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PERFORMANCE EVALUATION FOR SYSTEM OF RICE INTENSIFICATION (SRI) AND FARMERS' PRACTICE IN *BORO* RICE CULTIVATION

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ABSTRACT

The experiment was conducted at the village Boyra Sesmore, Bangladesh Agricultural University, Mymensingh from December 2012 to May 2013 to study the yield and economics of SRI and farmers method of *Boro* rice cv.BRRIdhan29 cultivation. The experiment consisted of a) cultivation of rice only by 10 tha^{-1} cowdung (T_1), b) recommended SRI package (T_2) with 5 tha^{-1} of decomposed cowdung +100% of recommend fertilizer RF; this coincides with the original concept of SRI), c) SRI modification-1 (T_3) with 100% of RF; SRI concept suggest to use manure), d) SRI modification-2 (T_4) (with 5 t ha^{-1} of decomposed cowdung + 50% of RF; 50 : 50 use of manure: fertilizer), e) modification-3 (T_5) with 10 t ha^{-1} of decomposed cowdung +50% of RF; 50% manure + 50% dose of fertilizer), f) Farmers practice of rice cultivation (T_6). The experiment was laid out in a randomized complete block design (RCBD) with three replications. The effect of various cultivation methods of SRI was significant in respect of all plant characters except plant height. The tallest plant height (100.23 cm), the highest number of total tillers hill^{-1} (35.01), effective tillers hill^{-1} (28.00), grains panicle^{-1} (152.60), grain yield (7.50 t ha^{-1}) and straw yield (9.41 t ha^{-1}) were obtained with 5 t ha^{-1} of decomposed cowdung +100% of recommend fertilizer RF (T_2); of SRI and the highest number of non-effective tillers hill^{-1} (6.58) was obtained from 10 t ha^{-1} of decomposed cowdung +50% of RF; 50% manure + 50% dose of fertilizer (T_5). The shortest plant height (92.85 cm) and the lowest grain yield (3.57 t ha^{-1}) were obtained from farmers own practice of cultivation. The lowest number of total tillers hill^{-1} (22.82) was obtained from only use cowdung, effective tillers hill^{-1} (17.00), grains panicle^{-1} (92.09) were recorded from cultivation of rice in T_1. The highest number of total cost of production (154397.00tk) was obtained from 5 tha^{-1} of decomposed cowdung +100% of recommend fertilizer (T_2) and lowest cost of production was (61957tk) observed from farmers own practice of rice cultivation . The lowest number of net return (27349.67tk) and the lowest BCR (1.18) was obtained from 100% of recommend fertilizer (T_3).
Key words: SRI, BRRI dhan29, manure, fertilizer, yields.

Introduction

System of Rice Intensification (SRI) has attracted attention because of its apparent success in increasing rice yield. It is claiming to be a superior technology (Barrett *et al.,* 2004) which can increase the yield to a fantastic level (Sheehy *et al.,* 2004). SRI was originated in Madagascar and was first synthesized by de Laulanie (1983), a French Jesuit priest. SRI raises productivity not by relying on external inputs, e.g., new seeds and fertilizer, but by changing the way farmers manage their rice plants, soil, water and nutrients (Uphoff, 2007). The success of SRI method of rice cultivation depends on the synergistic development of both tiller and root system. The main elements of SRI are to transplant young seedlings that preserve the full genetic potential for producing more viable tillers and root growth, to give the plants wide spacing with single seedling that can reduce competition between hills and keep the soil well-aerated that can allow maximum uptake of nutrients (Uphoff, 1999). In SRI method there are some components that are to be maintained properly for obtaining the maximum return from the method. For example, under this system less than 15 day old infant seedlings are transplanted within 30 minutes of uprooting with single seedling hill^{-1} and having spacing not less than 25 cm x 25 cm even up to 50 cm x 50 cm in square method of planting. Rice plants can better realize their potential for tiller and root growth and for subsequent grain filling when spaced more widely rather than more densely. Yield depends on the number and size of fertile tillers cm^{-1} rather than per plant, but total plant performance can be enhanced with optimum spacing rather than crowding. The seedlings are transplanted so that their roots remain in `L' shape instead of traditional

