SAFE Development Group

VERIFICATION AND REFINEMENT OF THE SYSTEM OF RICE INTENSIFICATION (SRI) IN SELECTED AREAS OF BANGLADESH (SP:36 02)

Supported by PETRRA Project

Trial Monitoring Report

by

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Executive Summary

The System of Rice Intensification (SRI) plots had more rice yield compared to the farmers' practice (FP) plots. The farmers from their SRI plots received 19% higher yield compared to their FP plot during the last Boro 2003 season. The SRI plots also produced more hay (12%) compared to the hay produced in the FP plot. The cost of production for SRI was marginally lower, by 3%. The costs of rice cultivation in SRI plots were less in land preparation, seed, fertilizer, pesticide and irrigation. Cost for own labor and 'other costs' was higher in SRI plots. The rice sales value (at the rate of 300 Taka per maund[1]) from the SRI plots showed a 19% difference. All in all, the SRI plots had 42% more gross return from rice production compared to FP plots.

The major difference in rice cultivation practices are: (1) The age of seedling when transplanted in the rice field SRI plot was around 15 days. While the age of seedling in the FP plots were generally more than 30 days old. (2) The SRI plots maintained a spacing of 25 X 25 cm while FP plots had the spacing of 15 X 15 cm. (3) The SRI plots were supplied with more organic fertilizer and less chemical fertilizers while the FP plots had less of organic fertilizer and more of chemical fertilizers.

The SRI plots had double the number tillers in FP plots (SRI plots 31 vs. PF plots 16 tillers). Similarly SRI plots had double the number of effective tillers compared to FP plots (SRI plots 24 vs. FP plots 12 effective tillers). SRI plots had 32% more grains per panicle than the FP plots. The rice grains of SRI plots had more weight compared to grains of FP plots.

Rice varieties *viz*. BR 29, Anamica, BR 28 and BR 16 shown to have better performance. The varietal performance may be in conclusive because of less number of samples.

The farmers at the end of the season result-sharing meeting, commented that SRI practice gave them more yields. They also said that the result of SRI practice gave them more confidence and they would like to extend SRI practices to larger plots. But the farmers feel that there are some social and technical barriers to overcome the current farmers' practice for adopting SRI method of rice cultivation in large scale.

[1] One maund is equal to 40 kg.

SRI Trial Monitoring Report

Introduction

This report presents results of trial on SRI conducted in the period of December 2002 to June 2003 i.e. Boro 2002. There were 50 farmers in Burichang and 50 in Debidwar involved with the project.

System of Rice Intensification is one of the improved systems of rice cultivation management that has been initiated in Madagascar, in the early 1980s, which contributes higher yield like 10-12 ton per hectare. China, Sri Lanka, Myanmar, Cambodia, the Philippines, Cuba, Indonesia, Laos, and several other countries have introduced the system for better yield. A little work has been done in Bangladesh with encouraging results of these countries. The SRI trials showed appreciable results in different parts of Bangladesh. So, it is the appropriate time to test SRI practices at the farmers' field to evaluate its performance with its different production factors and develop an appropriate strategy to better assist the resource poor farmers for achieving food security and improving their livelihoods.

Considering the high potentials of SRI under the socio-economic and agro-ecological conditions in Bangladesh, some organizations like CARE, BRRI, DAE, BRAC and Syngenta Bangladesh Ltd. started initial trials individually during the last two-three years. In January 2002, a national workshop on SRI was held in Dhaka where the representatives from different organizations involved in SRI trials participated along with Prof. Norman Uphoff, the Director of the Cornell International Institute for Agricultural Development (CIIFAD), and Dr. Noel Magor, Project Manager, PETRRA. The workshop resolved to carry on organized and systematic trials on SRI in Bangladesh. A Steering Committee was set up in the workshop.

Currently a PETRRA sub-project (sp:36 02) titled 'Verification and Refinement of SRI in selected areas of Bangladesh' has been operating in various areas of Bangladesh with the implementing organizations such as SAFE, POSD, BRRI, Syngenta, AAS. Safe has been working in Burichang and Debidwar Upazila of Comilla District since last Boro 2003 season. A total of 100 man farmers including 38 women were actively involved in 10 farmers field school groups (FFS's). During last Boro season a total of 30 SRI trials were set up by the resource poor farmers to test out the potentials and feasibility of SRI in their rice field. Farmers transplanted tender age rice seedling (15 – 20 days) at wider spacing in SRI practice. The SRI practice showed a higher yield by 19% compared to the traditional method that the farmers have been following since Green Revolution.

Methodology

The 100 farmers involved in the project were trained on SRI. The training started before the farmers started preparing seedbeds. The training was conducted rice growth phase/ stages wise. The trainings curriculum included all the phases of rice plant growth. Most of the training sessions were conducted before the farmers start seedbed preparation.

The farmers were given necessary information on SRI through the trainings but the practice they adopted was rested upon their discretion. This strategy of letting farmers take their own decision about the SRI trials, was followed to have the trials conducted in a more farmer-friendly way. For example no new variety was selected so that they cultivate the usual variety and find real difference between the result of SRI and FP plots. This was also meant to be more real life situation based intervention.

Each of the farmers was asked to have a portion of one of their piece of land separated with dikes for SRI practices. Therefore, each of the farmers had a small portion in one of their rice cultivating piece of land separately put forth for SRI practices. There were 11 farmers in Burichang and 19 in Debidwar who had SRI practice plots adjacent to one of their rice cultivating lands. The project staff visited the rice field often and worked with the farmers in terms of training and sharing information.

Cultivation Practices

The trial setting was done in a participatory approach. The choices of different practices by the farmers were at their own discretion. All the farmers had one SRI practice plot (SRI Plot), which was cultivated in a smaller piece of land adjacent to the farmers' practice plot (FP Plot).

Land area

The average land area for SRI practice plots was 3 decimals (*median=3, and mode=3*) while the farmers' practice plots were 18 decimals (*median=16, mode=22*).

Land Area

Project Area	SRI Plots			Farmers Plots		
	Number of Plots	Mean Land Size	St. Deviation	Number of Plots	Mean Land Size	St. Deviation
Burichang	11	2.81	.9816	11	16.18	9.8774
Debidwar	19	3.10	2.2582	19	19.10	12.1009
Total	30	3.00	1.8754	30	18.03	11.2510

Table 1: Distribution of plot area (decimals) by different cultivation practices.

