Participatory crop improvement in high potential production systems in India and Nepal

Plant Sciences Research Programme project R6748

CONTENTS

EXECUTIVE SUMMARY

The purpose of the project was to develop and promote participatory strategies for the introduction of new varieties and improved agronomic practices in high potential production systems.

The project had two study areas — Chitwan and Nawalparasi districts, Nepal and Lunawada sub-district, Gujarat, India. Baseline surveys were conducted in both study areas in 1997 to understand the farming systems and varietal diversity. In all of the main cropping seasons, participatory research was conducted on varietal choice and on simple agronomic interventions, particularly seed priming. Two participatory methods (participatory varietal selection and informal research and development) were employed that differed in their resource requirements. Adoption studies on newly introduced varieties were undertaken. In each cropping season a set of farmers' fields were intensively studied by means of a weekly farm diary to record inputs and outputs. Seed of successful new varieties was procured or multiplied and sold to farmers to partially meet demand of farmer-preferred varieties.

The major project outputs were:

- The most appropriate participatory method for the identification and adoption of new cultivars in a range of high potential systems was identified.
- New project-introduced varieties occupied 25 – 50% of the study villages after only three cropping seasons.
- Farmers' criteria for crop varietal choice, and farmer constraints on adoption in high potential areas of India and Nepal were identified and documented.
- Uptake strategies and constraints were assessed for the application of improved farmer participatory research methods by the research/extension systems in high potential areas of India and Nepal.
- Strategies for the introduction of new varieties and improved agronomic practices were developed and promoted.

There has already been impact with farmers in the study areas, and the approach if scaled up would significantly contribute to DFID's development goals.

BACKGROUND

Participatory research (PR) is increasingly being employed with resource-poor farmers in marginal environments. It has been extensively used for plant breeding research (Joshi and Witcombe, 1996; Sthapit *et al.,* 1996; and Witcombe *et al.,* 1996). In agronomic research, participatory rural appraisals (PRA) and participatory experimentation are used to better understand farmers' behaviour and reasoning.

Despite the effectiveness of PR in marginal areas it has been little applied in high potential production systems (HPPSs) because it was commonly assumed that:

- High literacy levels, knowledge of opportunities, and agro-ecological homogeneity in HPPS make it easier to obtain information and opinions on farmers' practices,

opportunities and constraints through conventional extension rather than by face-to-face PRA.
- A near-optimal use of genetic material and agronomic practices in HPPSs makes PR redundant.

However, below optimal resource use by farmers and inadequate agricultural extension in HPPSs strongly favour the use of alternative extension approaches such as PR (Virk *et al.,* 1996). For example, in India the average age of cultivated varieties is up to 20 years and in Nepal 25 to 30 years (Virk *et al.,* 1995; Sthapit *et al.,* 1996; and Witcombe and Virk, 1997). This may result from a low interaction between farmers and plant breeders and the provision of a very limited choice of cultivars - these constraints can be removed by using appropriate PR (Virk *et al.,* 1996). In the case of agronomic practices, farmers' yields in HPPS are far below research station yields. This is probably because farmers use below optimal agronomic practices, rather than it being explained entirely by unrealistic research station management.

The application of appropriate elements of PR could be even more effective than in marginal areas because, in HPPSs, there are:

- higher literacy rates and greater willingness to try new technology,
- improved infrastructure
- more resources, and
- easier access to credit.

In addition, large wealthy farmers can be contracted, or can undertake on their own, seed multiplication of identified varieties for sale within the village. The larger land area in a village and the greater grain surpluses than in marginal areas make this dissemination pathway more attractive.

PR methods could be adapted to HPPSs - the key elements of PR that remain are:

- providing choice (instead of recommended cultivar and package),
- promoting farmer experimentation (instead of researcher-led demonstrations and farmer visits), and
- using participatory assessment methods.

PR can be used to promote "key technologies", non-complex interventions that can significantly raise yields without extra inputs (Bayerlee *et al.,* 1986; Maurya *et al.,* 1988; and Joshi and Witcombe, 1996). The uptake of new varieties (a good example of a key technology) could provide the stimulus for farmers to invest in other inputs e.g. fertilisers, improved tools and crop protection methods because of any combination of the following factors.

- increased profits (due to increased yields and/or increased market price) that facilitate input purchase,
- increased responsiveness and increased economic returns to inputs,
- increased options in the farming system made available by short duration cultivars, and
- reduced risk.