`J' shape. The field should be kept moist, no standing water would be allowed until reproductive stage. It is a system of plant, soil, water, and nutrient management for irrigated rice, developed in Madagascar which has been yielding 5-8 t ha^{-1} even more on farmers fields where previous yield average was around 3 t ha^{-1}. Various cultivation methods of SRI was an important factor for successful rice production because it controls proper plant population $unit^{-1}$ area and increases the availability of sunlight, nutrient, water etc. and increases photosynthesis and respiration which may ultimately influence the yield and yield contributing characters of rice (Chowdhury *et al.,* 1993). Optimum use of cowdung may enable the rice plant to grow properly both in aerial and underground parts by utilizing maximum solar energy, space, nutrient and water and also could reduce seedling cost of farmers. Therefore, the present study was conducted with the objectives: i) to compare SRI method and *Boro* rice cultivation against farmers' practice, ii) to observe the growth and yield performance of *Boro* rice (cv. BRRI dhan29) through modification of SRI techniques, iii) to assess the performance of SRI method along with possible modifications of *Boro* rice and iv) to evaluate the economics of farmers' practice and SRI methods of Boro rice cultivation.

Materials and Methods

The study was conducted at the Agronomy Field Laboratory, Bangladesh Agricultural University, Mymensingh from December 2012 to May 2013 with a view to finding out the effect of number of seedlings $hill^{-1}$ and nitrogen management on the yield of *Boro* rice cv. BRRI dhan29 under SRI method. The experiment consisted of-

a. Cultivation of rice only by 10 tha^{-1} cowdung (T_1),
b. Recommended SRI Package (T_2) (with 10 t ha^{-1} of decomposed cowdung+100% of recommend fertilizer (RF); this coincides with the original concept of (SRI)
c. SRI modification-1 (T_3) (with 100% of recommend fertilizer (RF); SRI concept suggest to use manure only
d. SRI modification-2 (T_4) (with 5 t $ha^{-1}$of decomposed cowdung + 50% of RF; 50 : 50 use of manure: fertilizer
e. Modification-3 (T_5) (with 10 t ha^{-1} of decomposed cowdung + 50% of RF; full dose manure + 50% dose of fertilizer)
f. Modification-4 (T_6) Farmers own practice of rice cultivation.

The experiment was laid out in a randomized complete block design with three replications. The size of each unit plot was (2.5 m x 4 m) with the spacing of plant to plant 25 cm x 25 cm and the total number of plots was 18. Ten days old seedlings were transplanted on January 2013. Ten-Fourteen days old seedlings were transplanted in the field. Intercultural operations such as gap filling, weeding, and water management were done as and when necessary. Harvesting was done when 90% of the grains become golden yellow in colour. Five hills were randomly selected from each plot prior to harvest for recording data on plant characters and yield. Grain and straw yields were recorded plot-wise. Data on plant characters like plant height, number of total tillers $hill^{-1}$, effective tillers $hill^{-1}$, panicle length, grains $panicle^{-1}$, grain yield, straw yield and harvest index were recorded and analyzed following the ANOVA technique and the mean differences were adjudged by DMRT (Gomez and Gomez, 1984) using a statistical package MSTATC. The economic data were analyzed by treatment to treatment variation.

Results and Discussion

Plant characters at harvest and yield of Boro rice cv. BRRI dhan29 under SRI method of cultivation

The effect of various cultivation methods of SRI was significant in respect of all plant characters except plant height (Table 1). However numerically the tallest plant height (100.23 cm) was obtained from 5 tha^{-1} of decomposed cowdung +100% of recommend fertilizer) (T_2) and the shortest (92.85cm) one was obtained from SRI modification-3 (with 10 t ha^{-1} of decomposed cowdung +50% of RF). The highest total number of tillers $hill^{-1}$ (35.01) was produced with 5 tha^{-1} of decomposed cowdung +100% of recommend fertilizer (T_2)**,** on the other hand the lowest number was found when the rice cultivated only by 10 t $cowdung^{-1}$ (T_1).

