

Learning and experiences
of the PETRRA project, BANGLADESH

BOOK: 10/10

Sub-project briefs



PETRRA – an experiment in pro-poor agricultural research

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INTERNATIONAL RICE RESEARCH INSTITUTE



Bangladesh Rice Research Institute

**Poverty Elimination Through Rice
Research Assistance (PETRRA), 1999-2004**

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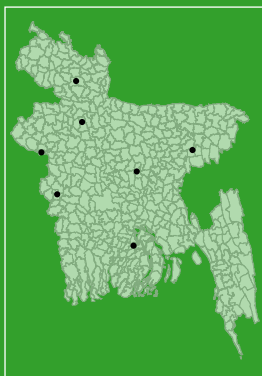
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Seed health improvement project (SHIP) (SP no. 00 99)

SP location:



Barisal
Bogra
Chuadanga
Gazipur
Habiganj
Rajshahi
Rangpur

SP duration:

April 1999 - June 2004

SP organisations:

IRRI, BRRI
CABI Bioscience, RDA
Proshika, GKF, BRAC
CARE, BAU, DAE, WAVE

SP team:

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INTRODUCTION

Good quality seed underpins good crop production and it is the only input that most farmers have control over. In Bangladesh, 88% of the rice seed used comes from farmers' own uncertified sources. Continuous saving of seeds from farmers' own harvests, without proper management, leads to severe deterioration of seed quality and lower yields. It has been shown experimentally that using good quality, clean seed can by itself increase the rice yield by between 7% and 20%.



OBJECTIVE

The objective of the sub-project (SP) was to develop appropriate technologies for improving the quality of farmers' saved seed, to disseminate these technologies and to enhance institutional capacity to address rice seed health issues. In this way the SP would contribute to poverty elimination, through increased rice production, by the production and use of good quality, healthy seed at the farm level.

METHODS

The SP had three phases. In the first phase, farmers' seed related problems were identified and prioritised. In the second phase necessary technologies were developed, and in the third phase these developed technologies were disseminated, following a variety of extension approaches.

Farmers' knowledge, attitudes and perceptions on seed health management issues were studied through a baseline survey carried out in sixteen villages, under eight districts, representing eight different agro-ecologies in Bangladesh. Information was also collected from published papers of earlier research.

Technology development research activities were conducted in seven key villages in the districts of Barisal, Bogra, Chuadanga, Gazipur, Habiganj, Rajshahi and Rangpur. At each site, 30 male and 30 female farmers participated directly in the research. Different organisations viz., the International Rice Research Institute (IRRI), Bangladesh Rice Research Institute (BRRI), Rural Development Academy (RDA), Department of Agricultural Extension (DAE), CABI Bioscience-UK with partner NGOs – Proshika, BRAC, CARE, Grameen Krishi Foundation (GKF) and WAVE Foundation were responsible for each of the seven sites. The seed pathology laboratory (SPL) of the Bangladesh Agricultural University (BAU) and the newly developed laboratory of BRRI provided laboratory support.

From each farmer, 500 gm. seed samples were collected to assess the seed quality.

Analysis revealed that saved seed was mixed with spotted and discoloured seed, deformed seed, partially filled and unfilled grains, smutted seed, weed seed, other varieties and insect damaged seed. Seed germination was also very low. These faults were due to lack of care in seed production and preservation.

Farmers saved seeds were cleaned by researchers and returned to the respective farmers to grow along with their own seed. After getting positive results, intensive farmer training was conducted on the assessment of seed quality. This enabled farmers to assess the quality of their own saved seed.

Each of the participating farmers then sorted one kg. of good seed from their own seed stock. This was grown alongside their unsorted seed and the differences observed. Several seasons' experiment revealed that by using good quality, apparently healthy seeds taken from farmers' own seed, average yield increased by 12.5% in the *boro* and *aman* seasons. After this observation, farmers became convinced that they could improve the quality of their own seed and wanted to learn about total seed production and preservation techniques. A selection of these techniques were introduced to the farmers, as follows:

Field seed health selection:

A portion of the rice field of each farmer, according to the quantity of seed they required, was selected and marked off using flags. The selected area was at least two metres away from fields planted with other rice varieties. Rogueing of weeds, other varieties and sheath rot infected panicles in the selected area was done three times. At ripening, the seed plots were harvested and threshed separately to avoid mixing. Threshing was done using two medium-strong beats on each side of the bundle to avoid threshing unfilled or partially filled grain.

Seed drying:

Using appropriate facilitation, participating female farmers came to understand the principles of seed drying and the innovation of the seed drying table.

Seed storage:

Group discussions with female farmers were conducted at all the sites and local options for storage containers and additives were collected. Containers tested included motka (earthen container), mokta painted on both sides, jute sack with polythene lining, tin, plastic drum, steel drum, silver container, polythene bag, and lemofoil bag. Among the additives, dry neem leaves, tobacco leaves, bishkatali leaves, eucalyptus leaves, tamarind seed, chalk powder, naphthalene and ash were tested. All the additives were placed on the top of the seed, except for tamarind seed and naphthalene which were mixed with the seed. The tested containers were completely filled with seed and additives and the lid was tightly closed.

In the case of the farmers' practice, seeds were dried several times during the storage period: this was not done for the tested practices. On-station experiments were also conducted for three seasons to validate findings at the farm level. Maximum and minimum temperatures and relative humidity of the store house were recorded daily at 0900 and 1400 hrs. Observations were made on insect infestation, insect damaged seed, mouldy seed and seed germination, following the standard method.

Plastic drums, motka painted on both sides and metal drums with airtight lids were found to be suitable for the safe storage of rice seed. The addition of about 5 gm. of

dry ash, dry neem leaves, dry tobacco leaves or one naphthalene ball per kg. of seed increased storage efficiency. The container was totally filled with the seed and additives and kept on a raised platform. No drying was needed during the storage period. The fundamental principle was air tightness.

Floataion method:

Just before sowing, seeds were cleaned again by the floatation method. The density of water in a bucket or other suitable open container was increased by adding salt or urea until an egg floated. Seeds were then placed in this water and stirred for 10-15 minutes. The floating portion was removed and the seed that settled at the bottom was collected, washed in clean water two or three times and then incubated for sprouting according to farmers' practice.

RESULTS

Improved storage techniques resulted in the seeding rate being reduced by 41%. Use of good quality, healthy seed increased average rice production per unit area by 12.5%. 100% of participating farmers achieved an increased yield and the net benefit was estimated at over Tk. 6,500 per hectare per year. The SP contributed positively towards food security: the rice provisioning ability of 89% of participating farmers increased by at least one month.

The SP activities also increased the social status of the participating farmers, all of whom have now brought 100% of their land under this practice. Farmers opined that they will continue this process even after the SP is over. Some farmers now produce seed in excess and earn extra money by selling the extra seed or seedlings. In addition to 420 participating farmers, 869 neighbouring farmers observed the activities and most of them are practising the techniques.

This technology will be sustained and disseminated further as the DAE, WAVE, GKF, BRAC and Proshika all have their own seed production programmes. Some of their staff have also been trained up through the SP, and it is expected that they will push forward the technology throughout the country. So far, more than 30,000 male and female farmers and staff from different partner organisations and uptake agencies have been trained up in the technologies developed by the SP.

There was less insect pest and disease pressure in the clean seed plot and it has been observed that during the project period the use of pesticides has been reduced by 50% in the project area. This is a positive indication of reduced environmental pollution.

The SP also gave emphasis to capacity building amongst concerned people. In addition to the farmers trained in improved seed management technology, the Principal Investigators and Research Officers from different partner organisations were also helped to become proficient in different aspects like facilitation, insect and disease identification, collection and processing of biological and socio-economic data, in addition to improved seed health management techniques.

A Molecular laboratory was established at BRRI and the necessary human resources have been developed to work in this line. A number of BRRI scientists are now proficient in 'fingerprinting' seed associated pathogens.

CONCLUSIONS AND RECOMMENDATIONS

Following all these practices the achievements obtained were:

- Rice yield at farmers field increased by 12.5% (on average);
- Overall seed germination rate increased by 20%;
- Farmers' seed rate reduced by 41%;
- Reduced disease incidence and insect damage in the field;
- Reduced pesticide use;
- Increased knowledge and skill of farmers producing good quality seed; and
- Changed attitude and perception towards seed health management.

The technologies developed by the SP are cost effective. It is estimated that if all farmers adopted these techniques, total national rice production would increase by 3.55 million metric tons (MMT), equivalent to 2.14 MMT of clean rice, or enough to feed more than 12 million people for one year. Nationwide, the savings on seed wastage would amount to 0.292 MMT per year, equivalent to more than Tk. 4 billion.

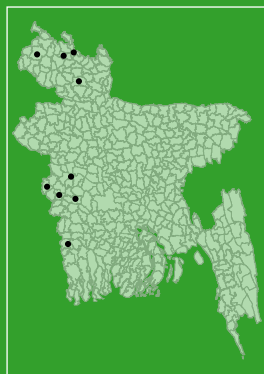
To get the full benefit from the developed technologies the following recommendations are put forward:

- DAE should take the lead for dissemination through partnership with leading NGOs;
- Extensive training of trainers should be conducted to develop the staff;
- Participatory trials/demonstrations could be arranged in each upazila (sub-district);
- Local government (union parishad members) and community leaders could be used for this purpose;
- Extensive video shows could be arranged;
- The technology could be included in the syllabus of farmers' schools;
- In each village some interested farmers could be encouraged to become seed producers and given help in marketing their seed. The block supervisor or extension officer could be empowered to ensure the seed quality; and
- A simple pictorial manual could be published on the technology and distributed among farmers.

Suggested citation:

Mew, T. W., Mia, M. A. T., Mele, P. V., Holderness, M., Zakaria, A. K. M., Haque, A. H. M. M., Rezaunnabi, M., Rahman, M., Fakir, G. A., Islam, A. S. M. N., Harun, E., Rahman, M. S. and Hossain, M. 2007. Seed health improvement project (SP 00 99). In: Magor, N. P., Salahuddin, A., Haque, M., Biswas, T. K. and Bannerman, M., editors. PETRRA - an experiment in pro-poor agricultural research. Technology sub-project brief no. 10.1.1. Dhaka (Bangladesh): Poverty Elimination Through Rice Research Assistance Project, International Rice Research Institute. 4 p.

SP location:



Chuadanga
Jhenaidah
Kushtia
Lalmonirhat
Meherpur
Nilphamari
Rangpur
Thakurgaon

SP duration:

April 2000 - June 2004

SP organisations:

BRRI
IRRI

SP team:

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M. Murshedul Alam
Ronald J. Buresh
J. K. Ladha

INTRODUCTION

Rice and wheat are the two main food grains of Bangladesh. The major cropping systems of the central-west region are rice-rice, rice-wheat and jute-rice-wheat. Declining soil fertility has been the striking problem for sustaining and increasing the productivity of intensive rice-based cropping systems.

Nutrient deficiencies, soil fertility and fertiliser management were identified by farmers and extension workers from Kushtia district as their 'first priority' concerns in a PETRRRA stakeholder consultation held in May 2000. In particular, they highlighted the time, rate and method of fertiliser application as key factors in achieving desirable yields and consequent profits from the cultivation of rice.



OBJECTIVE

The objective of this sub-project (SP) was to develop low cost technologies, tools and guidelines for managing fertilisers in rice-based cropping systems. Such technologies should maximise yield whilst sustaining soil fertility and protecting the environment from fertiliser pollution.

METHODS

The project was based at the Kushtia regional station of the Bangladesh Rice Research Institute (BRRI), with technical assistance from the International Rice Research Institute (IRRI). Three key research sites were established: Chandbill in Meherpur district, Baria in Kushtia district and Hatikata in Chuadanga district. The willingness of local farmers to work, good communications facilities, major cropping systems and problems of crop production, particularly those related to nutrients, were considered in selecting sites.

Using farmer participatory research, the project focussed on the concept of site specific nutrient management (SSNM). The capacity of soils to supply nutrients and the response to fertilisers in terms of grain yield varies greatly between farmers' fields. However, it was established that nitrogen (N) was the most limiting nutrient in all the sites, whereas phosphorus (P), potassium (K), sulphur (S) and zinc (Zn) were location or site-specific limiting factors for rice production.

The research demonstrated that 'real time' N management can be achieved by the use of a leaf colour chart (LCC). This is a plastic strip about 4 inches in length fabricated with four colour strips varying from light yellowish-green to dark-green. Farmers can decide to apply N fertiliser when leaf colour measurement by the LCC falls below the critical value for a particular rice variety.

RESULTS

The LCC is inexpensive and easy to use. Nevertheless, its use in the research sites increased yields by about 0.5 tons per hectare and boosted the agronomic efficiency of N by a factor of between 2 and 5. Estimates of soil nutrient supplying capacity based on the crop were found to be fairly accurate as well as simple to determine, and are useful to develop or refine P and K fertiliser recommendations.

These results were confirmed in validation experiments during 2002-3, using a farmer participatory approach in eight other sites, with the help of extension personnel. Based on the results of these experiments, some necessary refinements were made to the technology and the guidelines for its use, prior to the recommendation for up-scaling. This has been taking place since *aman* 2003 in twenty villages of greater Kushtia, greater Rangpur, Jhenaidha and Thakurgaon districts, conducted jointly by BRRI, the Department of Agricultural Extension (DAE), and the Rangpur Dinajpur Rural Service (RDRS).

The use of LCC to manage fertiliser inputs, instead of relying on farmers' traditional practise, led to an average yield increase of 0.27 tons per hectare in 2003 *aman* across this wider area. At the same time, N application decreased by 23 kilograms per hectare (kg./ha.). Yields increased still further when the LCC was used along with other nutrients at recommended levels. The average yield increases are shown in Table 1:

Table 1. Average yield increases for other nutrients used at recommended levels

Nutrient	Average yield increase (kg./ha.)	Range (kg./ha.)
K	150	52-212
S	80	0-326
Zn	140	23-444

The adoption of SSNM technologies and the consequent increase in yields improved the rice provisioning ability of both participating and non-participating farmers by between one and three months.

The high levels of urea application used under farmers' traditional practise encourage pest infestation and induce high sterility, which results in black-spotted, unfilled clean grains. LCC-based N management reduced grain sterility and pest infestation, so the rice required less cleaning and winnowing by women before cooking.

Reduced levels of N use also reduced hazards to health, improved air and water quality in the local environment and protected natural predators from the high rates of pesticide that would previously have been applied.

CONCLUSIONS AND RECOMMENDATIONS

SSNM is a valuable approach for developing fertiliser recommendations and management options for sustainable increases in production.

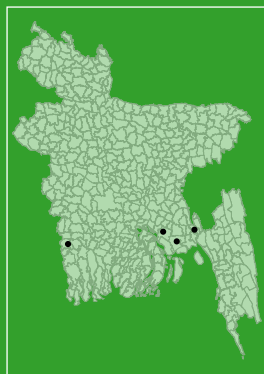
The activities of this SP have strengthened the linkages between institutions in the agricultural sector in Bangladesh. New linkages between research institutions and agriculture-based non-governmental organisations (NGOs) have been developed which is considered crucial for promotion of SSNM technologies in different regions of the country.

Suggested citation:

Khan, M. A. H., Rashid, M. H., Alam, M. M., Buresh, R. J. and Ladha, J. K. 2007. Nutrient management for intensive rice-based cropping systems (SP 10 00). In: Magor, N. P., Salahuddin, A., Haque, M., Biswas, T. K. and Bannerman, M., editors. PETRRA - an experiment in pro-poor agricultural research. Technology sub-project brief no. 10.1.2. Dhaka (Bangladesh): Poverty Elimination Through Rice Research Assistance Project, International Rice Research Institute. 2 p.

Development of high-yielding rice varieties for the coastal wetlands of Bangladesh (SP no.13 00)

SP location:



Feni
Lakshmipur
Noakhali
Satkhira

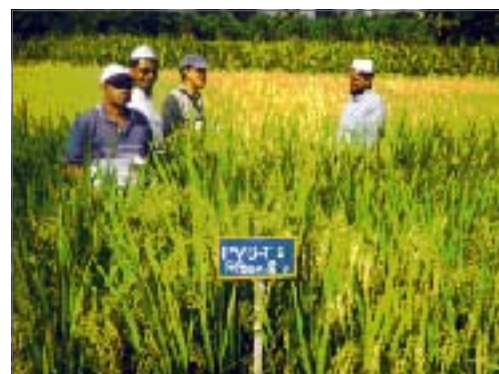
SP duration:
January 2001 - June 2004

SP organisations:
IRRI
BRRI
Dhaka University

SP team:
Glenn B. Gregorio
M. A. Salam
Nilufer Hye Karim
Zeba I. Seraj

INTRODUCTION

Soil salinity is one of the major constraints on rice production in about 1 million hectares of coastal Bangladesh. Reducing this salinity would require a large investment in major engineering structures and expensive soil amendments. Tailoring rice plants to adapt to salt stress, on the other hand, has proved to be practical and effective. A PETRRRA stakeholder analysis in the south-west of Bangladesh highlighted the urgent need for saline-tolerant rice varieties in the coastal areas. The challenge is to develop efficient methods of breeding high-yielding, salt-tolerant varieties with multiple resistances to soil-related disorders and flooding hazards. The tools of non-transgenic biotechnology offer the most promising means to address this problem.



OBJECTIVE

The purpose of the sub-project (SP) was to develop the capacity of the research system in Bangladesh to sustainably produce improved genotypes appropriate for resource-poor farmers (RPFs) in saline prone areas.

METHODS

The International Rice Research Institute (IRRI) was the lead agency in this SP, in partnership with the Bangladesh Rice Research Institute (BRRI) and Dhaka University (DU). Initial work was done at IRRI because of the relevance to the SP's objectives of existing ecosystem based research programmes. Later, five project sites in the southern districts of Satkhira, Lakshmipur, Noakhali and Feni were selected, representing the different cropping seasons in the saline prone coastal wetlands of Bangladesh.

Research consisted of three main components: the identification of salt-tolerant genotypes; the evaluation and categorisation of these genotypes by rice cropping season; and their transferral to farmers' fields in Bangladesh. Varieties identified as salt-tolerant were then tested for adaptability through participatory variety selection (PVS). Identified salt-tolerant varieties were also crossed with popular Bangladesh cultivars (both modern and traditional), applying modern biotechnological techniques such as anther culture (AC), marker-aided selection (MAS) and rapid generation advance (RGA).

Over three years, 245 salt-tolerant genotypes from IRRI and BRRI were placed in PVS 'mother trials' at the five project sites during the *aus*, *aman* and *boro* seasons. RPFs themselves then used their own plant type and yield criteria to select one or

two genotypes to grow in 'baby trials' in their own fields. Based on the yield data, the varieties selected by the RPFs were then recommended for national release.

RESULTS

The participatory approach to varietal selection used in this SP was very successful. A total of 528 RPFs, of whom 22 were female, participated in the PVS evaluation, finally choosing five genotypes for *aman*, four for *aus* and five for *boro*. The five *boro* genotypes selected in the PVS have now been submitted to the Seed Certification Agency (SCA) for distinct, uniform and stable (DUS) genotype testing. After 6 seasons of PVS, at least 500 RPFs are now using the farmer-selected salt-tolerant varieties for *boro* cultivation, and some non-governmental organisations (NGOs) are currently using these varieties in their own PVS activities.

The adoption of innovative breeding and selection techniques such as AC and MAS has been successful in developing readily transferable varieties and voluminous breeding materials for saline prone areas. More than 700 salinity-tolerant elite lines generated in this way have been characterised based on morphological characters and reactions to other soil-related stresses. This will help in matching the germplasm requirements of specific areas in the salt-affected regions of Bangladesh.

The AC facility of the Biotechnology Division of BRRI has been upgraded, and the MAS laboratory at the Biochemistry and Molecular Biology Department of DU now has the capacity to conduct molecular marker experiments and apply MAS for salinity tolerance breeding. Five molecular markers near the salt-tolerant gene have been identified and are undergoing validation and confirmation.

Plant breeders and biotechnologists have received training at IRRI on AC, MAS and salinity tolerance screening techniques. Workshops on AC and MAS were conducted at BRRI and DU, and two graduate students from BRRI are conducting their theses on techniques related to the SP. Farmers were given hands-on training in identifying suitable varieties, whilst the empowerment of RPFs through the PVS has resulted in a rapid spread of the new and improved varieties.

CONCLUSIONS AND RECOMMENDATIONS

This SP has developed the capacity of the research system in Bangladesh and institutionalised participatory breeding methods such as PVS. If RPFs are to adopt the new varieties generated by such methods, however, they must be widely available. The next major step is thus to ensure farmers in coastal areas have access to pure seed. This requires strong collaboration, with NGOs, local government agencies, extension workers and farmers participating in every aspect of variety selection and development.

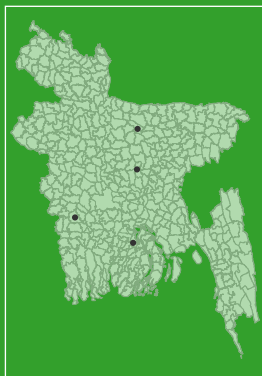
Documentation of the yield data from farmers' field trials is a requirement of the varietal release system in Bangladesh. There is also a need to conduct an assessment of the potential economic impact of the salt-tolerant varieties developed in this SP.

Suggested citation:

Gregorio, G. B., Salam, M. A., Karim, N. H., Seraj, Z. I. 2007. Development of high-yielding rice varieties for the coastal wetlands of Bangladesh (SP 13 00). In: Magor, N. P., Salahuddin, A., Haque, M., Biswas, T. K. and Bannerman, M., editors. PETRRRA - an experiment in pro-poor agricultural research. Technology sub-project brief no. 10.1.3. Dhaka (Bangladesh): Poverty Elimination Through Rice Research Assistance Project, International Rice Research Institute. 2 p.

Development and use of hybrid rice in Bangladesh (SP no. 15 00)

SP location:



Barisal & Jessore
Selected BADC farms
Selected BARD-AAS areas
Selected BRAC farms
Selected BRRI stations

SP duration:

April 2001 - June 2004

SP organisations:

BRRI
IRRI
BSMRAU
BAU
BRAC
BADC
AAS
RDRS
BARD
DAE

SP team:

A. W. Julfikar
M. Wazuddin
M. A. Khaleque Mian
Zahiruddin Talukder
Mozammel H. Howlader
F. A. M. Nurul Islam
Azizul Haque
M. G. Neogi
M. Harun-Ar-Rashid
S. S. Virmani

INTRODUCTION

With a plateauing trend in the yield of high-yielding varieties (HYVs) over the last decade, and an estimated reduction in agriculture land of 80,000 hectare per year, achieving 2.5% growth in annual rice production per hectare on a sustainable basis to match the growth in population is a challenge to rice researchers in Bangladesh. Amongst the various technological options, the exploitation of hybrid vigour is recognised as readily available, practically adaptable, and a feasible option.

Hybrid rice (HR) has contributed substantially to increased production in China, where about 15 million hectares are under HR, giving a yield advantage of 1-1.5 tons per hectare (t./ha.) over HYVs. Outside China, this technology has been commercialised in India, Vietnam and the Philippines during the past few years. The interest of the Government of Bangladesh (GOB) was manifested when, in the 1998-99 *boro* season, the country permitted the importation of up to 600 tons of HR seeds from India and China.



OBJECTIVE

The objectives of this sub-project (SP) were to generate and disseminate HR technologies of particular relevance to resource-poor farmers (RPFs), to develop a sustainable seed production technology and to strengthen the national capacity for HR development.

METHODS

This SP was undertaken by the Bangladesh Rice Research Institute (BRRI) in collaboration with eight partner organisations - Bangladesh Agricultural University (BAU), Bangabandhu Sheikh Mujibur Rahman Agricultural University (BSMRAU), Bangladesh Agricultural Development Corporation (BADC), Department of Agricultural Extension (DAE), Bangladesh Academy for Rural Development (BARD), Bangladesh Rural Advancement Committee (BRAC), Rangpur Dinajpur Rural Service (RDRS) and Agricultural Advisory Society (AAS) with one Principal Investigator (PI) from each organisation. Research institutions and universities, public extension and seed production agencies and non-governmental organisations (NGOs) also participated in the research. The Bangladesh Agricultural Research Council (BARC) and the Ministry of Agriculture (MOA) were indirectly involved in the project, particularly in the areas of networking and policy formulation and advocacy. This SP did not start in a vacuum but augmented ongoing activities.

There were four stages in the research for this SP:

- 1) HR technology generation;
- 2) Seed production;
- 3) Capacity building; and
- 4) Technology transfer and uptake.

The SP coincided with Bangladesh release its first HYV rice - BRRI hybrid dhan1. This provided opportunity for the SP to explore village seed production technology. Extensive on-farm demonstration through the DAE and seed production by BADC. The SP became a link that enabled a more critical mass for HR development in-country.

RESULTS

While assessing the research findings it was observed that:

- 1) Yield of BRRI hybrid dhan1 was higher by at least 1 t./ha. than BRRI dhan29;
- 2) Yields of promising hybrids for the *aman* season were higher by at least 1 t./ha. than recommended inbred varieties for *aman*; and
- 3) Net benefit of hybrid rice production was higher than that of inbred variety.

The major achievements of the project were:

- 1) Seed of the publicly released hybrid BRRI hybrid dhan1 is now available to RPFs for adoption in those areas of high potential where it has been released. Some farmers in such areas have already begun producing seed through a self-sustaining system. Private/imported hybrid seed is also available in the country but the price is high;
- 2) Facilities have been developed for the generation of parental lines for HR and research staff are now able to use modern techniques;
- 3) Two hybrids and one CMS line for *aman* were identified as promising; and
- 4) Co-ordination has been established between the technology generation, seed production and technology transfer groups.

CONCLUSIONS AND RECOMMENDATIONS

Past studies have shown that there is a significant negative relationship between farm size and HR technology adoption rates, implying that farmers with less land are more interested in the technology, in order to increase rice production and feed their families. Hence, RPFs are potential adaptors of HR technology in Bangladesh. The continuous increase in demand for HR seed in the test locations indicated that the neighbouring farmers were motivated by the results obtained by the participating farmers. This suggests that the technology will be sustained beyond the PETRRA SP.

Farmers using HR would have higher incomes due to increased yields. With this increased purchasing power, they would be able to raise their living standards and would be afforded more choices in their day-to-day lives. Farmers who follow recommended management practices strictly reap the most benefit from HR technology. Hence, the adoption of HR technology would tend to encourage RPFs to improve their farming practices, leading to modernisation of rice agriculture in the

country.

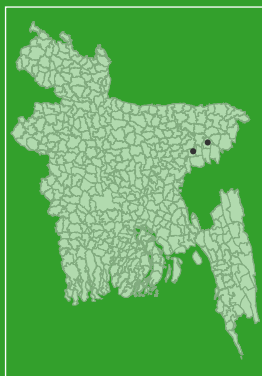
Land saved due to the higher yields of HR could be used to plant other agricultural crops, thus indirectly promoting biodiversity, or for other non-agricultural uses such as parks, thus indirectly improving the quality of life in the country. Moreover, the reduced area required for rice production would reduce the area treated with agrochemicals, thus indirectly protecting the environment through the reduction of air and groundwater pollution.

Suggested citation:

Julfiquar, A. W., Wazuddin, M., Mian, M. A. K., Talukder, Z., Howlader, M. H., Islam, F. A. M. N., Haque, A., Neogi, M. G., Rashid, M. H. and Virmani, S. S. 2007. Development and use of hybrid rice in Bangladesh (SP 15 00). In: Magor, N. P., Salahuddin, A., Haque, M., Biswas, T. K. and Bannerman, M., editors. PETRRA - an experiment in pro-poor agricultural research. Technology sub-project brief no. 10.1.4. Dhaka (Bangladesh): Poverty Elimination Through Rice Research Assistance Project, International Rice Research Institute. 4 p.

Participatory integrated plant nutrient management for intensive rice-based cropping systems (SP no. 17 00)

SP location:



Habiganj
Maulvi Bazar

SP duration:

December 2001-June 2004

SP organisations:

BRRI
AAS

SP team:

M. A. Saleque
M. Harun-Ar-Rashid

INTRODUCTION

Conventional research and extension activities have disseminated many valuable technologies on nutrient management for farmers. These are other site specific; and therefore the possibility of large scale dissemination is limited. Almost all these technologies require soil analytical data, but farmers in Bangladesh have limited access to such data. Moreover, given the large variation

in inherent soil fertility within a few hectares of a typical village, fertiliser recommendations developed from soil test results using a sampling of 100-200 hectares have little importance at the farmers' level.



OBJECTIVE

The objective of the sub-project (SP) was to encapsulate farmers' indigenous knowledge of soil fertility evaluation, and make use of this knowledge to prepare village level soil fertility maps, to prescribe participatory integrated plant nutrient management (PIPNM) packages for specific fields based on these maps and thus to increase rice productivity.

METHODS

This SP was executed in three upazilas of Habiganj and Maulvi Bazar districts between December 2001 and June 2004. During its two and a half year tenure, the SP worked in 216 villages, conducted participatory field experiments in 1,177 farmers' plots and trained 3685 farmers, of which about 30% were female.

At the start of the SP, village level soil fertility maps for 11 pilot villages were prepared with the active participation of farmers, who classified their soils into 3-6 grades based on soil fertility. Their indigenous diagnostic tools of soil fertility evaluation were then correlated with laboratory soil test results to verify the farmers' perceptions of the fertility of their soils. Laboratory results for organic carbon, total nitrogen, available phosphorus and exchangeable potassium showed good agreement with the farmers' perception of soil fertility. The 11 village level soil fertility maps were then geo-referenced using a geographic information system (GIS).

Traditional farmers' nutrient management packages (FP) for different soil fertility grades were identified in a meeting with the farmers, and an improved nutrient management package (IP) for each fertility grade was agreed in the same meeting.

The performance of the FPs and IPs was tested in 8-10 farmers' fields in each of the 11 villages, through participatory research. Farmers were involved in designing experiments, selecting fields, sizing plots and selecting varieties. They executed field

trials and took care of the plots like a researcher. They helped project staff in measuring plant heights, counting tiller numbers every 15 days and recording yield data. Rice leaves at the active growing stage were collected and analysed for nutrient concentration to check for deficiency or toxicity of any nutrient element. The crop was harvested at maturity, when the farmers desired.

RESULTS

The IPs out-yielded the FPs by an average of about 20% in *aus* and *aman* and about 40% in *boro*.

Both the village level soil fertility map preparation and the encouraging results of the improved nutrient management packages created tremendous interest in the farmers of the pilot villages. After each harvest, village level training workshops were arranged to discuss the field experiment results and prepare nutrient management prescriptions. Based on the soil fertility maps and the results of the field experiments, PIPNM packages for different soil fertility grades were prepared for the entire village.

In the second year of the project, activity was extended to neighbouring villages and fine-tuning of the PIPNM packages continued. Of the participatory farmers of the first year's villages, 17 were selected and designated as farmer extension agents (FEAs). The FEAs facilitated the preparation of soil fertility maps and identified FPs and IPs for neighbouring villages. After field experiments, PIPNM packages were prepared. Village soil fertility mapping, field experimentation to validate proposed IPs and the development of PIPNM packages covered 216 villages by the end of the second year of the project.

The third year of the project aimed at the extension of farmer-led PIPNM packages, with the FEAs taking the main leadership in their dissemination. By December 2003 (mid-third year of the project), PIPNM packages had reached about 14,000 farmers' fields.

CONCLUSIONS AND RECOMMENDATIONS

The PIPNM packages developed during this SP worked in all soil fertility grades, and participating farmers became familiar with the packages specific to their fields. The implication is that farmers themselves can decide, using the tools developed in this SP, how much fertiliser they need for soil of a specific fertility grade, and thus harvest tonnes in extra yield.

The SP worked initially with male farmers, but by the middle of the second year, 30 female farmers were participating in the project, which was about 25% of the total participation at that stage. SP activity kept pace with the environment through balanced fertiliser use, reducing fertiliser in some areas and minimising the degradation of soil nutrient resources in most areas.

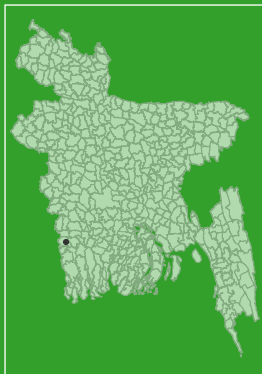
The SP established relationships between the Bangladesh Rice Research Institute (BRRI) and partner organisations and resource-poor farmers' groups in Habiganj and Maulvi Bazar districts. These relationships offer good capital for future participatory research.

