



Australian Government

Australian Centre for International Agricultural Research

ISSUE THREE 2016
aci-ar.gov.au

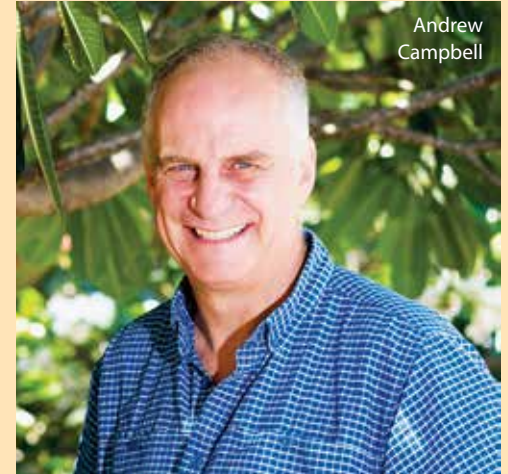
partners

IN RESEARCH FOR DEVELOPMENT



INNOVATIVE
PARTNERSHIPS

BROKERING BENEFITS THROUGH POSITIVE PARTNERSHIPS



Andrew Campbell

ACIAR PROJECTS PROVIDE FERTILE GROUND FOR SKILL SHARING AND MENTORING, AND CONTRIBUTE TO NETWORKING ACROSS DISCIPLINES AND CULTURES.

The Australian Centre for International Agricultural Research (ACIAR) is the Australian Government's specialist agricultural research-for-development agency. In its role as an **'honest broker'**, ACIAR builds partnerships to generate new knowledge and innovations that underpin improved agricultural productivity, sustainability and food-system resilience in the Indo-Pacific region.

This is my first *Partners* editorial since being appointed Chief Executive Officer of ACIAR by Foreign Minister Julie Bishop. It is an honour and a privilege to join such a wonderful organisation with a vital mandate and blessed with highly committed, expert and professional staff and a rich network of partners in Australia and the region.

The stories in this issue of *Partners* magazine attest to the vital importance of our partnerships in benefiting the region, including Australia. Some 70% of ACIAR's investments are channelled through bilateral projects—partnerships between Australian research organisations and about 60 developing country partners in the past three decades. These projects deliver significant benefits. A recent evaluation found that 103 projects (accounting for \$151 million of ACIAR investment) realised benefits of at least \$2.4 billion.

Our partnerships support **Australia's national interests** in many different ways.

Agricultural research for development contributes directly to regional peace and security, providing an effective and inclusive route to the aid goals of enhanced prosperity and reduced

poverty. Economic prosperity in neighbouring countries also has spillover benefits for Australia: stronger economies in the region offer new trade, investment and business opportunities.

Biosecurity research delivers direct benefits for Australia by managing risks before they reach the Australian continent. This issue of *Partners* highlights this with a story about an ACIAR-supported animal health project in the Philippines that is innovating management of the major respiratory diseases affecting Australian pigs. These diseases cause significant economic losses in Australia and wherever pigs are intensively raised. We show how the Australian pig industry has benefited from this ACIAR investment.

Other benefits include new technology and scientific capacity. Many of our partnership activities build new science capabilities in Australia and partner countries. Multi-partner projects provide fertile ground for informal skill sharing and mentoring, and contribute to formal and informal networking across disciplines and cultures, as our story about Scope Global illustrates.

Since 2014, the innovative alliance between ACIAR and Scope Global has played a role in cultivating early-career researchers, providing professional development opportunities and laying the foundations for a positive future for agricultural development aid work in our region and for research capacity in Australia through volunteer placements.

Several ACIAR projects over many years have benefited from the placement of Australian

Government-funded volunteers through the Australian Volunteers for International Development program. These strategic volunteer placements focus on economic development opportunities related to agricultural development, links with the private sector, and inclusiveness, specifically the empowerment of women and girls.

ACIAR's **partnerships** are built on strong people-to-people linkages, trust, transparency and mutual benefit. They are managed by a highly experienced, skilful and professional team. They have brought regional and international respect for ACIAR, and for Australia, and represent an integral part of the government's economic diplomacy strategy in the Indo-Pacific region.

For example, our story about the global cocoa industry highlights how ACIAR, with help from the Queensland Department of Agriculture and Fisheries (Queensland DAF), has helped Australian cocoa farmers to train their cocoa trees onto trellises—an idea borrowed from producers of temperate fruits such as apples and cherries. Trellising can increase productivity and open the way to at least partial mechanisation, as well as reduce the vulnerability of the trees to cyclone damage. ACIAR and Queensland DAF are evaluating and promoting the use of trellising with partners in smaller Pacific islands, such as Vanuatu, as part of a broader effort to increase the resilience of the region's economies to extreme weather.

Innovation is the key to agricultural development and economic growth, and ACIAR seeks and promotes innovation through its



PHOTO: JIM HOLMES/ACIAR

Above: Australian and Lao researchers sort young fish by species in Pak Peung, where new fishways are restoring ancient migration patterns on the Mekong.

Right: Ms Luyen from Tu Nhien village and Ms Vu Thi Phuong Thanh from Fresh Studios are proud of the premium strawberries being grown in Tu Nhien village, in Vietnam.



PHOTO: GORDON ROGERS

research partnerships. ACIAR's partnership with Canada's International Development Research Centre is a classic example of how innovation and collaboration can have lasting impacts. The A\$15 million Cultivate Africa's Future initiative is supporting applied research solutions to improve long-term food and nutrition security in Kenya, Malawi, Uganda, Zambia and Zimbabwe. The diversity and creativity of the selected partners generates new ideas, technologies and approaches. Innovation, along with adaptability and flexibility, are essential requirements in today's context of rapid change, and ACIAR has built these features into its ways of working with developing country collaborators. For example, Happy Seeder technology has given India a tool to avoid burning rice stubble, thereby improving air quality. Professor John Blackwell describes how conservation agriculture practice avoids ploughing soil and thereby conserves energy, soil moisture and fertility, delivering significant benefits to farmers.

Acknowledging the vital (and different) roles of women and men in agriculture—and the risk of project failure if these are not fully understood at the outset—ACIAR strives to address **gender** within all our work. This includes through gender-specific strategies and projects that focus on women's needs, as well as ensuring that gender is considered carefully in more conventional farming systems research projects. As a broker and manager of research partnerships, ACIAR also takes a lead in promoting gender awareness and action among partner groups and organisations.

As you will read, farmers—primarily women—in Vietnam's poor, north-western-highland villages in the Moc Chau district have increased their net income by an average of 150% by supplying high-quality, 'accredited safe' vegetables to retail stores and urban consumers in Hanoi.

The agribusiness model adopted by the villagers was developed through public-private partnerships brokered by ACIAR, in a project led by Gordon Rogers from Australian-based Applied Horticultural Research. In 2015, 68 project farmers—71% of them women and 10% from the ethnic Hmong minority—produced about 420 tonnes of accredited-safe vegetables on 22 hectares in the Moc Chau villages of Tu Nhien, Ta Niet and An Thai.

The **private sector** drives economic development and is an important and valued partner in ACIAR's research. The private sector brings a different perspective to research-for-development partnerships, as well as different approaches, different knowledge, different incentives and the capacity to take research outputs to scale. Two ACIAR forestry projects profiled in this issue are underway with Indonesian private-sector partners, one led by Dr Daniel Mendham focusing on the sustainable management of the transitioning plantations, and the other, led by the University of Tasmania's Dr Caroline Mohammed, dealing with disease management. These two projects work with three of the biggest Indonesian plantation companies, which together manage about two million hectares.

ACIAR manages Australia's contribution to

international agricultural research network **CGIAR**. With 15 research centres throughout the world dedicated to addressing poverty, hunger and nutrition, and environmental degradation, CGIAR is a global research leader and a key partner for ACIAR and Australia. Benefits from CGIAR's research programs also flow to Australia. For example, the results of global crop-breeding programs support the Australian grains sector.

ACIAR's increasing emphasis on agribusiness, and the use of the value-chain approach to shape its projects, has raised the profile of the many commercial players and their roles in agricultural development and in research for development. The stories in this issue of *Partners* illustrate convincingly that partnerships provide fertile ground for the exchange of ideas and knowledge, and for the creation of ongoing networks of people. ACIAR and its partners are gaining valuable insight into commercial needs and approaches in agricultural research for development, and how these insights can be aligned for better synergy, results and impacts.

I commend these stories to you.

PROFESSOR ANDREW CAMPBELL
CEO of ACIAR

OUR PARTNERSHIP PHILOSOPHY

BY **PETER HORNE**

General Manager, Country Programs

While ACIAR funds agricultural research, it is, more importantly, a research partnership broker. Rather than simply contracting research projects, we commission international research partnerships to effectively address high-priority needs in partner countries. This proven operational model draws largely on Australia's agricultural innovation system, itself built on partnerships, and recognises that long-term benefits come from research collaboration, not just through the delivery of research results.

Since the inception of ACIAR, the research landscape in the developing world has changed substantially. Globalised agrifood chains, increasing urbanisation, greater pressure on natural resources and the impacts of climate change on agriculture and fisheries have all contributed to a much more complex setting for research. In 2016, 800 million people are suffering from calorie deficiency but two billion are suffering from micronutrient malnutrition. The challenges of producing not only 70% more food by 2050 but more nutritious food to address malnutrition will require radically new frontiers in research. Furthermore, the factors that drove the Green Revolution—substantial increases in land area, crop productivity and crop inputs—will not be sufficient to drive the next needed revolution in global food production.

Transformational changes are needed in food-production systems, agricultural value chains and postharvest loss and wastage. Research will need to embrace a wide range of 'blue sky' and on-farm adaptation options.

While tightly focused research remains a core mandate for ACIAR, the more complex challenges described above will require much more integrated and multi-disciplinary research approaches.

With the increasing global need to develop competitive and equitable agricultural, fishery and forestry value chains, research partnerships are bringing together people and agencies that have not typically worked together. Many partner countries highlight the catalytic benefits of ACIAR projects in bringing their own capabilities from across different ministries to work together



SUCCESSFUL RESEARCH PARTNERSHIPS ARE FOUNDED ON A FINE BALANCE OF TECHNICAL GUIDANCE, NEGOTIATION, NURTURING, PERSONAL LIAISON, RESPECT AND TRUST.

Peter Horne

towards a common goal. These novel partnerships also by necessity involve the private sector as co-investors, with key benefits including:

- access to and understanding of market dynamics and opportunities
- innovation capability, such as machinery development and adaptation
- exposure of the private sector to research innovations
- scale-out capability of the private sector through its own supply and buying networks, and
- a better understanding of commercial constraints relating to an industry that may not be well understood by government agencies.

Against this backdrop of change, ACIAR is responding dynamically in brokering and managing the novel partnerships that are now needed. Earlier research projects were often simple government-to-government collaborations with a single technical focus. Today's partnerships (and the partnerships needed for tomorrow) are necessarily more diverse.

ACIAR has benefited from the research capability maintained by Australia's national and state research agencies, but as those systems become pressured by budget constraints, we are playing an increasingly important role in sustaining Australia's research capability in key areas such as forestry.

Building research partnerships across cultures and sectors is challenging. Often there is the need simply to develop a common language and an understanding about the challenges and

opportunities, and each partner's role, which takes substantial time and effort. It is through partnerships established this way that significant benefits flow from research. ACIAR actively encourages such partnerships to form so they can be supported over the longer time periods that are often needed to deliver impacts from research.

