

# South Asia

| Financial year | Regional expenditure | Percentage of total bilateral expenditure | Board target as percentage of expenditure |
|----------------|----------------------|---|---|
| 2004–05        | \$3,787,994          | 13.5                                      | <15%                                      |
| 2003–04        | \$4,018,897          | 15.7                                      | 10–20%                                    |
| 2002–03        | \$3,953,919          | 13.5                                      | 10–20%                                    |

ACIAR's South Asia program operates in two groups of countries. Countries in the first group—India, Pakistan and Bangladesh—where most population is centred, are emphasised in ACIAR programs. A small number of activities are under way in the second group—comprising Nepal, Sri Lanka, Bhutan and Afghanistan. For the region, the Board and Minister have set an expenditure target of less than 15 per cent of our overall bilateral research expenditure.

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| Nepal                              | 69        |
| Sri Lanka                          | 70        |



Christian Roth

Rice fields, typical of the Punjab and Haryana regions



Ian Willett

Rajasthan project scientists and farmers





Dr Kuhu Chatterjee,  
ACIAR Regional Manager, South Asia

# India

|   |             |
|---|-------------|
| Active projects in 2004–05                      | 22          |
| AOP budgeted expenditure in 2004–05             | \$2,500,000 |
| Actual bilateral country expenditure in 2004–05 | \$2,601,365 |
| Bilateral country expenditure in 2003–04        | \$2,482,097 |
| Bilateral country expenditure in 2002–03        | \$2,398,203 |

| Key performance indicators  | Performance 2004–05   |
|---|---|
| <ul style="list-style-type: none"> <li>• New arrangements for ACIAR project management and execution in India implemented, including greater involvement of NGOs and independent research institutes</li> </ul> | Two of three bilateral projects commenced involve NGOs, while a third major project to commence early in 2005–06 is to be led by an NGO. Collaborative cost-sharing venture on wheat molecular markers with Indian government institutes under negotiation  |
| <ul style="list-style-type: none"> <li>• Half of the new projects emphasise the rain-fed tropics and sub-tropics</li> </ul>   | Two projects commenced relate to trade and technology policy. Five biophysical projects commenced or in development, address rain-fed regions: two where agriculture is fully rainfed, one in a predominantly rainfed area and two in partly rainfed areas. |
| <ul style="list-style-type: none"> <li>• Increased emphasis on demand-led project identification in rain-fed semi-arid tropics, and all new projects have well-defined adoption pathways</li> </ul>             | Stronger emphasis on adoption pathways through involvement of local research organisations and NGOs in project design and execution, including projects in the semi-arid tropics.   |
| <ul style="list-style-type: none"> <li>• Farmers in Gujarat purchasing protected nutrient livestock feeds produced on a commercial basis</li> </ul>   | The Australian High Commissioner opened one factory in 2004 and two others will open in mid-2005.   |
| <ul style="list-style-type: none"> <li>• Improved institutional policies arising from ACIAR project research, promoting more equitable and efficient water use</li> </ul>                                       | Project participants still formulating policy principles.   |
| <ul style="list-style-type: none"> <li>• Novel seeding machine that handles heavy rice residues tested widely in Punjab State</li> </ul>  | Machines developed and being tested in over 10 districts.   |

## Position

Recent changes in approach to the development of bilateral donor-funded research have revised the priority mix between India and ACIAR. It is expected that ACIAR collaboration with both the Indian Council of Agricultural Research and the Council of Scientific and Industrial Research will be jointly funded. The Indian Government is also encouraging stronger links with independent research organisations and NGOs.

ACIAR's program in India emphasises sustainable smallholder crop and livestock systems through the introduction of better varieties and improved management technologies. Broad-scale land and water resource management research emphasises policy studies on water management, and there is work in progress to analyse policy constraints relating to all the above areas. The focus of project development is on marginalised farmers in particular states within rainfed, semi-arid areas of north and central India.