Suggested citation:

Saleque, M. A. and Rashid, M. H. 2007. Participatory integrated plant nutrient management for intensive rice-based cropping systems (SP 17 00). In: Magor, N. P., Salahuddin, A., Haque, M., Biswas, T. K. and Bannerman, M., editors. PETRRA – an experiment in pro-poor agricultural research. Technology sub-project brief no. 10.1.5. Dhaka (Bangladesh): Poverty Elimination Through Rice Research Assistance Project, International Rice Research Institute. 2 p.

Integrated crop and nutrient management for increasing the productivity of saline soils of Bangladesh (SP no. 18 00)

SP location:



Satkhira

SP duration:

May 2002 - June 2004

SP organisations:

BRRI
Shushilan

SP team:

M. Abdul Latif Shah
Mostafa Nuruzzaman

INTRODUCTION

Coastal saline soils represent a marginal but potentially productive land resource for Bangladesh. Presently soil salinity affects twenty southern districts where the livelihoods of about one-fifth of the population are at stake. The options of farmers in coastal regions are limited, as in the past sufficient research attention was not paid to the problems that they face.

In a stakeholders' meeting in 2002, coastal farmers clearly pointed out the need for the assessment of location-specific salinity and tidal submergence; the availability of appropriate rice varieties; and soil fertility management.



OBJECTIVE

The objective of the sub-project (SP) was to increase agricultural productivity through the development of site-specific integrated crop and nutrient management (ICNM) packages for resource-poor farmers (RPFs) in the coastal region of Bangladesh

METHODS

The Bangladesh Rice Research Institute (BRRI) and Shushilan, a non-governmental organisation (NGO), were involved in this project. A team visited Satkhira district in June 2002 to select suitable sites for conducting a participatory rural appraisal (PRA). Shushilan-Gobindapur and Roghurampur (Ratanpur) villages in Kaliganj upazila and Munshiganj village in Shyamnagar upazila were chosen, and PRA tools (transect-based on walking, social mapping, land type mapping, resource mapping, problem prioritisation and semi-structured interviews) were used for the study.

The PRA identified the problems of rice production in the less favourable environment of coastal saline soils, and suggested research to develop techniques, uptake pathways and knowledge that would be suitable for RPFs. It collected information about the landholding size and socio-economic condition of different households, and also selected participants (male and female) for a stakeholder analysis, which would focus on RPFs throughout the study period. RPFs were defined as farm households with a provisional ability of self-sufficiency in rice of only 3-8 months.

Based on the PRA findings, experiments were conducted on the plots of those farmers who cultivate rice in less than 0.4 hectare in either the *aman* or the *boro* season. ICNM package treatments were selected based on existing fertiliser management practices and soil tests, and utilised combinations of inorganic

fertilisers with different sources of indigenous organic materials such as cow dung, ash and dhaincha, a green manuring crop. A survey was conducted to estimate the available quantities of such organic materials within the study area.

BRRI-developed varieties were used in the experiments, including, BRRI dhan40 and BRRI dhan41 during *aman*, each has some salinity tolerance and BRRI dhan28 in *boro*. In addition, the fluctuation of water salinity was monitored through observational wells, rivers and pond water, to detect the low and high salinity periods of the year.

RESULTS

The survey suggested that about 9,000 hectares of land could be fertilised if all the available indigenous sources of organic materials were fully utilised. Cow dung and dhaincha are however mostly consumed as domestic fuels. Nevertheless, use of the ash produced in local rice mills alone could fertilise about 950 hectares of saline soil for rice production, representing a great opportunity for RPFs.

Soil test-based (STB) fertiliser packages provided 0.5 tons per hectare (t./ha.) higher grain yields than farmers' traditional fertiliser doses. STB packages supplemented by dhaincha or ash, applied at 5 t./ha., provided 1 t./ha. higher yields than farmers' practice.

The application of potassium (K), as a top dressing at 20 kg./ha., instead of *dhaincha* or ash, to supplement the STB package, provided still higher yields. Potassium applied in the easily available form of muriate of potash (MP) seems to fulfil the demands of the rice plants immediately and stimulate their essential physiological functions, with the consequent effect of a higher yield than that provided by the slowly available K in ash. This indicates that saline soils need higher K doses for optimum yields.

CONCLUSIONS AND RECOMMENDATIONS

Participating farmers and their neighbours were convinced by the results of the ICNM package trials, in which most achieved yield increases of 35-40%, and all showed a keen interest in adopting this technology in future.

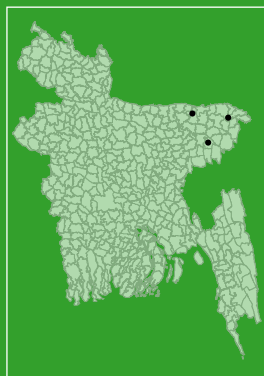
The findings of this SP suggest the combined application of inorganic and organic fertilisers in the saline belt to ameliorate the effects of soil salinity. In particular, it is important to address the increased K requirements of saline soil. If it is not possible to supplement an STB fertiliser dose with organic sources of K such as ash or dhaincha, a top dressing of K at 20 kg./ha. at the maximum tillering stage will provide higher yields.

Suggested citation:

Shah, M. A. L. and Nuruzzaman, M. 2007. Integrated crop and nutrient management for increasing the productivity of saline soils of Bangladesh (SP 18 00). In: Magor, N. P., Salahuddin, A., Haque, M., Biswas, T. K. and Bannerman, M., editors. PETRR - an experiment in pro-poor agricultural research. Technology sub-project brief no. 10.1.6. Dhaka (Bangladesh): Poverty Elimination Through Rice Research Assistance Project, International Rice Research Institute. 2 p.

Integrated rice-duck farming for resource-poor farm households (SP no. 19 00)

SP location:



Barisal
Maulvi Bazar
Sunamganj
Sylhet

SP duration:

July 2001 - June 2004

SP organisations:

BRRI
FIVDB
BDS

SP team:

Gazi Jashim U. Ahmed
Malik Anwar Khan
James P. Biswas

INTRODUCTION

Bangladesh produces about 26 million tons of rice annually and the country has almost attained self-sufficiency in food. However, this increased rice production depends heavily on higher use of chemical fertilisers, pesticides and herbicides, which has increased both the risk of environmental pollution and the costs of rice production.



Rice research in Bangladesh has so far centred on its cultivation as a sole crop. However, in China, Korea and Japan the rice-duck farming system has been widely adopted. Besides providing another source of income, ducks in the rice field are reported to control weeds and insects and add plant nutrients through their droppings. Traditionally, ducks are not allowed in the rice field in Bangladesh for fear of crop damage. Changing this age-old conception could increase the productivity and income of resource-poor farmers (RPFs) in the country.

OBJECTIVE

The objective of this sub-project (SP) was to develop and promote a rice-duck farming system through the direct involvement of RPFs. Such a system should improve productivity, reduce costs by decreasing the use of fertilisers and agro-chemicals, and conserve the natural eco-system of the rice fields

METHODS

The lead organisation in the implementation of this SP was the Bangladesh Rice Research Institute (BRRI). The partner organisations were Friends In Village Development Bangladesh (FIVDB), Sylhet, and the Bangladesh Development Society (BDS), Barisal.

The study was initiated in July 2001, and seven rice growing seasons were covered, from 2001 *aman* to 2004 *boro*. The study was located in two regions: Sylhet in the north-east and Barisal in the south.

A total of 266 RPFs participated directly in this study in four districts (Sylhet, Sunamganj, Maulvi Bazar and Barisal). Participating farmers were selected by the partner organisations and provided with training on all aspects of rice-duck farming.

In the rice-duck plots of participating farmers, only cow dung, at 5 tons per hectare (t./ha.), was used during land preparation. Ten days after rice transplantation, 20-day old ducklings were released into the plots. 350-400 ducklings were grazed in each hectare of land. No weeding took place and no insecticides or chemical fertilisers

were used. When the crop reached the flowering stage, the ducks were removed from the plot to prevent damage to the ripening rice. They were then reared in ponds and natural marshy land.

In sole-rice plots alongside, farmers applied nitrogen fertiliser and sprayed and weeded following their usual practice.

RESULTS

On average, yields in the rice-duck plots were 20% higher than in the sole-rice plots. This superiority was consistent across all locations and seasons.

The population of harmful insects in the rice-duck plots was significantly reduced compared to the sole-rice plots. The ducklings were very efficient catchers and eaters of insects. On the other hand, the populations of beneficial insects were similar in the rice-duck and sole-rice plots. Many beneficial insects were able to escape the attack of ducks.

Weeds were significantly controlled by ducks. The rice-duck plots were almost free from harmful weeds. The ducks ate the growing weeds and controlled them efficiently, saving farmers over Tk. 1,000 per hectare in hand weeding costs.

Only organic manure was used as a source of plant nutrients for rice cultivation. Duck droppings provided nutrients to the crop. In the rice-duck plots, the availability of nitrogen (N), phosphorus (P), potassium (K), calcium (C) and sulphur (S) were higher than in the sole-rice plots.

About 90% of the ducklings survived during the *aman* season and about 75% of ducklings survived during the *boro* season. Surviving ducklings had gained between 900 and 1300 grams in weight when they were removed from rice-duck plot. The ducklings contributed to higher farm incomes through their own value in addition to the increased grain yields.

Economic analysis indicated that the participating farmers were able to earn a net return of between Tk. 30,000 and Tk. 35,000 per hectare from the rice-duck system, compared with Tk. 10,000 to Tk. 15,000 per hectare from the traditional farming system of sole-rice. This enhanced income raised the rice provisioning ability of all participants, improved family nutrition and naturally increased their standard of living.

Organising workshops and seminars was an important part of the SP. A series of workshops were organised in Barisal and Sylhet (2001-2004) with the participation of different stakeholders, providing a positive opportunity to share learning and experience. Of particular interest is a participatory evaluation workshop that was held from December 30, 2003 to January 1, 2004, at Sylhet, to capture the response of the farmers to the rice-duck system. 30 farmers (24 males and 6 females) from Sylhet, Sunamganj and Maulvi Bazar districts participated in the workshop. The impact of the rice-duck system on different aspects of their livelihoods was thoroughly discussed. Different issues around the adoption of rice-duck farming were raised before them and their views were recorded and summarised. The main advantages they pointed out were:

- 1) Household income increases;
- 2) Chemical fertilisers and weeding are not required;
- 3) Insects are remarkably well controlled;

- 4) Duck dropping acts as fertiliser; and
- 5) Soil quality and fertility improved.

They also pointed out some disadvantages, which included:

- 1) Mongooses kill ducks;
- 2) Ducks need additional food; and
- 3) Excessive rainfall and hot weather are not favourable for ducklings.

But they opined that these problems are manageable for them.

The participation of women in the rice-duck system is remarkably high. About 80% of duck rearing activities were traditionally done by women. Activities such as hatching, housing, nursing, feeding, and herding are done exclusively by women. Women participated in the capacity building programme of the project and expressed their views in workshops and meetings. Women are primarily affected by poverty in a family, but duck rearing provided them with extra income from eggs and ducks, gradually enhancing their status in the family and in the community.

In the rice-duck system chemical fertilisers were not used. Organic manure was used and duck droppings supplied nutrients along with manure. Chemical fertilisers sometimes cause environmental pollution, which in turn adversely affects human health and the production of domestic animals, and may hamper land productivity. In this way, the rice-duck system helped the farmers to keep farm environment free from pollution. In the sole-rice systems, insecticides and herbicides need to be used heavily to protect the crops from pests and weeds. Insecticides and herbicides often pass into the water bodies and cause harm to the fishes and other aquatic flora and fauna. Moreover, these chemicals may persist in the soil and plants, poisoning different organisms including humans. In the rice-duck system, insecticides and herbicides are not required and ducks control insects and weeds, which in turn nourish the ducks. Thus the system not only keeps the environment free from pollution, but also enhances the productivity of the land. It does not adversely affect bio-diversity. The farmers who participated in the subproject were able to understand these benefits.

Training rice-duck farmers was a major task of the SP. The training was organised in different rice seasons for the resource-poor collaborating farmers, and improved their knowledge, skill and awareness. After receiving the training, they showed good performance in the adoption of technology in their community, and were able to transfer the knowledge to neighbouring community farmers. Large numbers of self-motivated farmers have since started using the rice-duck system, without any support from the project. Ducklings are now available from a local hatchery, helping to sustain the system.

BRRI, FIVDB and BDS formed a strong working relationship to accelerate the activities of the SP. The partner organisations played a significant role in making contact with other non-governmental organisations (NGOs) and government institutions, local government and the private sector. The participatory research in the farmers' fields was possible with the participation of partner organisation and farmers. The partner organisations recruited staff to carry out research activity in the field. It was observed that staff with agricultural background and community development experience did better work in conducting rice-duck field research.

The SP published different communication materials for farmers, policy makers and researchers, helping in the dissemination of the project concept and in the extension of the technology. Brochures, posters and a bulletin were published regularly. Research findings and the outputs of the workshops and seminars and the training were documented. A video was developed for different stakeholders, and the rice-duck system has featured on electronic media and been broadcast on radio and television several times.

CONCLUSIONS AND RECOMMENDATIONS

The findings of the SP, though very promising, are based on a relatively small number of field trials conducted in a few selected areas over a short period. A comprehensive research programme should be initiated, covering all areas of the country, to determine the performance of the technology under varied agro-ecological conditions and to study the effect of season and land type on the productivity of the system. The most suitable areas for the rice duck system should be identified. Studies should be undertaken to analyse scientifically the positive and negative impacts of the system on the environment and on farmers' livelihoods.

Pending this further research, the rice-duck technology may be extended throughout the country. Both government organisations and NGOs may take initiatives in this respect. The findings of the SP show that no risks are involved in this system and farmers can adopt it without any difficulty.

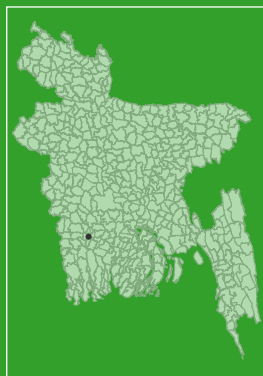
The experience gained in the SP should be compiled in a convenient package, both in print and using multi-media technology, for easy dissemination. Government organisations and NGOs could then spread this technology to suitable agro-ecological areas of the country, as an important income generating activity for small and marginal farmers.

Suggested citation:

Ahmed, G. J. U., Khan, M. A. and Biswas, J. P. 2007. Integrated rice-duck farming for resource-poor farm households (SP 19 00). In: Magor, N. P., Salahuddin, A., Haque, M., Biswas, T. K. and Bannerman, M., editors. PETRRRA - an experiment in pro-poor agricultural research. Technology sub-project brief no. 10.1.7. Dhaka (Bangladesh): Poverty Elimination Through Rice Research Assistance Project, International Rice Research Institute. 4 p.

Development and utilisation of coastal water resources for crop production and its impact on coastal ecosystem of Bangladesh (SP no. 20 01)

SP location:



Khulna

SP duration:

January 2002 - June 2004

SP organisations:

BRRI
HEED
Proshika
Khulna University

SP team:

Manoranjan K. Mondal
Abdul Mannan Chashi
Mobarak H. K. Chowdhury
M. Manirul Islam

INTRODUCTION

In Bangladesh, about one million hectares of coastal saline soils have been historically mono-cropped with low yielding traditional rice varieties. Most of this land remains fallow in the dry season due to high soil salinity and the lack of good quality irrigation water. Modern agricultural techniques have increased crop production two to three-fold in most of the country over the past few decades, but the coastal region has been deprived of these technological advances, and cropping intensity and production levels remain much lower in this region than in other parts of Bangladesh.



Many rivers flow into the Bay of Bengal through the coastal region, and during neap tides the water level in these rivers rises to between 1 and 3 metres above the agricultural land surface. This offers opportunities to develop irrigated agriculture in both wet and dry seasons, provided salinity levels permit.

OBJECTIVE

The objective of this sub-project (SP) was to develop appropriate water management and crop production technologies for the coastal region in order to improve the productivity and socio-economic status of its resource-poor farmers (RPFs) and to check the further salinisation and degradation of the coastal environment caused by expanding shrimp cultivation in the rice lands.

METHODS

Research was conducted between January 2002 and June 2004, in the south-west region of Bangladesh, where the most problematic saline lands lie. A series of meetings was held with farmers, local leaders and government and non-governmental organisation (NGO) officials to select the study site. The location chosen was at Kismat Fultola village under Batiaghata upazila in Khulna district. The 4 hectare experimental field adjoined the river Kazibachha. As the main focus of the SP was to develop coastal water resources management technologies, hydrological factors dominated site selection, rather than a particular focus on RPFs. Twenty nine farmers participated in the research programme, most of whose rice provision ability was more than 8 months.

Bangladesh Rice Research Institute (BRRI)-developed high-yielding varieties (HYVs), and the advanced line BR-6110-10-1-2, were grown from July to mid-November, both to increase yields and to reduce the growth span of wet season rice to allow dry season rice to be established early, avoiding the higher soil and water

salinity of April and May. Two short duration HYVs were grown from mid-November to mid-April. BRRI-recommended fertiliser and cultural management practices were followed.

Dry season rice was dependent on irrigation. From mid-November to mid-February, whilst water salinity remained below 4 deci-siemens per metre, this was provided through a flash-gate from the river during the neap tide. In the first week of February, before saline levels rose, water was diverted into a reservoir canal for conservation. This water was then used to irrigate the crop using a low lift pump.

RESULTS

The rice-rice cropping pattern introduced in this SP yielded farmers between 6 and 9 tons per hectare (t./ha.), compared with between 2 and 2.5 t./ha. under their traditional practice.

Coastal water resources were productively utilised for rice cultivation without disturbing the environment. In the research field, soil salinity in the dry season decreased due to use of relatively non-saline river water for dry season rice cultivation. Conservation of relatively non-saline river water in natural canals provided positive impacts for the health of the animal kingdom of the locality. Sedimentation owing to the use of river water for supplemental irrigation in the wet season improved soil health to some extent.

CONCLUSIONS AND RECOMMENDATIONS

HYV rice, whether salt tolerant or not, can be successfully grown in the coastal regions of Bangladesh. Rice production in the dry season in saline soil environments is a blessing for coastal farmers, and all the participatory farmers and more than 100 neighbouring farmers were using the water resources conservation and utilisation technologies developed under this SP in their rice cultivation in 2004.

The success of coastal water resources utilisation for dry season rice production was viewed positively from different corners. The development of technology for such a fragile environment was well received at both national and international level. Two NGOs working in Bangladesh expressed their willingness to disseminate these technologies in their project area and the International Rice Research Institute (IRRI) has taken up projects in Bangladesh and Vietnam to improve the productivity of coastal regions.

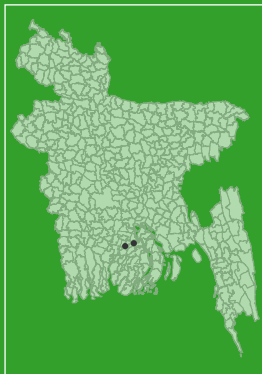
The participatory farmers were delighted to disprove their traditional beliefs: 'rice cultivation is not possible in the dry season,' and 'rice tastes bitter when grown by using chemical fertiliser.' There lie many rivers and canals in the coastal region of Bangladesh where non-saline river water and rainfall could be conserved for crop production. Steps should be taken to disseminate these technologies for improving the land productivity and the livelihoods of the RPFs of Bangladesh.

Suggested citation:

Mondal, M. K., Chashi, A. M., Chowdhury, M. H. K. and Islam, M. M. 2007. Development and utilisation of coastal water resources for crop production and its impact on coastal ecosystem of Bangladesh (SP 20 01). In: Magor, N. P., Salahuddin, A., Haque, M., Biswas, T. K. and Bannerman, M., editors. PETRRA - an experiment in pro-poor agricultural research. Technology sub-project brief no. 10.1.8. Dhaka (Bangladesh): Poverty Elimination Through Rice Research Assistance Project, International Rice Research Institute. 2 p.

Adaptation and adoption of USG technology for resource-poor farmers in tidal submergence-prone area (SP no.21 01)

SP location:



Barisal
Jhalokati

SP duration:

July 2001 - June 2004

SP organisations:

BRRI
IDE

SP team:

M. A. Mazid Miah
M. Badrul Alam

INTRODUCTION

The efficiency of nitrogen (N) fertiliser in wetland rice culture is very low: on average only 30% of applied N is recovered by the rice crop. In tidal wetland situations, it is often impossible to follow recommended practices for N application, and there is a high risk of losses of surface N to floodwater. In such situations, the deep placement of urea super granules (USGs) may provide a good alternative for increased rice yields.

USGs are made from prilled urea using a briquette machine, and look like naphthalene balls. They have the same chemical composition as prilled urea available in the market, and come in three sizes, the smaller two being used for the *aus* and *aman* seasons and the largest for *boro*. USGs are generally applied by deep point placement.

Around 12% of the total land area of Bangladesh is flooded twice a day for 4-8 months of the year with tidal water. Little research has so far been done on USG deep placement in this area of high potential.

OBJECTIVE

The objective of this sub-project (SP) was to improve rice production through adaptation and adoption of USG technology by resource-poor farmers (RPFs) in the tidal submergence-prone area.

METHODS

The Bangladesh Rice Research Institute (BRRI) and International Development Enterprise Bangladesh (IDEB), a non-governmental organisation (NGO), worked together with BRRI in managing research on recommendations. IDEB worked in market chain development, demonstration and promotion. The SP focused on refining the USG technologies that are suitable for the tidal submergence-prone ecosystem, and on developing a sustainable private sector supply chain consisting of a producer, dealers, and trained agricultural labour for USG deep placement.

The study was initiated in *aman* 2001, at research locations selected on the basis of rapid appraisal and benchmark surveys in Bakerganj and Nalchhity upazilas, under



Barisal and Jhalokati districts. Research partners included RPF groups, NGOs, government organisations and USG producers and dealers.

Field trials on USG packages were conducted to select suitable packages for uptake. At each of 15 different locations, seven treatments were tested, including native N only, farmers' traditional practice and various USG packages.

Selected packages were then demonstrated in farmers' fields, and the skills and knowledge of RPFs was developed using participatory training and motivational activities.

Soil samples from demonstration plots were collected and analysed, and the results compared with farmers' experiences with soil fertility.

RESULTS

Deep placement of USG produced a significantly higher grain yields than prilled urea in all seasons. However, in *aus* and *aman*, broadcast USG and the incorporation of USG at final land preparation were as effective as deep placement.

N doses as USG of 50 kilograms per hectare (kg./ha.) in *aus* and *aman* and 75 kg./ha. in *boro* appeared to be sufficient to provide these higher yields. USG use increased yields by an average of 16% and required 28% less N than prilled urea. The reduction of N losses through deep point placement of USG fertilisers controlled pollution of soil and ground water from N contamination.

A training programme was organised for both participating and non-participating farmers, the field level NGO and extension personnel and USG producers, dealers and retailers. Most of the participants learnt something new from these programmes and they were satisfied with the contents.

Both awareness of USG technology and skill at its application, as well as the adoption rate of USG by farmers, increased substantially in the project area. Availability of USG fertiliser to the local farmers has been ensured through the development of a USG producer in the project area and the establishment of a USG fertiliser distribution network through eight retailers. Some RPFs also increased their incomes by using USG in vegetables and other cash crops.

These findings have been documented through pictures, posters, fact sheets and reports etc. The USG technology success story was communicated to farmers through leaflets, folders, wall painting, roadside banners, cinema slides and other promotional materials like cotton bags, umbrellas and T-shirts.

Linkages between local NGOs, the Department of Agricultural Extension (DAE) and supply chain members have been facilitated in order to assist RPFs in accessing institutional credit if needed. Marketing efforts were initiated with available resources in order to promote USG technology.

CONCLUSIONS AND RECOMMENDATIONS

The superior performance of USG in terms of grain yield and N use efficiency indicate that USG may be a good alternative source of N fertiliser for sustainable higher rice production in tidal submergence-prone areas. The annual productivity per unit of land has increased after adoption of USG. Analysis of major indicators of

standard of living demonstrates that the use of USG has brought significant improvement of rice provisioning ability in general.

Promotional activities in remote locations are essential in order to develop a strong market for USG. Demonstrations, training and the mass media should all be used to educate farmers and dealers on USG use.

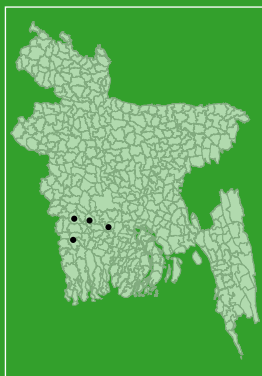
Research should focus on the development of coated USG for slow and controlled release of N in both wetland and upland crops, and the development of an easy-to-use applicator for tidal submergence-prone areas.

Suggested citation:

Miah, M. A. M. and Alam, M. B. 2007. Adaptation and adoption of USG technology for resource-poor farmers in tidal submergence-prone area (SP 21 01). In: Magor, N. P., Salahuddin, A., Haque, M., Biswas, T. K. and Bannerman, M., editors. PETRRRA - an experiment in pro-poor agricultural research. Technology sub-project brief no. 10.1.9. Dhaka (Bangladesh): Poverty Elimination Through Rice Research Assistance Project, International Rice Research Institute. 4 p.

Rice diversity and production in south-west of Bangladesh: using local knowledge to create sustainable livelihoods in the coastal area (SP no.22 01)

SP location:



Bagerhat
Jessore
Khulna
Satkhira

SP duration:

November 2001 - June 2004

SP organisations:

BRRI
CDP
IARD

SP team:

M. K. Bashar
Ashraf-Ul-Alam Tutu
Sukanta Sen

INTRODUCTION

Farmers in the south-west of Bangladesh are enmeshed in a wide network of interacting people, agencies and markets, all bound within a changing natural environment. In this context, understanding rice diversity, in both traditional and modern varieties, is important.



OBJECTIVE

The objective of this sub-project (SP) was to enhance and strengthen the sustainability, security and bio-diversity of agriculture-dependent livelihoods amongst resource-poor farmers (RPFs) in the south-west of Bangladesh, by making a wide variety of adapted modern and traditional rice varieties available through the collection and analysis of local rice diversity and indigenous knowledge.

METHODS

Project implementation was shared between the International Rice Research Institute (IRRI), the Bangladesh Rice Research Institute (BRRI), the Coastal Development Partnership (CDP), Integrated Action Research and Development (IARD) and 15 local non-governmental organisations (NGOs).

A baseline survey, conducted in 2002, provided information on: the rice varieties grown in the *aus*, *aman* and *boro* seasons; the area under both local and high-yielding varieties (HYVs); the costs of production; land ownership; and soil characteristics.

Ethnographic studies were conducted in six villages. These focused on farmers' indigenous knowledge of rice cultivation practices and on the use of traditional rice varieties. They found that decisions on the varieties to be cultivated are usually made by the head of the family, influenced by the selection of varieties by neighbouring farmers. They also made important findings on local practices. Some examples are: rat control through perching of night birds; using local varieties for combined shrimp and rice culture; natural selection of rice varieties through dew test; use of organic pesticide etc. These could be popularised widely.

Rice germ-plasm was collected from 311 RPF households in 20 villages from the four south-western districts of Bagerhat, Khulna, Satkhira and Jessore. Initially 784 rice samples were collected but after removal of duplicates 116 varieties were identified as genuine samples. Passport information and physiochemical properties of these 116 rice varieties were documented.

Three participatory variety selection (PVS) trials were conducted. The first, in *aman* 2002, tested 10 varieties including 7 local varieties and 3 HYVs. The second, in *aus* 2003, was conducted with 4 varieties, with a local check and the best 3 varieties from the first PVS. In *aus* 2003, a third PVS trial was conducted with 6 varieties.

RESULTS

The baseline survey found that the major varieties in the area were: *sadamota*, BR-23, and *jotabalam* in *aman*; *bapoi*, *kataktara* and BRRI dhan28 in *aus*; and BRRI dhan28, *bara ratna* and *ratna* in *boro*.

The results of the PVS trials differed from location to location. Generally, in *aus* BRRI dhan27 gave the highest yield, whilst in *aman* BRRI dhan23 and BRRI dhan40 and 41 gave higher yields than local varieties. However, local varieties like *jotabalam* and *birpala* were suitable for water depths greater than one metre, and were essential in waterlogged conditions in the research villages.

During the SP, rice provisioning ability amongst participating farmers increased by one month, on average. There was however a significant difference in the change in rice provisioning ability depending on the sub-ecosystems (from 1.6 months at Kanchanpur in Khulna district to 0.1 month at Kumlai in Bagerhat district). The average increase in rice provisioning was higher for female farmers (1.25 months) than for male farmers (1 month).

CONCLUSIONS AND RECOMMENDATIONS

The key message of the SP is explained on a poster developed from the participatory research:

'Select local or modern transplanted *aman* rice varieties according to the depth of water in your field, and choose at least two or three varieties for food security and sustainability.'

It was reported to the evaluation team by farmers that modern HYVs require higher levels of inputs such as fertilisers and pesticides. The HYV rice in the study was attacked by insect pests and disease, but due to the practice of integrated pest management (IPM), pesticide use was kept to the minimal level. Modern/HYV rice varieties as such do not have any negative impact on the environment.

In fact, shrimp monoculture is responsible for the negative impact on the environment in the coastal region. Farmers in the south-west have traditionally practiced combined rice and shrimp farming, although monoculture of shrimp brings larger profits. In some locations in the south-west, farmers are reporting increased pest pressure due to the reduction in rice area as shrimp monoculture expands. Farmers felt that increased rice-shrimp farming could solve this problem, especially with the use of new HYVs.

Analysing the information provided by the local NGOs indicated that 11 of them had no previous experience of crop research and PVS was totally new for all of them. The local NGOs opined that working in the SP made them capable of conducting research and particularly improved their data collection skills using PRA methods.

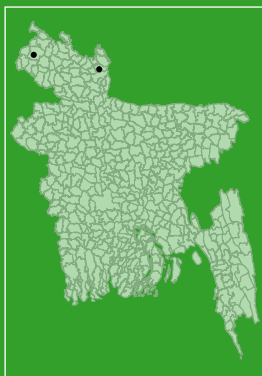
There are further opportunities for local variety germplasm collection in different areas in the south-west and BRRI should employ 2-3 persons well trained in field collection for this task.

Suggested citation:

Bashar, M. K., Tutu, A. A. and Sen, S. 2007. Rice diversity and production in south-west of Bangladesh: using local knowledge to create sustainable livelihoods in the coastal area (SP 22 01). In: Magor, N. P., Salahuddin, A., Haque, M., Biswas, T. K. and Bannerman, M., editors. PETRR - an experiment in pro-poor agricultural research. Technology sub-project brief no. 10.1.10. Dhaka (Bangladesh): Poverty Elimination Through Rice Research Assistance Project, International Rice Research Institute. 2 p.

Integrated crop management (ICM) in north-west region of Bangladesh (SP no. 25 01)

SP location:



Kurigram
Thakurgaon

SP duration:

October 2001 - June 2004

SP organisations:

BRRI
RDRS
GKF

SP team:

M. A. Sattar
Syed Samsuzzaman
Ramzan Ali

INTRODUCTION

Farmers in Bangladesh are trying their best to meet an increasing demand for rice from a growing population, but proper care in crop husbandry and soil health maintenance is often not taken. In the north-west of the country, soils are mostly light textured and low in organic matter. Imbalanced fertiliser doses and little addition of organic material have resulted in declining yields and the degradation of agricultural land.



Scarcity of surface water compels farmers in the north-west to use groundwater to irrigate rice in the dry season. Substandard irrigation water management along with the high water requirement of light textured soils results in high production costs, and many irrigation systems do not utilise the full potential of the equipment, due to social constraints.

Increased productivity in the north-west, where many farmers live beneath the subsistence level, could be achieved through the introduction of high-yielding varieties (HYVs), profitable cropping patterns and efficient, integrated crop, soil, nutrient and water management.

OBJECTIVE

The objective of this sub-project (SP) was to augment the productivity and improve the livelihoods of resource-poor farmers (RPFs) in the north-west in the following ways:

- Increasing water use efficiency and command area;
- Improving soil health for sustainable production; and
- Generating and disseminating site-specific crop production technologies.

