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Paddy Production Technology in Konkan Region of Maharashtra.

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Abstract

The study has assessed the economic analysis and impact assessment of production technology of paddy cultivation in Konkan region of Maharashtra for the year 2014-15, based on the data of costs and returns of crop. Apart from benefit-cost ratio (BCR), yield gap analysis, resource use efficiencies, adoption index and impact of improved paddy technology have been estimated in the study. It has shown that the per hectare cost 'C' was ₹ 49,393.85 and BCR is 1.41, whereas the per quintal cost production was ₹ 1,069.78 at the overall level for improved paddy cultivation methods. Further, there was a 16.59 per cent yield gap between actual yield and yield of demonstration plot, in which cultural practices (11.58) have shown a stronger effect than input use (5.01). The composit index of technology adoption was worked out to 67.46 per cent indicated that the sample farmers adopted less than 30 per cent recommended paddy production technology and obtained 36.65 qtls/ha yield. The contribution of different components on impact of paddy production technology in Kokan region, net returns was maximum (44.22 per cent) followed by gross returns and main produce.

The most important constraint in improved method of paddy cultivation has been identified as 'high cost of seed, fertilizers and labour charges, lack of knowledge about fertilizers application, seed treatment small fragmented holding and low price to produce. The improved paddy production technology method being more skill oriented, the study has observed that yields can be made on adoption and impact sustainable if constraints are addressed on war-footing basis.

Key words : Production function,Technological gap and resource use gap

Introduction

India is one of the leading paddy producing countries of the world with cultivated area of 43.97 Mha and production of 100 Mt in 2011-12. The leading states in paddy cultivation are: West Bengal, Uttar Pradesh, Orissa, Andhra Pradesh and Panjab. Maharashtra is one of the major paddy growing states in India. Paddy is grown on 15.40 million ha with an annual production of 35.00 million tonnes and productivity at 1821 kg/ha during the year 2011-12. Maharashtra ranks 12th in production and 13th in productivity among major rice growing states of the country .

In India, paddy is an important ingredient of household food-basket, yet its yield level is low, stagnant and uncertain (Barah, 2009). Among the various agronomic practices judicious use of manures and fertilizers is one of the important strategies for increasing production of paddy per unit area. The breeding of high yielding varieties have laid the basis for paddy production in India. The improved varieties can give the anticipated yield per unit area, when grown under favorable environmental conditions without which they are not able to manifest their maximum yield potential. The high yielding varieties are highly responsive to fertilizers. In India, taking

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into consideration the soils having low levels of organic carbon, it is a great challenge to feed hybrid paddy with balanced nutrition. Therefore, more attention needs to be given on organic sources like FYM, poultry manures and green manuring with optimum use of chemical fertilizers.

More specially, green revolution denotes the large increase in crop yields which in recent years, resulted mainly from the development and adoption of new hybrids and the improved technology associated with their culture.

The present study is an attempt to analyze the impact of improved technologies on paddy production in different regions of Maharashtra. The studies undertaken so far had mostly focused on the favorable effects of technological change. The reasons for the rate of adoption lagging behind expectation have been virtually unexamined. Therefore, a study which focuses on both aspects of technical changes i.e. its impact on yield, returns etc. as well as the reasons for non adoption of improved technology assumes great importance. Considering the above facts it was necessary to the "Economic analysis and impact assessment of production technology of paddy of Konkan region in Maharashtra".

However, in spite of many advantages, farmers have their own difficulties for not adopting improved technology at a rapid pace owing to improved methods of paddy production technology requiring management of resources skillfully which requires high precision in handling of farm resources. With this background, present study was undertaken with the view as

i. To study the regionwise resource use efficiency and cost and returns of paddy

ii.To study regionwise technology adoption and its impact on production of paddy and

ii. To examine the constraints in adoption of paddy production technologies

Materials and Methods

The study was conducted in the Konkan region of Maharashtra. Two districts from the region *viz.*, Thane and Raigad and from each district two tahsils were selected on the basis of maximum area under study . Two village from each tahsil were selected. Among each village, 6 samples were selected as per the size group of small, medium and large. The study was based on primary data for the year 2014-15.. From each district, 36 farmers were selected who were practicing improved production technology of paddy of cultivation. Thus, there were a total of 45 farmers with a sample size of 72 farms. The farmers were interviewed using specially prepared schedules. The farmers were also asked to prioritize the most important constraints they were facing in adopting improved method of paddy cultivation.

