Participatory research for sustainable yield improvement of rice in rainfed lowlands: a case study of eastern U.P., eastern India

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Abstract

Rice productivity in fragile lowland environments of eastern India is very low, possibly due to non - availability of suitable varieties that have high yields coupled with ample tolerance of submergence and or drought. Farmers mostly grow traditional varieties with yield potential of less than 2 t/ha. Most of the varieties developed in earlier times were not (sustainably) adopted. A participatory research approach involving farmers in variety development and evaluation was developed and warmly received by farmers and has led to improvement of yield of 20-25% and of income through rice of 5 % in the study domain. For future sustainability of the technology, concerted efforts are needed to further improve the productivity of these lowland ecosystems – so as to fulfill the mandate of poverty alleviation and sustainable food security for the billions of resource poor farmers of the region.

Media Summary

Participatory research involving farmers in selection of varieties from early generation, in collaboration with the International Rice Research Institute, will boost rice yield and farmers' livelihoods in fragile ecosystem of eastern India.

Key words

Income, adoption, diffusion, traditional, modern, ecosystem, participation

Introduction

Agriculture will continue to play a major role in economic development and poverty alleviation in India, since a majority of its population depend on it for livelihood security. India, a home for 18% of world's population, has only 20% of its land resource to meet people's basic requirements. An estimated requirement of 50 percent more food by 2025 (Khush, 1998) warrants more judicious use of soil, water and other natural resources, while preserving the ecological balance and biodiversity. India's food grain production must be increased from 200 million tonnes in 2000 to about 300 million tonnes by 2020 (Bhalla *et al*, 1999).

A major share in the national food pool comes from irrigated rice, which fortunately is the most productive ecosystem, safe and input responsive. Since irrigated rice yields have plateaued for the past several years, the next emphasis can be put on the rainfed lowland ecosystem, which encompasses the entire Eastern India with rice area of 12 m ha. Rice productivity of this ecosystem is less than 2t/ha, due to recurrent floods and sometimes drought, but could be raised at least to 3 t/ha by providing submergence tolerant high yielding varieties and improved crop management technologies. Farmers mostly grow traditional rice varieties which have a certain degree of submergence tolerance but very low yields and poor agronomic characters. Most efforts made earlier for effective interactions among the researchers and the farmers have addressed farmers involvement only in variety testing and evaluation, and these have often led to rejection of many of the released varieties by farmers. Participatory research involves farmers (along with researchers) in selecting the genotypes from early generation to suit farmer for local environments. Women farmer's inputs for varietal preferences in terms of harvesting, threshing, processing and use during selection are considered in this approach. Thus farmer's participation appears

essential to successful plant breeding and has facilitated the diffusion of varieties across target environments and led to raised productivity.

Methods

The participatory research approach involved framers in advance stages of technology generation, including selection of varieties and crop and nutrient management strategies. This enabled researchers to get feed-back from farmers about their preference and perceptions of the technology and to tailor the technology with farmer collaboration which led to its successful adoption. Faizabad (favourable rainfed lowland) and Siddharthnagar (unfavourable submergence prone lowland) districts of eastern Uttar Pradesh were used as case study areas to represent biophysical and socio-economic environments of eastern India. About 100 households from each study domain were sampled which comes from two villages (Sariyawan and Mungeshpur) in Faizabad and four villages (Basalatpur, Padari, Jagdishpur and Madaripur) in Siddharthnagar districts. A village level benchmark survey was initially conducted in 1997-98 to select farmers from different farm size groups, including women, and biophysical and socio-economic data were collected to assess constraints, cropping pattern and income standards of the farmers. Selected farmers (33 in Faizabad and 65 in Siddharthnagar) were provided with advance breeding lines and modern varieties to assess their field performance in the target locations. Farmer's participation in crop raising, ranking and rating, perception about the advance lines for their preferences and acceptability was the central focus of the study. All operations were done by farmers under supervision of researches, which helped to build confidence in farmers in knowledge sharing and technology generation. Diffusion of variety through farmers and researchers was assessed for impact analysis in both the districts. The farmers perception of advanced breeding lines were also included in the variety testing program and release proposals submitted to the National and State level varietal release systems.