METHODS

The organisations involved were the Bangladesh Rice Research Institute (BRRI), the Rangpur Dinajpur Rural Service (RDRS) and the Grameen Krishi Foundation (GKF), along with farmers' groups at the project sites. Based on communication facilities, the facilities of the partner organisations and on the rice provisioning ability of RPFs, two study sites were chosen, at Kurigram Sadar and at Pirganj, Thakurgaon. The SP started in October 2001.

A benchmark survey established the existing status of RPFs at each site, including livelihood data, crops and cropping patterns and fertiliser and water management.

On the basis of this survey and a participatory rural appraisal (PRA) a programme of action research was designed. This included irrigation infrastructure development and the selective introduction of HYVs.

Field level participatory research experiments were conducted at both sites. Staff from the partner organisations executed the work under the supervision of BRRI scientists. Farmers were trained in advance of each season on the improved crop production packages, both in the classroom and in the fields.

RESULTS

In general, farmers were using higher rates of urea than BRRI recommends, and there was high variability in their use of other fertilisers. Following recommended fertiliser and cultivation practices resulted in 18-33% higher yields.

Amongst the new varieties introduced in the *boro* season, farmers showed a positive response to BRRI dhan28 because of the short growth duration and high yield. Although BRRI dhan29 produced the highest grain yield, farmers were reluctant to cultivate it because of the longer growth duration. Amongst the new *aman* varieties, farmers were interested in short duration BRRI dhan33 and BRRI dhan39, to overcome the food shortage in late October and to improve their cropping patterns.

The selected cropping patterns evaluated in the research resulted in annual rice yields almost double (12-20 tons per hectare [t./ha.]) those achieved by traditional patterns. The highest gross return was achieved with the BRRI dhan33/39-Potato-BRRI dhan28 pattern, followed by the BRRI dhan33-Mustard-BRRI dhan28 pattern. As previously mentioned, farmers were able to harvest BRRI dhan33/39 in their food crisis period (locally known as *Monga*), from mid-October to the first week of November.

An evaluation of different nutrient management regimes showed that nutrient uptakes were higher with soil test-based (STB) fertiliser application, resulting in a yield advantage of between 1.3 and 2.5 t./ha. The response to STB applications was higher in long duration varieties.

Soil nutrient maps revealed that most soils in the area were deficient in phosphorus, potassium, calcium and magnesium. Adequate applications of triple super phosphate (TSP), murate of potash (MP) and gypsum (G) are required for sustained and profitable crop production.

Water conveyance losses with the existing earthen irrigation canals used at both sites exceeded 40% of pump discharge, due to evaporation, seepage and percolation, overflows, breaks and rat holes etc. The introduction of improved, compacted canals with *pakea* outlet boxes reduced these losses to 25-29%, and the use of hosepipes cut losses to only 2%. Significant savings in water and in labour, fuel and oil costs resulted. Analysis of the benefit-cost ratio (BCR) and the internal rate of return (IRR) of investment in such improvements to the distribution system suggests that it is economically viable and profitable.

Efficient on-farm water management in *boro* rice cultivation was investigated at the project sites. Continuous flooding, irrigation at saturation and irrigation at 3-day after disappearing standing water were compared with farmers' irrigation practice. It was found that there was no significant yield difference because of irrigation scheduling, but that water could be saved by 29-36%, whilst maintaining a satisfactory grain yield. The highest grain yield and water productivity was recorded in alternative irrigation up

to saturation followed by irrigation at 3 days after the disappearance of standing water in both the project sites.

Rainfall data indicated that supplemental irrigation was needed to maximise yields in the light-textured soils of both sites. A partial budget analysis found that supplemental irrigation of *aman* production increased profit by more than Tk. 5,000 per hectare at the Kurigram site and almost Tk. 3,500 per hectare at the Thakurgaon site. The main constraints to supplemental irrigation were: lack of or damaged irrigation channels; lack of irrigation water sources; and farmers' reluctance to use supplemental irrigation for *aman* production. Through project activities, this reluctance was reduced, thereby increasing yield, farm income and livelihoods.

A study was conducted to examine farming efficiency. Stratified random sampling was used to collect data from 60 participatory and 60 non-participatory farmers at both project sites. Tabular techniques and the Cobb-Douglas stochastic frontier production function model were employed to measure farm efficiency. The results are shown in Table 1 below.

Table 1. Farm-specific mean technical efficiencies

	Kurigram		Pirganj	
	<i>Aman</i>	<i>Boro</i>	<i>Aman</i>	<i>Boro</i>
Participating farmers	0.95	0.94	0.90	0.94
Non-participating farmers	0.84	0.81	0.77	0.79

It was found that net return and benefit-cost ratio from crop production was higher in participant farms than in non-participant farms.

A model for the sustainability of this ICM SP at the RDRS site was developed. In order to sustain the SP, as well as to utilise the skills of the trained beneficiaries (farmers), the SP would be continued based on learning experiences. RDRS would ensure a revolving fund to federations or farmers' groups. Through this revolving fund, each federation would continue the SP activities on a commercial basis (modified form), in which experienced farmer/trainers would earn an honourarium for their extension services. A technology transfer system would be followed, established in a memorandum of understanding (MOU) with RDRS and other related organisations. The federations would be the main actor to organise the training for these 'farmer extensionists', as well as their beneficiaries. Costs in relation to this training would be provided by the federations from their profit margin.

CONCLUSIONS AND RECOMMENDATIONS

This SP has had a major positive impact on cropping patterns and the adoption of HYVs in the study area. The introduction of ICM concepts has enhanced farmers' skills and know-how concerning agricultural production technologies, which has helped them to use their resources more intensively and judiciously. As a result, farmers who participated in the SP are technically more efficient in their crop production systems leading to increased per unit production.

At the Kurigram site, 60% of farmers reported that they have learnt how to prepare a standard seedbed, to replace traditional varieties with modern varieties and to apply

STB fertilizer management. About 50% of farmers were using technologies generated by themselves in collaboration with researchers on other fields. Moreover, it was found that 85% of the farmers would continue to follow ICM technologies after the end of the project.

All the farmers are now growing modern *boro* rice. Some of them are growing dhaincha and green gram as 'green manure' crops after wheat cultivation. 50% of ICM farmers and at least 20% of their neighbours are aware of and practicing a 3-day interval irrigation system. Project participants are now aware of the benefit of soil testing. However, to date they are not showing any interest in testing their soil on a payment basis. The introduced cropping patterns, on the other hand, such as BRRI dhan33-mustard-BRRI dhan28 and BRRI dhan33/39-potato-BRRI dhan28, are highly accepted by the farmers.

ICM has brought about a remarkable change in farmers' income levels, and housing and health facilities have improved markedly in both the Kurigram and the Pirganj study areas. Annual rice provisioning ability from farmers' own production increased from 8.55 months to 10.75 months, and significant livelihood improvement was observed in both sites.

The success of this SP suggests the following recommendations:

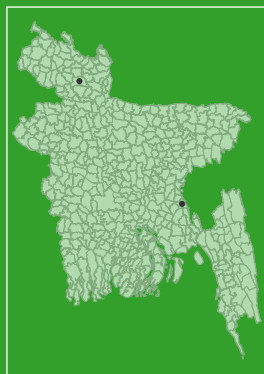
- The dissemination of modern crop varieties should be intensified, and similar projects focussing on crop production technologies established in other similar agro-ecological zones of Bangladesh;
- Massive motivational work at the grassroots level is required to establish fertiliser use based on the needs of the crops and the indigenous supplying capacity of the soil;
- In many cases, chemical analysis is needed to determine the deficiency of micro-nutrients such as sulphur (S), zinc (Zn) and boron (B);
- Micro-level soil nutrient maps should be produced and distributed amongst farmers for use at the village level;
- The government along with NGOs should take the initiative for small-scale development of irrigation infrastructure such as outlet boxes and improved canals; and
- On-farm water management practices should be further demonstrated in farmers' fields to ensure that water is being applied efficiently.

Suggested citation:

Sattar, M. A., Samsuzzaman, S. and Ali, R. 2007. Integrated crop management (ICM) in north-west region of Bangladesh (SP 25 01). In: Magor, N. P., Salahuddin, A., Haque, M., Biswas, T. K. and Bannerman, M., editors. PETRRRA - an experiment in pro-poor agricultural research. Technology sub-project brief no. 10.1.11. Dhaka (Bangladesh): Poverty Elimination Through Rice Research Assistance Project, International Rice Research Institute. 4 p.

Livelihood improvement through ecology (LITE) (SP no. 27 02)

SP location:



Comilla
Rangpur

SP duration:

April 1999 - June 2004

SP organisations:

IRRI
BRRI
AID-Comilla
DCPUK

SP team:

Gary C. Jahn
Nazira Quraishi Kamal
Rokeya Begum Shafali
M. Nurul Islam Dulu

INTRODUCTION

In the last ten years, the use of pesticides has been on the increase in Bangladesh, reaching a level of 12,000 tons (costing about 22 million US Dollars) in 1999. Chemically-based pest control strategies are unsustainable and not cost-effective, due to rising costs, insecticide-induced outbreaks of insect pests and the development of resistance to insecticides. Indiscriminate use of pesticides not only creates serious environmental problems but upsets the balance between pests and their natural enemies, leading to increased populations of key pests and even the creation of new pest problems.

OBJECTIVE

The objective of this sub-project (SP) was to improve the livelihoods, environment and health of resource-poor farm (RPF) households by reducing insecticide expenditures in rice crops by at least 10% within 2 years, and by optimising urea use.

METHODS

The need for this SP was identified in November 2000 at a two day PETRRRA integrated pest management (IPM) workshop, attended by scientists from the Bangladesh Rice Research Institute (BRRI) and the International Rice Research Institute (IRRI), by representatives of non-governmental organisations (NGOs), by agriculture extension agents, and by university researchers working in rice IPM in Bangladesh. From April 27 to May 9, 2001, scientists from IRRI and BRRI conducted the recommended needs and opportunities assessment (NOA). The workshop and NOA constituted the stakeholder analysis for this SP.

From discussions with farmers, extension agents, researchers, and NGOs working in IPM it was determined that the SP would consist of farmers conducting experiments in their own fields to assess the need for insecticides in *boro* and *aman* rice, under their normal fertiliser practices and under optimised fertiliser application regimes using leaf colour chart (LCC). We planned to convince hundreds of farmers to each withhold insecticides from half of one of their fields so we could identify the constraints to yield controlled by farmers' insecticide applications.

We expected unsprayed portions of the field to suffer higher crop loss due to pests. Our intention was to test the hypothesis that the type of crop loss suffered was



related to the types of crops surrounding the rice field, and to develop alternatives to the insecticides used to prevent that crop loss. As it turned out, withholding farmers' insecticide applications did not result in any additional crop loss in over 1000 field trials conducted over 4 seasons.

Details of these field trials are given below. Even under optimised urea applications, farmers' insecticide applications had no effect on crop loss. Therefore, it became unnecessary to develop alternatives to the insecticides. Instead, we simply began recommending to farmers that they cease using insecticides on *aman* and *boro* rice crops, and that they optimise urea management with the LCC.

At the beginning of the SP, 6 villages were selected in each of two districts, Comilla and Rangpur, a total of 12 villages. Three of the villages in each district were designated as target villages, where the experiments would be conducted; while the other 3 villages were designated as check or control villages, which were used to establish the normal changes in insecticide use over the life of the SP, in the absence of participatory research.

In Comilla district (sadar upazila) the target villages were Rajmongalpur, Ghilatoli, and Jorameher; and the control villages were Votua, Nosorail, and Anandapur. As Ghilatoli was roughly twice as large as the other villages we divided it into two, giving us 4 locations for field trials in Comilla. In Rangpur district (Pirgacha upazila) the target villages were Sullipara, Aladipara, Nagorjitpur; and the control villages were Omarkhan, Chalunia, and Piadpara. Before the start of the project, participatory rural appraisal (PRA) exercises established that the target and control villages in each district had comparable levels of insecticide use, rice yields and poverty.

At the beginning of the 2002 *aman* season we recruited 100 RPFs in each target village. Each of these farmers withheld insecticide from one half of one of his/her fields for the 2002 *aman* season. Fortnightly participatory evaluation meetings were held and the rice yield was measured from each treatment. Data on arthropod community structure and pest damage were collected from each treatment by BRRI and NGO staff. In addition, we collected data on arthropod diversity in relation to the type of neighbouring crop.

Of these 600 farmers, a subset of 180 farmers went on to participate in *boro* 2002, *aman* 2003 and *boro* 2004 field trials. In *boro* 2002, four lead farmers (LFs) in each target village supervised four participating farmers (PFs), making a total of 120 farmers in the six target villages in Comilla, and 60 farmers in Rangpur.

The PFs used the same split-field regime as in the *aman* 2002 rice season. The LFs divided their rice fields into four quadrants, to which they applied the following treatments: insecticide and LCC; insecticide and no LCC; no insecticide and LCC; no insecticide and no LCC. The farmers kept detailed records of their expenditures on insecticides and urea applications on their test plots in specially designed notebooks. The same fortnightly participatory evaluation meetings were held and the rice yield from each treatment measured at harvest time. Data on arthropod community structure and pest damage in relation to insecticide use, fertiliser use, and neighbouring crops were again collected by the BRRI and NGO staff. This was repeated in subsequent seasons.

RESULTS

The 'no insecticide and LCC' regime, called integrated natural resource management

(INRM), was introduced to reduce the cost of inputs without reducing rice yields. In *boro* and *aman* 2003, none of the 180 participating farm households used insecticides, and all used LCC. In the target villages, even those farm households who did not take part in the LITE experiments did not use insecticides in *aman* 2003, and only about 10% used insecticides in *boro* 2003. In the control villages, about 80% used insecticides in *boro* 2003, and about 75% in *aman* 2003. Amongst those who stopped using insecticides, 100% of the participating farmers cited LITE as the reason for stopping. Over 90% of non-participants in the target villages stopped using insecticides because of LITE. As for the control villages, about 40% of those who stopped using insecticides did so because of LITE.

There was no significant difference between yields in plots in which no insecticide was applied and yields in plots with insecticide applications. This was true in both rice seasons over 4 years and in 7 different villages in two different districts, consisting of a total of 1140 field trials.

There was no significant difference in yields of plots managed with and without LCC. This was true in both districts (Rangpur and Comilla). In *boro*, average urea use went down significantly with use of LCC in both districts. In *aman*, LCC use gave a significant reduction in urea use in Rangpur. But in *aman* in Comilla the amount of urea applied with and without the LCC was not significantly different.

The costs of insecticides and excessive nitrogen (N) fertiliser, as well as the labour costs of applying them, are avoided in the INRM regime, producing a direct saving for the farmer. These savings are achieved without imposing any additional labour costs on farmers, except for the time it takes to carry out the comparison of the rice leaf with the colours on the LCC. This process takes only a few minutes and is usually conducted at the time of regular fertiliser application, so added labour is negligible. The INRM regime is therefore highly cost-effective, as shown in Table 1 below:

Table 1. Cost savings under INRM

	Rangpur	Comilla
Average saving under INRM in <i>boro</i> per hectare (US Dollars)	32.46	16.39
Average land holding in <i>boro</i> (hectares)	0.52	0.41
Average saving under INRM in <i>boro</i> per household (US Dollars)	16.88	6.72
Average saving under INRM in <i>aman</i> per hectare (US Dollars)	19.08	16.06
Average land holding in <i>aman</i> (hectares)	0.51	0.37
Average saving under INRM in <i>aman</i> per household (US Dollars)	9.73	5.94
Overall average annual saving per household (US Dollars)	26.60	12.66
Average annual income from sale of rice (US Dollars)	225.35	242.09
Equivalent % increase in income under INRM	11.8%	5.2%

For RPFs, stopping insecticide use also eliminated the need to secure spraying equipment, which, for the poorest farmers, often must be rented. In addition, very poor farmers often needed to secure loans, at exorbitantly high local interest rates, in order to purchase these items.

Studies on the effects of neighbouring crops on diversity of pest and natural enemies continued as planned. Diverse habitats i.e., banana-rice, sugarcane-rice, homestead-rice, vegetable-rice showed higher abundance of natural enemies and lower abundance of insect pests; and also showed more diversity of arthropods (insect pests and natural enemies) compared to rice-rice habitat. We also studied the effects of insecticide and fertiliser interactions on arthropod diversity. We discovered that natural enemy and pest

abundance was highest in 'LCC-no insecticide' plots; and that natural enemy and pest abundance was lowest in insecticide-treated plots under farmers' fertiliser management.

CONCLUSIONS AND RECOMMENDATIONS

Following the LITE recommendations by eliminating insecticides and reducing urea applications enables farmers to make significant savings in the cost of inputs, without any reduction in yields.

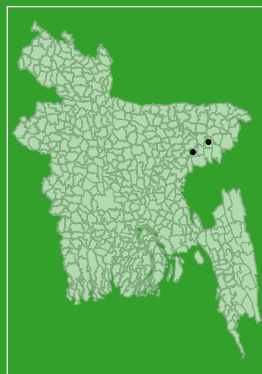
There was a tremendous variation in savings. Farmers who already used optimal amounts of urea and little or no insecticides saved very little, while farmers who spent a great deal on chemical inputs saved as much as Tk. 4,000. On average, however, these recommendations will save farmers roughly Tk. 1,000 per year, enough money to purchase rice for an additional month for a family of 5.

Suggested citation:

Jahn, G. C., Kamal, N. Q., Shafali, R. B. and Dulu, M. N. I. 2007. Livelihood improvement through ecology (LITE) (SP 27 02). In: Magor, N. P., Salahuddin, A., Haque, M., Biswas, T. K. and Bannerman, M., editors. PETRRA - an experiment in pro-poor agricultural research. Technology sub-project brief no. 10.1.12. Dhaka (Bangladesh): Poverty Elimination Through Rice Research Assistance Project, International Rice Research Institute. 4 p.

Production and marketing of fine, aromatic and glutinous (FAG) rice through farmers' participation in north-east region of Bangladesh (SP no. 28 02)

SP location:



Maulvi Bazar
Habiganj

SP duration:

April 2002 - June 2004

SP organisations:

HEED

AAS

BASC

SP team:

Abdul Mannan Chashi

M. Harun-Ar-Rashid

Manjur e Aziz

INTRODUCTION

Bangladesh is a land of great biodiversity in rice, due to thousands of years of cultivation and wide agro-ecological variations in both space and season. Many genotypes were lost after the introduction of high-yielding varieties (HYVs) in the 1960s, but a good many indigenous varieties survived and remain in cultivation due to special qualities appreciated by consumers, who are prepared to pay higher prices for them. Amongst this group are the fine, aromatic and glutinous (FAG) rice varieties.



There is a particularly strong demand for FAG varieties in the north-east of Bangladesh, and since people of this region constitute the majority of ethnic Bangladeshis living in the UK and USA, FAG varieties are also in demand in these countries. Agro-ecological conditions in the north-east are very diverse, providing suitable environments for growing rice varieties with wide genetic variations. Traditional varieties are still cultivated here, and vast areas of lowland grow only one crop each year, earning very little for the resource-poor farmers (RPFs) of the region.

OBJECTIVE

The objective of this sub-project (SP) was to identify FAG varieties and suitable cropping patterns for the RPFs of the north-east, to raise the milling yield by at least 5% and to establish a marketing system that ensures good prices for FAG rice.

METHODS

The SP built on the experience and expertise of RPFs, facilitated by non-governmental organisations - Health Education and Economic Development (HEED), with technical inputs from the Business Advisory Service Centre (BASC), Agricultural Advisory Society (AAS) and APEX. The SP was implemented in 145 villages of Maulvi Bazar and Habiganj districts. The research programme was participatory and took the form of demonstration trials conducted by farmers under the supervision of SP officials. It included the following stages:

- Collection of FAG varieties;
- Evaluation of collected varieties;
- Selection of suitable cropping partners;
- Determination of fertiliser and labour requirements;

- Arrangement for seed production;
- Improvement in milling technology; and
- Development of marketing.

In general, factors other than yield were considered during the research. These factors included farmers' priorities, weather, disease and pest vulnerability, high and low land factors, single and double crop suitability, grain quality and market demand.

RESULTS

Of the 35 varieties of FAG rice tested, the superiority of 12 was clearly established, and these varieties were selected by the RPFs who could see their potential.

Fertiliser trials proved the effectiveness of combined organic and inorganic fertiliser applications in the case of BRRI dhan34, one of the selected varieties. Amongst the cropping patterns tested, a rain-fed modern *aus* crop followed by FAG rice in double cropped land was the most successful.

Net production increased from 6.0 to 8.5 tons per hectare (t./ha.) amongst the FAG rice-cultivating farmers. FAG rice cultivation was also more cost effective compared to the modern varieties in terms of labour and fertiliser input. The RPFs themselves were inspired and they encouraged neighbouring farmers to undertake FAG rice cultivation. The number of participants increased from the initial 86 to 1,097 at the end of the project.

Milling of the FAG varieties remains a serious problem. In the existing milling method the FAG grains break easily.

Different training and workshops effectively helped the farmers to overcome problems relating to FAG rice cultivation. The RPFs and the various organisations became closer, in terms of the relationships that emerged through their interactions after joining different seminars, workshops and training courses. Both sides are expected to ensure the sustainability of this relationship.

Various documents produced by the SP will help planners, researchers, businessmen and RPFs to gain long term benefit by sharing the knowledge generated by the SP.

CONCLUSIONS AND RECOMMENDATIONS

Research activities carried out under the SP indicated that a large number of FAG varieties, representing a vast biodiversity of rice, are still cultivated in different parts of Bangladesh. Although the yields of these varieties are generally lower than those of the modern HYVs, cultivation of some of them remains economically feasible due to their special qualities, for which they command higher prices. They fit well into particular ecological conditions and respond to organic methods of production.

- A programme should be taken up to thoroughly collect and evaluate FAG varieties and to disseminate the promising ones in selected areas, in order to preserve biodiversity and bring economic benefits to RPFs;
- BRRI could take up a breeding programme to develop high-yielding FAG varieties, and the possibility of introducing such varieties from other countries should be explored;

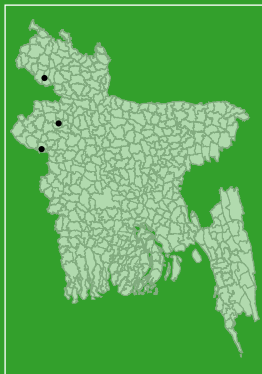
- Research on the post-harvest technology of FAG, particularly milling, needs to be strengthened. Increasing the recovery of unbroken grains would add considerable value to FAG production; and
- The development of a special marketing system for FAG varieties deserves consideration, and the demand for FAG rice in international markets should be explored.

Suggested citation:

Chashi, A. M., Rashid, M. H and Aziz, M. E. 2007. Production and marketing of fine, aromatic and glutinous (FAG) rice through farmers' participation in north-east region of Bangladesh (SP 28 02). In: Magor, N. P., Salahuddin, A., Haque, M., Biswas, T. K. and Bannerman, M., editors. PETRRA - an experiment in pro-poor agricultural research. Technology sub-project brief no. 10.1.13. Dhaka (Bangladesh): Poverty Elimination Through Rice Research Assistance Project, International Rice Research Institute. 4 p.

Technology development of a production, processing and marketing system for aromatic rice in north-west region of Bangladesh (SP no. 29 02)

SP location:



Dinajpur
Naogaon
Rajshahi

SP duration:

April 2002 - June 2004

SP organisations:

APEX
BREA
Awlia Engineering
Mark Industries
IRRI

SP team:

M. Abdus Salam
M. Hasanullah
Ravi Prasad Ghosh
Joe Rickman

INTRODUCTION

Aromatic rice has a special status amongst consumers. Within Bangladesh, it is consumed by rich and poor alike on the occasion of festivals, and is also served in restaurants, whilst in rice importing countries abroad, recipes based on aromatic rice are growing in popularity. However, the economic prospects of aromatic rice cultivation and export have been little studied in Bangladesh. Farmers in some areas grow traditional aromatic varieties, but yields are low and the acceptability of these varieties in export markets is unknown.

Demand in the internal market is limited, and prices are not always attractive to aromatic rice growers in Bangladesh. Thailand, India and Pakistan are presently meeting most of the growing global demand for aromatic rice. To enter this export market, Bangladesh will have to compete in respect of product quality, competitive price and timely supply. Milling of aromatic rice in Bangladesh is a particular problem as the traditional machinery is not designed to ensure a high quality product



OBJECTIVE

This sub-project (SP) aimed to identify demand-led aromatic rice varieties and associated suitable cropping patterns for resource-poor farmers (RPFs), attain an improvement of at least 5% in milling yield and establish an ensured market for the aromatic rice produced.

METHODS

The SP was implemented by a coalition consisting of APEX, a non-governmental organisation (NGO), Bangladesh Rice Exporters Association (BREA), International Rice Research Institute (IRRI), and private sector organisations – Mark Industries Ltd. and Awlia Engineering Workshop. Within the north-west region of Bangladesh, the SP worked specifically at Godagari in Rajshahi, at Mohadevpur in Naogaon, and at Chirir Bandar and Nowabganj, both in Dinajpur.

Four modern varieties of aromatic rice, BRRI dhan34, BRRI dhan37, BRRI dhan38 and *bashmati*, were selected for evaluation. Their performance was compared with

popular local varieties, under different cropping patterns, in 21 villages involving 36 RPFs.

A milling survey was carried out at 14 randomly selected rice mills, based on interviews with proprietors and managers. Milling trials were carried out at Raj Auto Rice Mills to collect data on milling parameters and demonstrate improved methods.

The market for aromatic rice, both domestic and export, was studied by means of a survey, and a campaign was organised to stimulate the establishment of a contract production system. Most of the interested participating and neighbouring farmers were brought under a contractual system for the production of market-preferred aromatic rice varieties. This system was established through a bilateral legal agreement between RPFs and the millers and exporters. This is first time in Bangladesh that RPFs have participated in a contractual production system for aromatic rice.

An Aromatic Rice Export Clearinghouse (AREC) was established to provide support to increase the export of aromatic rice to Bengali ethnic markets and overseas foreign consumers (www.arec-bd.org).

RESULTS

Grand mean yields from BRRI dhan34 and BRRI dhan37 were significantly higher than those from traditional varieties across all research locations, as shown in Table 1 below:

Table 1. Yields of traditional and modern aromatic rice varieties

Variety of aromatic rice		Yield (ton/hectare)
Traditional	<i>Chinigura</i>	1.89
	<i>Kataribhog</i>	2.01
Modern	BRRI dhan37	2.74
	BRRI dhan34	3.15

Among the cropping patterns, *aman* (aromatic rice)-*boro* (*bashmati*)-*aus* was the most profitable.

The milling system was modified to include low pressure rubber roll husking, low pressure double pass series polishing, length grading to separate broken rice and water polishing to improve the milled kernel lustre. Milling yield improved from 52.5% to 66%, outperforming the targeted improvement of 5% in milling performance and providing a better quality of milled rice.

All the farmers that grew aromatic rice under the contract marketing system introduced by the SP received an 18.2% price premium over their previous marketing channel.

The project had both positive and negative environmental impacts. Positive impacts included the introduction of semi-organic cultivation and the minimisation of dust emission in milling. The negative impacts related to the depletion of organic matter in the soil with the high intensity cropping pattern, and the risks to biodiversity maintenance of replacing traditional aromatic rice varieties with modern commercial alternatives.

CONCLUSIONS AND RECOMMENDATIONS

The key inference of the SP is that Bangladesh can be competitive in the global aromatic rice production by cultivating modern varieties and adopting modified milling systems and contractual marketing. To this end it is recommended to:

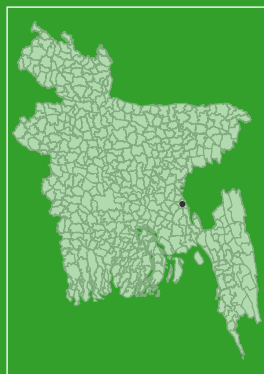
- Expand cultivation of BRRI dhan34 and 37 in *aman* and *bashmati* in *boro* to obtain increased rice productivity in terms of net benefit per unit of land;
- Support the improvement of selected rice mills in major aromatic rice growing areas, adopting rubber roll husking, low pressure double pass series polishing, length grading and water polishing; and
- Adopt a contract system as established in this SP between rice mills and farmer groups.

Suggested citation:

Salam, M. A., Hasanullah, M., Ghosh, R. P. and Rickman, J. 2007. Technology development of a production, processing and marketing system for aromatic rice in north-west region of Bangladesh (SP 29 02). In: Magor, N. P., Salahuddin, A., Haque, M., Biswas, T. K. and Bannerman, M., editors. PETRRA - an experiment in pro-poor agricultural research. Technology sub-project brief no. 10.1.14. Dhaka (Bangladesh): Poverty Elimination Through Rice Research Assistance Project, International Rice Research Institute. 4 p.

Ecologically-based rodent management for diversified rice-based cropping systems in Bangladesh (SP no. 30 02)

SP location:



Comilla

SP duration:

July 2002 - June 2004

SP organisations:

NRI-UK
CSIRO-Australia
BRRI
BARI
AID-Comilla

SP team:

Steven Belmain
Ken Aplin
Nazira Quraishi Kamal
Grant Singleton
Abul Kalam Azad

INTRODUCTION

Rodents disproportionately affect the lives of poor people: by damaging food crops and stores; by spreading diseases; by making food and water dirty and contaminated; and by reducing agricultural productivity. Current ways to lessen rodent damage are often based on the use of poisons. However, if poisons are not used correctly, they may fail to reduce rodent numbers. Incorrect use of poisons can also cause health problems for people and the environment.



OBJECTIVE

This sub-project (SP) aimed to develop environmentally and financially sustainable ways to reduce rodent pest problems that could be implemented by agricultural communities and individuals in rural areas of Bangladesh.

METHODS

Funding for this research was obtained through two separate programmes funded by the United Kingdom (UK) Department for International Development (DFID): the PETRRRA project, managed by the International Rice Research Institute (IRRI) Bangladesh office and the Crop Protection Programme (CPP) managed by Natural Resources Institute (NRI)-UK. The project was led by staff from NRI, with collaborators from the Sustainable Ecosystems Division of the Commonwealth Scientific and Industrial Research Organisation (CSIRO)-Australia; the Entomology Division of the Bangladesh Rice Research Institute (BRRI); the Vertebrate Pest Division of the Bangladesh Agricultural Research Institute (BARI); and the Association for Integrated Development (AID)-Comilla, Bangladesh.

Scientists from the UK and Australia worked together with experts from Bangladesh to collect information about rodent pests and the damage they cause. This information was then used to test different rodent management methods, with the collaboration of village farmers and households.

An important aspect of the SP was the collection of information on the biology of the different rodents found in and around villages, including their ability to breed during different times of the year, where they liked to live and what they liked to eat. Such information helps farmers to target their pest control actions and resources more cost-effectively.

Another important aim of this SP was to increase the ability of experts in

Bangladesh to obtain and deliver appropriate knowledge about rodent pests, by encouraging long-term research on the biology of rodents, and developing rodent control programmes that involve ordinary people suffering from rodent pest problems.

RESULTS

Rodent problems and damage were found both in field crops and in houses. Rodent damage to rice crops varied between fields, between different seasonal crops and from year to year. However, it was shown that farmers could predict whether their rice field would experience relatively high or low levels of damage by counting the number of active rodent burrows in and around their field and in adjacent rice fields.

Some effective ways of reducing rodent problems in rice fields involve making the environment less favourable to rodents, such as reducing the size of bunds and irrigation channels so that rodents can not burrow in them.

Rodent numbers could also be reduced by using trap barrier systems that reduce rodent migration to rice fields from other habitats, or by attracting rodents into a trap crop before they can damage the rice crops.

Household rodent damage and loss of stored food was found to be very high when rice was stored in open bins. Contamination of rice stores with rodent faeces was also high. Food stores were usually within human living and sleeping areas, which increased the risk of humans contracting diseases carried by rodents foraging inside their houses. The project team showed villagers ways of proofing food stores and reducing rodent access into houses.

