SOUTH AND WEST ASIA

The south and west Asia region includes India, Bangladesh, Pakistan, Afghanistan, Iraq and Bhutan.

India

Collaboration with India includes projects on better water management to improve livelihoods in the more-marginal rain-fed areas of central India, and also to develop policy to assist India with the implications of its transition from a highly regulated economy to a more open market economy.

Bangladesh

ACIAR’s program in Bangladesh focuses on constraints to broadacre crop production (especially the rice–wheat system) and the potential for adopting legumes into cropping systems. The program addresses issues facing those areas particularly impacted by seasonal climate variability and climate change.

Pakistan

ACIAR’s long-term focus in Pakistan is on linkages within the horticulture and dairy sectors, along with natural resources management issues such as efficient water use, salinity management and tillage options for irrigated cereal cropping.

Afghanistan

ACIAR’s collaboration with Afghanistan provides support to wheat and maize production. Activities include on-farm participatory testing of imported germplasm to identify better-adapted improved cultivars, and undertaking local multiplication and distribution of selected cultivars.

Iraq

ACIAR-managed and AusAID-funded projects in Iraq seek to facilitate the development of modern and sustainable agricultural production and marketing systems. A two-year scoping project focuses on understanding salinisation processes and water management.

Bhutan

In Bhutan ACIAR has already contributed to develop Newcastle vaccine for village chickens; other projects have helped manage fruit fly damage and footrot in ruminants. A major initiative to improve citrus production through pest and disease management is now underway.

INDIA

Highlights

- Farmers learn to use bi-weekly customised weather forecasts to adjust their farming operations and take the guesswork out of activities such as when to harvest rice or apply insecticides.
- Successful exchange of wheat lines between India and Australia helps the search for plants with deeper, faster-growing root systems to capture more water and boost the harvest in dry conditions.
- Broad bed and furrow trials to combat waterlogging show that this practice combined with balanced fertilisation produces 40–50 per cent higher soybean yield compared with a flat field using the same regime.

Overview

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

An in-country consultation held in India in February 2011 has helped ACIAR to formulate its medium-term strategy for 2011–16. The strategy focuses on joint partnerships with
increasing co-investment by ICAR and other partners. The large and well-developed national agricultural research system led by ICAR is a cornerstone of ACIAR’s program, which emphasises collaboration in four areas, or clusters, of Australian and Indian expertise. Research themes reflect strong common interests and point to areas with potential for positive impacts at both field and national levels in both countries.

The four major clusters focus on: research to improve agricultural water management, particularly in rainfed areas; sustainable intensification of zero-tillage cropping systems that incorporate pulses; faster breeding of crops to target (in the case of wheat) product quality aligned with emerging demands for better quality chapattis, bread and biscuits from India’s 200-million-strong middle class; and assisting policy development in relation to agricultural adjustment, water management and climate change.

Research achievements

Farmers from three villages in three districts of Andhra Pradesh are testing the use of bi-weekly customised weather forecasts to adjust their farming operations. Some have used the forecasts to determine the right time to harvest rice, while others have followed them to schedule the application of insecticides to control pests. Farmer groups meet twice a month to discuss the seasonal affects on crops and provide feedback on the advisories and the accuracy of weather forecasts. The study is part of a five-year initiative developing climate change adaptation strategies for rainfed, rice-based farming communities in India; Bangladesh, Cambodia and Laos farming communities are also involved.

ACIAR is funding a project to improve post-rainy season sorghum varieties to meet the growing grain and fodder demand in India. Post-flowering drought adaptation in sorghum is associated with the ‘staygreen’ phenotype, and interest is centred on the development of lines that best express this trait. In an effort to understand the physiological basis of the staygreen trait the scientists are testing genetic materials for water use efficiency and for possible differences in the capacity to extract water from the soil profile. In addition, the Australian team is using crop simulation modelling to characterise the types of water stress in the target regions, and to predict what effect the introduction of a given line possessing the staygreen trait would have on grain and stover yield across a range of locations.

