Effect of yield, quality attributes and cost of rice (*Oryza sativa L.*) variety under System of rice intensification (SRI) Organic & Conventional methods of rice cultivation.

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Abstract- System of Rice Intensification (SRI) paddy was introduced to offset the heavy cost of Conventional paddy cultivation. To decrease the cost of cultivation in Conventional paddy, to increase profits of the farmers in rice cultivation by decreasing the use of fertilizers, pesticides and minimizing water use by scientific water management in the face of labour scarcity, SRI paddy was introduced in Madagascar. In Conventional paddy the spacing of 20x15cms was followed and 20-25 days seedlings were used, and whereas, in SRI paddy cultivation, the wider spacing of 25x25cms was followed and by 8-12 days seedlings were used. Although large number of labour were needed for weed management in Conventional paddy, minimal labour was required for weed management in SRI paddy because of using weeders and machinery for weed management. While large amount of water to the tune of 2"-5" inundation was required for Conventional paddy cultivation, a film of water up to 1" only is maintained throughout in SRI paddy cultivation. The use of pesticides was heavy in Conventional paddy cultivation, where as the pest management is done without chemical pesticides in SRI paddy cultivation. The profits attained due to SRI paddy cultivation was higher as compared to Conventional paddy cultivation, therefore, SRI paddy was called as poor farmers' crop.

Index Terms- System of Rice Intensification (SRI) method, Conventional cultivation practices, Weed management, Pesticide management, Comparative cost analysis.

I. INTRODUCTION

Rice is staple food for millions of people in the world particularly in developing countries. Globally rice is covering about 160 million ha with 685 million tons of production annually (FAO, 2009). Out of this, Asia accounts for 90% of the production and consumption. A System of Rice Intensification (SRI) is a combination of several agronomic practices including changes in nursery management, age of seedling transplanted, organic nutrient management, alternate drying and wetting and mechanical weed management (Uphoff, 2002). This system was first developed in Madagascar by Fr. Henri de Laulanie and spread to many parts of the world during the 1990's thanks in large part to Dr. Norman Uphoff. SRI is an alternative to water intensive and high chemical input practices. Although proven effective in Madagascar, modified SRI systems adapted to various geographical areas have proven difficult to evaluate and are controversial. Proponents of SRI claim its use increases yield, saves water, reduces production costs, increases income and that these benefits have been achieved in 40 countries. SRI paddy was introduced for the benefit all the farmers. And as conventional paddy cultivation was oldest method of rice cultivation. The Conventional method needs extra labour and a lot of fertilizers, The Conventional paddy cultivation practices also had undergone changes due to changing times where, the cumbersome practices were replaced. The interest of the farmers in cultivating rice by using Conventional method has decreased as large numbers of farmers was using fertilizers and pesticides in the method of Conventional paddy cultivation to increase the production of rice. Farming with modern methods is also expensive using outside inputs. It was observed that, farmers adopting Conventional methods could increase their production only by using expensive inputs such as chemical fertilizers, pesticides and hybrid seed. It is becoming increasingly difficult for the community to afford these things. It is also known that using chemicals is harmful to the environment. a new method of growing rice is designed for increasing rice production which can use the organic compost, and also the local seed. This method is called "System of Rice Intensification" (SRI). In this context, a field experiment was carried out at the research farm of Nature Bio- Foods Ltd. (A Subsidiary of LT Foods Ltd.) DAAWAT group, the experimental site is located at 28.990°N 77.022°E 224.15m above mean sea level Sonipat district of Haryana. Experiment was conducted on effect of yield, quality attributes and cost comparison of cultivation.

II. METHODOLOGY

The study on two methods of paddy cultivation i.e., Conventional and SRI was undertaken in Sonipat, where both these methods were practiced. kamaspur village was selected for demonstration; two farmers selected for the supervision for cultivating paddy with Conventional and SRI methods. Four split plot design and total of 12 treatments replicated 3 times. The field irrigated by both natural precipitation and well water. and used standard pest monitoring techniques to evaluate pest levels in treatment plot on a weekly basis from time of transplanting to harvest, Plant height, Tillers, Insect and disease observation taken at 30, 60 & 90 days after transplanting (DAT) and at harvest.

