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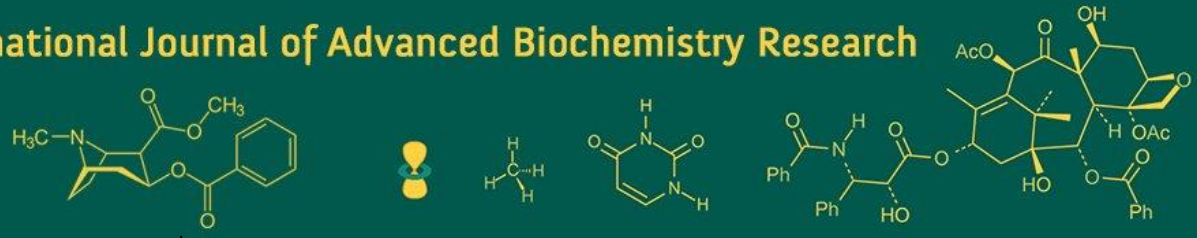

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Resource use efficiency of SRI v/s conventional method of rice cultivation and factor affecting adoption of SRI in Balaghat district

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Abstract
Rice is the staple food for about 50 percent of the world's population that resides in Asia. Where 90 percent of the world's rice is grown and consumed major objectives are to estimate efficiency in the traditional and SRI method of paddy cultivation and to examine reasons for adopting SRI and problems faced by traditional farmers in the adoption of SRI in Balaghat district of Madhya Pradesh. Four major paddy growing blocks were selected from each block and 2 villages was selected from each block. Totally 150 farmers were selected. The present study was undertaken on the basis of primary data collected from 150 paddy growers selected from Balaghat district during 2020-21. In spite of its advantage, the method gained less popularity among rice farmers. The present study an resource use efficiency analysis tried to analysis that SRI rice cultivation method provides higher grain yield returns compared to other conventional rice method. The increase net return realized in SRI method were constricted by the high cost of cultivation contributed by inter culture, harvesting and planting operation, from profitability point of view the reduction in the cost of cultivation is possible only by using cheap human labour or by including more family labour which poses the question of social sustainability. Therefore the SRI method to be refined with less labour intensive, technology oriented and user friendly improvement for the continued adoption.

Keywords: Resource use efficiency, SRI, rice, adoption, constraints

Introduction
In India rice is cultivated in 534 districts spread across 30 states and Union Territories of the country. Further intensification of irrigated rice farms is necessary to feed the growing population and to maintain food security in the near future. Rice farmers, however face several problems besides water scarcity, stagnating yield, declining profit (due to rising input costs and the low rice price), less land, and labour for rice cultivation, crop failures due to adverse weather, and growing environmental concerns. In an agrarian country like India, intensified efforts to improve both crop and water productivity and the farmers‟ income is a vital need of the hour. Besides inefficiency in resource use, the yield also stagnated in many parts of rice growing regions in India. There is little scope to increase in the area. Hence increase in production and productivity with an improvement in efficiency of production through farm technology is necessary to meet the growing demand. In this context, extensive efforts to relieve off from threats of water scarcity and enhance productivity have resulted in a farm technology consisting of a set of practices in wetland rice through System of Rice Intensification (SRI). The novelties of SRI include conservation of land, water and bio-diversity. SRI is gaining momentum among farmers. There are only less number of studies with fairly large sample in respect of resource use and technical efficiency of SRI in recent times that to after withdrawal of the promoting agencies. SRI was introduced in Madhya Pradesh little late but it is gaining wider acceptance in Balaghat District due to yield potential, lesser requirement of water and other inputs over traditional transplanting system.

Objectives of the Study
1. To determine the resource use efficiency in system of paddy intensification vs conventional method of rice cultivation.
2. To determine the factors influencing the adoption of SRI technology.