Another project seeks to develop wheat germplasm for India and Australia with deeper, faster-growing root systems that enable plants to capture more water and boost the grain harvest in dry conditions. Australian and Indian wheat research groups are exchanging germplasm, and an important achievement in the project was the arrival of Indian varieties in Australia where they are currently being grown in quarantine. The material comprises of 40 lines selected by the Indian team from long-running high yields in the central and peninsular water-limiting regions. In exchange Australian varieties have been sent to India where they are being grown to provide enough seed for trials at three sites to assess their water use and water use efficiency.

In the second year of a project on waterlogging, salinity and element tolerance of wheat, Indian and Australian project scientists have successfully conducted experiments in pot, microplot, field station and farmers’ fields. They have exchanged, developed and initiated new crosses, identified in detail some of the element constraints (deficiencies and toxicities) of soils from their target environments, and begun to confirm how certain wheat varieties deal with individual constraints—through traits such as bicarbonate/carbonate tolerance—and how these affect grain yield in the field.

Farmer livelihoods in rain-fed areas of the Indian Central Plateau (particularly Andhra Pradesh) could be enhanced through improvements to institutional performance of watershed development (WSD) programs. A project seeks to increase capacity for various Indian agencies to improve institutional design for WSD and other resource management activities. The project is also setting rules and coordinating mechanisms to ensure that the development and extraction of groundwater remain within sustainable limits. An extensive data set comprising over 500 beneficiary households has now been assembled. The sample covers three districts in Andhra Pradesh and 18 villages in total. Targeted sampling has ensured that the data cover differing WSD programs.
Waterlogging leaves large areas of arable land in Madhya Pradesh uncultivated during the kharif season (e.g. 20–25 per cent in Vidisha district). Some waterlogged fields are sown with soybean but yields are low due to poor establishment. A project team has made a preliminary evaluation of broad bed and furrow (BBF) as an agronomic strategy to overcome some of the adverse effects of waterlogging. Integrating BBF with balanced fertilisation (BF) produced 40–50 per cent higher soybean yield compared with a flat field using the same fertiliser regime. In the same project farmers have participated in trials to determine the right levels of nutrient input for better yields (more in the box below).

New fertiliser practices address nutrient shortfall

Farmers in Madhya Pradesh have participated in trials to learn how to overcome nutritional limitations in the soybean–wheat cropping system used on Vertisol soils in a monsoonal environment. A project has developed two fertiliser management strategies to help the farmers deal with the nutrient shortfall. The first involved an integrated nutrient management (INM) approach, combining application of farm yard manures (FYM) with inorganic fertiliser.

While the traditional practice has been infrequent application of a large amount of manure (20 tonnes per hectare), project trials showed that substantial benefits could be gained from a smaller application (5 tonnes per hectare), permitting farmers to treat a larger area with manure each year.

But the second management strategy was developed because even at a rate of five tonnes per hectare there was insufficient FYM for application to all of the cropped area; this strategy comprises an inorganic fertiliser regime termed balanced fertilisation (BF).

Farmers attended field days to increase their knowledge and also to gain a perception of the work. Then the newly developed methods were evaluated using a ‘Baby Trial’ strategy, with 95 trials distributed across 10 villages in three districts. The farmers conducted these baby trials, comparing INM, BF and their own long-standing practice.

The kharif (monsoon season) soybean crop under the BF regime produced yields 23 per cent greater than the farmer’s practice while the INM approach produced yields 46 per cent higher. The mean wheat grain yield showed that the INM produced 24 per cent more than the farmers’ practice, while balanced fertilisation increased the wheat grain yield by 30 per cent over the farmers’ practice.

John Dixon, ACIAR cropping systems and economics program leader and regional coordinator for south Asia and Africa, inspects a wheat research trial in India.
BANGLADESH

Highlights

- Introduction of new super-short-duration cultivars and the use of relay cropping help to reinvigorate national pulse production.
- Maize crops perform better under reduced tillage, strip tillage, and raised beds compared with farmers’ practice.

Overview

ACIAR’s focus in Bangladesh has been on food grain crops, and its strategy addresses one of Bangladesh’s key development challenges—food availability within the context of increasing climate-change vulnerability. Thus research activities relate to agricultural food production. In addition to this challenge, Bangladesh faces the problem of inadequate nutrition, which is not just limited to food availability. It is derived from multiple factors, for example gendered consumption practices, international market variations and effectiveness of government structures.

