Report on the System of Rice Intensification (SP 36 02)

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Abstract

The system of rice intensification (SRI) can significantly increase rice production through effective integration of soil, water, nutrient and plant management, without dependence on high-cost modern inputs. The method can improve soil quality and is environment-friendly. In the SRI method, the farmers are the implementers of the method that helps reduce the gap between scientists' and farmers' results. Scientists should be interested to find out scientific explanations why SRI yields often exceed the " maximum biological yield" for rice. The research steps under the SRI sub-project methodology included site selection, selection of resource-poor farmers (RPFs) through baseline survey, formation of FSS, provision of training, and trials in farmers' fields.

The findings of *Boro* 2003 season data show that SRI cost of rice production was 7% less than that of farmers' methods. Yields were 30% higher, and rice provisioning ability increased by at least one month for 41% of male and 14% of female farmers. Farmers' participation increased by 62%, and female farmers constituted 14% of all farmers. Farmers' return under SRI method increased by 58%, compared to their usual practice. Based on one season's results, tentative recommendations have been made that include extension of the trials by another three years, conducting research on both understanding of the SRI principles and improving the adaptability of SRI. For obtaining better results from SRI, appropriate area selection, taking measures for improving soil quality, and ensuring soil aeration are needed. For increasing sustainability of SRI, an active role of DAE and closer GO-NGO collaboration are necessary. Use of mass media is recommended for scaling up SRI methods.

Description of innovation

The System of Rice Intensification (SRI) is a new method of rice production management by farmers in which, with proper and effective integration soil, water, nutrient and plant management, rice production can be increased significantly without increasing inputs and production cost. The system involves transplantation of single (or often two) relatively young seedlings, with wider spacing, alternate drying and wetting of the plot, proper weeding for removing weeds and for soil aeration, using more organic manure and biomass, and consequently applying less and less chemical fertilizer and pesticides. The method has the added advantage of a favourable impact on soil fertility, offering a number of environmental benefits and contributing to sustainable production.

In the context of Bangladesh, where cultivable agricultural land has been declining every year and where an increasing population is creating additional demand for food crops, our farmers are using more and more chemical fertilizers, more irrigation, and more pesticides, which have adverse effects on soil quality and on its productivity. The farmers, especially those who are resource-poor, are losing interest in rice cultivation as its profitability is declining with the rise in input costs. The technology also aggravates environmental degradation.

The answers to all these problems may lie in adopting a new rice production method for ensuring higher yield while using less land and reducing the use of costly modern inputs such as chemical fertilizers, irrigation and pesticides. We also need to enhance the sustainability of rice production by increasing its profitability, improving soil quality, and reducing environmental hazards. In this context, the PETRRA sub-project on SRI was undertaken to examine the potentials of SRI for realizing the above goals.

Context

Our farmers have valuable indigenous knowledge of rice cultivation, which, however, may be further upgraded for increasing productivity, profitability and contributing to a more sustainable rice production system. Rice scientists have evolved modern technologies for raising yield of rice substantially, but these are heavily dependent on costly modern inputs such as use of chemical fertilizer and pesticides, having adverse effects on soil and environment. Increased exploitation of underground water for irrigation is also going to create environmental hazards. Usually scientists provide a new technology to the farmers after verification in their research plots. When this technology is recommended for practice in the farmers' fields, there may arise some gap between the scientists and farmers' results. Especially in Bangladesh this gap has been found to be significantly high.

In the SRI sub-project, to minimize this gap, farmers have been brought to the forefront. In this regard, resource-poor farmers were targeted for rice cultivation using SRI. The unique feature of the sub-project is that the farmers, through organised farmers' field schools (FFS), are the implementers of the methods under trial. The researchers' role is mainly that of facilitators in providing them with the basic knowledge on SRI methods, monitoring their field operations and management practices, and evaluating the results of their trials. The SRI method was initially evolved in Madagascar with direct participation of farmers. This system, which was developed there in the early 1980s, shows promise for substantially raising the yields of irrigated rice, to perhaps twice the present world average of 3.6 tons per hectare, while also offering a number of environmental benefits (CIIFAD, 1999; Stoop et al. 2002).

