

An Impact Assessment of Participatory Crop Improvement in the Low-altitude Regions of Nepal

†JR Witcombe, ‡‡KD Joshi, ‡S Gyawali, ‡A Subedi

†Centre for Arid Zone Studies, University of Wales, Bangor, Gwynedd

***‡‡DFID Plant Sciences Research Programme, CIMMYT Regional Office, Kathmandu,
Nepal***

‡Local Initiatives for Biodiversity in Research and Development, Pokhara, Nepal

ABSTRACT

The impact of Plant Sciences Research Programme projects on participatory crop improvement in Nepal has been assessed. These projects have targeted the improvement of low-altitude rice in the Terai (the lowlands bordering India).

Most farmers in the Terai are resource poor, food-deficit smallholders having less than 1 ha of land. There are many more poor people in the Terai than in the mid- and high hills; the Terai is more densely populated and, has a majority of its districts less developed than the average for Nepal.

Most of the land in the Terai was found not to be fully irrigated. Participatory plant breeding (PPB) has created new varieties for these less favourable areas where the crop is grown entirely under rainfed conditions or with limited irrigation. The varietal portfolio available to farmers has greatly increased, and the new varieties bring combinations of benefits from improved traits such as higher yield, superior grain quality and early maturity.

In 2002, there were over 1200 ha of project-identified early-season rice in Chitwan district alone. However, considerably more main-season rice is grown in Nepal so the financial analysis was restricted to this crop. Benefits of new rice varieties, identified or bred by these PSP-funded projects, on the poor farmers of the Terai in Nepal, were estimated.

Project-identified, main-season rice varieties are spreading and projections indicate very significant benefits to farmers. Depending on the assumptions made, these will amount, by 2010, to a net present value (NPV) of between £2 million and £29 million. By 2012, the NPV rises to between £4 million and £52 million with internal rates of return (IRR) ranging from 43% to 126%.

The amounts of project-supplied seed has been estimated conservatively. Strengthened institutional linkages between PSP-supported efforts and governmental and non-governmental organisations, to more efficiently promote the varieties, should lead to a more rapid and extensive uptake.

The impact of the project, in the long term, is likely to be increasingly outside of Nepal as international and national research systems adopt more participatory approaches to varietal identification and breeding. PPB methods greatly enhance the returns to investment in plant breeding by dramatically reducing the time needed for both the development and early adoption phases.

INTRODUCTION

We have assessed the impacts of several Plant Sciences Research Programme (PSP) funded projects in Nepal, the earliest of which commenced in 1997[†]. Research has been carried out on participatory technology development (PTD) in agronomy, new varieties and crops, and multipurpose trees. Only the outputs pertaining to new varieties of rice are considered here.

In the research on rice in these projects, participatory methods for improving farmers' varietal portfolios were employed — participatory varietal selection (PVS) and participatory plant breeding (PPB). Both methods are designed to give farmers new varieties that better meet their needs. PVS tests pre-existing varieties with farmers so it is more rapid than PPB that requires considerable time to create new varieties.

IMPACT IN NEPAL

Background

Total area of rice in the Terai

The area of rice in the Terai as a whole, of about 1.1 to 1.2 million ha, is about 75% of the total 1.5 million ha rice area of Nepal. Rice is grown in the main or *Barkhe* season (90% of the total area) and in the early or *Chaite* season (10% of the area). It is estimated that about 70% of the main-season rice in the Terai is grown under rainfed and limited irrigation water conditions.

Human development in the Terai

The UN has compiled a poverty and deprivation index for all of the districts of Nepal. The average index for Nepal and for the Terai as a whole is 0.47 (on a scale of 0 for least developed to 100 for most developed). This overall average development in the Terai is only because a few districts are highly developed (Fig. 1). Of the 20 Terai districts, 14 are average, or below average, in development. Several population groups in the Terai, including the Tharus and Musahars, have been disadvantaged for generations and remain so. Moreover, the improvement in the human development index from 1996 to 2000 in the Terai as a whole (12.1%) was lower than in the hills (17.5%).

[†] A total expenditure from 1997 to 2005 of £0.5 million in projects R6748, R7542, R7122 and R8071. These projects were executed by LI-BIRD and CAZS in partnership with Department of Agriculture's District Agriculture Development Offices (DADOs), the Nepal Agricultural Research Council (NARC) and several NGOs such as CARE, FORWARD, REGARDS and PLAN.