Analytical Tools

A, part from budgeting techniques, following analytical tools were employed:

Cobb-Douglas Type of Production Function: To identify the important factors affecting the paddy production technology for paddy cultivation, following Cobb-Douglas type of production function was employed. Five inputs were considered as important factor contributing to the production. The equation fitted was used in following form.

$$Y = aX_1^{b_1}X_2^{b_2}X_3^{b_3}X_4^{b_4}X_5^{b_5}e^{u}$$

Where,

Y = Output of main produce in quintals per hectare

a = Intercept

X_1 = Per hectare use of human labour in man days

X_2 = Per hectare use of Bullock in pair days

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X_3 = Per hectare use of Manure in quintals
X_4= Nitrogen (kg) per hectare
X_5 = Phosphorus (kg) per hectare
e^u = error term

Estimation of marginal value product

The marginal value products (MVPs) of the individual resources were estimated and compared with the marginal cost (MC). The MVP of individual resources was estimated by using the following formula,

$$\text{Marginal value product(MVP) of } X_i = b_i \frac{\bar{Y}}{\bar{X}} P_y$$

Where,

bi = Elasticity of production of i^{th} input
Y = Geometric mean of output
Xi = Geometric mean of of i^{th} input
Py = Per unit price of output

Technological gap analysis

Yield gap was worked out as the difference between demonstration plot yield and actual farmer's yield. The following Cobb-Douglas type of production function was used for this purpose. (*Guddi et al, 2002)*

$$Y = a_0 H^{a_1} B^{a_2} M^{a_3} N^{a_4} P^{a_5} e^u$$

Where,

Y = Output of main produce in quintals per hectare
a_0 = Intercept
H = Per hectare use of human labour in man days
B = Per hectare use of Bullock in pair days
M = Per hectare use of Manure in quintals
N = Nitrogen (kg) per hectare
P = Phosphorus (kg) per hectare
e^u = error term
a_1 to a_5 elasticities of production.

The combination of different resources to yield gap was estimated with the help of **Decomposition model**. The following functional form was used to work out the yield gap. *(Bisliah, 1977)* The Chow test was conducted for checking the production elasticity of the two functions.

$$\text{Log } (Y_2/Y_1) = [\text{Log } (b_o/a_0)] + [(b_1-a_1) \text{ Log } H_1 + (b_2-a_2) \text{ Log } B_1 + (b_3-a_3) \text{ Log } M_1 + (b_4-a_4) \text{ Log } N_1 + (b_5-a_5) \text{ Log } P_1] + [b_1 \text{ Log } (H_2/H_1) + b_2 \text{ Log } (B_2/B_1) + b_3 \text{ Log } (M_2/M_1) + b_4 \text{ Log } (N_2/N_1) + b_5 \text{ Log } (P_2/P_1)] + [U_2-U_1]$$

Technological adoption pattern on sample farm

In order to measure the technology adoption, index the adoption of paddy production technology viz; date of sowing ,method of sowing, seed rate, manures, application of FYM and chemical fertilizers and plant protection measures, etc; were considered. The Technology Adoption Index (TAI) in percentage was estimated by using the following formula.

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$$TAI = \frac{A_i}{M_i} \times 100$$

Where,

Ai = Average adoption score registered by the farmer for particular component

Mi = Maximum adoption score registered by the farmer for particular component.

Results and Discussion

The cost of cultivation of paddy includes the fixed cost and working cost. The per hectare cost of cultivation of paddy was worked out by using standard cost concepts. The information on various items of cost of cultivation of paddy for different size groups of holdings is presented in Table 1.

