India

A$0.8 million
Budgeted funding

8
Bilateral and regional research projects

6
Small projects and activities

Australia and India are strategic partners with strong political, economic and community ties, and these extend to shared values in relation to the challenges and opportunities arising in the Indo-Pacific region. Over the next 20 years, a growing India will need many of Australia's goods and services, including agriculture, education and skills training and healthcare. Australia does not have a bilateral development assistance program with India; however, ACIAR does work with partners in India and South Asia to support programs to facilitate economic growth and improve the livelihoods of the poor and venerable (especially women and girls). Tens of millions of people in India have been lifted out of poverty since the 1990s, but economic growth in the country remains uneven. Australia's engagement with India and its support of India's economic development is guided by *An India Economic Strategy to 2035*, which is available on the DFAT website.

India is the seventh largest country in the world by land area. With more than 1.3 billion people, it is the second most populous country after China, and accounts for 18% of the world's population.

Worth US$2.94 trillion, India is the world's fifth largest economy overtaking the United Kingdom and France. The level of urbanisation in India has increased from 28% to 31% over the past decade, but two-thirds of the population still lives in rural areas. Agricultural land is very scarce, with the average size of landholdings being 1.08 hectares. The proportion of the population that is undernourished is declining.

India is emerging as a major agricultural exporter of several key commodities and is currently the largest exporter of rice globally and the second largest of cotton. Owing to a new agriculture export policy, agricultural exports are anticipated to grow in the future. However, the contribution of the agriculture sector to India's GDP has declined from 18% in 2014–15 to 16% in 2019–20. Regardless, agriculture remains a major source of employment, accounting for about 43% of the total national workforce.

Agricultural production has been increasing by an average of 3.6% per year since 2011, due to improved access to inputs such as fertiliser and seed, irrigation and credit facilities. The sector has also diversified from cereal grains to pulses, fruit, vegetables and livestock products, largely driven by evolving demographics, urbanisation and changing consumer demand patterns. However, the country is still plagued with issues of low market prices, distorted subsidies, lack of storage infrastructure, inefficient use of natural resources and susceptibility to climate change and extreme weather events. The country has approximately 126 million small and marginal farmers with 86% of the total land holdings. Of these, 14% of operational landholders are female.

The Indian Government is focusing efforts largely on increasing the income of farmers, with a target of doubling incomes by 2022–23. An inter-ministerial committee, set up in April 2016, identified seven major sources of growth in the agriculture sector related to increasing crop and livestock productivity, decreasing cost of production, increasing cropping intensity, diversification and the shift to non-farm operations. Several initiatives have been taken to realise the above goal:

- minimum support prices of several kharif and rabi crops increased by 1.5 times of the all-India weighted average cost of production
- Pradhan Mantri Kisan Samman Nidhi (PM-KISAN) Yojana providing INR 6,000 per year to all farmer families across the country in three equal instalments every four months

- formation of Electronic National Agriculture Market (e-Nam), an online trading platform for buyers and sellers without having to share the same geographic location
- formation of 10,000 new farmer producer organisations by 2024
- direct benefit transfer of fertiliser subsidy in the whole country
- creation of a 16-point program to encourage the agriculture sector in the budget 2020–21, which includes creating cold storage facilities, promoting the village storage scheme, creating cold supply chains on trains and aircrafts, promoting horticulture and zero budget natural farming, providing support to two million farmers in setting up stand-alone solar pumps and a further 1.5 million farmers for grid connected pumps.

The Government of India, in its various policies and schemes, has recognised the role of women in agriculture. It advocates for mainstreaming of women's role in agriculture and has highlighted incorporation of gender issues in the agricultural development agenda. Although 30% of budgetary allocations under various schemes have been made for women farmers, fund utilisation under these schemes has declined. Moreover, due to the complex and varied nature of agriculture in India, there has been a trend of defeminisation in certain pockets of the country. Although policy articulation by the government on the rights of women farmers has shifted, there is still a huge knowledge gap and limited resources to implement gender-inclusive agricultural development strategies.

