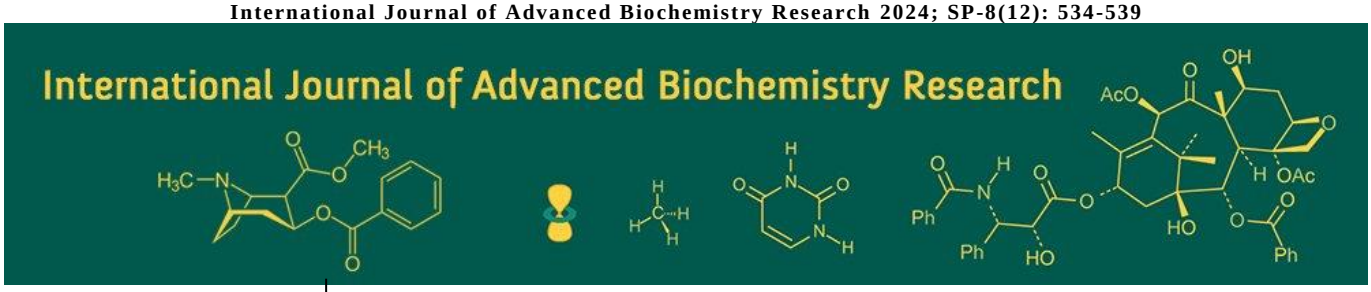

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Comparative analysis of cost and return in SRI v/s conventional method of rice cultivation and constraints of SRI in Balaghat district

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Abstract
The present study was undertaken to examine the cost and return of paddy technology and their constraints have been analyzed on the basis of primary data collected from 150 paddy growers selected from Balaghat district during 2020-21. Simple tabular analysis such as cost and return analysis, Garrette ranking, differentiate test for comparision between SRI and other conventional method of paddy cultivation.

Keywords: Cost and return, benefit cost ratio, SRI, cost of production, cost of cultivation

Introduction
Rice acknowledge as a commodity to mankind in the light of the fact the rice is really an existence, culture, custom, and method for business. The Area occupied under rice and its contribution and production in the world was found to be 163.093 million hectare and 769.228 million tones respectively. Out of which India occupied highest area accounted for 27.63% of the total world area and contributed 24.24% production of rice after China (27.54%) in the world as for as productivity is concerned it was found to be 4138 kg/ha which was found to be below (30.48%) to the world rice productivity (4717 kg/ha) (Agricultural statistics at a glance 2022). Rice occupied an important place in the cropping pattern of Madhya Pradesh. The Rice area in the state is stagnating over the years where as there is remarkable fluctuation in yield and production. The Area occupied under rice was reported to be 2.02 millions hectare and its contribution and production in Madhya Pradesh was found to be 5.63 millions tones and productivity was found to be 2789 kg/hac. Which was found to be 67.39 percent less than national productivity (4138 kg/ha). The top five district with higher rice area namely Balaghat, Seoni, Mandla, Rewa and Katni renowned as Rice Bowl of Madhya Pradesh. Balaghat ranked first in the state of Madhya Pradesh. Area occupied (14%) and contributed in production (24%) contributed. The study is undertaken to examine and compare the cost and return of SRI with conventional method (Transplant, Broadcasting, and Line sowing method) under paddy cultivation in Balaghat District of Madhya Pradesh with following objectives.

Objectives
1. To analyse the costs and returns of Paddy cultivation in the System of Rice Intensification and their comparison with conventional cultivation on sample farm
2. To identify constraints in adoption of system of rice intensification.

Research Methodology
The study is confined to 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 purposively. 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 were 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 was be considered for detail investigation. The primary data were collected by survey method using pre tested interview schedule. The data pertains agriculture year 2020-21.

Analytical tool

For analyzing cost and return of paddy cultivation cost concept used in CACP were employed and various profitability measures were also worked out to compare SRI with conventional method (Transplanting, Broadcasting and Line sowing) of rice cultivation. The Garrett ranking were used to study the opinion of the farmers regarding the adoption and non adoption of SRI. Mean differentiate test was also used to comparison SRI vis-à-vis conventional method of paddy cultivation.