Table 1. Effect of different treatments on the yield and yield contributing characters of *Boro* rice cv. BRRI dhan29 under SRI method

Treatment	Plant height (cm)	Total tiller hill^{-1} (No)	Effective Tiller hill^{-1} (No)	Panicle length (cm)	Grains panicle^{-1} (No)	Harvest Index (%)
T_1	98.93	22.82c	17.00c	25.33b	92.09c	42.68d
T_2	100.23	35.01a	28.00a	25.31b	152.60a	44.37a
T_3	95.29	31.79ab	26.33a	26.08a	146.38a	44.15ab
T_4	93.98	26.06b	20.00b	25.85b	141.82a	43.91b
T_5	92.85	27.25b	20.67b	26.09a	112.17bc	43.74c
T_6	97.01	25.95b	20.67b	26.09a	120.32b	40.43e
CV (%)	5.28	6.28	7.28	7.97	8.97	4.67
Level of significance	NS	**	**	*	**	*

In a column, figurers with same letter(s) or without letter do not differ significantly whereas figures with dissimilar letters differ significantly as per DMRT.

** = Significant at 1% level of probability, * = Significant at 5% level of probability, NS = Not significant.

T_1 = 10 tha^{-1} cowdung, T_2 = 5 t CD + 100% RF, T_3 = 100% RF, T_4 = 5 t CD + 50% RF, T_5 = 10 t CD + 50% RF, T_6 = Farmer's Practice

The highest number of effective tillers hill^{-1} (28.00) was observed with 5 t ha^{-1} of decomposed cowdung +100% of recommend fertilizer) (T_2) and the lowest (17.00) was recorded in cultivation of rice only by 10 t cowdung^{-1} (T_1). Panicle length was significantly influenced by various cultivation methods of SRI practices. However numerically the longer panicle (26.09) was observed with 10 tha^{-1} of decomposed cowdung + 50% of RF (T_5) and the shorter panicle (25.31) was obtained from 5 tha^{-1} of decomposed cowdung +100% of recommend fertilizer (T_2) (Table 1). Highly significant difference in the production of grains panicle^{-1} was observed due to the effect of various cultivation methods of SRI. The plant produced maximum grains panicle^{-1} (152.60) with 5 t ha^{-1} of decomposed cowdung +100% of recommend fertilizer (T_2) and the minimum grains panicle^{-1} (92.09) was in cultivation of rice only by 10 t cowdung $^{-1}$. Shah *et al.* (1991) also reported that number of grains panicle^{-1} increased with the increased of cowdung. The highest grain yield (7.50 t ha^{-1}) was observed from 5 t ha^{-1} of decomposed cowdung +100% of recommend fertilizer (T_2), and the lowest grain yield (3.57 t ha^{-}) was recorded in the farmers own practice of rice cultivation (T_6) (Fig. 1). The highest grain yield might be the cumulative effects of more effective tillers hill^{-1}, longest panicle and more numbers of grains panicle^{-1}. Here in the present study, increased grain yield recorded from 5 t CD+100% RF, which ensured better yield contributing characters like number of effective tillers hill^{-1}, panicle length and number of grains panicle etc. Straw yield was significantly affected by various methods of SRI at 1% level of probability. The Highest straw yield (9.41 t ha^{-1}) was observed from 5 t ha^{-1} of decomposed cowdung +100% of recommend fertilizer) (T_2), and the lowest straw yield (5.20 t ha^{-1}) was observed from the farmers practices of cultivation (Fig. 2). Khan and Shafi (1956) reported that straw yield increased with an increase in cowdung and recommended dose of fertilizer. Similar trend of straw yield was also reported by Srivastava *et al.* (1987), Khanda and Dixit (1996). SRI methods influenced vegetative growth in terms of plant height and number of tillers hill^{-1} that resulted in increased straw yield. From the above results of the present study it can be observed that 100% recommended dose applied appeared to be the best in respect of yield and yield contributing characters of *Boro* rice cv. BRRI dhan29. However, further studies are necessary in different Agro-ecological zones of Bangladesh for validation and confirmation of these results. Number of various cultivation methods of SRI showed highly significant effect on the harvest index at 1% level of probability. The maximum harvest index (44.37%) was obtained from 5 t ha^{-1} of decomposed cowdung +100% of recommend fertilizer) (T_2), and the minimum harvest index (40.43%) was obtained from farmers own practices of cultivation (T_6).

