

Pakistan

 **A\$3.59** million
Budgeted funding

 **9**
Bilateral and regional
research projects

 **4**
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. Lockdown 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. There 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.

2022-23 research program

- » **13 ACIAR-supported projects in Pakistan**
- » **10 projects are specific to this country**
- » **3 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.



The Quaid-i-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.

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. During 2022–23, researchers will analyse and report on the results of their study into the components of success and the different impacts of rural transformation on women and men.¹

Pulses are important to both agricultural systems and diets in Pakistan, but domestic production has declined in recent decades. Pakistan now imports 80% of lentils and 10% of chickpeas 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, with spillover benefits 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. Before the project concludes in 2023, researchers will deliver capacity building activities for smallholder farmers to improve connections between farmers and markets and finalise policy advice and recommendations for decision-makers to assist industry development.²

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-i-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 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 its fruit and vegetable value chain against Pakistan. This project is part of the ACIAR-IDRC Food Loss Research Program (page 23).³

Crops

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 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 amounts of hybrid seed 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.⁴

The demand for pulses in Pakistan has been increasing, while production is decreasing. Despite relatively high prices, pulses, especially chickpea and lentils, have been pushed out to the most marginal lands, and labour shortages are 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 its final year, the 6-year project led by Dr Ata-ur Rehman of Charles Sturt University will use results to engage partners and farmers in scaling out effective innovations to intensify pulses production and increase productivity. The project will also identify emerging knowledge gaps and research opportunities to improve pulses production in Pakistan.⁵

Horticulture

The horticulture sector in Pakistan is significant, both domestically and for export production. Dr Babar Ehsan Bajwa of CABI leads a project to strengthen 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, in 2022–23, the project team will deliver capacity building activities to support the implementation, scaling out and monitoring of interventions and improve pre and post-harvest processes, from improved seedlings and variety selection to better packaging, transport, and marketing.⁶

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 project led by Dr Rajendra Adhikari of the University of Queensland aims to improve the wellbeing of citrus-producing smallholder families through participation in inclusive value chains that meet market needs and provide equitable returns to farmers.⁷

Water

Salinity currently affects 4.5 million hectares of land across Pakistan and 54% of the southern Indus Basin, threatening 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 2022-23, the project will finalise analysis and report on the status and future trends of salinity in southern Indus Basin, including policy and management recommendations, and capacity building and mentoring of next users of groundwater monitoring and modelling tools. The project will report on for future research into adaptation strategies, drawing on value chain analysis; and prepare a strategy for scaling out selected adaption strategies beyond the life of the project.⁸

In Pakistan, inland groundwater reserves over a large area of the country are saline, and about 40,000 hectares of agricultural land are abandoned within the Indus Basin annually due to secondary salinisation. Aquaculture is an enterprise option for saline areas that are not suitable for crop cultivation. Scientists from the International Water Management Institute and the WorldFish Centre, led by Dr Mohsin Hafeez, reviewed 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. The project concludes in 2022 with the development of practical and simple guidelines to assist farmers and local extension agents implement viable options for brackish aquaculture, for sustainable livelihoods in saline areas.⁹

Irrigated cropping is critical to Pakistan's economy and food security, and effective management of the country's irrigation is an urgent priority. While basin-level 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 is being led by Mr Simon Dyer, Managing Director of Virtual Irrigation Academy, a company created to scale out water monitoring technology developed by CSIRO. The project aims to create viable and sustainable business models in Pakistan to supply farmers with water monitoring tools developed by the Virtual Irrigation Academy program, which 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.¹⁰



Irrigated cropping is critical to Pakistan's economy and food security, and effective management of the country's irrigation is an urgent priority, and a focus of several ACIAR-supported projects.

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. Dr Mobin-ud Din Ahmad of CSIRO leads a small project that is supporting and training in-country partners to use the tool for 2 rounds of seasonal planning (Kharif and Rabi). The experience will be used to further develop and refine the software and a user guide.¹¹

Groundwater is essential for more than 50% of irrigation requirements in Punjab and up to 20% in Sindh, but the resource is poorly understood and its use largely unregulated. Government and water users recognise the need to improve groundwater management but institutional frameworks for regulation and management are largely lacking. A two-level approach to groundwater management is needed: strategic planning and coordination of actions, and site-specific research and operational management. Dr Jay F Punthakey and Dr Catherine Allan of Charles Sturt University lead a new project to support knowledge creation, sharing and co-design for improved systems of sustainable groundwater management in selected farming communities in Punjab and Sindh. It is expected that this work will contribute to the development of national and provincial frameworks to sustain the long-term productive potential of groundwater and better integrate groundwater into water resource management plans. The project consolidates and builds on past and current ACIAR research investment in improving groundwater management in Pakistan.¹²

The combination of saline landscapes and low forest cover presents numerous and compounding challenges for smallholder farmers in Sindh, Pakistan. With strong linkages to existing ACIAR-supported projects, this small research activity will evaluate the potential of tree planting to manage salinity and increase income in smallholder farming systems. The project will synthesise existing knowledge of suitable species, their characteristics, uses and appropriate management; and well as identify and develop effective forestry extension methods and materials to deliver the knowledge to extension workers and educated smallholders. Concurrently, the project will engage with smallholders and extension workers to ground truth a synthesis of current literature and provide further insights into the knowledge, practices, needs and pressures of smallholders in several different landscapes.¹³

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Research Program Managers

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See page 186 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. Developing competitive and inclusive value chains of pulses in Pakistan (ADP/2017/004)
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)
4. Accelerating genetic gain in wheat through hybrid breeding in Bangladesh, Ethiopia and Pakistan (CROP/2020/167)
5. Increasing productivity and profitability of pulse production in cereal-based cropping systems in Pakistan (CIM/2015/041)
6. Strengthening vegetable value chains in Pakistan for greater community livelihood benefits (HORT/2016/012)
7. Improving smallholder wellbeing through participation in modern value chains: sustaining future growth in the Pakistan citrus industry (HORT/2020/129)
8. Adapting to salinity in the southern Indus Basin [Pakistan] (LWR/2017/027)
9. Opportunities for brackish and saline aquaculture in Pakistan (WAC/2020/179)
10. Virtual Irrigation Academy business models in Pakistan (WAC/2020/180)
11. Supporting inter-provincial water allocation decision making in Pakistan (WAC/2021/103)
12. Groundwater management in Pakistan (WAC/2021/134)
13. Trees for salinity management, Sindh, Pakistan (WAC/2021/136)