III. FINDINGS

General characteristics of demonstration field:

Two acre (87120ft*) area was selected for demonstration. area upland plain, sandy loam soil and Water type (Ca +Mg-HCO3) was found. to be of old age and middle age group whereas in SRI paddy farmer are found to be of younger age group. The average family size of Conventional paddy farmer was middle and large whereas the average family size of SRI Paddy farmer was medium. While Conventional paddy respondent was found to be educated (60%), the SRI paddy cultivator was found to be educated (90%). The average land holding of conventional paddy farmer was 3-5 acres, whereas, the average land holding of SRI paddy farmer was 4-6 acres.

Nursery management:

There are some differences between the SRI paddy and Conventional paddy in nursery management. While the SRI paddy cultivation needed 2kgs of seed per acre for nursery management, the Conventional cultivation needed 16kgs of seed per acre for nursery management. The cost of the nursery management in SRI paddy cultivation was 168 rupees per acre whereas, for the Conventional paddy nursery management it was 1250 rupees per half acre. Therefore, the farmers gained Rs 1082 per acre due to SRI cultivation up to nursery stage.

Germination percentage index was calculated using the following equation:

Germination rate is the average number of seeds that germinate over the 5- and 10- day periods.

$$\text{Germination (\%)} = \frac{\text{Number of seeds that germinated}}{\text{Number of seeds on the tray}} \text{ X } 100$$

86 seeds germinated in a tray of 100 seeds after 10 days, then

$$\text{10-day germination (\%)} = \frac{86}{100} \text{ x } 100 = 86\%$$

Method of transplanting:

There are major differences between the SRI and Conventional paddy cultivation in the method of transplanting. The method of transplanting in SRI cultivation needed 5-8 no's of labour per acre, while the Conventional paddy cultivation needed 10-12 no's of labour. The wider spacing was followed between the plants and rows in SRI paddy (25x25cms) as compared to Conventional paddy (20x15cms).Therefore, the cost of transplanting incurred in SRI paddy was 1200 rupees per acre, whereas, in Traditional paddy the cost was double more to that of SRI method i.e., 2400 rupees per half acre. Therefore, was a gain of Rs 1150 per acre for transplantation only due to SRI method of cultivation.

Weed management:

By using the Cono-weeder free of cost supplied by the Nature Bio-Foods Ltd., the SRI farmer took up weed management engaging any external labour, three time were engaged 2-3 labour for hand weeding per acre costing Rs600, while in the Conventional cultivation method the farmer engaged 10-12 no's of labour per acre costing Rs2500 per acre. Therefore, the SRI farmers gained Rs 1900 per acre for weed management.

Method of harvesting:

The crop attained maturity earlier by ten days for harvesting in SRI paddy (112 days) as compared to Conventional method of cultivation (125 days). But, the expenditure incurred was observed to be same in SRI paddy as well as in Conventional paddy cultivation methods for crop harvesting which was Rs.1500 per acre.

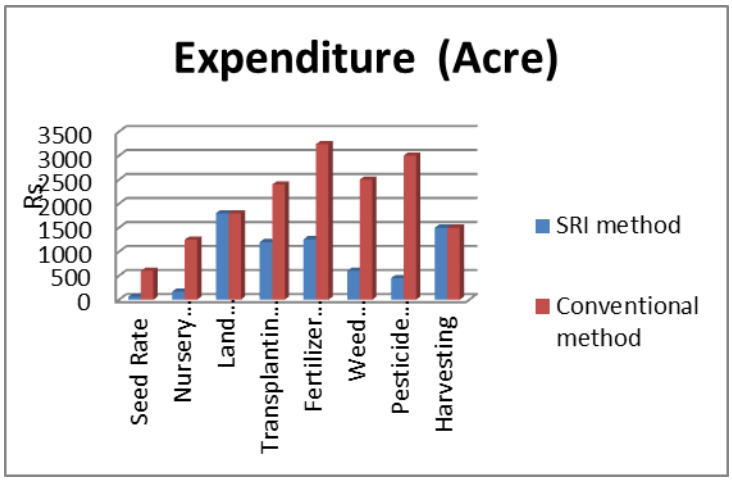
Yield and cost of cultivation:

The yield differences were observed in case of SRI and Conventional paddy cultivation methods. While the farmer following SRI method could get 25-26 bags of rice per acre, the farmer practicing the Conventional method of paddy cultivation could get only 16-18 bags of rice per acre. It was observed that in one bunch of paddy panicles of Kranti in SRI paddy method there were 3500-3700 grains, while in Conventional method, only 2400-2600 grains were observed. The total cost of cultivation per acre for SRI method was Rs.7038, while in Conventional paddy it was Rs.16290. Therefore, the profits gained due to SRI cultivation was Rs.9252 per acre.

The cost and expenditure of SRI paddy and Conventional paddy cultivation of sample farmers are given in the table as shown below

Table: The cultivation cost of SRI and Conventional paddy methods
(n = 60)

S.No	Cultivation Practices	Expenditure (SRI method)	Expenditure (Conventional method)
1	Seed Rate	Rs60	Rs600
2	Nursery management	Rs 168	Rs1250
3	Land preparation	Rs 1800	Rs1800
4	Transplanting management	Rs 1200	Rs2400
5	Fertilizer management	Rs1260	Rs3240
6	Weed management	Rs600	Rs2500
7	Pesticide management	Rs450	Rs3000
8	Harvesting	Rs1500	Rs1500
	Total	**Rs7038**	**Rs16290**



In the table shown above, it was observed that the Cost of production Qtl. of SRI paddy was Rs.270.69, whereas in Conventional paddy it was Rs.626.53. It was observed that in Conventional, many costs were incurred for land preparation and chemical fertilizers. In SRI paddy cultivation, less expenditure was observed in case of weed management and pesticide management. In Conventional paddy cultivation method, it was observed that there was much cost for fertilizers followed by pesticide management. Less cost per acre was incurred for SRI method for nursery management as compared to Conventional method. The land preparation costs and harvesting costs incurred for both the methods were same. The advantage of SRI method was seen in case of reduction in cost of cultivation, higher yields obtained per acre and lesser duration for harvesting the crop. Therefore, it is concluded that the SRI method of cultivation is advantageous to the paddy farmers as compared to Conventional method.

Growth parameters:

The plant geometry and spatial configuration is a crucial factor, which influences the growth, yield attributes and seed quality parameters of the genotypes. The results obtained on plant height at 30, 60 & 90 DAT and at harvest are presented.

Table: Response of method of cultivation variety of Kranti rice on days to 50 % flowering, yield attributes and seed yield (mean data of 2014- 2015).

Treatments	Variety	Days to 50 % flowering	Number of grains filled panicle	Number of grains unfilled panicle	Number of grains panicle	Panicle length (cm.)	Plant height (cm.)	1000 grain weight	Seed yield (q/ac)	Straw yield (q/ac)	Harvest Index (%)
O1	Kranti	91.3	167	13	156	21.8	80.4	24.8	24.6	3.57	89.8
C1		86.5	142	26	132	19.8	72.5	23.2	19.8	2.98	84.3

Table: Effect of seed quality attributes of Kranti rice (mean data of 2014- 2015).

Treatments	Variety	Other Grain %	MBD	MAD	Immature (%)	Red grain % Paddy	Dead grain	Green % in head rice	Chalky % in head rice	DD in head rice	Head rice %	Broken %	Total yield	Quality points	Amylose %	Length	Breadth
O**1**	Kranti	0	13.0	13.0	0.20	0	0.5	0.80	7.00	5.80	77.04	1.30	78.34	96.72	24.7	5.36	2.42
C**1**		1	14.76	13.90	1.18	1.5	1.0	1.1	8.60	6.20	79.05	2.02	72.18	89.86	19.10	4.98	2.12

O**1** - Organic method**,** C**1 –** Conventional method

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