In addition to a changing research landscape, our long-term overseas partners themselves have rapidly changing capabilities and expectations of research collaboration with Australia. Research agencies in major economies such as Indonesia, Vietnam, China and the Philippines are now seeking to co-invest with ACIAR to achieve greater reach from the collaboration. In some cases this involves co-investing in the ACIAR projects themselves and in other cases it is through funding parallel research activities that are functionally linked to the ACIAR research to maximise scale-out of benefits. Some of our partner countries are also seeking to work with ACIAR in other parts of the world in jointly funded trilateral arrangements that mobilise their own research capability to work with ACIAR-funded researchers.

Successful research partnerships are founded on a fine balance of technical guidance, negotiation, nurturing, personal liaison, respect and trust. ACIAR sees many partnerships that endure well beyond the time frame of ACIAR support.

The research partnership model has served ACIAR well for its first 35 years, and with a flexible, responsive approach will continue to serve us well for the next 35 years. ■



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IN RESEARCH FOR DEVELOPMENT

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

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ISSN 1031-1009 (Print)
ISSN 1839-616X (Online)

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PASSAGE TO PROSPERITY

Despite the presence of flood-control weirs, floodplains along the Mekong River in Laos are once again becoming nurseries for migratory fish species due to an extraordinary partnership of local communities and technical experts

PHOTOS: JIM HOLMES/ACIAR

KEY POINTS

- A suite of ACIAR projects to add fishways to the flood-control weirs along the Mekong River is reversing losses to fishery productivity.
- The projects have strong buy-in from local communities and their impact has inspired international interest in this conservation model.

BY CLARE BARRY

When the village chief's son opens the gates of the Pak Peung fishway in central Laos, he is but one of a chain of partners spread across the region and the globe. Their aim is to balance the delicate tussle between rice and fish production that ensues when the Mekong River breaks its banks and spills onto the surrounding floodplains.

The mighty Mekong runs the length of the country and can fluctuate in water level by up to 15 metres between wet and dry seasons.

In the rainy season it washes onto the floodplains, taking with it the eggs and larvae of migratory fish species that use the floodplain as a nursery before returning to the main channel at season's end. But this ancient migration has been interrupted in recent decades by the construction of thousands of weirs or 'regulators' on the river's

banks, as villagers strive to protect their floodplain rice crops.

"People who fish the floodplain swamps report a decline in species diversity as well as overall number of fish," says Dr Lee Baumgartner, a freshwater fish ecologist and project leader on two of three ACIAR projects bringing fish-passage technology to Laos. "Securing rice production has unfortunately come at the cost of fisheries production, which is something we are helping to fix."

Dr Baumgartner, now with Charles Sturt University, is part of a team that is building fishways, also known as fish 'ladders', in Laos, using technology tried and tested in Australian rivers.

The Australians teamed up with two crucial local partners: the National University of Laos and the Living Aquatic Resources Research Center (LARReC). LARReC, as a government body, was instrumental in getting local, district and provincial approvals and ensuring adherence to legislation. The university helped with project coordination, engaging villagers and organising students to help with the research.

"We had a really strong education component and also strong government engagement through LARReC, so the partnership was spectacular," Dr Baumgartner says.

"When we completed the first permanent fishway it would have been easy to organise a group of international contractors, they'd have

swept in, done the work and left. But what we wanted to do was build capacity within local contractors so that they could undertake the work themselves." The project team ran a tender process to find a Lao contractor with good links to the local village who could use local skills and knowledge to build the fishway.

"It was really important to make sure the initiative was run and championed by the Lao people, we just provided advice when they called on it," Dr Baumgartner says. "It's been wonderful working with the Lao team members over the last eight years. Fish passage is quite a complex field that mixes ecology with engineering with river hydrology. There are some fairly tricky concepts to understand, so part of our technology transfer has been teaching fish-passage design principles, while also learning about the Mekong, which is very different from Australian rivers.

"The University of Laos and LARReC researchers are now regional leaders recognised for their knowledge on how to build and operate fishways. They were invited to an inland fisheries workshop in Rome, run by the FAO, specifically to showcase this project. They have also been invited to extend their information on fishways at a range of other international forums."

The Pak Peung fishway opened in 2012. More than 150 species have been recorded moving upstream through the fishway, including some



Clockwise from left:
Dr Lee Baumgartner at work during construction of the Pak Peung fishway in central Lao PDR in 2012; sorting juvenile fish by species; casting a net in the Mekong River floodplains; University of Laos researcher Mr Phousone measures the catch; Lao contractors sandbag the channel for the Pak Peung fishway.

species that have not been seen in the wetland for more than 20 years. Now a second ACIAR project is working to ensure the safe passage of fish back to the main Mekong channel after the rainy season by redesigning the regulators to ensure the young fish are not injured on their return.

Hearing of the success of the work at Pak Peung, the World Bank funded the Lao Department of Irrigation to construct fishways as part of the bank's Mekong Integrated Water Resources Management Project. If a new study, led by Dr Baumgartner, produces scientific and economic evidence to substantiate broadscale fisheries recovery, donor bodies will likely continue their investment.

The US Department of the Interior has also invested, through the Smart Infrastructure for the Mekong program, by establishing an exchange program between US and Lao researchers.

"Quite a few Lao officers have now done one to three-month placements in the USA, so the existing collaboration is being extended across the Pacific into the US," Dr Baumgartner says.

"There's so much work that we as a project team can do. We don't have the resources to tackle all issues ourselves, so when someone offers to help or come on board we expand the team. Collaboration has been a real key and it's not just collaboration with Lao PDR, it's a multi-country collaboration across so many levels."

Fish scientist and consultant Dr Martin Mallen-Cooper, who reviewed the first ACIAR project, says the Australian teams' "deep engagement" and active fostering of relationships with local partners was vital. "If you wanted to run a project in Lao PDR and solely use Australian staff it just would not work. This is utterly and completely dependent on the partnerships."

Dr Baumgartner "played the long game", he says, fostering the Lao officers' careers, building knowledge gradually and exposing them to overseas conferences. "(They) knew their enthusiasm would be communicated to their hierarchy and bureaucracy, so they've gained a lot from that."

Back at the site of the first project, Pak Peung's villagers have taken ownership of their fishway, and while the village chief's son still liaises with the project team, he has ultimate discretion over when the fishway opens and closes.

"We have very little input into how they operate the fishway now," Dr Baumgartner says. "It really is a community-owned structure, which is exactly what we hoped for." ■

ACIAR PROJECTS: FIS/2009/041 'Development of fish passage technology to increase fisheries production on floodplains in the lower Mekong and Murray-Darling River basins'; FIS/2012/100 'Improving the design of irrigation infrastructure to increase fisheries production

An ever-growing list of partners has ensured a successful start to fish-passage technology in Laos:

Australian

NSW Department of Primary Industries
Queensland Department of Agriculture and Fisheries

Charles Sturt University
Australasian Fish Passage Services
Kingfisher Research
KarlTek Pty Ltd

Lao

National University of Laos
Living Aquatic Resources Research Centre
Department of Livestock and Fisheries
Department of Irrigation

International

World Bank
US Department of the Interior
Wetlands Alliance

in floodplain wetlands of the Lower Mekong and Murray-Darling basins'; FIS/2014/041 'Quantifying biophysical and community impacts of improved fish passage in Lao PDR'

MORE INFORMATION: Dr Lee Baumgartner, Charles Sturt University, lbaumgartner@csu.edu.au



PHOTO: ACIAR

A SPACE TO INNOVATE

Some of the poorest women farmers in India have proven to be innovative change agents when given the opportunity to engage as partners in agricultural research

KEY POINTS

- Women farmers who are research partners in an ACIAR project in East India have reduced endemic poverty and malnutrition by developing more diverse cropping systems.
- The research farmers demonstrated a flair for innovation, changing the way rice is cultivated and making it possible to also cultivate pulses, vegetables and oilseeds.

BY CATHERINE NORWOOD

Innovation was the essential ingredient needed to help disadvantaged tribal communities on the uplands of the East India Plateau, but outreach to these farmers was complicated by distrust of government agricultural services. Across the states of West Bengal and

Jharkhand, tribal farmers have been pushed on to less productive land—or even forced to claim land from wild jungle—and face endemic poverty and high rates of chronic malnutrition.

Compounding their difficulties, farmers attempted to cultivate rice as traditionally practised in the lowlands, by transplanting rice seedlings into flooded paddies. This practice is poorly suited to rainfed, upland landscapes and contributed to malnutrition by limiting production of rice to one crop a year.

But things are starting to change as a result of a remarkable partnership brokered by ACIAR between the women who are responsible for farming activities in these communities, Indian non-government agency PRADAN, and Australian researchers.

Professor Bill Bellotti, an agronomist and director

of the Food Systems program at the University of Queensland's Global Change Institute, says ACIAR saw that Australia had the knowledge to help these communities diversify and intensify their rice-based cropping systems. Reaching them, however, required a creative approach.

"Such a project wasn't possible without the means to engage local communities," he says. "In this project, trust was an important issue."

A decade ago, the first of two five-year projects got underway, resolving the trust issue through partnership with the highly regarded PRADAN.

The effects have been transformative.

"The project ended up affecting labour, gender equity, nutrition, climate resilience ... it changed for the better factors in the social, economic and environmental domains, not just agricultural productivity," Professor Bellotti says.

Clockwise from left: Vegetable crops help diversify the nutrients available to otherwise malnourished communities; women in Hazaribag, Jharkhand, harvest rice; research farmers Pirki Mandi (left) and Anjani Mandi view a thriving crop of tomato plants; disadvantaged tribal women on the East India Plateau proved clever innovators when engaged directly as research and extension partners in an ACIAR project.

INNOVATION MAVERICKS

Professor Bellotti attributes everything that was special about this project (initially led by Professor Peter Cornish) to the way the farmers—primarily women—were engaged directly as research partners.

“We are working in poor tribal farming communities and because there is not much income from rice, men look for work in the cities as labourers,” Professor Bellotti says. “Back at the village farms, doing the unpaid work, are women. We talk about this phenomenon as the ‘feminisation of agriculture.’”

The women who initially worked with ACIAR were selected from among the ‘Self-Help Groups’ that PRADAN established to assist poor communities with financial literacy, sanitation and health issues. Lessons include how to avoid falling into loan traps, how to budget and how to accumulate money so members of Self-Help Groups can lend money among themselves.

“When ACIAR came along it added the capacity for agricultural research into the region’s network of PRADAN Self-Help Groups,” Professor Bellotti says.

The key feature of the project was empowering the farmers by giving them ownership of the innovation process.

“Typically agricultural research provides results to extension agents who transfer the findings to farmers,” Professor Bellotti says. “This approach views farmers as passive recipients of technology. We turned that around and asked the farmers to perform the critical task of framing the research questions.”

The farmers then implemented the research directly in their fields. The women managed the trials, assisted with data collection and helped interpret the results. Through these activities, they developed a new way of growing rice called direct-seeded rice (DSR).

Rather than cultivating rice seedlings in a nursery before transplanting to flooded rice paddies—which requires back-breaking work traditionally done by women—DSR sows rice seed in lines directly into unflooded fields. This approach retains soil structure, allows rainfall to infiltrate the soil, and, importantly, allows a second crop to be grown from the same amount of yearly rainfall.

A modified rake was developed to form the lines. Seed and fertiliser are added to the furrows and then covered. This eliminates an extraordinary



PHOTOS: ACIAR



“THE PROJECT ENDED UP AFFECTING LABOUR, GENDER EQUITY, NUTRITION, CLIMATE RESILIENCE ... IT CHANGED FOR THE BETTER FACTORS IN THE SOCIAL, ECONOMIC AND ENVIRONMENTAL DOMAINS, NOT JUST AGRICULTURAL PRODUCTIVITY.”

– Professor Bill Bellotti

amount of labour, which is important to these women, who typically work from 5am to 9pm and are extremely time poor.

All the equipment needed for DSR is small, manually operated and suited to subsistence farms, yet it is part of a farming system that reduces labour.

