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Technological gaps and constraints in cultivation of rice in Kolhapur district of Maharashtra

RA Patil, HR Shinde and AA Dhende

Abstract
The present study is an attempt to analyze the "Technological Gaps and Constraints in Cultivation of Rice in Kolhapur District of Maharashtra". For present study traditional method, Char-suttri method and Saguna Rice Technology (SRT) method of paddy cultivation are studied. The per hectare total cost of cultivation of SRT cultivators was Rs. 89639.17 which less by Rs. 4231.59 than traditional cultivators Rs. 93870.76. Due to less seed rate, less irrigation, less labour requirement. The per hectare total cost of cultivation of char-suttri grower was Rs. 101214.17 which was more by Rs. 10515.15 than traditional cultivators Rs. 90699.02. In char-suttri method all operations are similar to traditional method and some additional operations and inputs are used so, char-suttri have more per hectare total cost. B:C ratio of traditional method was 1.23 which was less than SRT method (i.e. 1.88), B:C ratio of traditional method was 1.17 which was less than char-suttri method (i.e. 1.54). It indicates that SRT and char-suttri methods are more profitable than traditional method. Difficult management practices, non-availability of skilled labours and non-availability of machine and tools are major constraints faced by farmers.

Keywords: Char-suttri method, SRT method, Per ha cost of cultivation, B:C ratio, constraints

Introduction
Paddy having botanical name *Oryza sativa* L. Family Poaceae. Origin of Paddy is Indo-Burma. Paddy (*Oryza sativa* L.) is one of the important cereal crops of the world and forms the staple food for more than 60 per cent of population and known as king of cereals. Rice is one of the most ancient crops being cultivated in 117 countries, hence called as "Global Grain". The United Nations General assembly, in a resolution declared in the year of 2004 as the "International Year of Rice", which has tremendous significance to food security. It is not only a cereal crop but also a way of life in Asian countries. It contributes about 40 to 70 per cent of the total calorie intake. This study is for analyzing technological gaps in cultivation methods of paddy.

Objectives
1. To estimate the costs of cultivation of paddy for different methods of cultivation
2. To study the problems faced by paddy producers in different methods of cultivation

Material and Methodology
The study was conducted in the Kolhapur district of Maharashtra. Two tahsils Kagal and Karveer were selected purposively on the basis of maximum area under study. Three villages from each tahsils having maximum area under Kharif paddy cultivation and undertaking by SRT and char-suttri method of cultivation were selected purposively. The villages selected from Kagal tahsils were Yamage, Bidri, Bachani and the villages selected from the Kaveer tahsils were Ambewadi, Kuditre, Hanmantwadi. Total sample of 90 growers are selected who adopted traditional method, Saguna Rice Technology (SRT) method and char-suttri method. The comparison between 30 growers of SRT and 15 growers of Traditional and 30 growers of Char- Suttri are compared with 15 traditional growers which selected in same area for present study.

Corresponding Author:
RA Patil
Agricultural Economics Section,
RCSM College of Agriculture,
Kolhapur, Maharashtra, India

RA Patil
Agricultural Economics Section,
RCSM College of Agriculture,
Kolhapur, Maharashtra, India

HR Shinde
Agricultural Economics Section,
RCSM College of Agriculture,
Kolhapur, Maharashtra, India

AA Dhende
Agricultural Economics Section,
RCSM College of Agriculture,
Kolhapur, Maharashtra, India

Analytical tools
Cost analysis
Cost A, Cost B and Cost C for estimation of per hectare cost of cultivation.

Functional analysis
The transformation of inputs into output is described by the production function. The production function is described below,

$$Y = f (X1, X2, X3 \ldots\ldots\ldots\ldots Xn)$$

Where,
Y is the per hectare output of crop with a given set of inputs X1, X2, X3 ……...Xn per hectare.

