ACIAR COUNTRY PROFILES 2008–09: CHINA

ACIAR

Research that works for developing countries and Australia

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2008

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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Contents

1 Preface

The ACIAR Country Profiles are designed to give a snapshot of the collaborative research being carried out between Australia and our various partner countries. This publication contains short summaries of 15 projects that are active in China in 2008–09. There were another 3 projects under development, which are expected to start in 2008–09 financial year.

This publication also sets out the key outputs and outcomes from 10 projects that have been completed in 2007-08.

In addition to these project summaries, the publication includes information on ACIAR's work, including its training program, the China chapter from the Annual Operational Plan 2008-09 and the 2007–08 Annual Report.

ACIAR updates this profile each year and distributes it to key stakeholders in China and Australia.

We hope you find the publication useful as a record of the progress and achievements between Vietnam and Australia. For information on ACIAR's overall program, we invite you to visit our website at <www.aciar.gov.au>.

Peter Core

Chief Executive Officer

November 2008

2 Overview

2.1 About ACIAR

The Australian Centre for International Agricultural Research (ACIAR) is an Australian Government Statutory Authority that operates within the portfolio of Foreign Affairs and Trade. It was established in June 1982 under the ACIAR Act to assist and encourage Australia's agricultural scientists to use their skills for the benefit of developing countries, and at the same time work to resolve Australia's own agricultural problems.

ACIAR aims to enhance rural household incomes and broader economic growth by investing in international research partnerships that encourage agricultural development, sustainable use of natural resources and capacity-building.

Australia is in a particularly strong position to provide such assistance because it has a broad range of climates – cool and warm temperate, subtropical and tropical – that are typical of the Asia-Pacific region.

ACIAR-funded research harnesses Australia's outstanding strengths in agricultural research to develop partnerships with developing-country institutions. This research is mutually beneficial as the similar environments allow the results to be used in Australia and developing countries.

ACIAR is based in Canberra, with offices in China, India, Indonesia, Papua New Guinea, the Philippines, Thailand and Vietnam.

Our partnership model

ACIAR develops a specific program for each partner country that is aligned with its national agricultural priorities. The programs are developed in close consultation with government and research organisations from the partner country and Australia.

ACIAR's research also closely aligns with the Australian aid program's renewed focus on poverty reduction. It is integrated closely with the Australian 'whole-of-government' aid program strategies for specific regions.

Australia's scientists work within a very strong network of institutions in Australia and partner countries, including the CSIRO, federal and state government organisations and universities.

ACIAR's projects are split up into bilateral and multilateral projects. Bilateral projects are led by an Australian organisation, with collaborators in the partner country and Australia. Multilateral projects are led by an international agricultural research centre (IARC), in partnership with other research organisations.

Where we work

ACIAR carries out research in the Asia-Pacific region, and currently has projects in the following regions:

- South-East Asia (Cambodia, East Timor, Indonesia, Laos, Philippines, Thailand, Vietnam: >45% bilateral expenditure)
- Papua New Guinea and the Pacific islands (>20% of bilateral expenditure).
- North Asia (China: <15% of bilateral expenditure)
- South Asia (Afghanistan, Bangladesh, Bhutan, India, Iraq, Pakistan: <15% of bilateral expenditure)

Working internationally

ACIAR is also responsible for Australia's relationship with the International Agricultural Research Centres—the Consultative Group on International Agricultural Research (CGIAR) centres. ACIAR's annual outlay to the CGIAR centres is around $11 million.

These funds are used to facilitate CGIAR engagement in the Asia-Pacific and to commission projects that are consistent with ACIAR's country program strategies.

2.2 ACIAR's program in China

ACIAR has supported a program of collaborative agricultural research with China since 1984. Most of the program consists of bilateral projects, in which an Australian research organisation is commissioned to undertake a specified research activity in collaboration with a partner organisation in China. China is also targeted in ACIARs multilateral program delivered in conjunction with the international agricultural research centres.

ACIAR's program with China as at 30 June 2008.

Bilateral Program

Active projects	14 with a value over their lifetime of approximately $12.644 million
Projects under development	3
Completed projects	117

Multilateral Program

Active projects	1 with a value over their lifetime of approximately $1 million
Projects under development	1
Completed projects	16

Total project budget 2008–09	$2.36 million which represents 5.8% of the total project budget 2008–09

The research program in China is focused on north-western provinces and Tibet Autonomous Region, looking at the following agricultural priorities:

- more sustainable agricultural production from rainfed cropping systems in north-western China, focusing on technical and policy interventions for better natural resource management
- improved productivity of crop-l9icetsock systems in Tibet Autonomous Region
- policy research on implications of Chinese trade developments for smallholders.

Reflecting these priorities, the research program is split into the following subprograms:

China Subprograms

Subprogram 1: Increased water productivity of agriculture in north-western China

Subprogram 2: Improved agricultural productivity in Tibet Autonomous Region

Subprogram 3: Implications of Chinese trade developments for smallholders

2.3 Capacity building and training

Building the capacity of agricultural research institutions and researchers in partner countries is one of ACIAR's key priorities. The training program aims to enhance the research capabilities of institutions and individuals involved in ACIAR projects. This also assists in research adoption, productive partnerships and project development.

The ACIAR training program has a budget in 2008–09 of approximately $5.38 million. It comprises five elements:

- Fellowships for postgraduate students (John Allwright Fellowships)
- Postgraduate returnee follow-up awards (Returnee Small Project Awards Scheme)
- Leadership development opportunities for developing country scientists (John Dillon Memorial Fellowships)
- Non-award training (short courses and workshops), including support for the Crawford Fund
- On-the-job training.

Much of ACIAR's training is carried out systematically within individual projects. In addition, specialised, discipline-specific training activities may also occur within ACIAR's individual research and development programs.

John Allwright Fellowship

The objective of the John Allwright Fellowships is to increase the research and development capacity of ACIAR partner country institutions. The fellowships are awarded to partner-country researchers involved in an ACIAR project to undertake postgraduate studies in tertiary institutions in Australia. Studies focus on areas related to the topic or theme of the ACIAR project.

John Allwright Fellowships in China

		PhD	MSc/Other
Active	Male	1	1
	Female	1	4
Concluded	Male	10	2
	Female	4	0

Returnee Small Project Awards Scheme

The returnee small project awards scheme provides small grants to John Allwright Fellows after they complete postgraduate studies and return to their employers in their home country. The scheme allows Fellows to undertake an activity that continues, or is related to, the ACIAR project they are involved in. The funding is primarily for developing small-scale research projects, with the intention of catalysing longer-term support and ongoing international collaboration.

John Dillon Memorial Fellowship

John Dillon Fellowships provide career development opportunities in Australia for outstanding mid-career agricultural scientists and economists from ACIAR partner countries. The aim is to develop the leadership skills of Fellows in the area of agricultural research management, agricultural policy and/or extension technologies through exposure to Australian agriculture across a range of best-practice organisations involved in research, extension and policymaking.

Short courses and workshops

A limited number of short courses and workshops are undertaken as part of the training program for people involved in ACIAR projects. Most activities are directly managed by ACIAR, but some are managed by the Crawford Fund. The courses and workshops are presented by both public- and private-sector providers and topics are chosen based on advice from senior officials in partner countries.

On-the-job training

On-the-job training as part of ACIAR projects has been shown to deliver excellent returns in terms of capacity building (in addition to the benefits to farmers). The partnership model for ACIAR projects means that Australian and partner country scientists are working side-by-side throughout the life of the project.

2.4 Policy Advisory Council member

The ACIAR Policy Advisory Council is established under the Australian Centre for International Agricultural Research Act 1982. Members are appointed by the Minister for Foreign Affairs, and represent ACIAR's key stakeholders or the implementing agencies for ACIAR's program in partner countries and Australia. Council members are drawn from government departments, research providers and industry, and are therefore well placed to advise on their respective countries' development and agricultural priorities and research needs.

The current member from China is Mr Jia Jingdun, Deputy Director General, Department of Rural and Social Development in the Ministry of Science and Technology (MOST). Mr Jia has been a member of the Council since March 2003.

3 China chapter from the Annual Operational Plan 2008–09

GDP per capita (PPP[a] US$)	6,757
Population (millions)	1,313
Projected population (millions) 2015	1,389
Active bilateral projects	16
Active multilateral projects	1

[a]Purchasing power parity

Bilateral actual 2006–07	$2.9 m
Bilateral estimate 2007–08	$2.4 m
Bilateral budget 2008–09	$2.3 m
Bilateral + multilateral budget 2008–09	$2.4 m

3.1 Medium-term strategy

ACIAR's program in China will focus on sustainability aspects of agricultural production through policy and technical projects on better management of land and water resources in north-western China.

In addressing sustainable production, the need to raise farmers' incomes through increased productivity and marketability of produce is also taken into account in project design. In order to reach those most affected by poverty, the program will increasingly target rainfed cropping systems with an emphasis on north-western China (primarily Gansu). In the course of 2008–09 ACIAR will review its focus in north-western China with the intent of strengthening extension of previous and future work and forming a more closely linked cluster of projects.

There is a related but broader emphasis on improving agricultural productivity in Tibet Autonomous Region. Both north-western China and Tibet Autonomous Region are confronting significant environmental challenges which need to be addressed through strategies that foster income growth for smallholders. In recognition of the evolving nature of Australia's development assistance relationship with China, all new activities will take the form of partnerships that include significant co-investment by our Chinese partners.

3.2 Key performance indicators (2008–09)

- implementation of a farming systems program in Tibet Autonomous Region that addresses farm enterprise diversification and crop intensification
- evaluation of opportunities and constraints for R&D investment into water productivity in north-western China agricultural systems
- assessment provided on sustainable land-use policy in north-western China and progressive consideration of alternative options
- improved understanding by Chinese partners of opportunities and challenges from WTO accession and associated farm adjustment prospects
- progress towards understanding the economic costs attached to technical barriers impacting Chinese agricultural trade
- at least 40% of new projects designed to have components leading to significant farmer or policy impacts within 5 years of completion.

3.3 Position

ACIAR has had a program with China since 1984. Major areas of research have included agricultural water management, selection of Australian trees suited to Chinese forestry, improvement and integrated pest management in Brassica crops, studies of livestock production and diseases with a focus on sheep and wool, quality management in stored grains, and broadacre crop and citrus improvement. Adoption of conservation tillage in some central western provinces has been recognised as part of the solution to improve crop management and reduce wind-blown dust in Beijing. Over the last decade the focus of ACIAR's program has shifted towards western China, in line with the need to raise farmers' incomes in this

part of the country and to better manage land and water resources.

In view of the significant human and financial resources now available within the Chinese National Agricultural Research System, and the strong mutual benefits to Australia, ACIAR requires Chinese and Australian research providers to substantially share costs of projects in China. ACIAR will usually seek a funding commitment through case-by-case exchanges of letters at the development stage of full project proposals. Only a small proportion of the highest priority projects can be supported.

Projects chosen must:

- address the highest priority of Chinese partners
- address overall Australia–China development policy (to 'further mutual interest by supporting China's balanced development policies and working together in the region') complement other schemes for China–Australia collaboration, including the AusAID Australia–China Environment and Development program
- be in areas where the overwhelming driver is Australian technical comparative advantage
- complement rather than duplicate activities of other (larger) donors.

3.4 Australian intergovernmental cooperation

ACIAR projects form only one part of the China–Australia intergovernmental cooperation in agriculture and natural resource management. Australia's aid program in China has largely shifted away from discrete poverty reduction activities towards the sharing of ideas, high-level capacity building and policy engagement. AusAID's China strategy for 2006–10 has the goal of furthering mutual national interest by supporting China's balanced development policies and working together in the region. It has the three strategic objectives of building capacity in selected sectors in China, in particular governance, environment and health; enhancing the Australia–China relationship by building institutional linkages; and working collaboratively to strengthen the region.

ACIAR's China program, while maintaining a focus on sustainable resource management in poorer and environmentally degraded western regions, reflects the strategic objective of building capacity in China. It focuses strongly on capacity enhancement in technical and policy issues relating to the environment, as it is either affected by agricultural production or in turn affects production sustainability. This thematic focus will be enhanced by increased attention to policy development avenues. It will assist in identifying suitable reform programs which enable farmer adjustment and adoption of technical opportunities for income improvements through effective conservation practices. ACIAR's mode of operation in China is through the development of strong institutional linkages between Australian and Chinese government R&D and policymaking organisations, thus supporting the second strategic objective of the overall Australian aid program in China.

Other activities that are taken into account by ACIAR, and which may be alternative sources of support for researchers interested in China include:

- the Australia–China Agricultural Cooperation Agreement (ACACA, <www.daff.gov.au/marketaccess-trade/iac/acaca>), jointly administered by the Department of Agriculture, Fisheries and Forestry (DAFF) in Australia and the Chinese Ministry of Agriculture. ACACA provides funding for agricultural exchange projects between Australia and China. The present focus is on projects that demonstrate commercial potential and provide clear flow-on benefits to industry. DAFF has also established an Agricultural Technical Cooperation Program with initial projects in wool marketing and grasslands management. In addition, DAFF has formed a Strategic Partnership Agreement with AusAID to strengthen the whole-ofgovernment approach to development cooperation in the Asia–Pacific region. This partnership has helped facilitate recent water management assistance projects with China.
- Australian Government Department of Education Science and Training (DEST) 'International Science Linkages program' <www.dest.gov.au/science/isl>. This includes competitive grants under the Australia– China Special Fund for S&T Cooperation, in which agriculture,

biotechnology and environmental research form three of the priority areas. In addition, DEST supports international exchanges, targeted scientific and technological individual visits, missions and workshops to promote science and technology collaboration. These are managed by the Australian Academy of Science <www.science.org.au/internat/index.htm> and the Australian Academy of Technological Sciences and Engineering <www.atse.org.au>.

- the Joint Declaration on Bilateral Cooperation on Climate Change between the Australian Greenhouse Office (Department of Environment and Heritage (DEH)) and the National Development and Reform Commission for China <www.deh.gov.au/minister/env/2003/mr24oct203.html>, which sets out cooperation in technology development and policy. ACIAR and the Australian Greenhouse Office are currently jointly funding two projects (LWR/2003/039, LPS/2001/094) which are relevant to both the agricultural sustainability and greenhouse gas reduction agendas.
- the State Bureau of Foreign Experts Affairs of China, which is responsible for accrediting international educators in China, and identifying and negotiating training opportunities across the world which will be of benefit to China. The related China Association for International Exchange of Personnel <www.china.org. cn> is a government-sponsored institution also engaged in the international exchange of specialised technical and managerial personnel in several areas, including agriculture, science and technology.

3.5 Research priorities

ACIAR has consultations with China to establish priorities for research collaboration, including meetings with senior leaders and researchers from the ministries of Science and Technology, Agriculture and Water Resources, as well as the China Academy of Sciences, China Academy of Agricultural Sciences, universities and provincial authorities. ACIAR's China program for 2008–09 has the following themes:

Subprogram 1: Increased water productivity of agriculture in north-western China

- Selection of technologies for improved water-use efficiency, with an emphasis on dryland agriculture
- Development of policies and institutions for improved land and water use

Subprogram 2: Improved agricultural productivity in Tibet Autonomous Region

- Improvement in integrated crop–livestock systems in favourable areas of Tibet Autonomous Region

Subprogram 3: Implications of Chinese trade developments for smallholders

- Analysis of implications of more open trade and associated economic policy reforms for poor smallholders in China, regional developing economies and Australian interests
- Identification of policy constraints to adoption of research findings

4 Active projects in China

4.1 Subprogram 1: Increased water productivity of agriculture in north-western China

Chinese authorities consider water management initiatives to improve irrigation efficiency and achieve conservation practices in rainfed districts as matters of urgency. By scoping the best means to undertake further research, a more focused approach will be assured. This study will link closely with work on crop diversification and management systems to arrive at a more cohesive environmental agenda. The social aspects of farm-level motivation will be included in this cluster.

Projects:

ADP/2007/055: Improving the efficiency of land use change policy in China

Summary

Previous ACIAR projects have led to an improved understanding of Chinese agricultural and forestry policies, and also facilitated the development of institutional and technical capacity. One project titled 'Sustainable land use change in north west China' under the 'Conversion of Cropland to Forest and Grassland' program identified problems associated with the Program and showed it was possible and desirable to better target environmental considerations and improve cost-effectiveness of the Program. This project is using this base to investigate the potential of policy alternatives that will improve the cost-effectiveness of the various land-use change policies that the Chinese Government currently finances. Researchers will undertake a comprehensive analysis to determine whether the introduction of market-based instruments would improve the cost-effectiveness of these key land-use change programs. Specifically, they will explore the feasibility of a bidding scheme for conservation contracts in allocating government funds.

