

INDIA

Key statistics

GDP per capita (US\$) ^a	1,061
Population (million) ^a	1,215
Funding	\$m
2009–10 actual	2.92
2010–11 budget allocation	3.20
2011–12 budget estimate	4.60

^a data from 2009 & 2010 <<http://unstats.un.org/unsd/demographic/products/socind/>>

ACIAR CEO Nick Austin (centre) visiting Nemmani in Andhra Pradesh during India Week in February 2011, with members of various local NGOs, Watershed Support Services and Activities Network (WASSAN) and CSIRO

MEDIUM-TERM STRATEGY

The Indian Government recognises agricultural development as a key mechanism of inclusive growth. The goals of agricultural development in India are: growth in productivity and incomes while maintaining food security; sharing growth, with an equity focus on small and marginal farmers, women, and populations in eastern India and other rainfed areas; and maintaining sustainability of agriculture by concentrating on environmental concerns. Overall, agricultural R&D remains a high priority in India, with a strong focus on poverty reduction.

Australia and India share many of the same agricultural and natural resource management problems, as well as key commodity crops like wheat, resulting in researchable issues of mutual relevance to both countries. ACIAR has supported a program of collaborative agricultural research with India since 1983. Most ACIAR programs in India consist of bilateral projects, in which Australian research organisations collaborate with one or more Indian research institutions such as the Indian Council of Agricultural Research (ICAR), state agricultural universities, independent research organisations and NGOs. Multilateral programs are delivered in conjunction with the five IARCs that are active in India.

Australia is actively refocusing its development assistance program in India towards increased support for technical exchange in renewable energy, energy efficiency and water resource management, drawing on Australia's experience and scientific expertise.

Australian programs are well aligned with the national objectives of the Indian Government. Areas of possible focus for AusAID include:

- scaling out research results from West Bengal and Jharkhand projects

- conservation agriculture
- promotion of resilience around climate change.

The ICAR–ACIAR partnership held a formal in-country consultation in India during 10–18 February 2011 to consider and define future directions for ACIAR involvement in India.

As a result, ACIAR's medium-term strategy for 2011–16 is centred on joint partnerships with increasing co-investment by ICAR and other partners. The large and well-developed national agricultural research system led by ICAR is a cornerstone of ACIAR's program. The program emphasises collaboration in four areas, or clusters, of Australian and Indian expertise, and in themes in which both India and Australia have strong common interests and in which there is potential for positive impacts at both field and national levels.

The current strategy has the following guiding principles:

- maintaining the current four research clusters of the India–ACIAR program (see below)
- seeking synergies across multiple disciplines from projects in the clusters
- grounding and aligning the program with the strengths of the Indian system, and utilising a long-term approach to guide agricultural research
- undertaking a gradual shift in emphasis to the eastern states where poverty persists.

Key areas of continuing focus include:

- research to improve agricultural water management, particularly in rainfed areas

- sustainable intensification of zero-tillage cropping systems that incorporate pulses
- faster breeding of crops to target, in the case of wheat, product quality aligned with emerging demands for better quality chapattis, bread and biscuits from India's 200-million-strong middle class
- assisting policy development in relation to agricultural adjustment, water management and climate change.

The 10-year outlook is to maintain and enhance the cluster engagements currently underway. These underpinning priorities will guide adjustments as the program evolves. Co-funding of research will remain the norm, with a continued emphasis on capacity building within the partnership. Triangular partnerships with other South Asian nations will be considered—notably Nepal, for which many of the Indian research results are relevant. The medium-term priorities are grouped within four clusters.

Water management cluster

The water management cluster in India is focused on improved water management in the less favourable rainfed areas, in recognition of the fact that these areas were largely bypassed by the green revolution and are relatively poor. Focus areas are:

- planning of small water storage structures in rainfed areas
- demand management, organisation of water users, and technical solutions for improved use of water in small storages in rainfed areas
- consolidated and coordinated presentation of policy recommendations from the projects to policymakers
- exploration on extending the results to eastern India
- implementation and scaling up of the results of the projects through multidisciplinary teams.

Cropping systems cluster

Food security and poverty reduction, coupled with a threatened resource base for food production (water, soils), remain as common resource and crop management problems for India and Australia.

Focus areas are:

- sustainable intensification with diversification of farming systems
- orientation of the approach of farming systems to site-specific crop management for system productivity, water-use efficiency and nutrient-use efficiency
- year-round zero-tillage in rice- and wheat-based systems with integrated tillage–water–nutrient management practices and carbon sequestration

- technologies favouring precision agriculture
- developing and testing of appropriate delivery models in resource-poor and remote areas.

