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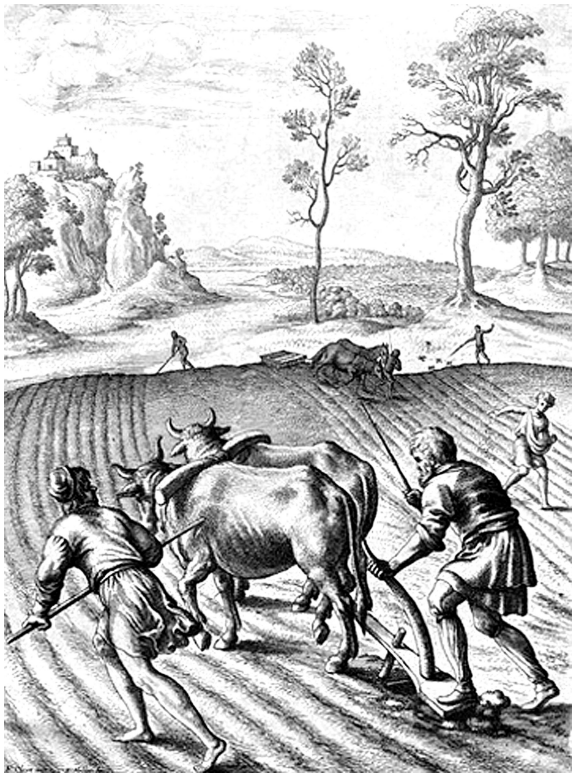

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Performance of BRRI Dhan 32 in SRI and Conventional Methods and Their Technology Mixes

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Abstract: An experiment was conducted at the Agronomy Field Laboratory of Bangladesh Agricultural University, Mymensingh from July to December, 2001 to study the performance of BRRI Dhan 32 in SRI and conventional methods and their technology mixes. The experiment was laid out in a split-plot design with three replications. The treatments used in the experiment consisted of (A) two planting methods viz., i) SRI planting method and ii) conventional planting method, (B) two types root placement e.g., i) J shape and ii) L shape and (C) three sources of fertilization viz., i) chemical fertilizer (N-60, P_2O_5-40, K_2O-40, S-10, Zn-5 kg ha^{-1}, respectively) ii) organic fertilizer (cowdung, 10 t ha^{-1}) and iii) 50% chemical fertilizer + 50% organic fertilizer. Grain and straw yields were the highest (5.6 and 5.98 t ha^{-1}, respectively) in SRI planting method. The highest grain yield of SRI planting method was mostly the outcome of higher total number of tillers $hill^{-1}$, highest panicle length and highest number of grains panicle. Conventional planting method produced the lowest grain and straw yields (3.65 and 4.29 t ha^{-1}, respectively). Among root placement methods L shape root placement found to be better and produced higher grain yield (4.97 t ha^{-1}). Fertilization with 50% chemical fertilizer + 50% organic fertilizer performed the best regarding both grain and straw yields. The highest grain yield (5.04 t ha^{-1}) and straw yield (5.67 t ha^{-1}) were produced when 50% chemical + 50% organic were applied while the lowest ones were recorded in chemical fertilizer.

Key words: SRI technique, root placement method, fertilization, rice yield

Introduction

A system of rice intensification (SRI) developed in Madagascar in the early 1980s (***le Systeme de Riziculture Intensive***, SRI) has been showing that yields can be doubled or more just by changing certain common practices for managing the interactions among rice plants, soil water and nutrients: by transplanting rice seedlings early, carefully, singly and widely spaced, with soil kept well aerated, i. e., moist but not saturated, during their vegetative growth phase (Laulanie, 1993). The success of SRI is based on the synergetic development of both the tiller and root system. A vigorous root systems is a prerequisite for a healthy plant. When seedlings are pushed into the ground rather than gently laid into soil, they must expend a lot of energy to resume growth. In addition, the tips of the roots will be pointed up toward the surface. The shape of the transplanted seedling will be like a "J", with its root bent upward. It is understood that the