Project information

Overseas Collaborating Countries: China

Commissioned Organisation: Australian National University, Crawford School of Economics and Government, Australia

Project Leader

Professor Jeff Bennett
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Collaborating Institutions

- China National Forestry Economics and Development Research Centre, China
- Victorian Department of Sustainability and Environment, Australia
- Sichuan Forestry Department, China
- Peking University, China

Project Budget: $409,128

Project Duration: 01/04/2008 to 31/03/2010

ACIAR Research Program Manager: Dr Simon Hearn

Project progress

First progress report due in 2009.

CIM/1999/072: Oilseed Brassica improvement in China, India and Australia

Summary

Oilseed brassicas are an extremely important crop in China and India. More than 6 million hectares are planted to *B. napus* (rapeseed) in China and *B. juncea* (Indian mustard) in India. Achieving canola quality oils (low in erucic acid and glucosinolates) is an aim for both countries. *B napus* varieties grown in Australia, Europe and Canada all achieve canola quality. Of the *B napus* types grown, those planted in Australia are best suited to Chinese and Indian growing conditions. Germplasm with improved traits for both *B napus* and *B juncea* will be tested to improve canola quality oilseed production in China, India and Australia.

Brassica production in all three countries is limited by a number of key diseases and environmental stresses. Sclerotinia and white rust resistant traits are needed to reduce the losses these diseases cause. Agronomic traits such as drought tolerance and quality will also boost yields and oil quality. Molecular genetic and quality analysis can be used to determine key traits including quality, disease resistance and drought tolerance.

This project is:

- identifying and developing effective screening/evaluation protocols for each key trait
- identifying appropriate variability for key traits through use of screening protocols
- enhancing germplasm in all countries for key traits through selection and breeding
- identifying heritability of key traits, genetic distance and heterotic pools (agronomic analysis, molecular analysis) by undertaking genetic variability/distance studies on germplasm from all countries
- developing and providing appropriate information on improved germplasm and disease epidemiology for incorporation into existing technology transfer protocols.

Project information

Overseas Collaborating Countries: China, India

Commissioned Organisation: University of Melbourne, Institute of Land and Food Resources, Australia

Project Leader

Dr Phil Salisbury
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Collaborating Institutions

- Department of Primary Industries, Victoria, Australia
- South Australian Research and Development Institute, Australia
- National Research Centre on Rapeseed-Mustard, India
- NSW Department of Primary Industries, Australia
- Oil Crops Research Institute, China
- University of Western Australia, Australia
- Punjab Agricultural University, India
- Tata Energy Research Institute, India
- Indian Council of Agricultural Research, India
- Huazhong Agricultural University, China
- Haryana Agricultural University, India
- Department of Agriculture, Western Australia, Australia
- Institute of Industrial Crops, China

Project Budget: $2,607,087

Project Duration: 01/01/2004 to 31/12/2009 (Project extended from 01/01/2009 to 31/12/2009)

ACIAR Research Program Manager: Dr Paul Fox

Project progress

Year 4 (01/01/2007-31/05/2008)

During 2007 the second round of screening of the series I B. napus and B. juncea germplasm from India, China and Australia was completed. Useful variation for several key agronomic, quality and disease resistance characters in the germplasm from each country was confirmed. The best performing lines have been used in breeding programs to enhance the germplasm in all countries for shatter resistance, disease resistance, agronomic and quality traits and drought tolerance. The second series of germplasm exchange was also undertaken in 2007, with 58 B.

napus lines (25 Chinese, 2 Indian and 31 Australian) and 60 B. juncea lines (20 Chinese, 23 Indian and 17 Australian) exchanged.

Some key traits were identified in the series II germplasm screening that will be beneficial to the breeding of improved lines for each country. These included white rust resistance in Australian B. juncea lines, low erucic acid and low glucosinolate levels in Chinese and Australian B. napus and B. juncea lines, Sclerotinia resistance in Chinese and Australian lines, terminal stage thermotolerance in Australian B. napus and Chinese B. juncea lines and seedling stage thermotolerance in Indian B. juncea lines, blackleg resistance in Australian B. juncea lines and shatter resistance in Indian and Australian B. napus lines.

In 2007, advances were made in verifying shatter resistance screening techniques. A very high correlation between the results of visual shatter observations and percentage of pod shattering on the main stem of Brassica lines that were left standing in the field 4 weeks post maturity was observed in India, indicating that either method is valuable for estimating shatter resistance. The genetic distance analyses of the series I B. napus and B. juncea germplasm, using the SSR technique, was completed in 2007. Cluster analysis of the data showed abundant genetic diversity among the lines of both species, and will assist breeders in their selection of the most diverse lines to widen their genepools.

The first F1 hybrid field trials of 13 B. napus parents and 84 F1 hybrids were conducted in Australia (WA, NSW, Vic), China (2 sites in Wuhan) and India (Punjab) in 2007-08. The F1 hybrid seed produced by hand-crossing in 2006 was distributed in 2007 together with seed of pure breeding lines of the parents. The parallel trials were designed with a special spatial randomisation program with 1-3 replicates per entry. The first data were received from Australian sites at the end of 2007. Seven agronomic traits were measured (vegetative vigour, date of 50% flowering, height of first branch, height of first pod, mature height, seed yield and 1000-seed weight) and data analysis is underway using a multi-environment trials analysis. Heterosis measured in F1 hybrids and combining ability measured in diallel crosses of pure lines and the relationship between molecular genetic distance and heterosis will be reported.

F1 seed produced from the second series of exchanged germplasm has been or will be sent to collaborators in 2008 for F1 hybrid trials in Australia (WA, NSW, Vic), China (1 site in Wuhan) and India (Punjab, Harayana) in 2008-09. Analysis of the relationship between molecular genetic distance and heterosis was also carried out in an additional experiment in China using 12 parents and 36 hybrids. The lines were planted in two Chinese locations and 11 traits were recorded. Positive mid-parent heterosis and positive high-parent heterosis for seed yield were observed. Most of the correlation coefficients between molecular genetic distance and mid-parent heterosis were positive, but few items were at a significant level. However, when dividing hybrids into intra- and inter-regional hybrids, correlations between genetic distance and mid-parent heterosis increased among intra-regional hybrids for most traits especially siliquas per plant and seed yield per plant. The results indicated that it may be possible to predict heterosis by molecular markers among intra-regional hybrids.

During 2007 significant progress was also made towards the objective of increasing the scientific skills of scientists collaborating in the project through scientific exchanges. Mr Wan Zhengjie (PhD student), Huazhong Agricultural University, Wuhan, completed his 5 months of molecular biology training at UWA in Assoc Prof Wallace Cowling's laboratory. Likewise, Dr Mei Desheng, Oil Crops Research Institute, Wuhan, completed 6 months of molecular biology training at CSIRO Plant Industry with Dr Allan Green.

In addition, Dr Chirantan Chattopadhyay (NRCRM, Bharatpur, India) undertook a 3 week training program in Australia in September 2007. Dr Chattopadhyay presented a paper at the Australian Research Assembly on Brassicas, participated in the pre-conference tour, met with project collaborators in WA, NSW and VIC, toured disease nurseries and attended a scientific writing workshop at the Australasian Plant Pathology conference.

In April 2007 a mid-term project progress meeting was held in Wuhan, China, and was attended by collaborators from each institute. The 3 day meeting consisted of presentations, trait group discussions and tours of laboratories and field trials. In early 2008 (Jan 28 to Feb 3), a progress meeting was held in India. The meeting comprised a one day workshop, followed by visits to each of the collaborating institutes to inspect the exchanged lines in the field.

CIM/2003/067: Ensuring productivity and food security through sustainable control of yellow rust of wheat in Asia

Summary

Wheat is a widely grown crop throughout many parts of Asia. Of the total worldwide areas planted to wheat more than 40 per cent is grown in Asia where it is an important staple food crop. Of the 95 million hectares devoted to wheat cropping almost half this area (some 43 million hectares) is susceptible to stripe rust.

Stripe rust's causal agent, *Puccinia striiformis tritici (Pst)*, can spread rapidly. It is capable of air-borne migration being carried long distances by wind. The agent can also evolve rapidly into new wheat races (those of a common ancestry). Growing numbers of wheat races have proven susceptible to yellow rust. Once wheat resistant gene, *Yr9*, present in several wheat races, in South, West and Central Asian countries has begun to break down, resulting in millions of dollars of losses from rust.

Current control measures, fungicides applied at the appropriate time in the cropping cycle, are adequate. These have, however, environmental and price constraints, causing pollution and adding to production costs. Growing new varieties with rust resistance is likely to produce the most successful control option, also addressing cost and environmental constraints. The ability of rust to travel distances, invade new races and break down resistant genes will require the identification and breeding of lines with a new genetic basis for resistance, the subject of this work.

The aim of this project is to increase the food security and profitability of wheat production systems in several countries of Asia and to protect the environment and human health through strategies contributing to the sustainable control of yellow rust disease of wheat.

Project information

Overseas Collaborating Countries: Afghanistan, Bangladesh, China, India, Pakistan

Commissioned Organisation: International Maize and Wheat Improvement Center, Mexico

Project Leader

Dr Ravi Singh
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Collaborating Institutions

- University of Sydney, Australia
- International Center for Agricultural Research in the Dry Areas, Syria
- Global Overseas Collaborators, Global

Project Budget: $1,000,050

Project Duration: 01/01/2005 to 31/12/2009

ACIAR Research Program Manager: Dr Paul Fox

Project progress

Year 2 (01/01/2006-31/12/2006)

ACIAR funding supports ongoing and new research and capacity building activities at CIMMYT, ICARDA, and PBIC-Sydney University to ensure productivity and food security through sustainable control of wheat yellow rust, caused by Puccinia striiformis tritici (Pst), in Asia. Development of new near-isogenic lines (NIL) for greenhouse and field monitoring for genes Yr2, Yr3, Yr4, Yr33, Yr34, Yr35, Yr36 is progressing to fill the gaps in the existing NIL set. NIL for gene Yr8 purified and multiplied and for Yr17 purified. Specific gene combinations are also under progress. Data from Yellow Rust Trap nurseries planted at key sites in South Asia, China and CWANA regions indicate significant variations in Pst populations in these areas. Virulence for Yr17, first detected in Central Asia, is now widely spread. Increasing virulence for Yr3 and its distribution in Pakistan and Afghanistan is a threat to the variety 'Tatara' the sown area of which has increased recently after the epidemic on 'Inquilab 91' during 2005. Lack of virulence for some genes that were ineffective previously is a major concern to progress in yellow rust breeding. A unified Yellow Rust Trap Nursery will now be planted in all countries except China which forms a different epidemiologic region with very different cultivars.

Several facultative/winter wheat cultivars grown, or newly released, in various countries of the CWANA region indicated that only a few were resistant at all sites except in Pakistan. This further demonstrated their vulnerability to diverse pathotypes predominant in different areas. Seedling gene postulation work on Central Asian cultivars conducted in Australia identified some of the commonly occurring genes, which have little or no value to provide resistance to some of the races known to occur in the region. Evaluation in Mexico of individual F2 derived-F5 lines from crosses of yellow rust susceptible Avocet with four Chinese cultivars that show moderate levels of resistance in China but immunity in Mexico confirmed F3 results that each cultivar carried 1 major gene and 2-3 minor genes.

Significant progress was made in incorporating durable resistance into several cultivars from China. Because these Chinese cultivars are highly resistant in Mexico but either susceptible or moderately resistant in China, we used a shuttle breeding strategy to speed up the breeding as well as select under high yellow rust pressure in China. During 2006 we identified 119 advanced lines with yellow rust resistance and desirable agronomic traits and planted them in replicated yield trials in farmers' fields during the 2006-2007 season. Selections were done on 62 new BC1-derived-F5 populations involving 13 additional Chinese cultivars from Sichuan and Yunnan provinces during 2006 in Chengdu and over 1000 advanced lines were planted for further evaluation and selection during 2006-2007. An additional 94 F4 populations were planted in Chengdu and Kunming following selection in the F2 and F3 generations in Mexico.

The '1st Elite Bread Wheat Yield Trial', containing 28 high-yielding entries with resistance to rusts, was grown at a total of 16 sites in India, Pakistan, Afghanistan, Iran and Turkey to find replacements for cultivars that are now susceptible to new races of yellow rust. Several new lines showed significantly higher yield potential and resistance at most of the sites in each country and were selected by the co-operators for further testing. Seed of high yielding entries for the '2nd Elite Bread Wheat Yield Trial' was multiplied during 2006 and planted at 30 sites in 11 countries. About half of the entries have shown high to moderate levels of resistance to the Ug99 race of stem rust pathogen.

Incorporation of yellow rust resistance in 21 facultative/winter wheat cultivars from Central Asian countries has been progressing well in Mexico. Populations in various generations from F1 to F3 were planted for either backcrossing or selection under yellow rust pressure in the 2006-2007 winter season at Toluca, Mexico.

A training course was organized in Uzbekistan for 20 scientists, mostly from Central Asia, to enhance their capacity in managing rust diseases of wheat and breeding for resistance. A Chinese scientist, Mr. Huazhong Zhu, attended a 3-month advanced training course on wheat improvement in Mexico. R.P. Singh, C. Wellings and A. Yahyaoui interacted with various scientists during visits to various breeding and pathology programs in China and Central Asia.

CIM/2005/111: More effective water use by rainfed wheat in China and Australia

Summary

In both north-western China and Australia, conservation farming practices are being promoted as an important component of more-sustainable farming systems. CSIRO Plant Industry has been achieving considerable breeding success for dryland wheat in Australia by targeting specific traits that make more effective use of available water. Some of these traits have also been shown to improve adaptation of wheat to conservation farming practices. This project aims to extend this breeding success to north-western China by working with leading breeding programs for dryland wheats in north-western China, based at Northwest Agriculture and Forestry University, Yangling, Shaanxi, and Ningxia Academy of Agriculture and Forestry Science, Yinchuan, Ningxia.

Project information

Overseas Collaborating Countries: China

Commissioned Organisation: CSIRO Plant Industry, Australia

Project Leader

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Collaborating Institutions

- Northwest Agriculture and Forestry University, China
- Ningxia Academy of Agriculture and Forestry Sciences, China

Project Budget: $871,689

Project Duration: 01/06/2008 to 30/06/2013

ACIAR Research Program Manager: Dr Paul Fox

Project progress

First progress report due in 2009.

CIM/2005/152: Australia-China linkage for improved rice cold tolerance

Summary

This small research activity will support important collaboration between Australian and Chinese rice breeders in the development of cold tolerance in rice varieties for both countries. This is a very high priority issue for Australia and very important in China. In addition it will transfer new molecular marker technologies to China from Australia which will have an impact on their cold tolerant activities and all plant breeding activities in China. Cold tolerant varieties will lead to prevention of substantial yield losses in cold years in both countries and also allow farmers to significantly reduce water applications to crops.

Project information

Overseas Collaborating Countries: China

Commissioned Organisation: NSW Department of Primary Industries, Yanco Agricultural Institute, Australia

Project Leader

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Collaborating Institutions

- Liaoning Academy of Agricultural Science, China
- Diversity Arrays Pty Ltd, Australia
- CSIRO Plant Industry, Australia
- Guangxi Academy of Agricultural Science, China

Project Budget: $99,796

Project Duration: 01/05/2006 to 30/06/2009 (Project extended from 01/07/2008 to 30/06/2009)

ACIAR Research Program Manager: Dr Paul Fox

Project progress

Year 2 (01/05/2007-31/05/2008)

The principal activity of this project during the period covered by this report was the completion of a study tour to five locations in China. Participants in the study tour included Dr Laurie Lewin, rice industry consultant, Dr Peter Snell, Rice Breeder, Mr Russell Ford, Manager, Rice Research Australia and delegate to the RIRDC Rice Research Committee, and Mr Leigh Vial, rice grower and delegate to the RIRDC Rice Research Committee.

The visit encompassed five locations in China, including Yunnan Agricultural University, Kunming, Guangxi Academy of Agricultural Sciences, Nanning, China Agricultural University, Beijing, Liaoning Academy of Agricultural Sciences, Shenyang and Heilongjiang Academy of Agricultural Sciences, Harbin.

The study tour highlighted the importance of Yunnan as the centre of origin of *japonica* cold-tolerant rice, and the novel genes for cold tolerance which exist in the genetic background of traditional varieties. Following the visit the strategy for the future is to develop collaborative projects which seek to identify new genes for adaptation to low temperature and their mechanism of action such that new varieties can have multiple sources of cold tolerance.

Much work has been carried out on developing cold-tolerant varieties in a number of improvement programs world-wide, however pedigree analysis reveals that many varieties are built on the same sources of cold tolerance, thus combining varieties may be fruitless if the original gene/s for tolerance are present in each of the parents.