CONCLUSIONS AND RECOMMENDATIONS

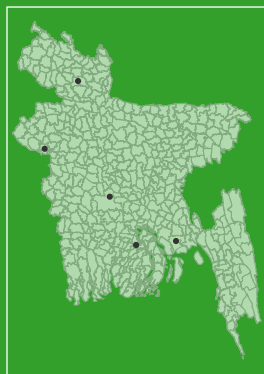
Managing rodents and reducing the problems they cause in field crops and households is possible, and a number of proven rodent management tools exist. Villagers may already be familiar with some of these: others may be new to them. However, it is important for villagers to understand the biology of rodents and the importance of targeting and timing their pest control activities effectively. Without this knowledge, rodent control can easily fail, making farmers feel that their efforts have been wasted. Researchers and extension staff can help to develop cost effective and sustainable rodent management, through education about rodent biology and the demonstration of appropriate methods of control.

Suggested citation:

Belmain, S., Aplin, K., Kamal, N. Q., Singleton, G., and Azad, A. K. 2007. Ecologically-based rodent management for diversified rice-based cropping systems in Bangladesh (SP 30 02). In: Magor, N. P., Salahuddin, A., Haque, M., Biswas, T. K. and Bannerman, M., editors. PETRRRA - an experiment in pro-poor agricultural research. Technology sub-project brief no. 10.1.15. Dhaka (Bangladesh): Poverty Elimination Through Rice Research Assistance Project, International Rice Research Institute. 2 p.

Farmers' participatory research on integrated rice-based farming for improved livelihoods for resource-poor farm households (SP no. 32 02)

SP location:



Barisal
Faridpur
Noakhali
Rajshahi
Rangpur

SP duration:

September 2002 - June 2004

SP organisations:

BARC
BARI
BRRI

SP team:

M. Nurul Alam
Ashis Kumar Saha
M. Abdul Quddus
M. Matiur Rahman
M. Sirajul Islam
M. Shafiqul Islam
A. F. M. Fazlur Rahman
M. A. Quayyum
A. T. M. Salehuddin Choudhury

INTRODUCTION

Rice production dominates the cropping systems of Bangladesh. Production has increased steadily with the introduction of irrigation, high yielding varieties, increased application of fertilisers and improved crop husbandry. However, it is reported from various sources that improvements in cropping systems technology alone cannot meet the diversified needs of Bangladesh's farmers, of whom more than 60% remain resource-poor. There is a need to address other income generating enterprises as part of the farming system in order to meet farmers' needs in a holistic approach.



OBJECTIVE

The objective of the sub-project (SP) was to develop and improve technologies appropriate to resource-poor farmers (RPFs), which may offer opportunities to increase the income and standard of living of the farmers.

METHODS

The Rice Farming Systems Division (RFSD) of the Bangladesh Rice Research Institute (BRRI) initiated this SP in 2002, at Banaripara upazila in Barisal district, in collaboration with the scientists at the BRRI Barisal regional station.

Prior to the start of activities at the site, a benchmark survey was conducted for site characterisation using a structured questionnaire. Through this benchmark survey, farmers' needs, problems and available resources were identified. Based on the survey report several interventions were made in different farm categories.

RESULTS

Farmers' participatory evaluation trials of the advanced line BR-6110-10-1-2 were established in dispersed farmers' fields under tidal, non-saline, wetland conditions. The improved yields achieved over the local check varieties are shown in Table 1 below:

Table 1. Results of participatory evaluation trials of BR-6110-10-1-2

Season	Local check	Yield advantage of BR-6110-10-1-2
Boro	Bhojon	76%
Aman	Sadamota	65%

A farmers' participatory production demonstration trial on the newly released BRRI

hybrid dhan1 was conducted in 3 dispersed farmers' fields, along with BRRI dhan29 as a check variety. BRRI hybrid dhan1 produced comparable yields to BRRI dhan29.

The late-planted, photosensitive rice varieties BR-22 and BR-23 were grown for adaptability testing in 3 dispersed farmers' fields under recommended management practices, along with *sadamota* as a local check variety. BR-23 gave an average yield of 4.0 tons per hectare (t./ha.), which was 5% higher than BR-22 (3.8 t./ha.) and 67% higher than *sadamota* (2.4 t./ha.), suggesting that BR-23 is more adaptive.



Farmers of the study area convert their croplands into raised beds known as *sorjon* or locally as *kandi*. These are used to grow vegetables and quick growing fruit crops. But the varieties that are being grown by the farmers are of poor quality and provide low yields. To increase the productivity of the *kandi* system, farmers' participatory production demonstration trials were conducted with improved varieties of summer and winter vegetables. Among the tested crops, Indian Spinach and Bottle Gourd performed better in all categories of households. The performance of Kangkong was also good but it needs further demonstrations to gain popularity among the farmers. Among the creeper vegetables, the highest yield and return was obtained from Sweet Gourd.

Under a duck rearing programme, 240 ducklings of the species *Khaki Campbell* and *Beijing* were distributed among 27 participating farmers from different farm categories. Monitoring data reveals that rearing of ducks is remunerative to the farmers.

A vaccination programme was implemented on 343 ducks and 380 chickens belonging to 32 farm families. Incidence of disease monitoring data revealed that the mortality rates of the vaccinated chicken and ducks were reduced by 5% and 4%, respectively.

A de-worming programme was executed on 79 head of cattle belonging to different farm families. Monitoring data indicated that feed intake ability and the physical appearance of the de-warmed cattle were improved.

4 she-goats were distributed among landless groups of farm families, along with training in goat rearing. Monitoring data suggests an average of Tk. 2,025 per goat could be earned within a period of four months.

Tilapia fingerlings were introduced in selected ponds, most of which lay unused or were used for catching naturally occurring fish only. Tilapia monoculture yielded an average of 835 kg. of fish per hectare, providing a gross margin of over Tk. 50,000 per hectare within a period of 177 days.

CONCLUSIONS AND RECOMMENDATIONS

The incomes and livelihoods of participating farmers improved after the SP interventions. The knowledge base of the farmers and the extension workers has improved, and the sharing of knowledge and experiences among the participants, scientists and others associated with the programme has been strengthened.

The following recommendations are made for future work:

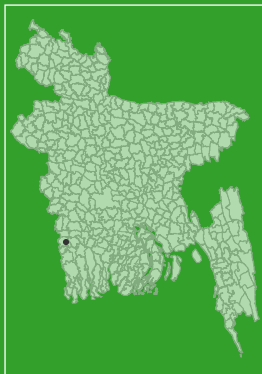
- BR-6110-10-1-2 should be released immediately as a variety, but further testing of BRRI hybrid dhan1 is required;
- De-worming is an easy and low cost technology for cattle health improvement, and should be disseminated widely;
- A detailed study is required on fertiliser management in the *sorjon* or *kandi* system of vegetable cultivation;
- A hatchery should be developed in the study area to make tilapia fingerlings available to farmers; and
- The poultry vaccination programme should be continued for sustainable egg and meat production.

Suggested citation:

Alam, M. N., Saha, A. K., Quddus, M. A., Rahman, M. M., Islam, M. S., Islam, M. S., Rahman, A. F. M. F., Quayyum, M. A. and Choudhury, A. T. M. S. 2007. Farmers' participatory research on integrated rice-based farming for improved livelihoods for resource-poor farm households (SP 32 02). In: Magor, N. P., Salahuddin, A., Haque, M., Biswas, T. K. and Bannerman, M., editors. PETRRA - an experiment in pro-poor agricultural research. Technology sub-project brief no. 10.1.16. Dhaka (Bangladesh): Poverty Elimination Through Rice Research Assistance Project, International Rice Research Institute. 4 p.

Validation and delivery of SRI methods to increase rice production of RPFs in south-west region of Bangladesh (SP no. 34 02)

SP location:



Satkhira

SP duration:

October 2002 - June 2004

SP organisations:

BRRI
Uttaran

SP team:

M. A. B. Siddique Sarker
Anjuman Ara Akter

INTRODUCTION

The system of rice intensification (SRI) was developed in the early 1980s by Fr. Henri de Laulanié, working with farmers in Madagascar. SRI is a set of agronomic practices which use principles of plant, soil, water and nutrient management to produce a more productive phenotype from existing genetic potential. Specifically, SRI involves the transplanting of young seedlings quickly



and carefully, into a well-spaced square pattern to facilitate weeding. Soil is kept well drained during the vegetative growth period, with early and frequent weeding, and nutrients are added to the soil, preferably in organic form. These principles should however be understood as starting points for experimentation and for fitting SRI to local conditions.

Both total rice area and production are declining in Satkhira district, in the south-west of Bangladesh, due to an increase in shrimp culture, salinity, inadequate management of irrigation water and other factors. Rice areas are now concentrated only in land of medium elevation, and farmers still practice very old production methods. As a result, yields are low, production costs are high and soil fertility is degraded. Increased productivity in this region could be achieved through the intensification of land use following SRI principles.

OBJECTIVE

The objective of this sub-project (SP) was to establish site-specific superior SRI methods of rice cultivation for resource-poor farmers (RPF) in the south-west of Bangladesh.

METHODS

The SP was initiated in October 2002, using a participatory research and extension approach. Uttaran, a popular local non-governmental organisation (NGO), was involved to establish and extend the SRI experiments. Before the initiation of the project, a stakeholder analysis at Tala, Satkhira, collected brief benchmark information. Participatory field experiments were then carried out to determine the effect on rice yields of variations in the following factors:

- Rice production methods and SRI principles under field conditions;
- Rice varieties in the *boro* season;
- Nutrient management practices for BRRI dhan28 grown under SRI methods.

RESULTS

The performance of different production methods in the participatory experiments is summarised in the following Table:

The highest grain yield was obtained from SRI and BRRI methods and the lowest from farmers' methods. The lowest costs were incurred by SRI methods, followed by BRRI methods.

Season	Highest	→	Lowest
Yield	SRI/BRRI		Traditional
Cost	Traditional	BRRI	SRI
BCR	SRI	BRRI	Traditional

Farmers' methods incurred the highest costs. The highest benefit-cost ratio (BCR) was obtained from SRI methods, followed by BRRI methods and farmers' methods.

According to the farmers, a 30 x 30 centimetre spacing, with 2 seedlings per hill using 15-day old seedlings was the best practice for SRI.

Amongst the *boro* varieties evaluated, farmers preferred BRRI dhan28 and BRRI dhan36 for cultivation due to their higher yields and shorter growth duration. BRRI dhan29 produced the highest yield but was not preferred, due to the longer growth duration, higher pest infestation at the ripening stage and irrigation problems. Farmers believed that production costs were higher for BRRI dhan29 than for BRRI dhan28 or BRRI dhan36.

Participatory evaluation of nutrient management options showed that participating farmers preferred BRRI-recommended nutrient management plus nitrogen (N) from *guti* urea, and site specific nutrient management (SSNM), as they provided the highest yields.

CONCLUSIONS AND RECOMMENDATIONS

Previously it was thought that SRI was not a suitable technology for Bangladesh. However, the results of this SP show that SRI principles could be usefully extended amongst RPFs in the *boro* season to increase yields. Participant farmers considered SRI a very environmentally-friendly method. Inorganic fertilisers were reduced and the application of organic material increased under SRI, improving soil health. Pest and disease attack was also reduced. Farmers mentioned the increased number of weeds as a negative effect of SRI, but some suggested that these could be uprooted and used as organic fertiliser.

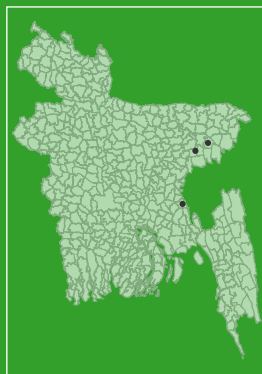
The SP caused a great awareness of SRI rice production methods amongst the farmers of the project area. All participating farmers showed a very positive attitude towards SRI and 90% are now practicing the methods and have increased their land under SRI. 20 neighbouring farmers practiced SRI methods from the second year of the SP. Many other farmers are not following SRI exactly but are trying to apply some SRI practices in their land. Some non-participant farmers suggested that SRI methods entailed higher risks than traditional methods, as seedlings could die during adverse weather conditions such as heavy fog and cold, a loss poorer farmers would find difficult to overcome. But on the whole the farmers considered SRI a useful and appropriate method because it requires less seed, less labour, less water, less seedlings and less fertiliser, yet increases production.

Suggested citation:

Sarker, M. A. B. S. and Akter, A. A. 2007. Validation and delivery of SRI : methods to increase rice production of RPFs in south-west region of Bangladesh (SP 34 02). In: Magor, N. P., Salahuddin, A., Haque, M., Biswas, T. K. and Bannerman, M., editors. PETRRA - an experiment in pro-poor agricultural research. Technology sub-project brief no. 10.1.17. Dhaka (Bangladesh): Poverty Elimination Through Rice Research Assistance Project, International Rice Research Institute. 2 p.

Extension of the SRI through verification (SP no. 35 02)

SP location:



Comilla
Habiganj
Maulvi Bazar

SP duration:

October 2002 - June 2004

SP organisations:

BRRI
AAS

SP team:

M. A. Latif
M. Harun-Ar-Rashid

INTRODUCTION

Bangladesh has more than 10 million hectares of rice land, of which 2.4 million hectares were once used for deepwater rice. However, the expansion of irrigation facilities and the introduction of modern *boro* cultivation have dramatically reduced this deepwater rice area. Of that which remains, most is seasonally flooded during the monsoon and remains under between 1 and 4

metres of water for 5 to 6 months. Farmers transplant rice with minimum tillage, and both weed infestation and the application of urea are low. With yields of about 5 tons per hectare (t./ha.), rice cultivation in this area is cost effective, but improved cultivation technologies could increase yields further.

A new approach known as the system of rice intensification (SRI) has drawn much attention in the rice world for its apparent success at increasing productivity. All the components of SRI have been studied before or are, in different combinations, already part of common cultivation practice in different parts of the world. Indeed, despite the claims of its proponents, farmer adoption of SRI in the areas where it has been promoted has been low, with high levels of 'disadoption' or abandonment. Even in Madagascar, where the method was developed, farmers who practice SRI rarely do so on more than half their land. Previously published comparisons of SRI with traditional management practices tend to be flawed as these traditional practices do not represent current best practice in modern rice production.



OBJECTIVE

The objective of this sub-project (SP) was to evaluate the major components of SRI in the Bangladesh environment and to compare its overall performance with that of existing conventional best management recommendations and farmers' practice.

METHODS

A series of on-station experiments were conducted during the 2003-3 and 2003-4 *boro* seasons at the Bangladesh Rice Research Institute (BRRI) research station, Comilla. These experiments were designed to assess different seedling raising methods, varieties, seedling ages, plant spacings, compost and herbicide applications and planting shapes, in rice grown following SRI management practices.

To assess the comparative performance of SRI methods, BRRI recommendations and traditional farmers' practice, a total of 70 participatory farmer field trials were carried out at different locations in Comilla, Maulvi Bazar and Habiganj districts, during the 2002-3 and 2003-4 *boro* seasons, with co-operation from the Department

of Agricultural Extension (DAE) and the Agricultural Advisory Society (AAS).

Based on both on-station trials and on-farm farmer participatory research, an improved rice cultivation package (IP) for high fertility, low-lying deepwater areas was developed. Though a modification of SRI, the IP was close to BRRI recommended management practices. 8 farmer field trials were conducted in low lying areas at Daudkandi, Comilla, to assess the comparative performance of the IP, SRI and farmers' practice. Following the trials, a group meeting was held with participating and neighbouring farmers, and their response to the trial results documented.

RESULTS

On-station experiments on different SRI components gave the following results:

- The normal seedbed method gave significantly higher yield than a modified dapog method, but was similar to polyethylene-covered seedbeds;
- Amongst the varieties tested under SRI methods, BRRI dhan29 gave the highest yield. In general, long duration varieties such as BRRI dhan29 appear to be most suitable for SRI, provided they fit into the cropping system;
- Seedling age had no effect on yield, suggesting that the use of young seedlings is not a requirement for high yields, even under SRI management;
- Plant spacing had a significant effect on yields. The highest yield from BRRI dhan29 of 7.5 t./ha. came from spacing of 25 x 15 centimetres (cm.), whereas the lowest yield of 5.1 t./ha. came from spacing of 40 x 40 cm.;
- Partial substitution of urea with compost applications at different rates had no effect on grain yield; and
- Weed control had a significant effect on yields. The highest yields were obtained from a combination of herbicide application and a single hand-weeding.

In both on-station comparisons and on-farm trials, BRRI-recommended conventional management performed significantly better than SRI. SRI plots averaged 60% unfilled grains, possibly due to heavy rain or wind during flowering. These are common phenomena in Bangladesh, but the late planting and long field duration of SRI crops may put them at higher risk. In the group meeting, 90% of farmers preferred the IP to SRI, due to easy transplanting and reduced seedling mortality.

CONCLUSIONS AND RECOMMENDATIONS

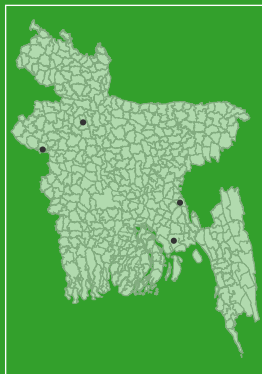
The results of these one-year studies suggest that several of the key management principles laid out in SRI had in fact little effect on rice yields. The acceptability of SRI practices among the farmers in the project villages was mixed at best. Further field verification of SRI, over longer periods in low lying and deepwater areas, needs to be undertaken before a final conclusion can be reached as to the overall suitability of SRI in Bangladesh. Preliminary results, however, are not too encouraging.

Suggested citation:

Latif, M. A., and Rashid, M. H. 2007. Extension of the SRI through verification (SP 35 02). In: Magor, N. P., Salahuddin, A., Haque, M., Biswas, T. K. and Bannerman, M., editors. PETRR - an experiment in pro-poor agricultural research. Technology sub-project brief no. 10.1.18. Dhaka (Bangladesh): Poverty Elimination Through Rice Research Assistance Project, International Rice Research Institute. 2 p.

Verification and refinement of SRI in selected areas of Bangladesh (SP no. 36 02)

SP location:



Bogra
Comilla
Noakhali
Rajshahi

SP duration:

October 2002 - June 2004

SP organisations:

BRAC
POSD
SAFE
Syngenta

SP team:

A. M. Muazzam Husain
Gopal Chowhan
A. F. M. Razibuddin
Aminul Haque

INTRODUCTION

The system of rice intensification (SRI) was first developed in the 1980s in Madagascar. It offers unprecedented opportunities for improving rice production without dependence on high cost modern inputs. About 20 countries of the world are currently conducting trials to further explore the potentials of SRI. Bangladesh needs a rice production system to significantly improve productivity, with less dependence on high cost inputs, for sustaining production and improving the food security and livelihoods of its farmers, most of whom are resource-poor.

Initial SRI trials were conducted by CARE and the Department of Agricultural Extension (DAE) in 1999-2000. Their success and the favourable perceptions of the participating farmers encouraged the Bangladesh Rice Research Institute (BRRI) and some non-governmental organisations (NGOs) to undertake organised and coordinated trials and research on SRI.



OBJECTIVE

The objective of this sub-project (SP) was to try out SRI practices of rice farming in farmers' fields, and explore their potential to enhance productivity in a sustainable manner and improve the livelihoods of resource-poor farmers (RPF).

METHODS

Trials were conducted by three NGO partners – Bangladesh Rural Advancement Committee (BRAC), Sustainable Agriculture and Farming Enterprise (SAFE) and the People's Organisation for Sustainable Development (POSD) with a private sector business organisation Syngenta Bangladesh Ltd. They took place in four districts of Bangladesh: Rajshahi, Bogra, Comilla and Noakhali, during two *boro* seasons, 2002-03 and 2003-04. The SRI trials involved motivating the farmers, organising them into farmer field schools (FFS), training them in different aspects of SRI practices, monitoring their production activities, collecting and analysing the data, participatory evaluation of the findings, and communication of the results.

Eighty percent of participating farmers were resource-poor, according to a flexible

definition determined through focus group discussion and wealth ranking exercises at the local level. Their practical experiences led to changes in certain operational aspects such as improving the transplantation method of young seedlings to reduce mortality, and the initiation of a community approach to improve water management.

Training sessions were held in each of the SP areas for farmers. Two training workshops were also organised for field staff and a national workshop was held, all of which helped to build capacity amongst the different stakeholders. Farmer cross-visits and field days were arranged.

RESULTS

The performance of the SRI trial plots, as compared to farmers' traditional practice, is summarised in Table 1 below:

Table 1. Performance of SRI trial plots

Agronomic variable	SRI plots vs. farmer practice
Tillers per hill	Higher
Panicle length	Higher
Grain weight/1000 grains	Higher
% unfilled grain	Lower
Seed saving	58%
Insecticide costs	Reduced
Total costs of production	Reduced by 7%
Yield	Increased by 30%
Net return/hectare	Increased by 35-73%

In the second year, the total number of participating farmers increased by 62% and the SRI acreage increased by 90%.

Environmental effects were positive. Farmers started using organic manure and reducing chemical fertiliser use, improving soil health. There was a substantial reduction in pesticide use.

CONCLUSIONS AND RECOMMENDATIONS

In both seasons in which trials were conducted, costs were lower and yields and profitability were significantly higher under SRI than under farmers' practice, for all SP partners, in spite of the many shortcomings faced by participating farmers in applying SRI methods. SRI led to increased tillering, grains per panicle, grain weight and biomass production. The SP findings thus tentatively show that a great potential exists in Bangladesh for replicating SRI practices for improving food security and livelihoods. The farmers' response to the methods was favourable in terms of voluntary participation and increase in number of farmers and acreage. 80% of participating farmers can now explain SRI methods.

Among the limitations of the SP were the short period of the study, the shortage of organic fertiliser, and the very small scale of the trial plots that hampered effective water management. Two seasons are considered to be too short a period to gain an adequate understanding of all the SRI practices and the ways of reaping optimum benefits from the method, and especially to determine the impact of the SP trials in areas like rice provisioning ability, consumption diversification, livelihood changes, and the improvement of soil quality and its sustainability for rice production.

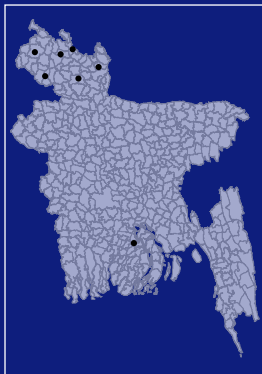
The study, therefore, recommends that further trials be conducted to sort out these unanswered questions, and that collaboration between government organisations and NGOs be strengthened to validate SRI practices in different favourable locations in the country. To tackle the problem of shortage of organic manure, training of farmers on preparation of composts should be taken up. Farmers should be encouraged to practice SRI on a larger scale, sufficient to cover the command areas of shallow tube wells and other small irrigation sources, to substantially reduce irrigation costs. It is also recommended that the SRI national steering committee should be kept active and provided with the necessary cooperation and support requirement and validation of SRI methods in Bangladesh.

Suggested citation:

Husain, A. M. M., Chowhan, G., Razibuddin, A. F. M. and Haque, A. 2007. Verification and refinement of SRI in selected areas of Bangladesh (SP 36 02). In: Magor, N. P., Salahuddin, A., Haque, M., Biswas, T. K. and Bannerman, M., editors. PETRRA - an experiment in pro-poor agricultural research. Technology sub-project brief no. 10.1.19. Dhaka (Bangladesh): Poverty Elimination Through Rice Research Assistance Project, International Rice Research Institute. 4 p.

ARD technology identification and uptake model & Rice production training for GO-NGO staffs (SP no.01 00)

SP location:



Barisal
Dinajpur
Kurigram
Lalmonirhat
Nilphamari
Rangpur
Thakurgaon

SP duration:

June 2000 - June 2004

SP organisations:

BRRRI
RDRS

SP team:

M. Musherraf Husain
M. Jahirul Islam

INTRODUCTION

Resource-poor farmers (RPFs) need rice production technologies that are appropriate for them with regard to their socio-economic condition. Improved technologies, such as new rice varieties and the associated resource management practices, could help increase rice productivity and improve the quality of life of RPFs, yet most of them have no access or limited access to these technologies.

Conventional methods of technology uptake are based on a top-down approach and cannot therefore ensure sustainability. For sustainable uptake of technologies, RPFs must themselves identify suitable technologies. This sub-project (SP) aimed to develop a model in which farmers and extension workers are intensively involved in the decision making process.

OBJECTIVE

The objectives of this SP were thus to establish a superior method of identifying technologies suitable for RPFs; to identify such technologies; and consequently to empower RPFs with better rice productivity, rice provisioning ability and livelihoods.

METHODS

The SP emphasised partnership between government all organisations (GOs), non-governmental organisations (NGOs) and the farmers themselves, to promote a synergistic approach to technology uptake. GO and NGO partner agencies were identified to enhance sustainability and multiplication of the impacts. A mutual understanding was developed among the partner agencies and stakeholders to collectively strive toward the common goal and to share responsibilities.

For the purposes of the SP, RPFs were identified as farmers with a farm size of less than 0.6 hectares or a rice provisioning ability of up to 9 months a year. Female farmers participated in the action research and were empowered in the technology identification and uptake decision-making process.

An improved technology identification and uptake model was developed. Called the 'GO-NGO-farmer technology identification model', it is based on six components:



- 1) Examine a broad selection of technologies;
- 2) Select sites covering a wide range of socio-economic and agro-ecological conditions;
- 3) Identify GO-NGO development agencies;
- 4) Develop partnerships with specific role descriptions;
- 5) Use action research to identify and demonstrate technologies; and
- 6) Build capacity amongst the participating farmers and partner agencies.

RESULTS

The Adaptive Research Division (ARD) of the Bangladesh Rice Research Institute (BRRI) validated this model between 2001 and 2004 (see Table 1). Following the requirements of the model, it examined a broad selection of technologies, focussing particularly on a wide range of rice varieties for the *aman* and *boro* seasons. The north-west region, including Rangpur, Dinajpur, Kurigram, Lalmonirhat and Nilphamari, was covered. The Rangpur Dinajpur Rural Service (RDRS), which has an extensive network in the region, was the key partner organisation. The Department of Agricultural Extension (DAE) was also involved. RDRS selected some 120 RPFs, of whom about 40% were women, to take part in the identification and evaluation of appropriate technologies. Group meetings, field visits, training and action research brought all actors closer together.

Table 1. GO-NGO-farmer technology identification model

	Model component	Validation example
1	Broad selection of technologies	Examined a wide range of rice varieties for <i>aman</i> and <i>boro</i>
2	Site selection covering wide range of socio-economic and agro-ecological conditions	Covered north-west region including Rangpur, Dinajpur, Kurigram, Lalmonirhat and Nilphamari
3	Identification of GO-NGO development agencies	RDRS the key partner. DAE also involved
4	Partnership development with specific role description	RDRS selected farmers, focussing on RPFs with both male and female participation
5	Action research to identify and demonstrate technologies	Planned by BRRI
6	Capacity building of participating farmers and partner agencies	Supported with training, field days, group observation of crop yield and farmer interviews

The research identified several rice varieties and management practices as superior to previous varieties and practices. These included:

- a) BRRI dhan28, IR-64 and BR-4828 for *boro* season; BRRI dhan31, BR-6110 as bold grain long duration varieties for *aman*; and BRRI dhan33 and BRRI dhan39 as short duration *aman* varieties;
- b) The use of leaf colour charts (LCC) for judicious application of nitrogenous fertiliser; and

c) The use of a drum seeder for direct wet-seeding.

To build capacity, some 1,160 farmers and Block Supervisors (BS) were trained in the first phase of the SP. In the second phase, some 330 persons were trained of whom 96 were female. Fifteen RDRS extension officers were given short training on direct wet-seeded rice and LCC, both of which technologies are now being widely used.

CONCLUSIONS AND RECOMMENDATIONS

The participation of the RPFs in testing the uptake method and identifying technologies was very encouraging. About 90% of the participating farmers were RPFs, based on the criteria detailed above. Some 76 participating farmers had achieved increased rice productivity by *aman* 2003. This was reflected in increases in their rice provisioning ability by up to two months.

The GO-NGO-farmer technology identification model offers a good mechanism for the identification and uptake of rice production technologies appropriate for RPFs. This collaborative model reinforces a partnership approach for technology identification and uptake, focussing on poverty and gender. It could be replicated by interested agencies working in other locations.

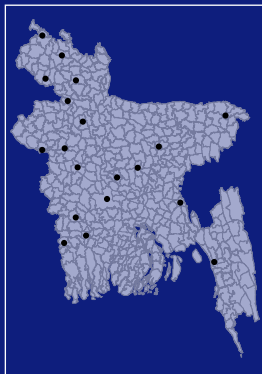
BRRI TRAINING COMPONENT

There was also a training component which was implemented by the Training Division of BRRI. The objective was to ensure that the training it offers is demand-led, pro-poor and to any organization or institution engaged in disseminating of technology. With this in mind the sub-project developed a needs based and location specific training module that was based on a series of participatory workshops held in Rajshahi and Khulna areas. Two special rice production training modules were prepared for Rajshahi and Khulna regions. A training of trainers (ToTs) was organized to develop a skilled cadre of trainers for PETRRA partner NGOs. These trainees in turn provided training to resource-poor farmers in their respective areas. During the sub-project period there were eight training courses conducted. Four courses were for one week and four for one month. A total of 118 trainees participated. The short courses were especially designed to meet the need of the PETRRA partner NGOs and the long courses were designed to mainly for DAE field staff. The trained staff of both the NGO and DAE staff trained under this component went on to positively contribute to the outcomes of the PETRRA sub-projects.

Suggested citation:

Husain, M. M., and Islam, M. J. 2007. ARD Technology identification and uptake model & rice production training for GO-NGO staffs (SP 01 00). In: Magor, N. P., Salahuddin, A., Haque, M., Biswas, T. K. and Bannerman, M., editors. PETRRA - an experiment in pro-poor agricultural research. Uptake sub-project brief no. 10.2.1. Dhaka (Bangladesh): Poverty Elimination Through Rice Research Assistance Project, International Rice Research Institute. 4 p.

SP location:



Bogra
Chittagong
Comilla
Dinajpur
Faridpur
Gazipur
Jessore
Jhenaidah
Joypurhat
Kishoreganj
Manikganj
Natore
Nilphamari
Pabna
Panchagarh
Rajshahi
Rangpur
Satkhira
Sylhet

SP duration:

November 2001 - June 2004

SP organisations:

BIRRI

SP team:

M. K. Bashar
M. Khalequzzaman

INTRODUCTION

Until 1997, the Genetic Resources and Seed Division (GRSD) of the Bangladesh Rice Research Institute (BRRI) had the main responsibility for producing and supplying breeder seed (BS) to the Bangladesh Agricultural Development Corporation (BADC), which then produced its own released and recommended varieties of foundation seed (FS) and certified seed/truthfully labelled seed (CS/TLS). Since the liberalisation of national seed policy in 1997 and 1998, non-governmental organisations (NGOs) and private sector seed entrepreneurs have had access to BS to produce FS and CS/TLS and supply it to farmers at a reasonable price.

However, there remains a tremendous scarcity of good quality formal seed in the country. The private sector is primarily interested in distribution rather than production, and the seed production programmes of NGOs are limited by a lack of infrastructure and skilled personnel. A single platform is required in which governmental organisation (GOs), NGOs and the private sector can work together.

OBJECTIVE

This sub-project (SP) aimed to use an additional BRRI BS production programme to establish a sustainable network of partners, including GOs, NGOs and the private sector, which would ultimately broaden access to FS and provide quality seed to the doorsteps of resource-poor farmers (RPFs).

METHODS

The rice seed network was designed as a system of quality rice seed production, preservation and distribution to farmers, involving public and private sector organisations and NGOs scattered throughout the country, via a collaborative partnership on a commercial basis. The network aimed to ensure the supply of demand-led varieties at the proper time and at an affordable price, preferably among RPFs at the farm/community SP. The seed flow of BS, FS and CS/TLS would also be maintained through this network.

মানসম্মত ধানবীজ প্রাপ্তির টেকসই মডেল

চাষী যথাসময়ে চাহিদামতো মানসম্মত ধানবীজ সংগ্রহ করতে সক্ষম হবে



কৌশলসম্পন্ন ও বীজ বিভাগ, বাংলাদেশ খান গবেষণা ইনস্টিটিউট, গাজীপুর

The network was designed to operate in the following way:

- 1) Identifying partners;
- 2) Building the partnership into a network;
- 3) Assessing the quantity of BS of specific varieties required to meet demand;
- 4) Supplying BS to partners;
- 5) Creating awareness amongst farmers of the need to replace their seed every 3 years
□□□□for inbred varieties;
- 6) Conducting training of trainers (TOT); and
- 7) Monitoring seed quality regularly.