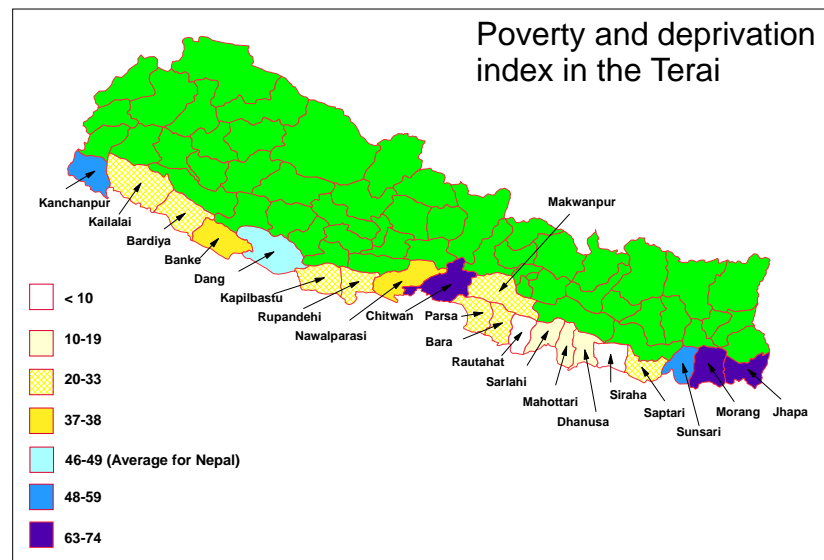


Figure 1. Poverty and deprivation index for the Terai districts and some adjoining hill districts in which seed has been disseminated.

The problem - farmers grow only a few, old rice varieties in the Terai

Participatory surveys, in the project villages of Chitwan and Nawalparasi, revealed that farmers were growing old varieties in both rice-growing seasons, sometimes as much as 40 years old. For example, the varietal diversity was often extremely low in main season rice, with the most-popular, very-old variety, Masuli, usually occupying the majority - sometimes over 90% - of the area (see Fig. 2).

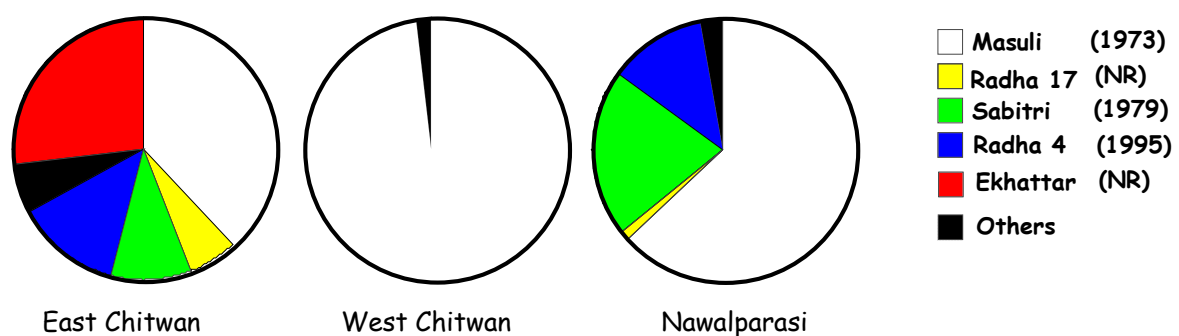


Figure 2. Area under main-season rice varieties in three village clusters of East Chitwan, West Chitwan and Nawalparasi, 1997. (Year of release of variety in parentheses; NR = not released).

Impact Assessment

PTD has produced new varieties that farmers like

The PTD projects in Nepal have identified an increasing number of rice varieties, from both PVS and PPB, that farmers wish to adopt. More recently, these new varieties are mostly the products from the PPB programme. Fifteen varieties have been identified that are suited to poorer farmers who cultivate the less productive medium upland and upland conditions[†] in the main season — most of the area in the Terai. These varieties were first tested in Chitwan and Nawalparasi where the rates of adoption by both men and women farmers have been high (Fig. 3). Adoption of project varieties is already over 40% of the rice area in many of the 34 villages surveyed in Chitwan and Nawalparasi in 2002.