With re-emerging concerns about Bangladesh’s ability to maintain food security in the light of its high vulnerability to the impacts of climate change, ACIAR’s emphasis is shifting towards increasing the productivity of rice as the main staple. Low-lying areas and rainfed cropping systems in Bangladesh are particularly negatively impacted by the effects of seasonal climate variability and change. Consequently, Bangladesh is one of four partner countries involved in ACIAR’s climate-change adaptation initiative. The major research thrusts are therefore intensification of cereal crops, diversification of rice-based systems, adaptation to climate change and alleviation of policy constraints.

Research achievements

The low-lying and rainfed cropping systems of Bangladesh are vulnerable to the effects of seasonal climate variability and change. Bangladesh is one of four countries involved in a project to develop multi-scale climate change adaptation strategies for farming communities. On-farm experimental plots were established in all four countries in time for the 2010 wet season and during the dry season 2010–2011. In the case of Bangladesh these plots were designed to initiate on-farm testing to establish options for adaptation.

One major objective of a joint project between the International Rice Research Institute (IRRI) and the International Maize and Wheat Improvement Center (CIMMYT) on sustainable intensification of rice–maize production systems is to conduct on-station and on-farm trials on rice–maize–mungbean and rice–potato–maize systems, using the principles of conservation agriculture. These trials are in progress across three project districts. On-farm adaptive trials with different tillage options in rice–maize–mungbean cropping systems conducted during 2009–10 rabi (winter) and aman (monsoon) seasons revealed that maize performed generally better under reduced tillage, strip tillage, and raised beds compared with farmers’ practice. Though rice yields in farmer’s practice did not differ significantly from any of the tillage practices in 2010, yields under reduced tillage and raised beds were more profitable than those from farmers’ practices.
Household livelihoods and the nutrition of the Bangladeshi people can benefit from crop diversification through intensification. A newly commissioned project will contribute to the drive to **reinvigorate national pulse production** by introducing varieties of short-duration pulses (lentil, mungbean and field pea) into new cropping niches and adopting minimum tillage in western Bangladesh. This tailoring process involves introducing new super-short-duration cultivars and the use of relay cropping—a technique of sowing pulses into the aman rice crop prior to its harvest.

**PAKISTAN**

**Highlights**

- ACIAR project team gathers new and reliable hydrological data to help optimise canal and groundwater management.
- Improvements to extension services have led to management and productivity improvements on approximately 40 per cent of the farms in one well serviced region and around 15 per cent in another desert region.
- Students from Charles Sturt University contribute to workshops for students from across Pakistan.

**Overview**

Development challenges in Pakistan are considerable, and the floods of 2010 have exacerbated these. Increasing pressure on availability of water resources for irrigation exists due to competing demands for urban and industrial uses. Poor irrigation management practices combined with poor drainage and soil management have resulted in significant salinity. High-value horticultural crops such as citrus and mangoes for both domestic and export markets are an important source of farm income; however, crop management practices are often suboptimal and losses along the value chain are high. Pakistan is also one of the world’s largest milk producers, with slightly less than half of that production from dairy cattle. Unit animal production is very low although genetic potential is quite good.

ACIAR’s strategy for Pakistan is to work closely with the Pakistan Government, AusAID, other donor partners, NGOs and the Pakistani private sector to provide R&D and technical capacity building, technical support and carefully targeted R&D interventions to underpin Pakistan development programs. Poverty reduction, linking smallholders to markets, and gender equality are major issues for development programs in Pakistan, and are a key consideration for the ACIAR strategy. Australia is well placed to assist Pakistan in addressing irrigation, drainage and salinity management in major cropping systems, and this is an important focus of the program.

ACIAR’s work in dairy and horticulture in Pakistan revolves around the Australia–Pakistan Agriculture Sector Linkages Program (ASLP). The program is moving into its second phase, and this extension will initially concentrate on the mango, citrus and dairy sectors. There will be a greater focus on gaining benefit for smallholder and poor farmers, benefits for other disadvantaged groups, greater involvement of women, dissemination of results and maximising project impacts.

