CGIAR Challenge Program on
WATER & FOOD
Andes • Ganges • Limpopo • Mekong • Nile • Volta

Partner of CGIAR
RESEARCH PROGRAM ON
Water, Land and Ecosystems

Vast Saline Lands Reclaimed by Simple Technologies in Coastal and Inland Asia

Photo: CPWF/Simon Cook

HIGHLIGHTS

- ✓ New salt-tolerant rice varieties made wet and dry season rice crops possible
- ✓ Farmers can now produce enough rice to cover household needs for the whole year

Outcome Stories

High salt stress is an imminent problem, progressively degrading lands and resulting in low productivity in over 20 million ha of salt-affected land in coastal and inland Asia.

Coastal salinity caused by seawater intrusion and shallow saline water tables is severe during the dry season, while flooding limits cropping to rice in the monsoon season. In inland areas, saline and sodic soils are widespread and progressively expanding because of improper water management.

Despite the facts, there is enormous potential to improve food security and livelihoods for millions of the world's poorest people struggling to survive on salt affected soils.

Rehabilitation

Rice is suitable for rehabilitating salt-affected soils because it can grow under flooding and has high potential for genetic improvement. Rice productivity in salt-affected areas is currently low but could be raised by 1-2 tons/ha, making better use of poorly exploited land and water resources in salt-affected coastal and inland areas covering millions of hectares globally. Scientists from a number of countries worked together to address these issues facing some of the poorest farmers. The project objective was to enhance land and water productivity of rice based cropping systems in salt affected areas, by integrating genetic improvement

Floodplain in dry season, Bangladesh

Photo: CPWF / Paul Thompson

"We no longer think about whether we will have enough to eat the next day," Orissa farmer

About CPWF Outcome Stories

The CPWF Outcome Stories document changes in knowledge, attitudes and practices that have emerged through CPWF-funded research. Outcomes occur when research outputs foster engagement processes that result in changes in practice or changes in behavior. These stories capture outcomes at a specific point in time; outcomes may have evolved since the completion of these projects.

and management strategies that are environmentally sustainable and socially acceptable.

New Approaches

Conventional approaches for introducing improved varieties have had limited success in unfavorable ecosystems in Asia, such as in salt affected areas, mainly because of the complexity and coexistence of multiple stresses, variable farmers' preferences, and site-specific adaptation requirements. A CGIAR Challenge Program on Water and Food (CPWF) project "Development of Technologies to Harness the Productivity Potential of Salt-Affected Areas of the Indo-Gangetic, Mekong, and Nile River Basins," emphasized the development and deployment of high-yielding salt-tolerant rice varieties and non-rice crops. These could be used together with matching management practices to enhance and sustain system productivity in coastal and inland salt-affected areas.

Both conventional and modern breeding tools were used to accelerate the development of salt-tolerant crop varieties. These were evaluated with matching crop and natural resource management practices.

Opportunities were explored for increasing crop intensity and diversity to improve farmers' incomes and livelihoods. Developing broadly adapted varieties was considered more viable for these particularly variable and complex areas because abiotic stresses and adverse growing conditions make it too risky for farmers to invest in inputs.

The project used participatory varietal selection (PVS), where farmers took part in varietal screening and adaptation testing, to accelerate adoption.

Breeding lines were developed at the International Rice Research Institute (IRRI) and shared with National Agricultural Research and

BRRI dhan 47: the first salt-tolerant rice variety suitable for dry season cropping in coastal Bangladesh, released in 2007

Photo: cdn4.wn.com

Extension Systems (NARES) through the International Network for Genetic Evaluation of Rice (INGER) network. These breeding lines were evaluated with farmers using PVS trial system. Promising material was promoted for release and used to develop optimum management options suitable for salt tolerant varieties.

The selected nutrient management options involved various combinations of green manures, chemical, organic, and bio-fertilizers, and local industrial byproducts such as 'pressmud,' a by-product of the sugarcane industry. Pressmud is rich in organic matter sulfur and zinc. Basal application of 10 tons of pressmud/ha resulted in an additional 30-60% increase in grain yield and also improved soil health on farmers' fields through reducing the pH. This allowed further crop intensification, and farmers have now started growing 2-3 crops of rice and non-rice crops each year (Ram *et al.* 2008).

Combining Benefits

The benefits of combining improved salt-tolerant rice varieties with matching management practices was demonstrated through on-farm trials, resulting in substantial increases in yield.

In most areas, farmers were able to increase their paddy yield from less than 2 tons/ha to more than 3.5 tons/ha using improved varieties and management. In some situations, these technologies made the difference between a failed crop (zero yield) and a yield of 2 to 3 tons/ha.

The success of the PVS model was recently witnessed by the release of the first salt-tolerant rice variety (BRRI dhan 47), suitable for dry season cropping in coastal Bangladesh. Numerous lines with substantially higher levels of stress tolerance have since been identified, some of them yielding more than 1 ton/ha., including four varieties

"Considerable opportunities exist for diversification of rice-based systems in saline ecosystems. For example, integrating the use of 'pressmud' with salt tolerant rice varieties substantially improves rice productivity on sodic soils."

introduced from Vietnam into Bangladesh.

Despite the unfavorable conditions prevailing in salt-affected areas, CPWF research has managed to explore and exploit their enormous potential for better system productivity. Farmers' responses to adoption of new crops have been encouraging and demand for seed is increasing rapidly in these areas. Expansion of rice and non-rice crops during the dry season is now possible for the first time in Orissa and some parts of Utter Pradesh, India, as well as in South Bangladesh and Vietnam. This has led to increases in food availability, employment and income in these areas. Continued efforts are needed to ensure that these promising technologies are further refined, validated, and out-scaled to reach the millions of poor people who still struggle to survive in salt-affected areas.

References

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Project Partners

Bangladesh Rice Research Institute
Central Rice Research Institute, India
Central Soil Salinity Research Institute, India
Cuu Long Delta Rice Research Institute, Vietnam
International Crops Research Institute for the Semi-Arid Tropics (ICRISAT)
International Center for Biosaline Agriculture
International Rice Research Institute (IRRI)
University of Agriculture and Technology, India
Rice Research and Training Center, Egypt
Rice Research Insitute of Iran
University of California at Davis.

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About CPWF

The Challenge Program on Water and Food was launched in 2002. CPWF aims to increase the resilience of social and ecological systems through better water management for food production (crops, fisheries and livestock). CPWF currently works in six river basins globally: Andes, Ganges, Limpopo, Mekong, Nile and Volta.

CPWF is a member of the CGIAR Water, Land and Ecosystems Research Program. The program focuses on the three critical issues of water scarcity, land degradation and ecosystem services, as well as sustainable natural resource management. CGIAR is a global agriculture research partnership for a food secure future. Its science is carried out by the 15 research centers who are members of the CGIAR Consortium in collaboration with hundreds of partner organizations.

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