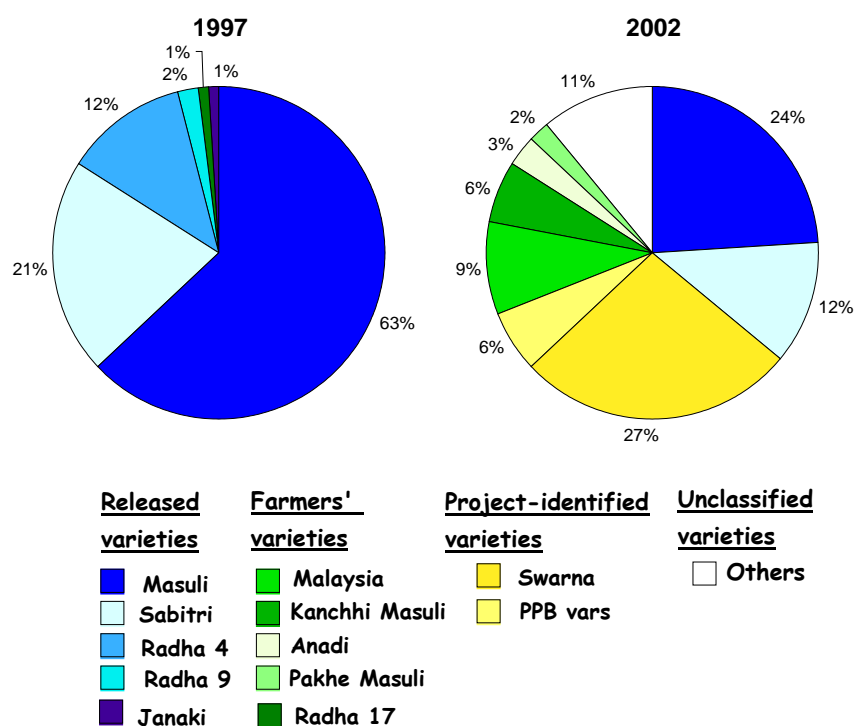


Figure 3. An example of adoption of project varieties. Changes in varietal adoption in Nawalparasi village cluster from the baseline survey (1997) to the 2002 main season. By 2002, the adoption of project varieties is 33% of the total rice area in the village cluster.

The National Programme has released relatively few varieties for the Terai, particularly in view of its importance in area, and only four varieties have been released in the last 10 years (the most recent in 1998). Only a minority of the varieties that have been released have been popular with farmers. Instead, many of the most popular varieties are farmers' introductions, such as Kanchi Masuli and Radha 17, most of which are from India.

[†] Having less productive fields is one of the indicators of a lower wealth rank.

Scaling up

The new varieties are widely disseminated in activities termed by the project 'scaling up'. By 2001, these activities covered most of the districts of the Terai (Fig. 4)

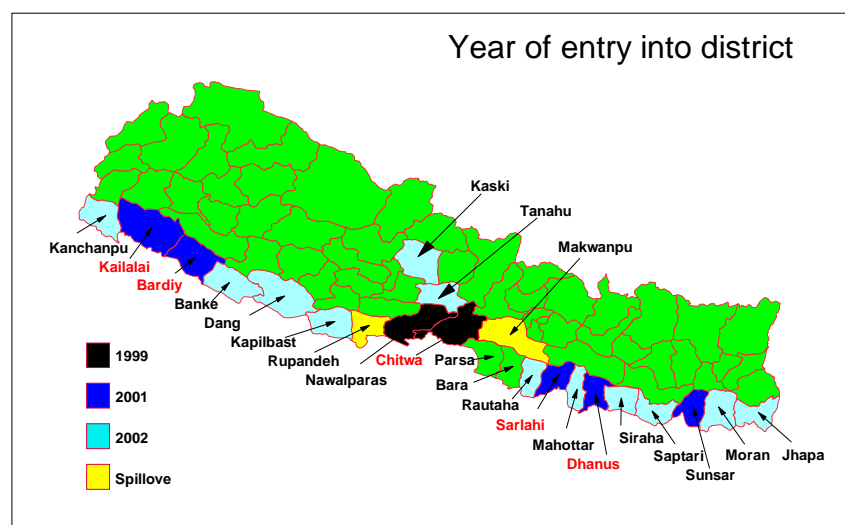


Figure 4. Year of first intervention by district, 1999-2001. There was a letter of agreement between LI-BIRD and the Department of Agriculture in districts in red.

Financial Analysis

Three scenarios have been examined to estimate the net present value of the new varieties identified or bred by the PTD projects in Nepal. All of the assumptions are supported by survey or trial data presented in the full impact assessment. For example, 2002 survey data show that in many villages adoption of project varieties in Chitwan is above 40% and that adoption is already in excess of 10% in Chitwan as a whole. Rates of spread have been measured from farmer-to-farmer for several varieties and vary, according to their popularity, from 1.5-fold to over 20-fold per annum. Recently, PPB varieties have increased on average in Chitwan (from main season 2001 to the main season of 2002) at a rate of over five-fold.

Assumption	Scenario		
	Conservative	Realistic	Higher
Rate of spread from farmer-to-farmer per year (multiple)	2	2.5	3
Adoption ceiling (% of total rice area)	20	40	50
Benefit (£ ha ⁻¹)	24	33	42
Amount of seed supplied per district (ha of transplanted rice)	5	7	9
Years seed supplied after first intervention	3	5	7

Costs

In all three scenarios the same cost assumptions are made of a continued expenditure of £100K per annum to cover the marginal costs of undertaking the PVS and PPB programmes.