A shift in emphasis to the identification of cold tolerance genes in landraces gathered from high altitude areas in Yunnan is warranted. Although ambitious, new research should be brought to bear on uncovering the genetic basis for cold tolerance in landraces and traditional varieties from cold, high altitude areas, so that these genomic regions can be transferred into other genetic backgrounds to provide robust tolerance at all growth stages.

A total of 740 varieties from the *Oryza rufipogon* collection in Nanning, Guangxi Province, have been screened for cold tolerance at both the seedling stage and at the reproductive stage, resulting in 4 varieties showing seedling stage tolerance and 2 varieties with reproductive stage tolerance. A backcrossing program has been initiated to transfer tolerance from the wild background into the Australian variety Millin, with regular screening throughout development. This project has not received direct funding and thus is of lower priority

with efforts proceeding in the background. Given the location of the institute in the southern part of China where production of *indica* types predominates, cold tolerance accords lower research priority. Ideally future research should be directed at elucidating the mechanism and genomic location of *O.rufipogon* cold tolerance genes in comparison with those of Yunnan *O.sativa* landraces.

There is a need to further explore the origins and mechanisms of cold tolerance in varieties utilised throughout the Liaoning and Heilongjiang provinces and develop the linkages between research institutions. The Heilongjiang Academy of Agricultural Sciences has a cold water screening facility at Harbin in which groundwater at 7ºC is mixed with surface irrigation water to obtain the desired temperature for screening segregating material.

Finally, further collaborative linkages are warranted with the comprehensive rice breeding program of China Agricultural University aimed at aerobic growing conditions. This research focuses on the development of varieties tolerant of water-limited conditions at all growth stages. Although not specifically aimed at cold tolerance, strategically these are high priority traits to build into future varieties as the Australian Rice Industry faces the prospect of generally lower and less reliable rainfall.

Technology to firstly identify genomic regions identified as contributing to cold tolerance and then to facilitate the efficient transfer of such regions will be increasingly important. Diversity Array Technology (DArT) is one means of obtaining an immediate representation of the genome, and by associating genotype with phenotype, regions associated with cold tolerance can be identified. Sequencing the DArT clones identified with specific positive regions allows identification of the location within the genome and suggests candidate genes for additional study.

Further, these areas can be tracked with DArT analysis throughout subsequent crosses and back-crosses made to transfer the traits into varieties with appropriate adaptation and grain quality attributes. Elements of this work are being carried out with segregating populations varying for cold tolerance already developed at Sydney University, however additional funding is necessary to advance the work and enhance the linkages with Yunnan Agricultural University.

LPS/2001/094: Sustainable development of grasslands in western China

Summary

China's western grassland regions provide the basis of the livelihoods of around 40 million people. The per capita income of Gansu, Xinjiang and Inner Mongolia are amongst the lowest in China, in part due to the poor productivity of the grasslands. A severe climate combined with overgrazing limit production, however, it is land degradation that is the main problem. Almost 90 per cent of the approximately 300 million hectares of grasslands are considered degraded. Dust storms, siltation of the Yellow River and declining biodiversity have all resulted and are accelerating and frequency and severity of such storms.

Rehabilitating these grasslands is a focus of Chinese Government policy and supporting international programs. Grasslands management concentrating on livestock farming systems aims to identify better strategies to overcome degradation and improve smallholder incomes.

The project is working to provide research support and training at a range of levels (including scientists, policy makers and extension staff) to contribute to the development and adoption of a systems approach to pastoral management. Achieving this will raise farmer incomes, while sustaining or enhancing the productivity of the resource base, and will help in identifying the priorities for research and development and Government programs by developing:

- a framework for grassland farming systems that integrates the major components that influence grassland use
- a suite of policy/regulatory approaches and on-farm strategies that impact positively on farmer incomes and grassland rehabilitation (using the farming systems framework).

Project information

Overseas Collaborating Countries: China

Commissioned Organisation: Charles Sturt University, Australia

Project Leader

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Collaborating Institutions

- Gansu Grassland Ecological Research Institute, China
- Gansu Agricultural University, China
- NSW Department of Primary Industries, Australia
- Inner Mongolia Agricultural University, China
- Chinese Academy of Agricultural Sciences, China
- University of Queensland, Australia
- Research Centre for Rural Economy, China
- Institute of Environment and Sustainable Development for Agriculture, China

Project Budget: $971,603

Project Duration: 01/01/2005 to 30/06/2009 (Project extended from 01/07/2007 to 30/06/2009)

ACIAR Research Program Manager: Dr Debbie Templeton

Project progress

Year 3 (01/01/2007-31/05/2008)

The grasslands of north and western China are widely acknowledged to be mildly to severely degraded. The farmers (herders) in these regions are among the poorer people in China. The Chinese Government has major programs for western development that include the goals of improving herder incomes and rehabilitating grasslands. This project has the same general objectives.

Identifying the tactics and strategies for improving incomes and rehabilitating grasslands has been the project focus. This is being done through the analysis of farm survey data in four study villages (two each in Gansu and Inner Mongolia), modelling the livestock production system and then seeking pathways to more sustainable outcomes. Part of that work involves considering the impacts of alternative livestock production systems on methane (greenhouse gas) production and on soil erosion / dust storms. Other project components have analysed policy implications and options. A broad sense sustainability outcome is likely to lead to

better solutions with more chance of adoption.

The on-farm work done to date has identified tactical principles within five categories that are likely to lead to real benefits. These tactics lead to an integrated strategy. The tactics are listed below in terms of (item 1) initial changes etc., that need to be made and then (item 2) additional considerations as farms become better organised. This project is focused on the initial changes.

- Financial
  - Minimise transition costs from any changes to the farming system.
  - Improve market power for farmers.
- Grassland management
  - Only graze grasslands during summer when grass is green in summer; Pen feed the livestock in autumn, winter and spring grazing when grass has been frosted and until summer pasture growth is at thresholds.
  - Manage grazing to enable rehabilitation of grasslands; Increase fodder harvested from grassland.
- Animal management
  - Select the most productive animals to keep and sell (cull) the rest; Use proceeds from sale of excess livestock to finance improvements; Improve animal health monitoring and treatment.
  - Determine animal breeding objectives and adjust livestock numbers and type to achieve a more profitable enterprise.
- Animal nutrition
  - Feed animals in greenhouse sheds, during the whole autumn-winter-spring period to at least maintain body weights / condition.
  - Improve the quantity and quality of fodder resources.
- Farm infrastructure changes
  - Basic farm improvements to include: greenhouse sheds; race within the stock yards to efficiently manage the livestock.
  - Fencing and watering points.

Current work aims to complete the cost and benefit analysis of this integrated on-farm strategy, including the analysis of impacts of strategies on methane and dust production. As a minimum no change in net farm income is the first criteria used.

LWR/2002/094: Promotion of conservation agriculture using permanent raised beds in irrigated cropping in the Hexi Corridor, Gansu, China

Summary

Gansu is a north western Chinese province in the Yellow River Upper Drainage Basin. Between Gansu and neighbouring Inner Mongolia, lies a distinct valley, the Hexi Corridor. In the past, reliable snowmelt water from the adjacent Qianlian Mountains has sustained the irrigated agricultural areas along the length of the valley. In more recent times, reduced snowmelt water has led to significant reductions in available surface water, whilst over extraction and decreased recharge has lowered water tables in groundwater driven systems. As a consequence, severe water restrictions are being placed on farmers (up to 50 per cent reduction in allocations).

Although delivery losses are being reduced, through better channel lining, few practical solutions are being offered to farmers to cope with the policy driven cutbacks in water allocations, water price increases and pumping costs. Other food production issues associated with water restrictions, such as small farms, low levels of mechanisation, high inputs, conventional tillage, low incomes and the loss of young men to the cities, are placing further pressure on farmer livelihoods.

Therefore this project is examining conservation agriculture, using practises such as zero tillage and permanent raised beds (PRB), to reduce irrigation water use, maintain farm yields and improve farmer incomes.

Project information

Overseas Collaborating Countries: China

Commissioned Organisation: University of Queensland, Australia

Project Leader

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Collaborating Institutions

- China Agricultural University, China
- Gansu Academy of Agricultural Sciences, China
- Gansu Agricultural Mechanisation Bureau, China

Project Budget: $707,000

Project Duration: 01/07/2005 to 31/12/2009 (Project extended from 01/07/2009 to 31/12/2009)

ACIAR Research Program Manager: Dr Christian Roth

Project progress

Year 3 (01/07/2007-31/05/2008)

The aim of this work is to introduce and extend conservation agriculture (CA) to improve water use efficiency and the prosperity of small farmers in the water-stressed area known as the "Hexi Corridor" of north-west China. Key constraints to implementation of CA in China are the lack of appropriate machinery and competition for crop residues. Comparative performance of irrigated spring wheat in permanent raised beds (PRB), fresh raised beds (FRB), zero till-control traffic (ZT) and conventional tillage (CT) was assessed on the Zhangye Research Station near Zhangye City, complemented by three demonstration sites which compared PRB, ZT and CT located in Shandan County, Wuwei and Jiuquan Cities, in Gansu Province. Irrigation volume was based on soil moisture deficit for PRB, FRB and ZT, while CT received 1.5ML/ha per irrigation (up to 6 irrigation events), which was normal farming practice. In 2007 yield of PRB was 7.1t/ha, 9% better than CT and significantly improved on all other treatments, despite a 10% poorer establishment than CT. Irrigation water savings from PRB was 43% in 2007, compared with that of CT. Soil profile salinity (EC) varied across the beds in both PRB and FRB. The centre of the bed at 0.20-0.30m soil depth had the greatest salt accumulation at 2.79dS/m. At 0.50-0.60m EC was also considerably higher than the other profiles at 2.47dS/m, but not enough to affect wheat yield.

Crop emergence, yield and applied irrigation water at the demonstration sites followed similar patterns to those found at the Zhangye Research Station. This indicates that conservation agriculture can be implemented in this region without loss of yield, and with considerable gains in natural resource conservation, provided that the operational capabilities of the prototype machinery continue to improve.

A second generation no-till planter was built in the winter of 2007 to enhance trash flow, improve depth control, reduce soil disturbance and to provide flexibility for use in flat and PRB farming systems. The machine incorporated 3 tool bars to maximize tine spacing and an optional powered cutter to clear >6 tonne/ha of residue. Depth control was achieved with press-wheels on floating seed tube knives. Furthermore, narrow vertical openers were used to minimise soil disturbance. The maize planting operations fell below expectations due to short pre season testing, heavy trash conditions, very moist soil, poor soil flow and the lack of appropriate row preparation and slot closing devices. The operational conditions and the necessity to minimise planter weight to operate on <20hp tractors also hampered maize, wheat and barley seeding operations at the demonstration sites.

A powered disc no-till planter was constructed and tested in Jiuquan City specifically for wheat after the 2008 maize crop. It too suffered from residue blockages, but was suitable behind a 20hp tractor. The planter will be retested in September 2008 after minor modifications to the maize stool cutting disc, bed renovation tools and structural strengthening. A weeder was also designed and developed in Jiuquan during the 2007-08 winter and is currently in the final stages of manufacture and initial testing.

Following minor modifications to blower speeds and seed separators, a tractor mounted wheat harvester was successfully tested in July 2007 on the research station site and local Zhangye farm. However, there were still minor issues with machine stability on uneven terrain and driver comfort that should be addressed prior to commercialisation.

A third demonstration site has been established in Wuwei City by the Gansu Agricultural Mechanisation Bureau. This site is the final of three sites established by the project along a 500km section of the Hexi Corridor. The site managers are fully committed and are very pleased with the results from all three sites. Local farmers invited to field days recognise the merit in the PRB farming system through reduced inputs such as labour, fuel and water, but still find it hard to believe yield can increase when less land is planted to cropping.

At this stage there is no documented evidence of farmer uptake of PRB, but there are other demonstration sites for conservation tillage and conservation agriculture in close proximity to each ACIAR demonstration site and the Zhangye Research Station.

In October 2007 training in Conservation Agriculture concepts and extension was delivered in Beijing to 25 people associated with the project. This is being followed up by 'Train the Trainer' training for village technicians and extension staff in Zhangye and by Farmer Farm Schools in CA concepts at each of the demonstration sites in June 2008. The training is a joint endeavour between ACIAR and the China-Canada Sustainable Agriculture Development Project, based in Gansu and Sichuan Provinces.

LWR/2003/039: Improving the management of water and nitrogen fertiliser for agricultural profitability, water quality and reduced nitrous oxide emissions in China and Australia

Summary

In China irrigated cropping demands careful management of water resources and other inputs. Wheat and maize are the two main irrigated crops grown in western provinces. Water use efficiency in these areas is often low despite water being a critical resource. The intensive nature of the cropping that is practised demands the use of fertilisers. Nitrogen fertiliser is the main type used but, as with water, its use is often inefficient and wasteful. The combination of water used inefficiently with more fertiliser than is needed creates environmental problems, beginning with nitrogen-rich runoff. Volatilisation of ammonia contributes to nitrogen loss, in turn requiring more fertiliser use. This also results in greenhouse gas emissions.

A Water and Nitrogen Management Model (WNMM) developed in past ACIAR research should help determine changes needed to improve current management practices. By working with the model and its associated decision support system in two AusAID projects in Inner Mongolia and Hebei provinces, better practices will be identified and then disseminated to farmers through the existing project channels.

The project is improving the management of water and N fertiliser to increase farm incomes, improve environmental quality and reduce N_2O emissions from agriculture. The systems to be studied are irrigated maize and wheat cropping systems and intensive vegetable farms in the western Yellow River basin of northern China, and intensive irrigated pasture and maize, and rain-fed wheat systems in Australia.

Project information

Overseas Collaborating Countries: China

Commissioned Organisation: University of Melbourne, Department of Agriculture and Resource Management, Australia

Project Leader

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Collaborating Institutions

- Shanxi Academy of Agricultural Sciences, China
- Chinese Academy of Sciences, China
- Cardno Acil Pty Ltd., China Office, Australia
- Chinese Academy of Agricultural Sciences, China
- China Agricultural University, China

Project Budget: $1,627,826

Project Duration: 01/04/2005 to 30/09/2009 (Project extended from 01/04/2009 to 30/09/2009)

ACIAR Research Program Manager: Dr Christian Roth

Project progress

Year 2 (01/04/2006-31/03/2007)

Most of the milestones outlined in the project proposal for the second year (of this four year project) have been achieved, and are summarized as follows:

In China:

1. Field experiments on irrigated maize in the Inner Mongolia Autonomous Region (IMAR), in collaboration with the AusAid project “Alxa League Environmental Rehabilitation and Management” have been completed. Using a combination of field measurement, modelling and 15N tracer techniques we found that 25 to 40% of irrigation water, and 186 to 255 kg N ha-1 of nitrate, was leached below the root zone. It was estimated that 50-90% of applied N fertiliser was lost.
2. The water and N management model, WNMM, has been adapted for simulating water and N dynamics under maize cropping in IMAR. Best management practices for these systems have been identified on the basis of WNMM simulations.
3. Two years of field experiments on water and N dynamics, plant growth and yield have been completed on irrigated wheat and maize at Yongji and Hongtong (Shanxi Province). The data is being used for testing WNMM in these environments. The Yongji site is extensively instrumented, including an

Eddy Covariance system for measuring evapotranspiration and CO2 fluxes and a wireless soil moisture monitoring system. The preliminary results indicate that in Shanxi 30 to 160 kg/ha N fertiliser can be saved without reducing maize yields, and the corresponding saving for wheat is 40 to 100 kg/ha. This translates to 120 to 640 RMB/ha cost saving (1A$=6RMB). Similarly, significant amounts of irrigation water can be saved without lowering yield.

4. Open path laser and micrometeorological systems were used for the first time at Yongji to measure NH3 losses from irrigated maize. Sprinkler irrigation improved water use efficiency and substantially reduced NH3 volatilisation.
5. An economic sub-model is being constructed and linked to WNMM, using data gathered from a previous ACIAR project (LWR1/1996/164) and new survey data from Fengqu county (Henan province). The combined model will be used to assess the trade-off between environmental and economic objectives, and to assess policy options for water and fertiliser management.
6. Three county-wide suveys in Yuci, Yongji and Hongtong, Shanxi Province have been completed. Soil, landuse and village maps have been digitised and most attribute database sets have been compiled. This information is needed for developing the county-scale WNMM model and decision support system. Landsat TM5 images for 2006 have been purchased to estimate crop biomass, leaf area index and N uptake to calibrate WNMM.
7. The Chinese Academy of Sciences has approved A$500,000 co-funding to establish a state-of-the-art auto-chamber system for N2O and NOx measurements at the Yongji site. The system will be ready in October 2007 for the start of the wheat season.
8. The University of Wollongong is building a more portable open path FTIR system, for simultaneously measuring NH3, N2O, CO2, CH4 and CO. The system will be ready to be deployed in the 2008 wheat and maize seasons at Yongji, as well as in wheat, pasture and sugarcane sites in Australia.
9. The Shanxi Agricultural Comprehensive Development Office has funded A$50,000 to assist the social and soil survey in 2007, and has agreed to further funding to support establishment of demonstration farms in Shanxi.

