Parliament House as part of their study tour visit in March of this year.

The Parliamentary Secretary acknowledged the key role the John Dillon Fellows have in promoting and strengthening the partnerships that ACIAR fosters between Australian researchers and their colleagues in research institutions, in the private sector and beyond.

"Agricultural research is vital in the development process. It is the source of new technology, and production technology is the source of economic growth. As projects have produced new technologies it has become important to ensure clear strategies are available to facilitate the efficient development, transfer and application to intended users."

– JOHN DILLON



Payakun Satria (left) receives his certificate of achievement from the Hon. Richard Marles MP, Parliamentary Secretary for Pacific Island Affairs.

NEW STAFF

David Shearer has been appointed as ACIAR's director corporate. Dave joined ACIAR in 2006 as Agribusiness research program manager and has acted in the role of director corporate since the departure of Lisa Wright. He is



experienced in delivering corporate objectives for a range of government agencies. He also brings a sound knowledge of ACIAR's operating environment, a broad understanding of the Australian Government's aid strategy and a strong understanding of agricultural development. These capabilities will assist in strategically positioning ACIAR during a time of rapid change in the aid program. Last year Dave received an Australian Development Council (ADC) Australian Leadership Award in recognition of his capabilities.

GLOBETROTTERS

ACIAR research program managers undertake a hefty travel schedule, with partner visits, project reviews and in-country consultations. We'll report on some of the highlights of trip visits in the next few issues of *Partners*.

In May, Debbie Templeton, ACIAR's Impact Assessment research program manager, travelled to Cambodia. She presented a 3 day workshop to 36 attendees representing four components of the New Policy Program Safeguarding Food Security in Rice-Based Farming Systems in the Mekong (CSE/2009/005 Improved rice germplasm for Cambodia and Australia; CSE/2009/037 Improved rice establishment and productivity in Cambodia and Australia; LWR/2009/046 Improved irrigation water management to increase rice productivity in Cambodia; and HORT/2009/064 Strengthening the Cambodian and Australian vegetable industries through adoption of improved production and postharvest practices).

ACIAR's principal adviser for strategy and policy, Simon Hearn, travelled to Jakarta in April. The purpose of the visit to Indonesia was to attend the International Food Policy Research Institute (IFPRI) Board meeting. He provided a discussion paper to an IFPRI workshop covering climate change, price volatility and food security. The workshop was co-hosted by the Ministry of Agriculture and the National Team for the Acceleration of Poverty Reduction (Indonesia). While in Jakarta, Simon also held bilateral discussions with project leaders covering two ADP projects: ADP/2005/066 Markets for high value commodities in Indonesia: promoting competitiveness and inclusiveness; and ADP/2005/068 Plausible futures for economic development and structural adjustment – impacts and policy implications for Indonesia and Australia.

In March, ACIAR's research program manager for Soil Management and Crop Nutrition, Gamini Keerthisinghe, travelled to Thailand to attend a project review workshop of SMCN/2007/215 Improving the reliability of rainfed, rice/livestock-based farming systems at Khon Kaen University. The overall aim of the project is to improve the reliability of achieving profitable returns at the household level from rice and cattle production in rainfed rice-based farming ecosystems in Mahasarakham province. Gamini also met with project proponents to discuss the formulation of a new regional project on rainfed lowland rice and livestock farming systems.

ACIAR COMMISSIONERS



Chair: Joanna Hewitt

With her depth of experience in international agricultural research—most recently on consultancy projects with the International Food Policy Research Institute, which is part of the Consultative Group on International Agricultural Research network—Ms Hewitt brings a lot to the Commission. Among her former appointments, Ms Hewitt was Secretary of the Department of Agriculture, Fisheries and Forestry and has held several Deputy Secretary positions at the Department of Foreign Affairs and Trade. Holding a Masters in International Relations, she was a lead negotiator with the World Trade Organization. She is also a former member of the ACIAR Board of Management.



Commissioner: Professor Kym Anderson

Kym Anderson is a professor with the School of Economics at the University of Adelaide. He is also Foundation Executive Director of the university's Wine Economics Research Centre, and formerly held the same position with its Centre for International Economics Studies. He is on the Board of Trustees with the International Food Policy Research Institute and holds several other international board memberships in the fields of rural development and commodity economics.



Commissioner: Dr Conall O'Connell

Dr Conall O'Connell is the Secretary of the Department of Agriculture, Fisheries and Forestry and has held several positions with government agencies. These include the Department of Environment, Environment Australia and the Department of the Prime Minister and Cabinet. He has completed a postdoctoral fellowship in the Research School of Social Sciences at the Australian National University.