**Research achievements**

Work is in progress to **optimise canal and groundwater management** and thereby assist water user associations to get the best from their crops and manage salinity. The Punjab Irrigation and Drainage Authority is working closely with the farmer organisations under the ongoing institutional reforms, in the command area of Lower Chenab Canal. The ACIAR project team has contributed to the process by gathering new and reliable hydrological data from 54 newly installed piezometers, three soil moisture probes and an automatic weather station at selective locations throughout the distributaries of the Lower Chenab Canal. Other hydrological parameters including water quality and groundwater extraction have been collected fortnightly.

Over 8.5 million smallholder dairy farmers throughout Pakistan depend on income from the production of their small herds of buffalo–cattle, but farmers struggle to boost on-farm efficiency because the relevant information is neither disseminated nor adopted in the farming community. One project seeks to **improve dairy production** in Pakistan through
improved extension services. Field extension workers and farmers have been introduced to the key fundamentals that contribute to high productivity from cattle and buffalo—feed and water management, cow health, calf rearing and reproductive management. Changes in productivity, carefully measured with bucket and scales, have related directly to changes in farm income. Members of the field staff have observed management and productivity improvements on approximately 40 per cent of the farms in the better serviced Okara region and around 15 per cent in the desert region of Bhakkar.

As a mark of the importance placed on working with the future generation of scientists, academics and field staff servicing the dairy industry, the project instigated workshops for students from across Pakistan. In 2010, students from Charles Sturt University helped to develop extension material to assist with the programs. The students focused on mastitis and milk quality, feed planning and ration formulation and breed improvement. The linkages forged through these workshops will be important in developing a cohesive and functional dairy industry for the future.

AFGHANISTAN

Highlights

- Four new wheat varieties will impart more durable rust disease resistance, minimise epidemics and remove the need for emergency fungicide applications.

Overview

ACIAR’s collaboration with Afghanistan started in 2002 and focuses support on wheat and maize production. Activity in Afghanistan continues through collaboration with CIMMYT and International Crops Research Institute for the Semi-Arid Tropics (ICRISAT). The operating environment is complex as a result of poor security and political uncertainty, which limits access by Australian scientists and hinders donor capacity for long-term planning.

Principal objectives have been to import seed of suitable cultivars, establish on-farm participatory testing of imported germplasm for the identification of better adapted improved cultivars, and undertake local multiplication and distribution of selected cultivars. Particular attention has been paid to capacity building, improving rust resistance in wheat (with specific attention to the new stem rust race variant designated Ug99) and promoting improved crop management, together with provision of improved cultivars of both wheat and maize.

Future initiatives may include community-based watershed development for dryland areas, and livestock production to improve livelihoods in dryland agriculture.

Research achievements

ACIAR and AusAID have a jointly funded four-year project ‘Sustainable wheat and maize production in Afghanistan’ that seeks to introduce improved wheat and maize varieties, and thus offer farmers an alternative to poppy cultivation. The project supports the screening and release of new high-yielding varieties and quality breeder seeds, and promotes the wheat–maize cropping system through new crop management practices. Project operatives are CIMMYT, the Ministry of Agriculture, Irrigation and Livestock, the

Children holding spikes of harvested wheat from an improved variety in Afghanistan. (Photograph courtesy of ICARDA)
Agricultural Research Institute of Afghanistan, the Food and Agriculture Organization of the United Nations (FAO) and the International Center for Agricultural Research in the Dry Areas (ICARDA).

The joint effort of collaborating agencies has led to the development of nine wheat and four maize varieties that are high-yielding and disease-resistant. Four new Ug99-resistant wheat varieties will impart more durable disease resistance (especially with respect to yellow rust and stem rust race Ug99), minimise epidemics and remove the need for emergency fungicide applications (often indiscriminate blanket applications by air).

Despite hardships farmers have shown tenacity in growing food crops and receptiveness to new technologies and seeds. They are encouraged to visit on-station trials and on-farm demonstration plots, thus increasing the interchange between farmers and project staff.

IRAQ

Highlights

- High uptake of zero tillage in the drylands of northern Iraq.

Overview

ACIAR-managed and AusAID-funded projects are supporting the recovery of Iraq’s agricultural sector, a key priority for the Iraq Government. Iraqi scientists have had limited access to international developments in the agricultural sector for over two decades. ACIAR’s country program is designed to facilitate the development of modern and sustainable agricultural production and marketing systems in Iraq. It has two broad focuses: improved management of field crops, and identification of improved salinity management in irrigated lands.