DSR also allows rice to be sown earlier. Combined with short-duration varieties, this innovation allows the rice crop to be harvested up to one month earlier than transplanted rice. This provides enough time to sow a second crop, such as a protein-rich pulse or a nutrient-rich vegetable or oilseed, which diversifies the food types and nutrients available to otherwise malnourished communities.

DSR is also more climate resilient than transplanted rice since it avoids the need for

ponded water. Even when the monsoon arrives late or rainfall is below average, there is usually enough soil moisture to grow a successful DSR crop.

The new cultivation system requires ongoing research to refine fertiliser management, pest and disease management, and identify high-yielding cultivars.

RESEARCH FARMERS

Aided by ACIAR to function as researchers, the participating farmers proved insightful innovators who were willing to share new technology with other farmers. The flair for independent innovation was especially apparent when DSR made second crops possible.

Instead of just growing rice as a monoculture followed by a second crop, the women demonstrated the viability of inter-cropping a →



Self-Help Groups, such as this one in Bhubhui village, Jharkhand, have been set up by Indian non-government organisation PRADAN to provide agricultural research assistance to women farmers.



One of the pioneer direct-seeded rice (DSR) research farmers, Kalpana Hansda, pictured with her neighbour's daughter, Devi Hansda, in Talaboru.

pulse (typically black gram) with rice. They also introduced relay cropping in which the women sow another crop (such as chickpeas) into the rice crop so that it emerges when the rice is harvested.

The women also independently introduced new vegetable crops, such as bitter melon, which are highly profitable when sold in local markets.

"Whether they inter-crop, relay crop or just plant a second crop, the women farmers have diversified production, creating novel nutritional and marketing opportunities," Professor Bellotti says.

Surplus produce can be sold in local markets and the farmers also barter, as well as lend and borrow from each other. There are examples emerging where sufficient quantities of a particular vegetable, such as tomato, are produced to allow consolidators (or middlemen) to accumulate product to sell in bigger markets in cities.

"The women are also astute observers and are excellent change agents," Professor Bellotti says. "They are excellent at disseminating what they have learnt, communicating DSR to other farmers so that in the space of one season, the practice spread quickly."

SPREADING THE WORD

At the outset ACIAR worked in three locations, targeting two or three Self-Help Groups at each site, resulting in 30 to 40 research plots per village comparing DSR to transplanted rice, or trialling new ways to grow vegetables.

Through the women's own initiative—and making use of PRADAN's network—the research

"WHAT WE FOUND WORKING WITH THESE WOMEN IS THAT IF THE TECHNOLOGY IS APPROPRIATE, SUBSISTENCE FARMERS CAN BE EXTREMELY INNOVATIVE."

– Professor Bill Bellotti

farmers have reached out to thousands of farmers to share the benefits of the research.

This flair for extension has, in turn, produced new income-generating opportunities, including research farmers being paid to share their knowledge. In addition to having the costs of travelling to other villages reimbursed, the women are paid to provide lessons and field demonstrations to other farmers through government sources, such as the National Rural Livelihoods Mission (NRLM).

"Traditionally that would have been the role of government extension agents and we are seeing this role shift directly to research farmers," Professor Bellotti says. "Government development agencies like the NRLM are recognising that it is worthwhile and effective to pay women farmers to share their knowledge and experience."

In the process of exploring new farming practices and engaging other villages, the women are generating new research questions in a cycle of ongoing self-improvement.

"Researchers often tend to ignore the most disadvantaged and least-resourced farming communities because they don't think they have the physical capacity to invest in new technology," Professor Bellotti says. "But what we found working with these women is that if the technology is appropriate, subsistence farmers can be extremely innovative."

"We had to learn to step back and open up a space for farmers to innovate."

The key to reaching the farmers, however, was having trusted local partner PRADAN, which contextualised agricultural research within a broader development framework that improves livelihoods and provides a sense of agency.

"The success of this ACIAR project had less to do with agricultural technology and more to do with developing human capacity for independent innovation," Professor Bellotti says. "This project was a case of agricultural research activities providing opportunities for adult learning."

The outcomes are allowing extremely poor women farmers to increase their income and the food and nutrition security of their households, and to become empowered leaders of more gender-equitable farming communities. ■

ACIAR PROJECT: LWR/2010/082 'Improving livelihoods with innovative cropping systems on the East India Plateau'

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AN ALLIANCE WITH SCOPE

Innovation and collaboration are at the core of ACIAR's alliance with Scope Global, which provides early-career researchers with opportunities to contribute to development projects

PHOTO: NOEL JANETSKI

Scope Global volunteer Luke Barron setting up for GPS mapping of the rehabilitated reef at Pulau Badi.

BY JUDE BLACKLOCK

ACIAR greatly values capacity building and the impact achieved when young researchers work in research for development. That is why its innovative partnership with Scope Global is so important.

Scope Global is an Australian company that specialises in delivering international development and education programs in Asia and the Pacific region, including managing volunteer programs.

Since 2014, the alliance between ACIAR and Scope Global has played a role in cultivating early-career researchers, providing professional development opportunities, and laying the foundations for a positive future for agricultural development aid work in our region, and for research capacity in Australia.

The alliance creates opportunities for more strategic volunteer placements in direct support of Australia's development policy. The placements focus on economic development opportunities related to agricultural development, links with the private sector, and inclusiveness, specifically the empowerment of women and girls.

More broadly, several ACIAR projects have benefited from the placement of Australian Government-funded volunteers through the the Australian Volunteers for International Development (AVID) program over many years.

"ACIAR has worked with volunteer organisations, including Scope Global, in the past and will continue to do so," says Dr Peter Horne,

ACIAR General Manager Country Programs. "Under the Scope Global-ACIAR partnership we are able to identify unique volunteering positions where extra support and funding can have a further impact on the success of the volunteer placement."

Its relationship with Scope Global enables ACIAR to foster partnerships with other organisations. One of ACIAR's current partners is Mars Symbioscience and its marine sustainability program in Indonesia. The program seeks to improve the long-term food security of small-island and coastal communities by developing alternative livelihood opportunities and rebuilding coral reef habitat to restore fisheries.

Three volunteers have been placed by Scope Global under the ACIAR partnership to develop Mars' breeding techniques for ornamental fish, improve hatchery processes, mentor staff and contribute to the coral reef rehabilitation programs.

Supervising the ACIAR-Scope Global volunteers at Mars is Noel Janetski, who says the volunteers provide significant input to its program and the development of its local team.

"Having a series of placements in succession broadens the overall impact of the volunteer program and continues to expand the experience of the local team, who adopt better practices and become more confident operating within an international environment." ■

MORE INFORMATION: Dr Peter Horne, ACIAR General Manager Country Programs, peter.horne@aciar.gov.au

THE LIFE OF A VOLUNTEER

Alex Basford spent nine months as a volunteer aquarium fisheries adviser at Mars Symbioscience from mid 2015. His role was to develop and train staff in improved ornamental marine fish breeding technologies and new hatchery systems that support sustainable small-scale aquaculture programs.

These programs provide economic opportunities for the local community while reducing pressure on wild fish stocks.

Among his most enjoyable roles was helping hatchery staff to consider more scientific methods to problem solve, and developing their leadership skills. "Developing new technologies, as well as implementing scientific protocols, helped make the hatchery's already great progress more consistent," he says.

"By helping the hatchery run smoothly the people on Pulau Badi [Southern Sulawesi] could expect regular deliveries of baby clownfish for them to grow out and sell."

Mr Basford is currently a PhD candidate at the National Marine and Science Centre, a position he attributes to his volunteering experience, which included funding from ACIAR to travel abroad.

His PhD placement is being part-funded by Mars and is helping to strengthen Mars' relationship with Southern Cross University, where he is based.

PLANTING THE SEED OF COOPERATION

Collaborative research helps keep tree plantations – which feed the world’s massive demand for wood and paper – both productive and sustainable

KEY POINTS

- Privately operated plantations in Indonesia have adopted fast-growing Australian tree species but they face novel pest, disease and management challenges that require ongoing research efforts.
- Where these companies previously ran separate, isolated research programs, ACIAR projects are helping to catalyse a shift from competitive to collaborative approaches to forestry research.

BY GIO BRAIDOTTI

Improving the productivity of forest plantations can help people in poor rural communities in Asia and the Pacific region improve the benefits of cultivating timber.

These benefits are spread across economic, environmental and social development markers.

They include regeneration of landscapes scarred by war in Vietnam using methods that boost wood-based industries and farmer income, while in Indonesia, plantations are easing the pressure on native forests, with the large pulp producers now supplied exclusively by sustainably managed plantation wood.

What both examples have in common is the adoption and utilisation of Australian tree species and Australian management know-how in commercially viable plantations whose development was facilitated by ACIAR.

Dr Daniel Mendham is a researcher with more than a decade’s experience partnering with developing countries in ACIAR forestry projects. Tasmania-based Dr Mendham, of CSIRO Land and Water, says plantation-based forestry projects face massive challenges but are enormously rewarding because of the significant opportunities for positive outcomes.

“We have looked at impacts of past projects and noted that forestry projects have the

ability to boost national economies, they can generate thousands of jobs linked to sustainably managed plantations, they draw infrastructure and investment to remote communities that are otherwise locked into subsistence farming, and they offer opportunities for conservation and regeneration of degraded land.”

The appeal of Australian tree species, such as acacias or eucalypts, is their fast growth rate and resilience to scarcity of nutrients and water.

Dr Mendham says ACIAR’s early ‘Seeds of Australian trees’ project made it possible to test Australian tree species across Asia for their potential use in plantations. This led to informed selection of Australian species that today cover millions of hectares in South-East Asia and supply wood sustainably to well-defined markets.

Initially it was acacias that were widely adopted in Vietnam and Indonesia, where the trees have driven a dramatic expansion of forestry-based commercial activity. In Vietnam, the acacias have helped transition the country from a small exporter of wood to the world’s largest. Acacias grow well on degraded sites, provide a good return on labour for smallholder farmers, and take pressure off harvesting areas of native forest, enabling it to regenerate.

In Indonesia, particularly on the islands of Sumatra and Kalimantan, commercial acacia plantations were able to supply one of the largest pulp industries in the world, relieving the pressure on the remaining native forest.

These plantations, however, face novel ecological contexts and Dr Mendham explains they require ongoing R&D investment to deal with emerging challenges. “What we are finding is that the acacia plantations face novel management, pest and disease pressures,” he says.

Despite efforts to match for environmental conditions by selecting species sourced from





Dr Daniel Mendham and Indonesian researcher Dwiko Permadi at a three-year-old plantation of *Eucalyptus pellita*, in the private-sector partner Finnantara's HTI lease area at Peta Sebaran Tamanan, West Kalimantan.

PHOTO: IONV BARTLETT

“ULTIMATELY, IT IS THE PLANTATIONS THAT HAVE TAKEN THE PRESSURE OFF NATIVE FORESTS—WE NEED TO ENSURE THAT THE PLANTATIONS CONTINUE TO PRODUCE LARGE AMOUNTS OF WOOD FROM A SMALL AREA.”

– Dr Daniel Mendham

northern Queensland and Papua New Guinea, the Indonesian acacia plantations succumbed to disease pressure and are no longer widely grown in Sumatra. Instead, Indonesia is about 80% of the way through a transition to the use of eucalyptus trees.

“The situation in Sumatra highlights that plantations remain vulnerable and require research to remain sustainable and productive,” Dr Mendham says.

How that research is delivered depends greatly on the social structures that make cultivation of the trees possible. In Vietnam it is mainly smallholder farmers who plant and maintain the trees. The situation is different in Indonesia, where plantations are commercial operations and require their own unique framework of partnerships.