PROJECT PURPOSE

Strategies for the introduction of new varieties and improved agronomic practices developed and promoted.

This addressed the following constraints to development:

- Below optimal resource use by farmers and inadequate agricultural extension in High Potential Production Systems.
- There is a slow turnover rate of cultivars and farmers grow a very restricted set of varieties. Farmers' yields in HPPSs are far below research station yields and PRAs reveal that farmers' practices are below optimal.
- Use of inputs is restricted by use of sub-optimal cultivars and the restricted range of options in the farming system caused by lack of cultivar diversity.
- Vulnerability of crops to pests and diseases is increased because of a lack of diversity among the cultivars farmers grow.

RESEARCH ACTIVITIES

The research activities were extensive, and included a wide range of participatory techniques. The methods used for varietal testing and adoption, a major focus of the project, are described below. Because of the extensive nature of the project that ran trials over six cropping seasons and several crops the activities are described in most detail for two crops - *Chaite* (February sown) rice in Nepal, and main season rice in India. Results are summarised in Figures 1 - 13, for a wider range of crops that include main season rice in Nepal, and wheat in India. Over the coming years, all of the huge amount of data the project has accumulated will be published as reports and journal articles and presented in international conferences and fora.

Participatory approaches used in Nepal and India

Two approaches, termed participatory varietal selection (PVS) and informal research and development (IRD), were used to provide a choice of varieties to farmers in India and Nepal. In both methods, a range of released and pre-release varieties was selected from within, but also from outside of the target region and given to farmers for testing. Cultivars from outside the target region were used extensively because an analysis of varietal trials in India for several crops over several years showed that they did not correctly identify where varieties are best grown (Packwood *et al.,* 1998).

In PVS, the varieties were tested in intensively evaluated farmer managed participatory research (FAMPAR) trials using the methods described in Joshi and Witcombe (1996 and 1998). IRD is a cheaper form of PVS because it uses less intensive evaluation. It was proven to be effective for popularising new varieties by Lumle Agricultural Research Centre, Nepal (Joshi and Sthapit, 1990). In IRD, small quantities of seed of the same range of varieties used in PVS were supplied to farmers and there was no monitoring or participatory evaluation during the growing season. Instead, farmer's perceptions were evaluated after harvest by informal interviews with only a sample of farmers. Data were collected on subsequent adoption and farmer-to-farmer seed dissemination to provide evidence on the degree of acceptance of each variety. Whilst FAMPAR trials are designed to satisfy the needs of both research and extension, IRD is predominantly targeted at extension.

In Nepal, six new varieties of *Chaite* rice, none of which were officially recommended by the extension services, were first offered to farmers to experiment with in the *Chaite* season (February to June) of 1997. Participatory well-being ranking was done to identify farmers from different resource categories (see survey details below). In each village 1 kg of seed of each new variety was given to two farmers in each of the three categories. The farmers grew the new variety alongside their existing variety as a control. Because CH45 was the most predominant local variety 78 out of the 80 farmers who conducted FAMPAR trials grew CH45 as the control. The numbers of participating farmers per variety were: 20 (Rhada 32); 13 (NDR 97); 16 (Kalinga III); 12 (IR13155); 5 (NR 10158); and 10 (BG 915-2). Participatory evaluation of the *Chaite* rice varieties was done by farm walks and focus group discussions. Area of the trial plots was measured by project staff while farmers measured yield in local volumetric units which were later converted to metric units. A paired t-test was used to test the significance of the difference for yield between the test entry and CH45. Household level surveys of all the participating farmers were done, some time after harvest, to assess farmers' perceptions and preferences for new varieties and included questions on grain quality and market price.

In India, ten new cultivars were first given to farmers to experiment with in the *kharif* (rainy) season (June to October) of 1997. Participatory well-being ranking was done to categorise farmers into different resource categories. Seed of each new cultivars was given to at least two farmers in each resource category in a village — 2 kg of one variety per participating farmer. In the participatory trials the farmers grew the new variety alongside the local variety as a control. Because of its popularity, GR11 was the control in all of the 219 analysed trials (Pusa Basmati 1, a low-yielding aromatic variety, was excluded). Evaluation methods were the same as those in Nepal. The test variety and check variety were grown alongside each other so a covariance between the yields of the two plots is expected across all farmers' fields. A regression analysis of the yield of the introduced variety against the yield of the local variety was computed to detect and remove erratic values. Outliers were removed that were more than two standard deviations from the regression line (Snedecor and Cochran, 1991), and then a paired t-test was used to test the significance between the test entry and GR11. After these exclusions the numbers of farmers per variety were: 26 (Pusa 33); 19 (Pusa 834); 22 (Pusa 44); 32 (Pusa 111); 26 (MTU 1001); 16 (BPT 5204); 30 (WGL 48684); 28 (PR 103); and 20 (MTU 7029).