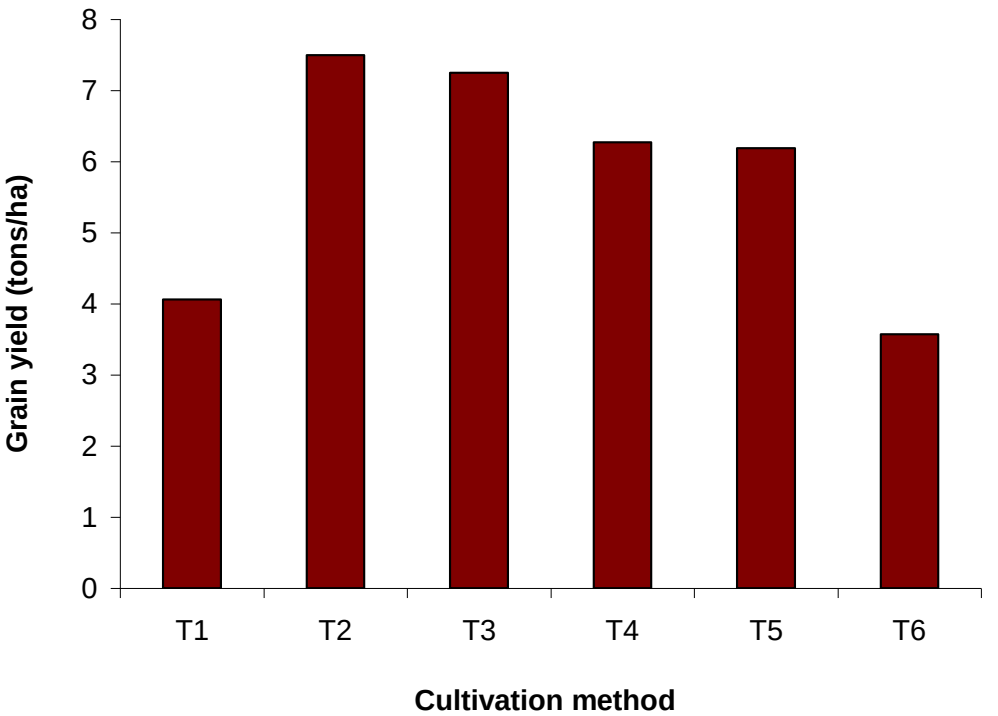

Fig . 1. Effects of different cultivation methods of SRI on Grain yield of Boro rice cv. BRRI dhan29

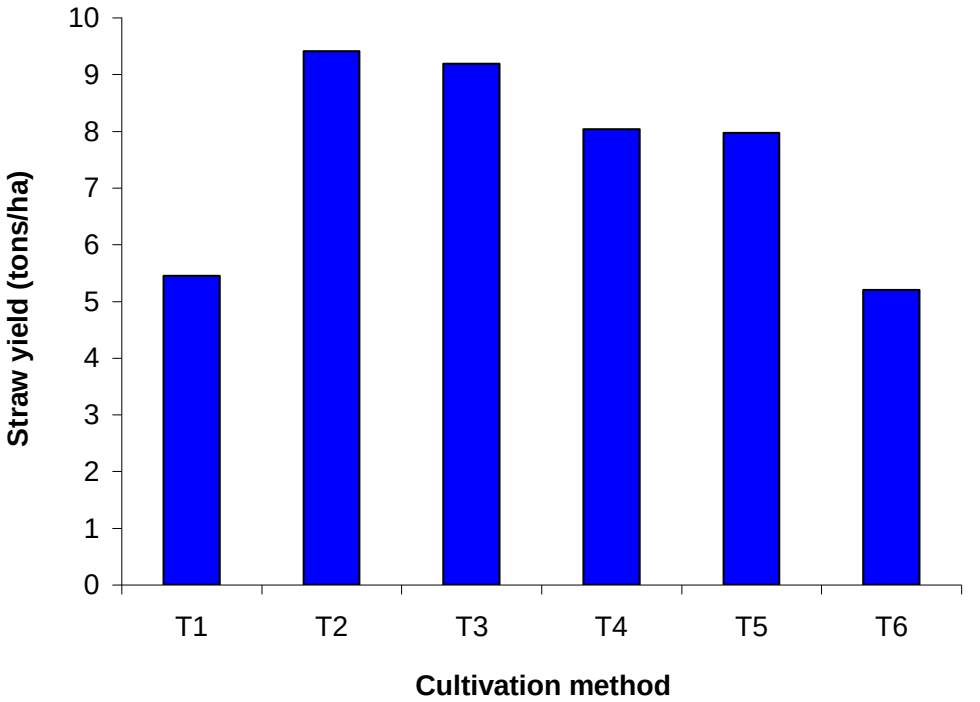

Fig . 2. Effects of different cultivation methods of SRI on straw yield of Boro rice cv. BRRI dhan29