In Australia:

This project is complimentary to work funded through the CRC-Greenhouse Accounting, Australian Greenhouse Office (AGO) and GRDC, mainly focusing on model development, measurement methodology and fundamental N process studies.

10. The WNMM has been significantly modified for Australian conditions:
    - The web-based version of WNMM has been completed.
    - The phosphorus sub-routine for WNMM has been developed and tested using the site dataset from Yuci County and will be tested for irrigated pastures in Australia.
11. Applications of WNMM in Australia assisted by this ACIAR project include simulation of water and N dynamics, and N2O emissions, for rain-fed wheat in Victoria and Western Australia and irrigated pastures in Victoria for AGO programs, and simulation of N dynamics in NSW within the ACIAR project led by Dr Jeff Evans. Other international applications, in association with the ACIAR project, include simulating N dynamics and NH3 volatilisation in rice for South Korea; simulating water and N dynamics for irrigated maize and wheat in the Yaqui valley, Mexico, by Stanford University, and; simulating N and water in legume systems in China by the Chinese Academy of Sciences.
12. Based on the ACIAR project, an application to the DEST China Special Fund, ‘Improving water and agri-environmental sustainability in the Murray-Darling Basin and the North China Plain’ was successful ($108,000). Also an additional $120,000 from AGO to fund two open path lasers for NH3 measurement was awarded.

LWR/2007/191: Improving farmer livelihoods through efficient use of resources in crop-livestock farming systems in western China

Summary

The development of integrated crop-livestock systems has potential to alleviate poverty and reduce resource degradation in western China. Recognising this potential, Chinese Government programs have introduced policies to replace cultivation on sloping land with perennial forages, promote conservation agriculture and develop livestock industries. However, there is a growing realisation that benefits will not be realised without the adoption of an integrated approach to research and development of crop-livestock systems, and steps are also needed to overcome some of the institutional barriers inherent in traditional research-extension pathways. This project will undertake farm experimentation with systems analysis tools (databases, simulation modelling, economic analysis) while focusing on integration of crop and livestock production. It will emphasise productivity, water-use efficiency and whole farm economic performance. The main anticipated economic impact will be improvement in farmers' incomes by helping them to more effectively establish perennial pastures and to optimise their cropping-livestock mix in relation to rainfall and market opportunities.

Project information

Overseas Collaborating Countries: China

Commissioned Organisation: University of Adelaide, School of Agriculture, Food and Wine, Australia

Project Leader

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Collaborating Institutions

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- CSIRO Sustainable Ecosystems, Australia
- University of Queensland, Australia
- Chinese Academy of Social Sciences, China
- Agriculture and Animal Husbandry Bureau, Quingyang City, China
- Agriculture and Animal Husbandry Bureau, Huanxian County, China
- Agriculture and Animal Husbandry Bureau, Xifeng District, China

Project Budget: $1,115,125

Project Duration: 01/04/2008 to 31/03/2012

ACIAR Research Program Manager: Dr Christian Roth

Project progress

First progress report due in 2009.

4.2 Subprogram 2: Improved agricultural productivity in Tibet Autonomous Region

Tibet represents unique research challenges given its environmental and economic characteristics. ACIAR projects in this region have a strong focus on production and income improvement in the valley districts. While conditions differ from other parts of China, there is a direct connection between the projects examining integrated crop–livestock systems, animal feeding and grassland management, together with farm diversification.

Projects:

LPS/2005/129: Mineral response in Tibetan livestock

Summary

A survey undertaken in 2005 determined the mineral nutrition status of pregnant sheep, lactating cattle and yaks in the Tibetan Autonomous Region (TAR) of China. The survey team found that livestock were at risk from a number of mineral deficiencies, especially sodium, phosphorus, copper and selenium, with selenium status being particularly low. These mineral deficiencies could be contributing to the poor to moderate condition of the livestock in TAR, with marginal deficiencies resulting in reductions in growth rate, wool production, fertility and milk production, while severe deficiencies resulted in rapid weight loss and increased mortality. The economic and social costs of these disorders are difficult to assess, particularly since marginal disorders are not readily identified in the field and in addition, there is a dearth of information on the response to supplementation.

Research capacity development and the ability to analyse biological samples for all minerals is an important component of this project. Survey and mineral response trials will involve field work with the most important livestock species in Tibet, i.e. yaks and sheep, using methods developed by Tashi *et al.,* (2005). Dr Geoff Tudor will lead the ACIAR study in Tibet, in conjunction with scientist from TAAAS/TLRI and the Mineral Nutrition Group of CAAS led by Professor Xugang Luo. Mr Jiu Bu, together with Dr Geoff Tudor, will plan adoption pathways for farmers in Tibet. These will centre on direct demonstrations and talks to farmers, interim and final reports for ACIAR, and publication of results in international refereed journals.

The aims of the project are to demonstrate the production benefits of improved mineral nutrition of livestock in TAR and to build local capacity to address these problems in future. These aims will be addressed by the following objectives and activities:

Objective 1: To refine information on the mineral nutrition status of livestock in the 4 major livestock production regions of TAR. (About 30% of the field program)

- Activity 1: Extend the mineral survey by Tashi et al., (2005) 3 in yaks and sheep into the summer and autumn growing period.

Objective 2: To determine the response to selenium, copper and iodine supplementation in sheep and to selenium and copper in yaks. (About 70% of the field program)

- Activity 1: Design and implement supplement response trials on well-controlled sites accessible from Lhasa.

Objective 3: To build the research capacity and extension capability of TAAAS personnel.

- Activity 1: Train TAAAS and CAAS scientists in animal mineral, energy and protein nutrition and feed nutritive value at workshop in Tibet.
- Activity 2: Train scientists and research assistants from the TAAAS in Beijing and at Murdoch University in mineral assay and instrumentation.
- Activity 3: Determine the local availability, quality and efficacy of appropriate supplements for use by smallholder farmers.
- Activity 4: Consolidate project outputs into extension material suitable for farmer communication.
- Activity 5: Disseminate information about the mineral responses and potential application of results.

Project information

Overseas Collaborating Countries: China

Commissioned Organisation: Murdoch University, School of Environmental Science, Australia

Project Leader

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Collaborating Institutions

- Tibet Academy of Agricultural and Animal Sciences, China
- Chinese Academy of Agricultural Sciences, China

Project Budget: $599,972

Project Duration: 01/01/2007 to 31/12/2010

ACIAR Research Program Manager: Dr Debbie Templeton

Project progress

Year 1 (01/01/2007-31/05/2008)

This project LPS-2005-129 extends and follows-up the recommendations of the survey of the mineral nutrition of pregnant sheep, lactating cattle and yaks in the Tibetan Autonomous Region (TAR) of China. As a first step, Dr Geoff Tudor, who had been the Senior Beef Research Officer in the Department of Agriculture and Food, Western Australia, was appointed to the project in February 2007 as a research fellow with the role and responsibilities to link operations between Perth, Beijing and Lhasa while located in Lhasa. Dr Tudor arrived in Lhasa in April 2007, and immediately began organising the staff and operations to complete the mineral survey the summer and autumn of 2007. Meanwhile, Dr Bill Winter, as manager of the Livestock Production Systems Program, coordinated a workshop involving the researchers and staff from the major ACIAR livestock projects in Tibet. The workshop took place in Lhasa from 21st May to 1st of June 2007. For LPS-2005-129 in particular, Professor Costa and Dr Tashi led a four-day workshop where all the personnel in the project established the project's scope and operations for 2007 and beyond.

At the workshop, TAAAS staff agreed to coordinate the daily operations of the mineral survey, and mineral response trials for the project, while CAAS staff agreed to conduct the mineral analyses on all samples. Dr Geoff Judson acted as a consultant to the workshop and research team and was instrumental in developing the standard operating procedures (SOPs) that will form the basis of sample collection, handling, processing, mineral analysis and data collection, collation and statistical analysis. A mineral survey strategy was developed for 440 farms across 10 counties. The equipment and consumables for these surveys were purchased in Australia and shipped to Lhasa ready for the survey to commence.

However, progress on the mineral survey was totally disrupted by the severe illness and subsequent withdrawal of Dr Geoff Tudor from the project. Without Dr Tudor's linking and on-ground coordinating role, and delays in obtaining visas for Mr Allan Clark, [formerly senior technician at Hamilton Research Station] who was initially contracted to assume leadership of the sample collection training role in Lhasa, meant that little progress was achieved in 2007.

Notwithstanding these setbacks, there have been some achievements for 2007: all of the project team are familiar with each other, everyone has agreed priorities and process for the project, and the basic infrastructure for conducting the mineral survey has been purchased in Australia and is in place in Lhasa and Beijing. Most importantly all of the consumables and equipment are in place, and the standard operating procedures confirmed which are the prerequisites to completing the survey work. Once a replacement for Dr Tudor has been confirmed, then the project is ready to continue and meet its objectives. Each collaborating institution remains committed to the success of the project.

LPS/2006/119: Integrated crop and dairy systems in Tibet Autonomous Region, PR China

Summary

Increasing the output of dairy products in the Tibet Autonomous Region of the Peoples' Republic of China (TAR) is identified by local and central government as a high development priority. Current milk supply is well below demand and deficits are predicted over the next decade. Grain production in TAR, whilst sufficient to satisfy demand for human consumption, will also need to be increased to support supplementation of livestock diets (particularly dairy cattle). This project is directed at increasing household income and industry productivity and at developing community-based initiatives in dairy, crop and fodder production for farmers in the central valleys of TAR (Shigatse, Lhasa, Shannon and Linzhi Prefectures). The objective of the project is to understand and utilise the key factors affecting the adoption of improved technology, this includes identifying the attitudes of farmers, practical constraints and opportunities in implementation of recommendations, and initiating strategies and structures for extension.

Project information

Overseas Collaborating Countries: China

Commissioned Organisation: University of Adelaide, School of Agriculture, Food and Wine, Australia

Project Leader

Professor David Coventry
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Collaborating Institutions

- NSW Department of Primary Industries, Australia
- Tibet Academy of Agricultural and Animal Sciences, China
- Tibet Livestock Research Institute, China
- Tibet Agricultural Research Institute, China
- University of Queensland, Australia
- Department of Primary Industries and Resources, South Australia, Australia

Project Budget: $1,414,232

Project Duration: 01/04/2008 to 31/03/2012

ACIAR Research Program Manager: Dr John Skerritt

Project progress

First progress report due in 2009.

4.3 Subprogram 3: Implications of Chinese trade developments for smallholders

Following accession to WTO and strong economic growth rates, there is a high level of interest in China and its trading partners on future policy options to maximise mutual benefits from trade. To achieve these outcomes, researchers need to focus on domestic policy options and future industry prospects, providing decision makers with well-analysed farm policies and information on trade liberalisation opportunities. Consequent farm income growth will, in turn, contribute to greater technical innovation and improved environmental management.

Projects:

Project number	Project title	Page
ADP/2008/005	Viability of alternative frameworks for agricultural trade negotiations	31

ADP/2008/005: Viability of alternative frameworks for agricultural trade negotiations

Summary

The current World Trade Organisation (WTO) framework is designed to reform and liberalise global trade in agriculture, however developing countries and Australia have not been well-served by it. The framework's failure to deliver results has reduced farm incomes, aggravated problems of rural development and had negative spill-over effects on international trade and political cooperation.

This project is looking at these problems and will attempt to develop viable alternative frameworks for agricultural trade liberalisation. It will identify and examine new options for the negotiation of agreements on agriculture within the WTO. It will also analyse the current state of agreement in the Doha Round, comparing the outcome to the opportunity that peer-reviewed economic models show would be available with more ambitious opening of world agricultural markets. In collaboration with the international partner institutions in Indonesia, India, and China the project will identify the reasons for the poor prospects for the Doha Round. The outcomes from this project will depend on the time frame and the strength of adoption of project recommendations.

Project information

Overseas Collaborating Countries: China, India, Indonesia

Commissioned Organisation: University of Adelaide, Australia

Project Leader

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Collaborating Institutions

- Inquit Communications Pty Ltd, Australia
- Strategic Asia, Indonesia
- Indian Council for Research on International Economic Relations, India
- Center for Chinese Agricultural Policy, China

Project Budget: $150,000

Project Duration: 01/05/2008 to 30/04/2009

ACIAR Research Program Manager: Dr Simon Hearn

Project progress

First progress report due in 2009.

4.4 Other projects

The following projects were part of previous agricultural research priorities in China and they are active in 2008–09.

Projects:

Project FST/1999/095: Improving the value chain for plantation-grown eucalypt sawn wood in China, Vietnam and Australia: Genetics and silviculture

Summary

Global demand for high-value hardwood timber is growing. There are two available sources of supply; native forests and plantations. Supply from native forests is under increased pressure, with less available areas for logging and a greater emphasis on conservation. This diminishing number of native forests has seen a rise in plantations of short-rotation hardwood species.

One of the limitations in growing short-rotation plantations is the difference in timber quality. Native forests take longer to mature, resulting in bigger and more robust log sizes that stand up to the stresses of sawing and processing. Plantation-derived logs have smaller diameters making them more prone to splitting, bending and curving during processing and sawing. Many plantations provide wood as a source of short fibre pulp and increasingly as a replacement for native forest products when this timber is in short supply.

In China, Vietnam and Australia an increased emphasis on conservation has contributed to reduced logging of native forests. This has increased the use of plantation timber in processing. Improving the useability of this young timber depends on understanding the impacts of growth stresses on wood properties and how these contribute to problems in sawing and processing. Such an understanding would help in guiding the choice of eucalypts suitable for short-rotation use and in the silvicultural management of these species.

Improve the economic returns to growers and processors from eucalypt plantations by developing and implementing silvicultural and genetic strategies to optimise yields of high-quality timber from eucalypt plantations in China, Vietnam and Australia by improving wood properties.

Project information

Overseas Collaborating Countries: China, Vietnam

Commissioned Organisation: State Forests of New South Wales, Tree Improvement, Australia

Project Leader

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Collaborating Institutions

- Guangxi Forest Research Institute, China
- China Eucalypt Research Centre, China
- Queensland Department of Primary Industries and Fisheries, Australia
- Hunan Provincial Forestry Department, China
- Chinese Academy of Forestry, China
- Forest Science Institute of Vietnam, Vietnam

Project Budget: $682,611

Project Duration: 01/07/2005 to 30/06/2009

ACIAR Research Program Manager: Dr Russell Haines

Project progress

Year 3 (01/06/2007-31/05/2008)

The 2007/2008 financial year the project completed the field work in China on assessing the wood quality of *Eucalyptus dunnii* 17 year old progeny trials in Guangxi China. Steve Boyton (Forests NSW) and Kevin Harding (DPI-QLD) assisted in the study and trained local counterparts in wood assessment techniques. The study aims to evaluate *E. dunnii* as a saw log in China, and attempts to understand the variation in growth and wood properties of *Eucalyptus dunnii* in China and Australia. Hunan is undertaking a similar study this financial year. Work has also been completed in Australia assessing *Eucalyptus dunnii* plantations using similar methodology on four sites in NSW, an additional 7 sites will be added this year. The combined studies should provide an excellent insight to the saw and veneer log properties of *E. dunnii* and provide information on the levels of variation in wood properties with varying site qualities.

Harvested logs from trees with known wood properties from all of these trials were

provided to FST/2001/021 for a range of sawing, veneer and drying trials. Results of the genetic and silvicultural traits on wood properties are still being analysed as well as the evaluation of a range of non-destructive assessment techniques.

Great progress has been made finishing the Resource and Plantation Management Review in China, Vietnam and Australia and a final draft of the report is now being reviewed. The final report will provide an excellent insight into the current resource and plantation management in each of the countries; it will also provide the base information for the economic impact modelling that will be completed next year.

Hunan Forestry Department (one of the Chinese project partners) is making excellent progress in completing their work plan that was developed in December 2006, and the Hunan team have received additional provincial funding to enable completion of this project. This will allow Hunan to establish and assess additional species, genetic and silvicultural trials over the life time of the project.

With the majority of the large number of wood quality assessments now complete the project is now moving in to a phase of analysis, modelling and evaluation of the economics of the results, working in close collaboration with the team of FST/2001/021 in the three countries.

Training was provided to Chinese collaborators “in-country” in the use of standing tree and log assessment techniques to evaluate wood properties. There has been excellent uptake of these methods in the partner countries with FAKOPP and Pilodyn now being routinely used for trial assessment in China and Vietnam.

In February 2008 three postgraduate students started with the project, all three are studying at Southern Cross University in Forests NSW.