RESULTS

The number of partners in the network has grown rapidly over the life of the SP, from 4 organisations in 1999 to 54 in 2003. Over the same period, production of BS has increased from 5.19 tons to 7.65 tons.

The increased capacity of the partner organisations is illustrated by the example of the Grameen Krishi Foundation (GKF). In the 2000-1 *boro* season, GKF received 140 kg of BS and produced 27.5 tons of FS. In *boro* 2001-2, GKF received 240 kg of BS and produced 9 tons of FS and 465 tons of TLS. It is estimated that today about 15% of demand can be met with seed that meets minimum standards of quality.

This increased availability of quality seed has led to productivity improvements. BRRI research has found that quality seed alone can improve yields by between 10% and 15%. In trials in Maulvi Bazar district, more than 75% of farmers reported increased rice provisioning of at least two months due to the use of quality seed.

CONCLUSIONS AND RECOMMENDATIONS

The rice seed network has minimised the barriers to quality seed access and allowed seed to reach RPFs in an easier, quicker and more affordable manner. The network partners are now capable of producing quality seed, which should allow them to emerge as profitable businesses.

The network has been implemented at the national level, as well as at regional levels. BRRI has been signing memoranda of understanding (MOU) with partner organisations, to make the partnership stronger. BRRI also provides training in seed production technology to the partners to increase their scientific skills.

The small private sector and NGO seed operations are not yet self-sufficient in terms of facilities, manpower and skills, but the rice seed network allows them to share experiences and inputs and improve their business by providing grassroots coverage.

The seed replacement rate remains low, however, at about 5%. This can be increased by the further implementation of the type of partnership programme developed in the SP. It is estimated that a seed replacement rate of about 10% can be achieved by using the following strategies:

- Assessment of location-specific seed requirement;
- Production of BS and FS to meet the demand;

- Distribution of BS and FS to the partners at right time;
- Monitoring of FS and TLS production for quality assurance; and
- Skill development amongst seed farmers and staff of the partner organisations.

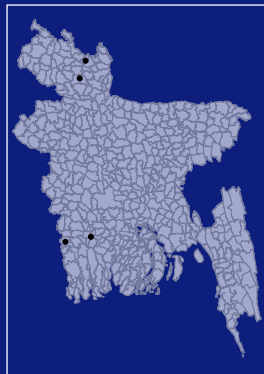
For more information see Chapter 17 of 'Innovations in rural extension: case studies from Bangladesh' edited by: Paul Van Mele, Ahmad Salahuddin and Noel P. Magor. 2005, CABI Publishing UK, ISBN 0 85199 028 2.

Suggested citation:

Bashar, M. K. and Khalequzzaman, M. 2007. Sustainable rice seed network (SP 02 00). In: Magor, N. P., Salahuddin, A., Haque, M., Biswas, T. K. and Bannerman, M., editors. PETRRRA - an experiment in pro-poor agricultural research. Uptake sub-project brief no. 10.2.2. Dhaka (Bangladesh): Poverty Elimination Through Rice Research Assistance Project, International Rice Research Institute. 4 p.

Strengthening resource-poor farmers' knowledge of improved agricultural practices for rice production (SP no. 03 00)

SP location:



Khulna
Satkhira
Rangpur
Lalmonirhat

SP duration:

January - September 2001

SP organisations:

BRAC

SP team:

M. Azizul Haque

INTRODUCTION

Rice is a staple food that constitutes 95% of the food grain production in Bangladesh and for which about 80% arable land is devoted. The population of the country is increasing at the rate of about 1.5% per year with an increased demand of food grain production leaving an annual food grain deficit of 1-2 million tons. Although the area under conventional modern rice varieties has

been gradually increasing, the growth of modern varieties (MVs) for last few years has more or less plateaued. On the other hand yield potential for MVs is from 4 to more than 6 ton/hectare (t./h.). With the present yield level and hectares under rice, there is scope for breaking the present yield ceiling of conventionally bred MVs and thus to increase total rice production as well as save land for other crops.

BRAC has been involved in extension on rice cultivation with the members of its village organisations and other farmers in rural areas for a number of years. Under this sub-project (SP) selected farmers received training on modern rice cultivation technologies, were exposed to good quality seed of MVs and were provided with credit support for inputs.



OBJECTIVE

This SP aimed to determine the following:

- 1) Create an action learning environment that would improve uptake for rice knowledge especially new rice varieties;
- 2) Promote appropriate MVs among resource-poor farmers (RPFs); and
- 3) Identify demand-led cost effective production technologies for the sub-project areas as well as for other rice growing locations.

METHODS

Different methods were conducted to achieve the purpose of this SP. The main methods are as follows:

- 1) Frontline demonstration;
- 2) High quality seed production as a block; and
- 3) Intensive personal contact.

RESULTS

Input use and availability:

- Farmers' knowledge was increased on quality seed production and rice cultivation techniques through training and personal contact;
- The farmers' attitude of using younger seedlings as compared to the tradition of older seedlings and also to use high quality seeds was positively changed;
- Farmers practiced a more balanced dose of fertiliser;
- In the Jamalpur area farmers identified BRRI dhan33 as the most suitable variety for the *aman* season, with this being followed by an additional short duration crop of potato or mustard;
- In the Kushtia area the *boro* variety BRRI dhan28 was found most suitable due to its short duration and low cost of production;
- Farmers were not interested in cultivating BINA dhan6 due to its long duration; and
- Farmers viewed demonstration, field day, partnership and linkages development, proper price of produced products as suitable tools and techniques for rapid dissemination of technology.

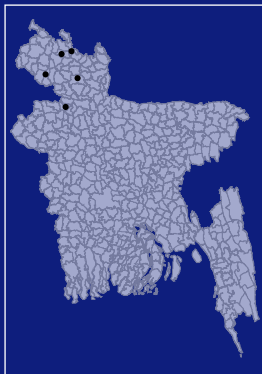
CONCLUSIONS AND RECOMMENDATIONS

The demand for this study arose out of the stakeholder analysis in the south-west of Bangladesh. Farmer participatory field demonstration of promising technologies of seed and management practices was an appropriate approach. The approach helped strengthen partnership and building relationship among farmers and extension agents through sharing of ideas and collective decision making.

Suggested citation:

Haque, A. 2007. Strengthening resource-poor farmers' knowledge of improved agricultural practices for rice production (SP 03 00). In: Magor, N. P., Salahuddin, A., Haque, M., Biswas, T. K. and Bannerman, M., editors. PETRRA - an experiment in pro-poor agricultural research. Uptake sub-project brief no. 10.2.3. Dhaka (Bangladesh): Poverty Elimination Through Rice Research Assistance Project, International Rice Research Institute. 2 p.

SP location:



Dinajpur
Joypurhat
Lalmonirhat
Nilphamari
Rangpur

SP duration:

May 2000 - June 2004

SP organisations:

GKF

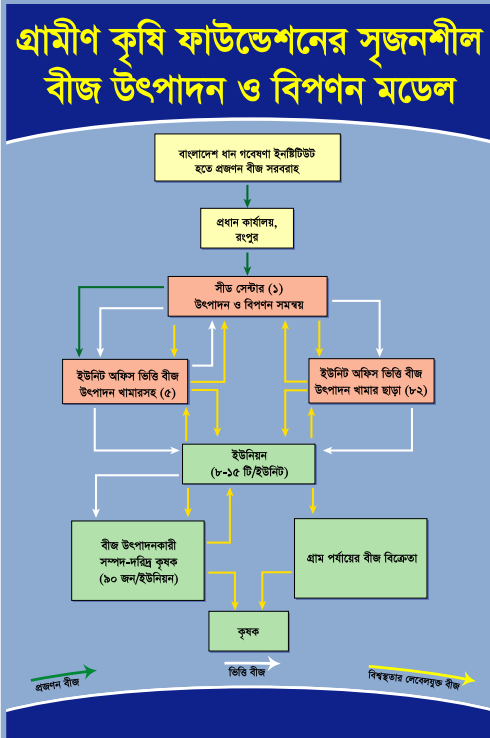
SP team:

M. Abdul Jabbar

INTRODUCTION

Agriculture is the single most important sector of the Bangladesh economy and the major source of livelihood for around 80% of the population. Of these, some 70% are resource-poor farmers (RPFs) who do not have access to quality rice seed. Quality seed alone can increase yields by about 12.5%, yet 94% of the seed required for rice production in Bangladesh is produced by the farmers themselves, with the consequent risk of degeneration. Lack of quality seed is thus a major constraint to increasing yields and improving the livelihoods of RPFs.

The Grameen Krishi Foundation (GKF) is an independent non-governmental organisation (NGO) working in agriculture development. Under its current seed programme, GKF signs up mainly small and medium farmers to produce seed. However, the lack of mechanisms to assess production targets and create local demand has led to inefficiencies in the seed production and distribution system.



OBJECTIVE

The objective of this sub-project (SP) was to assist RPFs to produce quality rice seed sustainably and improve their livelihoods through increased rice production.

METHODS

SP activities took place in the districts of Joypurhat, Nilphamari, Dinajpur, Lalmonirhat and Rangpur, in the north-west of Bangladesh. Activities began in the 2000-2001 *aman* season with the selection of 28 'demo' farmers. Selection was based on attitude and the ability to influence others in society. Control farmers with land adjacent to that of the demo farmers were also selected. Seeds of various high-yielding varieties (HYVs) and other inputs were supplied to the demo farmers on credit, and training on rice seed production, roguing, pest control and irrigation was provided. Further training on post-harvest processing was provided, which some female farmers attended. The results of the trials were shared with the farmers and the most suitable varieties for the ecological conditions selected.

In year 2 of the SP priority was given to the dissemination of these new varieties in

different locations. 500 farmers received training on HYV rice cultivation in 2001-2002. In year 3, GKF developed a pro-poor market-linked group based quality rice seed dissemination approach. 9 groups of 10 RPFs, each owning between 0.5 and 1.5 acres of land, were established. Demonstrations of HYV seed production were then set in all 90 plots, with signboards identifying variety, date of planting, fertiliser dosage etc. for the information of neighbouring farmers. The quality seed produced was procured by GKF at Tk. 1 per kilogram (kg.) above the prevailing market price as an incentive to the producers. Seed was then processed, graded and stored in moisture-proof bags in the GKF air-cooled store. In following seasons, participating RPFs and other RPFs will receive priority in purchasing seed at modestly subsidized prices.

RESULTS

Several new varieties have been adopted by farmers in the SP area, specifically BRRI dhan28, 29 and 36 in *boro* and BRRI dhan30 and 31 in *aman*. Yield increases of up to 1000 kg./acre have been achieved, and rice provisioning ability has improved substantially.

More than 500 farmers have now received training on all aspects of HYV seed production, including a number of women. Observation indicates that women share new knowledge rapidly through informal networks. Better understanding of the cropping cycle had led to a more balanced use of fertilisers and reduced use of pesticides. Of the RPFs trained, almost 90% had significantly higher yields, and all produced better quality seed. Farmers made on average a profit of Tk. 240 from seed production and Tk. 400 from retailing seed purchased from GKF to non-participating neighbours. The total profit of Tk. 640 equates to 80 kg. of rice or an increase in food provisioning of between 2 and 3 months.

CONCLUSIONS AND RECOMMENDATIONS

The training provided under this SP improved both seed production and overall crop production, and the inclusion of women meant that they felt their important role was recognised. National seed systems often underestimate the emotional attachment of farmers to their own seed. Whilst separate seed processing for each farmer would not be feasible, the approach developed under this SP guarantees farmers access to quality seed produced by their peers in their own locality.

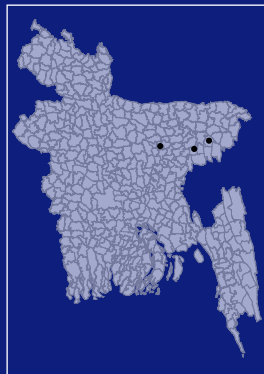
By buying quality seed produced by participating farmers at above the market price, the SP provided incentives for quality seed production. In giving priority to participating RPFs in the purchase of this same seed, appropriately processed, packaged and stored, again at a subsidized price, the SP encouraged seed producers to become seed retailers, as they could then sell the seed to their neighbours at a modest profit. Participating farmers began to develop a business mentality, whilst the access to quality seed for all farmers in the village increased exponentially. Involving resource-poor seed producers in the seed marketing system breaks down the barriers to quality seed access at the village level, and offers a mechanism for the rapid adoption of new varieties.

Suggested citation:

Jabbar, M. A. 2007. Quality rice seed marketing method (SP 04 00). In: Magor, N. P., Salahuddin, A., Haque, M., Biswas, T. K. and Bannerman, M., editors. PETRRA - an experiment in pro-poor agricultural research. Uptake sub-project brief no. 10.2.4. Dhaka (Bangladesh): Poverty Elimination Through Rice Research Assistance Project, International Rice Research Institute. 2 p.

Strengthening the FARMSEED extension method (SP no. 05 00)

SP location:



Habiganj
Kishoreganj
Maulvi Bazar

SP duration:

July 2002 - June 2004

SP organisations:

AAS

SP team:

M. Harun-Ar-Rashid

INTRODUCTION

Seed is the vital element of crop production. Irrespective of variety, quality seed alone can increase production significantly, about 12.5%. At present, Bangladesh requires a total of 400,000 metric tons (MT) of rice seed. In 2000-2001, only about 12,000 MT, or less than 5% of the nation's total requirement, could be supplied as improved seed through the formal seed system, mostly by the Bangladesh Agricultural Development Corporation (BADC).

The rest of the nation's seed requirement, often of indifferent quality, comes from farmers' own retained seed and from farmer-to-farmer seed exchange. The challenge for this sub-project (SP) was to improve the efficiency with which farmers are able to supply the remaining 95% of the seed they need.



OBJECTIVE

The objective of this SP was to increase rice production and incomes amongst the families of resource-poor farmers (RPFs) by ensuring the supply of quality rice quality rice seed. This would be achieved by developing the seed production, processing, preservation and distribution skills of RPFs themselves.

METHODS

The SP was implemented in 246 villages of Kishoreganj, Habiganj and Maulvi Bazar Districts, in collaboration with 31 non-governmental organisations (NGOs) (NGOs) and community-based organisations (CBOs).

Through participatory research with selected groups of skilled farmers and partner partner organisations, the FARMSEED extension method was developed. FARMSEED is based on the following steps:

Build partnerships and train trainers:

Local partner organisations are contacted and special training provided on seed seed production, storage and distribution.

Build RPF groups:

Groups are formed with members selected by the community. Both male and female groups are formed with an average of 25-28 members per group. Each group selects a coordinator.

Assess suitable varieties and validate technologies:

Through on-farm variety demonstrations, farmers themselves select the most promising and suitable varieties.

Ensure access to foundation seed:

Foundation seed (FS) provides the fuel for the FARMSEED engine to run. It can be procured from several sources, including BADC. Some large NGOs (e.g., BRAC) produce their own FS for use within their own seed production and distribution system. Smaller NGOs with a strong agricultural agenda can also purchase breeder seed from the Bangladesh Rice Research Institute (BRRI) with memoranda of understanding (MOU) and start producing their own FS.

Conduct group training activities:

Farmers are trained to become seed producers. They establish demonstration plots in plots in their own farms with the foundation seeds given to them earlier. Prior to the harvest of seeds, the seed producer groups, NGO staff and other members of the community assess the seed quality during a field day.

Monitor regularly:

Working closely and regularly together with the network of partner organisations, the organisations, the entire process of seed production and distribution is monitored. Feedback from the RPFs and their wives on activities and issues arising is made easier as there is hardly any communication gap between the partner organisations and the RPFs, especially with the CBOs. They are all part of the same community and live and work together day in and day out.

Let it roll, but keep eyes on the ball:

Depending on the variety and local conditions, farmers usually assign between 30-70% of their field to seed production. This gives an indication of the flexibility of the system and is an important consideration for RPFs in times of distress. Of the total amount of seed produced, about 10-20% is kept for farmers' own use. The rest is sold or exchanged within the community.

RESULTS

From the inception of the project to 2003, seed exchange in the project area has increased from 5% to more than 30%. About 90% of participating farmers were able to produce and distribute quality seeds, allowing 59% of farm families within the target communities to increase their access to and use of quality seed. 100% of participating RPFs recognised FARMSEED as a highly effective extension method.

About half of the 4,000 farmers trained by AAS as seed producers have been enlisted

enlisted as reliable producers of truthfully labelled seed (TLS) with AAS.

CONCLUSIONS AND RECOMMENDATIONS

Over the life of the SP, FARMSEED has evolved into a stable, sustainable mechanism for producing and supplying FS to participating farmers. For the first time, first time, RPFs in Bangladesh are able to control the flow and availability of quality quality controlled seed. FARMSEED also gives scope for the processing, storage and and distribution of quality farmer-to-farmer exchanged seed, through the RPF groups.

Nationwide replication of these successes could be achieved by:

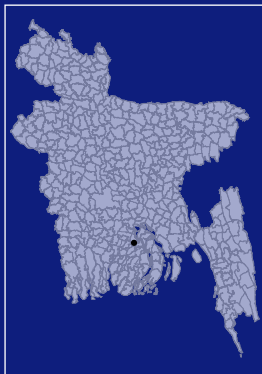
- Extending the informal FARMSEED network to ensure supply of FS nationwide; nationwide;
- Introducing a low-cost storage system for rice seed in the community;
- Developing research partnerships to build awareness of FARMSEED methods; and
- Increasing incentives for trained seed farmers to continue extending FARMSEED.

Suggested citation:

Rashid, M. H. 2007. Strengthening the FARMSEED extension method (SP 05 00). In: Magor, N. P., Salahuddin, A., Haque, M., Biswas, T. K. and Bannerman, M., editors. PETRRRA - an experiment in pro-poor agricultural research. Uptake sub-project brief no. 10.2.5. Dhaka (Bangladesh): Poverty Elimination Through Rice Research Assistance Project, International Rice Research Institute. 4 p.

Union federation-based extension approach for dissemination of environmentally-friendly rice and rice seed production (SP no. 06 00)

SP location:



Barisal

SP duration:

July 2000 - June 2004

SP organisations:

Proshika

SP team:

A. H. M. Mahfuzul Haque

INTRODUCTION

Bangladesh has an agro-based economy: more than 80% of the population is engaged in the agricultural sector. National research institutes have developed various technologies to support farmers in their attempts to meet the need for increased production, but few of these have been successfully disseminated to the farming community to date.

Proshika is a large national non-governmental organisation (NGO) in Bangladesh, and implements a diverse agricultural programme. An uptake method based on its union federations, involving a large number of farmers, could increase the speed of technology dissemination.

The use of green manures to improve the level of organic matter in soils and the introduction of high-yielding variety (HYV) rice seed provided technologies through which the effectiveness of the new uptake method could be assessed.

OBJECTIVE

The objective of the sub-project (SP) was to improve the livelihoods of resource-poor farmers (RPFs) by validating eco-friendly rice and rice seed production technologies through participatory research, and to develop an extension approach for those technologies based on union federations.

METHODS

Research for this SP was implemented in the sadar upazila of Barisal district.

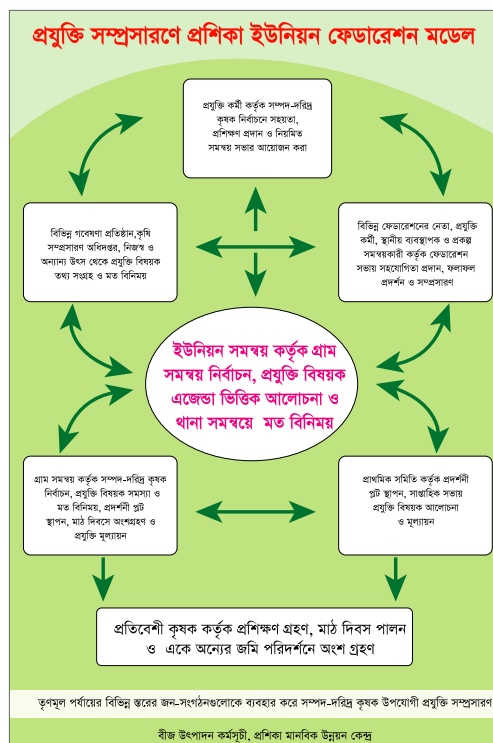
The uptake method developed included the following stages:

Federation discussion

The leaders of the village federations were brought together at the union federations, to discuss dissemination strategies and plan activities.

Farmer selection and training

Participating farmers were selected at village and union federation meetings. Farmers were required to hold between 0.05 and 1 acre of land, under irrigation, cultivated in



the *boro* and *aman* seasons and bordering a public road. Selected farmers received both village-based and residential training in the new technology.

Input supply

All necessary inputs such as seeds, fertiliser, weeders, threshers etc. were provided to the farmers for the establishment of demonstrations of the new technology.

Field days and cross-site visits

Field days and cross-site visits were conducted in which both participating farmers and neighbouring farmers could appraise the demonstrations.

Workshop

Workshops were arranged to share the results of the demonstrations among participating farmers, local leaders and personnel from government organisations (GOs) and NGOs..

RESULTS

The uptake method recommended by this SP was better in several aspects than the existing method. It helped to disseminate technology rapidly, with the federations playing an active role and a large number of farmers getting involved in a short period. Via the federations, farmers learnt about how to produce and preserve quality seed, under their own management and control, and about the use of green manures to improve soil organic matter content

The socio-economic status of the participating farmers increased rapidly. The application of green manures resulted in improved soils and soil ecology, reduced pest and disease attack, reduced input costs and better yields.

The introduction of HYV rice seed increased average production by 15% and reduced costs by 5% compared with traditional practices. Furthermore, participating farmers are now capable of producing and preserving good quality seed themselves. 100% of participating farmers achieved increased yields, with a net annual benefit estimated at over Tk. 15,000.

So far more than 1,500 farmers have been trained on these technologies. 50% of participating farmers were women.

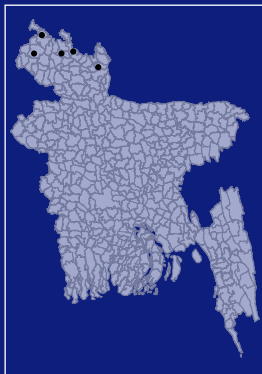
CONCLUSIONS AND RECOMMENDATIONS

The method builds on the organisational structure of the implementing organisation, Proshika. The village federations and the farmer federations are the contact part of the new information. For sustainability, the inputs of the demonstrations and the uptake by the federation members could be linked to the existing Proshika micro-credit programme.

Suggested citation:

Haque, A. H. M. M. 2007. Union federation-based extension approach for dissemination of environmentally-friendly rice and rice seed production (SP 06 00). In: Magor, N. P., Salahuddin, A., Haque, M., Biswas, T. K. and Bannerman, M., editors. PETRR - an experiment in pro-poor agricultural research. Uptake sub-project brief no. 10.2.6. Dhaka (Bangladesh): Poverty Elimination Through Rice Research Assistance Project, International Rice Research Institute. 2 p.

SP location:



Kurigram
Lalmonirhat
Nilphamari
Panchagarh
Thakurgaon

SP duration:

July 2002 - June 2004

SP organizations:

RDRS
Federations

SP team:

M. G. Neogi

INTRODUCTION

More than 70% of the seed used in rice production in Bangladesh comes from farmers' own saved stocks. But the quality of this seed is often poor, resulting in yields far below the potential of the variety. To enhance food security at the rural household level, the uptake of improved seed production and storage technologies amongst the farming community needs to be speeded up.

The lack of effective linkages between research and extension is a major constraint to the dissemination of such technologies. Research activities are often restricted to institutes and campuses, to which farmers have no access. Equally, researchers themselves often have limited opportunities to share their work with farmers and gather feedback.

The Rangpur Dinajpur Rural Service (RDRS) works with the rural poor through federations. A federation is an association of marginal and landless farmers, formed with the intention of attaining greater collective strength, cooperation and unity, and of creating a more productive agency to achieve the broader objective of sustainable development on behalf of their membership and community.

OBJECTIVE

The objective of this sub-project (SP) was to develop improved rice seed production and storage technologies and thus to ensure more sustainable livelihoods among resource-poor farmers (RPFs), by facilitating collaboration between the RDRS federations and the Bangladesh Rice Research Institute (BRRI), Bangladesh Agricultural University (BAU), Department of Agricultural Extension (DAE), local non-governmental organizations (NGOs) and community-based organisations (CBOs).

METHODS

Fifteen federations in five districts (Lalmonirhat, Kurigram, Nilphamari, Panchagarh, Thakurgaon) of northern Bangladesh were selected to participate in the SP, based on their interest and on the availability of resources such as suitable land and seed

টেকসই বীজ উন্নয়ন ও বিপণনে ফেডারেশন মডেল

সম্পদ-দরিদ্র কৃষক মৌসুমের শুরুতেই প্রয়োজনীয় সময়ে মানসম্পন্ন বীজ পাবেন



আরডিআরএস বাংলাদেশ

godowns. Each selected federation, along with RDRS staff, nominated households to participate, the men to work as seed growers and the women as seed processors. The following criteria were followed to select RPFs to participate in the SP:

- Farming less than 1.5 acres of land (own or rented);
- Farming rice;
- More than 50% of living costs come from agriculture; and
- Both males and females in the same household.

The SP established seed storage facilities at the federation level, based on the organic cocoon, an insecticide-free storage device which controls humidity, temperature, oxygen and pests.

BRRI and DAE jointly provided training to participant farmers and RDRS staff, through participatory 'learning by doing'. Master of Science (MSc) students from BAU selected research topics according to the needs of local farmers. Research findings were made available to the local farmers.

RESULTS

Farmers in the SP area benefited through the utilization of research findings. These findings allowed them to increase their land productivity, utilize their limited resources more efficiently, produce quality seed and develop effective storage facilities. Rice yields have increased by more than 50%.

The lower moisture content, reduced oxygen level and reduced insect attack provided by organic cocoon storage improved seed health and germination rate. Demand for cocoon seed increased day by day.

Integrated and coordinated extension services have created an opportunity to build upon the strengths of different stakeholders to enhance the farmers' capabilities, in terms of human, natural, financial, physical and social capital.

Women are directly involved in agriculture, especially in post harvest operations, but previously they had no access to technologies that could improve the effectiveness of their work. The uptake model developed in this SP addressed this issue by directly involving the women farmers in a way that was village based and friendly to the social environment.

CONCLUSIONS AND RECOMMENDATIONS

Through the collaboration of government organisations (GOs), NGOs, research institutes and farmer federations developed in this SP, RDRS has built bridges between technology providers and RPFs at the community level. This SP has created a model for ensuring sustainability. RDRS staff will continue to provide skill training and follow-up on quality seed production, preservation and marketing to 300 farmers' trainers (FT) and 2,500 farmers, even after donor support is over.

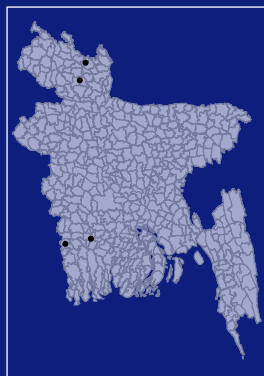
RDRS has already initiated more of the same activities based on the learning of this project. With positive results accruing from the exposure of teachers and students to the reality of farmers' lives, BAU and RDRS have agreed to replicate the student internship action research, and have signed an agreement on this for a ten-year period.

The challenge for the future is how to continue the partnership model developed under this SP, to build on the strengths of partners and make all stakeholders responsive to the needs of farmers for quality services.

Suggested citation:

Neogi, M. G. 2007. Federation model of quality seed production and marketing (SP no. 07 00). In: Magor, N. P., Salahuddin, A., Haque, M., Biswas, T. K. and Bannerman, M., editors. PETRRA - an experiment in pro-poor agricultural research. Uptake sub-project brief no. 10.2.7. Dhaka (Bangladesh): Poverty Elimination Through Rice Research Assistance Project, International Rice Research Institute. 4 p.

SP location:



Dinajpur

SP duration:

June 2000 - June 2001

SP organisations:

ABC

SP team:

K. M. Fashiur Rahman

INTRODUCTION

Availability of quality seed is a concern among the resource-poor farmers (RPFs) of Bangladesh. BRRI dhan28 & 29 were new high yielding varieties that could be grown in the boro season and similarly BRRI dhan30 and 31 for in the aman season. Farmers, who have been cultivating high-yielding varieties (HYV) are more or less familiar with production process but there is a need for seeing and



understanding most recent recommendations. However, since BRRI dhan28 & 29 were new varieties in the HYV family that were to be introduced, an effective awareness campaign was needed and with that local seed production. Under the sub-project ABC intended to develop a private sector led seed technology dissemination model.

OBJECTIVE

The sub-project aimed to determine the following:

- 1) Familiarize farmers with affordable best technology practices that will result in acceptable yields in terms of quantity and quality;
- 2) Demonstrate to target farmers the difference between quality seed and ordinary seed;
- 3) Train the RPFs of the sub-project areas on the production and preservation of quality seeds for their own use; and
- 3) Developing an ABC business plan for identifying and multiplying potential rice varieties for resource poor farmers.

METHODS

The sub-project targeted areas in which the coverage of modern rice varieties cultivation was low. An orientation program for the selected farmers was organized. On-the-job practical training in the form of demonstrations was organized in addition to the orientation program to inform farmers about BRRI dhan28, 29 and BRRI dhan30, 31. The training covered the method of cultivation, management, plant protection, post-harvest operations for seed production and storage.

Field days were organised to for farmers to see the performance of BRRI dhan28, 29 and BRRI dhan30, 31 at difference stages of growth & maturity and to compare these to neighboring farmer plots. A workshop was organised to share the experiences of individual farmers.

RESULTS

Farmers from several upazilas of Dinajpur district became familiar with the above new boro and aman rice varieties. About 20 MT modern variety seed was produced and distributed among the farmers during the aman and boro seasons. Modern variety seed was popularized among the farmers through field days and training. A strong business plan for ABC was developed that was hoped to continue even after the closing of PETRRA project.

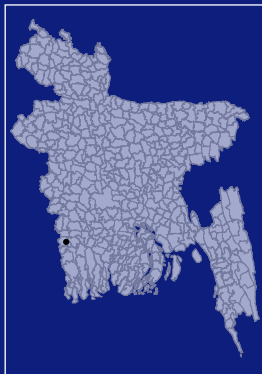
CONCLUSIONS AND RECOMMENDATIONS

Farmers residing within the sub-project areas were the main beneficiaries. They received quality seeds, training on latest production technologies and were exposed to practical knowledge on post harvest operations and seed storage systems. Their economic condition did improve. ABC hoped to continue their rice seed production, processing and marketing activities following the business plan they outlined during the sub-project period of PETRRA.

Suggested citation:

Rahman, K. M. F. 2007. Technology uptake: pilot scheme by Agri Business Corporation (ABC) (SP 08 00). In: Magor, N. P., Salahuddin, A., Haque, M., Biswas, T. K. and Bannerman, M., editors. PETRRA - an experiment in pro-poor agricultural research. Uptake sub-project brief no. 10.2.8. Dhaka (Bangladesh): Poverty Elimination Through Rice Research Assistance Project, International Rice Research Institute. 2 p.

SP Location:



Satkhira

SP Duration:

July 2000 - June 2004

SP Organisations:

Shushilan

SP Team:

Mostafa Nuruzzaman

INTRODUCTION

In Satkhira district, only a few local non-governmental organisations (NGOs) have an agriculture extension program, and in respect of methodology they entirely depend on the traditional extension methods of the Department of Agricultural Extension (DAE). Analysis suggests that these traditional methods tend to benefit middle income or rich farmers. Women and resource-poor farmers (RPFs) have a very limited role to play in such traditional extension systems.

OBJECTIVE

The objective of the sub-project (SP) was to facilitate access to technology, seed and input sources, and to disseminate high-yielding variety (HYV) rice production management technology amongst RPFs, through an innovative extension method.