Nevertheless, in conducting SRI trials in Bangladesh, scientists and especially in this case the microbiologists have to play a key role in finding scientific explanations for how the SRI yields often exceed "maximum biological yield" for rice. Scientists in other countries are already working in this area.

Methodology

As this was a participatory action research sub-project on a new method of rice production management, the main steps followed in this research were as follows:

1. Site selection: Noakhali (Begumgonj, Chatkhil), Comilla (Debidwar, Burichang), Bogra (Kahalu, Nandigram), Rajshahi (Putia, Durgapur)
2. Selection of RPFs through baseline survey and formation of FFS
3. Providing training to the RPFs
4. Trials on SRI in farmers' field
5. Monitoring and evaluation of trials by researchers
6. Experience sharing on comparative advantages and disadvantages of SRI vs. farmers' methods

Analysis

Variety cultivated: Different varieties were selected in different sites by the four partner organizations. These included BR 14, BR 16, BR 28, BR 29, IR 50, Anamika, and BINA 6.

Table 1: Cost-effectiveness (Tk/ha) in SRI and farmers' method (Boro season 2003)

Cost item	SRI practice	Farmer's existing practice	SRI cost reduction over FM (%)
Land preparation	2776.5 (13)	2598 (12)	-7
Seed	362.5 (2)	858.5 (4)	58
Fertilizer	3256.5 (16)	3377.5 (15)	4
Irrigation	4934.5 (24)	5016.5 (22)	2
Weeding	3600.5 (17)	4357.5 (19)	17
Labour	5516 (26)	5658.5 (25)	3
Pesticide	543 (3)	689 (3)	21
Total	20989.5 (100)	22555.5 (100)	7

Note: Figures in parentheses indicate percentage

Rice production cost: It was noticed that the SRI farmers applied both organic and chemical fertilizer in their rice field. Farmers were to some extent careful in applying required irrigation in the SRI field but generally used more than recommended. Due to fewer pest and disease problems, 90% farmers did not apply any pesticide in SRI fields. All these factors contributed to lower production cost (7%) compared to normal practice.

Table 2: Yield (t/ha) in *Boro* 2002-03 season for SRI vs. farmers' existing practice

Method	BRAC	SAFE	Syngenta	POSD
SRI method	8.3	7.7	7.1	6.8
Farmers' practice	5.8	6.5	5.0	5.6

Table 3: Farmer participation in SRI trial during 2003 and 2004

Farmers' participation	**BRAC**		**SAFE**		**POSD**		**Syngenta**	
Boro season	2003	2004	2003	2004	2003	2004	2003	2004
Male farmers	129 (100)	200 (100)	78 (83)	154 (81)	130 (65)	130 (65)	64 (100)	200 (100)
Female farmers	0	0	16 (17)	37 (19)	70 (35)	70 (35)	0	0
Total	129	200	94	191	200	200	64	200

Note: Figures in parentheses indicate percentage

Rice provisioning ability: Farmers' rice self-provisioning ability increased by at least one month for 41 % of the male and 14% of the female farmers. This has been due perhaps due to the increase in rice production through the practice of SRI methods. However, no judgment should be made yet on this based on one season's trials on very small plots.