In June 2020, the leaders of both countries participated in the Australia–India Leaders' Virtual Summit. At this meeting, the two Prime Ministers elevated the bilateral Strategic Partnership to a Comprehensive Strategic Partnership. One initiative agreed under the partnership is that India and Australia will boost collaboration on science, technology and research, initially focused on COVID-19 responses. The leaders committed to a new phase of the Australia–India Strategic Research Fund to promote innovative solutions for responding to and treating COVID-19, as well as other jointly determined priorities, to be preceded by a one-off Special COVID-19 Collaboration Round in 2020.

Country priorities

The ACIAR research program with India is delivered totally through a regional collaborative approach involving neighbouring countries with shared issues and opportunities. A report to the Australian Government, *An India Economic Strategy to 2035,* identified agribusiness development as one of the lead sectors of focus for collaboration. Substantial co-investment from India will become a prerequisite to maintain an ongoing program of collaboration in future.

The geographic focus on the eastern regions of India and its neighbours will remain the same, with a thematic focus on:

- management of agricultural water, including rainfed areas in the Eastern Gangetic Plains and coastal zone
- sustainable intensification and diversification of cropping systems with support of conservation agriculture/zero tillage
- breeding of improved varieties of wheat and mungbean
- assisted policy development for farmers' livelihoods and climate change.

Existing collaboration between ACIAR and organisations in India has the potential to evolve into a substantial co-invested partnership providing benefits for both countries. In 2020–21, as part of a partnership refresh and mitigation of COVID-19 pandemic impacts (as highlighted in the new Comprehensive Strategic Partnership between the two countries), we may explore the possibilities of:

- sustainable intensification with a nutrition framework
- diversification into new dry-season crops
- the role of biotechnology (BT chickpea, Omega 3 canola, higher nutritive value feed oil enriched crops (rice and wheat))
- new mechanisation opportunities including farm robotics
- a next phase of mungbean breeding for high yielding varieties
- groundwater management (over- and under-exploitation)
- co-investment and trilateral collaboration.

The International Mungbean Improvement Network has helped realise the potential of mungbean to improve cropping system productivity and livelihoods. Phase 2 of the network commenced in July 2020. ACIAR project: CROP/2019/144.

2020–21 research program

ACIAR supports 14 projects in India, two of which are specific to this country. The remainder are part of regional projects. The projects address our high-level objectives, as outlined in the 10-Year Strategy 2018–2027, as well as specific issues and opportunities identified by ACIAR and partner organisations.

The following sections briefly describe individual ACIAR-supported projects and anticipated outputs in India. The projects are grouped according to research program. Each project description is referenced in a list at the end of this section, which provides the project title and code.

Crops

The Sustainable and Resilient Farming Systems Intensification project is a large collaborative venture between ACIAR, the International Maize and Wheat Improvement Center (CIMMYT) and more than 20 partners from the research, development and educational sectors. The project aims to reduce poverty in the Eastern Gangetic Plains by making smallholder agriculture more productive, profitable and sustainable, while safeguarding the environment and involving women. Dr Brendan Brown of CIMMYT will lead the project in its final year to consolidate capacity development and credible pathways to scale out and support the widespread adoption of conservation agriculture for sustainable intensification methods, designed and validated by the project over the past six years.[1] This project is part of the SDIP, facilitated in the region by the Australian Government (see page 132).