Research Methodology

The present study seeks to examine the resource use efficiency of SRI cultivation vis-a-vis. other conventional method of rice cultivation. Balaghat district of Madhya Pradesh which comprises 10 development blocks namely, Balaghat, Waraseoni, Katangi, Kirnapur, Lalbarra, Kherlanji, Langi, Paraswada, Baihar and Birsa out of which four blocks i.e. Lalbarra and Balaghat (two with higher SRI production.) and Baihar, Birsa (two with lower SRI production) were selected. Similarly, cluster of two villages namely. Kochiwada and Maneganv from Balaghat block, Birsola and Chandpuri from Lalbarra block, Piparia, Kohaka from Baihar block and Manegaon, Kaniya from Birsa block were selected. After selection of the villages, a list of farmers who were practicing both SRI and conventional method of rice cultivation was prepared with the help of RAEO and further grouped into three size groups based on their size of land holding viz; Small (up to 2 hac), Medium (2.01 to 4 hac) and large (above 4 hac). From each group, 25 farmers with higher SRI production and 25 with lower SRI production who were practicing both SRI and traditional method of cultivation were selected randomly, constituting total sample size of 150 farmers which were considered for detail investigation. The total sample for the study was 150 farmers out of which 70 were practicing transplanting, 60 broadcasting and 20 line sowing along with SRI method of rice cultivation. The study require primary data to fulfill the stated objectives. The primary data were collected by survey method using pre tested interview schedule. Secondary data regarding block wise area, production and productivity of Rice under SRI in Balaghat District were collected from publication of Agricultural department, Balaghat. The collected data pertains to agriculture year 2020-21.

Analytical Tools

For analyzing resource use efficiency in the system of rice intensification and conventional method of paddy cultivation were used. ……. For determine the factor influencing the adoptions of SRI technology.

Results and Discussion

Table 1: Regression analysis of resource use on sample farm (Unit–₹ /ha)

S. No.	Particulars	SRI (150)	Transplanting (70)	Broadcasting (60)	Line Sowing (20)
	Regression coefficient				
1	SeedX_1	0.165*** (0.062)	0.129*** (0.044)	0.138*** (0.048)	0.124*** (0.034)
2	Fertilizer and Manure X2	0.245*** (0.065)	0.318*** (0.092)	0.308*** (0.100)	0.278** (0.070)
4	Plant Protection and MeasuresX_3	-0.002** (-0.001)	-0.003NS (-0.002)	0.002** (0.001)	0.01^{NS} (0.004)
5	Irrigation chargesX_4	-0.034*** (-0.013)	-0.026** (-0.012)	-0.037*** (-0.015)	-0.03*** (-0.011)
6	Human labourX_5	0.36*** (0.12)	0.312*** (0.117)	0.322*** (0.115)	0.275*** (0.088)
7	Machine labour X6	0.26*** (0.124)	0.208** (0.084)	0.202*** (0.079)	0.197*** (0.071)
8	Sum of b	1.024	0.938	0.983	0.854
9	R2	0.999	0.995	0.997	0.998

(Figure in brackets indicate standard error of concerned of regression coefficient)
***at 1% level of Significance
**at 5% level of Significance

It is observed from the table 1 value of coefficient of multiple determination (R^2) under situation measuring the proportion of variation in the dependent variable occurred due to included independent variable has been mathematically accounted for all independent variable together, which were as point 0.999, 0.995, 0.997 and 0.998 on SRI, transplanting, broadcasting and line sowing respectively.

The return to scale is the some of elasticities of the variable factor included in the behaviour of change of the total return while changing all the inputs simultaneously in the same proportion. At the SRI the sum of regression coefficient was 1.024 including increasing return to scale for SRI and transplanting value was 0.938 for broadcasting 0.983 and 0.854 for line sowing showing decreasing return to scale in the area under study. The regression coefficient for human labour as shown in the table 1 SRI was found to be more 0.36 and highly significant as compared to transplanting, broadcasting and line sowing indicating that an increase of investment on human labour will increase production of paddy. The regression coefficient for machine labour in case of SRI (0.26) was found to be maximum and highly significant as compared to transplanting (0.208), broadcasting (0.202) and line sowing (0.197) respectively. This showed that machine labour contributed to the production of paddy. The regression coefficient of fertilizer in the SRI were found to be maximum.

Resource Optimization

The existing and optimal resources used with give capital outlay on different method corresponding of Rice cultivation along with corresponding incremental yield through optimization as the existing resources use was deviating from optimum.