Rice variety

Farmers selected the variety of rice that they would prefer to cultivate. There was no instruction from the project on the selection of rice variety. The rice varieties were not intended to change so that impact of SRI can be observed in a better way.

Rice Variety Cultivated

Rice Variety	SRI Plots			FP Plots		
	Burichang	Debidwar	Total	Burichang	Debidwar	Total
Anamica		2	2		2	2
BINA 6	1		1	1		1
BR 14		9	9		9	9
BR 16	1	3	4	1	3	4
BR 28	4	2	6	4	2	6
BR 29	2	2	4	2	2	4
IR 50	1	1	2	1	1	2
IRRITON	1		1	1		1
Irrita	1		1	1		1
Overall	11	19	30	11	19	30

Table 2: Rice varieties cultivated by project area

There was no difference in rice variety cultivated in SRI plot and FP plot. All the varieties were HYV.

Plowing

The SRI plot was (for all farmers) a small piece of land adjacent to FP plot. The SRI plots were part of the FP plot separated by a dike made for the trial. Therefore, there was no difference in number of times the rice plots of SRI and FP were plowed.

Number of Times Ploughed

Number of Times	SRI Plots			FP Plots		
	Burichang	Debidwar	Total	Burichang	Debidwar	Total
Once	1	12	13	1	12	13
Twice	10	7	17	10	7	17
Total	11	19	30	11	19	30

Table 3: Plowing of land by project area

Fertilizer Application in Land Preparation

In the SRI training the farmers were advised to use more organic fertilizer in the SRI plot but they were told to use chemical fertilizers in usual dosage in the FP plot. The fertilizer use pattern is as practiced by the farmers during the trial period is presented below.

Fertilizer Use Pattern in Land Preparation

Project Area	SRI Plots							FP Plots						
	Organic	Urea	TSP	MP	Gypsum	Zinc	Other	Organic	Urea	TSP	MP	Gypsum	Zinc	Other
Burichang	11	0	7	7	9	7	9	8	2	9	9	1	3	4
Debidwar	19	0	10	10	13	15	14	3	3	17	18	0	1	3
Total	30	0	17	17	22	22	23	11	5	26	27	1	4	7

Table 4: Number of plots the particular fertilizer was applied by project area

Fertilizer Application in Top-dressing

Fertilizer Use Pattern in Top-dressing

Project Area	SRI Plots							FP Plots						
	Organic	Urea	TSP	MP	Gypsum	Zinc	Other	Organic	Urea	TSP	MP	Gypsum	Zinc	Other
Burichang	0	11	0	0	0	0	0	0	11	0	0	0	0	0
Debidwar	0	19	0	0	0	0	0	0	19	0	0	0	0	0
Total	0	30	0	0	0	0	0	0	30	0	0	0	0	0

Table 5: Number of plots the particular fertilizer was applied by project area

Seedling age when transplanted

The farmers in the training session for SRI were advised to transplant seedling on the 15th day or before from the seedbed to SRI plot. They were also told that in the FP plot they would transplant as before or the last year. About 92% of the SRI plots in Burichang was transplanted on or before 15th day while only 55% of the SRI plots were transplanted on or before 15th day.

The seedlings in FP plots were transplanted as they (the farmers) had done in the year before the trial. With two exceptions, most of the FP plots were transplanted on or after 30th day (*see Table 1 in the annex*).

Distance of rice plants

In all the SRI plots the distance from one plant to other plant was 25 cm and the row to row distance was also 25 cm. The plant to plant distance in the FP plot was 15 cm and row to row distance was 15cm. The distance maintained in FP plots were as they practiced in the previous years.

Irrigation

SRI plots were irrigated more number of times than FP plots. SRI plots were irrigated from 4 to 12 times with an average of 8 times and mode value of 7 as the number of times the plots irrigated. The farmers informed during the result sharing session that the amount of water put in the SRI plots was comparatively less than the amount of water put in FP plots. The FP plots were irrigated for 5 to 10 times with the mean value of 8 and mode value of 8.

Weeding

SRI plots having less water has shown to have more weeds than the FP plots. Where as moist soil in the SRI plot creates a favorable condition for weed seeds to germinate.

Number of Times Hand Weeding Was Done

Number of Times	SRI Plots			FP Plots		
	Burichang	Debidwar	Total	Burichang	Debidwar	Total
1		1	1	2	7	9
2	7	16	23	9	12	21
3	4	2	6			

Table 6: Weeding practices by project area

The less amount of water in SRI plots was conducive for the farmers to weed the field easily and frequently before the weeds could grow big. Higher level of water in the FP plot prevented many of the weed seeds from germination. The weeding of FP was not easily done as in the dry surface of SRI plot. Therefore FP plots were not weeded frequently and easily like the SRI plots. Thus it took long time for weeding FP plot and the cost was comparatively higher.

The SRI plots were weeded by mechanical weeder and manually comparatively more times than FP plots.

Number of Times Mechanical Weeder Was Used

Number of Times	SRI Plots			FP Plots		
	Burichang	Debidwar	Total	Burichang	Debidwar	Total
None	6	4	10	9	9	18
1	5	15	20	2	10	12

Table 7: Weeding done with mechanical weeder by project area

Pesticide use

There were 9 farmers who used pesticide for rice hispa infestation. Among the farmers who used pesticide in the rice field where trial is being done, 3 of them used pesticide in SRI plot as well. When they were asked about the reason for using pesticide in the SRI plot, 2 of them said they used it thinking rice hispa may infest the SRI plot, and 1 of the farmers said he had seen rice hispa in the SRI plot as well.

Name of Pesticide

Name of Pesticide	Burichang (no. of plots)	Debidwar (no. of plots)	Total
Basudin	1	3	4
Malathion		1	1

Sunfuradan	4		4
Total	5	4	9

Table 8: List of pesticides used in number of plots by project area

The pesticides were used for only one time in both the project area.