The Cobb-Douglas type of production function specified below is used for the present analysis.

$$Y = a\ x1b1\ x2b2\ x3b3\ x4b4\ x5b5\ x6b6\ U$$

Where,
Y = Yield of paddy crop (q/ha.)
a = Intercept, a scale parameter
X_1 = Per hectare seed rate (Kg.)
X_2 = Nitrogen (Kg.)
X_3 = Intercultural operating (No.) X4 = Labours (Man-days)
X_5 = Plant protection chemicals (Rs.)
X_6 = Per hectare quantity of manures (tonne)
b_1 to b_6 = Regression coefficient of respective variables
U = Error term

Thus, six independent variables and one dependent variable were selected for fitting the Cobb-Douglas production function to test the productivity of the selected resources in case of SRT, Char-suttri and Traditional methods of paddy cultivation.

Response priority index (RPI)
In the quantification of constraints expressed by the farmers, there was a problem, whether emphasis should be given for the number of responses to a particular priority or to the highest number of responses to a constraint in the first priority. But, both lead to different conclusions to resolve this, a Responses-Priority Index (RPI) was constructed as a product of Proportion of Responses (PR) and Priority Estimate (PE), where PR for the ith constraint gave the ratio of number of responses for a particular constraint to the total responses as per Equation

$$(RPI) = \frac{\sum_{j=1}^{k} f_{ij}.X_{[(k+1)-j]}}{\sum_{i=1}^{1}\sum_{j=1}^{K} f_{ij}} \quad 0 \leq RPI \geq 5$$

Where,
RPI = Response Priority Index for ith constraint,
f ij = Number of responses for the jth priority of the ith constraint (i=1, 2……, l; j= 1,2,3 …..k),

k
∑ fij = Total number of responses for the ith constraint,
j=1

k = Number of priorities, i.e. 5,

X [(k+1)-j] = Scores for the jth priority,

1K
∑ ∑ f ij = Total number of responses to all constraints, and
i=1 j=1

1
∑ RPI = Summation of RP indices for all constraints.
i=1

Result and Discussion
Comparative cost of cultivation of traditional and SRT sample cultivators
The profitability aspect of both the methods of paddy cultivation in the study area has been analysed by computing per hectare cost and returns. The pattern of inputs used in both the methods of paddy cultivation for sample farmers is depicted in Table 1.

Farmers of traditional paddy sample cultivators were found to use more of seeds 31.06 kg, N fertilizer 56.58 kg, P fertilizer 22.55 kg, K fertilizer 51.52 kg and plant protection chemicals Rs.
351.91 as against 19.32 kg of seeds, 43.03 kg of N fertilizer, 12.13 kg of P fertilizer, 26.87 kg of K fertilizer and Rs. 330 of plant protection chemicals by SRT paddy growers. However, SRT paddy growers used 12.68 man-days of male labour, 127.97 man-days of female labour, 6.55 pair days of bullock labour, 2.84 hours of machine labour and 4.77 tonnes of farmyard manure, against
22.03 man-days of male labour, 166.88 man-days of female labour, 11.61 pair days of bullock labour, 2.64 hours of machine labour, 4.58 tonnes of farmyard manure used by traditional paddy growers. Irrigation charges and depreciation were found to be more for traditional paddy method, whereas interest on working capital and rental value of land were found to be more for SRT paddy method. SRT method is mainly for drought area or area where less rainfall received. Due to that SRT method needs less irrigation compare to traditional method. SRT method needs less seed rate because in this method one or two seeds are directly sown with 25×25 cm2 planting distance compare to traditional method. In SRT method there are less intercultural operations are carried out so less labour is required compare to traditional method.