Wheat improvement cluster

The Indo-Australian program on marker-assisted wheat breeding (IAP-MAWB, or IAP) is a co-funded program working on problems of mutual interest. Marker-assisted selection is the hub or delivery mechanism, and the output is better and faster developed wheat germplasm for farmers, with focuses that include:

- tolerance to wheat rust through newly developed genetic markers
- water-use efficiency through root architecture and crop establishment
- tolerance to waterlogging and micronutrient stresses associated with sodic soils
- end-use processing quality, especially for better quality chapattis, bread and biscuits
- wheats with long coleoptiles suitable for zero-tillage.

Agriculture policy cluster

Past ACIAR research to examine the facilitation of efficient agricultural markets in India assessed competition and regulatory reform requirements and policy options for a new framework. The project components include emerging trends in food value chains, application of policy and infrastructure development.

Various options suggested by the recent consultations include:

- a regulation framework to include a transparent review process
- government focus on facilitating efficient input and output markets, with necessary targeted assistance and safeguards for vulnerable groups
- regular monitoring of the overall performance of the farm sector
- application of competition law to food chains
- management of the buffer stock by the Food Corporation of India
- a transition program from currently provided input subsidies to new farm programs, which focus on more-appropriate measures of productivity and on market failures in the agricultural sector.

2011–12 RESEARCH PRIORITIES AND PROJECTS

Water management

Better water management is one of the highest priorities for improving livelihoods in the more marginal rainfed areas of central India. Water harvesting, as part of a broader watershed development agenda to increase water availability, is a key policy initiative of the Indian Government in these areas.

The program comprises closely linked projects to enable a more holistic approach to water resource management.

CIM/2007/120 (multilateral, ICRISAT) Improving post-rainy sorghum varieties to meet the growing grain and fodder demand in India

The project addresses the growing demand for fodder in India through the development of dual-purpose varieties with high grain production and higher quality stover for ruminants.

LWR/2002/100 Water harvesting and better farming systems for benefit of small farmers in watersheds in the East India Plateau

The East Indian Plateau receives a lot of rain but 80% of it falls in the monsoon months between June and September. The project is improving watershed management, including water harvesting, and introducing new cropping systems.

LWR/2006/072 Impacts of meso-scale watershed development (WSD) in Andhra Pradesh (India) and their implications for designing and implementing improved WSD policies and programs.

This project aims to quantify the aggregated impact of watershed interventions on hydrology within and across watersheds at the meso scale. It will integrate and apply the knowledge arising from the project at local, state and national policy levels.

LWR/2006/158 Enhancing institutional performance in water resource development in Andhra Pradesh, India

The project is working to enhance livelihoods in rainfed areas of the Indian Central Plateau by improving the institutional performance of WSD programs. It will recommend rules and coordinating mechanisms for ensuring that the development and extraction of groundwater remain within sustainable limits.

LWR/2007/113 Adaptation of water resource management to climate change in the Krishna Basin, India

This project is assessing the potential impacts of WSD and climate change on the long-term water security for agriculture in the Krishna River Basin, and comparing the findings with forecast impacts and adaptation strategies in the Murray–Darling Basin.

Anton Wasson (left) and Michelle Watt (right) of CSIRO, and Ravish Chatrath (centre), the Directorate of Wheat Research in Karnal, India, examining the field experiments on root traits for greater water-use efficiency



LWR/2008/019 Building capacity of farming communities in Cambodia, Lao PDR, Bangladesh and India to adapt to climate change

This project is building capacity of farming households to enable them to adapt their rice-based cropping systems to accommodate climate variability and change. It will also develop strategies that enable policymakers to deliver more-effective climate adaptation programs relevant to farmer livelihoods and food security.

LWR/2010/015 (proposed) Improved village-scale groundwater recharge and management for agriculture and livelihood development in India

The project will focus on assessing the effectiveness of current rainwater harvesting and groundwater recharge structures and demand management strategies at the village scale.

LWR/2010/082 (proposed) Improving livelihoods with innovative cropping systems on the East India Plateau

The project will build on the successes in adoption achieved by working with NGOs in LWR/2002/100, and on scaling out to expand community impacts.

Cropping systems

The cropping systems research priority adds impact to improved wheat germplasm in two ways. Research is conducted on improved management of rice-wheat cropping systems to increase cereal and oilseed crop yields and improve the efficiencies of water, nutrient and other input use. This research also increases the resilience of cropping systems to climate and other risks, thus stabilising farmers' incomes.

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

Systematic interchange among the three participating countries has enhanced the genetic base for the improvement of oilseed brassicas in each.

CSE/2004/033 Zero-tillage rice establishment and crop weed dynamics in rice and wheat cropping systems in India and Australia

Complementing past projects on the development of no-till conservation practices in wheat production, this project has developed direct-seeded rice practices in Punjab, Haryana and Bihar. Advanced rice lines and integrated weed management practices are also being tested.

Wheat improvement

A set of projects revolves around the development of improved wheat varieties able to cope with biophysical soil constraints such as waterlogging, soil sodicity/salinity and other biotic constraints. A subset of these wheat breeding projects constitute the IAP-MAWB, following the 2007 agreement to strengthen the focus on the application of marker-assisted selection as a tool to achieve greater efficiencies in wheat breeding.

