

South Asia

South Asia

South Asia is an immensely diverse and densely populated region. It is home to 1.5 billion people – one-quarter of the world's population. South Asia has the highest concentration of poor people in the world, with more than 500 million people living in extreme poverty.

Despite the population pressure, the region has shown impressive annual economic growth at an average of 6.7%. However, the COVID-19 pandemic is projected to significantly and negatively impact on the economic growth of the region, pushing another 71 million people into extreme poverty. Many more people, particularly women, live marginally above the poverty line but do not have the opportunity to participate in the process of economic growth.

Compared with other regions in the world, South Asia has the highest regional Global Hunger Index and a very low Human Development Index. Half of the population depend on agriculture for their livelihood. Although the share of agriculture in rural employment remains high, growth of the rural non-farm sector is accelerating and now provides a sizeable share of rural income and employment, primarily in services.

Malnutrition is prevalent in South Asia. The region has among the highest burdens of child undernutrition in the world. Thirty-six per cent of children under age 5 are stunted, or too short for their age, which is an indicator of chronic undernutrition. Sixteen per cent are wasted, or too thin for their height, which is an indicator of acute malnutrition. South Asia also has a high prevalence of micronutrient deficiencies, overconsumption and diet-related non-communicable disease.

While the countries of South Asia face common challenges and opportunities in agriculture, there are also fundamental differences between and within these countries, in terms of the broad characteristics that influence the nature and success of agriculture. India has 15 distinct agroecological zones. Nepal has 3 distinct topographical zones. The northern hilly region of Bangladesh is geographically distinct from the southern coastal areas, mostly alluvial, with fertile floodplains associated with 3 major rivers. Pakistan's Indus plains are in sharp contrast to the arid regions of Sindh and the hilly and semi-arid areas of the northwest. Sri Lanka's landscape is clearly defined by its dry and wet zones. These regional variations throughout South Asia must be considered when designing a meaningful program for research collaboration to accommodate regional distinctions and varying degrees of vulnerability of the local population.

According to the International Food Policy Research Institute's 2021 global food policy report: transforming food systems after COVID-19, South Asia faces continuing and, in some cases, intensifying problems related to climate change, natural disasters, poor food safety and distortionary policies. Fall armyworm devastated Afghanistan, Pakistan and parts of India and Nepal in 2020. Bangladesh and India struggled with flooding during the pandemic and, in India, bird flu caused a nationwide food-safety scare. Distortionary policies, and the increasing costs of implementing them, remain, despite overwhelming evidence of their negative impacts and the potential to repurpose these much-needed resources for climate-smart investments or to build robust foodsafety institutions. A perplexing reality remains the relatively low volume of agricultural trade among the countries of South Asia.

Given the high population densities and large numbers of vulnerable people, the COVID-19 pandemic has been an especially huge challenge for South Asia. Agriculture is highly dependent on informal labour, which has been severely limited during lockdowns and restricted by social distancing measures. These are all disruptive factors for supply chains and agriculture markets.



Photo: Conor Ashleigh.

Partner countries in the South Asia region

- » Bangladesh
- » India
- » Nepal
- » Pakistan
- » Sri Lanka

Drivers of regional collaboration

Countries in South Asia share many opportunities and threats that drive the need for regional cooperation, especially in the Eastern Gangetic Plains. Rice and wheat are the region's major staple crops, accounting for about two-thirds of total dietary energy. However, food consumption patterns have changed in the region over the past few decades, and the changes are most apparent in rural areas. Consumption of cereals is declining while consumption of animal-sourced foods, fruits, vegetables and processed foods is increasing. Pressure to expand food production to meet growing demand is putting stress on natural resources. The resulting expansion and intensification of agriculture is leading to land degradation, deterioration of soil quality and loss of biodiversity, potentially jeopardising the region's capacity to meet future food demand.

Agricultural growth also poses risks for water resources. Facing the world's lowest per capita renewable freshwater resources, millions of rural people in South Asia have benefited from the growing use of groundwater. But aquifers are being depleted and, across the region, watertables are falling, particularly in India. Water quality is also deteriorating throughout the region due to nutrient overloads and industrial pollution, raising concerns about food safety and drinking water quality.

Large areas in several countries of South Asia are prone to natural disasters. Bangladesh and coastal parts of India are threatened frequently by cyclones and floods. Recurring droughts are a common feature in the arid and semi-arid parts of India and Pakistan. The impact of natural calamities is most severe on food-insecure households.

Climate variability, competing and increasing demands from agriculture and industry (including energy production) and population growth are creating severe demands on water availability. Regional cooperation is increasingly essential to manage these shared resources and address shared issues. There are also significant opportunities in regional cooperation to improve the productivity and diversification of agricultural crops, especially beyond cereals, and to improve the sustainability of farming systems through technical, institutional, value-chain and policy research and development.

ACIAR South Asia region program

Australian agricultural and resource management expertise is highly regarded in the South Asia region. ACIAR has a long history of research collaboration in improving crop productivity, forestry, water use efficiency and policy reforms. The South Asia regional program of the Australian Government seeks to underpin Australia's economic engagement in the region by addressing some of the key regionwide barriers to sustainable economic growth and connectivity through the Sustainable Development Investment Portfolio (SDIP) and South Asia Regional Trade Facilitation Program. Gender equality is a focus in all the investments under the regional program.

Our strategy in South Asia focuses on communities, production systems and resource management in the 3 main ecosystems of the region – highlands, plains and coastal areas – that are common to Pakistan, India, Bangladesh, Nepal and Sri Lanka.

Research in these areas looks to identify appropriate reform policy, increase adoption of technology (including post-harvest management), improve productivity and livelihoods in marginalised communities, and improve the productivity of crop, livestock, forestry and fisheries systems.

The major pathways of development in the region are modernisation of agrifood systems, technology support, strengthening service providers, developing rural non-farm sector, and local governance at district and state level. Overproduction in some areas and unequal distribution networks due to poorly developed supply-chain management are the major issues in India. Addressing these could play a major role in achieving food and nutrition security and stability in the region.

The medium-term to long-term strategy in the region focuses on creating regional collaborations that:

- » sustainably intensify and diversify cropping systems using conservation agriculture/zero tillage, farm mechanisation, saline land management and adaptation to climate change
- » eradicate extreme poverty through improved productivity of food-grain crops (especially wheat and pulses), livestock (in Pakistan), agroforestry (in Nepal) and fisheries (in Sri Lanka)
- » better manage agricultural water, including rainfed areas in the Eastern Gangetic Plains and coastal zone
- » influence policy about agricultural and farmers' livelihoods and climate change
- » increase the emphasis on meaningful gender inclusion and empowerment.

South Asia region program 2021–22

Partner country	No. projects
Bangladesh	11
India	7
Nepal	5
Pakistan	13
Sri Lanka	2

25

projects

Note that a project may be conducted in several countries, therefore the total number of projects in this table will be greater than the number of projects in the region.