The per hectare cost of cultivation (Rs. 89639.17) for SRT method was less when compared to that (Rs. 93870.76) of traditional method. At overall level per hectare cost of cultivation was (Rs. 91754.96). The share of male and female labour in total cost 3.52 and 21.33 per cent, respectively. For traditional Sample cultivators. 2.12 and 17.13 per cent, share of male and female labour respectively. For SRT Sample cultivators. The next important item of expenditure in both the methods of paddy cultivation was the expenditure made on bullock pair, which worked out to be 12.37 per cent and 7.32 per cent, respectively for traditional and SRT Sample cultivators. It indicated that traditional method has more bullock labours and it incurred more cost in total cost of cultivation. In SRT method bullock labours usage was less compare to traditional method and incurred less cost in total cost due that it helps in increase in profit.

The rental value of land was the major expenditure contributing to the fixed cost (21.98 and 33.26 per cent respectively for traditional Sample cultivators and SRT

Sample cultivators). The share of variable cost was 67.96 per cent (Rs. 63794.60) to the total cost in traditional method and 56.40 per cent (Rs. 50560.27) in SRT paddy cultivation. The variable cost was found to be less by about Rs. 13234.33 in SRT method, when compared with traditional method. The share of fixed cost was 25.63 per cent (Rs. 24061.42) and 38.00 per cent (Rs. 34063.58) for traditional and SRT Sample cultivators, respectively. Per quintal cost of production were (Rs. 1753.92) for traditional method cultivators and (Rs. 1048.80) for SRT method cultivators.

The per hectare paddy output obtained in both the methods is presented in Table 1. The yield per hectare realized in traditional method was 43.18 tonnes. The paddy yield realized by SRT Sample cultivators was 65.71 tonnes per hectare. There was a glaring difference between the two methods in the paddy straw yield.

Table 1: Comparative cost of cultivation of traditional and SRT sample cultivators (Rs. /ha)

Sr. No.	Cost items	Traditional		SRT	
		Qty.	Values	Qty.	Values
1	Hired labours (man days)				
	I. Male	22.03	3303.03 (3.52)	12.68	1903.23 (2.12)
	II. Female	166.88	20024.24 (21.33)	127.97	15354.84 (17.13)
2	Bullock pair (Days)	11.61	11616.15 (12.37)	6.55	6559.13 (7.32)
3	Machine (hrs.)	2.64	8747.48 (9.32)	2.84	9333.32 (10.41)
4	Seeds (kg)	31.06	1552.52 (1.65)	19.32	966.39 (1.08)
5	Manures (tonnes)	4.58	5707.06 (6.08)	4.77	5981.19 (6.67)
6	Fertilizers (kg)				
	I. N (kg)	56.58	1131.52 (1.21)	43.03	860.65 (0.96)
	II. P (kg)	22.55	703.42 (0.75)	12.13	378.42 (0.42)
	III. K (kg)	51.52	2060.61 (2.20)	26.87	1074.84 (1.20)
	IV. Zn (kg)	0.00	0.00	6.19	371.61 (0.41)
7	Irrigations charges (Rs.)		2020.21 (2.15)		1823.65 (2.03)
8	Plant protection charges (Rs.)		351.91 (0.37)		330.00 (0.37)
9	Incidental charges (Rs.)		1111.12 (1.18)		902.16 (1.01)
10	Repairing charges (Rs.)		707.06 (0.75)		608.61 (0.68)
	Working capital		59036.33 (62.89)		46448.03 (51.82)
11	Interest on working capital @ 6%		3542.18 (3.77)		2786.88 (3.11)
12	Depre. Charges (Rs.)		1125.18 (1.20)		1180.19 (1.32)
13	Land revenue (Rs.)		90.91 (0.10)		145.16 (0.16)
	Cost A		63794.60 (67.96)		50560.27 (56.40)
14	Rental Value of land		20632.82 (21.98)		29816.68 (33.26)
15	Interest on fixed capital		3428.18 (3.65)		4246.90 (4.74)
	Cost B		87855.60 (93.59)		84623.85 (94.40)
16	Family labours (man days)				
	I. Male	23.33	3500.00 (3.73)	21.90	3286.29 (3.67)
	II. Female	20.97	2515.15 (2.68)	14.42	1729.03 (1.93)
	Cost C		93870.76 (100.00)		89639.17 (100.00)
B.	Outputs (Qtls.)				
1	Main produce	43.18	97159.09	65.71	147870.97
2	Byproduce	151.12	18133.33	172.68	20722.58
3	Gross produce		115292.42		168593.55
C.	Cost-C net of byproduce		75737.42		68916.59
D.	Per quintal cost		1753.92		1048.80
E	B:C ratio		1.23		1.88