CIM/2005/020 Molecular marker technologies for faster wheat breeding in India

The project has refocused India's considerable capability in DNA-based technologies on wheat cultivar development. It also targets enhanced management of genetic information to increase breeding efficiency in north-western India and provides a data management hub for all projects within the IAP-MAWB.

CIM/2006/071 Indo-Australian project on root and establishment traits for greater water-use efficiency in wheat

New wheat root architecture for better water extraction from the soil, as well as semi-dwarf wheats with long coleoptiles for better emergence and crop establishment, have been introduced to India through the project, extending the IAP-MAWB's reach to central India where rainfed wheat predominates.

CIM/2006/094 Enhancing farm profitability in north-western India and South Australia by improving grain quality of wheat

Wheat fertilisation with emphasis on nitrogen has been researched, with opportunities identified for farmers to achieve price premiums through increased protein. Better nitrogen use has also decreased groundwater pollution, and significant gains from zero-tillage have been identified.

CIM/2006/177 Wheat improvement for waterlogging, salinity and element toxicities in Australia and India

The project focuses on exploiting interactions between micronutrients and soil water status in wheat cultivar development in environments with high levels of soil stress. The two main Indian nodes are at Karnal and Faizabad, the latter facilitating the IAP-MAWB's reach into eastern India.

CIM/2007/083 (proposed) Applying molecular markers to breeding wheat with enhanced processing properties in India and Australia

Diagnostic molecular markers for genes with significant effects on processing quality have been identified and will be used to predict the quality outcomes of potential crosses between available parental wheat stocks in north-western India. Such predictive capacity increases breeding efficiency, and traits beyond industrial quality can be targeted in the longer term.

CIM/2007/084 Molecular markers for broadening the genetic base of stem rust resistance genes effective against strain Ug99

Based in north-western India, the project will enhance stable resistance to stem rust in India, Australia and worldwide. Developing and deploying DNA-based markers enables complex 'bullet-proof' genetic combinations to be assembled.

CIM/2010/048 (proposed, multilateral, ICRISAT) Bioinformatics for breeding: data management and cross prediction

This project aims to expand and support the user base for the International Crop Information System in South Asia.

Agricultural policy

Creating the most appropriate domestic policy environment for reform in the agricultural sector has the potential to deliver major positive impacts. Australia has significant expertise in policy analysis, particularly in assisting India with the implications of its transition from a highly regulated economy to a more-open market economy. The current ACIAR partnership is addressing scope for phased deregulation and market reform options. As India moves towards domestic reform, its capacity to engage in more-open domestic and international markets is expected to increase, with consequent productivity and income opportunities for Indian farmers. In the broader environmental context, agricultural offsets are emerging as a key element of potential future greenhouse gas abatement policy in many countries. In India and Australia there is an increasing interest in policy and program mixes targeted at exploitation of cost-effective abatement schemes as new opportunities for farmers.

ADP/2010/008 (proposed) An investigation of the potential for greenhouse gas offsets in Indian agriculture

This project will assess the economy-wide impacts of agricultural policy reform and the introduction of an agricultural carbon offsets scheme on agricultural productivity, food security, rural incomes, trade and emissions. This includes analysing the scope for cost-effective emission abatement within India's agricultural sector, including case study regions.

Principal regional coordinator

Dr John Dixon

Key program managers

Dr John Dixon, Cropping Systems and Economics
Dr Paul Fox, Crop Improvement and Management
Dr Simon Hearn, Agricultural Development Policy
Dr Andrew Noble, Land and Water Resources

Country manager

Dr Kuhu Chatterjee

KEY PERFORMANCE INDICATORS (2011–12)

- Semi-dwarf wheats with long coleoptiles evaluated under Indian conditions
- The nature of the water stress environments experienced in Rabi sorghum production characterised and classified
- Advanced rice lines and integrated weed management practices tested in Punjab, Haryana and Bihar
- Area of zero-tillage increased
- Harmonisation achieved of Indian cluster of water projects to support the delivery of multiscale strategies and recommendations underpinning a more rational policy approach to watershed development in Andhra Pradesh and rainfed central India
- Fully integrated zero-tillage/direct-seeding technologies scaled out for rice–wheat systems adapted to the different socioeconomic and environmental conditions of the Indo-Gangetic Plain
- Definition of alternative policy and institutional arrangements to deliver agricultural greenhouse gas abatements defined
- In-depth understanding developed of farmers' capacity to adapt to climate change, underpinning the choice of feasible crop, water and nutrient management adaptation options
- New institutional arrangements defined to increase sustainability of groundwater extraction, and cost-benefit analysis completed
- Selected scientists trained in crop modelling using Agricultural Production System Simulator (APSIM-Oryza) and its application to enhance water-use efficiency in rice