rice plant root grows from its tip. If the tip is pointed upward due to improper transplantation, the root must change its position in the soil to become pointed downward before it can grow. Therefore, with SRI, one does not thrust seedlings downward into the soil. Rather each seedlings is slipped sideways into the soil, very gently and close to the surface, so that its root lies horizontally in the moist soil. This makes the shape of the transplanted seedlings more like an "L" than like a "J". With this surface, it is easier for the tip of the root to grow downward to the soil. When the plant is shaped more an "L" than a "J", less energy is necessary for the plant's root to start growing quickly downward and to begin putting more roots at the same time that it is sending tiller upward. Comparison between organic manures and mineral fertilizers in terms of their efficiencies are complicated. While organic manures and composts contain a wide range of nutrients, their qualities are known to be very variable in response to the origins of the initial material and how it was managed. By contrast, mineral fertilizers can be a purposeful balance among nutrients (not only N, P and K) in response to the soil fertility status and the specific nutrient requirements of a crop. However, the efficient management of mineral fertilizers under rainfed (unpredictable weather) conditions is also a complex problem. The impact of drought will be more serious in case of high plant densities and following high rates of N fertilizer (Franchis ***et al.***, 1990) a problem that will be accentuated under semi-arid conditions. Another aspect is the synergy between organic and inorganic sources of nutrients can improve the role of soil ***biota*** in nutrient management (Palm ***et al.***, 1997). Finally, the nutritional status of plants may affect their susceptibility to plant diseases. SRI is still being evaluated as an approach to raise rice production, requiring only changes in plant, soil, water and nutrient management. Its principles always need to be tested in as and adapted to varying environments, as there is no set formula for achieving the higher yields, SRI can produce. Rather the logic of the different components should be assessed and applied in order to see how the genetic potential that exists in all varieties of rice can be better evoked. It is now being studied and evaluated by scientists and rice growers in other countries and was found better than conventional method. But in Bangladesh, a very few research work have been done on the same. A study was therefore, undertaken to evaluate the performance of BRRI Dhan 32 grown under SRI and conventional planting techniques using organic and inorganic fertilization with different root placement methods.

Materials and Methods

The experiment was conducted at the Agronomy Field Laboratory of Bangladesh Agricultural University, Mymensingh from July to December 2001 to study the performance of BRRI Dhan 32 in SRI and conventional methods and their technology mixes. The experimental treatments included (A) two planting methods (viz., SRI and conventional planting methods) (B) two types of root placement (viz., J shape and L shape root placement) and (C) three sources of fertilization [viz., chemical fertilizer (N-P_2O_5-K_2O-S-Zn-@ 60-40-40-10-5 $kgha^{-1}$, respectively), organic fertilizer (cowdung, 10 t ha^{-1}) and 50% chemical fertilizer + 50% organic fertilizer]. The experiment was laid out in split-plot design with three replications. The unit plot size was 10 m^2 (4.0 × 2.5 m) and

space between main plots and subplots were 1.5 and 1 m, respectively. 15-day old seedlings were transplanted on 26 July 2001 at the rate of l seeding hill^{-1} with 25 × 25 cm spacing in case of SRI method while in conventional planting method, 25-day old seedlings were transplanted at the rate of 3 seedlings hill^{-1} maintaining the spacing 25 ×15 cm. In SRI method, due to high weed infestation weeding was done by hand pulling at 7day intervals starting from 12 DAT to 47 DAT. On the other hand, in conventional method, weeding was done only twice by hand pulling at 25 and 45 DATs. Since water management is an important factor for SRI technique, irrigation was done once a week due to lack of sufficient rainfall during the study period. But water stagnancy was avoided by maintaining drainage system. While in case of conventional method irrigation was done thrice during the whole growing period. Five hills (excluding border hills) from each plot were selected randomly and sampled just before harvesting the whole plot to record necessary data. The crops were harvested at full maturity which was determined when some 90% of the seeds became golden yellow in colour. Date of harvest for SRI and conventional methods were 3 November and 28 October 2001, respectively. The data on different agronomic characters were recorded from randomly selected hills in each plot and those on grain and straw yields were recorded from the whole plot harvested. Data were analyzed using the "Analysis of variance" technique and mean differences were adjudged by DMRT.

