

Towards food security for a better life

Australian agricultural expertise is helping to reduce water consumption in agriculture, through a suite of Australian Centre for International Agricultural Research Centre projects

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Reducing water use in agriculture



Increasing and competing demands for freshwater — for drinking, agricultural, urban and industrial uses — are placing increased pressure on global water resources. Irrigation of crops is the main user of freshwater resources in most developing countries and in Australia. Growing populations and associated urbanisation are, however, accelerating water consumption. ACIAR is supporting research on more efficient irrigation in developing countries, to relieve some of this pressure.

The use of water for agricultural irrigation dates back to the ancient civilisations of Egypt, Mesopotamia and China. These ancient civilisations organised their cultures around irrigation resulting in few competing demands for water.

Today rapid population growth has increased urbanisation, particularly in developing countries. More mouths mean more water for drinking; greater population densities require more water for sanitation; while industrialisation has raised the thirst for water from manufacturing and commercial sectors. Environmental flows to replenish depleted water resources are being utilised in a number of developed countries, and in some developing countries.

The resulting total of these demands is far greater pressure on water resources and water users. Laguna de Bay in the Philippines provides an excellent example of these competing needs. It is comprised of three bays that combine into the largest freshwater body in the Philippines. The Eastern Bay is planned as a freshwater resource for the expanding needs, and area, of Metro Manila, the country's capital and largest city. The eastern bay's main water source is the Pagsanjan River, a part of the Pagsanjan-Lumban catchment. Most of the water arises from runoff from agricultural land with potential for contamination by eroded soil and associated nutrients.

Utilising this resource for competing needs, in a sustainable manner, is the challenge faced in the Philippines, and mirrored elsewhere. ACIAR is addressing these challenges through projects, including one addressing the need to limit inflows of sediments and nutrients in eastern Laguna de Bay, that:

- introduce greater efficiency of agricultural water use, including optimising distribution within irrigation systems,
- manage and reduce impacts from water use, such as salinity and run-off and transport of agro-chemicals, and
- explore and develop alternatives to traditional approaches, both at the catchment and farmers' field levels.

Nowhere is water under greater demand than China. Irrigated rice production is vital in China and is one of the largest users of available water. Traditional rice growing included maintaining continuous flooding of paddy fields using a large amount of water to achieve high yields. Without these yields China would struggle to produce enough rice. The introduction of new irrigation methods for rice based on alternate wetting and drying of soils instead of continuous flooding have been trialled. Results showed less water is used while maintaining

high yields. Already 1.5 million hectares of land in China is under the wetting-drying technique, and this is now being trialled in Sri Lanka and the Philippines.

A separate project on China's Zhanghe Irrigation scheme identified the need to change farmers' approaches to ordering water. To reduce their water bills farmers tended to wait for rain, but if this did not arrive most ordered water in response to visible crop stresses. This often occurred at the same time, creating a peak demand period during which the system was unable to cope. Water saving irrigation technologies and changes to water delivery procedures helped maintain crop yields with reduced water usage.

Extensive irrigation can also contribute to other problems, notably rises in shallow groundwater and through, this salinisation. China's Yinchuan Plain is extensively irrigated from the nearby Yellow River. Competition between domestic and agricultural uses causes water shortages, while irrigation is accelerating the rise in groundwater. This rise is also mobilising soil-bound salt, resulting in salinisation.

Using hydrological models, digital maps of salinity hazard were developed. These have been used to determine high risk areas to introduce techniques such as deep open drains that reduce the shallow water table. Using some groundwater in conjunction with irrigated water and furrow irrigation reduces by 30 per cent water losses that occur in traditional irrigation.

Groundwater as a potential irrigation supplement for growing dry-season vegetable crops is being examined in the Philippines. Over-exploitation of groundwater is a threat to long-term agricultural production in areas relying on rainfall. Sustainable groundwater extraction practices are being examined for the Philippines' dry-season.

An ACIAR project has examined more efficient water distribution at the basin level of the Yellow River, focusing on irrigation demands within the context of government water and agricultural policies. More efficient water allocation can be achieved by establishing equitable institutional arrangements on a network-wide basis. Similar projects are underway in India and Vietnam.

India's Krishna Basin is a source of water for agriculture, industrial and domestic uses in Andhra Pradesh, Karnataka and Maharashtra. ACIAR is supporting decision making in the

affected states by assisting the development of an integrated framework to formulate and evaluate allocation strategies. Key trends and figures on water flows are being used in economic and scenario modelling.

Three other Indian states of the East India Plateau with a combined population of 27 million rely on rainfall during the monsoon for crop productivity. Watershed management and the sustainable use of water, such as through water harvesting, are priorities. ACIAR is working to improve these aspects of water management. A similar-themed project for the Philippines Inabanga watershed, on Bohol Island, has recommended management options for the area.

Raised crop beds have been trialled in India, Pakistan and Indonesia. India's rice-wheat cropping systems rely on irrigation water. Trials of the use of permanent raised beds on which crops are planted have lowered water consumption for irrigation. Raised beds have also been trialled for wheat-maize rotations in Pakistan, for vegetables on heavy clay soils in Indonesia, and for wheat in China. In each country increased yields and lower irrigation water use have been achieved.

Less water use also reduces opportunities for run-off. In the Philippines, China and Thailand pesticide contamination of water resources has potential to cause health and environmental problems. An ACIAR-World Vision project has reduced chemical runoff and contamination of nearby water sources, with the farmers involved earning a price premium for selling chemical-free vegetables.

A risk based approach to the management of pesticides was introduced in parts of the Philippines to minimise off-site flow of chemicals. Simple techniques at the field level and equipping catchment managers in integrated pest management have reduced the reliance on pesticides. In China production and handling systems are being examined to determine risk factors leading to vegetable contamination. The focus is on efficient decontamination strategies and introducing improved postharvest practices.

For further information

Visit the ACIAR website at:

<http://www.aciar.gov.au/web.nsf/projectdislist?openform&discipline=Land%20and%20Water%20Resources>

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