ENGAGING WITH THE PRIVATE SECTOR

In 2015, two ACIAR forestry projects got underway with Indonesian private-sector partners, one led by Dr Mendham focusing on the sustainable management of the transitioning plantations, and the other, led by the University of Tasmania's Dr Caroline Mohammed, dealing with disease management. These two projects work with three of the biggest Indonesian plantation companies, which collectively cultivate about two million hectares.

Dr Mendham explains that each company maintains its own R&D unit and each was willing to engage with the Australian team members. The three companies, however, were initially reluctant to work with each other. He suspects the situation arose from a culture of competition at the marketing level spilling over into unproductive competition when dealing with shared tree-production challenges.

“They grow the same species in the same environment yet run isolated management and breeding programs,” Dr Mendham says. “This means the companies miss out on benefits that come from understanding the system as a whole and they miss out on efficiencies intrinsic to collaborative research that shares in results equally.”

ACIAR project activities, however, provided the three companies with channels to build trust and discover the advantages of tapping into the efficiencies of collaborative research as they

face the non-trivial challenges of safeguarding sustainably sourced wood into the future to feed massive demand. The buy-in from technical staff came quickly; management is responding more conservatively. Yet experimental trials are underway on privately leased plantation sites that are inexorably breaking down barriers to collaboration. As Vietnam, too, considers a transition to eucalyptus trees on some sites, information sharing is now extending to project sites in the two different countries.

“The ACIAR project activities provide the only forum where researchers from different companies can come together collaboratively to understand the key wood production challenges,” Dr Mendham says.

“With so much at stake, it makes sense to work together to help acquire knowledge of best-practice management. Ultimately, it is the plantations that have taken the pressure off native forests—we need to ensure that the plantations continue to produce large amounts of wood from a small area.”

There are now pockets of protected and stabilised native forest in Sumatra and connecting green belts that are made possible by the productivity of plantations. There is also a growing respect at the corporate level regarding the importance of a social licence to operate that is helping to increase social capital.

“We are seeing in Indonesia all the hallmarks of an industry that is evolving into something more socially and environmentally sustainable,” Dr Mendham says. “With that inevitably comes cultural change. It is a similar trajectory of change taken by Australia over the past 50 years. What ACIAR allows these transitioning economies to do is share experiences, collaborate on finding solutions, and build frameworks to better tackle problems in the future.” ■

ACIAR PROJECTS: FST/2009/051 ‘Increasing productivity and profitability of Indonesian smallholder plantations’; FST/2014/064 ‘Maximising productivity of eucalyptus and acacia plantations for growers in Indonesia and Vietnam’

MORE INFORMATION: Dr Daniel Mendham, CSIRO Land and Water, daniel.mendham@csiro.au

RESEARCH BUILDS DEMAND FOR PARTNERSHIPS THAT ENDURE

Farmers who helped an ACIAR team analyse the most viable land-use options and policies in Fiji and Vanuatu have asked the Australian and in-country partners to come back and help communities implement change

KEY POINTS

- Land-use policy and practices in Fiji and Vanuatu have been reviewed due to concerns about unproductive and degraded land.
- The review was undertaken in partnership with Australia through a highly productive ACIAR project.

BY GIO BRAIDOTTI

Concern over degraded and unproductive land has prompted governments in Fiji and Vanuatu to review policies that affect land-use practices. The governments wanted to pursue a process based on strong empirical data. They opted to partner with ACIAR, whose team of in-country and Australian researchers used models of economic viability to supplement the analysis of existing land-use practices.

The review was done in 2015, in a project that is likely to have important impacts for years to come, says Dr Ejaz Qureshi, ACIAR Research Program Manager for Agriculture Development Policy.

"The goal of the project was to systematically catalogue land-use policy, the extent of land degradation and to explore land-use options, their financial viability and the nature of incentives needed to make change," Dr Qureshi says.

The project is now complete and produced an impressive body of work. The findings were compiled into 15 research articles and collated into an ACIAR monograph, which is due to be published by the end of this year. "This project was keenly supported by the governments of Fiji and Vanuatu and gained strong buy-in from key policymakers," Dr Qureshi says.

The exercise went beyond providing farmers with information about land-use options; it opened a gateway for Australia to support the governments of these partner countries to adopt, implement and restructure land-use policy in ways that increase the welfare of these Pacific island countries.

International law and governance expert Dr Saiful Karim, of Queensland University of Technology's Faculty of Law, led the analysis team. For Dr Karim, the ACIAR project was an opportunity to apply his longstanding interest in the impact of policy frameworks on land use in the Pacific region to practical research in Fiji and Vanuatu.

He says abandoned sugarcane plantations in Fiji are symptomatic of the problems these Pacific island countries face. In that instance, land ownership issues caused farmers to lose access to land that then became unproductive.

FOCUS ON AGROFORESTRY

Of particular concern is a steady decline in agroforestry, a land-use practice known for its environmental resilience, sustainability and high productivity. Agroforestry is a holistic farming-system approach. One of its core traits is the practice of recycling and re-using outputs in a sustainable way across crop, livestock and forestry production systems.

"Agroforestry has been practised for many years in the Pacific region, however, at a time when it is especially needed to help bring degraded land back into production, its popularity is in decline," Dr Karim says.

Dr Karim, with the help and mentorship of Professor Steve Harrison, who has worked on previous ACIAR projects, built a multi-disciplinary team to explore the legal, policy, economic and cultural issues that influence land-use choices in a Pacific context. The team comprised researchers from Australia as well as in-country partner organisations.

At a national level, the team identified the need for government-department unity, with separate departments responsible for areas of agroforestry expertise, including forestry, livestock and agriculture.

"We also looked at land ownership, particularly how to share benefits from farming where the

land is farmed by few, but it is owned communally," Dr Karim says. "Without a benefit-sharing arrangement land can become unproductive, as we have seen in some of Fiji's sugarcane plantations."

Security of tenure for farmers on agricultural lands is an issue. The challenge is to put in place frameworks that build confidence in livelihood security, encouraging long-term investment and commitment to sustainable agricultural practices.

NEW FINANCIAL MODELS

Finally, the team led by Professor Harrison, an agriculture and natural resource economics expert, examined the financial viability of different farming and land-use practices, including agroforestry practices that incorporate different kinds of species and commodities. The idea of developing the financial models was to better understand the costs, benefits and risks over the long periods of time required for trees and crops within these farming systems to mature and reach markets.

The project developed financial models for five overall mixed-species agroforestry systems and eight additional 'priority' tree and crop species. The models focused on the production of timber, fruit and nuts, cocoa, root crops, citrus, bananas, pulses and kava.

Both Dr Karim and Dr Qureshi stress that strong relationships and trust between the Australian and in-country governments, and their public-sector researchers, are essential to a policy-oriented project, where local nuances, cultural practices and historic context needs to be understood and respected.

There is a legacy of high-value, public-good impacts associated with ACIAR projects in the Pacific region. ACIAR's experience, reputation and established networks assisted greatly in the planning and negotiation stages of this agroforestry project. The project relied heavily on innovation-friendly partnerships with key

Dr Saiful Karim (right) with farmer Joseph Merib of Epi Cocoa Farmers Association, whose mixed-species agroforestry farm on Epi Island, Vanuatu, impressed the ACIAR team.



government departments and agencies in the Pacific region, namely:

- the Pacific Community, Fiji
- the Ministry of Trade, Commerce, Industry and Tourism, Vanuatu
- Ministry of Fisheries and Forest (MFF), Fiji.

The project's findings have provided a springboard to launch a more comprehensive project to implement best-practice policies and land-use options, built around reforms that introduce land-lease security and benefit-sharing mechanisms, as well as greater coordination among government departments. Dr Karim believes such an endeavour should include the establishment of proof-of-concept, community-based agroforestry models that adopt financially viable, best-practice options and protocols to share economic benefits.

Adding confidence are the economic models produced by Professor Harrison that allow would-be adopters—from farmers to governments—to foresee the risks and opportunities associated with different practices.

During many trips to the partner countries, Dr Karim had the opportunity to visit farming communities and gauge their interest in reform. He says many communities were enthusiastic about land-use reforms, but farmers stressed the need for ongoing involvement by the ACIAR team.

"We were asked by farmers whether we are coming back to help implement change," Dr Karim says. "We now know that with the right policy, legal and economic reforms it is possible for traditional owners to benefit from agroforestry. More importantly, the partnerships we have jointly created make implementation a real possibility." ■

ACIAR PROJECT: ADP/2014/013 'Promoting sustainable agriculture and agroforestry to replace unproductive land-use in Fiji and Vanuatu'

MORE INFORMATION: Dr Saiful Karim, project leader, mdsaiful.karim@qut.edu.au



Best known as a community-based strategy to prevent soil and water degradation, landcare did much more when it was adapted in the Philippines to reach farmers in isolated communities who have been exposed to conflict

LANDCARE BRINGS COMMUNITY TOGETHER FOR COMMON GOOD



PHOTO: EWE CARUSOS

Left: A farmer tending her cacao seedlings at a community nursery.

Above: Members of the Olo-clofe B'laan Landcare Association (OBLA) at a Farmer Field School training session.



PHOTO: NIKKI CORDERO

Project facilitators (front) assist farmers of the OBLA with a field demonstration on vegetable bed preparation.

KEY POINTS

- Conflict can exacerbate the impact of isolation on poor rural communities, including the loss of agricultural extension services.
- Trials in the Philippines found that extension via a modified landcare model helps isolated farmers improve farming outcomes, increase income and rebuild social capital.

BY GIO BRAIDOTTI

Isolated rural communities present a challenge to agricultural extension services and these difficulties become extreme when an area is affected by conflict. It often means farmers lose access to research findings, markets, investment and government services.

The Philippines contains such a situation in the western part of Mindanao Island. In this region, provinces wrangle with the co-existence of disparate religious, ethnic and political identities, aspirations and traditions that have sometimes flared into open conflict.

On top of these social constraints, the often-mountainous landscape itself is challenging—prone to soil erosion and land degradation. But agricultural research conducted elsewhere in the Philippines—including in partnerships with ACIAR—has demonstrated that improvements to the productivity of upland farms and to the cashflow of farmers is possible.

These improvements are based on innovative practices that diversify farmer livelihoods by introducing new food and cash crops while protecting the natural resource base. They were tested and rolled out in the Philippines through the community-based action model 'landcare', which has been active in the Philippines since the mid 1990s.

"WE FOUND THAT COMMUNITIES ARE INTERESTED IN PEACEFUL OUTCOMES AND ATTACH A STIGMA TO BEING DEFINED AS A 'CONFLICT ZONE'. A SIGNIFICANT FINDING FROM THE PROJECT IS THAT WE SEE AN INCREASE IN THE LEVEL OF TRUST AMONG DIFFERENT GROUPS. WE ARE SEEING A CAPACITY TO WORK TOGETHER FOR THE COMMON GOOD."

– Noel Vock

The Landcare Foundation of the Philippines was established in 2003 to help develop the landcare model. The foundation has become a major force helping farmers partner with ACIAR, Australian Landcare International and research organisations in both the Philippines and Australia.

Noel Vock has led some of the previous ACIAR projects undertaken with the Landcare Foundation and is well aware of the model's potential to improve livelihoods while conserving land and water resources. He says landcare's facilitation of ownership and action by community-based groups empowers farmers and communities.

These characteristics resonated with ACIAR when it examined whether an extension model based on landcare could be devised to reach the more isolated communities in conflict-vulnerable areas of western Mindanao.

"The question is quite challenging," Mr Vock says. "But when a pilot project was launched in

2007 to 2009, the question was largely whether the issues of conflict would negate the positive aspects of the landcare approach."

The small-scale investigation indicated that a landcare model could work and achieve change relatively quickly, with benefits even beyond improved livelihoods. There were indications the approach could also build the trust needed for communities to work together.