Results and Discussion

Economic analysis of cost and return under SRI vis-a-vis conventional method of paddy cultivation - The cost and return analysis of SRI and conventional method (transplanting, broadcasting and line sowing) were attempted and comparative analysis with respect to yield, cost of cultivation and net return were analyzed and presented in following sub heads.

Table 1: Cost of cultivation under SRI and conventional method of paddy cultivation

(Unit ₹/ha.)

Cost Item	SRI (150)	Transplanting (70)	Broadcasting (60)	Line sowing (20)
(A) Labour Cost				
1. Human labour	300	350	250	280
(i) Family	(2)	(3)	(2)	(3)
(ii) Hired	13990 (82)	9920 (77)	7265 (72)	5466 (56)
2. Bullock labour	289 (2)	186 (1)	193 (2)	86 (1)
3. Machine labour	2563 (15)	2485 (19)	2446 (24)	3965 (40)
Total labour cost	17142 (100) {62}	12914 (100) {57}	10154 (100) {56}	9797 (100) {54}
(B) Material cost				
(i) Seed	984 (11)	1392 (17)	1697 (25)	1394 (20)
(ii) Fertilizer	5798 (67)	4989 (60)	4236 (63)	5048 (72)
(iii) Manure	750 (9)	870 (10)	394 (6)	279 (4)
(iv) Irrigation	865 (10)	982 (12)	279 (4)	142 (2)
(v) PPM	289 (3)	134 (1)	105 (2)	134 (2)
Total Material cost	8686 (100) {32}	8367 (100) {37}	6711 (100) {37}	6997 (100) {39}
C. Interest on working capital (@ 10% annum)	1726 {6}	1448 {6}	1178 {7}	1225 {7}
Total Variable cost	27554 [44]	22729 [43]	18043 [40]	18019 [39]
D. Fixed cost	20854	16742	9146	15698
(i) Rental value of owned land	{70}	{67}	{41}	{66}
(ii) Deprecation	6600 {22}	6124 {25}	11856 {53}	6428 {27}
(iii) Land revenue/taxes	512 {2}	495 {2}	401 {2}	440 {2}
(iv) Interest on fixed capital (@10% annum)	1745 {6}	1484 {6}	1125 {5}	1201 {5}
Total fixed cost	29711 {100} [47]	24845 {100} [47]	22528 {100} [50]	23676 {100} [52]
Managerial cost	5727 [10]	4757 [10]	4057 [10]	4179 [10]
Total Cost	62992 [100]	52331 [100]	44628 [100]	45965 [100]

Source: Field survey

The total labour cost per hectare in case of SRI (₹ 17142) was found to be more than transplanting, (₹ 12914/ha), broadcasting (₹ 10154/ha) and line sowing (₹ 9797/ha).Out of which percent of total labour cost incurred in human labour was found to be more 17, 7 percent compared to broadcasting and line sowing and was found to be less 17 percent as compared to transplanting. The bullock labour cost in case of SRI (₹ 289/ha) was found to be more 36, 33 and 70 more as compared to transplanting (₹ 186/ha), Broadcasting (₹ 193/ha) and Line sowing (₹ 89/ha) respectively. The machine labour cost per hectare under SRI (₹ 2563) was found to be as compared to more 3, 5 as compared to transplanting and broadcasting and 55 percent less than line sowing. The material cost per hectare in case of SRI (₹ 8686/ha) was found to be 4, 23 and 19 percent more as compared to transplanting, broadcasting and line sowing.

The variable cost per hectare under SRI (₹ 27554/ha) was found to be more 17, 34 and 35 percent as compared to transplanting (₹ 22729/ha), broadcasting (₹ 18043/ha) and line sowing (₹ 18019/ha) respectively. Total fixed cost per hectare in case of SRI (₹ 29711/ha) was found to be more 16, 24, 20 percent as compared to transplanting broadcasting and line sowing. The Total cost per hectare in case of SRI (₹ 62992/ha) was found to be 17, 29 and 27 percent more as compared to transplanting (₹ 52331/ha), broadcasting (₹ 44628/ha) and line sowing (₹ 45965/ha) respectively.

Cost of cultivation of Rice under different cost concepts

Cost of manufacturing is determined by multiplying Cost A, Cost B, Cost C, Cost A2 + FL components by various standard methods shown in Table-5.2.3.