The project location in Nepal

The project area is in the *terai* (flat lowland bordering India) and is in parts of two districts, Chitwan and Nawalparasi. Eighteen villages (nine for FAMPAR and nine for IRD) were selected for study using criteria such as having >80 households; good irrigation facilities; land suitable for double rice cropping; and good access to agricultural markets. The villages were organised into three geographical clusters: East Chitwan, West Chitwan and Nawalparasi (Table 1).

There is over 53,000 ha of cultivated land in Chitwan and over 64,000 ha in Nawalparasi. Both districts have more than 72,000 ha of main season rice but only about 2,500 ha of *Chaite* rice. About 22 % of the land is irrigated in Chitwan and about 36 % in Nawalparasi. The annual average rainfall in this area is > 1500 mm per annum and 90 % falls between June to September. Farmers grow two or three crops per year. Main season rice is the major crop in June to October followed by lentil or wheat in the winter, followed by maize and *Chaite* rice in the spring. Though all of these villages are located in the *terai* region there is diversity in soil type, irrigation facilities and production potential. Productivity is generally higher in East and West Chitwan than in Nawalparasi. There are also variations in the farming systems within clusters e.g., some farmers in Chitwan grow maize and vegetables in the winter instead of wheat or lentils.

Production potential of these villages is high when compared to comparable production systems in, e.g., India (see below). Yields of the most predominant *Chaite* and main season rice variety were measured in FAMPAR trials in 1997. The average yield of CH45 in the *Chaite* season was 3. 6 t ha^{-1} and rice cultivar Mahsuri (known locally as Masuli) had an average yield of 4.2 t ha^{-1} in the main season.

The project location in India

Lunawada *taluka* (sub-district) of Panchmahals district in Gujarat has 54,000 ha of arable land of which over 80 % is irrigated through rivers, canals, wells and ponds. Rainfall is >1000 mm per annum. The most common crop rotation is rice in the rainy season (*kharif*) followed by wheat in the post-rainy (*rabi*) season.

Nine villages (Table 2) were selected for the study using criteria such as having > 50 households; rice-wheat as a major rotation; average land holdings of 1 to 3 ha; and substantial tracts of fertile irrigated land. PVS was tested in 6 villages (Kothamba, Ladvel, Thanasavli to the south of the Mahi river, and Vardhary, Chapatiya, Dalvaisavli to the north-west of the Mahi), and IRD in three villages (Panam Palla, Panch Mahudia and Dokelav to the south-east of the Mahi).

Table 1. Selected villages for FAMPAR and IRD activities in the Nepal study area

Name of cluster	Village Development Committee / Municipality	Names of selected villages: FAMPAR	Names of selected villages: IRD
East Chitwan	Chainpur	Kunaghari	
	Birendranagar		
	Kathar	Six Group	
	Ratnanagar		Kathar
	Panchkanya	Kharkhutte	Debauli
			Krishna Mandir Chowk
West Chitwan	Gitanagar	Champanagar-Devnagar	
	Gitanagar		
	Shivnagar	Amarabasti-Devnagar	
	Patihani	Radhapur	
	Patihani		
	Parwatipur		Pakaudi
			Ganganagar
			Parwatipur
Nawalparasi	Tamsaria	Chormara/Chaurangi	
	Kolhuwa		
	Kumarwarti		
	Shivmandir	Abhiyun	
	Shivmandir	Koilipani	Purbatola
	Deurali		
	Naya Belhaniya		Deurali
			Arunkhola/Kusunde

[1] Kharkhutte was adopted in replacement for Majhui village of Khairhani VDC

Table 2. Selected villages for FAMPAR and IRD activities in the India study area

Name of cluster	Name of village	Type of activity
PVS I	Kothamba, Thanasavli, Ladvel	FAMPAR, situated to the south of river Mahi.
PVS II	Vardhary, Chapatiya, Dalvai Savli	FAMPAR, situated to the north-west of river Mahi.
IRD	Panch Mahudia, Pamnam Palla, Dokelav	Informal research and development, situated to the south-east of river Mahi