6 small

research activities

19 research

projects

Research portfolio



Table 5.3 Current and proposed projects in the South Asia region, 2021-22

Project title	Project code	Country
Agribusiness		
Developing competitive and inclusive value chains of pulses in Pakistan	ADP/2017/004	Pakistan
Understanding the drivers of successful and inclusive rural regional transformation: sharing experiences and policy advice in Bangladesh, China, Indonesia and Pakistan	ADP/2017/024	Bangladesh, China, Indonesia, Pakistan
Developing food loss reduction pathways through smart business practices in mango and tomato value chains in Pakistan and Sri Lanka (Food Loss Program)	CS/2020/193	Pakistan, Sri Lanka
Climate Change		
Mitigation and adaptation co-benefits modelling trial in Bangladesh	CLIM/2021/109	Bangladesh
Crops		
Incorporating salt-tolerant wheat and pulses into smallholder farming systems in southern Bangladesh	CIM/2014/076	Bangladesh
Mitigating the effects of stripe rust on wheat production in South Asia and eastern Africa	CIM/2014/081	Ethiopia, India, Nepal, Pakistan
Increasing productivity and profitability of pulse production in cereal- based cropping systems in Pakistan	CIM/2015/041	Pakistan
International Mungbean Improvement Network 2	CROP/2019/144	Bangladesh, India, Indonesia, Kenya, Myanmar
Wheat blast resistant wheat	CROP/2020/165	Bangladesh
Accelerating genetic gain in wheat through hybrid breeding in Bangladesh, Ethiopia and Pakistan	CROP/2020/167	Bangladesh, Ethiopia, Pakistan
Enhancing farm-household management decision-making for increased productivity in the Eastern Gangetic Plains	CSE/2012/108	Bangladesh, India, Nepal
Fisheries		
Improved productivity, efficiency and sustainability of the culture- based fishery for finfish and giant freshwater prawn in Sri Lankan reservoirs	FIS/2018/157	Sri Lanka
Forestry		
Enhancing livelihoods through improved forest management in Nepal	FST/2017/037	Nepal
Horticulture		
Strengthening vegetable value chains in Pakistan for greater community livelihood benefits	HORT/2016/012	Pakistan
Improving smallholder wellbeing through participation in modern value chains: sustaining future growth in the Pakistan citrus industry	HORT/2020/129	Pakistan
Livestock Systems		
Improving smallholder dairy and beef profitability by enhancing farm production and value chain management in Pakistan	LPS/2016/011	Pakistan
Water		
Nutrient management for diversified cropping in Bangladesh	LWR/2016/136	Bangladesh
Adapting to salinity in the southern Indus Basin	LWR/2017/027	Pakistan
Mitigating risk and scaling-out profitable cropping system intensification practices in the salt-affected coastal zones of the Ganges Delta	LWR/2019/073	Bangladesh, India
Water management for small-holder farmers: outscaling ACIAR research in Andhra Pradesh Drought Mitigation Program	WAC/2018/164	India
Transforming smallholder food systems in the Eastern Gangetic Plain	WAC/2020/148	Bangladesh, India, Nepal
Regional foresight for food systems in the Eastern Gangetic Plains	WAC/2020/158	Bangladesh, India, Nepal
Opportunities for brackish and saline aquaculture in Pakistan	WAC/2020/179	Pakistan
Virtual Irrigation Academy business models in Pakistan	WAC/2020/180	Pakistan
Supporting inter-provincial water allocation decision making in Pakistan	WAC/2021/103	Pakistan

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Bangladesh

A\$1.8 million Budgeted funding

Bilateral and regional research projects

2 Small projects and activities

Agriculture plays a pivotal role in the Bangladesh economy and in the lives of the vast majority of the population.

The agriculture sector accounts for more than half of employment in Bangladesh. Notwithstanding its transformation from a country of chronic food shortages to one of net food grain self-sufficiency, Bangladesh still faces very substantial food security challenges. While poverty is steadily declining, many people still live below the poverty line.

Recently, Bangladesh has made impressive progress in achieving national food security. Investments in agricultural research have played a pivotal role in driving productivity increases of major crops. The ongoing challenge is to improve productivity of low-lying areas and rainfed cropping systems and increase rural incomes. This goal is adversely affected by increasing seasonal climate variability, reduced freshwater river flows and seawater intrusion.

Climate change is the most pressing issue for Bangladesh, with varying levels of vulnerability and impacts across the country. Coastal areas are prone to salinity intrusion and tropical cyclones, the floodplains in the central areas are prone to floods, the northwestern region is prone to drought, the north-eastern region is prone to flash floods and the hilly regions are prone to erosion and landslides.

Bangladesh is an active participant in the global effort to combat climate change and must develop adequate adaptive capacity to protect its people and economy. In view of the substantial long-term challenges presented by climate change, the government has developed a long-term Bangladesh Delta Plan 2100 that focuses on developing approaches to sustainable management of water, environment and land resources.

The Bangladesh Climate Change Strategy and Action Plan is the de facto policy document that provides strategic direction for work on climate-change related issues. Many elements of climate-change adaptation in the country are also being addressed through specific sectoral policies. Recent consultations highlighted that the consequences of climate change on rural livelihoods is the most pressing issue facing Bangladesh and is likely to drive thinking about future priorities for research collaboration with ACIAR.

Key priorities for Bangladesh (National Agriculture Policy 2018) that align with ACIAR objectives are:

- » diversification of crops, including production of high-value crops
- » development and promotion of stress-tolerant, disease-resistant and nutritious crop varieties
- » improvement of crop production systems for market-oriented agriculture
- » building national capacity in innovation
- » extension of technologies to increase overall productivity growth and reduce the difference between research farm and field-level yields.

We support regional approaches to assisting Bangladesh, including in the areas of natural resource management, improving trade connectivity and encouraging investments to empower women to participate in cross-regional trade opportunities.

Country priorities

Bangladesh has been an ACIAR partner country since the mid-1990s. Over time, the ACIAR program has shifted towards a farming systems approach supporting broader food security aspects, improved production and diversification of the rice-based farming systems and adaptation to climate change. This approach includes research on short-duration varieties of pulses to fit the farming system, conservation agriculture-based technologies and related mechanisation, saline land management and adaptation to climate change. ACIAR-supported programs in Bangladesh have focused on the undulating lands of the north and north-west regions and the coastal region (which is the poorest and most vulnerable region in the country). Bangladesh's ability to maintain food security given its high vulnerability to the impacts of climate change underpins the priorities for our support.

Key agricultural production challenges are common to many countries of South Asia, and we play a role in strengthening regional research linkages between Bangladesh and other countries, particularly India (Bihar and West Bengal states) and Nepal (eastern Terai region). Consultation with key research and development stakeholders in Bangladesh and Australia established the ACIAR-Bangladesh Collaboration Strategy 2021-2030 and confirmed the following priorities for research collaboration:

- » crop improvement, with a focus on wheat, maize and pulses
- » improved farming systems, with a focus on cropping systems and diversification
- water management, with a focus on managing both quantity (scarcity, groundwater and waterlogging) and quality (salinity)
- » soil fertility and soil management
- » markets, diversification and agricultural value chains.