Results and Discussion

Effect of planting method

Planting method significantly affected all the characters studied except number of non-effective tillers hill^{-1} (Table 1). SRI planting method produced higher number of total tillers hill^{-1} (12.29) and higher number of effective tillers hill^{-1} (11.31) than conventional method. Variable effects of planting method on number of total tillers hill^{-1} was also reported by Uphoff (1999) who noticed that number of total tillers hill^{-1} varied among planting methods. Longer panicle (25.74 cm), higher number of grains panicle^{-1} (142.28) and higher number of sterile spikelets panicle^{-1} (17.67) were also recorded with SRI planting method. Islam (2000) also opined that number of grains per panicle^{-1} varied among planting methods. SRI method performed better than conventional method regarding 1000-grain weight also. This finding closely resembles to that of Uphoff (2001). The performance of conventional method was better than SRI method with respect to only plant height and number of sterile spiklelets panicle^{-1}. Because the former method produced taller plant (130.04 cm) but less number of sterile panicle^{-1} (16.49) than the latter one (126.28 cm and 17.67, respectively). SRI planting method produced higher grain yield (5.67 t ha^{-1}) than conventional planting method (3.65 t ha^{-1}). Hirsch (2000) also reported in the same tune. Higher grain yield of SRI method was the outcome of higher number effective tillers hill^{-1}, longer panicle, higher number of grains panicle^{-1} and higher 1000-grain weight. Higher straw yield (5.48 t ha^{-1}), biological yield (11.65 t ha^{-1}) and harvest index (48.62%) were observed in SRI planting method. Higher straw yield of SRI method was the consequence of higher number of total tillers hill^{-1}.

Table 1: Effect of planting method on the crop characters of BRRI dhan 32

Planting method	Plant height (cm)	Total number of tillers hill^{-1}	No. of effective tillers hill^{-1}	No. of non-effective tillers hill^{-1}	Panicle length (cm)	Number of grains panicle^{-1}	Number of sterile spikelets panicle^{-1}	Weight of 1000 grains (g)	Grain yield (t ha^{-1})	Straw yield (t ha^{-1})	Biological yield (t ha^{-1})	Harvest index (%)
SRI planting method	126.28b	12.29a	11.31a	0.98	25.74a	142.28a	17.67a	21.40a	5.67a	5.98a	11.65a	48.62a
Conventional planting method	130.04a	9.11b	7.36b	1.81	23.83b	117.69b	16.49b	20.00b	3.65b	4.29b	7.94b	45.94b
S$\bar{x}$	05805.0	0.953	0.906	-	0.2292	1.6051	0.1814	0.1144	0.1173	0.1483	0.2119	0.1370
Level of Significance	0.05	0.01	0.01	NS	0.05	0.01	0.05	0.01	0.01	0.01	0.01	0.01

Table 2: Effect of root placement on the crop characters of BRRI dhan 32

Root placement	Plant height (cm)	Total number of tillers hill^{-1}	No. of effective tillers hill^{-1}	No. of non-effective tillers hill^{-1}	Panicle length (cm)	Number of grains panicle^{-1}	Number of sterile spikelets panicle^{-1}	Weight of 1000 grains (g)	Grain yield (t ha^{-1})	Straw yield (t ha^{-1})	Biological y ield (t ha^{-1})	Harvest index (%)
J shape root placement	126.69b	9.97b	8.62b	1.39	24.55	128.36	17.66	20.79	4.347b	4.86b	9.21b	47.07
L shape root placement	129.63a	11.43a	10.04a	1.39	25.02	131.61	16.50	20.65	4.972a	5.42a	10.39a	47.49
S$\bar{x}$	0.5805	0.1965	0.1314	-	-	-	-	-	0.1173	0.1483	0.1214	-
Level of Significance	0.05	0.01	0.01	NS	NS	NS	NS	NS	0.05	0.01	0.01	NS