- Dai Dang (PhD Candidate - Vietnam) Quantitative Genetics of the Red Mahoganies in Vietnam and Australia
- Le Son (MSc Candidate – Vietnam) Molecular Genetics of the Red Mahoganies
- Lan Jun (MSc Candidate – Guangxi, China) Genotype by Environment Interaction in *Corymbia variegata* in Australia and *Eucalyptus urophylla* in China.

In July 2008 all three candidates had made significant in roads in to their studies.

In December 2007, Michael Henson (Forests NSW) and John Simpson (DPI-QLD) visited all project partners in China and Vietnam as part of an internal mid-term view of the project and to set out a road map to achieve the project goals.

Project FST/2001/021: Improving the value chain for plantation-grown eucalypt sawn wood in China, Vietnam and Australia: sawing and drying

Summary

Traditional wood processing industries have utilised native forests for timber. As a result the industries in China and Vietnam, as elsewhere, have evolved processes for wood sawing that match the timber's used.

Increasing demand for timber has placed the burden of production on native forests, many of which are now in decline. Harvest restrictions are now being applied in China and Vietnam, limiting timber production from native forests. With these restrictions have come pressures on employment and a greater reliance on timber importation, creating trade imbalances.

A solution is planting eucalypts, together with other species as part of reforestation programs. Eucalypts primarily supply raw material for large industries: pulp and paper, fibreboard and chipping. Smallscale use in traditional industries is also undertaken, such as for furniture and joinery. Mainly small diameter (less than 30cms) are used,but growth stresses are released when these are sawn using traditional approaches, splitting logs and rending them useless. Such constraints and tendency of plantation-grown eucalypt wood to distort have discouraged use.

Project information

Overseas Collaborating Countries: China, Vietnam

Commissioned Organisation: CSIRO Forest Biosciences, Australia

Project Leader

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Collaborating Institutions

- Forest Science Institute of Vietnam, Vietnam
- China Eucalypt Research Centre, China

Project Budget: $519,932

Project Duration: 01/07/2005 to 30/06/2009

ACIAR Research Program Manager: Dr Russell Haines

Project progress

Year 3 (01/06/2007-31/05/2008)

FST 2001/021 continued joint activities with FST 1999/091 during the reporting period. The work in FST 2001/021 comprised a series of sub-projects (processing studies) that evaluated solid wood processing performance in commercial mills located in China, Vietnam and Australia. The mills applied a range of processing technologies with a number of species of plantation-grown eucalypt logs supplied by FST 1999/091. The logs were obtained from trees evaluated in the field to assess silvicultural and genetic effects of characteristics likely to affect solid wood processing. Where possible, in addition to establishing critical limits to growth stresses, tension wood, branch related defects and log quality, the sub-projects in FST 2001/021 tested silvicultural and genetic effects on processing performance.

The processing studies that commenced, continued from the previous reporting period or were completed during the reporting period are listed below with comments on their contribution to project objectives:

- A large processing trial with *E. grandis x urophylla* conducted in collaboration with the Dongmen veneer mill in Guangxi Province, China, was completed and the report circulated to collaborators and the final report submitted to ACIAR. This project utilised veneer peeling equipment and wood residue heated veneer driers because of the difficulty locating acceptable sawing technology for research in southern Guangxi. The inclusion of peeling was a modification to the project objectives that broadened the scope of FST 2001/021. As with the earlier inclusion of the multiple circular saw technology developed by Viesto Oy and Karasaw in Finland in sub-projects conducted in Australia, this modification required alteration to the project objectives and outputs. One of the main benefits of inclusion of peeling was the capability of making direct comparisons of financial viability of sawmilling and peeling of small diameter eucalypts in China and Vietnam.
- A processing trial was conducted with

northern Vietnamese *E. urophylla* in a saw mill located in central Vietnam. Sawing methods developed for teak using a Vietnamese built single horizontal bandsaw coupled with kiln drying methods for *Acacia* spp. were applied. Comparisons of processing performance and product quality and value were made with some experimental sawing methods that included log rotation. Experimental steam reconditioning treatments were also conducted on a sub-sample of boards sent to Australia. This experiment indicated that processors in Vietnam and China are likely to benefit from inclusion of a commercial steam reconditioning treatment before final drying. A draft report has been prepared for the Forest Science Institute of Vietnam. The final report will be submitted to ACIAR in 2008.

- Two other sawing and drying trials have been completed in Australia with *E. pillularis* from northern NSW and *Corymbia citriodora spp variegata* from southern Queensland. These sub-projects were conducted in collaboration with Forest Enterprises Australia with the HewSaw R200 located in Tasmania. Reports are being prepared for circulation to all collaborators.
- The final trial for FST 2001/021 is still in the planning stage because of delays to the project due to the severe cold weather that occurred in southern China early in 2008. This work will commence in July 2008 with *E. dunnii* logs in a mill in Liuzhou in northern Guangxi. The mill is equipped with a single vertical bandsaw and mill residue heated kilns for final drying. We will incorporate an evaluation of steam reconditioning which will require modification to existing drying equipment and drying practices at the mill. Protocols for evaluation of the drying performance of *E. dunnii* will also be established. At the conclusion of the experiments all major activities for FST 2001/021 will have been completed.

The modifications to the project scope and timing of some of the sub-projects required alteration to a number of project milestones and deliverables. However, given no further delays during 2008/2009 all of the milestones will be met and the project completed on time.

Specific outputs:

- September 2007; report on peeling trials with E. grandis x urophylla submitted to ACIAR.
- October 2007; paper presented at the Plantation Eucalypts for High Value Timber Conference, Melbourne.
- November 2007; Invited paper presented at Sawtech 2007, Melbourne.
- March 2007; draft report on processing *E. urophylla* prepared for Vietnamese and Chinese partners.

Project HORT/1999/081: Reducing spoilage and contamination risks of fresh vegetables in China and Australia

Summary

Population growth in China and the expansion of urbanisation have increased pressures on vegetable growers to meet demand. Peri-urban vegetable production has been promoted as a means of increasing the availability and diversity of fresh vegetables in the growing urban centres. Spoilage of vegetables remains a problem, being caused by a range of factors. Peri-urban vegetable production systems are land and pesticide intensive. Competition for land and other inputs is at a premium, resulting in pressures on production, handling and marketing systems. High postharvest losses caused by fungal and bacterial pathogens are common. Inadequate washing, grading and packing facilities contribute to this, as does limited options for disposing of wash-water and waste. Limited fresh water and water and sewage pollution from inadequate infrastructure result in poor quality irrigation inputs, sometimes utilising raw sewage. These also contribute further to pollution as they enter water courses as run-off. Vegetables are also often washed in these same water sources prior to sale.

Advances in the detection and monitoring of risk factors have been developed for vegetables, using polymerase chain reaction (PCR) technologies. These are applicable to monitoring of both vegetables and wash-water. Such technologies can also be used throughout the supply chain to detect human pathogen transmission risk factors. Much is known about the range of risk factors, how to prevent these spreading and how to improve systems management, inputs and monitoring. Some of this has been developed for Australian systems but is also applicable to China.

The project is analysing production and handling systems to determine risk factors leading to spoilage and contamination. Efficient strategies for decontaminating wash-water and introducing hygienic postharvest washing systems for vegetables and improved monitoring of human pathogen contamination risks during fresh vegetable handling and marketing are being developed.

Project information

Overseas Collaborating Countries: China

Commissioned Organisation:
Department of Primary Industries, Victoria, Institute for Horticultural Development, Australia

Project Leader

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Collaborating Institutions

- Food Science Australia, Australia
- Institute of Vegetables and Flowers, China
- China Agricultural University, China
- China National Green Food Industry Company, China

Project Budget: $867,775

Project Duration: 01/07/2004 to 30/06/2009 (Project extended from 01/07/2007 to 30/06/2009)

ACIAR Research Program Manager: Mr Les Baxter

Project progress

Year 4 (01/07/2007-31/05/2008)

Following a review in May 2007 the project has been extended to enable knowledge transfer.

The objectives of the extension are to:

1. maximise the uptake of improved postharvest practices by the vegetable industry in the Beijing district, reducing food safety and spoilage risks
2. to continue building the technical capacities within the partner organisations for research and development in postharvest technology, postharvest pathology and food safety
3. to attain recognition for the project and inform the research community by publishing findings in scientific journals.

Activities in 2007/08 concentrated on evaluating the processes in the vegetable supply chain from a food safety and product quality perspective and identifying the needs and priorities for process improvement. While there are over 40,000 vegetable growers in the Beijing region,

35% of produce is consolidated and distributed by fewer than 12 large companies. Eight of these companies participated in the process evaluation workshops and will benefit from an ongoing involvement in the project. The evaluations are also being used to develop guidelines for the production of safe, quality vegetables, which will be published later this year.

Experiments are underway to investigate the potential for ultrasonic washing to reduce spoilage and contamination risks. Tertiary students are assisting with these experiments on pak choi, carrot, spinach and tomato.

Mr Zhang Xuejie from the Institute for Vegetables and Flowers led a study tour by executives from the Chinese Academy of Agricultural Sciences to Australia in April 2008. The group examined vegetable supply chains in operation and met with the food safety and postharvest horticulture researchers at DPI and Food Science Australia to overview current research. The purpose was to assist the Chinese partner organisations to develop and to gain organisational support for postharvest horticulture projects.

Two scientific papers and one conference abstract have been submitted for publication. Further research outcomes will be presented in two international conferences to be held in Beijing in the second half of 2008; The China International Food Safety and Quality Conference and Expo (September 24-25, 2008) and Vege2008Beijing (October 14-17, 2008).

5 Projects expected to start in 2008—09

The following projects are expected to start in 2008–09.

Project number	Project title
ADP/2007/090	Scoping study on western China desertification
ADP/2007/022	Trade liberalisation: curse of blessing for water resources management? Impact of trade liberalisation and national basin water use under global environmental change
LWR/2008/001	Integrated water management in dryland Gansu, China

6 China chapter from the Annual Report 2007–08

AOP budgeted expenditure in 2007–08	$2,708,893
Actual expenditure in 2007–08	$2,407,226
Expenditure in 2006–07	$3,113,070
Expenditure in 2005–06	$4,161,160

Expenditure includes both bilateral and multilateral projects

Key performance indicators	Performance 2007–08
Options for economically viable rangeland management practices in Gansu and Inner Mongolia that have positive impacts on rangeland ecology and greenhouse gas emission identified and communicated to stakeholders	Analysis of livestock production systems in Gansu and Inner Mongolia identified several areas where improvements in household incomes could be achieved while also reducing the pressure on grasslands and methane outputs. These are: culling less productive animals, selling marketable animals by early autumn, only grazing grasslands over summer and pen-feeding livestock through autumn, winter and spring. Workshops to model and discuss this new approach have been held with partners and local officials in each province, and Department of Agriculture, Fisheries and Forestry project is modifying demonstration farms, arranging field days and developing training materials in Inner Mongolia.
ACIAR's program in Tibet Autonomous Region is refined by building on initial progress with crop-forage-livestock	A new project 'Integrated crop and dairy systems in Tibet Autonomous Region, PR China' designed and implemented to build on earlier ACIAR and other donor work in this area.
Useful genetic diversity for agronomically useful characteristics such as frost tolerance and disease resistance identified in Chinese pea or faba bean germplasm	In peas, tolerance to salinity and frost, high yielding ability under low rainfall and new sources of resistance to Bean Leaf Roll Virus (BLRV) and Seed-borne Mosaic Virus were identified. Faba bean germplasm from China provided source of resistances to Aschochyta blight and to BLRV and frost tolerance.
Evidence of utilisation of the results of economic, trade and policy-related research by Chinese Government policy makers	Financial and socio-economic assessment of the key 'Grain for Green' Program undertaken to examine incentives for farmers together with recommendations on the policies best able to deliver sustainable agricultural systems. Results of work on 'achieving food security in China: Implications of WTO accession' published in June 2008. Key policy collaborators examined trade and policy options to improve food security and determine the costs of alternative strategies.
At least 40 per cent of all new projects designed to have components leading to significant farmer or policy impacts within five years of completion	Two of the four new China projects ('Improving the efficiency of land use change policy' and 'Integrated crop and dairy systems in Tibet Autonomous Region') designed to have significant impacts within five years of completion.

6.1 Position

Over the last decade the focus of ACIAR's program has shifted towards a stronger, but not exclusive, focus on western China. This concentration on a geographic zone has been further limited largely to north-western China to focus limited funds and to address the major challenges of low farm incomes and significant land degradation in that part of the country. In this context an emphasis on soil and water management has emerged with agreement from Chinese partners as an important component of current and future research partnerships. This emphasis is combined with policy-research interventions designed to analyse and develop policy options to enable the application of well-designed environmental policy frameworks and associated rural adjustment, domestic regulation reform and trade liberalisation activities.

In view of China's current status as an emerging economy and its well-resourced National Agricultural Research System, ACIAR is increasingly requiring a shared-cost arrangement for collaborative projects. This mutual funding also extends to Australian research partners in cases where Australian benefits are also apparent. This current approach is in line with Australia's wider cooperation and aid programs in China. Australia's engagement with China has largely shifted away from discrete poverty-reduction activities towards the sharing of research and wider endeavours, high-level capacity building and policy-development partnerships.

6.2 Achievements

Subprogram 1: Increased water productivity of agriculture in north-western China

Pollution caused by dust remains a significant problem in north-east China. The problem arises from dust storms that come from the north-west pushed by prevailing westerly winds. Responding to this, the Chinese Government has implemented the Grain for Green Program (GFGP) offering farmers incentives to establish trees and perennial pastures. A project undertook some elements of **a cost–benefit analysis of the GFGP Program**. It addressed the priority issue of quantifying its ecological impacts, identified key areas for further research, and helped improve decision-making in the GFGP policy context. The researchers developed a model to simulate the natural hydrological processes in the Yellow River Basin from 1956 to 2000 and from this they determined that the GFGP had a relatively small potential impact on flood reductions in the Yellow River Basin. The researchers calculated an economic benefit from flood reductions of RMB362 million, a small amount compared with the total investment of around RMB65.5 billion in the region under the GFGP. Based on these findings, the potential economic benefits from flood reductions (due to reduced runoff under the Program) will be offset by the potential economic losses from lower agricultural production (RMB667 million) with reduced run-off under the program. A new project has commenced to examine alternative policy options to improve the cost-effectiveness of the various land use change programs that the Chinese Government currently finances.

In China and Australia, **large-scale revegetation using perennial plants** (grasses, shrubs and trees) is currently under way, and more is planned. The principal reason for revegetating the hilly parts of the Loess Plateau region of western China is to reduce soil erosion and thus improve water quality of the Yellow River. However, in both countries the impacts of large-scale revegetation on broad-scale hydrology are poorly understood. A project has developed a bilingual computer based simulation tool called ReVegIH (Re-Vegetation Impacts on Hydrology) that supplies terrestrial land-use managers (both forestry and agriculture) with suitability assessments of 38 perennial tree and shrub species, and identifies priority and target areas where revegetation activities should occur. It also enables them to assess the changes in water use that will result from revegetation activities.

In Sichuan province, extreme site degradation and the harsh, dry climate on much of the upper Yangtze catchment has made it difficult to re-establish the natural forest and native species after site degradation. Therefore Chinese forest scientists have tested a range of **exotic tree species for their suitability as protection forests**. *Pinus radiata*, a conifer widely used in Australia in

commercial plantations, holds promise, and a project has deployed Australian experts to work alongside Chinese scientists to test and introduce a better range of *P. radiata* germplasm to the catchment. They assessed the biological risks of establishing the species in such a new environment, and developed nursery, field and data management technologies to support the large expansion of plantings. A major task was to integrate information on site and climate in south-west China in general and in the dry river valley area in particular with knowledge on growth performance of *P. radiata* elsewhere in the world. This combination is enabling the team to identify suitable areas for environmental plantings of *P. radiata.*

Efforts have gone towards **increasing the productivity of cool season pulses** in rainfed agricultural systems of China and Australia. China provided Australia with a geographic pea core collection of 298 accessions, plus new collections of 95 faba bean and 93 pea landraces. In both China and Australia the imported germplasm continues to be assessed and used in the respective breeding programs. In peas, tolerance to salinity and frost, high yielding ability under low rainfall and new sources of resistance to Bean Leaf Roll Virus (BLRV) and Seed-borne Mosaic Virus were identified. Faba bean germplasm from China provided a source of resistances to Aschochyta blight and to BLRV and frost tolerance.