Research will focus on farming systems of north, north-west and coastal Bangladesh.

The Krishi Gobeshona Foundation is a strategic partner and co-investor with ACIAR in Bangladesh. The foundation is an agricultural research funding organisation that has made major investments in funding research and capacity building in ACIAR-supported projects. The partnership with the foundation for collaboration in agriculture research and development in Bangladesh was renewed in January 2021.



With a focus on grain-based agriculture, a project in China, Bangladesh, Indonesia and Pakistan endeavours to understand the nature and drivers of successful rural transformation in order to provide better evidence for policy advice. Photo: Conor Ashleigh. ACIAR project ADP/2017/024

2021-22 research program

- » 11 ACIAR-supported projects in Bangladesh
- » 4 projects are specific to this country
- » 7 projects are part of regional projects

The research program addresses our high-level objectives, as outlined in the ACIAR 10-Year Strategy 2018-2027, as well as specific issues and opportunities identified by ACIAR and our partner organisations. The following sections briefly describe individual ACIAR-supported projects and anticipated outputs in Bangladesh. 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.

Agribusiness

Success in rural transformation is measured not only by income growth in the rural population, but also by the degree of inclusiveness in the society. A project in China, Bangladesh, Indonesia and Pakistan, led by Dr Chunlai Chen of the Australian National University, endeavours to understand the nature and drivers of rural transformation in order to provide better policy advice to underpin the success of transformation. With a focus on grain-based agriculture, during 2021-22 the project will select study regions and collect data to understand the components of success and the different impacts of rural transformation on women and men.¹

Climate Change

There are many potential agricultural management changes that could help accelerate global responses to climate change, but the pace of climate response is slow. Co-benefits modelling could help accelerate climate response by allowing more efficient screening of many potential interventions at once, comparing them to identify the subset that is most promising. The Agricultural Model Intercomparison and Improvement Project is a global collaborative initiative that has developed such a co-benefits modelling approach. A small research activity, co-led by Dr Carolyn Mutter and Erik Mencos Contreras at Columbia University in New York, will collaborate with colleagues in Bangladesh to trial the modelling methods in rice production systems. The researchers will refine and validate the approach and identify climate responses that have the greatest potential for multiple benefits in a cropping system, which have local as well as global significance.²

Crops

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 the decision-making behaviour of farm households using a behavioural economics framework. During 2022, the project will report on its testing of interventions on agricultural extension, input provision and service delivery, which are designed to encourage the uptake by smallholder farmers of innovations developed by other ACIAR projects. The project will also strengthen organisational and institutional capacity to better target interventions in the Eastern Gangetic Plains.³

In the coastal regions of southern Bangladesh, agriculture centres on the annual cropping of rice in the monsoon season and other crops in the dry (rabi) season. While the system is profitable, it is limited by topography, soil salinity and irrigation availability. A 5-year project led by Professor William Erskine of the University of Western Australia aims to improve productivity and profitability of dry-season cropping on non-saline land, and introduce pulses and wheat with improved salinity tolerance for saline land. Finalyear activities for the project include demonstrations of best practice for mungbean, cowpea, garden pea and wheat production, field validation of wheat lines for salinity tolerance, and piloting the deployment of mini-mills to process pulses grains.⁴

A new fungal disease, wheat blast, is now established in Bangladesh and is a serious risk to food security in South Asia. Recent outbreaks have been small but widespread. A large-scale epidemic is inevitable in conducive conditions, and this will have a large impact on wheat production. A new project has been established to support the operation of the wheat blast screening platform established under a previous ACIAR-supported project. The platform is operated in Jashore by Bangladesh researchers, with support from CIMMYT, and is being used by the global wheat research community. Dr Pawan Kumar Singh of CIMMYT leads the new project, which will identify new sources of resistance to wheat blast, map the resistance genes, facilitate the rapid breeding of elite varieties for Bangladesh farmers and document variety adoption by farmers.⁵

Hybrid wheat has the potential to produce more grain from the same or less land, significantly contributing to food security and land sustainability. However, technical difficulties of hybrid wheat development and the high cost of hybrid seed have constrained the commercial development of new varieties for many decades. Professor Richard Trethowan of the University of Sydney leads a new project that aims to extend the benefits of new hybrid wheat systems to researchers, wheat breeders, farmers and consumers in Pakistan, Bangladesh and Ethiopia. The university has developed a novel, cost-effective and practical system to rapidly produce large numbers of wheat hybrid combinations for testing in breeding programs, and to produce large amount of hybrid seeds for sale to farmers at an acceptable cost. The project will establish the performance of the hybrids, and determine effective technical processes and business models to produce the seed in collaboration with the national programs and local seed providers in each country.6

Mungbean is an ideal rotation crop for smallholder farmers. The International Mungbean Improvement Network, established through a 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 in Bangladesh, India, Myanmar and Australia. Phase 2 of the network continues variety development for another 5 years, and extends the network to Kenya and Indonesia, providing access to new genetic material characterised for important traits, and improving cropping options for smallholder farmers in eastern Africa and South-East Asia.⁷

Water

Improved nutrient management to increase the profitability and sustainability of intensive and emerging cropping systems is the focus of a project in the coastal zone of Bangladesh, led by Professor Richard Bell of Murdoch University. The first phase of the project (2017 to 2021) established that the adoption of fertiliser recommendation tools can decrease production costs and increase income and yield for smallholder farmers. The project has been extended until the end of 2022 to scale out the use of tools developed by the project and advance practice change. The final phase of the project will test a collective action approach for nutrient management and expand the scope for monitoring and evaluation of the innovations.⁸

In the salt-affected coastal zones of the Ganges Delta, which lies in both Bangladesh and India, this project has clearly demonstrated that improved crop, water and salt management 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, 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 the 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 2100.9



ACIAR supports a project to understand how adoption and adaptation of technologies such as salt-tolerant wheat and pulses can be increased beyond project areas. Photo: Conor Ashleigh. ACIAR project CIM/2014/076



A new project aims to understand how food systems can be transformed to improve farm livelihoods while reducing inequity, production risk and unsustainable resource use. Photo: Conor Ashleigh. ACIAR project WAC/2020/148

The Eastern Gangetic Plains straddles Bangladesh, India and Nepal. The region is home to 450 million people and has the world's highest concentration of rural poverty. People in this region have a high dependence on agriculture for food and livelihood security. A new project, starting in 2021, aims to understand the processes and practices of transforming food systems through diversification to improve farm livelihoods while reducing inequity, production risk and unsustainable resource use. Dr Tamara Jackson of the University of Adelaide leads this project that begins with understanding the existing context for diversification in the region, covering a range of different technologies, scaling interventions, and policies and programs. The project will consider these elements individually and demonstrate the interactions between them using case studies to highlight where and how diversification has occurred in the past. In subsequent phases, the project will identify priority opportunities with communities and determine their fit with projected climate change and water availability, and the impact of high-level policies.¹⁰

The Sustainable Development Investment Portfolio (SDIP) drew on Australian expertise and technologies to improve integrated management of water, energy and food production in the basins of the Indus, Ganges and Brahmaputra rivers. ACIAR supported 10 projects over 8 years within this program in Bangladesh, India and Nepal. A small project will prepare delegates to build on the outcomes of SDIP at international and regional dialogues in the second half of 2021. Led by Dr Avinash Kishore of the International Food Policy Research Institute, a core team of local partners will undertake participatory 'foresight for food' exercises in their respective domains and then communicate their aspirations and concerns to policymakers and other stakeholders in the regional food systems.¹¹

Regional Manager, South Asia Dr Pratibha Singh

Research Program Managers

Agribusiness: Mr Howard Hall Climate Change: Dr Veronica Doerr Crops: Dr Eric Huttner Water: Dr Robyn Johnston

See page 197 for contact details.