Table 3: Effect of fertilization on the crop characters of BRRI dhan 32

Fertilization	Plant height (cm)	Total number of tillers hill^{-1}	No. of effective tillers hill^{-1}	No. of non-effective tillers hill^{-1}	Panicle length (cm)	Number of grains panicle^{-1}	Number of sterile spikelets panicle^{-1}	Weight of 1000 grains (g)	Grain yield (t ha^{-1})	Straw yield (t ha^{-1})	Biological y ield (t ha^{-1})	Harvest index (%)
Chemical fertilizer	125.95b	10.88a	9.58a	1.32	24.35b	125.83b	16.15	20.32	4.42	4.83b	9.25b	47.70
Organic fertilizer	129.55a	10.02b	8.79b	1.24	24.85ab	130.22ab	17.62	20.88	4.52	4.92b	9.44b	47.38
50% chemical+50% organic fertilizer	128.99a	11.19a	9.64a	1.62	25.15a	133.91a	17.46	20.96	5.04	5.67a	10.71a	46.67
S$\bar{x}$	0.9929	0.2553	0.02	-	0.1939	2.08	-	-	-	0.1483	0.1846	-
Level of Significance	0.05	0.05	0.05	NS	0.05	0.05	NS	NS	NS	0.01	0.01	NS

Mean values in a column having the same letter (s) or without letter do not differ significantly whereas figures with dissimilar letter (s) differ significantly

NS= Not significant at p>0.05

Effect of root placement

Root placement exhibited significant effect on some of the characters studied (Table 2). Crop characters like plant height, total number of tillers hill^{-1}, effective tillers hill^{-1}, grain yield, straw yield and biological yield were found to be higher with the L shape root placement compared to J shape root placement, while the other characters viz. panicle length, number grains panicle^{-1}, number of sterile spikelets panicle^{-1}, non bearing tillers hill^{-1}, 1000 grain weight were found independent of root placement method. Variable effects of root placement on total number of tillers hill^{-1} was also reported by Joelibarison (1998) who noticed that total number of tillers hill^{-1} differed among root placement methods. Higher grain yield (4.97 t ha^{-1}), straw yield (5.42 t ha^{-1}) and biological yield (10.39 t ha^{-1}) were recorded with L shape root placement compared to J shape root placement which produced lower values (4.34, 4.39 and 9.21 t ha^{-1}, respectively).

Effect of fertilization

Fertilization significantly affected only plant height, total tillers, effective tillers, panicle length, number grains panicle^{-1} straw yield and biological yield (Table 3) but grain yield was found non responsive to of effect of fertilization. Organic fertilizer and 50% chemical +50% organic fertilizer produced statistically similar and tallest plant, longest panicle^{-1} and maximum number of grains panicle^{-1}. While chemical fertilizer and 50% chemical + 50% organic fertilizer produced statically similar and also the highest number of total tillers and effective tillers hill^{-1}. Straw yield was found the highest with 50% chemical + 50% organic fertilizer while the other two treatments produced statistically similar straw yield. Maximum plant height along with maximum number of total tillers hil^{-1}mostly contributed to the highest straw yield produced by 50% chemical + 50% organic fertilizer. Biological yield was also found the highest with 50% chemical + 50% organic fertilizer. Similar positive trend was also reported by Rajaonarison (2000).

Interaction effect

Interaction effect of planting method, root placement and fertilization on grain and straw yields of BRRI dhan 32 were found non-significant but planting method and fertilization interacted significantly regarding grain and straw yields. Grain yield was found superior (6.33 t ha^{-1}) in SRI planting method with 50% chemical fertilizer + 50% organic fertilizer which was similar to SRI planting method with organic fertilizer (cowdung, 10 t ha^{-1}). The lowest grain yield (3.29 t ha^{-1}) was recorded under conventional planting method with organic fertilizer which was identical to the same produced under conventional method with 50% chemical fertilizer + 50% organic fertilizer and conventional method with chemical fertilizer. Similar trend was recorded also with straw yield and biological yield.

To conclude it may be said that BRRI dhan 32 should preferably be grown under SRI technique following L shape root placement method using 50% chemical fertilizer + 50% organic fertilizer to have better harvest. However, this conclusion is very much limited to this study, therefore, further investigation are necessary to arrive at a concrete decision.

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