A full-scale project was subsequently launched by Melbourne-based RMIT University and led by Mr Vock, Dr Ken Menz—an agricultural economist and former ACIAR research program manager—and Mary Johnson, a social science researcher and longstanding Australian landcare specialist.

The difficulty faced by the Australian team members in visiting project sites meant a Philippines team was given the major responsibility for on-the-ground activities, using a mix of expertise to mirror the Australian team, including experts in landcare methods, extension, agricultural economics and social science. These experts were drawn from the Landcare Foundation, the University of the Philippines Los Banos, and the University of the Philippines Mindanao.

"Based on our collective experience, we built an extension model that had three key platforms," Mr Vock says. "The model had to facilitate farmers' access to technical innovations, it had to improve social capital, including building trust between groups, and it needed to build more sustainable partnerships with local government and other organisations that have a role and presence in the community."

Three communities in three provinces participated to further trial and refine the model. Each community contained different mixes of religious, political and ethnic affiliations. The Landcare Foundation provided the field staff, →



A Maguindanao farmer shows a communal coconut seed garden, established by the Salman Farmers Association, to project staff and visitors.



Members of the project team receive training in vegetable production technologies on a farm in Bohol. Pictured on either side of the project officer (wearing a green shirt) are Ben-Errol Aspera (executive director of the Landcare Foundation) and Emy Carusos (project manager). The fact that the Landcare Foundation has staff involved in both projects provides an important synergy between ACIAR projects in the southern Philippines.

who worked as community facilitators to help farmers take control of project activities and ownership of research priorities.

TRUSTED LOCALS

"In selecting the community facilitators, we made a conscious effort to identify local people who were trusted in their communities and who could be trained to provide the project services under the Landcare Foundation," Mr Vock says. "We then worked with the facilitators to identify the best way to engage the community to create change. That meant protocols were modified and implemented locally, with assistance from the network of expertise available to the facilitators through the project."

Farmers welcomed the approach. Their traditional production systems involved environmentally destructive practices such as producing charcoal from wood and the long-term monoculture of corn. From this background, farmers were able to use the landcare model to rapidly diversify production into nursery trees and vegetables within a more sustainable farming system. New farmer groups were formed or existing farmer groups reinvented to drive changes to social capital.

"As groups, the farmers were provided with opportunities to visit innovative farmers and longstanding landcare project sites to see for themselves what is possible," Mr Vock says. "These 'inspirational cross visits' are a key part of the process and they had a big impact on our participating communities. Farmers were not only inspired to make changes themselves but also shared what they had learnt with other farmers, in what is a very effective extension process. By also involving local government and other officials in the tours, a shared vision for the community is built."

Gains extended beyond the productivity and sustainability of the farms, and included renewed trust in providers and access to government and other services. Participating communities often had reduced access to services or had lost trust in service providers as a result of past conflict.

TREE NURSERIES

Mr Vock cites the example of an existing local government program that seeks to promote tree planting. He explains that before the project, this typically involved bringing trees to the western part of Mindanao from other areas. This was expensive and often resulted in significant damage to nursery trees from transport over rough roads.

As a result of landcare-based activities, authorities with the tree-growing program were convinced that they could help local farmers to produce the trees, thereby reducing cost, improving tree quality and providing local farmers with an alternative income stream.

Importantly, these tree nursery activities have also dramatically reduced the practice of charcoal production.

"The landcare-based extension model proved successful on all three project platforms," Mr Vock says. "Communities that were once isolated are now proactive in accessing and tailoring services from local government, they are selling their vegetables in town through farmers' markets, and these communities are now helping to train other farmers."

Change was observed at all three project sites, irrespective of the mix of social identities among the farmers. All sites saw rapid change to farming systems and in farmers' abilities to improve livelihoods. There was also varying degrees of innovation in how farmers communicated with local government, including among disadvantaged indigenous people who otherwise

struggle to assimilate modern power structures with traditional practices.

"We found that communities are interested in peaceful outcomes and attach a stigma to being defined as a 'conflict zone'," Mr Vock says. "A significant finding from the project is that we see an increase in the level of trust among different groups of people, with the local government and with providers of technical support. We are seeing a capacity to work together for the common good and a better future."

Of course, ACIAR projects have a definitive end point. What happens to the isolated communities then? Mr Vock says the level of satisfaction from participating farmers and from the Landcare Foundation is high, which augurs well for the future.

Together, they have the potential to sustain support to the farmer groups and the means to reach out to more farmers. The process could become self-perpetuating, and how best to help that happen is the main focus of the remaining part of the ACIAR project.

The landcare model adapted for conflict-vulnerable zones has applications more broadly within government-based extension systems and aid agencies working in conflict and conflict-affected zones around the world. "There is a huge potential for the model to be scaled out," Mr Vock says. "We have validated that it works and demonstrated the benefits to farmers' livelihoods, along with the gain in social capital and trust. As farmers who participated said, this is a model that lets farmers know there is a world out there beyond the conflict zone, and they can be a part of it." ■

ACIAR PROJECT: ASEM/2012/063 'Improving the methods and impacts of agricultural extension in Western Mindanao, Philippines'

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SAVING A NATIONAL DISH

The marriage of high-calibre research and extension services in Bangladesh is helping farmers put the legumes needed to make dhal back into their modern crop rotations

Adding peas to the crop rotation in Bangladesh can increase farm income fourfold but creates demand for seed. On this farm, Ms Ruma Beghum works to dry a retained pea crop so it can be sold on to farmers the following season.

KEY POINTS

- The availability of shallow water pumps for groundwater in Bangladesh spurred a national increase in irrigated rice production through the late 1970s to 1980s, but at the cost of protein-rich legumes.
- An ACIAR project has provided a way for farmers, extension officers and researchers to work together to trial and scale-out farming innovation that reintroduces legumes to the crop rotation.

BY GIO BRAIDOTTI

The ability to cheaply pump subsurface groundwater fuelled a rise in irrigated rice production in Bangladesh, but had an unintentional nutritional consequence.

In a land where rice and dhal is a national dish, production of legumes—particularly lentils—is in decline. Instead, access to irrigation water through small-scale tube wells and low-lift pumps is used to cultivate a second, spring, rice crop. →

The decline in national lentil production has seen imports overtake production to meet demand, and this trend, since the early 2000s, is a major concern for the Bangladesh Government. Consequently, in conjunction with ACIAR, a five-year project was launched in 2010 to identify ways to reintroduce legumes into the rotation.

The Australian selected to lead the project, Professor William Erskine of the University of Western Australia (UWA), has longstanding ties with the legumes of Bangladesh. Prior to joining UWA in 2008, he was a lentil breeder and then deputy director-general (research) at the International Center for Agricultural Research in the Dry Areas (ICARDA).

As an ICARDA breeder, Professor Erskine worked with Bangladesh Agricultural Research Institute (BARI) researchers to release the lentil varieties that he was subsequently tasked by ACIAR to 'shoehorn' back into the crop rotation using crop-management innovations.

Achieving that goal meant working closely with farmers, BARI and the Bangladesh Department of Agricultural Extension (DAE). The participatory research methods based on trials in farmers' fields, however, served to restructure the relationship between BARI and the DAE, creating channels for joint engagement that have continued beyond the project.

A PASSION FOR DHAL

The project team was confronted with a farming system that grows two rice crops a year, interspersed with a short 70 to 80-day fallow. The first rice crop is grown on monsoonal rainfall, but the second is irrigated using groundwater. Where irrigation is not available—in the more marginal of Bangladesh's 64 districts (or 'zila') in the country's western region—the second crop relies instead on spring rainfall.

Professor Erskine says a research program was established to determine whether a short-duration legume crop could be cultivated during the fallow between the two rice crops, using residual moisture from the monsoon rains.

Outreach with farmers was central to the project from the outset. To that end, a participatory 'trial and demonstrate' process was used that relied heavily on the joint knowledge, capacity and dedication of BARI and DAE staff.

Critical to making the partnership work was local coordinator Dr Matiur Rahman, who was based at the International Rice Research Institute's (IRRI) Dhaka office in Bangladesh, having retired from a strong career as a researcher and administrator at BARI. Dr Rahman proved pivotal in bridging the gulf in working cultures between research and extension organisations so the entire team worked together.

The trials found a difference in the capacity of

irrigated and rainfed cropping districts to produce lentils following the monsoonal rice crop, with the more marginal districts possessing greater potential to add lentils into the crop rotation by replacing the fallow.

Side-by-side with farmers, BARI researchers and DAE extension officers, field trials established that lentil production was only possible in the rainfed zones using 'relay cropping', which involves planting the lentil crop two to three weeks before the monsoonal rice crop is due to be harvested.

"The timeframe during the fallow is simply too small to cultivate lentils any other way except using relaying cropping to buy extra time," Professor Erskine says.

Relay lentils germinate under the rice crop, where some of the seedlings will become waterlogged and die. The survivors also get "stomped on" when the rice is harvested. On the whole, however, the lentil seedlings recover and survive to maturity to set pods. Furthermore, no ploughing is needed in their cultivation and the legume matures on residual soil moisture from the monsoon.

"We also showed that it is possible to cultivate peas during the fallow in both the irrigated and rainfed zones without the need for relay cropping," Professor Erskine says. "These peas are harvested as green pods, not dry seeds, which truncates the time the crop is in the field. Replacing the fallow with a pea crop is attractive to farmers as it can increase farm net income fourfold."

Additionally, the team demonstrated the feasibility of adding in short-duration varieties of mungbean that were developed by the World Vegetable Center in Taiwan, in the season before the monsoon (called Kharif 1). Their successful cultivation required developing viable pest management systems that helped spearhead greater adoption by farmers and higher yields.

"Testing these various crop management systems was not enough to change production practices," Professor Erskine says. "The way the partnership was structured with BARI and the DAE was hugely important in getting the information out to farmers."

WORKING TOGETHER

The inclusion of the DAE—which runs an extension service that Professor Erskine describes as "large, important and efficient"—meant farmers in all nine participating districts had fast access to trial data and to hundreds of large demonstration sites in participating farmers' fields.

"This marriage of research and extension was able to rapidly disseminate crop management innovations to thousands of farming households during the life of the project, with dissemination an ongoing service provided by the DAE," Professor Erskine says.

Data collected by the field extension officers was also used to quantify the overall impacts of the new crop-management options.

During the course of the project, there was a 40% increase in lentil production from all the demonstrations undertaken with the DAE in the participating districts, compared with an increase of just 10% outside these districts.

This extra capability increased the amount of lentils harvested from 120,000 tonnes in 2010–11 to 170,000 tonnes in 2014–15. This included a yield increase of 24%.

Especially attractive to the farmers was the overall profitability of the new cropping options, given strong market demand for lentils. Where the land is left fallow, grazing cattle on weeds is the only gain to farmers.

Farmers themselves identified additional opportunities to earn income. One farmer, Mr Mintoo, realised the new crop management regime would increase demand for pea seed. He noted, however, that the crop rotation leaves no time to dry out pea pods for seed.

This realisation inspired Mr Mintoo to forgo planting the spring rice crop and instead produce pea seed to sell to farmers. This proved so profitable he has continued the agribusiness venture.

In the process, Mr Mintoo has identified a viable pathway to help ensure seed availability—an important consideration of the ACIAR team—while creating a new source of income.

PRODUCTION CHALLENGES

Having both research and extension capability on the ground in farmers' fields had other advantages. For example, Professor Erskine was surprised to note the ICARDA lentil varieties used by farmers who had retained lentils in their crop rotation were losing their tolerance to the fungal disease stemphylium blight.

"This loss of tolerance was threatening lentils nationally," Professor Erskine says.