It can be seen from the table that at the overall level, per hectare cost of cultivation of paddy i.e. Cost 'C' was ₹. 49,393.85. Amongst the different items of cost, rental value of land was the major item of cost which accounted to ₹.11,544.73 (23.37 per cent) followed by hired human labour charges ₹. 10,056.30 (20.36 per cent) and, family human labour ₹.7,497.77 (15.18 per cent). Of the total cost of cultivation of paddy, the Cost 'A' was . ₹.27,544.80 (55.77 per cent) and cost B was ₹. 41,896.08 (84.82 per cent). Among the size group of holdings, the per hectare yield was 37.07 quintals, 39.80 quintals, and 44.23 quintals in small, medium and large size groups, respectively. It indicated that the per hectare yield of paddy increased with an increase in the size of holdings. The gross income received from paddy was observed to be ₹.59, 912.09, ₹. 70,253.82 and ₹. 72,282.29 in small, medium and large size groups, respectively, While at overall level, it was ₹. 69,599.89.

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Table 1. per hectare cost of cultivation of paddy in Konkan region

(Value in Rs.)

Sr. No.	Cost items	Small			Medium			Large			Overall		
		Qty	Value	Per cent	Qty	Value	Per cent	Qty	Value	Per cent	Qty	Value	Per cent
I.1	Hired Human labour (Mandays)												
	a. Male	35.68	5351.65	11.62	32.74	4910.71	10.11	40.31	6046.62	11.88	37.27	5589.97	11.32
	b. Female	47.42	4741.76	10.29	46.91	4691.09	9.66	42.53	4253.34	8.36	44.66	4466.33	9.04
2	Bullock power (Pair days)	10.20	3060.00	6.64	6.53	1958.13	4.03	8.75	2623.96	5.16	8.33	2497.78	5.06
3	Machine power	5.11	2555.00	5.55	6.77	3386.70	6.97	10.89	5388.38	10.58	8.69	4313.82	8.73
4	Seed (Kgs)	60.83	1216.60	2.64	56.78	1249.16	2.57	82.13	1332.15	2.62	70.97	1287.92	2.61
5	Manures (Qtls.)	6.96	695.97	1.51	10.22	1022.17	2.10	7.93	793.36	1.56	8.46	845.52	1.70
6	Fertilizers (Kgs)												
	N	108.67	1759.43	3.82	109.53	1773.32	3.65	106.04	1716.83	3.37	107.53	1740.89	3.52
	P	91.21	1660.00	3.60	101.40	1845.40	3.80	106.09	1930.81	3.79	102.19	1859.81	3.77
	K	18.35	179.85	0.39	21.34	209.17	0.43	20.53	201.24	0.40	20.41	200.02	0.40
7	Irrigation Charges (Rs.)		50.55	0.11		41.95	0.09		16.84	0.03		30.01	0.06
8	Plant protection charges (Rs.)		400.00	0.87		510.00	1.05		312.00	0.61		386.04	0.78
9	Incidental charges (Rs.)		251.44	0.55		268.98	0.55		278.38	0.55		271.05	0.55
10	Repairs (Rs.)		301.13	0.65		285.36	0.59		272.69	0.54		281.25	0.57
	Working capital (Rs.)		**22223.38**	**48.24**		**22152.14**	**45.60**		**25166.60**	**49.45**		**23770.41**	**48.12**
11	Int.on Working Capital		1333.40	2.89		1329.13	2.74		1510.00	2.97		1426.22	2.89
12	Depre.on farm implements		2295.45	4.98		1829.13	3.74		2560.00	5.03		2292.922	4.64
13	Land revenue and taxes		40.00	0.09		50.00	0.10		63.00	0.12		55.25	0.11
	Cost 'A'		**25892.23**	**56.20**		**25347.39**	**52.17**		**29299.60**	**57.56**		**27544.80**	**55.77**
14	Rental value of land		9945.35	21.59		11658.97	24.00		11984.05	23.55		11544.73	23.37
15	Int .on fixed capital		2500.00	5.43		2812.00	5.79		2900.00	5.70		2806.55	5.68
	Cost 'B'		**38337.58**	**83.20**		**39818.36**	**81.96**		**44183.65**	**86.81**		**41896.08**	**84.82**
16	Family labour												
	a. Male	31.51	4726.65	10.26	32.66	4898.40	10.08	25.12	3767.30	7.40	28.45	4266.85	8.64
	b. Female	30.07	3007.33	6.53	38.65	3865.46	7.96	29.45	2944.82	5.79	32.31	3230.92	6.54
	Cost 'C'		**46071.56**	**100**		**48582.22**	**100**		**50895.77**	**100**		**49393.85**	**100**
II	**Output (Qtls.)**												
	a. Main produce	37.07	55604.40		39.80	65669.46		44.23	62736.16		41.70	64815.88	
	b. Bye-produce	43.08	4307.69		45.84	4584.36		50.46	5046.13		47.84	4784.01	
III	**Total Gross returns**		**59912.09**			**70253.82**			**72282.29**			**69599.89**	
IV	Cost 'C' net of bye produce		41763.87			43997.86			45849.64			44609.84	
V	Per quintal cost		**1126.62**			**1105.47**			**1036.62**			**1069.78**	
VI	B:C ratio at cost 'C'		1.30			1.45			**1.42**			**1.41**	