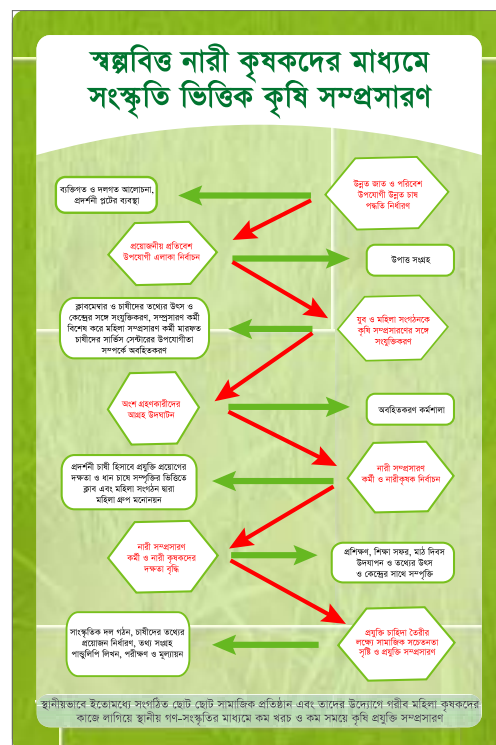
METHODS

The SP ran from July 2000 up to June 2004 and covered 17 villages in Kaliganj and Shyamnagar upazilas, in Satkhira district. It was implemented in three phases. Phase 1 was concerned with identification and verification of technology and dissemination methodology. Phase 2 dealt with the application of specific technologies and the trial of extension methodologies identified in Phase 1. Phase 3 was principally concerned with validation and documentation of the women-led cultural extension approach.

Farmers to participate in the SP were selected from resource-poor households owning less than 1 acre of land and with a monthly income of below Tk. 2,000. Women-headed households were given preference. The areas selected for attention were freshwater and brackish water low saline zones, threatened by the expansion of shrimp farming, with low status of rice production technology and acute seed shortage, but with high potential for seed production and marketing.

Rice and seed production technology packages from BRRI were tested in the specific agro-ecozone of the SP area. Diverse extension methodologies, including training, field days, farmers' meetings, village fairs and cultural shows, were put on trial.

The concept of a women-led cultural extension approach evolved over the life of



the SP. Its principal characteristics are:

- Selection of region-specific appropriate rice production technology;
- Greater involvement of female farmers in rice and seed production;
- Involvement of community SP organisations, clubs and women farmers in agricultural extension; and
- Use of dance, drama and folk song as a principal tool in extension.

A cultural core team of artists coming from amongst the farmers prepared a scripted cultural show from an assessment of farmers' needs and information from research institutes and DAE, to be performed to tunes from popular folk songs using traditional instruments.

RESULTS

The SP brought about specific changes in varietal uptake and cultural practice. The new varieties BRRI dhan28, BRRI dhan30, BRRI dhan33 and BRRI dhan41 have replaced the traditional varieties *swarna*, IT and China that were previously widely used. Use of 1-2 seedlings per hill instead of 6-8 seedlings per hill as before has reduced seed requirements significantly. The rate of seed application per hectare has come down by 50%. The application of chemical fertilisers has appreciably decreased. Use of organic fertiliser at the community level has improved soil health, whilst the adoption of biological control in pest management has reduced environmental pollution and the consequent health hazard. Average yields have increased from 3 to 4 tons per hectare (t./ha.) to 4 to 5 t./ha., with a consequent rise in income for resource-poor households.

The women-led cultural extension approach played a significant role in the dissemination of these improved technologies amongst farmers. Twenty-four cultural shows were held, raising awareness of improved rice and seed production technology amongst almost 25,000 farmers.

CONCLUSIONS AND RECOMMENDATIONS

The women-led cultural extension approach proved cost effective, time saving and responsive to the basic needs of RPFs. Female farmers proved their worth in the field through skilful adoption and successful implementation of improved technologies. Cultural shows acted as a catalyst for the dissemination of technological information; animating and motivating the audience and helping to forge new social relations.

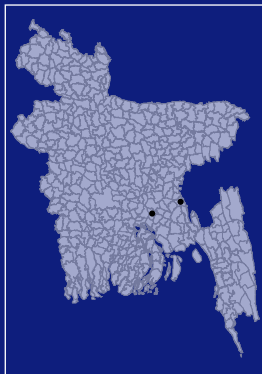
The uniqueness of the women-led cultural extension approach developed under this SP lies in its ability to be integrated with the needs and the traditional culture of rural people. Harnessing local clubs and women's organisations in agricultural technology dissemination offers a new dimension in the field of agricultural extension.

However, further intervention and support are required for the sustainability of cultural uptake tools. The DAE and other organisations involved in agricultural extension should in future give special attention to the role of women and traditional culture in technology dissemination.

Suggested citation:

Nuruzzaman, M. 2007. Women-led cultural extension methods (SP 09 00). In: Magor, N. P., Salahuddin, A., Haque, M., Biswas, T. K. and Bannerman, M., editors. PETRRA - an experiment in pro-poor agricultural research. Uptake sub-project brief no. 10.2.9. Dhaka (Bangladesh): Poverty Elimination Through Rice Research Assistance Project, International Rice Research Institute. 2 p.

SP location:



Chandpur
Comilla

SP duration:

July 2001 - June 2004

SP organisations:

BARD

SP team:

Tapash Ranjan Bose
Abul Kalam Azad
Newaz Ahmed Chowdhury

INTRODUCTION

The Bangladesh Academy for Rural Development (BARD) has since its inception played a vital role in agricultural development through conducting research, field demonstrations and training, and through organising farmers into cooperatives. It has been identified in BARD's various research studies that the availability of quality seed at the farmers' level is not up to the mark, and that fine tuning of cultivation practices is badly needed.

Comprehensive Village Development Cooperative Societies (CVDCs) are village-based groups which hold weekly meetings in which problems facing the community are discussed. All classes of people, regardless of gender and religion, have access to these institutions, with female members organising separate weekly meetings. Some CVDCs have as much as 40 years of footing in their respective villages, and offer a built-in mechanism for disseminating knowledge and experiences. The union parishad (UP), Bangladesh's oldest local government organisation, also has potential for disseminating rice-based technologies. Such institutions could provide a vehicle for the uptake of technologies and their sustainable adoption.

OBJECTIVE

The objective of this sub-project (SP) was to establish a village institutional approach (VIA) for technology dissemination, in order to sustainably increase the productivity of rice-based farming systems for resource-poor farmers (RPFs).

METHODS

The SP carried out research in 19 villages via CVDCs in Comilla district, and also in 2 villages via UP in Chandpur district.

The VIA uptake method developed had the following components:

- The managing committee of the CVDCS selected farmers to participate, organised the distribution of inputs and provided a venue for training;
- An honorary agricultural worker from each CVDCS played the role of facilitator,



motivating the participants and providing information at a weekly meeting;

- Selected farmers were trained to perform mini-demonstrations to disseminate technology;
- Every 3 CVDCSs were provided with a paid field level worker to help with organising, monitoring, evaluating and data recording;
- The Department of Agricultural Extension (DAE) Block Supervisor (BS) kept in touch and provided training and inputs where required, as did a range of supportive institutions; and
- In coordination with school authorities village students (Class-X) were given motivational training and provided with printed materials containing the latest information with which to help their parents, relatives and neighbours.

The uptake method was tested using various types of technology. These included modern variety rice seed, soil test based fertiliser management, integrated pest management (IPM), urea super granules (USGs) and organic cocoon seed storage.

Relevant officials from the DAE, the Bangladesh Rice Research Institute (BRRI), the Soil Research and Development Institute (SRDI) etc. were involved as resource trainers, and an information centre with a modern set of training materials was established in each society.

RESULTS

Participation in the uptake method through the weekly meetings was encouraging, at between 70% and 80%. Of the various micro-technologies introduced by the VIA, all were described as either good or very good by the participants. A participatory research appraisal showed that between 80% and 85% of participating RPFs were practicing these technologies at their own levels. 2500 mini-demonstration plots were established by participants over 3 rice seasons throughout the SP duration.

80% of the *aman* varieties and 50% of the *boro* varieties introduced through the SP were adopted by farmers. Farmers preferred BR-22 and BRRI dhan32 as coarse varieties, and BRRI dhan34, 37 and 38 as aromatic and fine rice varieties. Over 2,000 soil samples were tested by participating and non-participating farmers at their own cost, and 98% went on to use recommended fertiliser doses. The results showed that potash (P) levels were low and phosphate (K) levels high. Farmers' general practice is to apply low doses of murate of potash (MP) and high doses of triple super phosphate (TSP), the reverse of the soil requirements: a knowledge gap identified by the tests.

Farmers admitted that USG was an effective method of urea application, but technology adoption was slow, as USG was difficult to obtain, labour intensive and required the full costs of fertiliser to be paid at one time, instead of spread through the growing season according to financial ability. 70% of farmers used some IPM techniques, whilst 90% of farmers who preserved seed in the organic cocoon certified its quality, and the CVDCS began to use the cocoon commercially.

CONCLUSIONS AND RECOMMENDATIONS

The VIA for technology uptake developed in this SP is cost effective, sustainable, and environmentally-friendly. It is less time consuming than other methods, leads to less misuse of inputs, is more convincing and is capable of bringing improvements in

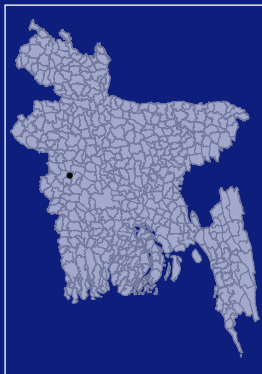
livelihoods and household food security to RPFs. BARD advocates the VIA because the village institutions provide permanent places of contact, their members are willing to take responsibilities, they facilitate the organisation of farmers and they will remain in the village and keep activities running even after the withdrawal of project interventions. Use of the VIA for effective uptake of rice based and other technologies should continue, through credit support and project interventions, in the major rice growing areas of Bangladesh.

Suggested citation:

Bose, T. R., Azad, A. K. and Chowdhury, N. A. 2007. Village institutional approach for rice technology dissemination (SP 23 02). In: Magor, N. P., Salahuddin, A., Haque, M., Biswas, T. K. and Bannerman, M., editors. PETRRA - an experiment in pro-poor agricultural research. Uptake sub-project brief no. 10.2.10. Dhaka (Bangladesh): Poverty Elimination Through Rice Research Assistance Project, International Rice Research Institute. 4 p.

Poverty alleviation through participatory group farming approaches (SP no. 31 02)

SP location:



Kushtia

SP duration:

April 2002 - June 2004

SP organisations:

Mukti Nari-O-Shishu

SP team:

Momtaz Roomy

INTRODUCTION

In the participatory group approach (PGA), resource-poor farmers (RPFs) continue to cultivate the land in their respective holdings, but plan this cultivation and the arrangement of inputs and other supports in a group. The idea behind this is that by organising themselves into groups, RPFs will be able to implement their plan in a cost-effective way, and help those members of the group who lag behind.



Group farming was initiated by the villagers of Maheshwar Chanda in Jhenaidah district in the 1980s, and gained momentum when the Bangladesh Academy of Agriculture (BAAG) began participatory research in the village in 1990. In previous years, the villagers could hardly feed themselves for six months of the year: now they are in surplus in food grains and there have been improvements in literacy, health and infrastructure.

Seventy kilometres away in Kushtia district, the farmers of Tantibond village were suffering from hunger, malnutrition and unemployment. The productivity of their traditional system of cultivation was very low, and tobacco was being cultivated instead of cereal crops, affecting soil health and creating a health hazard for the people.

OBJECTIVE

The objective of this sub-project (SP) was to attempt to replicate a PGA to poverty alleviation at Tantibond, Kushtia, using the Maheshwar Chanda experience.

METHODS

A workshop was organised at Tantibond village to discuss the group farming success story of Maheshwar Chanda. After they expressed their interest, a group of male and female farmers from Tantibond was taken to Maheshwar Chanda to participate in a day-long workshop with the farmers of that village, who narrated their experiences. Leader farmers from Maheshwar Chanda then visited Tantibond to provide guidance and suggestions for group farming activities. After a group discussion, the 'Tantibond Ekota Kishan-Kishani Samity' was formed with 76 members, 32 of which were women. Members came from 62 households, of which 71% were resource-poor.

Through the samity, the following group farming activities were carried out:

- The cultivated land of the village was divided into six blocks according to soil characteristics, and a land use plan and crop suitability chart were prepared, along with indications of the required doses of organic and inorganic fertilisers, with the assistance of the Soil Resources Development Institute (SRDI);

- Modern rice varieties BR-11 and BRRI dhan29 were adopted for *aman* 2003 and *boro* 2004;
- Integrated pest management (IPM) was practiced in both *aman* and *boro*;
- Training courses were organised to enhance capacity in vegetable cultivation, seed selection and preservation, identification of soil characteristics, fish farming, vermi-culture etc; and
- Further workshops were arranged to exchange ideas with villagers from Maheshwar Chanda, to discuss crop cultivation and the bad effects of tobacco cultivation.

RESULTS

Farmers who adopted the modern varieties obtained better yields to the extent of about 15 maunds of paddy in *aman* and 20 maunds in *boro*, helping with rice provisioning amongst the RPFs. More farmers intend to grow modern varieties in the next season, and others would follow if seeds were available. Joint cultivation of vegetables on 0.25 of an acre earned Tk. 1,500 after family consumption.

The introduction of IPM practices reduced production costs in *aman* 2003 by 15% by eliminating the costs of pesticides. The practice of IPM, the use of appropriate doses of fertiliser, the preparation of vermi-compost and the reduction of tobacco cultivation by 10% helped the process of environment preservation in the village. Women members of the samity played a pioneering role in convincing their husbands and neighbours to adopt modern varieties of rice and to reduce the tobacco growing area in the village.

CONCLUSIONS AND RECOMMENDATIONS

Though the SP period was short, some promising results have been achieved. In particular, the involvement of women and the role they are now playing paints an encouraging picture. Their active participation in meetings and willingness to involve themselves in new technologies show a potential for the further involvement of women in agriculture beyond their traditional role in post-harvest activities.

The SP came up with the following ideas for consideration:

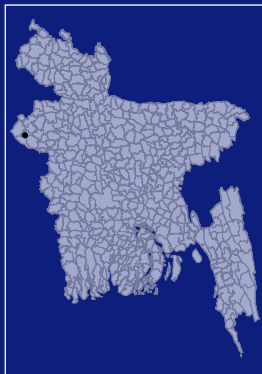
- PGA should be followed in agricultural and rural development efforts by the government organisations (GOs) and non-governmental organisations (NGOs);
- Support from GOs, NGOs and donors is necessary for building capacity amongst the villagers and for ensuring certain inputs and services;
- Village organisation is necessary for PGA, and innovations should only be introduced after a participatory needs assessment has been carried out;
- Women should be involved in the process of decision making regarding the adoption of new technologies; and
- Since this adoption involves some costs there is a need for credit support for RPFs from NGOs or other micro-finance organisations.

Suggested citation:

Roomy, M. 2007. Poverty alleviation through participatory group farming approaches (SP 31 02). In: Magor, N. P., Salahuddin, A., Haque, M., Biswas, T. K. and Bannerman, M., editors. PETRRR - an experiment in pro-poor agricultural research. Uptake sub-project brief no. 10.2.11. Dhaka (Bangladesh): Poverty Elimination Through Rice Research Assistance Project, International Rice Research Institute. 2 p.

Dissemination of BRRI farm machinery among RPFs and improvement of fine rice processing technology in north-west region of Bangladesh (SP no. 33 02)

SP location:



Chapai Nawabganj

SP duration:

October 2002 - June 2004

SP organisations:

BRRI
PROVA

SP team:

M. Syedul Islam
A. K. M. Saiful Islam
M. A. Musa

INTRODUCTION

In the drive to produce more food from limited land, cropping intensity in Bangladesh has risen, and the turn around time between seasons has been reduced. Moreover, the rural labour force has started to shift to the industrial sector, creating an acute agricultural labour shortage during certain peak periods. Mechanised Power Tillers, Rotary Weeders and Threshers can help

ensure that land preparation, crop establishment, harvesting, threshing and drying are carried out in a timely manner. In the case of flood, drought and other natural disasters, mechanisation is often the only option for rapid recovery.

As Bangladesh attains self-sufficiency in coarse grain paddy, emphasis is switching to the production of fine rice. Prices in the domestic market are often unattractive, but the existing processing technology is incapable of producing export quality fine rice. The development of appropriate methods of drying, milling, cleaning, grading and packaging will help resource-poor farmers (RPF) augment their income by shifting to long grain rice production, and could provide employment opportunities for rural women in the mills.

The function of extension is essential to the agricultural development process. Farmers cannot successfully adopt a new technology unless they are aware of it and know how to incorporate into their farming system. Demonstration is one of the strongest tools to introduce new machines among farmers. The Bangladesh Rice Research Institute (BRRI) has limited manpower to disseminate BRRI developed machines among the farmers, whereas the Department of Agricultural Extension (DAE) and non-governmental organisations (NGOs) have root level manpower and communication facilities. A partnership approach is therefore the most viable approach to carry technology successfully to the beneficiaries.



OBJECTIVE

The objective of this sub-project (SP) was to disseminate farm machines developed at the Bangladesh Rice Research Institute (BRRI), and to improve long grain rice processing technology.

METHODS

The machines selected for demonstration were: BRRI weeder; BRRI open drum thresher; and BRRI rice-wheat thresher (TH7). Thirty-seven demonstrations were performed with these machines at different locations in Chapai Nawabganj district. At each site, at least 50 participants were invited, including male and female farmers,

DAE officials, NGO workers and manufacturers. Farmers' reactions to the machines' performance were collected through a short questionnaire.

The recently developed aromatic rice varieties BRRI dhan37 and BRRI dhan38 are comparatively longer than existing aromatic varieties and need improved processing technology to minimise breakage and improve product quality. An industry level experiment in processing the new varieties was conducted at a rubber roll type automatic rice mill in the north-west region.

RESULTS

After demonstration, farmers consented that the BRRI weeder was very useful, and agreed to practice line transplanting with a view to using the machine. Between 50% and 90% expressed their satisfaction with the performance of the BRRI open drum thresher, and between 90% and 100% of the farmers wanted to purchase the machine. However, respondents argued that the price should be below Tk. 10,000 per unit.

Because the open drum thresher produced long straw, farmers preferred it to the BRRI rice-wheat thresher (TH7), which broke the straw.

In the processing trial of the new aromatic varieties BRRI dhan37 and BRRI dhan38, the highest crushing strengths were obtained after 3 days of drying and tempering. Kernel translucency increased with drying duration for both varieties. BRRI dhan38 provided its highest milling yield of 60.1% after 3 days of drying, but BRRI dhan37 produced its highest milling yield of 60.2% after 4 days of drying.

In panel tests, respondents opined that both varieties were moderately aromatic and suitable for export to the ethnic market. After milling and packaging in polythene bags, the rice was stored in an uncontrolled storehouse for 9-10 months with no deterioration in quality.

CONCLUSIONS AND RECOMMENDATIONS

Uptake of agricultural machinery can save time and labour and help RPFs improve their livelihoods and alleviate poverty. Both men and women can operate the machinery, and no negative environmental consequences have been observed. Information on agricultural machinery should be provided by television and other mass media to quickly develop awareness, and a supply of the machines should be ensured for the beginning of the crop season. The government should provide subsidies, and bank loans at reasonable interest rates should be provided to help farmers purchase machines.

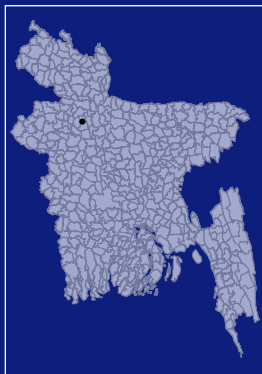
The technology package developed for processing long grain rice adds value to the product, and could help increase the income of millers, labourers and rice farmers. This technology however should be tried in other rubber roll huskers for verification and modification. To produce exportable product, automatic mills need modern equipment for grading, sorting and packaging. The government should be approached for tax relief on the import and installation of equipment and spare parts.

Suggested citation:

Islam, M. S., Islam, A. K. M. S. and Musa, M. A. 2007. Dissemination of BRRI farm machinery among resource-poor farmers and improvement of fine rice processing technology in north-west region of Bangladesh (SP 33 02). In: Magor, N. P., Salahuddin, A., Haque, M., Biswas, T. K. and Bannerman, M., editors. PETRR - an experiment in pro-poor agricultural research. Uptake sub-project brief no. 10.2.12. Dhaka (Bangladesh): Poverty Elimination Through Rice Research Assistance Project, International Rice Research Institute. 2 p.

Learner-centred video production to enhance women-to-women extension of post-harvest innovations (SP no. 37 02)

SP location:



Bogra

SP duration:

October 2002 - June 2004

SP organisations:

CABI Bioscience-UK
Countrywise
Communications-UK
RDA
TMSS

SP team:

Paul Van Mele
A. K. M. Zakaria
Josephine Rodgers
Hosne-Ara Begum

INTRODUCTION

The communication gap between research, extension and farmers has been under serious scrutiny over the past few decades. This has resulted in a range of alternative approaches, based on community participation in both research and extension, and on learner-centred methods. In particular, improving access for women to extension services is recognised as a major issue not only in Bangladesh but in many developing countries. Women often have little access to information and are seldom involved in cross-site visits or other traditional extension tools. Video offers a possible vehicle for the sharing of experiences between women from different villages.



OBJECTIVE

The objective of this sub-project (SP) was to explore the efficiency of participatory video production to enhance women-to-women extension.

METHODS

A team comprising CABI Bioscience, Countrywise Communication, the Rural Development Academy (RDA), Bogra, together with the women-focussed non-governmental organisation (NGO) Thengamara Mohila Sabuj Sangha (TMSS), produced a series of training videos. The programmes covered the following four different seed health-related technologies:

- Spotted seed means diseased seed;
- Seed sorting by the flotation method;
- Well dried seed is good seed; and
- Seed preservation technique.

Each training video lasted only about 5-7 minutes. Videos were made as separate entities, allowing them to be shown at relevant times in the season, based on local needs. An entire video show and group discussion could easily be conducted within an hour. For extension purposes, a video player, television (TV) and generator were rented so that the team could easily show the programmes.

The video approach was compared with demonstration days to assess the impact of both approaches on women's knowledge, attitudes and practices (KAP) related to seed health.

RESULTS

Video proved to be a very effective means of communication, leading to significant changes in post-harvest practices. Women mentioned that the messages in the video were convincing, because they could see that other village women had also tried these new techniques and achieved good results. One woman mentioned that the

techniques can easily be tested for their validity, and that this was a message she could easily get across to her husband. Women attributed higher credibility to seeing and hearing things on video, compared to hearing people talk in real life.

Each of the videos had a different response from the community. Programmes on seed sorting and seed floatation focussed on skills development, and the technologies concerned were not generally adopted by the women who saw the videos. On the other hand, programmes on seed drying and storage emphasised building knowledge from underlying scientific principles. As well as being very popular, these programmes resulted in a high level of experimentation by resource-poor women.

In March 2004, the video programmes produced under this SP won an international award for effective communication from the International Visual Communication Association in London. Bangladeshi private satellite TV channels Channel-i and ATN Bangla have aired the programmes, and they are currently being used both nationally and internationally by extension service providers.

CONCLUSIONS AND RECOMMENDATIONS

The process of involving village women in the development of the videos and the communication strategy provided useful insights for extension providers in the future, both within and beyond Bangladesh. By involving women in the development and validation of videos, communication and adoption barriers are reduced. The participatory method used in this SP to develop video stories and to analyse their effectiveness can be used in other technologies. Further project support will be needed to keep the spirit and skill of the video team viable.

These days a video player can be found in nearly every village, and players are also available along with TVs on a rental basis. Any organisation with an interest in these video programmes could make use of such services, with households being asked to pay a nominal fee if needed to cover rental costs. The government extension service under the Ministry of Agriculture (MOA) also has well equipped audiovisual units at the district level, as does the District Information Office (DIO) under the Ministry of Information (MOI). Both are potential users of the videos produced under this SP.

Suggested citation:

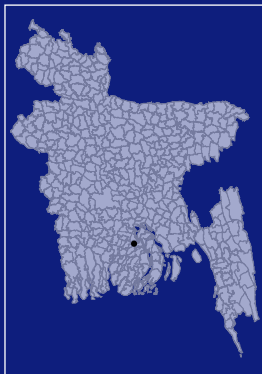
Mele, P. V., Zakaria, A. K. M., Rodgers, J. and Begum, H., A. 2007. Learner-centered video production to enhance women-to-women extension of post-harvest innovations (SP 37 02). In: Magor, N. P., Salahuddin, A., Haque, M., Biswas, T. K. and Bannerman, M., editors. PETRR - an experiment in pro-poor agricultural research. Uptake sub-project brief no. 10.2.13. Dhaka (Bangladesh): Poverty Elimination Through Rice Research Assistance Project, International Rice Research Institute. 2 p.



Photo shows (from left): Josephine Rodgers of Countrywise Communication, Basanti Chakraborty of TMSS, Dr. Paul Van Mele of CABI Bioscience, AKM Zakaria of RDA and Rina Nasrin of TMSS after receiving the prestigious award in London for effective communication from the International Visual Communications Association (IVCA).

Local entrepreneurship and network development for mobile pump dissemination in rice cultivation (SP no.38 02)

SP location:



Barisal

SP duration:

October 2002 - June 2004

SP organisations:

IDE

SP team:

M. Badrul Alam

INTRODUCTION

Most farmers in Barisal district in southern Bangladesh cultivate only *aman* rice, leaving their land fallow during the *boro* season. The risk of salinity means there is little possibility for ground water irrigation in the area. Surface canal water is available, but there are no irrigation devices available for resource-poor farmers (RPFs), as they cannot afford the high costs of mechanised irrigation.

Diesel operated pumps are difficult to maintain, and support services are expensive.

The mobile pump is a foot-operated, appropriate technology for lifting surface water from ponds, canals and rivers, and also ground water from tube wells. Each mobile pump has a discharge capacity of between 0.8 and 1 litre per second, and can irrigate an average of 40 decimals or 0.16 hectares of land. As it is a foot-operated device, the mobile pump is an absolutely environmentally friendly technology with no use of fossil fuel, no emission of smoke and no operational noise.



OBJECTIVE

The objective of this sub-project (SP) was the development of a sustainable local network for the dissemination of mobile pump technology amongst RPFs, using a private sector supply chain of producers, dealers and mechanics/installers.

METHODS

The SP was implemented by International Development Entreprises (IDE). Through a system called local entrepreneurship and network development (LEND), IDE formed strategic alliances with producers, dealers, mechanics, non-governmental organisations (NGOs), the Department of Agricultural Extension (DAE) and local government.

Three target villages and 3 control villages were selected in Uzirpur upazila of Barisal district, where tidal canal water for irrigation is readily available. A local engineering workshop was selected and trained to produce quality mobile pumps and 3 dealers were selected and trained to distribute the pumps amongst RPFs in the SP area. Mobile pumps were manufactured by the producer and distributed through the dealers to the RPFs, along with the provision of field based training. The pump producer sold his pumps with a 20% profit margin and the dealers added another roughly 15%.

20 mechanics received training on mobile pump installation, maintenance and repair, and 72 RPFs were trained in smooth pump use. Women family members received training from their husbands, brothers or fathers, and other community members

learnt about the pump and its operation through regular field days and by interacting with pump users in the community.

The effectiveness of the local network method as compared with traditional methods of technology dissemination was assessed by comparing a range of indicators in the target and control villages. These included product availability and quality, price and technical support.

RESULTS

To date, 146 pumps have been distributed to RPFs. Seventy-two of these were provided at subsidised rates along with formal training for pump operation, maintenance and repair. Through the network established by the SP, 74 other neighbouring RPFs have already bought mobile pumps at full cost. The development of a local network for production and distribution has reduced the cost of mobile pumps to RPFs by 19% (from Tk. 1,300 to Tk. 1,050). Most of the farmers who bought mobile pumps were able to finance their investment using accumulated savings and current income. This investment has been highly profitable.

The use of mobile pumps has enabled farmers to generate significant additional income and increase their rice provisioning ability, as they can now irrigate their land in the dry season. Over 20 hectares of fallow land in the SP area has come under crop production through irrigation by mobile pump. The yield of rice irrigated by mobile pump was higher than shallow tubewell (STW) irrigated land: according to farmers' statements, they may get 2 to 3 maunds more yield per 33 decimals of land due to optimal and timely irrigation. Some farmers also use their pumps in vegetable fields during the idle time of *boro* rice fields.

mobile pump users tend to generate relatively lower levels of incremental income during the initial years of mobile pump ownership, indicating the need for further training and advisory services to help farmers derive the maximum benefit from mobile pump use. Overwhelmingly, however, users are happy to be an owner of an irrigation pump. One user commented: *"This is pedalling the poor out of poverty."*

CONCLUSIONS AND RECOMMENDATIONS

The establishment of LEND under this SP has ensured availability of mobile pumps to RPFs, both male and female, and allowed them to improve their livelihoods through the increased productivity the pumps can provide. The experience of the SP suggests the following recommendations:

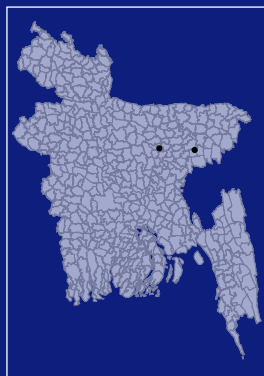
- Advisory services for promotional and motivational activities related to mobile pumps for RPFs may continue for 2-3 years to further consolidate the network; and
- Engagement with local NGOs with credit programmes is an important link and RPFs to have access to mobile pumps.

Suggested citation:

Alam, M. B. 2007. Local entrepreneurship and network development for mobile pump dissemination in rice cultivation (SP 38 02). In: Magor, N. P., Salahuddin, A., Haque, M., Biswas, T. K. and Bannerman, M., editors. PETRRRA - an experiment in pro-poor agricultural research. Uptake sub-project brief no. 10.2.14. Dhaka (Bangladesh): Poverty Elimination Through Rice Research Assistance Project, International Rice Research Institute. 2 p.

Women-led group extension method for rice and rice seed drying and storage technology (SP no. 39 02)

SP location:



Habiganj
Kishoreganj

SP duration:

November 2002 - June 2004

SP organisations:

AAS
MBNMS
SABA

SP team:

Latifun Nessa Helen

INTRODUCTION

In Bangladesh, rice is the most strategic commodity. It is not only the staple food crop for 130 million people: it dominates the country's economy, politics and culture in many ways. Bangladesh has achieved remarkable progress in producing food grain, but production trends still stand behind the level required to provide food security for the people of the country. In particular, rice production fluctuates due to: the non-availability of

quality seeds of high yielding varieties; crises in the supply of fertilisers and fuel; unpredictable natural conditions; and loss and wastage of rice and rice seed at the post-harvest stage. Finding solutions for all four factors is difficult, but the last factor at least could be minimised, if the knowledge and skills of the main actors involved in processing rice and rice seed post-harvest could be enhanced.

The women of agrarian societies in Bangladesh have since time immemorial played a very significant role in the processing and storage of rice and rice seed, despite the prevailing religious and cultural restrictions in the country. Once the paddy arrives in the courtyards of rural houses, the responsibility for stacking, threshing, winnowing, drying, storing and maintaining the rice and rice seed goes to women. resource-poor female farmers (RPFFs) deserve access to affordable, appropriate and environmentally friendly technologies for drying and storing rice and rice seed.



OBJECTIVE

The objective of this sub-project (SP) was to help increase productivity by introducing an innovative women-led group extension method (WLGE) for the dissemination of drying tables and improved storage techniques for rice and rice seed amongst skilled RPFFs.

METHODS

The SP was implemented by the Agricultural Advisory Society (AAS) in 26 villages of Kishoreganj and Habiganj districts, in the north-east of Bangladesh. 4 further villages were isolated to serve as control areas. Female staff members of ten local partner organisations were trained as trainers. Benchmark surveys were carried out to assess the participation of RPFFs in rice cultivation, existing drying and storage techniques, and the roles of RPFFs in family decision-making.

RPFFs from the target villages were selected to participate in the SP according to strict criteria and formed into groups. These groups received training on organisation, communication and technical aspects of post-harvest processing in the

houses of group members. This made participation easier and created a relaxed learning environment. The search for local solutions was stimulated through group discussions based on a set of photographs depicting real-life situations around the seed drying issue. This resulted in a range of multi-purpose drying tables being made of local materials such as bamboo.