## Achievements

Ruminants including sheep are important providers of staple food and income for many smallholders. **Demand for milk is rising.** Smallholders have the chance to tap into new markets if they can increase animal productivity. Poor feed quality is an important limiting factor to animal productivity. Boosting milk production is the subject of related projects. The first has developed two supplements that enhance the performance of fungi living in ruminant stomachs. This increases fibre digestion, releasing nutrients that boost productivity. Increased dry matter intake has been demonstrated in trials of both treatments, lifting weight gain and milk production. An associated project recently concluded has introduced feed supplements that boost the animal's protein and fat intake. The extra fat and protein help increase milk production; cattle fed the supplements produce an extra one–two litres of milk a day, which smallholders can sell. The success of the research led to establishment of a commercial-scale factory producing feed supplements.

Sheep numbers in Maharashtra continue to increase following the introduction of a genetic trait for fecundity in sheep. Rams and ewes carrying the trait have been introduced into local flocks. The gene, originally found in Garole sheep from Bengal, **results in more multiple births.** More than half the lambs produced by mating these sheep with local animals have inherited the gene.

Cropping remains the major source of staple foods for many smallholders. Chickpea is a protein-rich crop, but yields and quality in drought-prone areas are low. Improved **varieties have been trialled for their ability to adapt to drought-prone environments.** A key component of these trials is evaluation of how well plants utilise available water. The higher the level of adjustment, the greater is the likelihood of increased adaptability to drought conditions. The role of water availability is also the subject of research into growing wheat, but in this case there is **too much water.** In some areas of India waterlogging of soils makes growing difficult. Identifying varieties that tolerate waterlogging through determining the genetic basis of their tolerance has confirmed waterlogging as a 'hidden' constraint to yield and characterised the soils where this is likely to occur. Lines tolerant to waterlogging are being incorporated into breeding programs. Scientists also uncovered the physiological mechanisms of waterlogging tolerance and they will employ this knowledge when making varietal choices in the future.

Two projects are introducing improvements to crop management for wheat systems. The first is helping farmers in Madhya Pradesh improve their management of soil nutrient inputs. Despite the availability of farmyard manure—a **potential fertiliser replacement**—it is not properly used to remediate soil nutrient deficiencies. The project team is developing recommendations for better manure use.

In north-west India rice and wheat are grown in rotation, using irrigation in the rice phase. The impacts of this practice on nitrogen in soils and



S.S. Kulkarni

water availability, together with low yields, have led to calls for a more sustainable approach to management. Permanent raised beds may offer a potential solution. Now in its fourth year of research the project has refined management strategies for raised beds, relating to the timing of irrigation and sowing. Scientists are calculating water productivity to gain an improved understanding of water balance in soils in Punjab Province. Raised beds offer a promising yield advantage when rice is replaced in the rotation by either maize or soybean. **The Happy Seeder, a tractor for direct sowing wheat into rice stubble,** developed during the project, is now being built by an Indian machinery company.

Further refinement of the seeder has led to the improved 'Combo Happy Seeder'. The drill technology is now being widely tested in northwest India.

Postharvest treatment of rice and maize are largely inefficient in West Bengal, being based on old technology. These systems leave moisture in grain, a contributor to spoilage and postharvest losses. **Current storage environments are being assessed** for temperature and humidity to determine how these affect germination of seeds. A two-stage dryer to achieve reduced moisture levels is being introduced to these storage facilities, and scientists are testing and adapting it to local conditions.

Mandarin production is in decline in Sikkim Province, despite a lucrative market and rising demand. The cause of this decline was thought to be huanglongbing, or citrus greening. ACIAR-supported research has confirmed this and is examining ways to boost production both through improved management and better germplasm. The distribution of the disease has been determined through field surveys. Trees exhibiting superior health and yield in the presence of the disease have been identified and samples collected in an effort to find out why. In a separate project **to boost eucalypt plantation productivity** in Kerala state, scientists at Kerala Forest Research Institute **have received training** in improved silvicultural practices, tree establishment, water-tree interactions and growth potential modelling.