Table 4: Rice provisioning ability (RPA)

Rice Provisioning Ability (RPA) at the beginning of the project			Number of farmers who increased their RPA by the end of the project, by number of months and sex								Percentage of farmers who increased RPA by at least one month	
RPA category (months)	No. of participating farmers		0		1		2		3 or more			
	M	F	M	F	M	F	M	F	M	F	M	F
Less than 3	7	1	4	0	3	1	0	0	0	0	38	13
3-5	21	9	12	0	9	8	0	1	0	0	30	30
6-8	125	43	39	14	71	20	12	9	3	0	51	17
Greater than 8	112	22	67	14	25	8	15	0	3	0	32	6
Total:	265	75	132	28	108	37	27	10	6	0	41	14

Agronomic findings: The total number of tillers and effective tillers per hill was found to be about twice under SRI compared to farmers' practice. The number of grains per panicle and grain weight were also higher under SRI, while the percentage of unfilled grain was lower (Table 5). These appeared to have contributed to the higher SRI yield.

Table 5: Agronomic findings of SRI vs. farmers' practice

Yield components	SRI	Farmers' practice
No. of tillers per hill (40-45 days before harvest)	32	17
No. of effective tillers per hill (5-10 days before harvest)	25	12
No. of grains per panicle	169	131
Weight of grain (g/1000 grains)	27	24
% of unfilled grains	14	19

Income level: Farmers have been able to make a substantial increase in net return from their SRI fields (Tk 35,212) compared to their rice plots cultivated with standard methods (Tk. 22,311) calculated on a hectare basis. However, these data, based on one season's result, may not be treated as conclusive.

Recommendations

SRI is not considered as a technology but a method. However, if we consider its different practices as a technology, particularly in the context of PETRRA sub-project, the following recommendations may be made. These may be termed as tentative since they are based on one production season only.

Next step: One major limitation of the SRI/ PETRRA was that the evaluation of SRI trials under the sub-project could be done for only one production season. The results were positive and encouraging. Farmers received higher yields, increased their rice-provisioning ability (RPA), and showed great interest in adopting SRI cultivation during the second production season. Therefore, it is recommended that SRI trials be continued for a further period of three years, to come up with more reliable recommendations.

During the extended period, attempts should be made to refine SRI practices for Bangladesh conditions and assess their adaptability. Attempts should also be made during this period to conduct soil microbiological research and identify scientific reasons behind the higher yield response under SRI practice. Adaptive research would also be useful on seedling raising and transplantation, particularly during the cold winter season (Boro) to minimize mortality rate and help better crop establishment under different agro-ecological conditions.

Potential risks: SRI method would not be suitable for application all over the country, because it needs good soil drainage and controlled irrigation facilities for best results. If soil improvement measures like adding organic matters and biomass and appropriate cropping pattern are ignored, SRI methods will not provide the optimum results. Weed management is another major factor for successful SRI cultivation. If weeding is not done both to remove weeds and increase soil aeration, SRI method will not give all the benefits attainable.

Sustainability: SRI method needs proper understanding of its principles and good management skills of the farmers. It needs farmers' interest and motivation and close supervision by field-level extension workers at the initial stage. The DAE needs to be actively involved to provide technical and support services, including farmers' training and extension. NGOs can also play an important role in extending SRI. GO-NGO collaboration is essential to promote and sustain this new method of rice production in the long run.

Scaling up: Large farmers, who are better able to be risk takers, may be brought under the SRI cultivation programme, which will ultimately encourage the smaller and resource-poor farmers to follow suit.[1] Extensive use of mass media should also be made for scaling up SRI method throughout the country.

In conclusion, better human resource development and enhancement of research endeavours are the key factors for realizing the available benefits from SRI. It may not be an exaggeration to say that from a better understanding of the science behind SRI, we might get important insights about agricultural production methods for tomorrow's survival.

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[1] Under PETRRA auspices, a team of researchers involved with this sub-project visited Andhra Pradesh in April, 2004, to observe the use of SRI in that state of India. We were surprised and pleased to learn that one commercial farmer in the Godavari delta was cultivating, in boro season, a continguous field of 110 acres (44 ha) of SRI rice, so this is not limited to small farmers. From that field, a yield of 10 t/ha was expected. This was the production level expected for about 6,000 hectares of SRI rice fields. The new methods were introduced into that state only in the previous kharif season.