Plastic drums were introduced in group sessions and their benefits in rice storage explained. However, availability of drums in local markets was an acute problem, and AAS intervened by organising and paying for transportation of plastic drums to the project area. Better-off farmers could purchase containers, but at full cost.

Brochures, posters and a video film were produced documenting the innovations introduced in the SP. Six festive village fairs were held, attended by 2,335 people, of whom 72% were women, at which participating RPFs demonstrated aspects of seed drying and storage.

RESULTS

Both female staff members of partner organisations and trained RPFs proved effective communicators. Early successes amongst participating RPFs spread to other female family members, followed by other group members and the wider community.

Within a year, more than 50% of the participating RPFs had made their own seed-drying tables, and adoption of the technology amongst non-participating women was increasing.

CONCLUSIONS AND RECOMMENDATIONS

The experience of the SP suggests the following recommendations or 'keys for success' in technology dissemination:

Good selection criteria and procedures

RPFs play a significant role during post-harvest processing and hence were sincerely motivated to participate in the SP. Careful selection of the participants is one of the key factors for success.

Confidence building and respect for the local knowledge system

By validating their traditional knowledge, people's confidence in their own problem-solving skills is enhanced.

Cultural sensitivity

The capacity building sessions did not make the participating women move outside the family boundary, to which the society could have objected. The organisation of functional groups of RPFs helped empower women while training and exposure increased their confidence. Interpersonal communication processes between women ensured effective dissemination of information.

Accessible and environmentally friendly technology

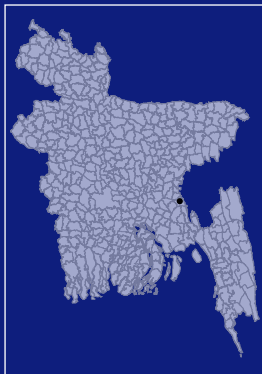
No high-technology or capital-intensive entrepreneurship was required in this SP. The bamboo required for making a drying table is available in every rural area and the farmers themselves can easily make the tables.

Suggested citation:

Helen, L. N. 2007. Women-led group extension method for rice and rice seed drying and storage technology (SP 39 02). In: Magor, N. P., Salahuddin, A., Haque, M., Biswas, T. K. and Bannerman, M., editors. PETRR - an experiment in pro-poor agricultural research. Uptake sub-project brief no. 10.2.15. Dhaka (Bangladesh): Poverty Elimination Through Rice Research Assistance Project, International Rice Research Institute. 2 p.

Private sector-led farmer field school method for herbicide use in rice cultivation (SP no. 40 02)

SP location:



Comilla

SP duration:

October 2002 - June 2004

SP organisations:

SAFE
Syngenta

SP team:

Gopal Chowhan
M. Mahbubur Rahman

INTRODUCTION

Many labour households in the Comilla district of Bangladesh now survive on income from off-farm activities like small trading, construction work and other activities. For this reason, farmers generally face difficulty in getting labourers and affording the costs of timely weeding. Farmers complain that in recent years labourers have become so hard to get that people have to 'honour them like a son-in-law', with three meals of nice food, and still they are hard to find. The result is a labour crisis during the peak periods of rice weeding in January/February and July/August.

Rice herbicides are gradually gaining popularity amongst rice farmers in Bangladesh, for the timely control of weeds and significant reduction in weeding costs they offer. Farmers need to spend about Tk. 1,600 to weed an acre of rice field but for only Tk. 550 can effectively control weeds in the same area by using herbicides. In this way, herbicides significantly reduce the unit costs of rice production. The low cost of herbicides relative to hiring labour for weeding make this technology appropriate for resource-poor farmers (RPFs).

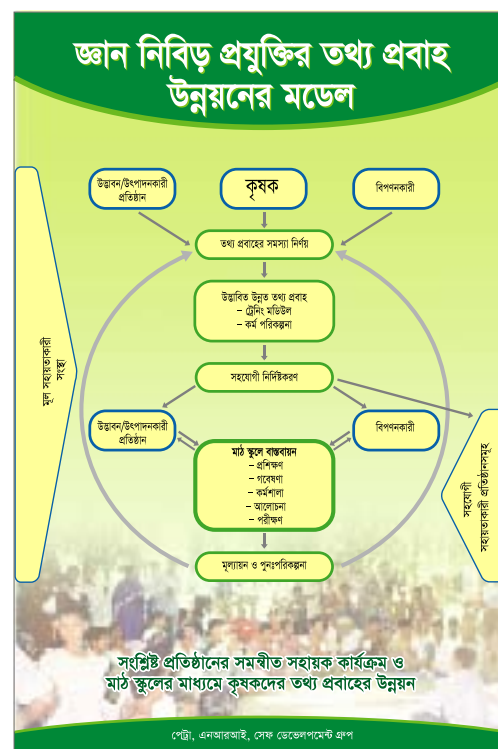
However, an information gap has been identified between the farmers and the herbicide suppliers. Farmers need proper information, followed by a process of experimentation, to build their confidence in order to effectively incorporate herbicides into their weed management. Many farmers have a wrong idea that herbicides may cause damage to the rice plants and soil. Because of this idea, farmers are not fully convinced of the benefits of herbicide application in rice weed control, despite the labour crisis and financial problems many of them face.

OBJECTIVE

This sub-project (SP) aimed to develop an extension strategy for better information flow on herbicide use and safety measures, between the RPF community and local agro-chemical retailers.

METHODS

Sustainable Agriculture and Farming Enterprise (SAFE), a local non-governmental organisation (NGO), in collaboration with Syngenta Bangladesh Ltd., a private multinational agro-chemical company, started working with the RPFs at Burichang



and Debidwar upazilas, Comilla district, in the *boro* 2003 season. The Bangladesh Rice Research Institute (BRRI) and the Natural Resources Institute (NRI)-UK assisted with technical backstopping.

The SP followed the farmer field school (FFS) approach, to develop farmers' understanding of the current problems of weed control, and to carry out experiments on the effectiveness of herbicides. A total of 300 farmers including 78 women participated in 10 FFSs. Farmers observed the field situation and analysed the costs and benefits of their weed management.

Because herbicides were not readily available in the area, SAFE trained the owners of local small shops, and encouraged them to stock herbicides. The training covered rice management, introduction to the project, and weed management. The shop owners also attended a results sharing workshop with farmers. News of the herbicides was spread by field days, and as farmers chatted in teashops. The experimental fields had signs posted in them explaining the product and the dose. Some farmers read the signs while walking past them, and bought a bottle of herbicide in town.

RESULTS

Farmers found that with the application of herbicides they needed to hire only 4 labourers to weed an acre of land, where before they would have required 20 labourers to achieve the same result. There was no yield reduction: rather farmers noticed minor increases in a few cases. Participating farmers were able to reduce their production costs by an average of 12%, and more than 40% reported an increase in rice provisioning ability from these savings.

Sales of herbicides in the SP area have increased dramatically in the two years since the beginning of SP activities.

CONCLUSIONS AND RECOMMENDATIONS

Rural farmers today consider information as the key to positive change in agricultural development. Via this SP, the resource-poor farming community realised the importance of establishing linkages with the local agro-input retailers, for improving their production practices and reducing the cost of cultivation. Similarly, the local agro-input retailers came forward to learn information to disseminate among the farmers, to boost their businesses by developing a partnership with them. The agro-chemical companies found the idea of improving their information system among the dealers and retailers effective in achieving and exceeding their sales targets.

However, even though FFSs can be wildly successful at promoting agrochemicals, the chemical companies will not directly adopt the FFS method, in its entirety, on their own. They prefer faster and cheaper methods of getting people to buy their products. Nevertheless, the agro-chemical companies will improve their existing demonstration methods, to promote sales of herbicides by ensuring participation of more farmers.

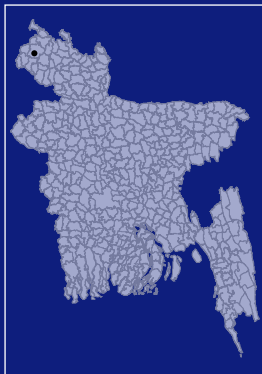
Herbicide use is increasing rapidly in Bangladesh. Knowledge of correct use is a present priority.

Suggested citation:

Chowhan, G. and Rahman, M. M. 2007. Private sector-led farmer field school method for herbicide use in rice cultivation (SP 40 02). In: Magor, N. P., Salahuddin, A., Haque, M., Biswas, T. K. and Bannerman, M., editors. PETRRRA - an experiment in pro-poor agricultural research. Uptake sub-project brief no. 10.2.16. Dhaka (Bangladesh): Poverty Elimination Through Rice Research Assistance Project, International Rice Research Institute. 2 p.

Women-led farmer field schools for disseminating rice-potato-rice cropping patterns in northern Bangladesh (SP no. 41 02)

SP location:



Thakurgaon

SP duration:

December 2002 - June 2004

SP organisations:

RDRS
BRRI
JSS

SP team:

Syed Samsuzzaman
M. G. Neogi

INTRODUCTION

bean cropping patterns have been developed recently to reduce poverty in the north-west part of Bangladesh. Potato, rice and pulses are important commodities in northern Bangladesh, and when cultivated in the cropping patterns mentioned above, their high production and high cash value play an important role in food security and poverty alleviation in the region. Potato in particular gives better yields in a low temperature regime, sandy loam soil and cloud free conditions. Climatic and other factors give the northern part of Bangladesh great scope for the introduction of these cropping patterns.

However, in general farmers are not aware of the importance of good matching of different varieties in a cropping pattern for a particular area. They have limited information about soil and fertiliser management. The introduction of an effective and appropriate extension method may reduce this type of information and communication gap and help male and female resource-poor farmers (RPFs) get better access to information on a regular basis, from an effective extension medium such as the farmer field school (FFS) method.

The Rangpur Dinajpur Rural Service (RDRS) approach to poverty alleviation is rooted in organising and mobilising the rural poor, especially women. Currently, RDRS is working with more than 250,000 households, providing development education and social and economic promotion.

OBJECTIVE

The objective of this sub-project was to compare a women-led FFS approach with traditional extension methods, through the introduction of the rice-potato-rice/mung bean cropping pattern and the use of leaf colour charts (LCCs) in fertiliser management, in northern Bangladesh.

METHODS

The SP emphasised partnership between government organisations (GOs), non-RPFs were selected to participate on the basis of following criteria:



- Farming less than 0.6 hectares of their own or rented land;
- Cultivating rice; and
- More than 50% of living cost comes from agriculture.

Nine FFSs were established in four selected areas (Jagannathpur, Nargoon, Mohammadpur, and Salander). Each FFS consisted of a group of 10 women led by a farmer promoter (FP). With a view to developing the FPs' facilitation skills, a series of training sessions was offered on rice-potato-rice/mung bean cultivation, as well as how to run a FFS effectively.

FPS then disseminated different demand-driven technologies, such as the rice-potato-rice/mung bean cropping pattern and the use of an LCC to determine the time and quantity of urea fertiliser application in the rice fields.

RESULTS

Before the start of the sub-project, the average household income from traditional cropping patterns amongst the participants of the FFSs was Tk. 2,265. The average area cultivated was 300 sq. m. After implementation of the new cropping pattern introduced at the FFSs, average income increased to Tk. 4,318, a rise of over 90%.

A study carried out by an MS student from the Bangladesh Agricultural University (BAU) revealed that amongst farmers who had attended the FFS, 11% had high levels of knowledge, 78% were classified as medium and 11% as poor. On the other hand, amongst non-FFS farmers, none were classified high or medium- all had poor levels of knowledge. 22% of FFS farmers had high skill levels, 71% medium skill levels and only 7% poor skill levels. But amongst non-FFS farmers, none had high or medium skill levels- all had poor levels of skill in agricultural activities.

Ninety-three percent of the women farmers participating in the women-led FFSs shared their experience and knowledge with their male partners. In equivalent male-led FFSs, only 30% of male participants do the same with their female partners. Women were also more sincere in their participation in throughout the FFS season. 85% of female participants attended regularly, as compared with 58% in male-led FFSs. The women-led FFSs improved the social environment. As a village based concept, women felt more comfortable participating in the FFS than they would at an outside training centre.

Neighbouring farmers also had access to information and technology through the FPs, from their FFS sessions, study plots, participatory research etc. At the end of the project period, an average of between 10 and 12 neighbouring farmers under each FFS session were implementing the FFS technologies in their own fields.

CONCLUSIONS AND RECOMMENDATIONS

Women-led FFS activities qualitatively change farmers' capacity for improving intensive crop cultivation practice, in the wider spectrum of the community. Farmers who attend these FFSs are more aware, skilled and advanced in term of social and agricultural activities, in both the production and post-harvest stages. As their involvement in income generation and leadership grows, the recognition and social acceptance of women increases day by day.

The success of the women-led FFS model enabled RDRS to innovate an organisational

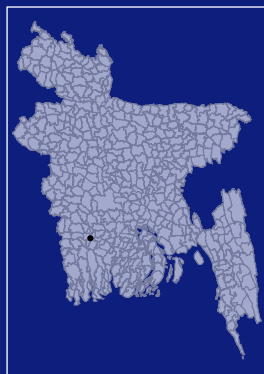
extension model, in which RDRS has incorporated the FFS model into its core programme. Others projects and organisations, such as the North-west Crop Diversification Project (NWCDP), are now introducing the FFS concept in their own programmes, after observing its effectiveness and sustainability.

Suggested citation:

Samsuzzaman, S. and Neogi, M. G. 2007. Women-led farmer field schools for disseminating rice-potato-rice cropping patterns in northern Bangladesh (SP 41 02). In: Magor, N. P., Salahuddin, A., Haque, M., Biswas, T. K. and Bannerman, M., editors. PETRRA - an experiment in pro-poor agricultural research. Uptake sub-project brief no. 10.2.17 Dhaka (Bangladesh): Poverty Elimination Through Rice Research Assistance Project, International Rice Research Institute. 4 p.

Women-led community-based extension method for rice seed cleaning and storage (SP no.42 02)

SP location:



Khulna

SP duration:

October 2002 - June 2004

SP Organisations:

EPRC

SP Team:

Bilqis Amin Hoque

INTRODUCTION

Bangladesh has achieved significant success in increasing rice production, but there is scope for further improvement, particularly in reducing losses during post-harvest activities. Women play key roles in these activities, but they have limited access to information about appropriate post-harvest technologies and techniques. During consultations with personnel from the Department of Agricultural Extension (DAE), and focus group discussion with resource-poor farm women (RPFW), in Khulna division in the south-west of Bangladesh, it became clear that women lack complete information about critical operations such as drying, cleaning, soaking and parboiling, storing and milling. Existing methods for the extension of such information often fail to reach RPFW, and there is a need for research on innovative uptake pathways. The development of an effective uptake method to promote proven technologies in drying and cleaning rice seed would contribute towards building capacity amongst RPFW in the import post-harvest stage of rice production.



OBJECTIVE

The objective of this sub-project (SP) was to develop an innovative extension method for the dissemination of cleaning and storage technologies for rice and rice seed amongst RPFW in Bangladesh

METHODS

This SP was implemented by the Environment and Population Research Centre (EPRC), in partnership with DAE, Khulna. The study was undertaken over about 2 years, from October 2002 to May 2004. The Khulna area was selected for study because of its reliance on rice production and its environmental vulnerability, particularly to salinity intrusion and arsenic contamination. Six socio-economically similar village study units were selected, and a baseline survey conducted to assess the level of knowledge about cleaning and storage technologies amongst RPFW in the study units.

Extension materials for the technologies and methods were developed in consultation with the Bangladesh Rice Research Institute (BRRI), DAE staff and RPFW key informants from the study area. Three different extension methods were selected, packaged and compared as follows:

- 1) Poster only;
- 2) Video plus poster; and
- 3) Intensive use of poster plus courtyard meeting.

These three methods were tested using the following basic proven technologies associated with post-harvest cleaning and storage:

- Preliminary drying and cleaning, before winnowing using wind or manually with *kula*;
- Separation of foreign materials and drying on table or mat, then testing for dryness;
- Addition of herbal insecticides or naphthalene to cleaned rice;
- Storage in airtight plastic drum, painted earthen pot or plastic bag; and
- Storage in cool, dry place and testing for moisture.

The performance of the uptake methods was monitored through focus group discussions, and through a final survey.

RESULTS

All three uptake methods brought about a significant improvement in knowledge about the post-harvest technologies they were promoting. Overall, however, the courtyard meeting plus poster method performed best across all the technologies and study units. This method allowed both a general introduction of the technology via the poster and detailed communication and discussion among the stakeholders in the courtyard meetings.

The SP also satisfactorily implemented a partnership between the DAE and the EPRC, in which the EPRC planned, implemented and monitored the SP in consultation with the DAE. The SP trained a number of local volunteers and DAE extension workers in the extension method and the post-harvest technologies. Because of this the sustainability and replication potential of the SP is high.

CONCLUSIONS AND RECOMMENDATIONS

There was a significant improvement in the knowledge about the promoted technologies amongst RPFW during the SP. There was also an improvement in the related practices of rice storage and cleaning. However, there remains substantial scope for further improvement in these practices. Such improvement requires financial support and time involvement on the part of the RPFW. As there was no such financial support and no incentives for the RPFW, the improvement in knowledge did not lead to improved practices for all the RPFW.

The experience gained during the SP suggests the following recommendations:

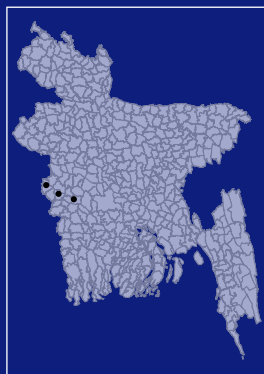
- The development of extension methods for building capacity amongst RPFW should be based on their needs and demands;
- Extension methods for post-harvest activities should combine general and close communication techniques, as exemplified by the poster and courtyard meeting method.
- Promotion of behavioural change should be linked to the provision of financial and logistical support to RPFW. Educational work alone cannot provide containers or paint.

Suggested citation:

Hoque, B. A. 2007. Women-led community-based extension method for rice seed cleaning and storage (SP 42 02). In: Magor, N. P., Salahuddin, A., Haque, M., Biswas, T. K. and Bannerman, M., editors. PETRR - an experiment in pro-poor agricultural research. Uptake sub-project brief no. 10.2.18. Dhaka (Bangladesh): Poverty Elimination Through Rice Research Assistance Project, International Rice Research Institute. 2 p.

Validation of technology uptake pathways for SSNM for intensive rice-based cropping systems in central-west Bangladesh (SP no. 43 02)

SP location:



Chuadanga
Jhenaidah
Meherpur

SP duration:

Aprin 2003 - June 2004

SP organisations:

BRRI
DAE
IRRI
WAVE

SP team:

M. Harunur Rashid
M. Akhter Hossain Khan
M. Murshedul Alam
Ronald J. Buresh
J. K. Ladha

INTRODUCTION

Crop production in Bangladesh is a family activity. resource-poor farmers (RPFs) use their family labour intensively for increasing rice productivity: all immediate family members take part in the production and post-harvest processing of crops, and the whole family is affected by production decisions and their results. Traditionally, however, the Department of Agricultural



Extension (DAE) and those non-governmental organisations (NGOs) involved in technology transfer activities have focussed on the household head or lead farmer as the key person in the dissemination of improved production technologies. The role and participation of family members is not usually taken into account.

The Wheat Research Centre (WRC) of the Bangladesh Agricultural Research Institute (BARI) and the International Maize and Wheat Improvement Centre (CIMMYT) developed a gender- and task-unbiased whole family approach (WFA) training programme for post-harvest technologies in wheat production. Later on they extended these approaches to overall wheat and maize production. CIMMYT has recorded higher degrees of technology adoption through this approach.

Under a separate PETRRRA sub-project 'nutrient management for intensive rice based cropping systems' (SP 10 00), the Rice Farming Systems Division (RFSD) of BRRI has developed and validated a system for real time, crop need based nitrogen (N) management in rice based on the use of a leaf colour chart (LCC). The success of this system has led to demand for its rapid and wide dissemination in different regions of the country.

OBJECTIVE

The objective of this SP was to evaluate the WFA, compared with the traditional technology transfer method or lead farmer approach (LFA), in the dissemination of LCC based N management technology.

METHODS

This The central-west districts of Chuadanga, Meherpur and Jhenaidah were selected as the study area for the SP. In each district, two villages were purposively selected to act as a comparison between the LFA and the WFA. The pairs of villages were similar in all bio-physical and socio-economic aspects but sufficiently distant to avoid any interaction on the part of their respective farmers.

In the WFA villages, training in LCC N management was provided to 10 families. In the LFA villages, 16 lead farmers were trained by the traditional, lead farmer

approach. The mode of training was very informal for both situations. The knowledge base of the participants and their efforts to adopt the technology themselves and disseminate it amongst neighbouring farmers were monitored for both groups.

RESULTS

100% of the WFA farmers responded positively to the technology and began using LCC in fields other than their demonstration plots. In the LFA villages, 65%

responded positively and only 52% were prepared to transfer the technology to their other fields. The LCC technology is sensitive to the correct timing of leaf colour readings: 80% of WFA farmers measured leaf colour at the right time, whereas only 40% of LFA farmers followed the recommendations. Similarly, 87% of WFA farmers applied N on the recommended date, compared to only 40% amongst LFA farmers.

Focus group meetings revealed that women play an important role in keeping the LCC in a safe place and reminding male members of the family to perform the LCC activities on time. 100% of women in the WFA groups took on this role, whereas in the case of LFA only 25% of women became actively involved. Family members trained under the WFA were more likely to share their experience with neighbouring, untrained farmers, through personal and family contact. On average, 1.3 neighbouring farmers were motivated to adopt LCC N management by each family, which equates to 0.38 per trained family member, compared with 0.16 per trained farmer in the LFA villages.

The introduction of LCC N management increased grain yields in all the study villages. However, more thorough and careful following of the LCC recommendations in the WFA villages led to grain yields higher by an average of 0.55 tons per hectare (t./ha.) than those achieved in the LFA villages.

CONCLUSIONS AND RECOMMENDATIONS

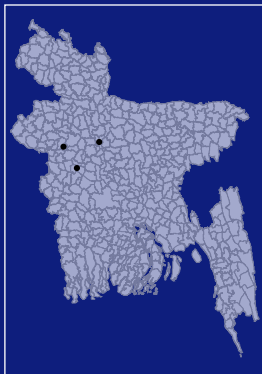
Technology adoption was remarkably enhanced by the participation of family members. Although the initial costs of providing training to family members are higher than to lead farmers alone, the trained family members adopt technology in an efficient way. Participant family members under WFA were more attentive during training and were able to explain the technology to others more clearly than the farmers trained under LFA. Neighbouring farmers learnt about the LCC technology in farmers' meetings and from trained family members, increasing their rice productivity and reducing costs. Young sons or brothers of the farmers helped in demonstrating the new technology, whilst young daughters and wives helped in keeping the LCC in a safe place and reminding the farmers about the dates for taking LCC readings and the correct applications of fertiliser. This SP has proved the superiority of the whole family approach, and WFA should be promoted to facilitate the effective and rapid dissemination of technology.

Suggested citation:

Rashid, M. H., Khan, M. A. H., Alam, M. M., Buresh, R. J., Ladha, J. K. 2007. Validation of technology uptake pathways for SSNM for intensive rice-based cropping systems in central-west Bangladesh (SP 43 02). In: Magor, N. P., Salahuddin, A., Haque, M., Biswas, T. K. and Bannerman, M., editors. PETRRA - an experiment in poor agricultural research. Uptake sub-project brief no. 10.2.19. Dhaka (Bangladesh): Poverty Elimination Through Rice Research Assistance Project, International Rice Research Institute. 2 p.

Whole family extension approach for rice knowledge adoption (SP no. 44 02)

SP location:



Natore
Pabna
Sirajganj

SP duration:

January 2000 - June 2004

SP organisations:

AAS
LUSTRE
Pabna Protishruti
WDP

SP team:

M. Harun-Ar-Rashid

INTRODUCTION

Our understanding of the knowledge and technology dissemination process has evolved from the old concept of a 'pipeline' of technology transfer from researchers through extension workers to farmers. These days, the prevailing approach is rather more complex but also more productive. Now there are many more actors involved in the process than was envisioned by the old model. On the other hand, the new model enables us to visualise vastly higher levels of output.



In Bangladesh, the public sector agricultural extension service providers disseminate most agro-technology through trained male farmers. Little comprehensive research has ever been undertaken regarding the unique role of women in the acquisition and dissemination of rice cultivation knowledge within the farming community. However, rice production in Bangladesh has always been a whole family exercise. All family members (from the very young to the very old) participate in the production cycle and all family members are affected by production decisions and final harvest/yield results. They are rarely divided into gender-segregated and/or task-specific categories. Farm families in Bangladesh are, in fact, integrated rice production units.

This sub-project (SP) was launched in an effort to document the role of 'whole families' are playing in the development and operation of Bangladesh's agriculture sector. The use of non-gender oriented 'whole-family extension methodologies' aimed to reinforce Bangladesh's tradition for making farming decisions on the basis of 'inter' and 'intra' family dialogue: the healthy, family based farm decision making process that is already pervasive in the country.

OBJECTIVE

The objective of this SP was to introduce and organise 'whole family training programmes' on improved rice technology transfer and its dissemination among resource-poor farmers (RPFs).

METHODS

The SP selected four distinct approach to closely study their comparative advantages and effectiveness in order to assess the overall performance of whole family member extension approach. These approach were:

- a) Whole family approach (WFA);

- b) Half family approach (husband & wife);
- c) Husband approach; and
- d) Wife approach.

The project was implemented in collaboration with three partner organisations, mostly local non-governmental organisations (NGOs), in three districts of Rajshahi division. During the one and a half year project period, the project trained 639 farmers on different aspects of rice production, using the four extension approach mentioned above. The participatory research methods used imparted skills to selected family members and allowed them to monitor and compare their results based performance. The SP also provided training to staff so that they enjoyed an enhanced capacity to facilitate the research and extension aspects of the SP.

All interventions were targeted at resource-poor farm families, which were identified and selected randomly. Participating farmers undertook to assist with a benchmark survey through participatory group discussion. Participatory field-testing was then conducted on small plots, and a participatory monitoring system established to provide a framework for rice knowledge adoption and transfer among the various participating family types. To assess the effectiveness of the four tested methods, the project conducted an independent evaluation, based on an average of 20 families who attended focus group discussions.

RESULTS

Regardless of the approach, farmers of all categories made a significant improvement in terms of their knowledge and skills which ultimately resulted in a significant improvement in their total rice production and rice provision ability. More than 95% of the trained farmers have been applying the new technologies, and between 67% and 100% of non-participant farmers who learned from the participating farmers are also using the new technologies in their own fields

The highest percent improvement, in both rice yield and rice provision ability, was recorded in the half family group [(b) above]. The whole family group [(a) above] experienced the second highest increase; however most farmers mentioned that time was a constraint with this approach, as the whole family had to attend the training sessions. Both the whole family and half family extension approach [(a) and (b) above] were more effective than those approach based on the participation of husband or wife alone.

CONCLUSIONS AND RECOMMENDATIONS

The results of this SP suggest that it is important to study the role of women in improving rice knowledge and its dissemination among farmers, and to target and train families as rice producing units, demonstrating respect for the family's internal operations, rather than categorically dividing training into gender-specific and/or task-specific segments

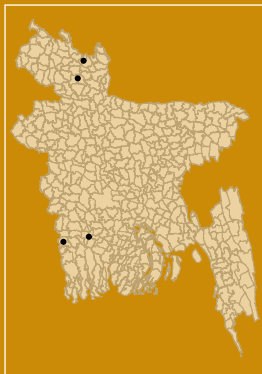
The success of both whole family and half family extension approach, and the minor differences between them, suggest that both should be considered family approach. These family approach are promising. They overcome many social and cultural constraints, which would normally be a bar to women participation in training. Such

useful approach should be promoted widely. Regional and national workshops would be very useful to present the findings and explain the concept. However, it would be also useful to conduct a further validation in economic terms, by comparing the effectiveness of such approach on long-term basis.

Suggested citation:

Rashid, M. H. 2007. Whole family extension approach for rice knowledge adoption (SP 44 02). In: Magor, N. P., Salahuddin, A., Haque, M., Biswas, T. K. and Bannerman, M., editors. PETRRA - an experiment in pro-poor agricultural research. Uptake sub-project brief no. 10.2.20. Dhaka (Bangladesh): Poverty Elimination Through Rice Research Assistance Project, International Rice Research Institute. 4 p.

SP location:



Khulna
Satkhira
Rangpur
Lalmonirhat

SP duration:

January - September 2001

SP organisations:

NRI
BAU
BRRI
RDRS
Shushilan

SP team:

Andrew Goodland
W. M. H. Jaim
M. A. Jabber

INTRODUCTION

Access to good quality agri-inputs (fertiliser, pesticides and seed) is vital for farmers to increase productivity and consequently to improve their livelihood status. Poverty Elimination Through Rice Research Assistance (PETRRRA) project stakeholder analyses in south-west Bangladesh at the end of 1999 identified that farmers experienced problems with obtaining and using inputs in the generally liberalised input markets that exist in Bangladesh. Following PETRRRA stakeholder analyses, this research was commissioned to explore in greater depth the issues of access to good quality agri-inputs for resource poor rice producing households.



OBJECTIVE

The sub-project (SP) aimed to determine the following:

- 1) Identify the factors the factors which influence access to good quality inputs by resource-poor rice farming households;
- 2) Identify and recommend possible options to improve access to good quality inputs by these households; and
- 3) Increase the capacity of Bangladesh Rice Research Institute (BRRI) staff to conduct marketing research.

METHODS

The research began in March 2001 with visits to field sites in Khulna and Satkhira in the south-west (a focus region for PETRRRA), and Rangpur and Lamonirhat in the north-west (a contrasting region). In all these sites focus group discussions were held with farmers in selected villages to debate issues related to input access. In addition, input traders, local non-governmental organisations (NGOs) and government officers were consulted to develop a better understanding of the issues. Following this a farmer questionnaire survey was developed to understand farmer behaviour and perceptions in greater depth. The questionnaire survey was conducted during May to July 2001 among 120 randomly selected farmers of whom 83% were poor (cultivated maximum up to half a hectare of land). In June 2001 a rapid market assessment examined how the market functions and where the quality of inputs may be threatened.

RESULTS

Input use and availability:

- There is a high level of fertiliser and pesticide use, even on the smallest farms, and there is a general lack of knowledge of fertiliser and pesticide use for both farmers and traders;
- Pesticide, fertiliser and seed markets are more or less liberalised, with private trade and competition. The markets for fertiliser and pesticide appear to function well, with the types and quantities that farmers use available locally; and
- In the seed market, Bangladesh Agricultural Development Corporation (BADC) seed is most desired, but is not readily available even though farmers are willing and eager to purchase it.

Input accessibility:

- Price is an important component of access, and price is influenced by market efficiency;
- The markets that were explored in the study areas appear to be competitive and efficient, with no evidence of monopolies or excessive prices in open market;
- However, smaller farmers are often forced to purchase inputs on credit (especially fertiliser and pesticides), limiting their options and increasing opportunity for exploitation; and
- Obviously, financial capital (i.e. levels of cash) is important in gaining access to desired inputs, however, social capital is also very important for those farmers who are unable to pay cash on the spot, as they depend on credit either from the input sellers or from other informal sources (friends, family, moneylenders). Credit will only be given to farmers by people who trust them.

Input quality:

- It is very difficult for farmers to assess quality of inputs (fertiliser, pesticides and seed) by the means available to them (basically visually). Laboratory testing is the only sure way of determining quality (other than by using the input, by which time, of course, it is too late for the farmer if it is poor quality);
- The majority of farmers believe that fertilisers and pesticides are adulterated. More farmers believe fertilisers and pesticides are adulterated than have actually experienced it;
- The difficulty for farmers to assess quality means that they depend on trust for quality, however there is little trust on sellers;
- There are opportunities in particular in the fertiliser market for adulteration at different levels of the marketing system - this is because the fertiliser is often loose and therefore mixing is relatively easy. It may not be the actual sellers of the inputs who are adulterating them, though they often receive the blame from farmers;
- Adulteration in the pesticide market is less easy for wholesalers and retailers as it comes in sealed bottles. However, there are widespread allegations of adulteration - possibly this occurs at the manufacturing level, or possibly adulteration is blamed for the poor application of pesticides;

- Inferior quality pesticides are smuggled from India, especially in border areas. Some smuggled pesticides are banned in Bangladesh and potentially have negative health and environmental impacts. Smuggled produce escapes import duties and is therefore sold cheaply in Bangladesh;
- International brands of pesticides are recognised as the best quality - however, developing a brand is expensive and increases prices to beyond many farmers' means; and
- BADC is recognised as the best seed, though is not always available or accessible as prices of demanded seeds escalate to beyond farmers' means.