Water resource management has improved after introducing an assessment framework to analyse water institutions. Water managers now have **more accurate information**. A key focus has been identifying and developing methods to improve links between formal water resource management institutions and informal groups involved in irrigation and water allocation. A similar framework will assist the development of water allocation strategies in the Krishna Basin, to support the recently convened Krishna Basin Tribunal.

*Permanent raised bed cropping systems may provide farmers with a more sustainable approach.*

In places where water has been contaminated by salt few viable options for income generation exist. One possibility is **the use of saline water ponds for aquaculture**. In areas where low aquifers have become saline, water is pumped to holding ponds. Culturing of species such as giant freshwater prawn is being trialled. Problems of **salinity in and around tanneries** have a different origin but raise similar issues. Salinity arises from the disposal of water polluted with substances used in processing hides and skins. This includes high levels of salt. Changes to preservation and processing techniques, such as chilling, and different approaches to applying and removing salt are reducing the level of salinity in the effluent. These techniques are now being introduced to tanneries in two states.

As with many emerging trade nations in the region the impacts of WTO accession and regulations on agricultural sectors are not clear. A newly commissioned project is examining some of the likely impacts, and the implications for government policy. The aim is to **determine the changes needed to create improved market efficiencies**. State trading enterprises are a particular focal point.



Stewart Fielder

*Aquaculture is being trialled in degraded inland saline areas*



# Pakistan

Active projects in 2004–05 5

|   |           |
|---|-----------|
| AOP budgeted expenditure in 2004–05             | \$500,000 |
| Actual bilateral country expenditure in 2004–05 | \$506,033 |
| Bilateral country expenditure in 2003–04        | \$697,496 |
| Bilateral country expenditure in 2002–03        | \$212,104 |

## Key performance indicators

| Key performance indicators   | Performance 2004–05  |
|--|--|
| <ul style="list-style-type: none"> <li>Initiation of a project to extend positive results obtained on use of permanent raised beds for irrigated maize-wheat cropping</li> </ul> | Project commenced prior to wheat planting in November 2004. Two farmer groups involved from initiation with more than 20 on-farm whole-field bed plantings of wheat. |

## Position

ACIAR and Pakistan have collaborated on projects since 1984, with major research areas focusing on management of water resources and finding agricultural and forestry solutions to managing saline lands. Since late 2001 security issues have curtailed further project development and hindered progress on project development and implementation for existing projects. ACIAR's program has been small and remains so, concentrating on major natural resource problems. These include water efficiency of crops, salinity and drainage associated with irrigated and dryland cropping.

## Achievements

In Pakistan ACIAR's three projects are addressing issues relating to crop management—two **introducing sustainable practices in 'at-risk' saline areas** and the third seeking solutions to Gemini virus diseases. A new project is furthering the results of a past project by introducing permanent raised cropping beds in Pakistan's irrigated cropping land near Mardan. Changes in soil–water interactions and the impacts of the system on crop yields are being assessed in field trials. Pakistani partners are benefiting from research results out of the related Indian project on raised beds.

The second project has **collected data from saline-affected lands** at two sites to develop farming systems suitable for saline lands. The project has developed systems that utilise salt-tolerant tree and crop species to limit the discharge of saline effluent into rivers and waterways. Other research is helping determine the way saline water and crystalline salt mobilise and drain into soils and rivers.

Controlling Gemini viruses, an emerging group of plant viruses that have caused severe epidemics of plant disease, is important to Pakistan's horticulture and cotton industries. Scientists have **discovered how to create genetic defences by inoculating plants** and have halted the spread of disease in controlled conditions. Initial testing reveals that these defences are most effective when virus-specific. A viral protein that helps the virus penetrate the epidermal cells of plants has also been identified.