While ICARDA was alerted and initiated a breeding-based response, a short-term solution was needed on the ground in Bangladesh. The joint Australian-BARI team was in a position to



PHOTO: WILLIAM ERSKINE

ONE FARMER, MR MINTOO, REALISED THE NEW CROP MANAGEMENT REGIME WOULD INCREASE DEMAND FOR PEA SEED, INSPIRING HIM TO FORGO PLANTING THE SPRING RICE CROP AND INSTEAD PRODUCE PEA SEED TO SELL TO FARMERS IN A PROFITABLE AGRIBUSINESS VENTURE.

When an ACIAR project demonstrated the feasibility of cultivating green peas between rice crops in Bangladesh, Mr Mintoo (right) saw an opportunity to raise income by producing pea seed.

run trials that determined the optimum fungicide application regime to minimise costs to farmers, yet optimise the production value.

Bangladesh-raised Dr Moin Salam, principal research officer at the Department of Agriculture and Food, Western Australia, then transferred disease modelling capacity to BARI. This allowed BARI to predict disease events and determine when to apply the minimum amount of fungicide for the maximum effect.

“As a result, there has been a resurgence in lentil production on these 100,000 hectares where farmers were keen to continue cultivating lentils,” Professor Erskine says.

Throughout, the fully integrated presence of DAE extension officers meant results were communicated to farmers both as information and via access to demonstration sites.

“This means that while the ACIAR project is now mostly completed, BARI and the DAE continue to refine the cropping system, working together in a partnership first forged through an ACIAR project,” Professor Erskine says.

Having first visited Bangladesh in 1981 and having seen the country change over the years, Professor Erskine feels great optimism for its prospects.

“When I first visited Bangladesh, the country was considered a ‘basket case’ with too many people and not enough food,” he says. “Now the country is humming along.”

He has seen rural economies diversify, mechanise and start up small enterprises. There is employment in cities, especially for young women in the garment industry, and funds from micro-credit and from people who work abroad.

“I watched the country transform into a dynamo,” Professor Erskine says.

“They are winning.” ■

ACIAR PROJECT: CIM/2009/038 ‘Introduction of short duration pulses into rice-based cropping systems in western Bangladesh’

MORE INFORMATION: Professor William Erskine, University of Western Australia, william.erskine@uwa.edu.au

A POVERTY-BUSTING AGRIBUSINESS MODEL

With the assistance of public-private partnerships, remote Vietnamese smallholder farmers prove they can reliably supply 'accredited safe' vegetables to modern chain stores, supermarkets and hypermarkets

KEY POINTS

- Smallholder vegetable producers in Vietnam's north-western highlands have pioneered an agribusiness model that is supplying Hanoi with accredited-safe vegetables.
- The new agribusiness model has been effective in reducing poverty.

BY DR GORDON ROGERS

Applied Horticultural Research

Farmers in Vietnam's poor north-western highland villages in the Moc Chau district have increased their net income by an average of 150% by supplying high-quality, 'accredited safe' vegetables to retail stores and urban consumers in Hanoi.

The agribusiness model adopted by the villagers was developed through public-private partnerships brokered by ACIAR, in a project led by Dr Gordon Rogers from the Australian-based Applied Horticultural Research.

The project used the good soil and elevation of the participant villages to produce temperate vegetables—such as tomatoes, lettuce and cabbage—when demand is high but supplies are low during Hanoi's hot summer months.

Furthermore, adoption of accredited-safe farming practices addresses health risks commonly associated with unsafe pesticide and nitrogen fertiliser residues—a prevalent issue in Vietnam's existing vegetable supply chains—creating a market advantage for the smallholder produce.

Critical to the project's success was the inclusion of project partners that helped the farmers to adopt new farming practices and also create effective two-way communication and direct trading relationships with supermarkets and specialty 'safe vegetable' stores in Hanoi.

Through this collaboration, the partners successfully linked farms less than a hectare in size to modern supply chains. The new agribusiness model delivers clear economic benefits to the smallholder farmers and amounts to a completely new approach and market for local farmers.



Ms Luyen, leader of the Tu Nhien village, with one of the trucks she bought to transport vegetables from Moc Chau to Hanoi.

In 2015, 68 project farmers—71% of them women and 10% from the ethnic Hmong minority—produced about 420 tonnes of accredited-safe vegetables on 22 hectares in the Moc Chau villages of Tu Nhien, Ta Niet and An Thai.

The production rate of accredited-safe vegetables from Moc Chau is now growing at an average of 35% per year, and the area of safe, off-season vegetable production has increased from 4 ha in 2012 to 30 ha in 2016.

Participating farmers from Tu Nhien village earned an average net income of 300 million dong (A\$18,000) per ha in 2015. This compares with an average net household income of 120 million dong (A\$6,900) per ha for the village's non-participant vegetable farmers. This amounts to an increase of 150% in net income.

Ms Luyen, the leader of 38 farmers in the Tu Nhien village, says farmers who work in the new value chain are no longer poor and do not have to borrow money to grow their next crop. "Many of the farmers have been able to improve their houses, and can more easily afford to send their children to school!"

In the neighbouring project village of Van Ho, ethnic Hmong farmers have been producing vegetables for only one season, but have already recorded a net income from vegetables of 116 million dong (A\$7,300) per ha per year, an increase of 480% on the 20 million dong (\$1,190) per ha they earn from rice.

Alternative land uses, such as growing maize or rice, return a net income to the farmer of about 20 million dong (\$1,190) per ha per year, about 7% of the income they could make from producing accredited-safe vegetables.

Having now trialled the agribusiness model, farmers are starting to capitalise on new economic possibilities. For example, Ms Luyen has been able to buy two trucks to send high-quality vegetables from Moc Chau to Hanoi in good condition.

She has also built a covered packing area and a separate crop receivals area where local farmers can bring their produce for grading and packing before it is sent to retailers such as FiviMart Ly Thai To, Mega Market Vietnam (formerly Metro Cash & Carry) and BigGreen in Hanoi.

Before the project started in 2011, all the

Mr Bui Van Tung and Ms Nguyen Thi Quynh Chang, from the Northern Mountainous Agriculture and Forestry Science Institute, inspect a cabbage crop in Van Ho.



PHOTOS: GORDON ROGERS

marketing of vegetables from Moc Chau was either to the local markets or via traders to Hanoi, and questionable production techniques were widely practised.

“Before the project, it was mainly women working in the field growing vegetables, but now more men are working in the fields with their wives,” Ms Luyen says.

THE POWER OF PARTNERSHIP

Supplying retailers—such as Mega Market Vietnam (a self-service wholesaler catering to professionals), supermarket chain FiviMart and hypermarket Big C—was a process that required on-farm technical innovation to improve the quantity, quality and consistency of the vegetables delivered.

Project staff worked closely with Moc Chau farmers to improve their practices to the standard required in Vietnam for accreditation as suppliers of safe vegetables—a statutory requirement for suppliers of fresh produce to Vietnamese supermarkets.

Essential to these quality innovations were partnerships with food consulting company Fresh

Studios and Vietnam public-sector organisations, including:

- Northern Mountainous Agriculture and Forestry Science Institute
- Fruit and Vegetable Research Institute
- Vietnam National University of Agriculture
- Center for Agrarian Systems Research and Development.

Together they provide services related to sustainable agriculture, particularly agronomy, quality assurance, and coordinating supply and demand. Testing for pesticide residues is done by the Ministry of Agriculture and Rural Development, which also oversees safe-vegetable accreditation.

In another key achievement, a Moc Chau safe-vegetable certification trademark has been approved by the Vietnamese regulator, the National Office of Intellectual Property of Vietnam. The Moc Chau District People’s Committee is the owner of this trademark. This achievement is essential for future scaling up of Moc Chau safe vegetables and to differentiate Moc Chau safe vegetables in the marketplace. To use the logo, crops must be grown in Moc Chau and be accredited safe.

Training was also needed in postharvest techniques, in coordination with the retailers, and in record keeping—both to ensure the produce’s traceability and to capture changes in socioeconomic activity in the three participating villages.

Having laid the foundations for a new agribusiness model, the ACIAR team, farmers, retailers and public-sector partners have high expectations for Moc Chau’s vegetables, especially given 6% growth in demand for vegetables in Vietnam per year.

Rollout of the model to more farmers and villages is underway, along with activities to ensure it is self-sustaining and ultimately self-funding.

Broader rollout of project outcomes to more villages will rely on effective and sustainable links between the growers and modern retailers. ■

ACIAR PROJECT: AGB/2009/053 ‘Improved market engagement for counter-seasonal vegetable producers in north-western Vietnam’

MORE INFORMATION: Dr Gordon Rogers, Applied Horticultural Research, gordon@ahr.com.au

Pigs in a farmyard in Candaba. The Philippines Government links smallholder farmers into a network of animal-health research activities and diagnostic laboratories.

BETTER DIAGNOSTICS FORGE HEALTHY PARTNERSHIP

PHOTOS: ACIAR

A common interest in controlling disease in pig herds has seen Australia and the Philippines create relationships that are benefiting the pig industries of both countries

KEY POINTS

- Australia has helped the Philippines strengthen its capacity to diagnose diseases in smallholder pig herds.
- The same project built relationships that allowed the scope of the work undertaken to deepen to a whole-farm-system approach, with important implications for both Philippine smallholder pig farmers and Australian free-range farm practices.

BY GIO BRAIDOTTI

Those fortunate enough to have tasted the succulent flavours of a Philippine pork belly adobo or a roasted lechon (suckling pig) will not be surprised that pork is a national favourite in the Philippines. Supporting this culinary preference are tens of thousands of smallholder pig farmers who account for about 70–80% of the Philippines' pig production.

On these smallholder farms, pig herds are

generally small, managed using family labour, and fed locally available, mostly non-commercial feeds. But the traditional rural facade hides a high-technology aspect to these operations. The Philippines Government has worked hard to link these smallholder farmers into a network of animal-health research activities and diagnostic laboratories that extends into the highest international research centres.

Partnering the Philippines on this journey of animal health innovation is an ACIAR project led by microbiologist Dr Pat Blackall, of the Queensland Alliance for Agriculture and Food Innovation at the University of Queensland.

Dr Blackall first assembled a team in 2012 to work alongside the Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development (PCAARRD), led by Dr Edwin Villar, then director of PCAARRD's Livestock Research Division. The team's initial focus was on respiratory diseases.

A SPECIAL RELATIONSHIP IS BORN

Dr Blackall says a lot of skill and capacity already existed in the Philippines, so the aim of the project was to pull that capacity together to work in a more integrated and coordinated fashion. "Many more benefits are available to farmers once diagnoses are framed in knowledge about on-farm practices and the broader state of health of pig herds," he says.

Driving the integration process were Philippine field officers who visited farms and performed disease investigations. In diagnostic laboratories, equally committed scientists were involved in implementing standardised disease testing at both the regional level—working directly with farmers—and the national level in the capital, Manila.

"We produced a number of manuals to assist both on-farm work and the diagnostic laboratories, where we established simple tests based on standardised methods that don't require a lot of

money or expensive equipment," Dr Blackall says. "We also provide quality control reagents to these laboratories from Australia to help ensure the ongoing calibration of the diagnostic tests."

Among the introduced technology is a protocol that has worked well in Australia called 'lung scoring'. This technique involves taking the opportunity to examine pig lungs for signs of past infections through regular slaughterhouse visits.

"This can be a very informative way to monitor health issues across many farms," Dr Blackall says. "We set up this system in the Philippines and it is now being widely adopted through the national meat inspection system."

Along the way, it helped resolve a longstanding curiosity—that respiratory disease is a bigger problem for the intensive pig industry in the Philippines than it is for smallholder producers. The finding was made by a well-designed epidemiological study undertaken by the Philippine team members.