Current and proposed projects

- 1. Understanding the drivers of successful and inclusive rural regional transformation: sharing experiences and policy advice in Bangladesh, China, Indonesia and Pakistan (ADP/2017/024)
- 2. Mitigation and adaptation co-benefits modelling trial in Bangladesh (CLIM/2021/109)
- Incorporating salt-tolerant wheat and pulses into smallholder farming systems in southern Bangladesh (CIM/2014/076)
- Enhancing farm-household management decisionmaking for increased productivity in the Eastern Gangetic Plains [Bangladesh, India, Nepal] (CSE/2012/108)
- 5. Wheat blast resistant wheat [Bangladesh] (CROP/2020/165)
- Accelerating genetic gain in wheat through hybrid breeding in Bangladesh, Ethiopia and Pakistan (CROP/2020/167)
- 7. International Mungbean Improvement Network 2 [Bangladesh, India, Indonesia, Kenya, Myanmar] (CROP/2019/144)
- 8. Nutrient management for diversified cropping in Bangladesh (LWR/2016/136)
- 9. Mitigating risk and scaling-out profitable cropping system intensification practices in the salt-affected coastal zones of the Ganges Delta [Bangladesh, India] (LWR/2019/073)
- Transforming smallholder food systems in the Eastern Gangetic Plains [Bangladesh, India, Nepal] (WAC/2020/148)
- Regional foresight for food systems in the Eastern Gangetic Plains [Bangladesh, India, Nepal] (WAC/2020/158)

India

A\$0.7 million Budgeted funding

> Bilateral and regional research projects

) 2

Small projects and activities With more than 1.3 billion people, India is the second most populous country in the world, after China, and accounts for 18% of the world's population. Two-thirds of India's population live in rural areas, with landholdings averaging 1.1 hectares. The rural population is highly vulnerable to the impacts of a declining natural resource base, biosecurity threats and climate change.

Worth US\$2.94 trillion, India is the world's fifth largest economy, overtaking the United Kingdom and France. 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 exporter of cotton. While the contribution of the agriculture sector to GDP is declining, agriculture remains a major source of employment and accounts for 42% of the total national workforce.

The COVID-19 pandemic and associated lockdowns affected all sectors of the Indian economy; however, agriculture emerged as the main driver of economic growth, recording positive growth of 3.4% (at constant prices) in 2020–21.

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 sector is still challenged by inefficient market mechanisms, subsidy distortions, lack of storage infrastructure, inefficient use of natural resources and susceptibility to climate change and extreme weather events.

In response to the COVID-19 pandemic, the government announced the 'Atmanirbhar Bharat Abhiyan' (Self-Reliant India) program in 2020. The initiative included institutional credit facilities at concessional rates, creation of an Agriculture Infrastructure Development Fund for projects at farm-gate and aggregation points, and release of emergency funds to provide working capital to farmers through crop loans. The initiative continued into 2021 with increased allocation to the infrastructure fund.

The Government of India, in its various policies and schemes, focuses closely on the role of women in agriculture. It advocates mainstreaming of women's role in agriculture as part of all programs 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, where they 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. As part of the response being coordinated by Australia's High Commission, in 2021-22 ACIAR is working to clarify the role we can play in supporting the ambition for increased research collaboration between India and Australia.



India and Australia will enhance collaboration on science, technology and research during 2021-22, with one focus being sustainable intensification with a nutrition framework. Photo: Conor Ashleigh. ACIAR project WAC/2020/158

Country priorities

ACIAR has supported a program of collaborative research with India since 1983. Presently, the ACIAR research program with India is delivered entirely through a regional collaborative approach involving neighbouring countries with shared issues and opportunities. Substantial co-investment from India will increasingly become a desired characteristic of our partnership 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 2021-22, as part of a partnership refresh between ACIAR and Indian Council of Agricultural Research, we will explore, at India's request, the possibilities for enhanced collaboration in:

- » sustainable intensification with a nutrition framework
- » diversification into new dry-season crops
- » the role of biotechnology in crop development
- » new mechanisation opportunities including farm robotics
- » a next phase of mungbean breeding for high-yielding varieties
- » groundwater management (overexploitation and under-exploitation)
- » co-investment and trilateral collaboration.

2021-22 research program

- » 7 ACIAR-supported projects in India
- » 1 project is specific to this country
- » 6 projects are part of regional projects

The research program addresses our high-level objectives, as outlined in the ACIAR 10-Year Strategy 2018–2027, as well as specific issues and opportunities identified by ACIAR and our 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

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 the decision-making behaviour of farm households using a behavioural economics framework. During 2022, the project will report on its testing of interventions on agricultural extension, input provision and service delivery, which are designed to encourage the uptake by smallholder farmers of innovations developed by other ACIAR projects. The project will also strengthen organisational and institutional capacity to better target interventions in the Eastern Gangetic Plains.¹

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, which aims to reduce the vulnerability of wheat to stripe rust in South Asia and eastern Africa, also benefits wheat production across the globe, including Australia.²

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Water

Australian experts are providing technical support to 5 large land and water management programs in the Indian states of Andhra Pradesh and Odisha. These programs draw 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. COVID-19 outbreaks in South Asia mean that training will be delivered online and field activities have been postponed. There is growing interest in the training, and other partners may join during 2021-22.⁴

In the salt-affected coastal zones of the Ganges Delta, which lies in both Bangladesh and India, this project has clearly demonstrated that improved crop, water and salt management 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, 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 the 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 2100.⁵

The Eastern Gangetic Plains straddles Bangladesh, India and Nepal. The region is home to 450 million people and has the world's highest concentration of rural poverty. People in this region have a high dependence on agriculture for food and livelihood security. A new project, starting in 2021, aims to understand the processes and practices of transforming food systems through diversification to improve farm livelihoods while reducing inequity, production risk and unsustainable resource use. Dr Tamara Jackson of the University of Adelaide leads this project that begins with understanding the existing context for diversification in the region, covering a range of different technologies, scaling interventions, and policies and programs. The project will consider these elements individually and demonstrate the interactions between them using case studies to highlight where and how diversification has occurred in the past. In subsequent phases, the project will identify priority opportunities with communities and determine their fit with projected climate change and water availability, and the impact of high-level policies.⁶

The Sustainable Development Investment Portfolio drew on Australian expertise and technologies to improve integrated management of water, energy and food production in the basins of the Indus, Ganges and Brahmaputra rivers. ACIAR supported 10 projects over 8 years within this program in Bangladesh, India and Nepal. A small project will prepare delegates to build on the outcomes of the Sustainable Development Investment Portfolio at international and regional dialogues in the second half of 2021. Led by Dr Avinash Kishore of the International Food Policy Research Institute, a core team of local partners will undertake participatory 'foresight for food' exercises in their respective domains and then communicate their aspirations and concerns to policymakers and other stakeholders in the regional food systems.7

Regional Manager, South Asia Dr Pratibha Singh

Research Program Managers Crops: Dr Eric Huttner

Water: Dr Robyn Johnston

See page 197 for contact details.