During June 2005 the President of Pakistan, HE General Pervez Musharraf visited Australia and met with the Australian Prime Minister John Howard, with discussions including agricultural development. This led to development of a program to expand the agricultural linkages between Pakistan and Australia—the *Australia–Pakistan Agriculture Linkages Program*.

The program has three components: involving development scholarships to be managed by AusAID; facilitation of market linkages to be managed by Austrade; technical activities, to be managed by ACIAR. Each is designed to build linkages between Pakistani and Australian research scientists and organisations, academic institutions and commercial companies and markets, in order to enhance agricultural production and sustainability.

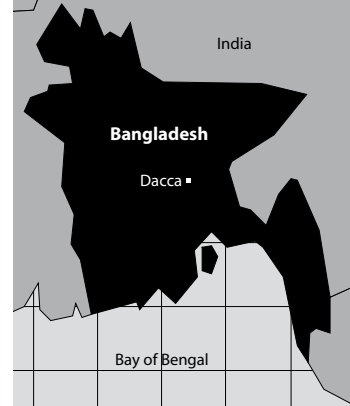
The ACIAR-managed technical activities component, funded by AusAID and costing \$5 million, will involve seminars, staff exchanges, research and analytical activities. Some small projects addressing mutual priorities will begin in 2005–06.

# Bangladesh

Active projects in 2004–05

3

|   |           |
|---|-----------|
| AOP budgeted expenditure in 2004–05             | \$240,000 |
| Actual bilateral country expenditure in 2004–05 | \$243,712 |
| Bilateral country expenditure in 2003–04        | \$276,729 |
| Bilateral country expenditure in 2002–03        | \$368,485 |



| Key performance indicators   | Performance 2004–05  |
|--|--|
| <ul style="list-style-type: none"> <li>• Outputs from arsenic project adopted by Bangladesh government and other agencies</li> </ul>                 | UNICEF and national agencies currently developing communication strategies to communicate which vegetables are more likely to contain elevated levels of arsenic. No evidence of change in dietary practices or government policy. |
| <ul style="list-style-type: none"> <li>• Training of farmers in diagnosis and management of Botrytis Grey mould and pod borer of chickpea</li> </ul> | More than 100 on-farm, paired experiments set up during 2004–05 and training provided at each site before and during season.   |

## Achievements

Naturally occurring **arsenic results in elevated levels in groundwater in Bangladesh. The arsenic finds its way into human diets** through several avenues. Arsenite, a type of arsenic, is the dominant form in alkaline soils in the country. Groundwater, bore water, soils and crops in three villages in Bangladesh’s Munshiganj, Narayanganj and Comilla districts were sampled for arsenic presence. Arsenite was found at all three locations at concentrations exceeding the current Australian drinking-water standard of 7 mg per litre. The highest concentration was 800 mg per litre with the average around 20 mg per litre. Accumulation of arsenic in crops is most likely caused by irrigation. Information is being distributed to extension agencies responsible for informing farmers in arsenic-affected areas.

A second year of field screenings of chickpea varieties for resistance to Botrytis Grey Mould (BGM) has been completed. Several hundred lines from Bangladesh, Australia and ICARDA have now been trialled, with **77 lines showing potential for effective resistance**. These will now be assessed for incorporation into breeding programs. The molecular analysis of *Botrytis cinerea*, the causal agent of BGM, has revealed Bangladesh has a relatively homogeneous *Botrytis* population. This improves the likelihood of controls working more effectively. A farmer participatory program is now beginning to test chickpea varieties for their suitability. Farmer groups testing integrated crop management packages to control BGM and pod borer are getting higher yields, thus many farmers are starting to adopt these approaches. A newly commissioned project is introducing plant health management packages for faba bean, chickpea and lentil and will also examine germplasm improvement for resistance to certain diseases and stresses.