(Figures in parentheses are percentage to the Cost C)

Comparative cost of cultivation of traditional and char-suttri sample cultivators

The pattern of inputs used in both the methods of paddy cultivation for sample farmers is depicted in Table 2.

Farmers of traditional paddy growers were found to use more of seeds 33.48 kg, N fertilizer 62.72 kg, P fertilizer 14.79 kg, K fertilizer 42.38 kg and plant protection chemicals Rs. 296.55 as against 32.24 kg of seeds, 53.66 kg of N fertilizer, 21.62 kg of P fertilizer, 29.90 kg of K fertilizer and Rs. 321.28 of plant protection chemicals by char-suttri paddy growers. However, char-suttri paddy growers used 23.34 man-days of male labour, 149.83 man-days female labour, 11.28 pair days of bullock labour, 2.59 hours of machine labour and 7.55 tonnes of farmyard manure, against 18.86 man-days of male labour, 151.48 man-days of female labour, 11.14 pair days of bullock labour, 2.31 hours of machine labour, 5.45 tonnes of farmyard manure used by traditional paddy growers. Irrigation charges was found to be more for traditional paddy method, whereas depreciation charges, interest on working capital and rental value of land were found to be more for char-suttri paddy method. Char-suttri method is mainly for lowland area or area where high rainfall received and puddling operation is carried out. Char-suttri method have main characteristics i.e. use of urea briquette for fertilizer application. Urea briquette is a complex fertilizer of urea and DAP which helps in reduces leaching losses which is major problem with other fertilizers. In char-suttri method use of green manuring was more compare to traditional method.

The per hectare cost of cultivation (Rs. 101214.17) for char-suttri method was more when compared to that (Rs. 90699.02) of traditional method. At overall level per hectare cost of cultivation was (Rs. 95956.59). The share of male and female labour in total cost 3.12 and 20.34 per cent, respectively. for traditional Sample cultivators. 3.46 and 17.76 per cent, share of male and female labour respectively. for char-suttri Sample cultivators. The next important item of

expenditure in both the methods of paddy cultivation was the expenditure made on bullock pair, which worked out to be 11.14 per cent and 11.28 per cent, respectively. for traditional and char- suttri Sample cultivators. The rental value of land was the major expenditure contributing to the fixed cost (20.45 and 25.50 per cent respectively. for traditional Sample cultivators and cha-suttri Sample cultivators). The share of variable cost was 67.20 per cent (Rs. 60952.12) to the total cost in traditional method and 63.39 per cent (Rs. 64164.17) in char-suttri paddy cultivation. The variable cost was found to be less by about Rs. 3212.05 in char-suttri method, when compared to that in traditional method. The share of fixed cost was 24.97 per cent (Rs. 22643.45) and 39.71 per cent (Rs. 30070.69) for traditional and char-suttri Sample cultivators, respectively. Per hectare cost of production were (Rs. 1867.71) for traditional method cultivators and (Rs.13337.43) for char- suttri method cultivators.

The per hectare paddy output obtained in both the methods is presented in Table 2 The yield per hectare realized in traditional method was 39.66 tonnes. The paddy yield realized by char-suttri Sample cultivators was 59.52 tonnes per hectare. There was a glaring difference between the two methods in the paddy straw yield.