Pesticide Usage

Number of Times	SRI Plots						FP Plots					
	Burichang		Debidwar		Total		Burichang		Debidwar		Total	
	n	%	n	%	n	%	n	%	n	%	n	%
None	9	54.5	18	84.2	22	73.3	6	54.5	15	78.9	21	70.0
1	2	45.5	1	15.8	8	26.7	5	45.5	4	21.1	9	30.0
Total	11	100	19	100	30	100	11	100	19		30	100

Table 9: Number of times pesticide used in number of plots by project area

IPM methods used for pest control

An account of five of the IPM practices was taken from the farmers. The farmers took multiple approaches in IPM practices. Two of the most common practices are organic and cultural. The farmers learned beneficial (predatory) and harmful insects/ organisms' role in the rice field. This helped them to observe and understand biological method of pest control in the rice field. Besides this, the learning on rice ecosystem enhanced their confidence level that rice plants have capacity to compensate its yield if there is any insect pest infestation at the early stage of the crop

IPM Practices

IPM Methods	Project area					
	Burichang		Debidwar		Total	
	n	%	n	%	n	%
Organic IPM methods	3	27.3	17	89.5	20	66.7
Mechanical	-	-	-	-	-	-
Cultural IPM	6	54.6	14	73.7	20	66.7
Chemical	9	45.5	5	26.3	10	33
Crop cycle management	-	-	-	-	-	-

Table 10: List of IPM methods used in number of plots by project area

Disease control

There was only one farmer who had used chemical for disease control. It was used for fungal infestation. The chemical used is called Malathion. The fungal infestation was only in one of the farmers practice plots.

Agronomical Findings

Tillers

In SRI plot a single seedling was transplanted. In FP plot more than 4 rice plants were transplanted per hill. In 40 to 45 days after transplanting, the number of tillers grown per hill is shown in the table below. The numbers are averages of 10 different counts. SRI plots have almost double the number of tillers grown in the FP plot. The difference in the number of tillers grown in SRI plot (31 tillers per hill) and FP plot (16 tillers per hill) is statistically significant ($p = 0.000$, $n_1 = 11$ and $n_2 = 19$)[2].

Area-Specific Tiller Growth

Project Area	SRI Plots			FP Plots		
	n	Number of Tillers	St. Deviation	n	Number of Tillers	St. Deviation
Burichang	11	37.05	1.87	11	18.72	1.03
Debidwar	19	27.74	3.73	19	14.89	1.47
Total	3	31.15	5.53	30	16.29	2.29

Table 11: Number of tiller per hill by project area

Number of tillers grown varies among the varieties of rice in the field. It also differs by project areas. BR 29 in Burichang shows the highest number of tillers (39 tillers per hill) grown in 40 to 45 days. Where as in Debidwar BR 29 had 29 tillers per hill the highest. In Debidwar Anamica had the highest number of tillers grown. The varietal performance is given in the tables 12, 13, and 14.

Varietal Performance in Tiller Growth

Burichang						
Rice Variety	SRI Plots			FP Plots		
	n	Number of Tillers	Std. Deviation	n	Number of Tillers	Std. Deviation
BINA 6	1	38.70	-	1	18.00	-
BR 16	1	35.70	-	1	20.10	-
BR 28	4	37.48	1.36	4	18.58	.53
BR 29	2	39.05	1.63	2	19.85	.92
IR 50	1	35.60	-	1	18.20	-
IRRITON	1	34.10	-	1	16.80	-
Irrita	1	35.40	-	1	18.80	-
Total	11	37.05	1.87	11	18.72	1.03

Table 12: Number of tillers per hill by rice variety in Burichang

[2] Only significant differences are mentioned

Varietal Performance in Tiller Growth

Debidwar						
Rice Variety	SRI Plots			FP Plots		
	n	Number of Tillers	St. Deviation	n	Number of Tillers	St. Deviation
Anamica	2	31.35	.35	2	15.60	.00
BR 14	9	27.21	3.46	9	14.31	.58
BR 16	3	29.53	6.58	3	16.03	3.26
BR 28	2	25.40	2.40	2	14.30	.28
BR 29	2	27.40	2.55	2	15.45	2.33
IR 50	1	25.30		1	15.30	
Total	19	27.74	3.73	19	14.89	1.47

Table 13: Number of tillers per hill by rice variety in Debidwar

Varietal Performance in Tiller Growth

Overall						
Rice Variety	SRI Plots			FP Plots		
	n	Number of Tillers	St. Deviation	n	Number of Tillers	St. Deviation
Anamica	2	31.35	.35	2	15.60	.00
BINA 6	1	38.70		1	18.00	
BR 14	9	27.21	3.46	9	14.31	.58
BR 16	4	31.08	6.19	4	17.05	3.35
BR 28	6	33.45	6.41	6	17.15	2.25
BR 29	4	33.23	6.95	4	17.65	2.29
IR 50	2	30.45	7.28	2	16.75	2.05
IRRITON	1	34.10		1	16.80	
Irrita	1	35.40		1	18.80	
Total	30	31.15	5.53	30	16.29	2.29

Table 14: Over all number of tillers per hill by rice variety

Effective tillering

SRI plot had double the number of effective tillers per hill. The numbers are averages of 10 different counts. Rice variety, i.e., the average effective number of tillers in SRI plot, was 24 per hill and 12 per tiller for FP plot.

BINA 6, BR 29 had better performance in Burichang while BR 14 in Debidwar had better performance. Tables below (Table 16, 17 and 18) presents detail information on effective tiller growth.