Current and proposed projects

- Enhancing farm-household management decisionmaking for increased productivity in the Eastern Gangetic Plains [Bangladesh, India, Nepal] (CSE/2012/108)
- 2. Mitigating the effects of stripe rust on wheat production in South Asia and eastern Africa [Ethiopia, India, Nepal, Pakistan] (CIM/2014/081)
- International Mungbean Improvement Network 2 [Bangladesh, India, Indonesia, Kenya, Myanmar] (CROP/2019/144)
- 4. Water management for small-holder farmers: outscaling ACIAR research in Andhra Pradesh Drought Mitigation Program [India] (WAC/2018/164)
- Mitigating risk and scaling-out profitable cropping system intensification practices in the salt-affected coastal zones of the Ganges Delta [Bangladesh, India] (LWR/2019/073)
- 6. Transforming smallholder food systems in the Eastern Gangetic Plains [Bangladesh, India, Nepal] (WAC/2020/148)
- Regional foresight for food systems in the Eastern Gangetic Plains [Bangladesh, India, Nepal] (WAC/2020/158)



New cropping technologies and improved water management techniques will be identified in a new project in the salt-affected coastal zones of the Ganges Delta, which lies in both Bangladesh and India. Photo: Conor Ashleigh. ACIAR project WAC/2019/134

Nepal

A\$0.7 million Budgeted funding

Bilateral and regional research projects

Small research activity

Agriculture is the largest economic sector of Nepal, supporting the livelihoods of 66% of the population and contributing 36% of national GDP. Farming is largely subsistence in nature and cropping is mostly integrated with livestock production.

Nepal has seen much political change in recent decades. In 2008, the country became a republic, ending 240 years of monarchy. In 2015, after a series of short-term governments, Nepal's new constitution established a secular democratic republic with a federal system of 3 tiers of government.

Agriculture in Nepal is highly diverse due to the wide range of climates and geographies in the country. The challenges facing agriculture in the lowland Terai ricewheat farming systems (part of the Eastern Gangetic Plains) are vastly different to those in the mixed croplivestock-tree farming systems of the hill and mountain areas. Broadly, however, the challenges include:

- » the need for seed system improvements
- » degradation of natural resources
- » underdeveloped agricultural institutions and policies
- » declining availability of labour
- » lack of productive technologies and mechanisation that limit the improvement of farm household livelihoods.

Natural disasters also frame the recent history of the country. In 2015, the deadliest earthquake in 81 years struck Nepal, followed by hundreds of aftershocks and another severe earthquake 17 days later. The process of recovery continues. In 2017, Nepal was hit by devastating floods, causing US\$172 million in losses and damage to the agriculture sector alone.

Nepal's Agriculture Development Strategy 2015-2035 outlines a vision for a self-reliant, sustainable, competitive and inclusive agriculture sector that drives economic growth and contributes to improved livelihoods and food and nutrition security. It conceptualises transformation of Nepal from a society primarily based on agriculture to one that derives most of its income from services and industry. The 20-year strategy aims to halve poverty in less than 10 years through an agriculture-led economy achieving improved governance, higher productivity, profitable commercialisation and increased competitiveness.

The Agriculture Development Strategy also guides policies that include women, and states that all agricultural programs will be designed to benefit women. It promotes women's organisations and agroenterprises led by women through specific programs and recommends equal wages for women labourers. The strategy also promotes action to raise awareness of women's rights to land, and builds the capacity of women to manage irrigation, water resources and finances.

Country priorities

ACIAR has supported collaborative research with Nepal since the early 1990s, including projects on small ruminants, wheat and legumes. The focus for ACIAR during 2021-22 continues to be the engagement of Nepal in a regional program to improve integration of soil, water, crop, livestock and tree components of the farming systems.

Increased farm and forest productivity remains a core priority of Nepal for collaboration with ACIAR to improve food and nutrition security of the rural poor. In the Middle Hills districts, where the impacts of earthquakes and floods remains, our program supports the request of the Nepalese Government to focus primarily on research to support increased timber production from community forests. Another area of requested focus is understanding the implications of federalism on agriculture in Nepal.

Given the common agricultural production challenges across the alluvial plains of Nepal, eastern India and Bangladesh, cooperative research linkages with neighbouring countries will be explored further during 2021-22. The focus will be on conservation agriculture, to address key issues such as declining soil health, burning of rice stubble, falling groundwater levels and inequities in access to water.

Nepal hosts an important regional research body - the International Center for Integrated Mountain Development. In 2021–22, ACIAR will work with the centre to identify prospective areas for research collaboration.

2021-22 research program

- » 5 ACIAR-supported projects in Nepal
- » 1 project is specific to this country
- » 4 projects are part of regional projects

The research program addresses our high-level objectives, as outlined in the ACIAR 10-Year Strategy 2018–2027, as well as specific issues and opportunities identified by ACIAR and our partner organisations. The following sections briefly describe individual ACIAR-supported projects and anticipated outputs in Nepal. 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

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 the decision-making behaviour of farm households using a behavioural economics framework. During 2022, the project will report on its testing of interventions on agricultural extension, input provision and service delivery, which are designed to encourage the uptake by smallholder farmers of innovations developed by other ACIAR projects. The project will also strengthen organisational and institutional capacity to better target interventions in the Eastern Gangetic Plains.¹

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, which aims to reduce the vulnerability of wheat to stripe rust in South Asia and eastern Africa, also benefits wheat production across the globe, including Australia.²

Forestry

The Middle Hills of Nepal are home to 44% of the country's population, and most people gain their livelihoods from a combination of agricultural and forest products. Most forest lands have been handed over to community forest user groups, largely with suboptimal management and very limited timber harvest. Previous work supported by ACIAR demonstrated the effectiveness of a silvicultural management package called Active and Equitable Forest Management to improve livelihoods, social equity and environmental impacts. Dr Ian Nuberg of the University of Adelaide leads a project to facilitate the adoption of the package, in order to improve forest management practices in community forests and on private land in Kahbre Palanchok and Sindhu Palchok districts. The project is working with 15 community forest user groups in each district, focusing on adoption of improved forestry practices; development of community forestry planning, governance and gender equity frameworks; and establishment of pro-poor, small-scale forest enterprises.³