Supporting the Sustainable and Resilient Farming Systems Intensification project, a small research activity led by Dr Neal Menzies of the University of Queensland, will identify future soil health research needs, focusing on soil acidification in areas where nitrogen fertiliser use has increased, the potential for zinc fertiliser to increase rice yields, changes in soil structure under conservation tillage practice and understanding system sustainability through partial nutrient budgets.[2]

In South Asia, adoption and adaptation of many farming system innovations are variable and low outside project areas, particularly for conservation agriculture-based sustainable intensification. A project, led by Dr Fay Rola-Rubzen of the University of Western Australia, will complete its research on understanding decision-making behaviour of farm households using a behavioural economics framework. The project will test interventions on agricultural extension, input provision and service delivery, which are designed to encourage smallholder farmers' uptake of innovations. The project, which is also part of SDIP, will also strengthen organisational and institutional capacity to better target interventions in the Eastern Gangetic Plains.[3]

Mungbean is an ideal rotation crop for smallholder farmers. The International Mungbean Improvement Network, established through an ACIAR-supported project led by Dr Ramakrishnan Nair of the World Vegetable Center, helped realise the potential of mungbean to improve cropping system productivity and livelihoods by improving researchers' access to genetic material, and coordinating and providing technical support to variety development work in Bangladesh, India, Myanmar and Australia.[4] Phase 2 of the network commences in July 2020, continuing variety development for another five years and extending the network to Kenya and Indonesia, providing access to new genetic material and improved cropping options for smallholder farmers in eastern Africa and South-East Asia.[5]

Stripe rust (also called yellow rust) is a common and important disease of wheat worldwide. While fungicides can be used for in-crop control, genetic resistance is more economically and environmentally sound. A project, led by Professor Robert Park of the University of Sydney, has established and equipped a collaborative network of key wheat improvement centres across South Asia and eastern Africa. In its final year, it will consolidate the knowledge base to enable ongoing research and development at the centres. The project has identified markers linked to effective resistance genes, which can be used in pre-emptive breeding and the development of rapid diagnostic tests. The project, set to reduce the vulnerability of wheat to stripe rust in South Asia and eastern Africa, also benefits wheat production across the globe, including Australia.[6]

Water

About 65% of people living in the coastal zones of Bangladesh and West Bengal in India live below the poverty line. Owners of marginal land, those without land, tribal people, women and those who rely on ecosystem services (such as fishing communities) often do not benefit from agricultural development. A project led by Dr Christian Roth of CSIRO Agriculture and Food has investigated ways to provide more equitable and less-risky development pathways for marginalised communities. During 2020–21, this research will support the design and delivery of agricultural intensification programs that are more socially inclusive.[7]

In the same region, a project conducted over the past five years clearly demonstrated that improved crop, water and salt management strategies can lift agricultural productivity and rural welfare when projects engage with farmers to understand their needs and priorities. A second phase of this work, led by Dr Mohammed Mainuddin of CSIRO Agriculture and Food, will use predictive modelling techniques, field trials and targeted demonstration to identify and implement packages of technologies, such as new cropping systems and improved water management that are tailored to the characteristics of different parts of the Ganges delta region. Key to process will be identification of risks to adoption due to variable climate and variable environments. The outputs of this project will provide information to support implementation of the Bangladesh Delta Plan 2100.[8]

The Andhra Pradesh Drought Mitigation Program was implemented to strengthen the adaptive capacity and productivity of agriculture in the rainfed areas of five districts in the south of Andhra Pradesh. Australian experts are providing technical support to the program, drawing on previous ACIAR-supported projects on climate risk management, participatory groundwater management and social learning for irrigation management and governance. Dr Uday Nidumolu of CSIRO Agriculture and Food leads the project, which will work with Indian counterparts to integrate the research, support out-scaling and then co-learn about out-scaling.[9]

A suite of projects with a common theme of optimising the management of natural resources and adopting new practices to increase productivity and sustainability will operate on the Eastern Gangetic Plains in Bangladesh, India and Nepal during 2020–21. These projects ultimately aim to improve the livelihoods of the many and varied communities of the plains, and are part of the SDIP program (see page 132).

The traditional concept of a physiological crop yield gap is considered useful in national food security planning but, across the Indo–Gangetic Plains, socioeconomic constraints often limit production and overexploitation of regional water resources causes environmental problems. A project led by Dr Donald Gaydon of CSIRO Agriculture and Food will determine if there are feasible alternatives to quantify yield gaps in terms of economics and water use sustainability. The project will make a preliminary assessment of the effects of conservation agriculture and sustainable intensification, future climate scenarios and some economic variables on food production capacity.[10]

A suite of projects in the Sustainable Development Investment Portfolio (SDIP) program has identified technologies and practices, as well as levels of individual and institutional capacity, required to sustainably improve agricultural production and livelihoods. Photo: Conor Ashleigh. ACIAR projects: see page 132.