The study villages are in a high potential production system. The average yields of local rice cultivars, in trials in *kharif* 1997, were 4 to 4.5 t ha^{-1} (depending on variety) while the state mean yields for Tamil Nadu (the highest yielding state) was 3 t ha^{-1} in Tamil Nadu in *kharif* 1994 and 1995. In wheat trials (not reported here) the average yield of local cultivars in *rabi* 1997-98 exceeded 3.5 t ha^{-1}. This is not far behind the average wheat yield in the most productive Indian state (Punjab) of 3.9 t ha^{-1} during *rabi* 1994-95 and 4 t ha^{-1} during 1995-96.

Villages south of the Mahi have more fertile soils and better access to irrigation than those to its north-west. Considerable ecological variation is also found within some villages. For example, in Kothamba water remains in low-lying fields so they are rarely ready for timely sowing of the following wheat crop.

Survey of varietal diversity

In Nepal, baseline surveys for varietal diversity of *Chaite* rice were conducted in 1997. All of the 1487 households in the nine FAMPAR villages were surveyed. In each FAMPAR village, key informants were interviewed to obtain a well-being ranking and categorise farmers into rich, medium and poor groups. Out of the nine surveyed villages, *Chaite* rice was grown in five of them and 657 households grew this crop. The baseline study documented varietal diversity, area coverage under each variety and the number of farmers growing this crop. In subsequent seasons the spread of new *Chaite* rice varieties was monitored. In June-July 1999 all farms that had been given seed in 1997, or had received seed from those farmers in 1997 or 1998, were surveyed in the nine villages.

In India, baseline surveys on diversity for main (*kharif*) season rice were made in early 1997, in three villages of Lunawada sub-district, Gujarat—Kothamba, Thanasavli and Ladvel. First farmers were classified into three wealth categories, upper, medium and lower primarily on the basis of land holding. A sample of 180 farmer-households were then surveyed, 60 households per village, with 20 farmers per category. Farmers were asked which varieties they grew and the area devoted to each on their farm.

The survey was repeated in 1999 in the same three villages during the rice growing season, the third opportunity for the farmers given seed in 1997 to grow the introduced variety. Fifty-four participating farmers (18 per village and 6 in each wealth category) were interviewed using the same questionnaire as in the 1997 survey. In addition, surveys were also conducted in a sample of one IRD village, one non-project village and three control villages.

OUTPUTS

Participatory research in HPPSs for new varieties

Participatory research approaches have increasingly been used in crop improvement, both in marginal areas and high potential systems (Witcombe, 1999 and Witcombe *et al.,* 1996). There are now NRSP/PSP funded case studies on these approaches in HPPSs in Nepal and India (DTZ Pieda, 1998; Joshi *et al.,* 1998; Warner *et al.,* 1999; and Witcombe *et al.,* 1999). Initial livelihood baseline studies identified a number of widespread constraints, e.g. very low agrobiodiversity with very old, widely grown varieties (Figs. 1 and 2) and an increasing shortage of fodder and fuel wood (DTZ Pieda, 1998 and Warner *et al.,* 1999).

Participatory trials have identified a number of new crop varieties that have several advantages over existing ones in terms of yield, maturity, irrigation requirement, and reactions to biotic and abiotic stresses. In a short period of two seasons following introduction of new crop varieties there has been a significant adoption and increase in biodiversity. The impact and adoption of new varieties of *Chaite* and main season rice in Nepal and main season rice and wheat in India has been presented in Figures 3 to 10.

At the start of the project CH45 variety of *Chaite* rice was the most predominant being grown over 96-99% of the area. After two seasons (in 1999), new *Chaite* rice varieties (Kalinga III, Radha 32, NDR 97, IR13155, BG 1442, NR 101158 and B4 915-2) have been adopted in varying proportions by a considerable number of farmers. These new varieties together covered 24% of 334 hectare area in the project villages with an average yield advantage of 15%. NDR 97, which has a potential to occupy substantial area in Chitwan and Nawalparasi, showed a 26% yield advantage over CH45. Early maturing varieties in *Chaite* rice are desirable as their physiological maturity not only allows them to escape the damage from insect-pests but also allows them to evade spoilage of grain from rains. These features are found in varieties Kalinga III, NDR 97 and NR 10158. Kalinga III has a modest yielding ability but is spreading in non-traditional *Chaite* rice growing areas where it can to contribute to overall food security.