Water

The Eastern Gangetic Plains straddles Bangladesh, India and Nepal. The region is home to 450 million people and has the world's highest concentration of rural poverty. People in this region have a high dependence on agriculture for food and livelihood security. A new project, starting in 2021, aims to understand the processes and practices of transforming food systems through diversification to improve farm livelihoods while reducing inequity. production risk and unsustainable resource use. Dr Tamara Jackson of the University of Adelaide leads this project that begins with understanding the existing context for diversification in the region, covering a range of different technologies, scaling interventions, and policies and programs. The project will consider these elements individually and demonstrate the interactions between them using case studies to highlight where and how diversification has occurred in the past. In subsequent phases, the project will identify priority opportunities with communities and determine their fit with projected climate change and water availability, and the impact of high-level policies.⁴

The Sustainable Development Investment Portfolio drew on Australian expertise and technologies to improve integrated management of water, energy and food production in the basins of the Indus, Ganges and Brahmaputra rivers. ACIAR supported 10 projects over 8 years within this program in Bangladesh, India and Nepal. A small project will prepare delegates to build on the outcomes of the Sustainable Development Investment Portfolio at international and regional dialogues in the second half of 2021. Led by Dr Avinash Kishore of the International Food Policy Research Institute, a core team of local partners will undertake participatory 'foresight for food' exercises in their respective domains and then communicate their aspirations and concerns to policymakers and other stakeholders in the regional food systems.⁵

Regional Manager, South Asia Dr Pratibha Singh

Research Program Managers

Crops: Dr Eric Huttner Forestry: Dr Nora Devoe Water: Dr Robyn Johnston

See page 197 for contact details.

Current and proposed projects

- Enhancing farm-household management decisionmaking for increased productivity in the Eastern Gangetic Plains [Bangladesh, India, Nepal] (CSE/2012/108)
- Mitigating the effects of stripe rust on wheat production in South Asia and eastern Africa [Ethiopia, India, Nepal, Pakistan] (CIM/2014/081)
- Enhancing livelihoods through improved forest management in Nepal (FST/2017/037)
- 4. Transforming smallholder food systems in the Eastern Gangetic Plains [Bangladesh, India, Nepal] (WAC/2020/148)
- Regional foresight for food systems in the Eastern Gangetic Plains [Bangladesh, India, Nepal] (WAC/2020/158)



ACIAR supported 10 projects within the Sustainable Development Investment Portfolio over 8 years in Bangladesh, India and Nepal. A new project will support local partners to undertake participatory 'foresight for food' exercises. Photo: Conor Ashleigh. ACIAR project WAC/2020/158

Pakistan

A\$3.1 million Budgeted funding

10 Bilateral and regional research projects

3 Small projects and activities Agriculture is the largest sector of Pakistan's economy, contributing 19% to GDP and engaging 38% of the national workforce. This is the largest segment of the workforce and two-thirds are women. Pakistan's strong research system has been driving innovation and improvements in this sector.

The COVID-19 pandemic has put significant pressure on the economy of Pakistan. Drastic measures to control the pandemic significantly reduced economic activity (including activity in agrifood systems), with consequent impacts on livelihoods, food security and nutrition.

Before the pandemic, about 25% of the population lived below the national poverty line. Food insecurity is typically high, with 20–30% of the population (40 to 62 million people) experiencing some form of food insecurity and chronic vulnerability through natural hazards and shocks, including the ongoing pandemic. The continued lockdown has affected the demand for food. This is due not only to limited physical access but also declining financial resources. The lockdown has reduced or eliminated the earnings of almost 3 million informal daily wage labourers working in agriculture and other related activities.

Food market mechanisms in Pakistan are strong and well-integrated but temporary supply shocks occurred due to disturbance in logistics. This affected the price and supply of perishable goods, imported food and processed food. Along with a high rate of population growth, food and water security are among the most pressing challenges for Pakistan in the current circumstances.

Pakistan recognises that cost-effective availability of energy, water and food is essential to ensure sustainable economic growth and development. Sizeable national and provincial programs are being funded to revolutionise the agriculture and livestock sectors. These programs are aimed at increasing agricultural productivity and value addition, reducing dependence on imports, supporting and stimulating agriculture-based industries, and improving the livelihoods and wellbeing of farming communities.

Pakistan is ranked third in the world of countries facing water shortages. It is estimated that Pakistan will become the most water-stressed country in South Asia by 2040, with absolute water scarcity by 2025. The are many reasons for the country's water scarcity. The most important are climate change, urbanisation and high dependence on groundwater for agriculture and other operations.

Country priorities

Australia has a 70-year development assistance relationship with Pakistan, which has contributed to Pakistan's long-term economic prosperity, stability and resilience. ACIAR is regarded as a key international partner supporting agricultural research in Pakistan. Australia is seen as a country with deep, relevant expertise in agriculture, livestock production and water management. Our work is high profile and regularly gains the attention of policymakers at national and provincial levels.

Australia has helped Pakistan increase livelihood opportunities for men and women living in poverty by enhancing agricultural productivity and expanding revenue streams for farmers through improved water management practices, adding value to raw agricultural products and improving access to markets. Our programs have invested in the people of Pakistan, especially women and girls.

Our program with Pakistan is based on Australia's global expertise in areas that are high-priority concerns for Pakistan, and the recognition that water and food security are critical to Pakistan's long-term stability. Pakistan's strong network of researchers has a longstanding platform of collaboration with Australian researchers, which is highly valued by both countries.

The ongoing focus of our research collaboration is:

- » empowering women to enhance farm incomes
- water management, particularly horizontal expansion, salinity management, water harvesting, and low-cost/high-efficiency irrigation systems
- » crop improvement, particularly productivity enhancement and access to novel breeding techniques
- » horticulture, including fresh produce and nursery certification systems
- » agribusiness development, including background research in value-adding, product development, branding and traceability systems for growing private sector needs, which the national system cannot provide
- » models for rural transformation.

When pandemic conditions permit, we will recalibrate our relationship with Pakistan with a 10-year plan for research cooperation. This will enable a stronger equal partnership of international research collaboration with substantial co-investment for mutual benefit.

2021-22 research program

- » 13 ACIAR-supported projects in Pakistan
- » 9 projects are specific to this country
- » 4 projects are part of regional projects

The research program addresses our high-level objectives, as outlined in the ACIAR 10-Year Strategy 2018-2027, as well as specific issues and opportunities identified by ACIAR and our partner organisations. The following sections briefly describe individual ACIAR-supported projects and anticipated outputs in Pakistan. 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.