Area-Specific Effective Tiller Growth

Project Area	SRI Plots			FP Plots		
	N	Number of Effective Tillers	St. Deviation	n	Number of Effective Tillers	St. Deviation
Burichang	11	22.41	2.35	11	13.26	1.16
Debidwar	19	24.83	5.84	19	12.25	.72
Total	30	23.94	4.95	30	12.62	1.02

Table 15: Number of effective tiller per hill by project area

Varietal Performance in Effective Tiller Growth

Burichang						
Rice Variety	SRI Plots			FP Plots		
	N	Number of Effective Tillers	St. Deviation	n	Number of Effective Tillers	St. Deviation
BINA 6	1	25.50		1	14.50	
BR 16	1	21.20		1	11.40	
BR 28	4	21.82	.79	4	13.22	.84
BR 29	2	25.80	.56	2	14.55	.21
IR 50	1	18.50		1	11.50	
IRRITON	1	21.10		1	13.20	
Irrita	1	21.40		1	13.30	
Total	11	22.41	2.35	11	13.26	1.16

Table 16: Number of effective tillers per hill by rice variety in Burichang

Varietal Performance in Effective Tiller Growth

Debidwar						
Rice Variety	SRI Plots			FP Plots		
	n	Number of Effective Tillers	Std. Deviation	n	Number of Effective Tillers	Std. Deviation
Anamica	2	25.05	.63	2	12.55	.91
BR 14	9	26.66	8.12	9	12.31	.64
BR 16	3	22.60	2.53	3	11.90	.72
BR 28	2	22.40	.14	2	12.60	1.55
BR 29	2	24.00	.98	2	11.65	.21
IR 50	1	21.10		1	12.70	
Total	19	24.83	5.84	19	12.25	.72

Table 17: Number of effective tillers per hill by rice variety in Debidwar

Varietal Performance in Effective Tiller Growth

Overall						
	SRI Plots			FP Plots		
SRI Plot Rice Variety	n	Number of Effective Tillers	Std. Deviation	n	Number of Effective Tillers	Std. Deviation
Anamica	2	25.05	.63	2	12.55	.91
BINA 6	1	25.50	-	1	14.50	-
BR 14	9	26.66	8.12	9	12.31	.64
BR 16	4	22.25	2.18	4	11.77	.63
BR 28	6	22.01	.68	6	13.01	1.00
BR 29	4	24.90	1.23	4	13.10	1.68
IR 50	2	19.80	1.83	2	12.10	.84
IRRITON	1	21.10	-	1	13.20	-
Irrita	1	21.40	-	1	13.30	-
Total	30	23.94	4.95	30	12.62	1.02

Table 18: Overall number of effective tillers per hill by rice variety

Grains per panicle

The rice plants in SRI plots had more number of grains per (198 grains per panicle) panicle compared to rice plants in FP plots (150 grains per panicle). Rice plants in SRI plots had 32% more grains per panicle than FP plots. The difference in the number of grains per panicle between SRI plots and FP plots is statistically significant ($p = 0.001$, $n_1 = 11$ and $n_2 = 19$).

The rice variety *viz.* BINA 6 and BR 29 had better performance in producing number of grains per panicle. Tables below (Tables 20, 21 and 22) show the varietal performance in producing grain per panicle by rice variety.

Area-Specific Number of Grains per Panicle

Project Area	SRI Plots			FP Plots		
	n	Average Number of Grains	Std. Deviation	n	Average Number of Grains	Std. Deviation
Burichang	11	229.86	36.18	11	191.63	32.61
Debidwar	19	179.69	32.85	19	125.23	15.37
Total	30	198.09	41.54	30	149.58	39.65

Table 19: Number of tiller per panicle by project area

Varietal Performance in Grains per Panicle

Burichang						
Rice Variety	SRI Plots			FP Plots		
	n	Number of Grains per Tiller	Std. Deviation	n	Number of Grains per Tiller	Std. Deviation
BINA 6	1	260.33		1	202.66	
BR 16	1	228.78		1	201.44	
BR 28	4	224.03	25.92	4	184.27	24.94
BR 29	2	275.83	31.82	2	231.44	45.88
IR 50	1	165.44		1	137.77	
IRRITON	1	207.78		1	180.22	
Irrita	1	218.33		1	185.88	
Total	11	229.86	36.18	11	191.63	32.61

Table 20: Number of grains per panicle by rice variety in Burichang

Varietal Performance in Grains per Panicle

Debidwar						
Rice Variety	SRI Plots			FP Plots		
	n	Number of Grains per Tiller	Std. Deviation	n	Number of Grains per Tiller	Std. Deviation
Anamica	2	191.67	4.09	2	121.38	13.12
BR 14	9	163.19	15.92	9	118.51	5.66
BR 16	3	197.85	5.32	3	130.88	11.72
BR 28	2	166.94	27.89	2	125.83	22.70
BR 29	2	251.17	5.26	2	156.55	19.64
IR 50	1	132.33		1	112.66	
Total	19	179.69	32.85	19	125.23	15.37

Table 21: Number of grains per panicle by rice variety in Debidwar

Varietal Performance in Grains per Panicle

Overall						
Rice Variety	SRI Plots			FP Plots		
	n	Number of Grains per Tiller	Std. Deviation	n	Number of Grains per Tiller	Std. Deviation
Anamica	2	191.67	4.09	2	121.38	13.12
BINA 6	1	260.33		1	202.66	
BR 14	9	163.19	15.92	9	118.51	5.66
BR 16	4	205.58	16.06	4	148.52	36.55
BR 28	6	205.00	37.78	6	164.79	37.24
BR 29	4	263.50	23.44		4	51.95
IR 50	2	148.89	23.41	2	125.22	17.75
IRRITON	1	207.78		1	180.22	
Irrita	1	218.33		1	185.88	
Total	30	198.09	41.54	30	149.58	39.65

Table 22: Overall number of grains per panicle by rice variety

Weight of rice grains

The weight presented here is in terms of 1,000 rice grains. Rice of SRI plots had 13% more weight compared to FP plots. Farmers mentioned that they noticed that the rice grains in the SRI plots were more nourished compared to the FP plots. They feel that it happened due to availability more nutrients in the SRI plot considering the plant population.

Area-Specific Weight of Rice Grains

Project Area	SRI Plots			FP Plots		
	n	Weight in Grams/ 1000 Rice Grains	Std. Deviation	n	Weight in Grams/ 1000 Rice Grains	Std. Deviation
Burichang	11	27.7273	2.4936	11	24.0000	2.7928
Debidwar	19	30.4211	4.7178	19	27.3158	4.5099
Total	30	29.4333	4.2074	30	26.1000	4.2374

Table 23: Weight of rice grain by project area

The weight of rice grains of different varieties are presented in the tables below (Table 24, 25 and 26).