The results did not surprise Dr Blackall: "Respiratory disease is generally a problem when you put a large number of pigs together."

MUTUAL BENEFITS

The Australian pig industry has also benefited from this ACIAR project. Among the major problematic respiratory diseases affecting Australian pigs are porcine pleuropneumonia (caused by *Actinobacillus pleuropneumoniae*) and Glasser's disease (caused by *Haemophilus parasuis*). The disease-causing bacteria cause significant economic losses in Australia and indeed wherever pigs are intensively raised. Dr Blackall's laboratory in Brisbane serves as an international diagnostic reference centre for both of these bacteria and tests samples sent from around the world.

The relationships with the Philippines proved instrumental in advancing the control of both diseases through the development of improved diagnostic tests to guide vaccination programs. In addition, improved methods to detect resistance in the bacteria to antimicrobial agents have been developed and are used to identify the most effective treatment options and help prevent the continued emergence of antimicrobial resistance.

Central to these efforts was a young veterinarian from a regional laboratory in the Philippines, Dr Denise Dayao, who received her PhD in Dr Blackall's laboratory with the support of ACIAR's John Allwright Fellowship program.

Dr Dayao used molecular biology technologies to provide—for the first time—an understanding of the genes that drive acquisition of antimicrobial resistance in respiratory pathogens in Australian pigs. She sequenced the genomes of important bacteria and used that information to explain the pattern of resistance seen in piggeries. Importantly,



"THE PROBLEMS ARE NOW MUCH THE SAME WHETHER YOU ARE A SMALLHOLDER FARMER IN THE PHILIPPINES OR A FREE-RANGE PIG FARMER IN AUSTRALIA."

— Dr Pat Blackall

A farm visit at Barangay, San Pablo.

Dr Dayao also validated a laboratory test for antimicrobial resistance.

International recognition of the significance of her work has followed. A 'ring test' was initiated in which the technology is transferred to laboratories in Australia, Europe and the United States to show that the method holds up against all the different respiratory bacteria isolated from pigs around the world.

As these data accumulate, they create the basis for a standardised international protocol that all the diagnostic laboratories around the world can use. "Her work was so important that we received funding from the Australian pig industry to pay for the operating costs of Denise's research," Dr Blackall says. "Most importantly, Denise has now brought back the new technical skills she learnt to the Philippines. I hope that her knowledge and expertise will spread through the government system to improve laboratory capacity in the Philippines."

Additionally, a vaccine manufacturer that works closely with Dr Blackall was so impressed with the research findings from the ACIAR project that it opted to set up operations in the Philippines. The company's facility is being built near one of the ACIAR project sites and is tapping into the project's network of relationships with government diagnostic laboratories.

"The company aims to provide a support service for the Philippine pig industry that does not exist at the moment," Dr Blackall says. "Vaccines are an alternative to antimicrobials and the more they are used—guided by sound diagnostic information—the less pressure there is to use antimicrobials. As a result, there is less resistance and less negative impact of antimicrobials on the pigs themselves and on the environment. That's a good outcome for the pig industry."

DEEPER ENGAGEMENT

With so many benefits flowing to both partner countries, ACIAR decided to build on the

relationship and launch a second project with broader aims. The new project is participatory, based on a strong knowledge of the smallholder farm system, with research questions set by the farmers. The researchers hope to use their expertise to identify simple changes to key production factors—such as nutrition and animal housing—that can make a big difference to the pigs and to household livelihoods.

Although the focus appears to be on the smallholder farming system, Dr Blackall predicts there will also be important outcomes for the Australian pig industry in the second project. He explains that demand is growing in Australia for free-range pork, poultry and eggs. This requires production systems that, in many ways, resemble the practices of Asian smallholder producers.

However, as more pigs in Australia return to being reared outside, there is a change in types and prevalence of disease. Dr Blackall explains that the practice introduced in the 1950s of rearing pigs and poultry indoors coincided with a decline in a range of diseases. Those diseases are now making a comeback, piggybacking on changes in farming practices.

"We now have to look 'back to the future' to learn how to control diseases that we thought had been eliminated," Dr Blackall says. "In my view that makes ACIAR increasingly relevant in Australia because the problems are now much the same whether you are a smallholder farmer in the Philippines or a free-range pig farmer in Australia." ■

ACIAR PROJECT: AH/2012/066 'Improving the production and competitiveness of Australian and Philippines pig production through better health and disease control'

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A BURNING SOLUTION

The frontline defence of air quality across the Indo-Gangetic Plain is an agricultural machine designed in Australia

KEY POINTS

- Burning is the normal method of rice stubble management in mechanically harvested rice-wheat growing areas of north-west India, but results annually in a deterioration of air quality.
- A machine designed in Australia through an ACIAR project has made it possible to sow directly through rice residue without burning it and is now spearheading efforts to improve air quality.

BY GIO BRAIDOTTI

The most popular cropping system in South Asia—practised on about 13.5 million hectares across the Indo-Gangetic alluvial plain—is a monsoonal rice crop quickly followed by wheat.

In north-west India, combine harvesting of rice and wheat is common practice but it leaves large amounts of crop residue in the field. While the wheat residue is used for animal feed, the paddy residue—rice straw—has no local economic uses and is agronomically problematic.

The rice stubble is thick, stringy and tough, and clogs up the sowing tines needed to sow the wheat crop. Farmers have just 15 to 20 days to sow the wheat crop or risk substantial reductions in yields. In order to seed on time, farmers in the states of Punjab and Haryana use traditional methods to burn most of the rice straw. As a consequence, as much as an estimated 22 million tonnes of rice stubble is burnt each year.

The resulting air pollution in October and November impacts the entire Indo-Gangetic Plain, travelling thousands of kilometres and enveloping the region with a thick aerosol layer that measured as much as 2.5 km high in 2012. The dense smoke plumes are a serious risk to human and animal health—they modify atmospheric gas composition, cause traffic accidents through loss of visibility, and contribute to 'Asian pollution outflow'.

For authorities such as Punjab Commissioner of Agriculture Balwinder Singh Sidhu there is a solution to the fires—a small, affordable machine that drills wheat seed through the tough straw,

bypassing the need to burn it. The machine—the Happy Seeder—has permitted India to explore the option of enforcing a ban on the burning of paddy residue.

The Happy Seeder was originally developed through an ACIAR project headed by Australian Professor John Blackwell, an agricultural engineer at the Charles Sturt University Institute for Land, Water and Society.

THE HAPPY SEEDER

Australia has a strong track record in agricultural engineering, including the development of machines that allow farmers to adopt more sustainable farming practices. Not even in Australia, however, had it been possible to sow directly through rice stubble, despite years of attempts by researchers worldwide to engineer a solution.

ACIAR engaged Professor Blackwell to revisit the problem and consider the design of a suitable machine. Professor Blackwell embodies Australia's proud agricultural engineering tradition—particularly in making the most of the limited water resources available to Australian dryland farming.

Professor Blackwell experienced his 'Eureka' moment after a conversation with then research program manager Dr Tony Fischer. That night, Professor Blackwell imagined the design of a new kind of seeder—a design he found had never before been tried.

Through ACIAR, Professor Blackwell travelled to India to build the first prototype at the workshop of the Punjab Agricultural University (PAU) with Indian collaborators. Progress improved when PAU's Dr Harjinder Singh Sidhu, senior research manager at the Cereal Systems Initiative for South Asia (CSISA) hub, took up the challenge.

"The prototype worked amazingly well," Professor Blackwell says. "We were able to sow with the prototype through 10 tonnes per hectare of rice straw."

There was, nonetheless, room for improvement—in a process that has involved public-sector researchers, especially from

PAU, and private-sector developers in India. Professor Blackwell particularly credits Dasmesh Mechanical Works, in Punjab, for the innovation that culminated in the development of the Turbo Happy Seeder, which uses a rotor to cut and brush away the rice straw, clearing the way for the machine's sowing tine.

Professor Blackwell says the Turbo Happy Seeder can sow any seed into any stubble and pasture. For example, he has used it to sow wheat into 12 t/ha of standing millet. It can also be used as a standard direct drill when little or no stubble is present. Importantly, the Turbo Happy Seeder is lighter than its predecessor and has reduced power requirements, allowing it to be operated by the 35-horsepower tractors common in India.

Evaluation of impacts associated with this technology found it is more profitable than conventional cultivation or direct drilling after burning. It is financially viable for farmers, while delivering important advantages to the broader community and environment.

The approach amounts to a 'conservation agriculture' practice. It avoids ploughing soil and thereby conserves energy, soil moisture and fertility, delivering significant benefits to farmers.

"To some degree the Happy Seeder technology has given India a tool to avoid burning the rice stubble," Professor Blackwell says.

ADOPTION IS KEY

Despite a ban on the burning of paddy residue, India's capital, New Delhi, was engulfed in a thick smog in 2015 when fog and smoke from paddy residue fires combined to reduce visibility and pose a serious threat to human health.

Mr Sidhu says that subsidies for farming implements, such as the Turbo Happy Seeder, are in place to help farmers manage rice straw in a sustainable manner.

But, he says, "farmers, especially the small ones, still prefer to burn paddy stubble rather than using solutions like Happy Seeders as they think it involves spending money".

One farmer who has tried and adopted the



PHOTO: MELISSA MARINO

Farmer Malkeet Singh (left), who owns a Happy Seeder, hosts a visit by research manager Dr Harminder Singh Sidhu.

technology is Mr Praduman Singh, from Nagar village, Punjab, who is pleased with the new approach to rice-wheat cultivation. He says: "After a year with straw-managed fields and using the Turbo Happy Seeder, my rice crop was in better condition than those that were managed with burnt residues."

Data collected from field sites indicates improvement in yield (3–10%), soil health (from recycling the residues), a decline in weed populations, a reduction in herbicide use by up to 50%, and irrigation water savings of up to 10–12 centimetres/ha. There are also remarkable energy savings due to a reduction in tractor operation, as burnt paddies no longer require extensive soil cultivation.

In 2015, the Agricultural Innovation Program, led by The International Maize and Wheat

Improvement Center (CIMMYT) and funded by USAID, also began testing the Turbo Happy Seeder with Punjab farmers in Pakistan.

Dr Imtiaz Hussain, project leader and former cropping systems agronomist at CIMMYT, confirms the new practice is not only more sustainable, but also a more productive way to manage rice residues and raise wheat yields. "It allows earlier sowing of wheat, which increases yields and dramatically cuts the time, labour and fuel needed to plant wheat, which normally requires as many as seven tractor passes."

In Sheikhpura District, and in partnership with Engro EXIMP AgriProducts Private Limited, CIMMYT has promoted the seeder with progressive farmers who receive technical training on the Turbo Happy Seeder and conservation agriculture.

Among these farmers is Nabi, who used the

training to sow wheat on 3 ha without burning rice residues, thereby saving more than 260 litres of diesel. At the 2015 Pakistan Agriculture Conference and Expo, in Islamabad, Nabi described his experience to Mr Sikandar Hayat Khan Bosan, Pakistan's Federal Minister for Food Security and Research.

"CIMMYT helped me improve my farming practices," Nabi said. "The crop growth is great. Planting wheat with the zero-tillage Happy Seeder is a new experience—a very modern practice that saves my time and resources." ■

ACIAR PROJECT: CSE/2006/124 'Fine-tuning the Happy Seeder technology for adoption in northwest India'

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INNOVATING FOR HEALTH AND WEALTH IN THE COCOA INDUSTRY

As the global cocoa industry shapes up for the 21st century, ACIAR-managed partnerships are playing a crucial role in promoting and extending innovation, while ensuring that cocoa-farming families prosper

BY ANNE MOORHEAD

Global demand for cocoa is soaring, but the current production system is failing to keep up. With hard work needed for limited returns, the smallholder farmers who produce the vast majority of the world's cocoa are voting with their feet and moving into more profitable crops. The cocoa industry needs innovation, and fast, before a great opportunity is lost.