Permanent raised beds (PRBs) have been promoted through ACIAR research to minimise the effects of waterlogging, reduce irrigation water and improve the biological and physical health of the soils—all to increase productivity of crops. But design criteria for PRBs, in terms of infiltration and drainage, are not well developed and have frequently come about in relation to machinery specifications. Other concerns are correct fertiliser placement for nutrient and solute management, and minimisation of salt build-up. A project in China, India, Pakistan and Indonesia sought to underpin existing ACIAR project work and develop criteria for optimum bed design. Scientists determined that the main advantages of PRBs were good utilisation of water and fertilisers when bed configuration is correct, and much better aeration for all soils (especially clays) following irrigation. The main disadvantages for permanent raised beds were salt build-up in the centre of beds and leaching of nutrients and agro-chemicals to the groundwater. Other issues needing further scrutiny were bed width and uniform wetting of soil throughout the bed.

ACIAR has invested in **conservation agriculture** in the water-stressed Hexi Corridor in Gansu, using permanent raised beds in irrigated cropping. Key constraints are the lack of appropriate machinery and competition for crop residues. A second generation powered disc no-till planter and a tractor-mounted wheat harvester are among the machinery being tested. Comparative performance of irrigated spring wheat in permanent raised beds, fresh raised beds, zero till-control traffic and conventional tillage was assessed. Crop emergence, yield and applied irrigation water at three demonstration sites followed similar patterns to those found at the Research Station. This indicates that conservation agriculture can be implemented in this region without loss of yield, and with considerable gains in natural resource conservation, provided that the operational capabilities of the prototype machinery continue to improve.

An **evaluation of opportunities and constraints for R&D investment into increasing water productivity** and agriculture in north-west China has been completed. The project has scoped the development, promotion and adoption of practical and low-cost technologies of rain water harvesting and in-field soil water conservation for the dryland farming systems of Gansu and Shanxi provinces. The project has identified a range of technical, institutional and coordination issues which warrant attention for the future and will be jointly considered with Chinese partners.

Subprogram 2: Improved agricultural productivity in Tibet Autonomous Region

In efforts to improve **dairying in Tibet**, scientists conducted a study on 36 smallholder family farms in four regions – Lhasa, Shigatse, Bailang and Naidong. The project established benchmark data on diet composition, milk production, reproduction parameters, and rates of survival and growth – all previously unknown to the Tibetan dairy industry. The scientists found that current feeding systems relying heavily on cereal straw did not allow full expression of genetic potential in the animals, and this constrained farm and industry production. Further work investigated sources of high quality green feed which are necessary to formulate annual feed budgets, and also evaluated suitable protein supplements.

Subprogram 3: Implications of Chinese trade developments for smallholders

Concern has grown in China that technical regulations such as **sanitary and phytosanitary standards** are increasingly being used to discriminate against some of its exports. This is especially in the European Union, Japan and the United States where China has the highest stakes but also encounters the most barriers. Moreover, because of the difficulty of legally challenging these standards, it is often considered more practical to meet these foreign standards. Although China has enacted many laws and regulations on food and agricultural production, many problems still exist in its food safety regulatory system, and a project involving the International Food Policy Research Institute has undertaken an economic analysis of technical barriers limiting agricultural trade of China. It is also helping to build capacity in both the public and the private sectors to help China move toward better food safety status and create more trade opportunities.

A project to **improve postharvest practices within the vegetable industry** in the Beijing district has been extended to maximise the uptake of results by lifting food safety and reducing spoilage risks. Activities focus on evaluating the vegetable supply chain from a food safety and product quality perspective and identifying the needs and priorities for process improvement. The project team is using these evaluations as the basis for drawing up guidelines for production of safe, high quality vegetables. The team is also receiving help from tertiary students to investigate the potential for ultrasonic washing of pak choi, carrot, spinach and tomato which could reduce spoilage and lower the risks of contamination.

In both China and Australia, fruit rots caused by *Rhizopus*, *Alternaria, Geotrichum* and *Fusarium* fungi are the **major diseases causing postharvest losses in melons**. New options are needed to reduce reliance on fungicides and maintain quality during transport and marketing. A project has studied how to protect melons from postharvest disease, either by boosting natural defence mechanisms or by better treatments to maintain quality during transport to distant retail markets in China and Australia. In one trial of melon fruit a postharvest dip for one minute in 30 parts per million iodine solution at 55°C provided excellent postharvest disease control, equivalent to that achieved by conventional fungicides.

ACIAR has published the results of a recent study by researchers in the Crawford School of Economics at the Australian National University and the China Centre for Economic Research at Peking University. This report summarises the results of an analysis of the World Trade Organisation (WTO) accession for China's agricultural sector. Major findings of the project are that there should be a clear welfare gain from WTO trade liberalisation for the Chinese economy as a whole. However, there will be some sectors in agriculture and in other parts of the economy that will be losers (including land-intensive agricultural industries such as grains). Labour-intensive agricultural activities such as horticultural production and agricultural processing will gain most. The study entitled **Achieving food security in China: implications of WTO accession** provides important information to help address key policy reform decisions in China, including the economic costs of food self-sufficiency policies.

Subprogram 4: China linkages scheme

During the year an Australian industry and research group visited China and met with collaborators in a range of important cold regions which have rice varieties with significant **cold tolerance characteristics**. These have been grown for many years in these regions. A total of 740 of these varieties have been screened for high levels of cold tolerance and the four most promising have been used in Australian breeding activities to transfer the genes to Australian varieties. The project has been extended for an additional year to allow for a final visit by the Chinese collaborators to see some of the Australian research outcomes during the Australian rice growing season and finalise transfer of molecular technologies. This year the lack of an Australian rice crop inhibited this visit.

6.3 Projects concluded in 2006-07

ADP/2002/021: Sustainable land use change in the north west provinces of China

Summary

Pollution caused by dust has been, and remains, a significant problem in northeast China. Dust storms, pushed by prevailing westerly winds, begin in China's western provinces, from where the dust blows eastwards, resulting in air pollution to cities, most notably Beijing, and even reaching Korea and Japan. The dust storms have their beginnings in land and water resource degradation in western areas of China, which are also the source of the Yangtze and Yellow Rivers. Estimates put the extent of this degradation at 135 million hectares or approximately 14 per cent of China's land mass. This equates to 30 per cent of total pasture land in China being eroded, desertified or salinised. Of greater concern is that these degraded areas are expanding by 1.3 million hectares a year.

Responding to this, the Chinese Government has implemented the Grain for Green Program (GFGP) offering farmers incentives to establish trees and perennial pastures. Uptake has exceeded expectations, putting the financial viability of this program at risk. So far the Program has not sufficiently answered one key question: what will happen to the farmers in these areas if land use and agricultural practices are not sustainable and profitable? Developing sustainable land use requires farmers to earn an income in the short- and long-term. Short-term income assistance is on offer through the program, but this will only last five years and there are signs that this may be an insufficient period of time to establish sustainable industries. The challenge is to develop land use practices that address degradation and ensure agriculture can continue sustainably well into the future.

This project facilitated the development of policies that will ensure changes in land use management in China's northwest provinces that are sustainable in the long term (defined in terms of the financial viability of farming communities, social acceptability and environmental impacts).

Project information

Overseas Collaborating Countries: China

Commissioned Organisation: Australian National University, National Centre for Development Studies, Australia

Project Leader

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Collaborating Institutions

- China National Forestry Economics and Development Research Centre, China

Project Budget: $499,217

Project Duration: 01/01/2003 to 30/09/2007 (Project extended from 01/01/2006 to 30/09/2007)

ACIAR Research Program Manager: Dr Simon Hearn

Project outcomes

The project focused on elements of a cost-benefit analysis of the GFGP Program. However, due to the limitation of time available for the initial project, the impact of the GFGP on watershed protection, especially on flood mitigation, was not quantified and evaluated. The lack of information on the flood mitigation impact of the GFGP and the associated economic benefits so derived constrained the comprehensive assessment of the Program.

Thus the extension phase of the project aimed to fill this information gap through an analysis of the flood mitigation effect of the GFGP in the Yellow River Basin. In this extension, the researchers developed a physically-based distributed hydrological model (WEP-L model) to simulate the natural hydrological processes from 1956 to 2000 in the Yellow River Basin. From this they determined that the GFGP had a relatively small potential impact on flood reductions in the Yellow River Basin, with an economic benefit from flood reductions of CNY362 million. Compared to the total investment of around CNY65.5 billion in the region under the GFGP, these benefits are small. Based on these findings, the potential economic benefits from flood reductions will be offset by the potential economic losses from lower agricultural production (CNY667 million) due to reduced runoff under the Program.

The research contributed to the knowledge base of current research work on the

GFGP. It addressed the priority issue around the implementation of the GFGP which is the quantification of its ecological impacts, identified key areas for further research, and helped improve decision-making in the GFGP policy context. The work also has implications for the ranking of the management options (either structural or non-structural) to mitigate flood disasters in the Yellow River Basin.

Two other tasks undertaken during the extension phase were the compiling of a book based on the project research reports and scoping of a new research report as part of continuing the collaboration between ANU and the State Forestry Administration in China.

ADP/2004/044: Economic analysis of technical barriers limiting agricultural trade of China

Summary

It is widely recognised that rising sanitary and phytosanitary (SPS) standards have created numerous obstacles to the international exchange of agricultural commodities. The issue is of particular importance for developing countries as they seek to exploit their comparative advantage and expand their exports of labour-intensive, high-value-added agricultural products to the more lucrative developed-country markets. Agricultural exporters in developing countries are often required to meet stringent developed-country SPS standards. Not only are these standards much higher than international standards and those prevailing in developing countries, but they are also subject to frequent upward revisions.

China is a large agricultural producer and exporter. As China's agricultural trade continues to increase, the country has experienced more challenges in meeting the SPS standards set by its trade partners. While many of the SPS standards are legitimate and necessary for protecting human, animal, and plant health, others are considered to be disguised forms of protection. Concern in China has grown that technical regulations such as the SPS standards are increasingly being used to discriminate against some of its exports. The European Union (EU), Japan, and the United States are the three markets in which China has the highest stakes but also encountered the most SPS barriers.

Legitimate and necessary standards of importing countries need to be met by exporters. Moreover, because of the difficulty of challenging questionable foreign SPS barriers, it is often considered more practical to meet these foreign standards. To this end, China has enacted many laws and regulations on food and agricultural production. Despite efforts, many problems still exist in China's food safety regulatory system that need to be resolved.

The first objective was to identify technical barriers for which strategies can be developed to expand trade opportunities. The second component was to provide in-depth analysis, integrating risk-assessment and economic information necessary to make effective arguments for modification or elimination of selected barriers.

Project information

Overseas Collaborating Countries:
China

Commissioned Organisation:
International Food Policy Research Institute, USA

Project Leader

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Collaborating Institutions

- Australian National University, Research School of Pacific and Asian Studies, Australia
- Renmin University of China, Department of Agricultural Economics, China

Project Budget: $175,921

Project Duration: 01/07/2005 to 31/12/2007 (Project extended from 01/01/2007 to 31/12/2007)

ACIAR Research Program Manager: Dr Simon Hearn

Project outcomes

An inventory was compiled, describing the technical barriers facing agricultural exports from China that may be alleviated by changes of regulations or by adoption by exporting firms of new technologies or compliance procedures, and also outlining the food regulatory systems of China. The basic methodology proposed for the study was specified conceptually as an economic model and an analysis completed for specific cases of Chinese exports.

The research team found that domestic food regulations were usually not consistent with or less restrictive than standards in developed-country export markets. Second, there was little coordination among the various government ministries and agencies when they establish agricultural standards and food safety controls. Third, there was a lack of technical, institutional, and managerial capacity to control and ensure compliance, thus making the regulations and standards ineffective. Small-scale production, aggravating environmental conditions and

pervasive rent-seeking activities among Chinese bureaucrats all added significantly to the current food and product safety problems.

An analysis was initiated to assess the impacts of existing and potential North American SPS regulations on the importation of fresh apples from China. Expanding apple export opportunities has been a high priority of Chinese agricultural trade authorities. The history of recent regulatory decisions concerning apple and pear exports from China, and subsequent trade, was reviewed and analysed with a focus on the United States, Canada and Australia. Field research was undertaken to further understand the export requirements and procedures for Chinese apples to various countries. Several papers presenting the basic methodology and related empirical application were presented at international conferences and finalised for publication.

The team recommended that capacity-building in both the public and the private sectors would help China move toward better food safety status and create more trade opportunities. The private sector, including the farm sector, has the main responsibility for producing and selling safe food. Attracting more foreign direct investment (FDI) and establishing Hazard Analysis and Critical Control Point (HACCP) systems and coordinated supply chain management in agriculture should be the main focus. The government, however, sets the framework within which the private sector operates, thus the role of the public sector in organising public services and in promoting and monitoring food safety should be emphasised.

ADP/2004/045: Exploring alternative futures for agricultural knowledge, science and technology (KST)

Summary

The means by which agricultural knowledge, science and technology (KST) reach end-users, particularly farmers, remain poorly understood. While introduction of technologies has led to a variety of improvements and science continues to deliver new knowledge, some innovations likely to help many farmers, fishers and others have yet to reap benefits.

The gap between the developed and developing worlds can, in part, be narrowed by extending agricultural productivity improvements to poor farmers. But in many developing countries the means of increasing production have failed to reach poor farmers, when KST is not delivered in a suitable format. An increasing level of uncertainty stemming from a variety of factors – changing socio-political environments, shifts in public and private investment, population and economic growth and changes in avenues or pathways to adoption – mean future delivery of KST will need to be well understood.

This project undertook research to develop alternative pathways to agricultural KST adoption and cater to likely future trends. Researchers examined the implications of these on policy options and investment strategies including economy-wide trade and subsidy policies. Descriptive narratives to support these scenarios were used and models of these scenarios were developed. These actions were undertaken in close collaboration with the two-year International Assessment of Agricultural Science and Technology for Development (IAASTD) initiative.

Project information

Overseas Collaborating Countries: China, India

Commissioned Organisation: International Food Policy Research Institute, USA

Project Leader

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Collaborating Institutions

- Australian Bureau for Agricultural and Resource Economics, Australia
- Center for Chinese Agricultural Policy, China
- World Bank, USA
- National Council of Applied Economic Research, India

Project Budget: $590,209

Project Duration: 01/06/2005 to 30/06/2008

ACIAR Research Program Manager: Dr Simon Hearn

Project outcomes

Although this project was designed as a stand-alone ACIAR/IFPRI project (with collaborators from ABARE; Indian NCAER and China CCAP) it was also designated to provide input into the now completed multinational International Assessment of Agricultural Science and Technology for Development (IAASTD) – <www.agassessment.org>. The project successfully provided up-to-date analysis of world food and environmental developments on a global basis, with individual assessments at the China and India levels.

Much of the evidence-based material so generated has been used in the current debate on world food prices, food security and climate change. The subsequent release of the first set of outputs from the IAASTD initiative was very timely, given the debate on rising food prices, underlying causes, and appropriate short-, medium-, and long-term means to address higher food prices and adverse impacts on the poor. This issue is of critical importance to Australian agriculture, given potential positive and adverse impacts for trade of key Australian agricultural commodities as well as impacts from new trade protection policies of some Asian countries for Australia's food imports.

IFPRI has used the results from the alternative KST scenarios in discussions with the Asian Development Bank regarding investment options for agriculture in Asia; and has presented scenario results at several other venues. Research on China as well as global results contributed to the preparation of a policy document *China's Science and Technology Roadmap toward 2050* and policy recommendations

for China's research and development investments in the future.

Key impacts that emerged during the development of Chapter 5 of the IAASTD report, and during the development of the entire global report and summary and synthesis papers include:

1. early write-up about tightening of world food markets and increasing food prices as a result of increased pressure on land and water resources, including from biofuel policies
2. development of alternative scenarios which demonstrate how food prices can be influenced in the medium- to longer-term based on increased investment in agricultural research, irrigation, roads, and complementary rural services (safe water and female secondary schooling)
3. development of a broad list of factors that need to be addressed in addition to these investments, including information and communication technologies, land tenure, and safe biotechnology
4. evidence-based assessment of the role of biotechnology and trade liberalisation, two of the most debated and contentious policy instruments to increase food security for the poor.

CIM/2000/038: Use and improvement of sugarcane germplasm

Summary

The sugarcane industry is large and economically important in southern China, where sugarcane is currently the second most important crop and its relative importance is expected to rise in the future. Sugarcane industries continue to rely heavily on development of new and more productive varieties to maintain industry viability in increasingly competitive world markets. Sugar industries have invested heavily in breeding programs in the past to maintain a steady flow of more productive varieties. However, parent clones within industry breeding programs around the world trace back to the same relatively small number of key ancestors.

This small sample of genetic diversity in breeding programs, combined with an awareness that there are many desirable traits in exotic sugarcane-related germplasm, has led to strong interest in introgression of new sources of germplasm in breeding programs in Australia and China. In China, large-scale collection of sugarcane-related germplasm from the wild, especially from southwest China, occurred during the 1980s and 1990s, and most of this material is now housed in collections. Chinese and Australian sugarcane breeders expect that many of these clones will contain individual traits and genes of commercial value if these could be identified and recombined in other agronomically suitable genetic backgrounds.