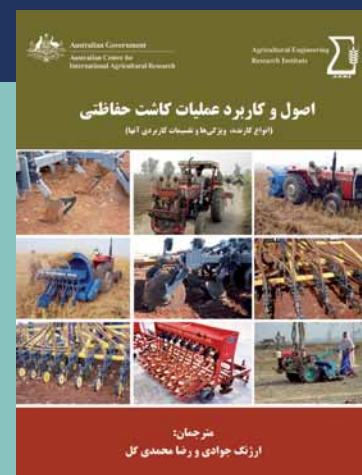
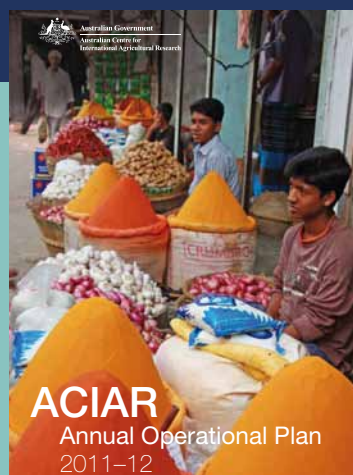


Reappointed Commissioner: David Crombie

Mr Crombie has more than 30 years commercial and representational experience in agriculture, including as managing director of major agricultural development and pastoral companies. He is Director of GRM International and a former President of the National Farmers Federation, as well as Chair of Meat and Livestock Australia and the Australian Rural Leadership Foundation.

Continuing Commissioners

Mr Peter Baxter, Director-General of AusAID; Dr Joanne Daly, member of the CSIRO Executive Management Council; and Dr Nick Austin, chief executive officer of ACIAR.



NEW PUBLICATIONS

CORPORATE PUBLICATIONS

ACIAR Annual Operational Plan 2011–12 *ACIAR's planned R&D priorities, corporate expenditures and key performance indicators for the year ahead, AOP 2011–12, 138 pp.*

TECHNICAL REPORTS

Hidden economies, future options: trade in non-timber forest products in eastern Indonesia *A.B. Cunningham, W. Ingram, W. Daos Kadati, J. Howe, S. Sujatmoko, R. Refli, J.V. Liem, A. Tari, T. Maruk, N. Robianto, A. Sinlae, Y. Ndun, I. Made Maduarta, D. Sulistyohardi and E. Koeslutat, TR77, 115 pp. \$42 (plus postage & handling)*

IMPACT ASSESSMENTS

Extending low-chill fruits in northern Thailand: an ACIAR–World Vision collaborative program *David N. Harris, IAS70, 52 pp. \$40 (plus postage & handling)*

The economic impact in Indonesia and Australia of investment in plantation forestry research, 1987–2009 *Bob Lindner, IAS71, 90 pp. \$55 (plus postage & handling)*

MONOGRAPHS

Planters and their components: types, attributes, functional requirements, classification and description [Persian translation] *J.R. Murray, J.N. Tullberg and B.B. Basnet [Persian translation by Arzhang Javadi and Reza Mohammadi Gol; translation reviewed by Mohammad Reza Daahij], MN121a, 221 pp.*

Integrated pest and disease management for sustainable cocoa production: a training manual for farmers and extension workers (2nd ed.) *John Konam, Yak Namaliu, Rosalie Daniel and David Guest, MN131(2nd ed.), 36 pp. \$9 (plus postage & handling)*

Jorani and the green vegetable bugs [Lao translation] *Bob Martin and Deborah White, MN137b, 48 pp.*

Beef production in crop–livestock systems: simple approaches for complex problems *W.H. Winter (ed.), MN145, 160 pp. \$57 (plus postage & handling)*

FINAL REPORTS (AVAILABLE ONLINE ONLY)

ASIA

Applying wheat quality markers in India *Howard Eagles and Karen Cane, Final Report for project CIM/2010/014 <aciarc.gov.au/FR2011-06>*

Seeds of Life 2 *Harry Nesbitt, Final Report for project CIM/2003/014 <aciarc.gov.au/publication/FR2011-13>*

Realising genetic gains in Indonesian and Australian plantations through water and nutrient management *Daniel Mendham and Eko Hardiyanto, Final Report for project FST/2004/058 <aciarc.gov.au/publication/FR2011-07>*

Enhancing tree seedling supply via economic and policy changes in the Philippines nursery sector *John Herbohn, Final Report for project ASEM/2006/091*
<aciarc.gov.au/publication/FR2011-08>

Oilseed brassica improvement in China, India and Australia *Phillip Salisbury and Allison Gurung, Final Report for project CIM/1999/072* <aciarc.gov.au/publication/FR2011-11>