Also in the Nepal study area, a number of new main season rice varieties (Swarna, AS 781, PNR 381, PR 103, Pant 10, Sarwati, Radha 11, IR51672, PR 106) were adopted by farmers that covered over 25% of 828 ha area in the project villages with a mean yield advantage of 18% over the existing varieties. Average yield increase of all new varieties over Masuli was over 36% with about 1100 kg ha^{-1} extra grain. Assuming all seven farmer-preferred varieties are equally adopted, there could be on average 632 kg ha^{-1} extra grain yield without changing the agronomy. Adoption survey in 1999 revealed that new varieties of main season rice could give about 135 tons of extra brown rice in the project villages. This extra yield is worth NRs. 1,346,160 (=£12821) per season when sold at NRs. 10 per kg.

Swarna, a late maturing variety of main season rice introduced into Nepal from India by the project, is becoming very popular in the project area in niches with shallow water previously grown to Masuli— a variety prone to lodging and yield losses. Swarna is input responsive, lodging resistant and high yielding. It has spread in one village, Aviyun, from 6 kg, given for trials in 1997, to an amount sufficient to cover 28 ha in 1999 (see Fig. 8). Swarna yields 40 % more grain with a higher milling recovery than Masuli, the variety it has replaced. Hence, in Aviyun village alone the value of additional grain in the 1999 season to the adopting farmers is estimated as £4285/- (at NRs10/- kg^{1}). The additional benefits become considerable when the estimated total area already under Swarna in the project area (86 ha in 1999), its rate of expansion, and the number of seasons that farmers will benefit are considered.

In Nepal, none of the pipeline varieties from the national programme have been outstanding successes — the two most adopted rice varieties (Swarna in the main season and Kalinga III in the *Chaite* season) are introductions from India. In India, in the study area in Gujarat, the greatest success of the participatory approach in rice and wheat has been to promote with great effect recently released varieties i.e., GW 496 and GW 503 wheat and Gurjari rice (Figs. 9 and 10). The uptake of these varieties in the project villages is substantial while in control villages uptake is negligible. Nonetheless, several non-recommended varieties of rice and wheat have been adopted by farmers in the Indian study area. Moreover, in other crops in the India study, such as mung, maize and chickpea, all of the best varieties are not recommended. The impact of project-introduced varieties had travelled, by 1999, to at least 12 non-project villages where farmers purchased seed of new varieties.

In Nepal, studies in R6748 on varietal adoption and uptake have shown an extremely variable pattern of varietal types (old releases, new releases, unreleased material of known and unknown origin, and a very small proportion of landraces). In some clusters large areas are occupied by non-released varieties e.g., Ekhattar has 28 % of the area in East Chitwan cluster. The project has detected recent, significant increases in the area under Mala, Malaysia and Bihari that are of unknown origin. Moreover, variety Sabitri was released by the national programme in 1979 and is only now beginning to occupy a significant area (22% in Nawalparasi cluster). Radha 4 (known as Chaurasi locally) was released in 1995 and already occupies 13% of the area in East Chitwan — project activities have aided its adoption in Nawalparasi where only 2% of the area was occupied by the variety at the time of the baseline survey. All these findings can be exploited in future participatory research.

In Nepal, a phenomenon has emerged of farmers expanding the area under a new variety in the second season, only to reduce the area (or stop adoption) in the third season. This emphasises the need for longer-term research.

Comparison of methods

A comparison of participatory methods, an intensive approach called FAMPAR (for Farmer-Managed Participatory Research) and a less intensive approach called IRD (for Informal Research and Development) showed that IRD was equally effective as FAMPAR. In both Nepal and India the same varieties were identified by either approach (see Fig. 10). Indeed IRD methods are less likely to give misleading results since the only proof required of the acceptance of a variety is its adoption. Hence a most cost-effective approach has been found for identifying new varieties and promoting them. It is also effective for either promoting the adoption of recently-released, recommended varieties or identifying those that are unacceptable to farmers. There are many more data on comparison of IRD and FAMPAR that are not presented here.

Scaling up

In Nepal, LI-BIRD has developed linkages with the District Agricultural Development Office (DADO), Chitwan, to spread project-identified varieties more widely. A simple IRD technique was chosen that was analogous to the minikit programme already undertaken by DADO. In the main season 1999, nearly 750 two-kg-packets of seed were distributed to farmers in 12 villages across the entire district.