Varietal Performance in Weight of Rice Grains

Burichang						
Rice Variety	SRI Plots			FP Plots		
	n	Weight in Grams/ 1000 Rice Grains	Std. Deviation	n	Weight in Grams/ 1000 Rice Grains	Std. Deviation
BINA 6	1	34.0000		1	31.0000	
BR 16	1	29.0000		1	26.0000	
BR 28	4	26.7500	1.2583	4	22.7500	1.2583
BR 29	2	26.5000	.7071	2	23.5000	2.1213
IR 50	1	25.0000		1	21.0000	
IRRITON	1	28.0000			24.0000	
Irrita	1	29.0000		1	24.0000	
Total	11	27.7273		11	24.0000	

Table 24: Weight of rice grain by rice variety in Burichang

Varietal Performance in Weight of Rice Grains

Debidwar						
Rice Variety	SRI Plots			FP Plots		
	n	Weight in Grams/ 1000 Rice Grains	Std. Deviation	n	Weight in Grams/ 1000 Rice Grains	Std. Deviation
Anamica	2	23.5000	2.1213	2	21.0000	1.4142
BR 14	9	32.6667	.8660	9	29.5556	.7265
BR 16	3	36.0000	3.6056	3	32.6667	2.5166
BR 28	2	27.5000	.7071	2	24.0000	1.4142
BR 29	2	26.0000	1.4142	2	22.5000	3.5355
IR 50	1	22.0000		1	20.0000	
Total	19	30.4211	4.7178	19	27.3158	4.5099

Table 25: Weight of rice grain by rice variety in Debidwar

Varietal Performance in Weight of Rice Grains

Overall						
Rice Variety	SRI Plots			FP Plots		
	n	Weight in Grams/ 1000 Rice Grains	Std. Deviation	n	Weight in Grams/ 1000 Rice Grains	Std. Deviation
Anamica	2	23.5000	2.1213	2	21.0000	1.4142
BINA 6	1	34.0000		1	31.0000	
BR 14	9	32.6667	.8660	9	29.5556	.7265
BR 16	4	34.2500	4.5735	4	31.0000	3.9158
BR 28	6	27.0000	1.0954	6	23.1667	1.3292
BR 29	4	26.2500	.9574	4	23.0000	2.4495
IR 50	2	23.5000	2.1213	2	20.5000	.7071
IRRITON	1	28.0000		1	24.0000	
Irrita	1	29.0000		1	24.0000	
Total	30	29.4333		30	26.1000	

Table 26: Overall weight of rice grain by rice variety

Unfilled grains

Randomly taken 100 rice grains were divided into two parts. Ones that had filled-in grains were separated from the unfilled ones. More among the rice grains of FP plots had unfilled grains. The SRI plot rice grains had on average 14 unfilled grains where as FP plots had 19 unfilled grains. There were 36% more unfilled grains in the rice of FP plots.

Area-Specific Number of Unfilled Grains

Project Area	SRI Plots			FP Plots		
	n	Number of Unfilled Grains/ 100 Grains	Std. Deviation	n	Number of Unfilled Grains/ 100 Grains	Std. Deviation
Burichang	11	14.18	2.13	18		
Debidwar	19	14.63	2.40	19	19.21	3.18
Total	30	14.46	2.28	30	18.83	3.15

Table 27: Number of unfilled grains by area

Among the rice varieties BR 29 had the least number of unfilled grains. The varietal difference in having number of unfilled grains are presented in the tables in the next page (Table 28, 29 and 30).

Varietal Performance in Unfilled Grains

Burichang						
Rice Variety	SRI Plots			FP Plots		
	n	Number of Unfilled Grains/ 100 Grains	Std. Deviation	n	Number of Unfilled Grains/ 100 Grains	Std. Deviation
BINA 6	1	13.00		1	15.00	
BR 16		13.00			17.00	
BR 28	4	15.50	2.64	4	20.25	2.50
BR 29	2	12.00	1.41	2	16.00	2.82
IR 50	1	14.00			14.00	
IRRITON	1	16.00		1	22.00	
Irrita	1	14.00		1	19.00	
Total	11	14.18	2.13	11	18.18	3.12

Table 28: Number of unfilled grains by rice variety in Burichang

Varietal Performance in Unfilled Grains

Debidwar						
Rice Variety	SRI Plots			FP Plots		
	n	Number of Unfilled Grains/ 100 Grains	Std. Deviation	n	Number of Unfilled Grains/ 100 Grains	Std. Deviation
Anamica	2	13.5000	.7071	2	19.0000	1.4142
BR 14	9	15.0000	2.6926	9	20.0000	3.5707
BR 16	3	13.6667	1.5275	3	17.3333	2.5166
BR 28	2	14.0000	1.4142	2	18.5000	.7071
BR 29	2	13.5000	.7071	2	16.5000	.7071
IR 50	1	20.0000		1	25.0000	
Total	19	14.6316		19	19.2105	

Table 29: Number of unfilled grains by rice variety in Debidwar

Varietal Performance in Unfilled Grains

Overall						
Rice Variety	SRI Plots			FP Plots		
	n	Number of Unfilled Grains/ 100 Grains	Std. Deviation	n	Number of Unfilled Grains/ 100 Grains	Std. Deviation
Anamica	2	13.5000	.7071	2	19.0000	1.4142
BINA 6	1	13.0000		1	15.0000	
BR 14	9	15.0000	2.6926	9	20.0000	3.5707
BR 16	4	13.5000	1.2910	4	17.2500	2.0616
BR 28	6	15.0000	2.2804	6	19.6667	2.1602
BR 29	4	12.7500	1.2583	4	16.2500	1.7078
IR 50	2	17.0000	4.2426	2	19.5000	7.7782
IRRITON	1	16.0000		1	22.0000	
Irrita	1	14.0000		1	19.0000	
Total	30	14.4667	2.2854	30	18.8333	3.1523

Table 30: Overall number of unfilled grains by rice variety

Rice yield

Rice of a selected area of 10 square meter area (sq. m.) was harvested separately both for the SRI and FP plots. The thrashing was done separately. The yield of the plots was calculated according to the amount of rice from the 10 sq. m. area. SRI plots had more than 1 ton per hectare increase (19%) compared to FP plots. The SRI farmers in Burichang has comparatively more yield difference from the FP plots compared to farmers of Debidwar.