Ensuring productivity and food security through sustainable control of wheat yellow rust in Asia *Ravi Prakash Singh, Colin Wellings, Kumarse Nazari and Amor Yahyaoui, Final Report for project CIM/2003/067* <aciarc.gov.au/publication/FR2011-12>

PNG AND PACIFIC ISLAND COUNTRIES

Sustainable management of coffee green scales in Papua New Guinea *Sean Murphy, Alex Brook, Richard Shaw, Wendy Shaw and staff of the Research and Grower Services Division (R&GSD), PNG Coffee Industry Corporation (CIC), Final Report for project ASEM/2004/047* <aciarc.gov.au/publication/FR2011-05>

Assessment, management and marketing of goods and services from cutover native forests in Papua New Guinea *Julian Christian Fox, Rodney John Keenan, Final Report for project FST/2004/061* <aciarc.gov.au/publication/FR2011-10>

Accelerating economic development through engagement and development of local industry institutions in Pacific island countries *Brian Ramsay, Final Report for project ADP/2010/024* <aciarc.gov.au/publication/FR2011-09>

Identifying pilot sites and research methods for soil health research in the Pacific region *Dr Mike Smith, Dr Tony Pattison and Mr John Bagshaw, Final Report for project PC/2010/038,* <aciarc.gov.au/FR2011-03>

NEW PROJECTS

ASEM/2009/053	Developing agricultural policies for rice-based farming systems in Lao PDR and Cambodia
FST/2010/013	Developing markets and products for the Pacific island and PNG <i>Canarium</i> nut industry
FST/2009/051	Increasing productivity and profitability of Indonesian smallholder plantations
HORT/2010/011	Improving the sustainability of cocoa production in eastern Indonesia through integrated pest, disease and soil management in an effective extension and policy environment
LPS/2008/048	Sustainable livestock grazing systems on Chinese temperate grasslands

EVENTS

15–16 August 2011	Crawford Fund National Conference, Parliament House, Canberra, Australia < www.crawfordfund.org/conference/conf2011.html >
26–29 September 2011	14th International River Symposium, Brisbane Convention Centre, Brisbane, Australia < riversymposium.com >
26–29 September 2011	5th World Congress on Conservation Agriculture (ACIAR-sponsored event) (This event is held in conjunction with the 3rd Farming Systems Design Conference) Brisbane Convention Centre, Australia < wcca2011.org >
30 September 2011	Indo-Australian Forum on Agricultural Research, Brisbane Convention Centre, Brisbane, Australia < aciarc.gov.au/IAAR-Forum >
April 2013	International Spiny Lobster Aquaculture Symposium Bali, Indonesia To express interest in attending, presenting, hosting or sponsoring, contact Clive Jones (clive.jones@deedi.qld.gov.au , telephone +61 7 4057 3782)

5th World Congress of Conservation Agriculture

Incorporating

3rd Farming Systems Design Conference

Brisbane Convention & Exhibition Centre Australia

26-29 SEPTEMBER 2011

Incorporating Landcare and proudly supported by foundation sponsors

Australian Government
Australian Centre for International Agricultural Research

GRDC
Grains Research & Development Corporation

www.wcca2011.org

ACIAR'S DISTRIBUTION POLICY

ACIAR provides complimentary copies of its publications to developing-country libraries, institutions, researchers and administrators with involvement in agriculture in developing countries in ACIAR's operating areas, and to scientists involved in ACIAR projects. For enquiries about complimentary copies, please contact ACIAR's Communications Unit, comms@aciarc.gov.au.

For other customers, please use our online ordering facility at <aciarc.gov.au> or direct enquiries to our distributors, National Mailing & Marketing, PO Box 7077, Canberra BC ACT 2610, Australia, phone +61 2 6269 1055, fax +61 2 6260 2770, aciarc@nationalmailing.com.au.

Copies of most publications are available as free downloads from the ACIAR website <aciarc.gov.au>.

ACIAR'S VISION

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



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

Back cover: Dr Chiranjeevi Tallapragada addresses farmers during the village meeting in Nemmani, India. In February 2011 CSIRO researchers Zvi Hochman and Christian Roth and their Indian colleagues Raji Reddy, Sreenivas (Acharya N.G. Ranga Agricultural University) and Kosaraju Suresh (from the NGO Watershed Support Services and Activities Network) attended meetings in the villages in India to assess how farmers are adapting to climate challenges.

Front cover: A farmer from Nemmani village, India, checks for soil moisture. Water management projects in India that also encompass social, economic, regulatory and equity issues are helping vulnerable smallholder farmers.



ACIAR
aciar.gov.au