In India, there was project-aided, demand-led sale of seed where the project procured the seed of farmer-preferred varieties of rice, wheat, summer mung and chickpea and sold it to farmers in both project and non-project villages. The project-aided supply was, however, far less than the seed demand for farmer-preferred varieties. There was also evidence, from seed flow studies, that farmers saved their own seed for growing in the next season, and also sold seed to other farmers within and outside their villages. The evidence suggests that some farmers have the capability and capacity of seed production. Seed demand of 1 t each of rice and wheat varieties in R7323 (Punjab project), in 1999, was met by purchases made from participating farmers in Lunawada.

Agronomy, fodder and fuelwood

In Lunawada district, India, a large number of participatory seed priming trials were carried out in wheat that gave a consistent yield gain of 5% (Harris *et al.,* 1998). Seed priming merely involves the soaking of wheat seed in water overnight and its subsequent surface drying before sowing. Since the cost of this intervention is negligible and a 5% increase in yield produces about 250 kg ha^{-1} of additional grain this is a very cost-effective intervention. Similar results, with wheat and maize, have been obtained in Nepal. FAMPAR trials conducted in wheat in Nepal and India showed multiple effects of seed priming and nearly all participating farmers will adopt it (Fig. 11 to 13).

Research has commenced on improved fodder and fuelwood strategies following the identification of a major lack of fodder and fuelwood in the baseline surveys in India and Nepal. In Nepal, a new legume crop, kidney bean, was introduced into the farming system. This offers a high economic return and a more sustainable rotation than wheat followed by rice. The adoption of new varieties and new practices gives rise to opportunities for farmers to optimise their cropping systems (and profitability). For instance, shorter duration varieties require less irrigation and their earlier harvest increases the choice of subsequent crops, including the possibility of growing an intervening green manure. Similarly, there is some evidence that a primed wheat crop uses nitrogen more efficiently (as a result of increased seedling vigour). This could have important consequences for reducing fertiliser rates.

Intensive data plots

Farmers maintained weekly records of inputs and field operations in selected marked plots and also recorded outputs at the end of the crop season. These plots were called intensive data plots (IDPs). One of the objective of the IDPs was to compute a cost-benefit analyses to compare the extent of net returns by wealth categories as part of a livelihoods approach.

IDPs were conducted for *Chaite* and main season rice in Nepal and for *kharif* rice, wheat and summer mung in India. The analysis revealed that resource rich farmers, in the India study area, accrued a net gain of 100% in wheat and 86% in summer mung compared to net gains of 38% for wheat and 23% for summer mung by the resource poor farmers. However, in rice, the resource rich farmers had smaller gains of 36% in comparison to 57% by the resource poor farmers. The major components of cost were: chemicals, fertilisers and farm yard manure (49%) in rice; land preparation and seed cost and sowing in summer mung (61%) and wheat (45%). Analyses will be completed for the impact of new varieties for both Nepal and India.

However, no clear trend was observed for differences in net-returns among the wealth categories for *Chaite* rice in Nepal. In Nepal, there is some evidence from IDPs that profitability of new farmer-preferred varieties is less than it might be due to conservative pricing in the market. It is likely that traders will only pay a 'fair' price for new varieties if and when they constitute an appreciable volume of traded grain. Nevertheless, data from IDPs suggest that farmers' decisions to adopt new varieties do not necessarily depend on the financial returns from that crop alone. More research is required to reconcile widespread adoption of new varieties with some of the micro-economic data from IDPs.

In view of the novelty of the approach one internal report relating to IDPs and baseline data for the India study area is appended (Baseline study in Lunawada by AGB Raj, 1999).

Independent review of R6748

An external review of R6748 for DFID in 1998 noted that the project had, after only two years, successfully introduced a large number of acceptable new varieties to farmers much more quickly than would otherwise be the case (DTZ Pieda, 1998). They also noted evidence of rapid farmer-to-farmer seed spread, an increase in biodiversity, increased yield and positive changes in farming practices. However it takes a farmer a number of years to fully test new varieties, given variation in climate, diseases and other stresses. The consultants concluded that on the basis of the findings to date a strong case could be put forward for an extension of this programme for a further three years. A six year period would give sufficient time to prove the PCI methodology and demonstrate impact at a local and national level. The economic impact analysis using very conservative assumptions, gave a net benefit of around 33%. A more recent cost benefit analysis for the last three years, using exactly the same assumptions, indicated that benefits exceed the cost by 53%. Nonetheless, more refined assumptions are required before a high degree of confidence can be placed on such figures.