Results and Discussion

A sizeable decrease in rice area under traditional varieties (TV) could result from improved availability of technology including modern varieties (MV), through participatory research at the two sites. Adoption pattern also changed toward MV, and adoption rate was approximately 3 times higher in the case of marginal farmers in Siddharthnagar than in Faizabad (Fig 1).

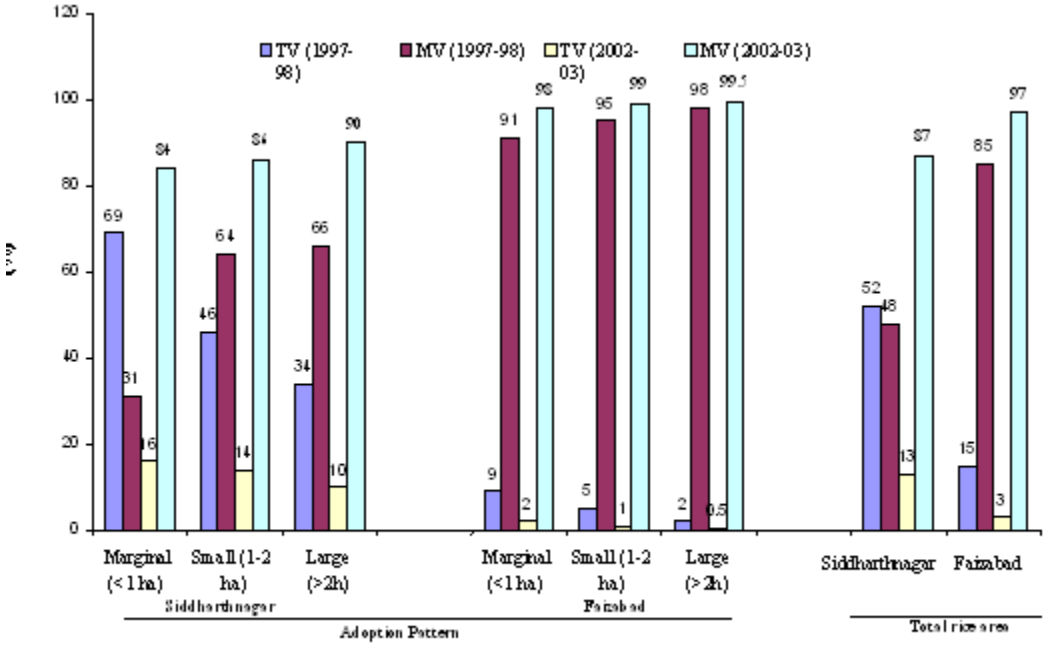

Fig.1. Area distribution and pattern of adoption of modern rice varieties by different groups of farmers of eastern U.P., India'

Yield improvement at the selected sites occurred mainly through adoption of modern varieties and other crop management strategies. Rice yield in Siddharthnagar (TV+MV) improved by 15-27 % over a study period of 5 years, against only 5-18 % in favourable lowlands of Faizabad. There is higher adoption level of MV (Fig. 2). Some of the PVS lines provided to farmers in Siddharthnagar have ample submergence tolerance and better regeneration ability and this resulted in higher yields even after floods. Witcombe and Joshi (1996) reported wide adoption of the rice variety Kalinga III selected through participatory research in Nepal and a return of 47-70% for the overall project.