Dr Richard Markham, manager of ACIAR's horticulture research program, explains: "We need a real shake-up of the industry—to streamline production, but also to realign the value chain so farmers can target and reach the markets that will give them better returns on their efforts."

Innovation is needed across the board, and that understanding has prompted a new approach in

ACIAR's latest cocoa project. Launched in February, the project focuses on the Autonomous Region of Bougainville in Papua New Guinea, where two-thirds of the population depends on cocoa farming for a living.

A HOLISTIC APPROACH

"The project is taking a genuinely holistic approach," says project leader Professor David Guest, of Sydney University. "We believe that agricultural development projects often have little impact because their focus is too narrow so they fail to really engage with farming family needs."

Improving the productivity of cocoa farming is central to the project, and the team will be promoting new ideas in soil fertility and crop nutrition developed in a previous project in Sulawesi, where confectionery manufacturer Mars was a key partner. But the project goes further and includes a human health and nutrition component.

"As part of the intensification effort, we are proposing to farmers that they invest more work in their cocoa farms—but it could be that poor health and nutrition are limiting their ability to do so," Professor Guest says.

He also points out that, conversely, low cocoa productivity and incomes may be limiting the impacts of programs aimed at



PHOTOS: RICHARD MARKHAM, DAVID GUEST, GRANT VINNING,

From far left: Cocoa grown on trellises at Mackay Estates in Queensland offers higher productivity and resistance to cyclone damage; veteran Bougainville cocoa grower James Rutana; goats can provide an extra source of income for farmers and extra nutrition for the cocoa crop; Glen Toviriki, awarded gold by an international panel of judges at the Bougainville Chocolate Competition.

improving health and nutrition. The team will be carrying out research to investigate and better understand the links between health and agricultural productivity. The Sydney School of Public Health at the University of Sydney is providing expertise and support for the Bougainville Department of Health for this component of the project.

ALIGNING FARMERS AND MARKETS

Alongside cocoa system productivity, the second area in dire need of innovation is cocoa marketing, or the cocoa value chain. The global demand for different types and qualities of cocoa is changing rapidly and cocoa farmers need to understand and target their market well if they are to make good profits.

The farmers in Bougainville are gaining from the experience of a recent ACIAR project in Vanuatu that linked smallholders directly to the high-end niche market for single-origin fine-flavour chocolate that is developing in Australia and around the world. A new generation of 'bean-to-bar' chocolate makers pay premium prices for high-quality beans that have been carefully fermented and dried on-farm, which enhances the all-important flavours. Prices can be as high as \$10,000 per tonne, compared with the normal price of about \$3,000 per tonne.

At the other end of the market there is a large and growing demand for lower-quality cocoa for the global confectionery industry, which largely reflects increasing wealth in Asia. Although prices are lower, with increased productivity on the farm

this could still be a very profitable enterprise. The key is knowing which market to target, and the market must respond to quality.

"The strategy is to foster negotiation and mutual respect," explains project team member Grant Vinning. "We need to get the market to recognise the different qualities of cocoa and make sure that farmers understand the various dimensions of quality. Not all cocoa can reach 'fine flavour' status, but through negotiation farmers can ensure that they are paid appropriately for their efforts."

AUSTRALIA'S DYNAMIC COCOA INDUSTRY

The exchange of ideas and experiences among ACIAR's projects is fostering innovation in Australia and in partner countries. Australia's cocoa industry is smaller and younger than those of its neighbours, but is highly dynamic. With much higher labour costs than most cocoa-growing countries, the Australian industry needs the highest possible levels of productivity to survive, and this is driving rapid innovation.

For example, with help from Queensland's Department of Agriculture and Fisheries (QDAF), Australian cocoa farmers are looking at training their cocoa trees onto trellises—an idea borrowed from producers of temperate fruits, such as apples and cherries. Trellising can increase productivity and open the way to at least partial mechanisation, as well as reducing the vulnerability of the trees to cyclone damage. In due course, ACIAR and QDAF will evaluate and promote the use of trellising with partners in smaller Pacific islands such as Vanuatu,

as part of a broader effort to increase the resilience of the region's economies to extreme weather and climate change.

The Queensland farmers are also commercialising the use of 'small-batch' fermentation, which was tested in ACIAR-funded research in Papua New Guinea more than a decade ago. The idea did not catch on then, but Australian producers are now finding that fermenting their cocoa in trays is the best way to prepare small quantities of fine beans for discerning chocolate makers.

ACIAR projects are providing a bridge between Australia's dynamic industry and cocoa farmers in Papua New Guinea, the Pacific islands and Indonesia. Some of the ideas are trialled first in Australia, others overseas, but in the end all the partners have access to the results and can adapt the ideas to meet local needs and circumstances.

Reshaping the cocoa industry for the 21st century is an ambitious task and ACIAR and its partners are rising to the challenge, contributing a unique research and innovation element while keeping the health and prosperity of cocoa-farming families at the heart of the business. ■

ACIAR PROJECTS: 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'; HORT/2014/094 'Developing the cocoa value chain in Bougainville'

MORE INFORMATION: Dr Richard Markham, richard.markham@aciar.gov.au

WORKING TOGETHER TO DELIVER IMPACT

Agribusinesses, youth entrepreneurs and business developers are among those forming new kinds of partnerships to help change lives in southern and eastern Africa

KEY POINTS

- Delivering impact from research requires building collaborative partnerships to change behaviours and ensure adoption of research deliverables.
- Cultivate Africa's Future (CultiAF), part-funded by ACIAR, is a four-year, \$15 million initiative that supports innovative, applied research solutions to improve long-term food and nutrition security.

BY MELLISSA WOOD

General Manager Global Program

Partnership lies at the heart of ACIAR's work in international agricultural research for development. We have long appreciated that research partnerships between Australian and international scientists, in-country researchers and local farmers are essential for developing and trialling new solutions to agricultural problems, such as creating disease-resistant varieties of cocoa plants or new vaccines to immunise village chickens against Newcastle disease. However, ACIAR and other agricultural research organisations are now appreciating that partnerships are also key to realising impact.

Agricultural innovations need to move beyond research sites for them to have meaningful impact in the lives of people and to address today's challenges. At ACIAR, we prioritise delivering and measuring impact but there is no blueprint for how to achieve this and no golden rules for which partnership strategies are more likely to increase impact. Delivering impact from research requires building collaborative partnerships with those beyond the farm gate to change behaviours and ensure next and end-user adoption of research deliverables. These partnerships include producer organisations, agribusinesses such as traders and processors, policymakers, civil-society organisations, knowledge institutions, donors and international agencies.

DEVELOPING AGENCY IN AFRICA

ACIAR, through the establishment in 2011 of the Australian International Food Security Research Centre (AIFSRC), has been trialling new types of partnerships with donor agencies, foundations, the private sector, youth entrepreneurs and biosecurity agencies to help assess what partnership strategies work best to deliver real and meaningful impact in eastern and southern Africa.

AIFSRC was a four-year initiative established as part of the Australian Government's enhanced Africa Food Security Initiative. The research centre, which finished activities in 2015, committed Australian agricultural expertise to help African farmers, agencies and the private sector. Case studies from this initiative demonstrate how multi-sector partnerships can increase uptake leading to impact, as well as the benefits of agencies working collaboratively in program development and funding.

Cultivate Africa's Future (CultiAF) is a four-year, \$15 million initiative that supports innovative, applied research solutions to improve long-term food and nutrition security in eastern and southern Africa. It is co-funded by ACIAR and Canada's International Development Research Centre (IDRC). Competitive research grants through the initiative support eight projects across Kenya, Malawi, Uganda, Zambia and Zimbabwe.

CultiAF focuses on three areas critical to transforming African agriculture: reducing postharvest loss, reducing the rates of persistent

malnutrition, and improving sustainable water use. The World Bank estimates that sub-Saharan Africa loses US\$4 billion worth of grain through postharvest loss every year—enough to feed 48 million people. CultiAF is supporting research to identify and test new and effective ways of reducing postharvest loss in the fishing and grains sectors while increasing returns to producers. In Malawi and Zambia, where four of 10 fish are lost after capture, CultiAF is testing new solar-drying technology, which has been shown to reduce physical loss and microbial contamination by up to 20 times compared with traditional techniques. New business models for fish processing are also being developed, ensuring women's cooperatives of fish processors have greater access to markets, including a national supermarket chain.

Beans are an important source of protein and nutrients in low and medium-income households in Kenya and Uganda. However, bean consumption is constrained by high energy costs and long cooking time. CultiAF researchers have selected 12 bean varieties and developed pre-cooked bean products that cook in 10 to 15 minutes, compared with three hours for non-pre-cooked beans, as well as bean snacks. Consumer studies have shown these products, once available, will increase bean consumption in low-income households by three meals a week. This will result in reduced time spent by women on household cooking, improved food and nutrition security, and larger, more lucrative markets for bean farmers.





PHOTO: ACIAR

Beans are an important source of protein in Kenya and Uganda. CultiAF researchers have developed pre-cooked bean products that cook in 10 to 15 minutes, instead of the usual three hours.

Fish and poultry are primary sources of animal protein for many Africans. CultiAF researchers in Kenya and Uganda are testing the scientific and economic benefits of using insects to feed poultry and fish as opposed to the more costly soybean and fishmeal typically used. To date, insects have been found to be a superior source of protein and, if included, will release significant amounts of fish and soybean for human consumption. For example, the use of crickets would release 67,000 tonnes of fishmeal per year for human consumption and reduce costs for small-scale farmers.

If correctly harnessed, African agriculture could be powered by youth entrepreneurialism—CultiAF is already benefiting from engaging youth entrepreneurs in its products, from the early stages of research, to identify and realise agribusiness opportunities. These youth are seeking viable employment opportunities and business partners, and are targeting product markets for income generation.

By developing business skills and linkages with business development services and markets, youth entrepreneurs can strengthen the pathways for product adoption by farmers and consumers. The entrepreneurs' efforts will also reduce unemployment and stimulate economic development.

CultiAF projects have a broader range of project partners than just farmers and researchers. They include processors and traders, business developers, the private sector, government,

community radio and other communication and public-awareness agencies, youth and community groups. After just two years, this suite of projects is already demonstrating the benefits of multi-sector partnerships in improving outreach and adoption, with a view to achieving greater impact in the longer term. The results of the research are already moving beyond the farm and fishing research sites and into people's lives.

Both ACIAR and IDRC have benefited from this partnership. Each agency brings differing areas of expertise and project-development mechanisms to CultiAF, but they share similar goals and approaches to project management. In addition to leveraging increased funds through the co-funding modality, which resulted in a more ambitious program than either agency could otherwise implement, the risks and responsibilities were shared through broadening the decision-making process. While developing new partnerships comes at a cost, in this case the benefits have outweighed the initial costs with ACIAR managers, regional program managers and IDRC project managers continuing to benefit from sharing project management, capacity building and public outreach experiences and approaches. We are also increasing our knowledge on partnership strategies that are more likely to increase impact in Africa. ■

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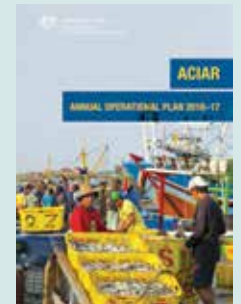
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ACIAR'S VISION

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.



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Back cover:
Families get involved in the community-owned project to build a fishway at Pak Peung in central Laos.

Front cover:
A Lao contractor works on the fishway construction at Pak Peung, Laos.

PHOTO: JIM HOLMES/ACIAR