Cost- return analysis of Boro rice cv. BRRI dhan29 under various methods of cultivation

The cost analysis table (Table 2) indicated that the cultivation method had noticeably significant effect on total cost of production. The highest total cost of production (154397tk) was observed from 5 tha^{-1} of decomposed cowdung +100% of recommend fertilizer) (T_2), and the lowest total cost of production (61957.72 tk) was recorded in the farmers practices (T_6). The total cost of production is highest in T_2 because of the accumulation of 5 t CD + 100% RF, which influence the better growth and development of the plants. The highest gross return (187626.67) was observed from 5 tha^{-1} of decomposed cowdung +100% of recommend fertilizer) (T_2), and the lowest gross return (92113.33) was observed from the farmers practices. Cultivation methods influenced vegetative growth in terms of plant height and number of tillers $hill^{-1}$ that resulted in increased gross return. It is pointed out that gross return increased significantly with increased rate 5 t CD + 100% RF. The net return is very important for crop production. The highest net return was notice in (39528.86 tk) from 5 t ha^{-1} of decomposed cowdung + 50% of RF (T_4) and the lowest net return was notice in (28984.18 tk) in SRI modification-1 (T_3) with 10 t ha^{-1} of decomposed cowdung). The benefit cost ratio plays a vital role in crop production. On the other hand, the highest benefit cost ratio was noticed in (1.61) cultivation of rice only 10 t $cowdung^{-1}$ (T_1), and the lowest benefit cost ratio was notice in 1.18 from SRI modification-1 with 100% of recommend fertilizer (T_3). Grain yield increased in all SRI cultivation methods compared to that of farmers practice. The highest increase (84.88%) in grain yield was obtained with the application of 100% recommended fertilizers which was followed by 100% recommended fertilizers plus 5t CD ha^{-1}. Among the SRI cultivation methods with modification application of only 10 t CD ha^{-1} produced the lowest increase in grain yield compared to that of farmers practice.

Table 2. Cost- return analysis of *Boro* rice cv. BRRI dhan29 under SRI method of cultivation

Treatment	Grain yield (kg/ha)	Straw yield (kg/ha)	Gross Return (Tk.)	Production cost (Tk.)	Net return (Tk.)	BCR	Grain yield Increased (%)
T_1	4056.67d	5453.33c	102946.67c	63962.49d	28984.18d	1.61a	12.12
T_2	7500.00a	9406.67a	187626.67a	154397.00a	33229.66c	1.31cd	84.88
T_3	7250.00ab	9186.67ab	181746.67ab	143083.88b	38662.70f	1.18d	78.72
T_4	6270.00b	8033.33b	157533.33b	102514.66c	35628.67a	1.45ab	64.56
T_5	6193.33c	7970.00b	155746.67b	106207.81c	37528.86b	1.47b	52.67
T_6	3565.00e	5203.33d	92113.33d	61957.72e	29155.61e	1.48b	
CV (%)	5.67	6.67	7.67	8.67	9.67	10.67	
Level of significance	**	**	**	**	**	**	

In a column, figurers with same letter(s) or without letter do not differ significantly
** = Significant at 1% level of probability
T_1 = 10 tha^{-1} cowdung, T_2 = 5 t CD + 100% RF, T_3 = 100% RF, T_4 = 5 t CD + 50% RF, T_5 = 10 t CD + 50% RF, T_6 = Farmer's Practice

Conclusion

Therefore, it may be concluded that BRRI dhan29 grown with various cultivation methods of System of Rice Intensification (SRI) may be practiced by the farmers. However, further studies are necessary in different Agro-ecological zones of Bangladesh for validation and confirmation of the results of the study.

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