Table 2: Comparative cost of cultivation of traditional and char-suttri sample cultivators (Rs./ha)

Sr. No.	Cost items	Traditional		Char-suttri	
		Qty.	Values	Qty.	Values
	A. 1 Hired labours (man days)				
	I. Male	18.86	2827.59 (3.12)	23.34	3500.00 (3.46)
	II. Female	151.48	18179.31 (20.04)	149.83	17979.31 (17.76)
2	Bullock pair (Days)	11.14	11149.41 (12.29)	11.28	11264.38 (11.13)
3	Machine (hrs.)	2.31	7034.48 (7.76)	2.59	7879.31 (7.78)
4	Seeds (kg)	33.48	1673.55 (1.85)	32.24	1611.48 (1.59)
5	Manures (tonnes)	5.45	6810.34 (7.51)	7.55	9425.28 (9.31)
	6 Fertilizers (kg)				
	I. N (kg)	62.72	1254.48 (1.38)	53.66	1073.10 (1.06)
	II. P (kg)	14.79	461.52 (0.51)	21.62	674.55 (0.67)
	III. K (kg)	42.38	1747.59 (1.93)	29.90	1195.86 (1.18)
	IV. Zn (kg)	7.00	420.00 (0.46)	3.86	231.72 (0.23)
7	Irrigations charges (Rs.)		3200.00 (3.53)		2568.38 (2.54)
8	Plant protection charges (Rs.)		296.55 (0.33)		321.28 (0.32)
9	Incidental charges (Rs.)		643.69 (0.71)		918.38 (0.91)
10	Repairing charges (Rs.)		655.86 (0.72)		639.66 (0.63)
	Working capital		56354.38 (62.13)		59282.69 (58.57)
11	Interest on working capital @ 6%		3381.26 (3.73)		3556.96 (3.51)
12	Depre. Charges (Rs.)		1093.72 (1.21)		1177.97 (1.16)
13	Land revenue (Rs.)		122.76 (0.14)		146.55(0.14)
	Cost A		60952.12 (67.20)		64164.17 (63.39)
14	Rental Value of land		18545.69 (20.45)		25813.52 (25.50)
15	Interest on fixed capital		4097.76 (4.52)		4257.17 (4.21)
	Cost B		83595.57 (92.17)		94234.86(93.10)
	16 Family labours (man days)				
	I. Male	30.10	4517.24 (4.98)	28.86	4327.59 (4.28)
	II. Female	21.55	2586.21 (2.85)	22.10	2651.72 (2.62)
	Cost C		90699.02 (100)		101214.17 (100)
	B. Outputs (Qtls.)				
1	Main produce	39.66	89224.14	59.52	133887.93
2	Byproduce	138.62	16634.48	180.10	21613.79
3	Gross produce		105858.62		155501.72
C	Cost-C net of byproduce		74064.54		79600.38
D	Per quintal cost		1867.71		1337.43
E	B:C ratio		1.17		1.54

(Figures in parentheses are percentage to the Cost C)

F- test analysis of traditional and SRT sample cultivators
F- test is any statistical test in which the test statistic has an F-distribution under the null hypothesis. It is most often used when comparing statistical models that have been fitted to a data set, in order to identify the model that have been fits the population from which the data were sampled the Table 3 indicates that the cost incurred by the traditional sample cultivator was comparatively higher than the SRT sample cultivators.

In cost A the accepted difference between the traditional sample cultivators and SRT sample cultivators was Rs. 8306.00 and the actual difference was Rs. 13234.00. Cost A incurred by traditional sample cultivators was comparatively higher than the SRT sample cultivators.

Table 3: F- test analysis of traditional sample cultivators and SRT sample cultivators

Sr. No.	Particulars	Difference	CD (Critical Difference)	SE (Standard Error)
1	Cost A	13234.00	8306.00	2179.11
2	Cost B	3232.00	11367.00	2982.32
3	Cost C	4231.00	-	3481.80

In cost B the accepted difference between the traditional sample cultivators and SRT sample cultivators was Rs. 11367.00 and the actual difference was Rs. 3232.00. Cost A incurred by traditional sample cultivators was comparatively higher than the SRT sample cultivators.