Input regulation:

- Generally, suitable regulation is in place in all the input sectors considered; however, enforcement of regulation is fairly weak, due to resource constraints, in particular the sampling and laboratory testing of agri-chemicals; and
- Even where systems for regulating the markets are implemented, there are accusations of corruption, with authorities accused of 'turning a blind eye' to the importation of sub-standard inputs and to subsequent adulteration.

CONCLUSIONS AND RECOMMENDATIONS

The demand for this study arose out of the stakeholder analysis in the south-west of Bangladesh. Fertiliser and pesticide markets were more or less liberalised and appeared to function well. There was more a question of quality control and risk of adulteration. There are regulations in place but enforcement is weak. For the seed sector there is in contrast more a question of access to desired varieties.

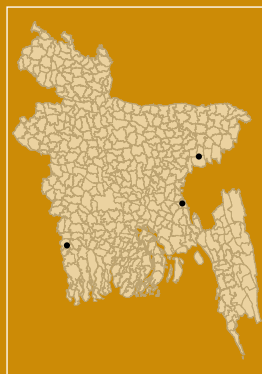
Next steps for resource-poor farmers of Bangladesh in accessing good quality inputs may be tackled through targeted projects to experiment in such areas as local group action, improving the monitoring and enforcement of regulations through using local organisations and community groups and improved information for farmers and traders on input quality. For seed innovations on increasing availability of seed at the farmer level may be implemented. It would appear on the policy arena that systems are in place.

Suggested citation:

Goodland, A., Jaim, W. M. H. and Jabber, M. A. 2007. Improving access to good quality agri-inputs. In: Magor, N. P., Salahuddin, A., Haque, M., Biswas, T. K. and Bannerman, M., editors. PETRRA - an experiment in pro-poor agricultural research. Policy sub-project brief no. 10.3.1. Dhaka (Bangladesh): Poverty Elimination Through Rice Research Assistance Project, International Rice Research Institute. 4 p.

Rice and livelihood in the diversifying economy of Bangladesh (SP no. 14 00)

SP location:



Satkhira
Comilla
Maulvi Bazar

SP duration:

January - October 2001

SP organisations:

NRI
BRRRI
BARD
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HEED

SP team:

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M. A. Jabber

INTRODUCTION

Agriculture in Bangladesh is a sector in transition. It achieved self-sufficiency in rice in the late 1990s. It is diversifying and commercialising in response to rural-urban changes, to urban growth and to new patterns of food consumption. These trends are associated with re-allocation of resources leading to complex shifts in combination of rural economic activities and livelihood patterns. The purpose of the sub-project (SP) was to understand the income diversity mix of various socio-economic groups, with particular attention to locating rice within the livelihood strategies and income portfolios of resource-poor households in the three selected regions of Bangladesh: Satkhira, Comilla and Maulvi Bazar.



OBJECTIVE

The SP aimed to understand the following:

- 1) Improve understanding of the nature and type of livelihood diversification taking place in the study regions;
- 2) Understand the importance of rice within the livelihood strategies of resource-poor farmers; and
- 3) Identify approaches to livelihood opportunities for resource-poor households.

METHODS

The districts selected fell in three different agro-ecological zones. The villages selected were Gobindopur and Uttarkadamtala from the saline tracts in Satkhira district; Chandiara union in Comilla basin, a rich agricultural area; and Aloachowra-Khasi Punji-Moarichowra Noya Basti in the tilla region of Maulvi Bazar.

The study used a combination of participatory approaches with quantifiable measures of income diversification in order to achieve the objectives of the study. A household survey was used to elicit detailed information (e.g., on income, assets base, dependency on rice, among others) that could not be obtained through rapid participatory appraisals. The overall approach to the problem was to move from an understanding of community down to the household level. The sustainable livelihoods (SL) approach provided the framework for analysis.

RESULTS

Chandiara union in Comilla district:

- The village as a whole has benefited from agricultural growth and from the opportunities for diversification of livelihoods;
- The difference between the small and marginal farmers is also considerable; the average income of the small farmers being nearly twice that of marginal farmers. The small farmers, even with the same level of human capital, have been able to enter the market for overseas workers. This requires considerable initial investment;
- Small and marginal farmers respond in different ways to income generating opportunities. Wage labour income is more important to marginal farmers than to small farmers. The latter prefer to enter into self-employment. This could be related to the fact they appear to have more financial resources and hence are able to provide the seed capital to set up a small business;
- Though Chandiara has limited scope for intervention in rice, it is possible to note some of the wider problems, both current and future. Farmers have adopted the appropriate varieties of rice, but there is insufficient knowledge of use of pesticides and limited understanding of proportions of fertiliser application;
- There is scope for increasing income by sustaining vegetable production. This can be achieved by improving availability of good quality seed and by improving facilities for post-harvest crop management. Currently producers face a shortage of appropriate storage facilities and much output damaged by rodents. It was noted by the farmers that they have very little control over the storage facilities for potatoes. They are often forced to sell harvest to the cold storage owner, thus considerably reducing their profit. The NGOs can play a role in building partnerships between the private sector firm and farmers' organisation to address this problem; and
- There has been a decline in the amount of manure available following mechanisation. Encouraging households to keep dairy cattle would partly address this problem and increase the availability of milk.

Aloachawra-Khasi Punji-Moarichowra Noya Basti, Maulvi Bazar district:

- There is considerable scope to improve crop-based income. In addition to providing technical assistance, raising awareness among cultivators of using the right variety of seed, fertilisers, their application and the use of pesticide will have to be the starting point;
- Though there is scope for improving rice-based income, rice currently provides only a small share of overall household income. Thus, focusing only on rice will have little impact on household income. The opportunities for growing other, higher value crops should also be pursued;
- It is important to note that households have moved to non-farm activities because the opportunity cost of agriculture is high. Any initiative to raise income from crop-based activities must more than compensate this to attract farmers back to the land; and
- The principal constraint to growing vegetables, spices and fruits for the market is the poor accessibility of the village. It implies that targeting only one aspect of the

problem will have little impact;

- An improved road network would also increase income-generating opportunities in the non-farm sector. This sector has already proved important to marginal farmers and landless households; and
- The principal natural capital in this tilla region is the forests. The *Khasi* community demonstrates that it can be used to build SL strategies that provide substantial income. *Panjhum* also provides long term income without negative environmental consequences. The Bengali community could be encouraged to develop forest-based activity. This has implications for the entire tilla region that is susceptible to landslips and has limited scope for crop-based activities.

Gobindopur and Uttarkadamtala villages in Satkhira district:

- Rice is still the most important crop. However, the opportunity cost of persisting with agriculture on a small piece of land is high. This is because, on one hand, poor management of inputs and land results in low return, and on the other, there are new income-generating opportunities opening up in the non-farm sector. Any assistance to increase income from rice will give substantial benefits to most households;
- The principal constraints to raising rice – and other crop-based income are social and economic in nature. These are: lack of knowledge of appropriate application of fertilisers and pesticides; poor land management under modern varieties (MV) of rice; poor quality of seed; use of inappropriate variety of rice; low literacy that prevents farmers from questioning the traders supplying inputs; and high local cost of inputs;
- Raising awareness and understanding of cultivating MVs of rice and providing some informal education related specifically to agricultural issues that are central to farmers will generate substantial benefits. The community has identified training as fundamental to achieving any change; and
- Whilst provision of micro-credit is important, providing credit without addressing the issues noted above will not be sustainable. It could even take the beneficiaries of credit deeper into debt.

CONCLUSIONS AND RECOMMENDATIONS

- Diversification may cut through location, farm size, and ranges of wealth and income, but it has to be analysed with caution. The process is in response to micro-level variations in community and individual asset bases, cultural background and location; and to national-level mediating influence of policy and its implementation. Given the spatial variation in the pattern and dynamics of livelihood diversification, all rural poverty alleviation projects and policy design should be informed by an understanding of the push-pull factors, and of the emergent sectors offering alternative livelihood opportunities to resource-poor households;
- Whether the strategy to increase rice-based income is the most appropriate to enhance overall livelihood opportunities of resource-poor households has to be judged within the wider spectrum of problems and opportunities of the region;
- Care has to be exercised in identifying target groups. Further research could help to

identify more clearly the pathways out of poverty and the combination of assets (community and individual) that enabled them to do so. This knowledge would help to target intervention more efficiently. A study on 'Pathways from poverty: household-level processes of graduation in Bangladesh' (SP 26 02) gave considerable insights on strategies being taken by households and how policy interventions may support positive pathways (see Policy brief no. 3.3 in this series); and

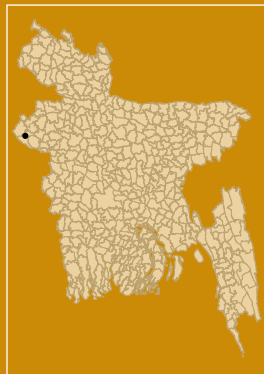
- Households are reallocating resources resulting in complex shifts in livelihood strategies. There is need to rethink who constitutes the target group and how it should be defined.

Suggested citation:

Dasgupta, N. and Jabber, M. A. 2007. Rice and livelihood in the diversifying economy of Bangladesh. In: Magor, N. P., Salahuddin, A., Haque, M., Biswas, T. K. and Bannerman, M., editors. PETRRRA - an experiment in pro-poor agricultural research. Policy sub-project brief No. 10.3.2. Dhaka (Bangladesh): Poverty Elimination Through Rice Research Assistance Project, International Rice Research Institute. 4 p.

Arsenic in food chain: assessment of arsenic in water-soil-crop systems in target areas of Bangladesh (SP no. 16 00)

SP location:



Chapai Nawabganj

SP duration:

January 2001 - June 2004

SP organisations:

BRRI
BAU
AAS

SP Team:

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M. Jahiruddin
M. S. Rahman

INTRODUCTION

Arsenic (As) is a metalloid element toxic to plants, animals and man. Ground water contamination by As is a severe problem in Bangladesh. Fifty-nine districts and 60% of the total land area are affected, placing about 20 million people at risk. Attention has mainly been given to the contamination of drinking water, yet aside from domestic purposes significant quantities of water from shallow aquifers are used for agricultural purposes, especially for the irrigation of dry season *boro* rice. Long-term use of As-contaminated water for irrigation may result in elevated As concentrations in soils, possibly leading to crop yield losses and elevated As concentrations in cereals, vegetables and other agricultural products.

The existing research in this area in Bangladesh is highly limited. Yet where rice is the staple food crop and is dependent on As-contaminated irrigation water, as in much of the country, such work is clearly important.



OBJECTIVE

The sub-project (SP) aimed to determine the following:

- i) Status of As in irrigation water, soil, rice grain and straw in selected districts;
- ii) Levels of As in different types of vegetables;
- iii) Yield loss in rice due to As accumulation in soil and irrigation water;
- iv) Effects of added As in the presence of phosphorus on yield and arsenic accumulation in rice;
- v) Effect of water management practices on As load in soil; and
- vi) As fixation, adsorption and desorption in soil.

METHODS

The Bangladesh Rice Research Institute (BRRI) was the lead organisation, in collaboration with the Bangladesh Agricultural University (BAU) and Agricultural Advisory Services (AAS), a non-governmental organisation (NGO). Research was conducted in 22 districts throughout Bangladesh, and involved the laboratory analysis of water, soil and plant samples; geographic information system (GIS) mapping; greenhouse experiments on the growth performance of rice in pots with varied doses of As and phosphorus; field experiments with different water management practices; and laboratory studies on As fixation, adsorption and desorption in soil.

RESULTS

Analysis of water samples taken from deep and shallow tube wells in 22 districts showed that about 24% of samples contained As levels above the permissible limit for drinking water in Bangladesh of 0.05 parts per million (ppm.). GIS mapping of As levels in groundwater showed that these levels tended to decrease as distance from rivers increased. Year-round monitoring of As levels in water from shallow tube wells showed that concentrations increased from December/January to May/June and then declined.

Analysis of 61 soil samples taken from 17 districts showed that 6 samples or just under 10% contained As levels above the permissible limit of 20 ppm. These 6 samples came from Kishoreganj, Shatkira and Jessore districts. Analysis of rice grain and straw in Chapai Nawabganj district showed mean As levels of 0.76 ± 0.23 ppm. in grain and 5.87 ± 3.32 ppm. in straw.

The As content on a dry-weight basis of 28 different vegetables in Chapai Nawabganj district varied widely. Mean As levels of above 0.55 ppm. were detected in tomato, papaya, brinjal, cauliflower, okra, chilli, bottle gourd, data shak, bean, lal shak, spinach, pat shak (tender jute leaf), sponge gourd, coriander, radish, *kachu shak*, ridge gourd and bitter gourd (*karala*). The highest levels were found in mustard, which showed a mean As level of 1.87 ppm., and the lowest in garlic, at 0.33 ppm.

Pot experiments using the rice varieties BRRI dhan29 and 30 and BR11 with As-contaminated irrigation water showed that grain yield declined significantly when As was applied at 20 ppm. The experiments also suggested a residual effect, indicating a deleterious effect on rice production in the long term. However, the study also suggested that the phytotoxicity of As to the crop decreased with the length of the exposure. Similar results were obtained with vegetables. Two studies of As and phosphorus interaction produced contradictory results

CONCLUSIONS AND RECOMMENDATIONS

The results of the SP suggest that As levels in irrigation water in the study areas are unlikely to affect the growth or yield of rice crops. Levels of As in soil of above 20 ppm. are however likely to affect yields, and the application of high levels of phosphorus may increase the toxicity of As-contaminated soils. Concentrations of As of below 1 ppm. in rice grains and most vegetables suggest that these are safe for use as food. However, high concentrations of As recorded in straw require further investigation where this is being used as fodder.

Further investigation is required to understand the wide variation and lack of correlation in the As content of water, soil, grain and straw. The seasonal variation in As levels in soils due to contaminated irrigation water and monsoon rains also needs further investigation on a long term basis.

Suggested citation:

Shah, M. A. L., Jahiruddin, M. and Rahman, M. S. 2007. Arsenic in food chain: assessment of arsenic in water-soil-crop systems in target areas of Bangladesh. In: Magor, N. P., Salahuddin, A., Haque, M., Biswas, T. K. and Bannerman, M., editors. PETRRA - an experiment in pro-poor agricultural research. Policy sub-project brief No. 10.3.3. Dhaka (Bangladesh): Poverty Elimination Through Rice Research Assistance Project, International Rice Research Institute. 2 p.

Dynamics of livelihood systems in rural Bangladesh: generation of information for facilitating dialogue on strategies and policies pertaining to the elimination of poverty (SP no. 24 01)

SP location:



B. Baria, Barisal, Bogra, Chapai Nawabganj, Chittagong, Comilla, Dhaka, Dinajpur, Gazipur, Joypurhat, Khulna, Kishoreganj, Kushtia, Lalmonirhat, Mymensingh, Netrokona, Rajshahi, Rangpur, Satkhira, Sylhet

SP duration:

October 2001 - June 2004

SP organisations:

IRRI
CPD
Socioconsult
BRRI
BRAC
BIDS

SP team:

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Rita Afsar
B. A. A. Mustafi

INTRODUCTION

This sub-project (SP) aimed to improve knowledge on the operation of the rural household economy in Bangladesh, and the impact of recent changes in technologies, infrastructure and institutions on poor households. This information will help build the capacity of policy makers, through debate on policy options, to improve the livelihoods of the rural poor. In addition, the SP went beyond understanding the role of rice cultivation in the household economy to consider resource allocation among all crops and other farm and non-farm activities.



OBJECTIVE

Specifically, the SP aimed to:

- 1) assess the relationship between the asset base of the household and its livelihood strategies, and how this relationship is mediated by the operation of the different organisations and institutions;
- 2) analyse the determinants of technological progress and how it benefits different socio-economic groups;
- 3) study the interface between changes in the operations of markets for seeds, land, labour, credit, and water, and other institutions; and
- 4) assess the contribution of technology, infrastructure, and institutions to the elimination of poverty.

METHODS

The International Rice Research Institute (IRRI) conducted the study, through support from the United Kingdom Department for International Development (DFID)-funded Poverty Elimination Through Rice Research Assistance (PETTRA) project, and in collaboration with a number of Bangladesh institutions engaged in socio-economic and policy analysis such as Centre for Policy Dialogue (CPD), Bangladesh Institute for Development Studies (BIDS), the Research and Evaluation Division of Bangladesh Rural Advancement Committee (BRAC), the Agriculture Economics Division of BRRI, the Economics Department of Jahangirnagar University (JU) and Socioconsult Ltd., a private consultancy firm.

To analyse the changes in agro-socio-economic conditions in the different rice-growing environments in Bangladesh over the period 1988-2000, data from a 1987-88 survey conducted by BIDS and IRRI over 62 villages was used as a benchmark,

and data from a re-survey of 30 selected villages in 2000-2001 used to see changes in the household economy. In addition, focus group discussions using participatory rural appraisal (PRA) techniques were conducted by Socioconsult, to generate qualitative data to supplement the quantitative data collected through the structured questionnaire.

These two data sets were used to prepare background technical papers on key policy issues relevant to poverty reduction, and for facilitating policy dialogues involving the different stakeholders in Bangladesh civil society. The policy dialogues discussed improvements to existing policies to promote agricultural development. In particular, they dealt with the following areas:

- 1) seed delivery systems;
- 2) rice research and extension linkages;
- 3) farmer-research dialogue on demand for improved rice technologies;
- 4) promoting the rural non-farm economy;
- 5) impact of trade liberalisation on the crop sector;
- 6) biotechnology for rice improvement;
- 7) participation of rural women in economic activities; and
- 8) rural poverty mapping. Senior government officials, including Ministers and Secretaries of the different government agencies, political leaders, academics, researchers and scientists from agriculture and development agencies, donors, NGOs, and journalists participated in the dialogues. Outputs from the policy dialogues were published as policy briefs by CPD. The media also took part in the dissemination of the dialogue outputs, with articles on the issues discussed and the recommendations developed published immediately after each dialogue in the country's top newspapers. The findings will be published in a book by the University Press Ltd (UPL).

RESULTS AND RECOMMENDATIONS

Poverty reduction through rice research

Rice research has contributed to poverty reduction in Bangladesh via both direct and indirect pathways. Owner and tenant farmers have benefited from higher productivity and lower unit cost of production, and from increased incomes obtained from the adoption of modern varieties (MVs). Landless labourers have benefited from increased employment opportunities in rice cultivation and in the processing, trade and transport of rice and agricultural inputs. This is the direct pathway. On the other hand, increased rice productivity has helped to reduce price of rice relative to other commodities. Lower rice prices have indirectly helped to reduce poverty, as nearly 40% of the expenditures of the poorest 60% of the population are on rice. In the long run, poverty alleviation requires a structural transformation of the economy away from agriculture towards non-farm activities (industry and services). Increased rice productivity has facilitated this process by releasing resources for diversification into more productive and profitable non-farm activities.

Rural non-farm economy

The importance of the rural non-farm economy in Bangladesh is well recognised and it

accounts for over 40% of rural employment, contributing about 31% to the country's gross domestic product (GDP) compared with 23% by the agricultural sector. Exploitation of this potential, however, requires support from the public sector in the development of infrastructure, particularly transport, power and communications; improvement in the quality and coverage of technical education; providing market information and training facilities for entrepreneurship development; and providing access to finance or credit facilities to resource-poor rural households.

Trade liberalisation and the crop sector

Bangladesh is gradually integrating her economy into the global economy and liberalising her crop sector. However, both farmgate prices and margins are substantially higher in Bangladesh compared to Thailand and Vietnam because of the high cost of irrigation. Further, in recent years, India has been exporting rice and wheat at half of their economic cost. Under these conditions, Bangladesh must take a pragmatic approach in her trade policy: 1) allow unrestricted import of crops where Bangladesh does not have a comparative advantage such as wheat, sugarcane, rapeseed and mustard; 2) increase tariffs within the bound rate on rice importation and consider imposition of anti-dumping duty; 3) provide subsidy on diesel and consider rapid electrification to reduce irrigation costs; and 4) vary tariff rates in the annual budget on the basis of assessment of harvests and the prevailing world market prices.

Biotechnology in rice research

The application of biotechnology tools in rice research is an option for sustaining growth in rice production. However, biotechnology is still new in Bangladesh and there is currently some opposition from the private sector due to perceived risks. Nonetheless, Bangladesh civil society is not yet hostile to biotech research and genetically modified organisms (GMOs), if regulated under international standards of bio-safety. An implementation mechanism should be put in place so that research organisations can start testing genetically engineered products in Bangladesh, and the education and research infrastructure adjusted to bring the benefits to poor farmers and consumers.

Rice marketing in Bangladesh

During the harvest season, when rice supply is high, the price is low. Since most farmers sell their produce right after the harvest, their gross incomes are also low. The problem is aggravated by a lack of proper market information and the absence of storage facilities. Results of the study showed a high variation in rice prices among the different marketing channels. An effective and efficient network of paddy/rice marketing should be developed in and around the production zones to simplify the marketing system and divert profit from market intermediaries to the rice farmers.

Seed delivery system and seed policy

Studies show that continuous use of unclean seeds from farmers' own produce lowers production, whereas the regular use of purchased seeds increases yield by 12-17%. The seed delivery system in Bangladesh was being managed by the public sector until recently when the private sector and non-governmental organisations (NGOs) became involved. This development improved seed delivery in the country but an efficient seed delivery system has yet to emerge. Study of the rice seed delivery system showed three weaknesses: 1) infrequent replacement of seed by new varieties; 2) long delays in the

development and release of a variety; and 3) lack of institutionalised coordination among the research and development (R&D) institutions. An efficient seed delivery system is required with the active participation and collaboration of private and public sectors and farmers' organisations.

Increased participation of women in rural economic activities

To increase the participation of rural women: 1) all government programmes must target rural women as equal stakeholders; 2) Technology development research should be sensitive to women's increasing role in agriculture; 3) The government should initiate a special project for training women on improved agricultural technologies, and livestock management; 4) The pilot project on family approach to extension should be replicated nationwide; and 5) Agricultural credit should be channelled through women.

Rice research strategy by ecosystems

Rice research needs and consequent research strategies vary among ecosystems. In favourable ecosystems, rice research strategies must focus on shifting yield potential through hybrid and super rice; technologies for efficient use of inputs (water and nutrients); and development of shorter maturity varieties to support crop diversification. In flood prone ecosystems, research strategy should focus on developing cold-tolerant shorter-maturity *boro* varieties; systems research on pairing of *boro* and *aman* varieties and management practices for expansion of *aman* area; pure line selection of traditional land races; and rice-fish systems in flood-plains. In drought prone ecosystems, the major issues are supplementary irrigation, the disappearance of *aus* rice and flexibility in land use for diversification. Research for the improvement of *aus* rice is a waste of resources, and research strategies for drought prone ecosystems must focus on development of shorter maturity varieties for crop diversification and on saving water in rice cultivation; developing direct-seeded methods and technologies for weed control. Labour saving technologies for all ecosystems are essential.

Farmers' assessment of research needs

Agricultural diversification cannot be achieved unless resources are released from rice cultivation. Further growth in rice productivity is needed so that rice needs can be met with less land, labour and water. Agricultural research must keep in view the needs of the system, rather than individual crops. This will require much stronger coordination among research institutes, and greater interaction between researchers and farmers.

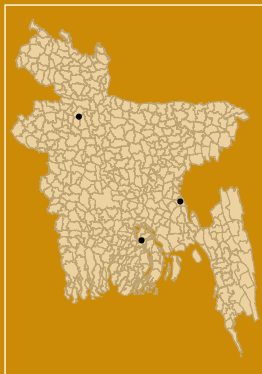
During a farmer-researcher dialogue, researchers presented technologies believed to have potential, and farmers shared their views and expectations. Farmers demanded new rice varieties with the following characteristics (in order of priority): high yielding and short duration, lodging resistance, grain shattering resistance, and good quality grain; drought tolerance, submergence tolerance, and cold tolerance. Flood prone farmers preferred tall plant suitable for lowlands. Rice researchers must take these views into account when they prioritise their research agenda.

Suggested citation:

Hossain, M., Deb, U. K., Chowdhury, A., Sen, B., Afsar, R. and Mustafi, B. A. A. 2007. Dynamics of livelihood systems in rural Bangladesh: generation of information for facilitating dialogue on strategies and policies pertaining to the elimination of poverty (SP 24 01). In: Magor, N. P., Salahuddin, A., Haque, M., Biswas, T. K. and Bannerman, M., editors. PETRRA - an experiment in pro-poor agricultural research. Policy sub-project brief No. 10.3.4. Dhaka (Bangladesh): Poverty Elimination Through Rice Research Assistance Project, International Rice Research Institute. 4 p.

Pathways from poverty: household-level processes of graduation in Bangladesh (SP no. 26 01)

SP location:



Barisal
Bogra
Comilla

SP duration:

October 2001 - June 2004

SP organisations:

NRI
BRRRI
BARD
RDA
DEVCOM

SP team:

Alastair W. Orr
Barbara Adolph
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INTRODUCTION

At present, we know more about poverty as a fixed state or condition than about poverty processes. From a policy perspective, this is an important knowledge gap. Poverty is a dynamic phenomenon, with households moving backwards and forwards across the poverty line. Better knowledge of these poverty processes would allow government and development organisations to devise more effective policies and programmes to eliminate poverty.



New rice technology plays a critical role in the economics of graduation. By increasing household food production and stabilising the price of rice, it frees resources for investment in education, health care, etc. and allows farm households to specialise in economic activities that increase income. Hence, new rice technology makes rural livelihoods more diverse and (paradoxically) less dependent on agriculture. This does not mean, however, that increased rice production plays only a limited role in eliminating poverty. Rather, high rice productivity and stable rice prices provide the platform for increasing income through specialisation in high-value farm products and diversification into non-farm economic activity.

The sub-project (SP) Pathways from poverty used qualitative methods to investigate poverty processes at the household level in three purposively-selected villages in Bogra, Barisal, and Comilla districts. The qualitative tools used included participatory rural appraisal (PRA) for site characterisation, participatory poverty analysis (PPA), and household case-studies. Results were presented in the form of three narrative reports for each research site. The research was designed to complement the SP Dynamics of livelihoods systems (DOLSys) (see policy sub-project brief 10.3.4 in this series) that conducted a quantitative panel survey on poverty trends, part-funded by PETRRRA. This research focused on processes of upward mobility and exit routes from poverty to complement previous research on vulnerability and the dynamics of downward mobility.

The Natural Resources Institute (NRI), UK was the lead agency in partnership with three local research bodies, namely the Bangladesh Rice Research Institute (BRRRI), the Bangladesh Academy for Rural Development (BARD) and the Rural Development Academy (RDA). A fourth partner was the local firm DEVCOM Ltd., which was contracted to shoot two videos. The first was a documentary showing case studies of poverty processes, targeted at policy-makers. The second was a longer documentary showing the research process and methodology used by the SP, which would be suitable for further training in the use of qualitative methods by research partners.

OBJECTIVE

The SP aimed to determine the following:

- i) Increased capacity among partner institutions to design and conduct qualitative research on poverty;
- ii) Enhanced knowledge among key stakeholders (researchers, policy makers, trainers, donors) of poverty processes; and
- iii) Strengthened dialogue between policy-makers and researchers on constraints and opportunities for pro-poor policies.

METHODS

The research component of the SP lasted one calendar year and was conducted in four stages.

- In Stage 1 (four months), research sites were characterised and described using qualitative methods.
- In Stage 2 (two months), partners conducted a PPA and made a mini-survey to collect basic quantitative information about each household in the village. The mini-survey comprised a household census, and surveyed 169 households in Dariabad (Barisal), 208 households in Bhabanipur (Comilla), and 222 households in Darikamari (Bogra Sadar).
- In stage 3 (six months), researchers conducted a detailed series of purposively selected household case-studies to document poverty processes. Case-studies numbered 11 households (Dariabad, Barisal), 9 households (Darikamari, Bogra), and 10 households (Bhabanipur, Comilla) giving a total of 30 households.
- In Stage 4, research findings were summarised in short presentations that were delivered at a Final Workshop at BARC Auditorium, Dhaka.

RESULTS

- Capacity-building was viewed as a major output of the SP with research teams from BRRI, BARD, and RDA (14 people) being trained in the use of qualitative methods for poverty research;
- A methods manual (Rice and poverty: a casebook for researchers and practitioners) and a video documenting training methods were prepared and circulated to the relevant stakeholders. The SP produced two videos. The first was designed to be screened before policy-makers, and included case-studies of three households that had recently graduated from poverty. This video was screened at the final workshop and appreciated by the audience;
- Research findings were presented at the workshop on Agriculture and policy organised by Centre for Policy Dialogue (CPD) in April 2003, and in a one-day final workshop at BARC in January, 2004; and
- A policy brief summarising main policy impacts was written and circulated to the relevant stakeholders (see policy brief no. 3.3 in this series).

CONCLUSIONS AND RECOMMENDATIONS

- Findings from village studies could not provide general recommendations. Supported by data from the panel survey, however, they offer useful insights for policy-makers and rice researchers;
- Many poor households had improved their position over the past decade. But overall poverty remains high because many households who were once extremely poor are still moderately poor, and because some households have recently become poor. Thus, poverty elimination requires policies that both a) help people get richer; and b) stop people getting poorer;
- Graduation from poverty was closely linked to the household life-cycle. Saving by cutting consumption was critical in the first phase. In the second phase, households invested savings in low-risk strategies and re-invested income. Women's income was important to minimise cash outlays. In the third phase, income rose as children began earning. Households moved into riskier, higher-paying strategies. Savings were invested in land, housing, and education that signified their new status. Finally, income declined if children separated to form households of their own but might continue to rise in joint families;
- Unexpected shocks posed severe setbacks to graduation. High medical bills and fraud were common experiences. This highlighted the importance of effective institutions (medical services, contract enforcement and the legal system) in enabling households to move out of poverty;
- Non-farm income was the main pathway from poverty. This included income from overseas migration, which was important for households moving out of moderate poverty. Opportunities for non-farm jobs in transport and construction were high in the peri-urban village but limited in the riverine village;
- Graduation from poverty was about food security as well as income. The majority of households that moved up also increased the number of months they were self-sufficient in rice. Irrespective of livelihood strategy, successful households invested in rice production and in land. Thus while non-farm income was the principal means of graduation, household food security was an important livelihood outcome;
- Agriculture was an important pathway from poverty where poor households could rent land. Land-poor households were moving into the space vacated by richer households as they left agriculture for non-farm occupations. This was particularly striking in Comilla, where overseas migration had increased the land available for rent. The shift to cash rents increased economic incentives among tenants, and created opportunities to tailor rice technology to meet the needs of poorer farmers. Land tenure legislation that might reduce the supply of land for rent would be counter-productive;
- Urban markets had created new opportunities for poor households in agriculture. These included labour-intensive enterprises like milk-production and cash crops like *kochu* in which poorer households had a comparative advantage. Improvements in infrastructure and transport would increase these opportunities;
- The paradox of remarkable upward mobility among the poor with slow aggregate

decline in poverty, explained by high vulnerability, which created more poor households. This underscored the role of PETRRA in targeting tomorrow's poor; and

- The importance of agriculture in providing households with a food security platform for diversification, and the need for government to re-engage with agriculture and revise price policies that had eroded the profitability of rice production.

For further reading:

- Policy brief number 3.3 in this series.

Suggested citation:

Orr, A. W., Adolph, B., Islam, M. R., Barua, B. K. and Rahman, H. 2007. Pathways from poverty: household-level processes of graduation in Bangladesh. In: Magor, N. P., Salahuddin, A., Haque, M., Biswas, T. K. and Bannerman, M., editors. PETRRA - an experiment in pro-poor agricultural research. Policy sub-project brief No. 10.3.5. Dhaka (Bangladesh): Poverty Elimination Through Rice Research Assistance Project, International Rice Research Institute. 4 p.



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