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Other dissemination of results:

Conference papers

International Conference on Food Security and Crop Science, Nov. 3-6, 1998 held at CCS Haryana Agricultural University, Hisar and HPKVV, Palampur (29-31 Oct. 1998) invited two lead papers from J.R. Witcombe and D.S. Virk and devoted a full session on participatory methods that focused on results of the PCI project.

Harris, D. 1997. Potential versus practical sustainability: the importance of impact. Paper presented at a Workshop on 'The challenge of production system sustainability: long term studies in agronomic research', 8-11 December, 1997 at ICARDA, Aleppo, Syria.

Witcombe, J.R. 1999. PVS and PPB in high potential production systems- DFID Research Programmes/ LI-BIRD/ WIRFP/ CAZS. Paper presented in 'Participatory Plant Breeding Seminar' during CGIAR International Centre's week, 24th October, 1999, Washington D.C.; for CGIAR program on participatory research and gender analysis.

Papers in preparation

Relevance of participatory crop improvement in high potential production systems of Chitwan and Nawalparasi Nepal. PhD thesis (By the end of year 2000).

Enhancing food security through diversity deployment in high potential production systems of Chitwan and Nawalparasi, Nepal. Journal article (By the end of 2000).

Is it possible to increase varietal diversity with modern vanities in uniform environments ? a case study of rice in high potential production systems of Chitwan and Nawalparasi, Nepal (Journal article (by the end of year 2000) .

Relevance of varietal scaping and GIS application for monitoring agrobiodiversity change at community level (Journal article).

CAZS discussion papers on baseline data and intensive data plots.

Paper on participatory approaches to wheat improvement (forthcoming conference on South Asia Participatory Plant Breeding in Nepal from 1-5 May, 2000.

Paper on biodiversity in wheat in India following PVS for International Symposium: Scientific bases for participatory improvement and conservation of crop genetic resources. Mexoico 8- 14 October, 2000.

Others

A training course for IGFRI (Indian Grassland and Fodder Research Institute, Jhansi) scientists was organised from 8-11 March in the project area in Lunawada. The scientists interacted with farmers and found that participatory varietal selection (PVS) undertaken in the project was enormously successful.

The project activities generated a great demand for farmer-preferred varieties. Seed of farmer-preferred varieties of wheat, chickpea, rice, summer mung and was sold in both project and non-project villages to enhance dissemination rates in India. Similarly seed of rice varieties was sold in Nepal. Significant farmer-to-farmer dissemination of farmer-preferred varieties in these crops has begun in India and Nepal.

The staff of the department of agriculture in Lunawada taluka was made aware of the results of PVS through visits and discussions.

Extension workers of department of agriculture in Nepal attended meetings of the project. In Chitwan and Nawalparasi districts of Nepal, joint monitoring of Chaite and main season rice by LIBIRD and the DADO (Department of Agriculture Development Office) was undertaken. LIBIRD conducted orientation programmes for 65 staff of department of agriculture.

Meetings were held with the staff and policy makers of the Institute of Agriculture and Animal Sciences, Rampur at Bharatpur on 31.5.99, and the Nepal Agricultural Research Council (NARC) at Kumaltar, Kathmandu on 1.6.99. These meetings were organised by LIBIRD and also involved six scientists and policy makers from Punjab Agricultural University, Ludhiana (in June 1999), as representatives of another high potential production system in India.

Two staff of SOTEC, an Indian NGO, visited LI-BIRD in March 1999 to learn techniques used in R6748.

CONTRIBUTION OF OUTPUTS

The intended outputs of the project have been largely achieved. However, three years is insufficient to prove the approach. True adoption only begins in the third year (the first year is experimentation, the second is confirmation, and only in the third year does true adoption take place). Hence, validation of the outputs are needed. When a highly credible case can be put forward, then wider adoption by other institutes is likely. In Nepal a target institution, the Department of Agriculture District Office, Chitwan, has already adopted the approach on a large scale.

Project R7542 will validate the results, test new technologies, and scale-up the approach to reach thousands of farming households in Chitwan.

A great deal of attention will be paid to dissemination of results from R6748, as well for new results from R7542. It can be seen from the publications and dissemination activities for R6748, that did not have dissemination as such a high priority as in R7542, that they were still substantial.

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