F-test analysis of traditional and char-suttri sample cultivators

Table 4 indicate that in cost B the accepted difference between the traditional sample cultivators and char-suttri sample cultivators was Rs. 10614.00 and the actual difference was Rs. 10640.00. Cost B incurred by char-suttri sample cultivators was comparatively higher than the traditional sample cultivators.

Table 4: F- test analysis of traditional sample cultivators and SRT sample cultivators

Sr. No.	Particulars	Difference	CD (Critical Difference)	SE (Standard Error)
1	Cost A	3212.00	-	1920.12
2	Cost B	10640.00	10614.00	2784.76
3	Cost C	10515.00	10425.00	2787.76

In cost C the accepted difference between the traditional sample cultivators and char- suttri sample cultivators was Rs. 104257.00 and the actual difference was Rs. 10515.00. Cost C incurred by traditional sample cultivators was comparatively higher than the SRT sample cultivators.

Cost and returns of traditional and SRT paddy sample cultivators

Table 5 indicated that the gross return from traditional method was Rs. 123469.70 and

Table 5: Cost and returns of traditional and SRT sample cultivators (Rs. /ha)

Sr. No.	Particulars	Traditional	SRT
1	Production (Qtl.)	46.82	65.71
2	Gross income (Rs.)	123469.70	168593.55
3	Total cost		
	1) Cost A	63794.00	50560.00
	2) Cost B	87855.60	86623.85
	3) Cost C	93870.76	89639.17
4	profit at		
	1) Cost A	59675.70	118033.55
	2) Cost B	35614.10	81969.70
	3) Cost C	29598.94	78954.38
5	B:C ratio		
	1) Cost 1	1.94	3.33
	2) Cost 2	1.41	1.95
	3) Cost 3	1.23	1.88

Rs. 168593.55 in SRT method. The benefit cost ratio over, cost C1 was 3.33 and 1.94, cost C2 was 1.95 and 1.41, cost C3 was 1.88 and 1.23 for SRT and traditional method respectively. These findings clearly indicated that SRT is a better yielding technology though it involves low costs. SRT demands less inputs like irrigation, labour, it required less seeds and fertilizers. Therefore, SRT promotion could result in the gain of substantial yield and use of scarce resources efficiently. The productivity in SRT method was higher than

Estimates of production function for traditional and SRT sample cultivators

Table 7 shows that the regression coefficients of Traditional method for seed rate was 2.9822, it indicated that seed rate is significant at 1 per cent level of significance. Positive relationship of seed rate indicates that with increase input, output would also increase. Labour and Plant protection charges have regression coefficient 0.3280 and 0.8787 positive respectively. Labour and plant protection charges are significant at 5 per cent level of significance. Positive 7)

traditional method was proved on the basis of gross income and B:C ratio, hence here we found that technological yield gap was easily seen in SRT and Traditional method.

Cost and returns of traditional and char-suttri sample cultivators

Table 6 indicated that the gross return from traditional method was Rs. 110074.14 and Rs. 155501.72 in char-suttri method. The benefit cost ratio over, cost C1 was2.42 and 1.81, cost C2 was 1.80 and 1.32, cost C3 was 1.54 and 1.17 for char-suttri and traditional method respectively. These findings clearly indicated that char-suttri is a better yielding technology though it involves low costs. Char-suttri demands more manures but other inputs like labour, bullock pair are required near about same quantity. The productivity in char-suttri method was higher than traditional method was proved on the basis of gross income and B:C ratio, hence here we found that technological yield gap was easily seen in Char-suttri and Traditional method.