Table 2: Cost of cultivation of rice under different cost concepts

(Unit ₹/ha.)

Particulars	SRI (150)	Transplanting (70)	Broadcasting (60)	Line sowing (20)
COST A1	34154	28853	29899	24447
COST A2	34154	28853	29899	24447
COST A2 +FL	34454	29203	30149	24727
COST B1	36199	30687	31274	25928
COST B2	57053	47429	40420	41626
COST C1	36499	31037	31524	26208
COST C2	57265	47574	40568	41786
COST C3	62992	52331	44628	45965

Source: Field survey

The cost of cultivation of Rice under SRI (₹ 62992/ha) was found to be more as compared to transplanting (₹ 52331/ha), broadcasting (₹ 44628/ha) and line sowing (₹ 45965/ha). The Total Cost A2 + FL under SRI (₹ 34454/ha) was found to be more 15, 12, 28 percent more as compared to transplanting (₹ 29203/ha), broadcasting (₹ 30149/ha) and line sowing (₹ 24727/ha) respectively. Cost B_1 under SRI (₹ 36199/ha) was found to be more 18, 14, 28 percent as compared to transplanting (₹ 30687/ha), broadcasting (₹ 31274/ha) and line sowing (₹ 25928/ha) respectively. Cost B_2 under SRI (₹ 57053/ha) was found to be more 17, 29, 27 percent as compared to transplanting (₹ 47429/ha), broadcasting (₹ 40420/ha) and line sowing (₹ 41626/ha) respectively. Cost C_2 under SRI (₹ 57265/ha) was found to be more 17, 29, 27 percent as compared to transplanting (₹ 47574/ha), broadcasting (₹ 40568/ha) and line sowing (₹ 41786/ha) respectively.

Cost of production of Rice under different cost concepts

Cost of manufacturing is determined by multiplying Cost A, Cost B, Cost C, Cost A2 + FL components by various standard methods shown in Table-3.

Table 3: Cost of production of Rice under different cost concepts

(Unit –₹/ha)

Particulars	SRI (150)	Transplanting (70)	Broadcasting (60)	Line sowing (20)
COST A1	475	497	752	437
COST A2	475	497	752	437
COST A2 +FL	478	500	758	466
COST B1	494	516	779	458
COST B2	785	807	1016	785
COST C1	498	518	784	473
COST C2	789	808	1025	789
COST C3	868	889	1128	868

Source: Field survey

The cost of production of SRI (₹ 868/ha) was found to be less 2, 30 percent as compared to transplanting (₹ 889/ha), and equal to line sowing (₹ 856/ha) but less than broadcasting (₹ 1185/hac). The cost A_2 + FL under SRI (₹ 478/ha) was found to be less 5, 58 percent as compared to transplanting and broadcasting and more than 3 percent to line sowing. The cost of Cost B1 in case of SRI (₹ 494/ha) was found to be less 4 percent, 57 percent as compared to transplanting and broadcasting and, more 7 percent from line sowing. The cost of B_2 under SRI (₹ 785/ha) was found to be less 3, 29 percent as compared to transplanting (₹ 807/ha), broad casting (₹ 1016/ha) and equal to line sowing (₹ 785/ha) respectively. The cost C_2 under SRI (₹ 784/ha) was found to be less 3, 30 percent as compared to transplanting, broadcasting and equal to line sowing respectively.

Profitability Measure

Table 4: Profitability concept of SRI and various conventional method of rice cultivation

(Unit ₹/ha.)

Particular	SRI (150)	Transplanting (70)	Broadcasting (60)	Line sowing (20)
1. Main Product (Qtl/ha)	72	56.42	39.4	55
2. Value of main product (Rs./Qtl.)	1940	1940	1940	1940
3. By product (Qtl/ha)	155	125	79	107
4. Value of by product (Rs./Qtl.)	110	110	110	110
5. Gross income	156730	123204.8	85126	118470
6. Net income	93738	70873.4	40497.9	72505.4
7. Total cost	62998	52331	44628	45965
8. Net return	93738	70873.4	40497.9	72505.4
9. Family labour income	99677	75775.8	47706	76844
10. Farm business income	156255	122707.8	84374	118033
11. Farm investment income	99377	75425.8	44456	76564
12. Net return over cost (A_2+FL)	156255	122707.8	84374	118033
13. B:C ratio	2.5	2.4	1.9	2.5

