

# 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. 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.

## 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.<sup>1</sup>

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.<sup>2</sup>

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).<sup>3</sup>

### 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.<sup>4</sup>

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.<sup>5</sup>

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 farmer-led research and demonstrations of improved varieties, agronomic practices and community seed production to increase the production and profitability of pulses.<sup>6</sup>



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.<sup>7</sup>

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.<sup>8</sup>

## 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.<sup>9</sup>

## 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.<sup>10</sup>

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.<sup>11</sup>

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 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.<sup>12</sup>

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.<sup>13</sup>

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### Research Program Managers

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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)
4. Mitigating the effects of stripe rust on wheat production in South Asia and eastern Africa [Ethiopia, India, Nepal, Pakistan] (CIM/2014/081)
5. 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)
7. Strengthening vegetable value chains in Pakistan for greater community livelihood benefits (HORT/2016/012)
8. 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)