Table 6: Cost and returns of traditional and char-suttri sample cultivators (Rs. /ha)

Sr. No.	Particulars	Traditional	Char-suttri
1	Production (Qtl.)	41.52	59.52
2	Gross income (Rs.)	110074.14	155501.72
3	Total cost		
	1) Cost A	60952.12	64164.70
	2) Cost B	83595.57	9423.86
	3) Cost C	90699.02	101214.17
4	profit at		
	1) Cost A	49122.02	91337.02
	2) Cost B	26478.57	146077.86
	3) Cost C	19375.12	54287.55
5	B:C ratio		
	1) Cost A	1.81	2.42
	2) Cost B	1.32	1.80
	3) Cost C	1.17	1.54

Estimates of Production Function for Traditional and SRT Sample Cultivators

Table 7 shows that the regression coefficients of Traditional method for seed rate was 2.9822, it indicated that seed rate is significant at 1 per cent level of significance. Positive relationship of seed rate indicates that with increase input, output would also increase. Labour and Plant protection charges have regression coefficient 0.3280 and 0.8787 positive respectively. Labour and plant protection charges are significant at 5 per cent level of significance. Positive relationship shows that with increase input, output would also increase.

N have regression coefficient -1.1416, it shows that there is negative relationship between N and output. Its means that with increase input, output will decrease. Variables like intercultural operations and manures are non-significant, means it does not contribute either increase or decrease output. The value of R^2 was 0.87, which suggested that the six resources included in the production function had jointly explained as high as 87 per cent of total variation in the traditional method.

The regression coefficients of SRT method for seed rate was 0.2335, it indicated that seed rate is significant at 10 per cent level of significance. Positive relationship of seed rate indicates that with increase input, output would also increase. N have regression coefficient 0.2689, positive relationship indicates increase output with increase input. N is significant at 5 per cent level of significance.

Table 7: Estimates of production function for traditional and SRT sample cultivators

Sr. No.	Variables	Traditional	SRT
1	Seed rate (Kg)	2.9822 *** (0.7944)	0.2335 * (0.1352)
2	N (kg)	-1.1416 ** (0.4775)	0.2689 ** (0.1021)
3	Intercultural operations	-0.2971 NS (0.1670)	0.0269 NS (0.0375)
4	Labours	0.3280** (0.1293)	-0.2015 * (0.0711)
5	PPC (Rs.)	0.8787 ** (0.3089)	0.0008 NS (0.0249)
6	Manures(tonne)	-0.1575 NS (0.1405)	-0.0116 NS (0.0328)
7	R2	0.87	0.51

(Figures in parentheses are standard error), * Significant at 10 per cent level of significance, ** Significant at 5 per cent level of significance, *** Significant at 1 per cent level of significance.

Labours are negatively significant at 1 per cent level of significance, having regression coefficient -0.2015. Negative relationship indicates that, with increase input, output will decrease. Variables like intercultural operations, plant protection charges and manures are non-significant, means it does not contribute either increase or decrease output. The value of R^2 was 0.51, which suggested that the six resources included in the production function had explained that 51 per cent of total variation in the SRT method.

Estimates of production function for traditional and char-suttri sample cultivators
Table 8 shows that the regression coefficients of Traditional method for Intercultural operation was 0.2827 indicated that Intercultural operation is significant at 5 per cent level of significance. Positive relationship of Intercultural operation indicates that with increase input, output would also increase. N and labour have regression coefficient 0.4457 and 0.3604 positive respectively. N and Labour are significant at 10 per cent level of significance. Positive relationship shows that with increase input, output would also increase.