Yield of Rice obtained under SRI (72 qt/ha) was found to be higher 27, 45 and 24 percent as compared to transplanting (56.42 qt/ha), line sowing (55 qt/ha), broadcasting (39.4 qt/ha). The yield of by product was found to be more under SRI (155 qt/ha) was found to be more 19, 49 and 31 percent as compared to transplanting (125 qt/ha), broadcasting (79 qt/ha) and line sowing (107 qt/ha.). The gross income of SRI (₹ 156730/ha) was found to be 21, 46, 24 percent more as compared to transplanting (₹ 123204.8/ha), broadcasting (₹ 85126/ha) and line sowing (₹ 118470/ha) respectively. The net income of SRI (₹ 93738/ha) was found to be more 24, 57 and 23 percent as compared to transplanting (₹ 788873/ha) broadcasting (₹ 40497.9/ha) and line sowing (₹ 72505/ha) respectively. The family labour income under SRI (₹ 99677/ha) was found to be more 24, 52 and 23 percent as compared to transplanting, broadcasting and line sowing.

The net return over cost A2 + FL under SRI (₹ 156255/ha) was found was found to be 21, 46 and 24 percent more as compared to transplanting (₹ 22707/ha), broadcasting (₹ 84374/ha) and line sowing (₹ 118033/ha) respectively. The net return per rupees investment was found to be more under SRI (2:6) as compared to transplanting (2:4), broadcasting (1:9 and line sowing (2:5)

Comparative analysis across various method of paddy cultivation

To determine which sowing technique is better than the other conventional methods, the mean difference test (f test) was used across multiple conventional methods with respect to cost of cultivation (Rs/ha), yield (qt/ha), and net return (Rs/ha). The identical is displayed under the following subheads

Comparative analysis with respect to cost of cultivation

The table 5 lists the numerous conventional approaches along with the mean, standard error, and level of significance.

Comparative analysis with respect to cost of cultivation

Table 5. List the numerous conventional approaches along with the Mean, standard error, and level of significance.

Table 5: Comparison between the cost of cultivation of different conventional method

(Unit ₹/ha.)

Methods of sowing	Mean	S.E.
SRI	59794.25[a]	26.12
Transplanting	51018.71[b]	26.99
Broadcasting	42333.7[d]	26.56
Line sowing	42934.05[c]	46.33

(F statistics – 791.53, P value – 9.5E-146 Fcrit-2.633, CD-0.303)

Among the average value of the cost of cultivation/ha for above four method of sowing F-statistic showing significant value. Cultivation cost for SRI is determine to be significantly highest from all the other methods of sowing i.e.₹ 59794.25/ha followed by transplanting ₹ 51018.71/ha, in line sowing₹ 42934.05/ha and in broadcasting ₹ 42333.7/ha. The cost of farming (in rupees per hectare) using different conventional methods varies significantly from one another.

Comparative analysis with respect to yield

The table 6 lists the numerous conventional approaches along with the mean, standard error, and level of significance.

Table 6: Comparison between the yields of conventional method

(qt./ha.)

Method of sowing	Mean	S.E.
SRI	73.793[a]	0.084
Transplanting	53.939[c]	0.304
Broadcasting	34.139[d]	0.298
Line sowing	54.192[b]	0.419

(F statistics –6752.32, P value – 9.7 E-285, Fcrit-2.633, CD-0.303)

Among the average value of the yield qt./ha for above four method of sowing F-statistic showing significant value. Yield for SRI is determine to be significantly highest from all the other methods of sowing i.e. 73.793 qt./ha followed by line sowing 54.192 qt./ha, transplanting 53.939 qt./ha and in broadcasting 34.139 qt./ha. The yield using different conventional methods varies significantly from one another.

Comparative analysis with respect to net return

The table 7 lists the numerous conventional approaches along with the mean, standard error, and level of significance.