## Position

Bangladesh and ACIAR have maintained a small research program since the mid-1990s. The domination of rice farming and a multitude of agricultural problems limit Australia’s capacity to deal with Bangladesh’s research issues. ACIAR’s strategy is to focus on constraints to production and postharvest handling of broad-acre grain crops. Projects connect with Bangladeshi programs at the International Agricultural Research Centres, to maximise impact in Bangladesh.

## Other South Asian countries

|   |            |
|---|------------|
| Active projects in 2004–05                      | 6          |
| AOP budgeted expenditure in 2004–05             | \$270,000  |
| Actual bilateral country expenditure in 2004–05 | \$436,885  |
| Bilateral country expenditure in 2003–04        | \$526,575* |

\*The 2004–05 Annual Operational Plan grouped Afghanistan, Bhutan, Nepal and Sri Lanka together under Other South Asia, for budgeting and reporting purposes. Bilateral expenditure figures for these countries are grouped together in the table above. Similarly, key performance indicators for Other South Asia were grouped together and are reported against below.

| Key performance indicators  | Performance 2003-04  |
|---|--|
| <ul style="list-style-type: none"> <li>Documentation of a significant increase in aquaculture production from seasonal tanks in five districts (Sri Lanka)</li> </ul> | Farmer-based trials successfully completed, best practice guidelines developed, and the legal and institutional enabling environment improved. All 34 farmer groups involved in the study have continued with fish culture using their own resources, with results being extended more broadly by the National Aquaculture Development Agency and through an ADB-funded project. |
| <ul style="list-style-type: none"> <li>Provision of new lentil cultivars to farmers (Nepal)</li> </ul>  | One lentil cultivar (Shital) released to farmers and two other cultivars nearing release.  |

|   |   |
|---|---|
| Active projects in 2004–05                              | 1 |
| Wheat and maize productivity improvement in Afghanistan |   |

## Afghanistan

### Position

ACIAR's work in Afghanistan is cofunded by AusAID and implemented as multilateral projects led by CIMMYT. The short- to medium-term focus is on supporting wheat and maize production, principally by providing seed of improved cultivars and strengthening capacity in this field. Yellow rust in wheat and improved crop management techniques are also priorities.

### Achievements

A follow-on project to the successful introduction of improved wheat and maize has begun. The 'Seeds of Strength' project identified wheat and maize varieties suitable for growing in local conditions. Three hundred tonnes of wheat seed and two and half tonnes of maize seed were delivered. A key outcome was **restoring farmer confidence through improved crop yields**. This helped encourage farmer participation in varietal trials. A number of scientists received training in crop breeding techniques and evaluation varieties. Training programs have enhanced skills in surveying trial plots and taught farmers to diagnose yield-limiting factors. Wheat germplasm trials and nurseries have been established, including at the Darul Aman Research Station near Kabul. The new project will continue this work, multiplying quality seed to ensure future supply. Crop management techniques tailored to the new varieties and conditions will also be included in the research. Specific subjects include introducing weed controls, improvements to plant establishment, soil fertility management and conservation tillage.



# Bhutan

## Position

Bhutan is a country where Australia has a relatively low comparative advantage. Past projects have concentrated on managing livestock diseases and current project work aims to address the issue of pest management in horticulture.

## Achievements

Fruit flies are a major pest of citrus crops in Bhutan, with almost all trees suffering some degree of fruit loss. In an effort to introduce field controls researchers have surveyed the distribution of pest species and are now conducting experiments to learn more about the life cycle of target species. These include bagging of branches and selectively revealing fruit for a two-week period to determine when flies lay eggs and how these develop. This has **provided a reliable data set** on when target species deposit eggs. A second phase of the life cycle, when pupae emerge from soils in infested areas, is also being defined. This is done through capturing the emergent pupae in traps. Both experiments are providing valuable insights into the life cycle of flies to inform researchers on the best field control options.



|                            |   |
|----------------------------|---|
| Active projects in 2004–05 | 1 |
|----------------------------|---|

A survey of fruit flies in Bhutan and a field control program for the Chinese citrus fly

# Nepal

## Position

Nepal's mainly rural population is engaged in cropping and livestock, with ACIAR's program reflecting these disciplines. Crop production and management is the main research focus, targeting the lowland Terai region, the area with the most commonality to Australian agricultural production environments.