The rice yield of different varieties are put in the tables below (Table 32, 33 and 34)

Area-Specific Rice Yield

Project Area	SRI Plots			FP Plots		
	n	Tons per Hectare	Std. Deviation	n	Tons per Hectare	Std. Deviation
Burichang	11	7.006	.597	11	5.406	.538
Debidwar	19	7.040	.674	19	6.190	.878
Total	30	7.027	.637	30	5.903	.852

Table 31: Yield by project area

Varietal Performance in Rice Yield

Burichang						
Rice Variety	SRI Plots			FP Plots		
	N	Tons per Hectare	Std. Deviation	n	Tons per Hectare	Std. Deviation
BINA 6	1	7.260		1	6.380	
BR 16	1	6.600		1	5.793	
BR 28	4	7.003	0.883	4	5.243	0.591
BR 29	2	7.516		2	5.390	0.155
IR 50	1	6.746		1	5.500	
IRRITON	1	7.040		1	5.426	
Irrita	1	6.380		1	4.620	
Total	11	7.006		11	5.406	

Table 32: Yield by rice variety in Burichang

Varietal Performance in Rice Yield

Debidwar						
SRI Plot Rice Variety	SRI Plots			FP Plots		
	n	Tons per Hectare	Std. Deviation	n	Tons per Hectare	Std. Deviation
Anamica	2	6.820	0. 414	2	7.076	2.022
BR 14	9	7.194	0. 252	9	6.314	0.560
BR 16	3	6.844	1.169	3	6.257	0.928
BR 28	2	7.443	0.259	2	6.013	0.207
BR 29	2	7.406	0.207	2	5.720	0.311
IR 50	1	5.133	-	1	4.400	-
Total	19	7.040	0.674	19	6.190	0.878

Table 33: Yield by rice variety in Debidwar

Overall Varietal Performance in Yield

Overall						
SRI Plot Rice Variety	SRI Plots			FP Plots		
	n	Tons per Hectare	Std. Deviation	n	Tons per Hectare	Std. Deviation
Anamica	2	6.820	0.414	2	7.076	2.022
BINA 6	1	7.260	-	1	6.380	-
BR 14	9	7.194	0.252	9	6.314	0.560
BR 16	4	6.783	0.962	4	6.141	0.792
BR 28	6	7.149	0.730	6	5.500	613
BR 29	4	7.461	0.162	4	5.555	0.276
IR 50	2	5.940	1.140	2	4.950	0.777
IRRITON	1	7.040	-	1	5.426	-
Irrita	1	6.380	-	1	4.620	-
Total	30	7.027	0.637	30	5.903	0.852

Table 34: Overall yield by rice variety

Straw produced

Straw of the selected area of 10 sq. m. area was measured. The amount of straw produced was calculated according to the amount of straw from the 10 sq. m. area. SRI plots had more than 0.76 tons per hectare (12%) hay compared to FP plots.

Area-Specific Straw Production

Project area	SRI Plots			FP Plots		
	n	Straw Tons per Hectare	Std. Deviation	n	Straw Tons per Hectare	Std. Deviation
Burichang	11	6.6894	.6552	11	5.8712	.4807
Debidwar	19	7.2544	.8359	19	6.5263	.8208
Total	30	7.0472	.8114	30	6.2861	.7752

Table 35: Straw production by project area

Straw production performance of different varieties are put in the tables below (Table 36, 37 and 38).

Varietal Performance in Straw Production

Burichang						
Rice Variety	SRI Plots			FP Plots		
	n	Straw Tons per Hectare	Std. Deviation	n	Straw Tons per Hectare	Std. Deviation
BINA 6	1	8.0833		1	6.9167	
BR 16	1	6.4167		1	5.6667	
BR 28	4	6.3958	0.342	4	5.5000	0.272
BR 29	2	7.3750	5.893	2	6.1250	.4125
IR 50	1	6.2500		1	6.1667	
IRRITON	1	6.0833		1	5.7500	
Irrita	1	6.4167		1	5.8333	
	11	6.6894	.6552	11	5.8712	.4807

Table 36: Straw production by rice variety in Burichang

Varietal Performance in Straw Production

Debidwar						
Rice Variety	SRI Plots			FP Plots		
	n	Straw Tons per Hectare	Std. Deviation	n	Straw Tons per Hectare	Std. Deviation
Anamica	2	7.1667	.2357	2	6.2500	.3536
BR 14	9	7.3889	.4082	9	6.8704	.3799
BR 16	3	7.1667	1.3017	3	6.1667	1.0000
BR 28	2	7.6667	.2357	2	6.4167	.1179
BR 29	2	7.7500	.1179	2	7.1667	.0000
IR 50	1	4.6667		1	4.0000	
Total	19	7.2544	.8359	19	6.5263	.8208

Table 37: Straw production by rice variety in Debidwar

Overall Varietal Performance in Straw Production

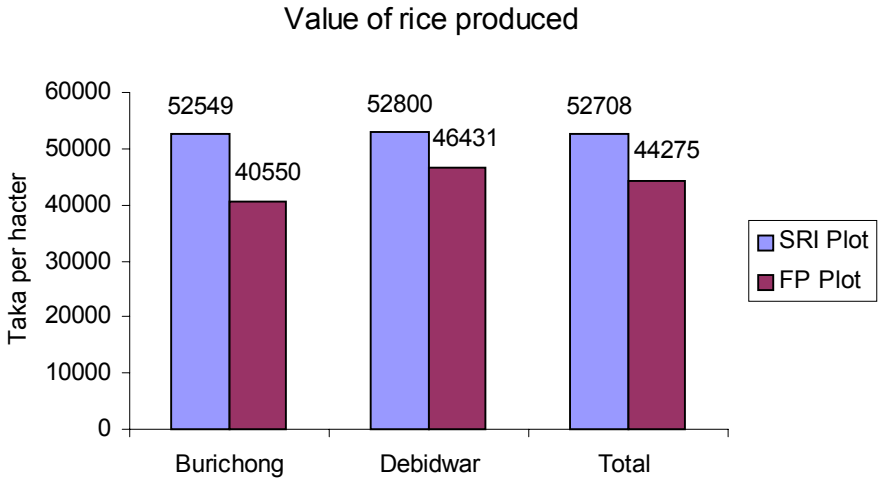
Overall						
Rice Variety	SRI Plots			FP Plots		
	n	Straw Tons per Hectare	Std. Deviation	n	Straw Tons per Hectare	Std. Deviation
Anamica	2	7.1667	.2357	2	6.2500	.3536
BINA 6	1	8.0833		1	6.9167	
BR 14	9	7.3889	.4082	9	6.8704	.3799
BR 16	4	6.9792	1.1271	4	6.0417	.8539
BR 28	6	6.8194	.7157	6	5.8056	.5209
BR 29	4	7.5625	.2295	4	6.6458	.6468
IR 50	2	5.4583	1.1196	2	5.0833	1.5321
IRRITON	1	6.0833		1	5.7500	
Irrita	1	6.4167		1	5.8333	
Total	30	7.0472	.8114	30	6.2861	.7752