Table 8: Estimates of production function for traditional and char-suttri sample cultivators

Sr. No.	Variables	Traditional	Char-suttri
1	Seed rate	-0.4343 NS (0.3519)	0.4008 NS (0.4399)
2	N (kg)	0.4457 * (0.2146)	0.3348 ** (0.1444)
3	Intercultural operations	0.2827 ** (0.1124)	0.0055 NS (0.0593)
4	Labours	0.3604 * (0.1808)	0.4246 ** (0.1940)
5	PPC	-0.2575 * (0.1222)	-0.0252 NS (0.0485)
6	Manures(tonne)	-0.0367 NS (0.0681)	0.1344 ** (0.0629)
7	R2	0.83	0.47

(Figures in parentheses are standard error), * Significant at 10 per cent level of significance, ** Significant at 5 per cent level of significance

Plant protection charges have regression coefficient -0.2575, it shows that there is negative relationship between Plant protection charges and output. Its means that with increase input, output will decrease. Variables like seed rate and manures are non-significant, means it does not contribute either increase or decrease output. The value of R^2 was 0.83, which suggested that the six resources included in the production function had jointly explained as high as 83 per cent of total variation in the traditional method.

In char-suttri method the regression coefficients for N was 0.2335, it indicated that N is significant at 5 per cent level of significance. Positive relationship of seed rate indicates that with increase input, output would also increase. Labours and manures are positively significant at 5 per cent level of significance. The positive relationship indicates increase output with increase input.

Variables like seed rate, intercultural operations and plant protection charges non- significant, means it does not contribute either increase or decrease output. The value of R^2 was 0.47, which suggested that the six resources included in

the production function had explained that 47 per cent of total variation in the char-suttri method.

Constraints faced by farmers
Regarding the problems of paddy production, problems were ranked according to Response Priority Index (RPI).
The major problems faced by the traditional growers are difficult management practises ranks first, followed by lack of water availability, Non-availability of skilled labours, High cost of fertilizers & pesticides, Non-availability of machine & tools, less use of green manuring, Non- availability of cash & credit, Lack of confidence in taking new technology and Lack of guidance from department officials.
The major problems faced by the SRT Sample cultivators are Non-availability of skilled labour ranks first, followed by Non-availability of machine & tools, Lack of confidence in taking new technology, Lack of guidance from department officials, High cost of fertilizers & pesticides, Difficult to management practises, Lack of water availability, Less use of green manuring, Non- availability of cash & credit.

The major problems faced by the char-suttri Sample cultivators are Difficult to management practises ranks first, followed by Lack of water availability, Non-availability of skilled labour, less use of green manuring, High cost of fertilizers & pesticides, Non-availability of machine & tools, Lack of confidence in taking new technology, etc.

Table 9: Constraints faced by traditional, SRT and char-suttri Sample cultivators

Sr. No.	Constraints	RPI	Traditional	RPI	SRT	RPI	Char-suttri
1	Difficult to management practices	0.58	1	0.55	6	0.25	1
2	Lack of water availability	0.47	2	0.47	7	0.18	2
3	Non-availability of skilled labour	0.35	3	0.41	1	0.57	3
4	Non-availability of machine & tools	0.29	5	0.31	2	0.55	6
5	Lack of confidence in taking new technology	0.25	8	0.23	3	0.44	7
6	Lack of guidance from department officials	0.19	9	0.17	4	0.40	8
7	High cost of fertilizers & pesticides	0.33	4	0.34	5	0.35	5
8	Less use of green manuring	0.28	6	0.38	8	0.14	4
9	Non-availability of cash & credit	0.26	7	0.15	9	0.13	9

Conclusion

The per hectare total cost of cultivation of SRT cultivators was Rs. 89639.17 which less by Rs. 4231.59 than traditional cultivators Rs. 93870.76. Due to less seed rate, less irrigation, less labour requirement. The per hectare total cost of cultivation of char-suttri grower was Rs. 101214.17 which was more by Rs. 10515.15 than traditional cultivators Rs. 90699.02.

The major problems faced by the traditional growers are difficult management practises ranks first, followed by lack of water availability.

The major problems faced by the SRT Sample cultivators are Non-availability of skilled labour ranks first, followed by Non-availability of machine & tools.

The major problems faced by the char-suttri Sample cultivators are Difficult to management practises ranks first, followed by Lack of water availability.

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