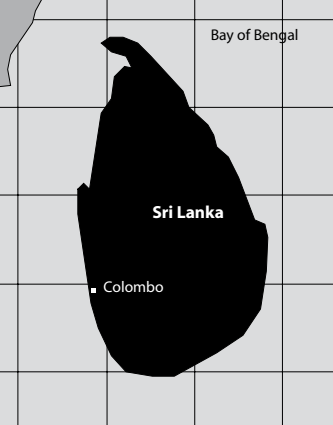
## Achievements

Genotype-by-environment trials to determine improved lentil varieties for introduction to a range of growing conditions have been completed. Two varieties that have consistently performed well in the Terai, demonstrating increased yields, are now **being scaled up for large-scale planting**. The best of these, variety ILL7723 should soon be available for widespread release, with more than 16 tonnes of seed now available through farmer participatory schemes. This variety has reasonable resistance to wilt and *Stemphyllium* blight. Lentil varieties resistant to vascular wilt (a disease caused in part by frequent planting to meet market demand) have also been identified, with two varieties highly resistant and 38 resistant. The new ILL7723 line is one of the resistant varieties. Several other resistant varieties are suitable for growing in hill and mid-hill conditions. Improved *Lathyrus* (grass pea) lines that can tolerate being sown in the waterlogged conditions of standing rice have also been identified. During the project 15 scientists received training in experimental design, data handling and statistical analysis methods relating to crop varietal trials during the project.



|                            |   |
|----------------------------|---|
| Active projects in 2004–05 | 1 |
|----------------------------|---|

Lentil and Lathyrus in the cropping systems of Nepal



# Sri Lanka

## Position

ACIAR maintains a small program with Sri Lanka, which was an original partner country. Many agricultural scientists have a high level of skill and this, combined with their excellent English, facilitated positive training outcomes. As a result recent collaboration has focused on targeted research projects for specific issues, particularly to benefit smallholder farmers.

## Achievements

Aquaculture practiced in perennial reservoirs has the potential to provide increased returns for smallholders in inland areas. The National Aquaculture Development Authority has **implemented a predictive yield model**, developed in earlier research, to help in stocking 44 reservoirs. Monitoring of stock densities, species combinations, growth yields and limnology (the physical, biological and geographical characteristics of water bodies) in these reservoirs has been undertaken over a two-year cycle. Data collected from 36 reservoirs have been incorporated into a best-practice model. Legislative changes to permitted activities in non-perennial reservoirs are in train to open up aquaculture opportunities in such areas. This has been achieved through cooperation between Government departments involved in the project's research and dissemination. Scientists have also developed extension materials to support the spread of aquaculture.

A forestry project, also operating in India, Indonesia, Laos, Pakistan, Philippines, Thailand and Vietnam concluded during the year. The project

helped these countries better **utilise germplasm of Australian tree species**. Approaches to meet the needs of individual partner countries were implemented. A key outcome has been raising awareness of the need to use genetically improved seed. The results of this project have been published as ACIAR Proceedings 111, *Eucalypts in Asia*, available in hard copy and through the ACIAR website.

Active projects in 2004–05

3

Management of postharvest diseases of sub-tropical and tropical fruit using their natural resistance mechanisms

Management strategies for enhanced fisheries production in Sri Lankan and Australian lakes and reservoirs

Domestication of Australian trees for reforestation and agroforestry systems in developing countries



Best practice guidelines are being developed for aquaculture carried out in perennial reservoirs