Table 38: Overall straw production by rice variety

Economic Findings

Value of rice produced

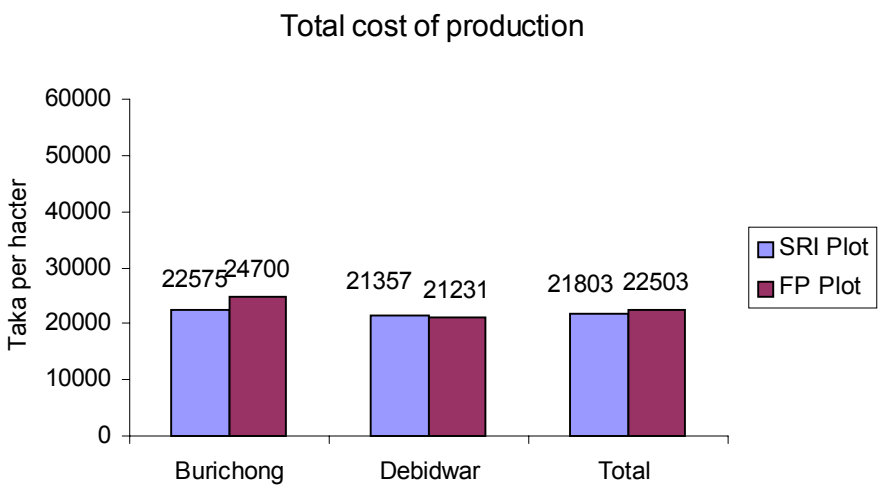
SRI plots have more yield of rice. Therefore, the value of rice of SRI plots is subsequently more. The value of rice produced in SRI plot is 52,708[3] Taka per hectare, which is 19% more than the rice of FP plot (44,275 Taka).



Rice cultivation cost

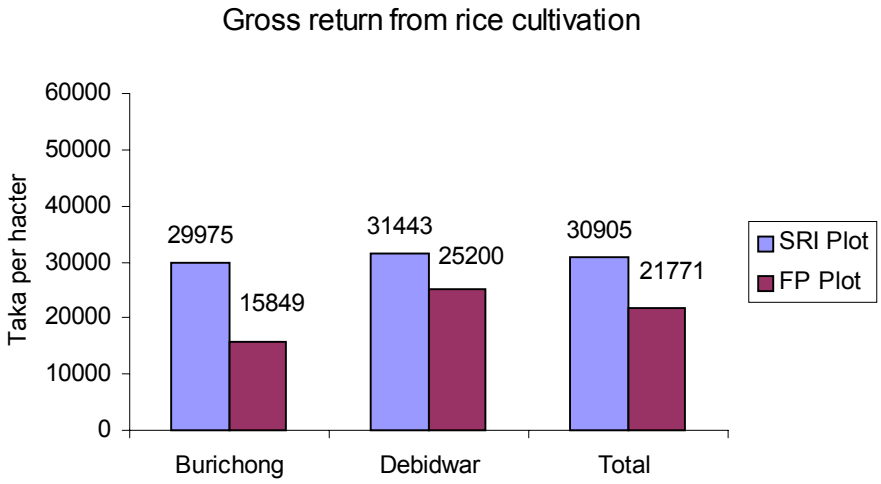
The cost of rice production is marginally higher for FP plots due to more use of fertilizer, irrigation, seed, weeding cost, and pesticide use. The production cost of FP plots was little more than 3% compared to SRI plots.

[3] The value of rice was calculated at the rate of 300 Taka per maund.



Gross return

SRI plots has more gross return compared to FP plots. The SRI farmers got a gross return of 30,905 Taka per hectare, which is 42% more than the FP plots (21,771 Taka).



Comments on SRI cultivation process and results

A the end of the season a result sharing meeting was conducted. During the meeting each of the participating farmers and an equal number of neighboring farmers present at the meeting were asked to comment on SRI cultivation. The table below presents the responses with number of farmers of Burichang and Debidwar.

Comments on SRI

Comments at the end of the season information sharing	SRI Farmers		Neighboring Farmers	
	Burichang	Debidwar	Burichang	Debidwar
Need less seed	10	13	5	9
Less pest infestation	7	14	4	13
More tillers	5	9	6	3
Good rice grains	5	8	1	5
Panicles initiated at the same time	5	7	4	2
More yield	4	14	6	14
Good color of grains	4	6	0	3
More light and air	4	4	1	3
Less disease infestation	4	4	1	0
Rice ripens at the same time	3	6	2	0
Need less amount of water	3	5	1	1
No pesticides needed	3	0	1	0
More number of grains	3	0	0	7
Less expense	1	1	5	5
Less unfilled grains	1	0	4	2
Tillers are longer	0	7	3	6

Table 39: List of comments on SRI

Conclusion

Rice cultivation in SRI practice was an interesting and exciting event to the farmers. During the last Boro 2003 season, farmers tried SRI in small pieces of land. Many other farmers who did not participate but had kept a close eye on this new idea. Those farmers who did practice SRI faced unexpected criticism just after transplanting the field because no rice plants were visible in their fields. It looked like a fallow field due to the tiny rice seedlings. But the attitude of the farmers started changing after the 3rd week of the transplanted seedling when they had seen a huge number of tillers starting to emerge out. The average number of tillers in the SRI plot was 31 compared to 16 in the farmers' plot. Farmers noticed 19% higher yield with less production cost in the SRI practice. The hay production was also higher (12%) in the SRI fields. Pest and disease infestation was also less in the SRI fields due to healthier rice plants, and consequently, the farmers used no or less pesticide in the SRI plots.