Achieving sustainable increase in domestic production is now a national imperative. Pressures to abandon cereal–fallow rotations have exacerbated soil degradation and nutrient depletion, and now established cropping systems are in serious decline. The introduction of sustainable tillage is playing a key role in restoring these systems, and spillover benefits are expected beyond Iraq. The relevance of Australian expertise to Iraqi conditions has helped to shape the project, but lack of access to project sites in Iraq has constrained the work of Australian scientists. The project focuses on the enhancement of barley, wheat and grain legume production under dryland conditions in northern Iraq through the introduction and evaluation of appropriate modern varieties; and on the adaptation of improved management practices, including tillage, fertiliser and weed control techniques.

The 2-million-hectare central-southern irrigated zone that produces vegetables, fruit and cereals is under increased pressure from salinity, long identified as a major threat to agriculture in Iraq. Political tensions with neighbouring countries since the early 1980s have hampered efforts to improve irrigation and drainage practices. Increasing levels of salinity in irrigation water from both the Euphrates and Tigris rivers due to changed water regimes have exacerbated the problems. ACIAR’s has developed a 2-year scoping project to focus on understanding salinisation processes, water management and the use of moderately saline soil for agricultural production.

Research achievements

In a project to develop conservation cropping systems in the drylands of northern Iraq the uptake of zero tillage through the project has been described by project participants as ‘spectacular’. Project activity is focused in Ninevah Governorate, where there has been a strong imperative to reduce cultivation now that diesel fuel that was formerly highly subsidised has risen to world price parity. The demand for zero tillage (ZT) seeders has soared. Overall around 6000 ha of ZT crops were grown by 54 farmers in Ninevah in 2010. About 80 per cent of this area was actual adoption by farmers using their own or a rented/borrowed ZT seeder. In addition, significant yield improvements are being observed, a promising sign given that current yields are only about one-third of comparative crops under similar conditions in developed countries.

Work is currently underway within Iraq to explore production gains from saline agronomy. An ACIAR project to gather baseline information and provide a framework for the development of long-term salinity management strategies in central and southern Iraq commenced.
during the year. The assessment of salt distribution and its drivers and irrigation water salinity at different scales—farm, irrigation district, and river basin—are the key features of the project. This information will be used to develop methodologies for salinity control and productivity enhancement of saline water and salt-affected soils.

**BHUTAN**

**Highlights**

■ Delegation from Bhutan citrus industry learns about current production and marketing during visit to Australia.

**Overview**

ACIAR maintains a small tightly focused program in Bhutan. Its strategy is to work closely with the Bhutanese Government, local industry and other donors to ensure that planned R&D interventions are appropriate, consistent with the most recent government 5-year plan and complementary to the work of other donor agencies. A major initiative on improvement of citrus production (Bhutan’s largest horticultural export industry) through improved planting material and integrated crop management is currently being implemented. The Bhutan Government has identified crop irrigation management, integrated crop management of vegetables (particularly chilli) and development of contract farming crops (e.g. walnut, grapes, asparagus, pomegranate) as priorities for future collaborative R&D.

**Research achievements**

Traditional Bhutanese mandarin producers rarely prune their trees, use few inputs, and are faced with pests and diseases such as Chinese citrus fruit fly, powdery mildew and citrus greening (Huanglongbing). As a result the fruit can be of poor quality, with average yields less than half that of Australian trees. An ACIAR project has provided a foundation for the adoption of new technologies throughout the Bhutanese citrus industry.

As part of the process a **Bhutanese delegation visited Australia** in April–May 2011. The group toured citrus industry groups, farms, nurseries, packing sheds, markets and research facilities in the Mildura, Sydney and Mundubbera/Gayndah areas. The Bhutanese observed how Australian citrus growers prune their trees—of interest because it is one of the main ways they are improving production in Bhutan. They also benefited from seeing the operations of Auscitrus, the industry organisation that supplies high health status budwood and seeds to the Australian industry. There is a move to introduce clean grafted citrus trees because they can fruit in 3–4 years, significantly earlier than the seedling trees in Bhutan that take on average 7–8 years to fruit.