Aquifer storage and recovery may be effective for storing large volumes of water at relatively low cost, without the need to build large surface reservoirs. Dr Prabhakar Sharma of Nalanda University completes a project during 2020–21 that will report on the technical viability of such systems, based on an indigenously developed system at several sites in South Bihar. The project will deliver a hydrogeological map and an operating manual for long-term monitoring of the system. It will also report on benefits and key social factors that will encourage adoption by smallholder farmers.[11]

There are proven benefits of conservation agriculture-based sustainable intensification systems in the Eastern Gangetic Plains but there are also potential trade-offs. Weed control is one of the biggest challenges when these systems are implemented. A project led by Dr Brendan Brown of CIMMYT has documented farmers' knowledge, attitude and practices around weed management under conservation agriculture and sustainable intensification systems, and will report on the gendered implications for equitable and sustainable intensification in the Eastern Gangetic Plains of South Asia.[12]

A small project was developed to encourage and support a core team of local partners in Bangladesh, India and Nepal to undertake participatory 'foresight for food' exercises in their respective domains using scenario-based approaches and systems thinking. Dr Avinash Kishore of the International Food Policy Research Institute leads the project, which continues to build the capacity of national partner institutions and support young farmers to communicate their aspirations and concerns to policymakers and other stakeholders in the regional food systems.[13] The project will be extended until the end of the 2020–21 year, to allow time to consider the impact of the COVID-19 pandemic on regional food systems.[14]

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See page 209 for contact details

Current and proposed projects

1. Sustainable and resilient farming systems intensification in the Eastern Gangetic Plains (SRFSI) (SDIP) [Bangladesh, India, Nepal] (CSE/2011/077)
2. Identifying soil constraints in the Eastern Gangetic Plains (SDIP) [Bangladesh, India, Nepal] (CROP/2018/210)
3. Enhancing farm-household management decision-making for increased productivity in the Eastern Gangetic Plains (SDIP) [Bangladesh, India, Nepal] (CSE/2012/108)
4. Establishing the International Mungbean Improvement Network [Bangladesh, India, Myanmar] (CIM/2014/079)
5. International Mungbean Improvement Network – phase 2 [Bangladesh, India, Indonesia, Kenya, Myanmar] (CROP/2019/144)
6. Mitigating the effects of stripe rust on wheat production in South Asia and eastern Africa [Ethiopia, India, Nepal, Pakistan] (CIM/2014/081)
7. Promoting socially inclusive and sustainable agricultural intensification in West Bengal, India and Bangladesh (LWR/2014/072)
8. Mitigating risk and scaling-out profitable cropping system intensification practices in the salt-affected coastal zones of the Ganges Delta [Bangladesh, India] (WAC/2019/134)
9. Water management for smallholder farmers – outscaling ACIAR research in Andhra Pradesh drought mitigation program [India] (WAC/2018/164)
10. Quantifying crop yield gaps across the Indo-Gangetic Plain from new perspectives – production, farmer profit and sustainability of water use (SDIP) [Bangladesh, India, Nepal] (WAC/2018/169)
11. Aquifer characterisation, artificial recharge and reuse of suddenly available water in South Bihar (SDIP) [India] (WAC/2018/211)
12. The implications of sustainable intensification on weed dynamics in the Eastern Gangetic Plains (SDIP) [India, Nepal] (WAC/2018/221)
13. Regional foresight for food systems in the Eastern Gangetic Plains (SDIP) [Bangladesh, India, Nepal] (WAC/2019/136)
14. Food futures for the food systems in the Eastern Gangetic Plains [Bangladesh, India, Nepal] (WAC/2020/158)