Farmers were happy with the performance of SRI practice but many expressed some valid barriers of SRI adoption at the farmers' level. Production and handling of tiny, 10 –15 days rice seedlings requires an intensive careful attention. In normal practice, the farmers generally throw a large amount of sprouted seed in a fairly large clay field along a canal, pond or any low-lying areas where flood or stagnant water has been recessed in November or December. They go for uprooting this seedling after 30 - 40 days after germination or even more than that. There is no specific time to start the irrigation machine (STW or DTW) as it depends on the collection of timely contribution from the growers of the command area. The start-up of the machine is also dependent on the connection time of the rural electrification department, subject clearing up last season's electric bill. Farmers stated in their field day sessions and some other forums that there is a need to develop a community approach for building consensus among farmers for understanding and adoption of SRI practice. This process might take a couple years for popularizing SRI among rice farmers.

Annex

Age of Seedlings When Transplanted

Age of Seedlings (in days)	SRI Plots			FP Plots		
	Burichang	Debidwar	Total	Burichang	Debidwar	Total
14		2	2			
15	10	10	20		1	1
16	1	1	2			
17		1	1			
19		2	2			
20		2	2			
22		1	1			
25					1	1
30					7	7
34				1		1
35				3	2	5
36				3		3
37					1	1
38				2		2
40				2	3	5
45					3	3
55					1	1
	11	19	30	11	19	30

Annex Table 1: Seedling transplantation age by project are

Number of Times SRI Plots Were Irrigated

Number of Times	SRI Plots			FP Plots		
	Burichang	Debidwar	Total	Burichang	Debidwar	Total
4		1	1			
5		1	1	1	1	2
6		3	3	1		1
7	2	6	8	3	4	7
8	2	6	8	3	6	9
9	3	2	5	1	5	6
10	1		1	2	3	5
11	1		1			
12	2		2			
Total	11	19	30	11	19	30

Annex Table 2: Irrigation of rice plot by project area

Costs

Land Preparation Cost

Project Area	SRI Plots			FP Plots		
	n	Land Preparation Cost (Taka/hectare)	Std. Deviation	n	Land Preparation Cost (Taka/hectare)	Std. Deviation
Burichang	11	2386	392.75	11	2508	95.82
Debidwar	19	2288	272.48	19	2186	533.22
Overall	30	2324	318.70	30	2304	452.39

Annex Table 3: Land preparation cost by project area

Seed Cost

Project Area	SRI Plots			FP Plots		
	n	Seed Cost (Taka/hectare)	Std. Deviation	n	Seed Cost (Taka/hectare)	Std. Deviation
Burichang	11	242	91.41	11	666	90.04
Debidwar	19	431	91.40	19	566	85.36
Overall	30	362	128.90	30	603	98.65

Annex Table 4: Seed cost by project area

Fertilizer Cost

Project Area	SRI Plots			FP Plots		
	n	Fertilizer cost (Taka/hectare)	Std. Deviation	n	Fertilizer cost (Taka/hectare)	Std. Deviation
Burichang	11	3179	549.95	11	4132	1453.40
Debidwar	19	3585	856.08	19	3569	738.82
Overall	30	3436	773.75	30	3775	1069.24

Annex Table 5: Fertilizer cost by project area

Pesticide Cost

Project Area	SRI Plots			FP Plots		
	n	Pesticide Cost (Taka/hectare)	Std. Deviation	n	Pesticide Cost (Taka/hectare)	Std. Deviation
Burichang	1	444	-	5	712	101.71
Debidwar	2	593	104.79	5	666	177.13
Overall	3	543	113.18	10	689	138.36

Annex Table 6: Pesticide cost by project area

Irrigation Cost

Project Area	SRI Plots			FP Plots		
	n	Irrigation cost (Taka/hectare)	Std. Deviation	n	Irrigation cost (Taka/hectare)	Std. Deviation
Burichang	11	7281	1037.12	11	7570	356.02
Debidwar	19	5848	1441.19	19	5947.62	327.87
Overall	30	6373	1467.46	30	6542	861.70

Annex Table 7: Irrigation cost by project area

Weeding Cost

Project Area	SRI Plots			FP Plots		
	n	Weeding Cost (Taka/hectare)	Std. Deviation	n	Weeding Cost (Taka/hectare)	Std. Deviation
Burichang	11	2612	569.34	11	3098	549.28
Debidwar	19	2203	452.28	19	2670	487.06
Overall	30	2353	528.08	30	2827	543.31

Annex Table 8: Weeding cost by project area

Hired Labor Cost

Project Area	SRI Plots			FP Plots		
	n	Hired Labor Cost (Taka/hectare)	Std. Deviation	n	Hired Labor Cost (Taka/hectare)	Std. Deviation
Burichang	11	1097	1899.23	11	1828	1596.56
Debidwar	19	639	1314.21	19	934	1367.75
Overall	30	807	1538.21	30	1262	1494.10

Annex Table 9: Hired labor cost by project area

Own Labor Cost

Project Area	SRI Plots			FP Plots		
	n	Own Labor Cost (Taka/hectare)	Std. Deviation	n	Own Labor Cost (Taka/hectare)	Std. Deviation
Burichang	11	2788	1949.15	11	1598	1445.71
Debidwar	19	3044	1423.70	19	2283	1415.86
Overall	30	2950	1607.45	30	2032	1441.37

Annex Table 10: Own labor cost by project area

Other Costs

Project Area	SRI Plots			FP Plots		
	n	Other Costs (Taka/hectare)	Std. Deviation	n	Other Costs (Taka/hectare)	Std. Deviation
Burichang	11	2949	678.25	11	2976	627.97
Debidwar	19	3256	925.29	19	2901	443.90
Overall	30	3144	844.25	30	2928	509.56

Annex Table 11: Other costs by project area