NARC and DADO already commit funds to varietal breeding and popularisation. Hence, popularising varieties from PTD are, therefore, not considered to be an additional cost in the analysis.

The total benefits are substantial in all three scenarios (Fig. 4). The net present values (NPV) range from £2 to £29 million by 2010, and £4 million to £52 million by 2012. Even by 2005, the end of the current DFID RNR strategy plan, all scenarios show a positive return, with the higher scenario giving an NPV of more than £3 million. The internal rates of returns vary in 2012 from 43% to 126%. Hence the returns on this agricultural research are high, and at least as good as those for other development activities.

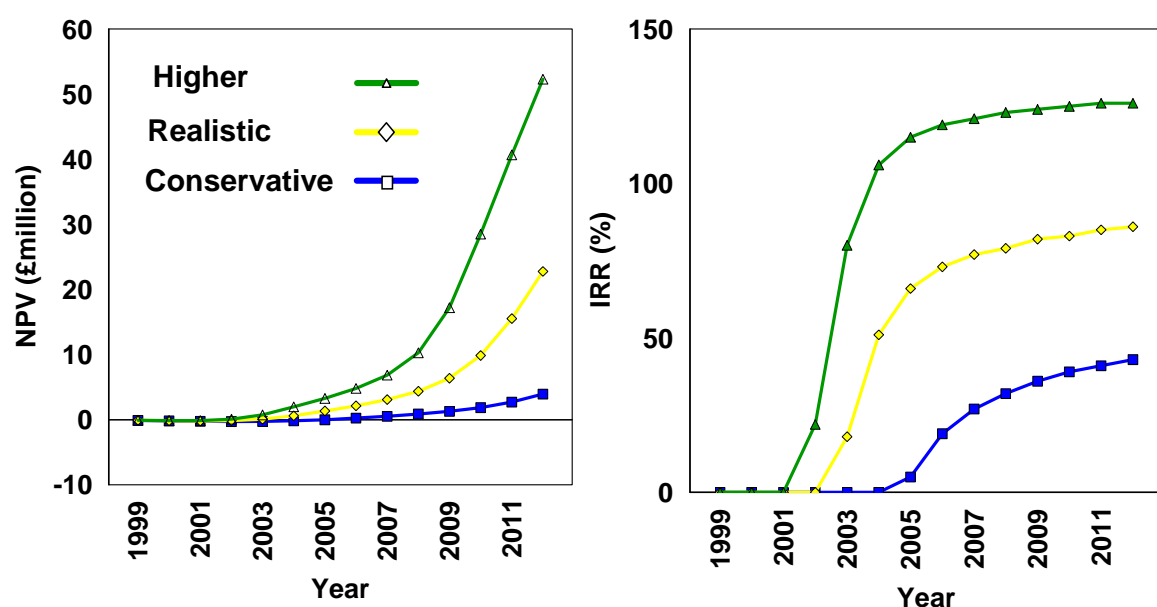


Figure 4. The NPV and IRR over time with the ‘conservative’, ‘realistic’ and ‘higher’ scenarios.

As the surveys on adoption continue over the years, these estimates will be revised. The data available for adoption in 2002 are intermediate between the realistic and higher scenario, and for anticipated amounts of project-supplied seed in 2003 below that of the higher scenario.

IMPACTS BEYOND NEPAL

Wider impacts of these projects are of two types — the spread of the methods to other breeding programmes and the spread of the rice varieties bred in the PPB programme to countries outside of Nepal.

Methods

The methods employed in the PPB in Nepal have, so far, been published as chapters in two books, two scientific journal articles and five chapters in two conference proceedings. Although such indirect impacts are difficult to measure in financial terms, it is probable that many breeding programmes will be favourably influenced by this research, including those of IRRI, WARDA, and NARC.

The PPB methods employed:

- Greatly increase the speed of adoption of varieties and hence increase the benefits from the research that are diminished less by discounting.
- Greatly enhance the cost-effectiveness of the breeding programme by simple changes in breeding methods, such as testing for grain quality before yield testing.
- Will greatly enhance the efficiency of breeding by using simple methods and the active collaboration of farmers who carry out selection in their own fields.

Germplasm

Varieties from the PPB and PVS programmes have been sent to:

- DFID bilateral projects implemented by the Gramin Vikas Trust (GVT) in India
- an NGO in Bangladesh (People's Resources Oriented Voluntary Association - PROVA)
- China (Anhui Academy of Agricultural Sciences).

Reports from India and Bangladesh indicate that some of these varieties are likely to be adopted by farmers because of their grain quality, high yield and earliness.