Table 7: Comparison between the net return of different conventional method

Methods of sowing	Mean	S.E.
SRI	91244[a]	24.66
Transplanting	69274.3[c]	163.31
Broadcasting	39646.47[d]	25.70
Line sowing	70300.75[b]	59.28

(F statistics – 15743, P value – 6.5E-278, Fcrit-2.633, CD-0.303)

Among the average value of the yield qt./ha for above four method of sowing F-statistic showing significant value. Yield for SRI is determine to be significantly highest from all the other methods of sowing i.e.₹ 91244/ha followed by line sowing ₹ 70300.75./ha, transplanting ₹ 69274.3/ha and in broadcasting ₹ 39646.47/ha. The net return using different conventional methods varies significantly from one another.

Constraints in Rice cultivation

In the table- 8 various constraints were listed along with their relative importance. These included financial constraints, technological ignorance Unavailability of good quality seed, Financial constraints, no credit support for purchasing implements, Constraints in availability of fertilizer on time and inadequate Quantity, Costly pesticide, in effective weedicide, Lack of skill in nursery raising and transplanting tiny seedling, Lack of mechanization, lack of confidence, Unawareness of technologies, lack of education, Non availability of labour for transplanting, High rent charges of agricultural machinery.

Table 8: Constrains

Particulars	Rank
Unavailability of good quality seed	7
Financial constraints, no credit support for purchasing implements	3
Constraints in availability of fertilizer on time and inadequate Quantity, Costly pesticide, in effective weedicide	5
lack of skill in nursery raising and transplanting tiny seedling	1
Lack of mechanization, lack of confidence	8
Unawareness of technologies, lack of education	2
Non availability of labour for transplanting	4
High rent charges of agricultural machinery	6

Source: Field survey

Various constraints were listed along with their relative importance. These included financial constraints, technological ignorance, a lack of good quality seed, a lack of labour for transplanting, a lack of credit support for the purchase of implements, an expensive pesticide that is an effective weed killer, a lack of fertilizer that is available on time and in sufficient quantities, etc.

The village is remote from the town and agricultural training centers, Krishi Vigyan Kendra, so the residents are unaware of the technologies that could help them increase their profits, according to the farmer, who also ranked lack of expertise in nursery rear in and transplanting little seedling first. Un awareness of technologies and a lack of confidence are the second and third constraints, respectively.

The third constraint is financial limitations and the lack of loan support for acquiring implements, as small farmers can not afford expensive seeds, fertilizers, and pesticides that are essential to obtaining larger yields. As there is currently a shortage of hired labour and during the time of transplanting all the farmers needed manpower, there is a lack of labour available, which is the fourth limitation. Lack of education also plays a significant role in this situation. Due of a labour shortage, some farmers are switching to the traditional methods of broadcasting and lining.

Costly pesticides and inefficient weed killers make up the fifth restriction. Due to the shortage of fertilizer and the quantity available on the market, many pesticides that are toxic in nature are expensive and out of the reach of farmers. Additionally, because farmers frequently use weedicide, weeds have developed resistance to its chemical makeup, making it ineffective. Farmers exclusively receive fertilizer from one association in one village. They purchase fertilizer at the same time based on the land holding, which results in fertilizer being unavailable at the appropriate time and in insufficient quantities. Farmers received fertilizer from society at a lower cost than merchants. The sixth constraint is high agricultural machinery rental fees.

Since small and marginal farmers lack heavy machinery, they must pay high fees based on an acre's worth of land per hour, which is a significant amount. Large farmers with land larger than 2 ha have tractors, and farmers with land larger than 5 ha have heavy machines like harvesters. There is no machine for transplanting in the village, making it a more labor-intensive technology, and they didn't get much yield per hectare, which is the main reason they don't practice transplanting and SRI. Lack of mechanization and the lack of good seed quality are also considered to be the seventh constraint.

Conclusion and Policy Implementation

The findings of this study demonstrate the superiority of SRI in terms of yield and returns advantage. However, it is worth mentioning here that the actual adoption rate of SRI among paddy growers is good, these observation needs of popularizing the SRI method such as government, NGOs, and other agencies should take initiative and enhanced the extension services for SRI method. Skilled labour requirement particularly for transplanting and weeding operations was the major constraint in paddy cultivation under SRI method. So, timely guidance to the farmers and Agricultural labours through

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