This project is providing more productive sugarcane varieties to growers and sugar industries in China and Australia by assessing genetic diversity in sugarcane germplasm collections and using wild germplasm to develop improved sugarcane clones.

Project information

Overseas Collaborating Countries: China

Commissioned Organisation: CSIRO Plant Industry, Australia

Project Leader

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Collaborating Institutions

- Yunnan Sugar Research Institute, China
- Bureau of Sugar Experiment Stations Limited, Australia
- Guangzhou Sugarcane Industry Research Institute, China
- CSR, Australia

Project Budget: $1,411,755

Project Duration: 01/07/2002 to 31/12/2007 (Project extended from 01/07/2007 to 31/12/2007)

ACIAR Research Program Manager: Dr Paul Fox

Project outcomes

Sugarcane is an important crop in both China and Australia. In China, it is of particular importance in the poor and less developed areas of south-west China. For both China and Australia variety improvement is the highest research priority, with a focus on yield improvement and disease control.

Important germplasm related to sugarcane, especially *Erianthus* spp. and *S. spontaneum* grows wild in China. The Chinese government put significant effort into collecting sugarcane related germplasm, much of which is now maintained at the National Nursery for Sugarcane Germplasm Resources by the Yunnan Sugar Research Institute (YSRI). Both Chinese and Australian sugarcane breeders have a mutual interest in using genes of value from these new germplasm materials for commercial sugarcane improvement.

This project developed a collaborative breeding program utilising wild germplasm from China for sugarcane improvement in both China and Australia. Complementary inputs were provided from both Chinese and Australian breeding programs, and both sides shared the outputs (seeds, breeding clones, new knowledge).

The project was largely successful in achieving its objectives. Results from the genetic diversity studies indicated a high level of genetic diversity in both *S. spontaneum* and *Erianthus arundinaceus* in China, and provides a basis for targeted sampling and use of this material in future

breeding efforts. Two hundred and two crosses from a range of *S. spontaneum* and *Erianthus* clones generated viable seeds, and 100 of these crosses have been verified (to date) using DNA markers as producing true hybrids. This result was significant for *Erianthus* spp. providing the first report of verified fertile *Saccharum x Erianthus* hybrids in the world, despite many past efforts. Several case study populations derived from *S. spontaneum* and *Erianthus* were used for Quantiative Trait loci (QTL) mapping. Several apparently important QTL for cane yield were identified from *S. spontaneum*. An approach to apply DNA markers in future introgression breeding in sugarcane is recommended based on the results and experience obtained. Good (R^2>0.6) genetic correlations in performance of families and clones between trials in China and Australia were observed, suggesting mutual benefits from ongoing collaboration between China and Australia via exchange of selection trial results and selected germplasm.

Recommendations are made regarding ways to develop commercial outcomes from the outputs of the project to date. The genetic material generated has been incorporated into sugarcane breeding programs in China and Australia. This material is a source of new parental material for these programs and may have particular value in likely future production systems which obtain value from both sugar and fibre (for energy) components.

CIM/2002/093: Intensifying production of grain and fodder in Central Tibet farming systems

Summary

Agriculture in the central area of Tibet Autonomous Region takes place mainly on the floors and lower slopes of river valleys. Soils are fertile and average rainfall, mostly falling between July and October, sufficient to support cropping. Barley, wheat, rapeseed, faba bean, maize, vegetables, potato and fodder crops are all grown. The high altitude of the cropping zone means growing periods are characterised by high sunshine intensity and large divergence between day and night temperatures. These characteristics require specific management practices for cropping.

Current levels of grain production are close to achieving self-sufficiency but need further improvement, as importing of grain to so remote a region is costly. This shortfall also has implications for livestock production, another very important component of agriculture in Tibet Autonomous Region. Animal rearing provides opportunities for additional cash incomes, but dependence on grassland grazing as the main form of fattening hampers growth rates in comparison to feeding with fodder crops. This poor nutrition remains an impediment to increased growth and limits possible cash returns.

Intensifying overall cropping in both grain and fodder production will result in improvements through the whole system – bringing cereal self-sufficiency closer and improving animal growth to boost incomes.

Project information

Overseas Collaborating Countries: China

Commissioned Organisation: University of Adelaide, Department of Agronomy and Farming Systems, Australia

Project Leader

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Collaborating Institutions

- Tibet Agricultural Research Institute, China

Project Budget: $522,702

Project Duration: 01/01/2004 to 31/12/2007 (Project extended from 01/07/2006 to 31/12/2007)

ACIAR Research Program Manager: Dr Paul Fox

Project outcomes

The project was successful in obtaining information on the natural resource base and current systems for crop and fodder production in Tibet, and in compiling this into a comprehensive review. The researchers concluded that the valleys of central Tibet are highly suitable for the production of high-yielding grain crops, but that the current cropping systems leave significant plant growth resources unutilised. This review now provides a foundation for further agricultural research and development work both locally at Tibet Agricultural Research Institute (TARI) and with international collaborators.

Secondly, two different options were explored to boost fodder production in Tibet without unacceptable impacts on grain production – these were the broadcast-sowing of vetch (*Vicia sativa*) seed into maturing stands of winter wheat, and the inter-row sowing of vetch and lucerne (*Medicago sativa*) into widely sown crops of winter wheat and barley. The broadcast sowing of vetch allowed the production of around 3 tonnes per hectare of vetch in average rainfall years, with minimal impact on grain yield. The inter-row sowing of vetch allowed similar levels of vetch production, but led to grain yield reductions of 16–37%, while inter-row sown crops of lucerne led to grain yield reductions of at least 70–80%. As such, the broadcasting of vetch into maturing winter cereal crops appeared the best intercropping method.

Sole crops of vetch and lucerne produced dry matter yields of 8 and 14 tonnes per hectare, respectively. Over the course of the project zero-till equipment was brought into Tibet for the first time, and preliminary experiments suggest that double crops of vetch, sown using zero-till seeders in the Lhasa district, may also be a viable strategy for fodder production on many farms – yielding, for little extra work, around 5 tonnes per hectare of vetch hay.

At the conclusion of the project in 2007 the project team was able to recommend a number of best-bet strategies for producing fodder in three different agro-climatic areas within Tibet's central cropping zone, and these methods are now ready for testing on farms.

Finally, excellent progress was made throughout the project in the area of capacity building, leading to the establishment at TARI of a strong research facility with the capacity to conduct agronomic research to drive agricultural development in Tibet well into the future.

LPS/2002/104: Increasing milk production from cattle in Tibet

Summary

Dairy products, notably milk and butter, are traditionally important foods in the Tibetan diet. Demand for these products, particularly milk, continues to rise, driven by changing consumption patterns and, secondly, population growth. Local supply has fallen well behind demand, with increasing reliance on imports. Milk production has traditionally relied on yaks grazed in pastoral lands outside central Tibet Autonomous Region. Recently yak numbers have begun to decline, with cow's milk making up much of the production gap. Production in pastoral areas has also declined, with an increased expectation that central Tibet Autonomous Region's crop-livestock zone will make up for this shortfall.

A specialist dairy sector would help boost production by an estimated minimum of 20 per cent. This can be achieved by improved feeds with greater nutritional value being made available to cattle. Livestock are largely fed crop residues (straw) and crop by-products and grazed on grasses and weeds, along with crop regrowth. This is poor nutrition and limits milk production. Improved feeding systems based around the effective utilisation of crop residues and by-products, better silage management practices, information on yearly feed availability and knowledge of responses to different feeds should achieve the 20 per cent boost in dairy production needed to meet supply and establish a specialist dairy sector.

The project major objective was to improve cattle nutrition and thus increase milk production, leading to better income from mixed crop/livestock farms of the Tibet Autonomous Region (TAR).

Project information

Overseas Collaborating Countries: China

Commissioned Organisation: NSW Department of Primary Industries, Australia

Project Leader

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Collaborating Institutions

- Tibet Academy of Agricultural and Animal Sciences, China
- Tibet Livestock Research Institute, China

Project Budget: $452,669

Project Duration: 01/07/2004 to 31/12/2007 (Project extended from 01/07/2007 to 31/12/2007)

ACIAR Research Program Manager: Dr Jon Tanner

Project outcomes

To identify constraints, a benchmark study was undertaken as the major activity of the project. Feed resources were characterised (type and availability) and data were collected to describe milk production and key parameters of reproduction. The most consistent and relevant finding of the benchmark study was the high reliance on cereal straws as the basis of most diets, and this was rarely supplemented sufficiently to provide adequate feed quality in total dietary intake. Associated with the generally poor nutritional status was depressed performance in all production parameters – low milk production (average ~ 5–6 kg/cow/day), low fertility (average 69% calving rate), low birthweights of calves (average 20–25 kg) associated with poor survival rates (average 64%) and followed by low growth rates (average 0.2–0.3 kg/day).

Although inadequate nutrition had been implicated as a major problem prior to this project, the research team gained a firm basis on which strategies for improvement (feed budgeting, forage production, diet composition, etc) could be developed. Apart from providing the benchmark data, the project has had significant immediate impact in promoting awareness of the nutritional scenario restricting current production and the principles to be applied in designing remedial strategies. In this regard, an unexpected outcome of great importance was the potential to influence local policy makers and funding agencies in deciding the best way(s) to improve production and alleviate farm family poverty. It appeared that previous and current decisions were often based on little or inappropriate advice on aspects of animal nutrition and production, and

therefore unlikely to be biologically or economically effective.

The feedback suggests that this project has already had considerable impact in this direction within a short time frame, a significant benefit from the ACIAR investment.

The project built on the local capacity to improve agricultural production by improving the skills of the scientists and field staff and provision of infrastructure. The upgrading of capacity for feed quality evaluation (including staff training and expansion of techniques) is vital for future research, as animal nutrition is without doubt the most important immediate area to be addressed in removing constraints to production. The animal house built at TLRI with ACIAR and local funds is the first and only facility of its kind in Tibet and of a global standard for conducting nutrition experiments. This will be pivotal to the key research required to evaluate feed quality, animal responses to varying feed regimes, examining responses of different genotypes and many other components required in the process of developing efficient and sustainable feeding and production systems. The facility will be available for use in many other projects and thus is a major asset for Tibetan animal research into the future.

Following the external review of the project, it was recommended that ACIAR fund a further project to build on the outcomes here, as well as those of the contemporary ACIAR agronomy project (CIM/2002/093), in a systems approach to improving livestock and agronomic production. The follow-on project (LPS/2006/119 – *Integrated crop and dairy systems in Tibet Autonomous Region, PR China*) commenced in April 2008.

LWR/2005/059: Modelling water and solute processes and scenarios for optimisation of permanent raised bed systems in China, India, Pakistan and Indonesia

Summary

Permanent raised beds have been promoted to minimise the effects of waterlogging, reduce irrigation water and improve the biological and physical health of the soils – all for the purpose of increasing productivity of crops. But design criteria for permanent beds, in terms of infiltration and drainage, are not well developed and have frequently come about in relation to machinery specifications. Other concerns are correct fertiliser placement for nutrient and solute management and to minimise risk of build-up of salts. This project underpinned existing ACIAR projects by helping develop criteria for optimising bed design from analytical and numerical modelling of water and solute transport, and designing fertiliser placement strategies to maximise fertiliser usage and minimise leaching into ground water. Researchers also determined the likelihood of salinisation over time in different scenarios.

Project information

Overseas Collaborating Countries: China, India, Indonesia, Pakistan

Commissioned Organisation: CSIRO Land and Water, Australia

Project Leader

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Project Budget: $84,816

Project Duration: 01/04/2006 to 30/09/2007 (Project extended from 01/07/2007 to 30/09/2007)

ACIAR Research Program Manager: Dr Christian Roth

Project outcomes

This report presented the results of simulations of water and solute transport in permanent raised beds (PRBs). As well as a generic research on modelling of raised beds the team undertook four case studies – one each in China, India, Pakistan and Indonesia – related to projects already funded by ACIAR. The work also included assimilation of data, estimation of soil properties, collation of climate data and estimation of crop rooting patterns. Simple models were developed for estimating optimal bed width for wetting by furrow irrigation, and drainage of beds when low permeability soils occur at the base of the beds.

The work highlighted some potential advantages and disadvantages of permanent raised beds and the need for further modelling and experimental work. The main advantages determined for permanent raised beds in this work were:

- Good utilisation of water and fertilizers are possible if bed configuration is correct
- Beds can provide much better aeration for all soils following irrigation, and especially clay soils.

The main disadvantages for permanent raised beds that need further scrutiny were:

- Bed width and wetting of the bed
- Salt build up in the centre of beds
- Leaching of salts and agro-chemicals to the groundwater.

The research team recommended that a combined effort of modelling and experimental work was the best way to move forward with future research on permanent raised beds.

LWR/2006/076: Evaluation of opportunities and constraints for R&D investment into increasing water productivity of agriculture in NW China

Summary

An increase in rainwater use efficiency through innovative technologies can have a significant impact on production in the rainfed farming systems of north-west China and south-western Australia, where shortages of water occur in late spring and early summer. ACIAR contracted a team whose major task was to identify investment priorities and develop project design principles for a coherent and effective cluster of projects to increase the productivity of agricultural water in north-west China.

The ultimate goal is to improve farmer incomes in dryland farming systems of Gansu and Shaanxi provinces in north-west China by developing and promoting the adoption of practical, low-cost technologies of rainwater harvesting and in-field soil water conservation. In south-western Australia researchers examined the potential to reuse fresh water harvested from surface and subsurface drains and then develop technologies for supplemental irrigation of wheat and canola.

Project information

Overseas Collaborating Countries: China

Commissioned Organisation: Agricultural and Agribusiness Consultant, Australia

Project Leader

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Collaborating Institutions

- URS Sustainable Development, Australia
- Chinese Academy of Sciences, China
- Chinese Academy of Agricultural Sciences, China

Project Budget: $122,464

Project Duration: 01/11/2007 to 29/02/2008

ACIAR Research Program Manager: Dr Ian Willett

Project outcomes

The four-person mission followed an internal ACIAR 'Water Use in China' workshop in August 2007, at which key ACIAR Australian co-operators presented progress reports on their current China projects. The mission spent two weeks in China in November/December 2007 and during that time held meetings and discussions with more than 30 agencies, institutions, farmer groups, individual farmers, and various levels of government.

In March/April 2008, the team conducted workshops in Lanzhou and Beijing with stakeholders to discuss an Interim Paper published in late 2007 and then refine its recommendations.

At the end of these two missions to China the team recognised that Gansu Province is facing a major crisis in terms of water supplies for irrigation. China (and Gansu) are already responding to this situation, especially in terms of saving irrigation water by lining distribution canals and commencing water allocation, quota and payment systems. Unfortunately this response has not always been supported with widespread on-the-ground application of existing and proven on-farm water use efficiency (WUE) technologies. However, programs which include government subsidies for technology, such as plastic film for mulching, are being well adopted. There have also been large government-supported programs to collect water in dryland areas for use in greenhouse vegetable production and supplementary crop irrigation.

Pasture management programs in China's north-west focus on the use of deep rooted perennials such as lucerne, as a WUE method and as a source of animal feed. There is also considerable use of trees to replace cropping and grazing on some land types for degradation control, and programs such as 'Grain for Green' are very obvious. However, there is very limited consideration of total watershed water input and output balances which would lead to better allocation of water into its highest value uses.

The team found that ACIAR's program is highly regarded by those stakeholders who are directly involved, but the program is virtually unknown outside this small circle of people. In addition, the R&D findings are being used by few extension officers. ACIAR's project results are rarely incorporated into government programs for the relevant county because appropriate stakeholder linkages have not been well

developed. The team determined that there are many opportunities for future ACIAR-funded research projects to assist the Government of Gansu to improve on-farm WUE. Some of these should be based on existing and known technologies which are ‘sitting on the shelf’ and simply need efficient and effective extension systems for dissemination to irrigation and dryland farmers.

The main project recommendation was for ACIAR to operate a technically directed program in a geographic location (preferably a small catchment) in Gansu Province which was not currently being substantially impacted on by large-scale national, provincial or bilateral aid or development support. This recommendation should result in larger and more multi-disciplinary R,D&E programs for ACIAR to fund, in conjunction with their counterpart stakeholders in Gansu. A bidding process should be used to plan new R,D&E programs which focus on specific catchments in Gansu Province and comply with design criteria that have evolved as a result of the mission’s findings.

PLIA/2006/151: Establishment of beef industries in an additional 10 red soil provinces in China

Summary

ACIAR has supported several large projects to find productive enterprises for smallholder farmers in the degraded Red Soils region of southern central China. The outcomes have been successful selection of plants species for livestock feeding. Now the Jiangxi Agricultural University and Red Soils Research Station are distributing many tonnes of seed and cuttings to smallholder farmers and are making additional plantings in an endeavour to meet the strong demand. Training of extension staff and farmers alike is increasing with support from Chinese funding.