Agribusiness

Pulses are important to both agricultural systems and diets in Pakistan, but domestic production has declined in recent decades and now 80% of lentils and 10% of chickpeas are imported to meet domestic demand. A project led by Dr Rajendra Adhikari of the University of Queensland is developing socially inclusive and competitive value chains for pulses in Punjab and Sindh, and spillover benefits are expected for Khyber Pakhtunkhwa. These 3 regions are characterised by gender inequality within industry and society. Chickpeas, lentils and mungbean are well-suited to smallholder farming by both women and men. By developing production and market knowledge and increasing capacity of farmers and stakeholders, the project will improve connections between farmers and markets. The project will produce policy advice and recommendations for national and district level decision-makers and assist industry development.1

Success in rural transformation is measured not only by income growth in the rural population, but also by the degree of inclusiveness in the society. A project in China, Bangladesh, Indonesia and Pakistan, led by Dr Chunlai Chen of the Australian National University, endeavours to understand the nature and drivers of rural transformation in order to provide better policy advice to underpin the success of transformation. With a focus on grain-based agriculture, during 2021-22 the project will select study regions and collect data to understand the components of success and the different impacts of rural transformation on women and men.²



Horticulture, especially fresh fruits and vegetables are important food commodities in both Pakistan and Sri Lanka. Maintaining quality and freshness under humid tropical conditions presents a vast challenge in meeting the growing demand for domestic consumption and export. Supply chains are inadequate and inefficient. Food losses are large, especially during seasonal gluts. Associate Professor Anwar Shah of Quaid-e-Azam University leads a new project using mango and tomato as focal commodities to map value chains in Pakistan and Sri Lanka, to identify the extent and root causes of food losses. The project will then design and demonstrate affordable technological and organisational options to mitigate losses and create new economic opportunities. Sri Lanka provides a useful case study to contrast the fruits and vegetables value chain of Pakistan, as the 2 countries are at different stages of development and face different exposure regimes and vulnerabilities. This project is part of the ACIAR-IDRC Food Loss Research Program (see page 8).³

Crops

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, which aims to reduce the vulnerability of wheat to stripe rust in South Asia and eastern Africa, also benefits wheat production across the globe, including Australia.⁴

Hybrid wheat has the potential to produce more grain from the same or less land, significantly contributing to food security and land sustainability. However, technical difficulties of hybrid wheat development and the high cost of hybrid seed have constrained the commercial development of new varieties for many decades. Professor Richard Trethowan of the University of Sydney leads a new project that aims to extend the benefits of new hybrid wheat systems to researchers, wheat breeders, farmers and consumers in Pakistan, Bangladesh and Ethiopia. The university has developed a novel, cost-effective and practical system to rapidly produce large numbers of wheat hybrid combinations for testing in breeding programs, and to produce large amount of hybrid seeds for sale to farmers at an acceptable cost. The project will establish the performance of the hybrids, and determine effective technical processes and business models to produce the seed in collaboration with the national programs and local seed providers in each country.⁵

The demand for pulses in Pakistan has been increasing, while production is decreasing. Despite relatively high prices, pulses, especially chickpea and lentils, have been progressively pushed out to the most marginal lands, with labour shortages being a major production constraint. Reintroducing legumes into existing cropping systems would have nutritional, economic and environmental benefits and has been identified as a priority for agriculture development by the Pakistan Government. In 2022, a project led by Dr Ata-ur Rehman of Charles Sturt University will finalise farmerled research and demonstrations of improved varieties, agronomic practices and community seed production to increase the production and profitability of pulses.⁶



Pakistan is one centre in a network of wheat improvement centres across South Asia and eastern Africa working to reduce the vulnerability of wheat to stripe rust. Photo: Conor Ashleigh. ACIAR project CIM/2014/081



Case studies and evaluations highlighted key success factors associated with a value-chain approach to rural development projects in the dairy sector, and will be a useful basis for other research groups. Photo: Conor Ashleigh. ACIAR project LPS/2016/011

Horticulture

The horticulture sector in Pakistan is significant, both domestically and for export production. The Australia-Pakistan Agriculture Sector Linkages Program made significant progress in strengthening the value chains for mango and citrus, and exploring prospects for developing heat-tolerant varieties of vegetables. Dr Babar Ehsan Bajwa of CABI leads a project that is strengthening selected vegetable value chains in Punjab and Sindh provinces, as part of the Agriculture Value Chain Collaborative Research Program (Aik-Saath). Focusing on potatoes, chillies, tomatoes and onions, the project has identified opportunities for engagement and entrepreneurship, and small-scale production, post-harvest processing and trading. During 2021-22, technical innovations and scaling out improvements to increase the capacity and incomes of farming families, traders and intermediaries will be tested and developed.⁷

Citrus is Pakistan's leading fruit crop and although production is increasing, productivity is below comparable countries, farm-gate waste is high and value is stagnant. Waste continues throughout the value chain, with post-harvest losses in citrus ranging between 23% and 38%. Despite these limitations, the industry's main product, Kinnow mandarin, has market potential at higher levels of quality and value, especially for export. Further, citrus industry development is a priority for provincial and national governments. A new project in 2021, led by Dr Rajendra Adhikari of the University of Queensland, aims to improve the wellbeing of citrus-producing smallholder families from participation in inclusive value chains that meet market needs and provide equitable returns to farmers.⁸

Livestock Systems

Rising demand and prices for beef in Pakistan present new opportunities for smallholder farmers. Traditionally, beef is a by-product of the dairy sector. Male animals and old cows are used for meat, so there are trade-offs between increasing milk production and growing cattle and buffaloes for meat. A project led by Dr David McGill of the University of Melbourne identified practices to improve on-farm efficiency and profitability, and new value-chain opportunities. The project concludes in 2022 with case studies and evaluations to highlight the key success factors associated with the value-chain approach to rural development projects. These examples form a useful basis for other research groups, projects and organisations.⁹

Water

Salinity currently affects 4.5 million hectares of land across Pakistan and 54% of the southern Indus Basin. In this region, salinisation and sodification of surface soils and waterlogging threaten agricultural production and livelihoods, resulting in high rates of poverty for communities living in affected areas. A project led by Dr Michael Mitchell of Charles Sturt University aims to build the adaptive capacity of farming and coastal communities in salinity-affected areas to maintain and improve their livelihoods. During 2021-22, the project will conduct activities in Pakistan and Australia to understand biophysical and institutional trends in relation to agricultural production systems, develop an accessible database of salinity adaptation options for farmers, and investigate and develop monitoring tools and decision-support applications for use by farmers.¹⁰

In Asian mega-deltas such as the Mekong and Ganges, one response to salinisation from seawater intrusion has been a shift from cropping to brackish and saline water aquaculture. In Pakistan, aquaculture production is relatively limited. During 2021-22, scientists from the International Water Management Institute and the WorldFish Centre, led by Dr Mohsin Hafeez, will review the options and potential for brackish and marine aquaculture in Pakistan, and the extent to which aquaculture could provide a transformative adaptation strategy for areas affected by salinisation in the southern Indus Basin."