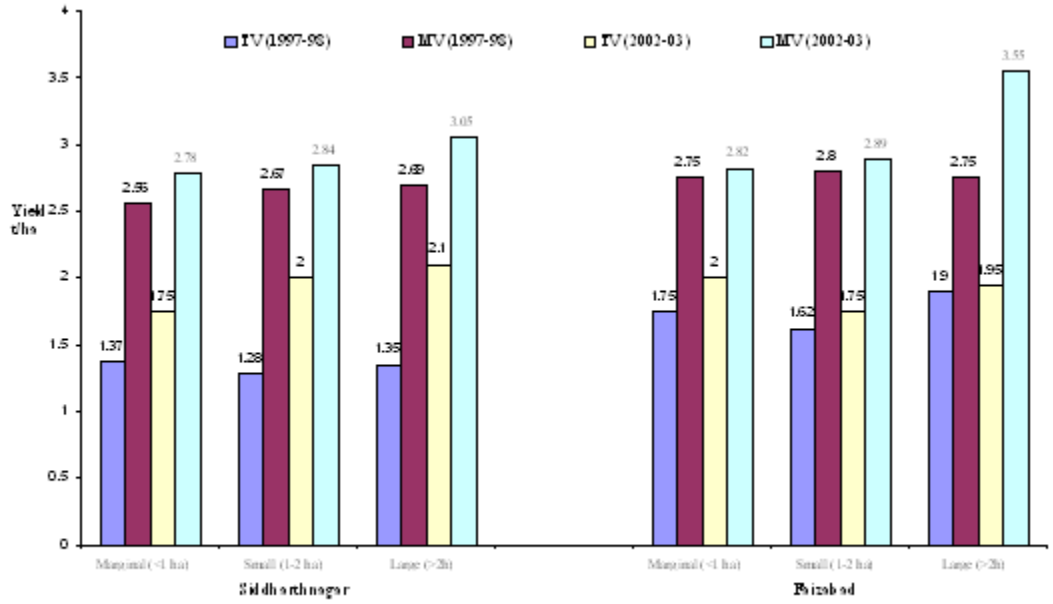

Fig 2. Rice yield improvement through technology adoption in selected sites of eastern U.P.

The assessment of impact of adoption of the technology including the MV improved the household income from rice, by about 5 % of total income in Siddharthnagar and 3 % in Faizabad. Income from other crops comes through crop diversification in both the areas. Better income from higher rice yields motivate farmers towards rice cultivation which is indicated in lower non-farm income at both places (Table 1).

Table 1: Impact assessment of household income (% of total income) through adoption of modern varieties in the study domain.

Source of income	Study sites			
	Siddharthanagar		Faizabad	
	1997-98	2002-03	1997-98	2002-03

Rice	24	29	15	20
Other crops	13	22	47	40
Off farm	04	07	06	02
Non farm	59	42	32	38

The diffusion pattern of new PVS lines provided through participatory research (Table 2) indicated good acceptance of the technology by farmers. Further diffusion could be made possible through farmer's field days and farm visits organized at the farm sites. Farmers were provided opportunities to assess technology and to rank and rate different PVS lines and varieties. A notable point is the diffusion of MV from farmers to farmers across location and other neighboring districts close to the study areas. The diffusion is primarily governed by the men and women farmer's perceptions of the varieties. Women farmers look for threshing ability, post harvest processing including cooking quality and fodder quality of straw, while men farmers go for yield, quality of grain and straw, disease resistance and duration to fit the cropping system**.**

Table 2. Diffusion of new PVS Lines from selected study areas and their performance at national and state level variety testing programs

PVS Lines	Diffusion		Performance of variety	
	Through institutions	Through farmer	National level testing	State level testing
		Siddharthanagar		
NDR8002	14	**10**	Recommended for release	
NDR 96005	11	**6**	-	Final testing before release
NDR 9730020	0	12	-	2nd year testing (1 rank)
NDR 9830116	**9**	**5**	**-**	**-**
NDR 9830132	**5**	**-**	**-**	**-**
NDR 9830139	**7**	**-**	**-**	**-**

NDR9830141	**12**	**-**	**-**	**-**
NDR9830144	**2**	**5**	2nd year testing	2nd year testing
NDR 9830145	**5**	**-**	**-**	**-**
		Faizabad		
NDR8002	**15**	**10**	Recommended for release	-
NDR 96005	**5**	**2**	-	Final testing before release
NDR9830102	**2**	**15**	**-**	Final testing before release
NDR9830114	**2**	**-**	**-**	**-**
NDR 9930116	**4**	**-**	**-**	**-**
NDR9830141	**1**	**-**	**-**	**-**
NDR9830144	**6**	**-**	2nd year testing	2nd year testing

Conclusion

The success of participatory research in the study domain over 5 years in terms of rice yields and income improvement of otherwise resource poor farmers seems promising. Some of the lines viz., NDR 80002, NDR 96005 selected jointly by the farmers and researchers are now at the stage of final release as improved varieties. If sufficient support and feedback is provided by the research institutions and government, the farmer's food security and livelihood in fragile environments of eastern U.P. can effectively be improved. This approach could easily be extrapolated to entire Eastern India, which has similar biophysical and socio-economic environments and is home to more than 2 billion poor farmers totally dependent on rice for their meals and social security.

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