This small R&D project to establish beef industries in an additional 10 red soil provinces in China was recommended as a finalisation linkage activity arising from the earlier research.

Project information

Overseas Collaborating Countries: China

Commissioned Organisation: CSIRO Livestock Industries, Australia

Project Leader

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Project Budget: $46,468

Project Duration: 01/03/2007 to 31/12/2007

ACIAR Research Program Manager: Dr Jeff Davis

Project outcomes

The ACIAR-sponsored project established the basis for a profitable beef industry in two of the 12 provinces that are incorporated within the Red Soils region, viz. Hunan and Jiangxi. This was achieved by defining inventories of potential feedstuffs for both provinces, and then designing appropriate feed year plans based on producing improved forages and developing cattle feeding strategies to accommodate moderate to rapid live weight gains in cattle.

Prior to farmers adopting the forage and feeding management technologies that have been developed in this project, beef production on smallholder farms was only marginally profitable because feeding strategies were largely based on straws and other feedstuffs of low nutritive value and growth rates of cattle were very low.

Outputs from the project included two models. One model matches land area available for forage production, forage yields and cattle feed requirements. It is used to determine the number of cattle a smallholder household can fatten, given the area of land available for forage production and the desired growth rate of the cattle. It also allows the smallholders to determine the land areas sown to summer and cooler season forages so a complete feed year plan can be achieved.

A second economic and resource allocation model provides an assessment of the potential contribution that cattle raising and fattening activities can make to total household income. This model allows the economic optimisation of livestock and cropping activities in a Chinese smallholder mixed farming system

The translation of the scientific outputs to significant on-farm impact has been achieved by close collaboration of Chinese project staff and the Provincial extension agencies. The main impact to date has largely been confined to the two Provinces where feeding trials were conducted and extension activities were undertaken by local Provincial officers. The challenge remained to achieve adoption in the other 10 Red Soils Provinces by demonstrating to senior officers the success that has already been achieved in Jiangxi and Hunan.

Forty senior officials from all Red Soils Provinces attended a workshop in Hunan. Proceedings of the workshop were published in bound volumes and distributed to participants. There was demonstrated interest from four additional Red Soil Provinces (Fujian, Guangxi, Sichuan, Hubei) in adopting the newly introduced forage production and beef feeding technologies. There was strong support for the formation of a Red Soils Research and Extension network to ensure the adoption of appropriate forage and cattle feeding technologies across the region.

The data suggest that this project has already made a major contribution to the establishment of profitable beef production in two provinces of the Red Soils Region of

China. The forage production and cattle feeding technologies that the project developed have now been used by smallholder farmers for 3–4 years. At a later date the project team intends to undertake an evaluation exercise to measure the lasting impacts of the adoption of beef production on the financial well being and quality of life of smallholder households in the region.

PLIA/2006/153: Evaluation of catchment filter pilot study in Shanxi, China

Summary

In Australia, the Land-FILTER (Filtration and Irrigated cropping for Land Treatment and Effluent Reuse) technique was developed and field-tested for treatment and reuse of primary/secondary treated sewage effluent, on soils with impeded drainage. Appropriate management can provide adequate pollutant removal in subsurface drainage water and ensure the system's long-term sustainability. An earlier project (LWR/2002/113) at Datong in Shanxi Province clearly demonstrated the two-dimensional Land-FILTER technology could be modified into the three-dimensional Catchment-FILTER approach for wastewater renovation and reuse in the northern China provinces.

The modification better suited the region's more permeable, freely-draining soils, very cold winter conditions and wet summers which diminish the need for wastewater irrigation. The Shanxi Province wastewater management authorities have now obtained central government funding to install a pilot project of the catchment-FILTER technology, and this new activity is allowing collaboration between the wastewater management authorities and Australian researchers, to ensure the best field application of the FILTER technology in Shanxi.

Project information

Overseas Collaborating Countries: China

Commissioned Organisation: Charles Sturt University, Australia

Project Leader

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Collaborating Institutions

- Department of Water Resources, China

Project Budget: $51,350

Project Duration: 04/06/2007 to 30/06/2008

ACIAR Research Program Manager: Dr Jeff Davis

Project outcomes

Final report not yet submitted by the Project Leader.

7 Impact assessment program

ACIAR has always had a significant investment in impact assessment (IA), which is part of the Policy Linkage and Impact Assessment program (PLIA). The purpose is to provide an important after-the-event dimension to the comprehensive monitoring and evaluation processes ACIAR has had in place for many years. These processes are used to ensure that ACIAR's funds are used to support priority issues and are undertaken so that objectives are achieved efficiently and effective impacts result.

The IA functions include an important accountability role in providing key stakeholders with a clear measure of the returns on the funds ACIAR invests. ACIAR continues to expand the measures of these returns to include quantification of all 'economic' impacts, that is, financial, environmental, social and capacity building/stock of knowledge. In addition the assessments are increasingly providing a basis for improving the research selection process by identifying lessons learnt from past activities and feeding them into the project development and selection process.

Emphasis is also placed on developing collaborative links with partner countries, Australian and international groups undertaking similar activities to enhance ACIAR's effectiveness in this area. These collaborative links help improve the accuracy of the information used in assessing the impacts of the research and also the effectiveness of the methodology used to quantify the returns on investment.

ACIAR currently undertakes two types of impact assessment; adoption studies and detailed full benefit-cost impact assessment studies. Adoption studies are undertaken three to four years after a project has been completed and they involve the project leader reviewing the level of adoption of project outcomes, as well as the impact on the communities. Impact assessment studies are done by external reviews and they measure economic growth and environmental, social and capacity-building impacts. They are usually done on a suite of related projects to look at the full impact of ACIAR-funded research.

7.1 Impact assessments undertaken in 2007-08

In 2007-08 nine impact assessment studies were undertaken. Seven were finalised and reports published. The other two are being finalised and will be published in early 2008–09. These results demonstrate that the returns on ACIAR and its partners investments are very high. In total the programs and projects assessed have been shown to have returned a net present value of $2.3 billion in welfare gains from the investments. Some of the investments have shown extremely high rates of return with benefit to cost ratios of up to 250:1 and internal rates of return up to 210 per cent.

We have continued to focus on quantification of capacity building impacts. The study on pig improvement in Vietnam specifically focused on this and continued to demonstrate that this is an important aspect of ACIAR's partnership modality. Two dimensions were again identified. The first is the contribution the capacity building makes to enhancing the impact of the technology specifically developed by the research. The second is the longer term impact the enhanced capacity has on future activities and investments; this was again shown to be a significant source of welfare gains from the R&D. Several other studies considered the capacity building impacts but it was found that if the elapsed time since completion of the project had not been long enough, it was too early to reliably identify the subsequent impacts.

Breeding and feeding pigs in Vietnam: assessment of capacity building and an update on impacts

The impact assessment (IA) found that the net present value of the benefits to all funding is $1,988.3 million with $1,105.5 million attributable to the original ACIAR and partner funding and the balance to the other funders of subsequent development activities. The rates of return to this ACIAR activity were estimated as a benefit to cost ratio of 257:1 and an internal rate of return of 74 per cent. The study also shows that $422.7 million of the total $1,988.3 million benefits are attributable to the capacity building activities developed in the ACIAR- and partner-funded activities.

The impact of increasing efficiency and productivity of ruminants in

India by use of protected-nutrient technology

The dairy sector is an important part of agriculture in India. Productivity of dairy cows is recognised as being relatively low by international standards and feed quality and availability was identified as an important contributor. The adaptation of known protected nutrient technology from Australia to different feeds available in India was the focus of the ruminants research. The assessment estimates that the net present value of the welfare gains from the impact is $232.1 million. The returns on the R&D investment are estimated as a benefit to cost ratio of 123:1 and an internal rate of return of 44 per cent.

ACIAR fisheries projects in Indonesia: review and impact assessment

This study provides a review of all ACIAR-funded fisheries research in Indonesia and two detailed impact assessment studies – tuna capture fisheries and shrimp aquaculture. For captured fisheries management, the assessment shows that the capacity developed in early projects contributed significantly to Indonesia becoming a member of a regional fisheries management group and to the associated access to high value markets for southern blue fin tuna caught in Indonesian waters. The estimated net present value of the welfare gains from the investments required to achieve Indonesian membership of this regional group is $1,100 million. The share of these returns attributable to the ACIAR supported component is assessed to be $168 million, indicating a return on ACIAR- and partner-invested funds of a benefit to cost ratio of 179:1 and an internal rate of return of 210 per cent.

For shrimp aquaculture the research developed effective technologies for pond remediation. The net present value of the welfare gains from the impact is estimated to be $547 million with a benefit to cost ratio of 52:1 and internal rate of return of 26 per cent.

A review and impact assessment of ACIAR's fruit-fly research partnerships, 1984–2007

Fruit flies are a major pest in Australia and most of ACIAR's partner countries. ACIAR has invested in several areas of fruit fly research for over 20 years. The review and impact assessment of this major research program found a complex story with a diversity of potential impacts and strong demands on institutional and policy systems to be able to capitalise on research results. The return from the substantial investment by ACIAR and its partner countries is significant with a net present value of $208.1 million, a benefit to cost ratio of 5:1 and an internal rate of return of 33 per cent. However, these benefits are distributed in a complex manner between the 15 partner countries and Australia.

7.2 Planned impact assessments in 2008–09

- At least five impact assessment studies (IASs) of completed projects will be published. Measurement of economic growth, environmental, social and capacity-building impacts will be incorporated where identified as important and possible.
- Review and publish the 2008–09 project leader adoption studies for the set of large projects concluded in 2003–04.
- Review the application and impact of ACIAR forages research activities and determine the implications of the impacts for future research in this area.
- Undertake an assessment of at least one program of research for at least one significant partner country.
- Collaborate with the Standing Panel on Impact Assessment (SPIA) of the Consultative Group for International Agricultural Research (CGIAR) to undertake a detailed study of the impact of CGIAR research on ACIAR's mandate regions. This study will make use of past CG Centre impact assessment studies and/or undertake some new impact assessments.
- Continue to add to a small database of all past impact assessment studies and start a process of Project Impact Assessment Summaries (PIAS) studies to provide a basis for and complement to the Adoption and Impact Assessment Studies.

Project-specific

Publish five assessments of the impacts of completed projects in 2008–09. Measurement of economic growth,

environmental, social and capacity-building impacts will be incorporated where identified as important and possible. This year we will continue the process of selecting some projects for assessment using a stratified sampling process. The stratification of projects will be based on a range of considerations such as program area, geographic location, types of research and sector of the economy.

Review and publish the 2008–09 project leader adoption studies for the set of large projects concluded in 2003–04.

Capacity building

Develop closer links with partner-country impact assessment groups to enhance estimation of technology adoption levels in future assessments. Training for partner-country impact assessment groups will also be included where appropriate. This training will include collaboration with the ATSE Crawford Fund.

Develop collaboration with international CG centres in impact assessment activities, particularly of projects jointly funded through ACIAR.

Provide feedback on the implications of impact assessment studies for research project development and management within ACIAR, through 'lessons learnt' style meetings with all staff.

Enhance the clarification and estimation of the outcomes of new projects, by assisting project research groups during peer review of their proposals and by including impact analysis in the project design. In particular, summaries of the implications of impact studies will be provided to meetings of these groups.

Thematic studies

Review the application and impact of ACIAR forages research activities and determine implications of the impacts for future research in this area.

Undertake an assessment of at least one program of research for at least one significant partner country.

Continue to develop a database of all past impact assessment studies and start a process of project impact assessment summaries (PIAS) studies, to provide a basis for and complement adoption and impact assessment studies.

Work closely with the Office of Development Effectiveness (ODE) to ensure ACIAR's impact assessment work maintains close links with ODE's activities.

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9 Appendix 2: ACIAR Publications

This is a list of ACIAR publications produced in 2007–08. Print copies are available by emailing comms@aciar.gov.au, or electronic versions may be downloaded from ACIAR's website <www.aciar.gov.au>.

Monographs	
119b	*Guidelines for surveillance for plant pests in Asia and the Pacific [Vietnamese translation].* Teresa McMaugh, Vietnamese translation by Phan Thuy Hien, 2008, 192 pp.
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128	*Quality management of fresh produce from the highlands of Papua New Guinea: a postharvest manual*. Vincent Haguluha and Ernest Natera, ed. by John Spriggs, 2007, 86 pp.
129	*Diagnostic manual for plant diseases in Vietnam.* Lester W. Burgess, Timothy E. Knight, Len Tesoriero and Hien Thuy Phan, 2008, 210 pp.
130	*Soil Constraints and Management Package (SCAMP): guidelines for sustainable management of tropical upland soils*. P.W. Moody and P.T. Cong, 2008, 85 pp.
131	*Integrated pest and disease management for sustainable cocoa production: a training manual for farmers and extension workers.* John Konam, Yak Namaliu, Rosalie Daniel and David Guest, 2008, 36 pp.
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68	*Economic potential of land-use change and forestry for carbon sequestration and poverty reduction*. Oscar Cacho, Robyn Hean, Kirsfianti Ginoga, Russell Wise, Deden Djaenudin, Mega Lugina, Yuliana Wulan, Subarudi, Betha Lusiana, Meine van Noordwijk and Ni'matul Khasanah, 2008, 98 pp.
69	*Achieving food security in China: implications of World Trade Organization accession*. Chunlai Chen and Ron Duncan, 2008, 67 pp.

Working Papers	
59a	*A survey of the mineral status of livestock in the Tibet Autonomous Region of China [Mandarin translation].* Nyima Tashi, Luo Xugang, Yu Shunxiang and Geoff Judson, 2008, 36 pp.

Impact Assessment Series Reports	
52	*Breeding and feeding pigs in Vietnam: assessment of capacity building and an update on impacts.* Hayden Fisher and Jenny Gordon, 2008, 56 pp.
53	*The impact of increasing efficiency and productivity of ruminants in India by the use of protected-nutrient technology.* Michael Monck and David Pearce, 2008, 32 pp.
54	*Impact of improved management of white grubs in peanut-cropping systems in India.* Michael Monck and David Pearce, 2008, 34 pp.
55	*ACIAR fisheries projects in Indonesia: review and impact assessment.* G. Martin, 2008, 75 pp.
56	*A review and impact assessment of ACIAR's fruit-fly research partnerships,* 1984–*2007*. Bob Lindner and Paul McLeod, 2008, 164 pp.
57	*Management of internal parasites in goats in the Philippines.* N.D Montes, N.R. Zapata Jr, M. Alo and J.D. Mullen, 2008,44 pp.
58	*Guidelines for assessing the impacts of ACIAR's research activities.* Jeff Davis, Jenny Gordon, David Pearce and Debbie Templeton, 2008, 36 pp.

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2007-07 [PLIA/2005/148]	*Papua New Guinea coffee and cocoa policy linkages.* Derek Quirke, Matthew Harding, Bob Warner, 2007, 74 pp. http://www.aciar.gov.au/node/3940
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2007-09 [PLIA/2006/180]	*Happy Seeder policy linkage scoping study.* P. Pagan, R.P. Singh, 2007, 33 pp. http://www.aciar.gov.au/node/5019
2007-10 [SMAR/2007/042]	*Vegetable value chains in eastern Indonesia—a focus on chilli.* B. White, P. Morey, R. Natawidjaja and W. Morgan, 2007, 73 pp. http://www.aciar.gov.au/node/3943
2007-11 [SMAR/2007/200 – Part 1]	*Securing the profitability of the Flores coffee industry.* Tony Marsh, Jeff Neilson and Surip Mawardi, 2007, 23 pp. http://www.aciar.gov.au/node/3942
2007-12 [SMAR/2007/200 – Part 2]	*Securing the profitability of the Toraja coffee industry.* Tony Marsh and Jeff Neilson, 2007, 38 pp. http://www.aciar.gov.au/node/3942
2007-13 [SMAR/2007/209]	*The citrus market in Indonesia— an eastern Indonesian perspective.* Phillip Morey, 2007, 44 pp. http://www.aciar.gov.au/node/3944
2007-14 [PLIA/2006/012 Part 1]	*Livestock health and vaccines in Cambodia and Laos.* Matthew Harding, Robert Warner, David Kennedy, 2007, 119 pp. http://www.aciar.gov.au/node/5195

2007-15 [PLIA/2006/012 Part 2]	*Cattle and buffalo in Cambodia and Laos: the economic and policy environment for smallholders.* Matthew Harding, Derek Quirke, Robert Warner, 2007, 98 pp. http://www.aciar.gov.au/node/5196
2007-16 [ASEM/2001/037]	*Improving the marketing system for fresh produce of the highlands of PNG.* John Spriggs and Barbara Chambers, 2007, 67 pp. http://www.aciar.gov.au/node/8457
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