Irrigated cropping is critical to Pakistan's economy and food security, and effective management of the country's irrigation is an urgent priority. While basinlevel water management is efficient, distribution of water at the community level is inefficient and unfair, and yields and water productivity are low. A small project led by Dr Richard Stirzaker of CSIRO, in partnership with Pakistan Council for Research on Water Resources, will demonstrate use of the Virtual Irrigation Academy (including Chameleon and Full-Stop soil moisture monitoring) to understand its potential to improve irrigation water management in Pakistan. The Virtual Irrigation Academy provides a digital platform to monitor soil water, underpinned by a process of social learning to improve irrigation management at the farm and scheme level. The program was developed through ACIAR-supported projects in southern Africa.¹²

The Indus Basin Irrigation System is the world's largest continuous irrigation system and it provides water, energy and food security for Pakistan. Responsibility for the system's surface water resources is shared between the Indus River System Authority, the Water and Power Development Authority and provincial irrigation departments. Allocation of the water resource is a complex process that is only a few people understand. CSIRO, through a DFAT-funded project in close collaboration with partners in Pakistan, developed the Water Apportionment Accord Tool to enable a more transparent and consistent allocation process. A small project will consolidate and expand the use of the tool during 2021-22. Dr Mobin-ud Din Ahmad of CSIRO will support and train in-country partners for the next 2 rounds of seasonal planning, and further develop and refine the software and training material associated with the tool.¹³

Country Manager, Pakistan Dr Munawar Raza Kazmi

Research Program Managers

Agribusiness: Mr Howard Hall Crops: Dr Eric Huttner Horticulture: Ms Irene Kernot Livestock Systems: Dr Anna Okello Water: Dr Robyn Johnston

See page 197 for contact details.

Current and proposed projects

- 1. Developing competitive and inclusive value chains of pulses in Pakistan (ADP/2017/004)
- 2. Understanding the drivers of successful and inclusive rural regional transformation: sharing experiences and policy advice in Bangladesh, China, Indonesia and Pakistan (ADP/2017/024)
- 3. Developing food loss reduction pathways through smart business practices in mango and tomato value chains in Pakistan and Sri Lanka (Food Loss Research Program) (CS/2020/193)
- Mitigating the effects of stripe rust on wheat production in South Asia and eastern Africa [Ethiopia, India, Nepal, Pakistan] (CIM/2014/081)
- Accelerating genetic gain in wheat through hybrid breeding in Bangladesh, Ethiopia and Pakistan (CROP/2020/167)
- 6. Increasing productivity and profitability of pulse production in cereal-based cropping systems in Pakistan (CIM/2015/041)
- Strengthening vegetable value chains in Pakistan for greater community livelihood benefits (HORT/2016/012)
- Improving smallholder wellbeing through participation in modern value chains: sustaining future growth in the Pakistan citrus industry (HORT/2020/129)
- 9. Improving smallholder dairy and beef profitability by enhancing farm production and value chain management in Pakistan (LPS/2016/011)
- 10. Adapting to salinity in the southern Indus Basin [Pakistan] (LWR/2017/027)
- 11. Opportunities for brackish and saline aquaculture in Pakistan (WAC/2020/179)
- 12. Virtual Irrigation Academy business models in Pakistan (WAC/2020/180)
- 13. Supporting inter-provincial water allocation decision making in Pakistan (WAC/2021/103)

Sri Lanka



Bilateral and regional research projects

Following a 26-year civil war and a tsunami in 2004 that left tens of thousands of people dead, injured or homeless, Sri Lanka has moved ahead to achieve middle-income country status. ACIAR is exploring opportunities for re-engagement based on mutual benefit and co-investment.

While Sri Lanka ranks 72 out of 189 countries on the Human Development Index 2020, growth has not been uniform. Significant pockets of poverty exist in the former conflict districts of Mullaitivu, Manar and Kilinochchi in the Northern province, as well as Batticaloa in the Eastern province and Moneragala in the Uva province.

Australia has a strong interest in ensuring Sri Lanka continues its development as a secure, stable and prosperous partner of Australia in the Indian Ocean region, underpinned by an effective post-conflict reconciliation process.

ACIAR had a broad collaborative research program with Sri Lanka from 1980 to the early 2000s, which covered fisheries, agriculture policy, forestry, animal health and crops. In 2016, Australia's Commission for International Agricultural Research requested an assessment of re-establishing a collaborative research program with Sri Lanka. A scoping study concluded that there was a conducive environment to re-establish a collaborative research program with Sri Lanka, and that it should start with a multidisciplinary project in aquaculture for freshwater shrimp, focused on communities in the Northern province. Given Sri Lanka's middle-income status, any further reengagement with Sri Lanka will build on lessons from this first project and on significant co-investment from Sri Lanka.

2021-22 research program

The 2016 scoping study for ACIAR's re-engagement with Sri Lanka identified 6 broad areas for potential future collaboration with Sri Lanka. Given that the partnership is completely new, in 2020–21 we started a single multidisciplinary project in aquaculture for freshwater shrimp, which includes a socioeconomic component, focused on communities in the Northern province.

This year we start a second project looking at ways to reduce food loss in fruit and value chains in Sri Lanka and Pakistan, as part of the Food Loss Research Program (see page 8).



ACIAR is supporting a project that is investigating stocking, monitoring and harvesting practices to optimise fish and prawn productivity and improve product quality. ACIAR project FIS/2018/157

Agribusiness

Horticulture, especially fresh fruits and vegetables are important food commodities in both Pakistan and Sri Lanka. Maintaining quality and freshness under humid tropical conditions presents a vast challenge in meeting the growing demand for domestic consumption and export. Supply chains are inadequate and inefficient. Food losses are large, especially during seasonal gluts. Associate Professor Anwar Shah of Quaid-e-Azam University leads a new project using mango and tomato as focal commodities to map value chains in Pakistan and Sri Lanka, to identify the extent and root causes of food losses. The project will then design and demonstrate affordable technological and organisational options to mitigate losses and create new economic opportunities. Sri Lanka provides a useful case study to contrast the fruits and vegetables value chain of Pakistan, as the 2 countries are at different stages of development and face different exposure regimes and vulnerabilities. This project is part of the ACIAR-IDRC Food Loss Research Program (see page 8).

Project: Developing food loss reduction pathways through smart business practices in mango and tomato value chains in Pakistan and Sri Lanka (Food Loss Research Program) (CS/2020/193)

Fisheries

Sri Lanka has a well-developed and sustainable inland reservoir fishery that makes up about 12-15% of total fish production and significantly benefits rural communities in the former conflict-affected Northern province. Management practices and stocking strategies for sustainable culture-based fisheries, based on a co-management strategy, have been established in a previous ACIAR project and have increased the productivity of the reservoir fishery. The Government of Sri Lanka has long recognised the potential for the extensive culture of the indigenous giant freshwater prawn (Macrobrachium rosenbergii) in inland reservoirs, but development has been ad hoc, with productivity and returns relatively low. A project led by Dr Clive Jones of James Cook University is investigating stocking, monitoring and harvesting practices to optimise fish and prawn productivity and improve product quality. The project will also conduct market-chain analysis to ensure farming practices meet market product requirements and benefits are socially equitable.

Project: Improved productivity, efficiency and sustainability of the culture-based fishery for finfish and giant freshwater prawn in Sri Lankan reservoirs (FIS/2018/157)

Regional Manager, South Asia Dr Pratibha Singh

Research Program Manager

Agribusiness: Mr Howard Hall Fisheries: Prof Ann Fleming

See page 197 for contact details.