Table 2: Existing and optimum resource allocation of SRI and conventional method of Rice Cultivation (Rs/ha)

Resources	Human Labour	Machine Labour	Seed	Fertilizer	Irrigation	Plant Prot.	Cost Incurred	Productivity (qt./ha)
SRI Method								
Existing	14290	2563	984	6548	865	289	25539	39.8
Optimum	14508	2555	1003	6353	820	300	25539	40.1
Amt. Allocated	218	-8	19	-195	-45	11	0	0.3
Remark	UU	EU	UU	UU	EU	UU		
Transplanting Method								
Existing	10270	2485	1392	5859	982	134	21122	23.6
Optimum	10200	2480	1448	5600	970	424	21122	28.4
Amt. Allocated	-70	-5	56	-259	-12	290	0	4.8
Remark	EU	EU	UU	EU	EU	UU		
Broad casting Method								
Existing	7515	2446	1697	4630	982	105	17375	17.3
Optimum	7550	3146	1423	4800	253	200	17375	18.8
Amt. Allocated	35	703	-274	170	-729	95	0	1.5
Remark	UU	UU	EU	UU	EU	UU		
Line Sowing Method								
Existing	5746	3965	1394	5327	142	134	16708	9
Optimum	5685	3950	2233	4270	320	250	16708	10
Amt. Allocated	-61	-15	839	-1057	178	116	0	1
Remark	EU	EU	UU	EU	UU	UU		

Ih Note: UU -Under utilized EU - Excess Utilized

Negative regression value due to insignificant/ negligible cost incurred in plant protection.

In the beginning of the study it was assumed that the farmer had not allocated their resource optimally under discussion we have seen that the ranges of both positive and negative regression coefficient on the basis of observed facts analyzing regression.

The existed enough scope for increased expenditure on human labour, seed, fertilizer and plant protection measures. The optimization resulted into an increase of yield of 0.3 q/ha over the existing level.

The exiting expenditure on machine labour, irrigation was substantially higher than its optimal level. Suggesting curtailment of expenditure on these input and using the same for purchase of human labour, seed, fertilizer and plant protection measures which would given higher yield of 0.3, 0.48, 1.5 and 1 respectively.

The needed resources adjustment within units of capital outlay would result in an increased yield by 0.3 q/ha over and above the existing level.

Factors influencing the adoption of SRI technology

Table 3: Factors influencing the adoption of SRI technology.

Variables	Particulars	"b"	S.E.
x_1	Age of the farmer	-0.053	0.287
x_2	Education	0.361***	0.120
x_3	Farm size	0.124**	0.042
x_4	Household size	0.315***	0.082
x_5	Monthly income	0.272**	0.080
x_6	Years of rice farming	0.409**	0.121
x_7	Extension services	0.703***	0.141
x_8	Knowledge about SRI	0.136**	0.090
x_9	Labour charges	-0.030***	-0.011
x_{10}	Distance from canal	0.201**	0.089
R2		0.999	

(- Significant at the 1 percent level, *Significant at the 5 percent level)

To evaluate the factor, which affects adoption pattern of SRI technology of paddy growers like Age of the farmer, education, farm size, household size, monthly income, years of rice farming, Extension services, knowledge about SRI, labour charges and distance from canal were considered. Out of these, education, farm size, Extension services, house hold size, monthly income, knowledge about SRI, showed positive and highly significant response over adoption pattern, while Age of the farmer, labour charges farm size, and distance from canal showed negative and significant response over adoption. The flitted Cobb-Doglous production function explained 99.9% affects from these variables revealed that remaining was the affects of other unknown variables, which were not considered in this function.

Conclusion

The SRI rice cultivation method provides higher grain yield and net return when compared to other conventional method. The total cost of cultivation was higher in SRI than other conventional method. The existing expenditure on machine labour, irrigation was substantially higher its optimal level. The existed enough scope for increase expenditure on human labour, seed, fertilizer and plant protection measures. To ensure continued adoption, less labour intensive technology oriented and user friendly improvement are required to be made in SRI rice cultivation method.

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