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Comparative analysis of system of rice intensification (SRI) and traditional technology of rice cultivation with respect to some selected parameters in farmers' field conditions

R. GHOSHAL AND D. BASU

Department of Agricultural Extension, Economics and Statistics (EES)
Palli Siksha Bhavana,Visva Bharati, Birbhum, West Bengal

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ABSTRACT

Rice is a staple food for about 50 per cent of the world's population. In much of India, rice is the main food. In the Green Revolution, the yield of paddy was increased. But the large increases in production of paddy were restricted to irrigated belts of the country. Almost 20 years ago, the System of Rice Intensification (SRI rice cultivation) came to light in India . SRI is an agroecologically-based system of production of rice, relying on changes in management rather than on different or increased material inputs. SRI involves the application of certain practices which all together provide better growing conditions for rice plants, particularly in the root zone, compared to those for plants grown under traditional practices. This system offers to promise to overcome the shortages of water constraining irrigated rice production because the larger and better root systems promoted enable rice plants to thrive with less water application. This study was conducted in three villages of North 24 Parganas district with the objective to observe the merits and demerits of SRI in farmers' fields. From the study it can be concluded that farmers who cultivated paddy in SRI method got more grain yield than with traditional methods as all yield-contributing parameters of the plants were much higher with SRI methods in comparison to non-SRI methods, and the requirements of irrigation water, plant-protection chemicals, and chemical fertilizer were all much less with SRI methods in comparison to non-SRI methods.

***Keywords*:** Comparative analysis, parameters, system of rice intensification

The Green Revolution started in the 1960's was oriented to high input usage, particularly fertilizers and plant protection chemicals, coupled with more irrigation water, intended to meet the food demands of a growing population even though there was escalation in the cost of cultivation of paddy (Uphoff, 1999). The cultivation of paddy became less sustainable economically and less environment-friendly (Rai, 2004).

SRI is regarded as superior to the traditional rice-growing methods, referred to here as SRT (Chen *et al*., 2006). It was observed that SRI increases production, reduces the yield gap, and contributes to greater household food security for the vulnerable sections of small and marginal farmers. It is also a less water-consuming method of rice cultivation, which is suitable to poor farmers who have relatively more labour than land and capital (Barah, 2010). In addition, researchers have verified that SRI crops are more resistant to most pests and diseases, and better able to tolerate adverse climatic influences such as drought, storms, hot spells, and cold snaps. The length of the crop cycle (time to maturity) is also often reduced, with higher yields (Uphoff, 2007). The resistance of SRI rice plants to lodging caused by wind and/or rain, given their larger root systems and stronger stalks, can be quite significant (Uphoff, 2007).Adoption of SRI methods reduces the agronomic and economic risks that farmers face in general (Uphoff, 2007), and adoption of SRI enhances the income of adopters (Bassey, 2016).

Experienced researchers throughout the world had highlighted the advantages of SRI method over the traditional process of paddy cultivation, but most of their studies are based on research station experiment and results. The reality of farmer's fields is different from the reality of research stations (Chambers *et al*., 1989). The merits and demerits of SRI have been less explored in farmers' fields. The performance of SRI on farmers' fields in terms of social, economic and environmental benefits should be of concern for not only to farmers, but also to researchers, policy-makers and extension specialists too. If requirement of plant protection chemicals, chemical fertilizers will be less for paddy production the cost of production will be less resulting more economic benefit of the farmers. This present study was conducted in farmers' fields to explore these several dimensions in a holistic manner, keeping farmers' perspectives in view with respect to variables such as yield attributes, irrigation hours, quantity of plant protection chemicals used, and usage of chemical fertilizers.

Short communication
Email: riyabckv2007@gmail.com

The present study was conducted in Barasat block-I of North 24 Parganas district of West Bengal during 2014-15. The area was within Bappur Mouza (a revenue district), chosen purposefully because the agroecological situation is relatively homogenous here for winter rice cultivation, and it had a sufficient number of SRI and non-SRI plots as identified by the Agricultural Officer for the block which could be evaluated. For the selection of respondent farmers, a total enumeration of all rice-cultivating farmers (SRI and non-SRI) in the revenue district was undertaken. Farmers belonging to three villages within Barasat Block-I of North 24 Parganas district, namely Narayanpur (47 SRI+ 51 non-SRI), Madavpur (48 SRI + 52 non-SRI), and Bappur (55 SRI+ 52 non-SRI),were identified considered for this assessment as they operated under similar agro-ecological conditions. Total of 305 farmers, 150 SRI and 155 non-SRI farmers, were accordingly interviewed.

