

PROJECT 8

Natural resource management for rainfed lowland and upland rice ecosystems

The farm families who live and work in unfavorable rice environments are among the poorest people in the world. Rice yields in these difficult ecosystems, where 80 million families farm a total of 60 million hectares, are low and unstable. Erratic water supplies, crop diseases and pests, and problem soils cause risk that discourages farmers from investing in improved rice-production and resource-management techniques. Unsustainable farm practices degrade the natural resource base, condemning communities to ever-deepening poverty. Many inhabitants of these areas, especially the highlands, belong to socially and politically marginalized ethnic minorities. Project 8 seeks to overcome these problems by improving crop and natural resource management practices.



Output 1: Crop and natural resource management practices for improved livelihood in rainfed lowlands developed and evaluated

Ways to improve yield and sustainability in direct-seeded rice areas of Karnataka, India, were identified. The suggested resource management practices could help to improve the livelihoods of poor farmers. The state agricultural department is keen to demonstrate the practices, which may result in more farmers changing from transplanting to the direct-seeding method. We will investigate whether improvements can be made in Sri Lanka, where nearly all rice is farmed by this method, and in areas

with similar agroclimatic conditions in other parts of South Asia.

Improved nutrient management strategies developed at IRRI for flood-prone areas were tested successfully at sites in Bangladesh and India, where yields improved by more than 1 ton per hectare. Low seeding rates (75 grams per square meter) in nurseries resulted in seedlings better capable of surviving flooding than those seeded at the normal rate (150 grams per square meter).

Survival of seedlings in the cold temperatures of the early boro season in Bangladesh was enhanced by placing nurseries under polyethylene covers, and further improved when combined

with other improved nursery and nutrient management regimes.

In salt-affected areas, the earlier finding that application of excess calcium and phosphorus substantially improves seedling survival and growth was confirmed; the two nutrients act synergistically. We found that zinc oxide root dipping in saline areas improved grain yield by more than 1 ton per hectare, a finding that will next be tested in farmers' fields in collaboration with the Narendra Deva University of Agriculture and Technology (Faizabad, Uttar Pradesh).

IRRI's crop model ORYZA2000 has been evaluated for the first time in



rainfed conditions, using a standard procedure that we developed. The model worked satisfactorily in a wide range of rainfed lowland rice conditions in Central Java. Although some parameters are yet to be incorporated, we can begin to use the model to explore management options to improve rainfed rice productivity and stability.

Nutrient management recommendations for rainfed lowlands in Lao PDR were evaluated on-farm. We found that fertilizers have considerable potential to increase productivity but farmers lack knowledge on their use. Production of a poster to help farmers make decisions on where and when to use fertilizers has been delayed. An evaluation of nutrient recommendations in northeastern Thailand's rainfed lowlands showed that there seemed to be little potential for gain with the varieties in use there and a re-evaluation of the research strategy is needed.

Output 2: Crop and natural resource management practices for improved livelihood in upland rice systems developed and evaluated

The widespread *bolon* system in Bangladesh (photo above), which involves double transplanting of rice to avoid submergence in heavy flooding, is expensive in terms of labor and has low productivity. Research is continuing on the reasons for low productivity, socioeconomic issues, and overcoming constraints to improving the system. One result to date is an improved *bolon* system using tillers for double transplanting in second lowland fields and single transplanting on higher lands.

Management options suitable for smallholders in upland areas infested with the perennial grass *Imperata cylindrica* are being explored through field experiments. Options include sowing various legumes and forage grass, combined with flattening the

Imperata with a drum or plank to allow the replacement species to establish. The use of a herbicide (glyphosate) was included as an option in the experiment to provide a comparison. The trial was established in the wet season of 2004. However, seed shortages meant that a replicated design was not possible and this is planned for 2005. Initial results suggest that the use of one legume (pigeon pea) may be an attractive option for farmers and that glyphosate addition prior to rice provides excellent control of the weed with very little regrowth. The work on improved fallow species builds on previous studies in Laos.

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