The farmers interviewed were classified into three groups, *i.e*., low, medium and high, on the basis of their economic well-being and social standing, identified through participatory card-sorting methods as suggested by Grandis (1988). The SRI and non-SRI plots were identified in the revenue map of the Mouza by the local farmers. To carry out the comparative analysis, some appropriate variables were identified with the help of experts. These variables were yield attributes, irrigation hours, quantity of plant protection chemicals used, and usage of chemical fertilizers as lesser requirement of agrochemical inputs results less economic involvement and less environmental hazard. To measure the variables, standard procedures adopted by other researchers were followed. Data on yield-contributing parameters were measured personally in the field, and data on irrigation hours, amounts of plant protection chemicals used, and usage of chemical fertilizers were collected from farmers directly with the help of a structured-interview method.

There was significant difference between SRI and non-SRI *i.e.* traditional farmers of three well-being group (low, medium and high) in respect of plant height, panicle length, number of effective tiller hill^{-1}, number of filled grain panicle^{-1} (Table 1, 2, 3). It is observed from the table that all the yield attributing parameters are much higher in case of plants cultivated in SRI method rather than plants cultivated in traditional method. Pandiselvi *et al.* (2010) had reported in the same line that two methods of rice cultivation *viz*., SRI and conventional were compared, the results revealed that adoption of SRI favourably influenced all the yield attributes of rice.

Significant differences between SRI and non-SRI *i.e.* traditional farmers of three well being group (low, medium and high) in respect of irrigation hrs, quantity of plant protection chemicals usage and chemicals fertilizer usage were observed (Table 4,5 and 6). It is observed from the table that requirement of irrigation water, plant protection chemicals and chemical fertilizer is much lesser in case of SRI method in comparison to Non- SRI method . Uphoff (2003) also reported that SRI methods can reduce water requirements for irrigated rice by 25 to 50 per cent while raising yields 50-100per cent or more.

Table 1: Comparison of yield-contributing parameters of SRI and non- SRI farmers on lower well-being group of farmers

Variables	Mean		t value
	SRI farmers	Non-SRI farmers	
Plant height	106.6	94.8	26.11*
Panicle length	26.6	22.8	57.51*
Number of effective tiller hill^{-1}	26.52	13.1	43.27*
Number of filled grain panicle^{-1}	119.8	91.2	52.41*

*Note: * Significant at the 5% level*

Table 2: Comparison of yield attributing parameters of SRI and Non- SRI farmers on medium well being group of farmers

Variables	Mean		t value
	SRI farmers	Non-SRI farmers	
Plant height	106.4	94.8	42.9*
Panicle length	26.66	22.68	76.1*
Number of effective tiller hill^{-1}	26.5	12.8	68.9*
Number of filled grain panicle^{-1}	120.2	91.2	95.00*

Table 3: Comparison of yield attributing parameters of SRI and Non- SRI farmers on high well being group of farmers

Variables	Mean		t value
	SRI farmers	Non-SRI farmers	
Plant height	106.1	95.6	22.97*
Panicle length	26.5	22.9	58.74*
Number of effective tiller hill^{-1}	26.3	13.1	49.69*
Number of filled grain panicle^{-1}	119.3	91.4	57.18*

Table 4: Environmental impact on SRI and Non- SRI farmers of low well being farmers group

Variables	Mean		t value	Difference in percentage
	SRI farmers	Non-SRI farmers		
Irrigation hrs 300(57.22%)	525 (100%)	-794.59*	42.78%	
Plant protection chemicals usage	8.172 (35.33%)	23.125 (100%)	-71.00*	64.67%
Chemical Fertiliser Usage	3.82 (37.78%)	10.11 (100%)	-41.39*	62.22%

Table 5: Environmental impact on SRI and Non- SRI farmers of medium well being farmers group

Variables	Mean		t value	Difference in percentage
	SRI farmers	Non-SRI farmers		
Irrigation hrs. 300(57.22%)	525(100%)	-794.59*	42.78%	
Plant protection chemicals usage	8.625(36.25%)	23.791(100%)	-111.80*	63.75%
Chemical Fertiliser Usage	4.031(35.45%)	11.372(100%)	-147.70*	64.55%

Table 6: Environmental impact on SRI and Non- SRI farmers of high well being farmers group

Variables	Mean		t value	Difference in percentage
	SRI farmers	Non-SRI farmers		
Irrigation hrs. 300.41(57.22%)	525(100%)	-794.59*	42.78%	
Plant protection chemicals usage	9.122(38.83)	23.492(100%)	-62.78*	61.17%
Chemical Fertiliser Usage	4.257(36.58)	11.637(100%)	-82.58*	63.42%

Table 7: Comparison of grain yield of SRI and Non-SRI farmers of 3 well being groups

Variables	SRI farmers	Non-SRI farmers	Difference in Grain Yield
Grain yield	267.714 t acre^{-1}	223.212 t acre^{-1}	44.502 t acre^{-1}

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