(Figures in parentheses indicate percentage to the respective cost C)

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At the overall level, the returns were ₹.69,599.89. The per hectare net profit increased with the increasing size of group.

At the overall level B: C ratio was 1.41. From the above discussion it is indicated that the per unit cost of cultivation was declining as size group increased.

Per hectare resource use levels of paddy in Konkan region

The quantities of various inputs used directly affected the cost of cultivation and therefore, utilization inputs such as human labour, bullock labour, seeds, manures, fertilizer etc., have been studied in per hectare physical and monetary terms. The per hectare utilization of physical quantities of different inputs are presented in Table 2.

It was accompanied by lower cost of cultivation in improved method of paddy owing to the higher requirement of inputs, except manure. This might be because of organic nature of the improved method of paddy cultivation. Inputs played a significant role for boosting production of paddy. The production and productivity of paddy depend on the judicious and the balanced use of inputs. The adoption level of production technologies for paddy was primarily influenced by the human labour, bullock power, seed, manures, fertilizer etc. Besides this, the balance use of these inputs was also very important.

Table 2.Per hectare resource use levels of paddy in Konkan region

Sr. No.	Particulars	Size group			
		Small	Medium	Large	Overall
1	Total Human labour (Days)	144.68	150.96	137.41	142.68
	a. Male	67.19	65.39	65.43	65.71
	b. Female	77.49	85.57	71.98	76.97
2	Bullock power (pair days)	10.20	6.53	8.75	8.33
3	Machine power in hrs.	5.11	6.77	10.89	8.69
4	Seed (Kg.)	60.83	56.78	82.13	70.97
5	Manures (Qtls.)	6.96	10.22	7.93	8.46
6	Fertilizers (Kg.)				
	N	108.67	109.53	106.04	107.53
	P	91.21	101.40	106.09	102.19
	K	18.35	21.34	20.53	20.41
7	Irrigation Charges (Rs.)	50.55	41.95	16.84	30.01
8	Plant protection charges (Rs.)	400.00	510.00	312.00	386.04

Per hectare resource use gap of paddy in Konkan region

Table 3 presents the per hectare resource use gaps of paddy cultivation in recommended and actual use levels of input and output as per the adoption level.

The Agricultural Universities and various research institutes recommended the input use for higher production of the crops. This differs usually from the actual use of inputs by the farmers.

At the overall level in Konkan region, the inputs viz; human labour, bullok power maures and potash were utilized less than the recommended. At the overall level, the per hectare excess use of phosphorous was more than recommendation in konkan region (52.19 per cent) followed by nitrogen (30.97 per cent) and seed (7.53 per cent), for maintaining the plant population and to

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increase the grain production.

In case of manures, the recommendation is 10 tons/ha for the crop. The farmers used the more than recommended dose due to the availability and increasing cost of manures. The gap between actual and recommended yield was 16.59 per cent. It was maximum in phosphorus (104.38 per cent) and it was followed by manures (91.54 per cent), seed (77.42 per cent), bullock labour (66.70 per cent), potash (59.18 per cent), human labour (35.44 per cent) and nitrogen (7.53 per cent).

Table 3. Per hectare resource use gap of paddy forKonkan region

Sr. No.	Particulars	Actual use	Recommended dose	Absolute Gap	% Gap
1	Total Human labour (Days)	142.68	221	48.32	35.44
2	Bullock power (Pair days)	8.33	25	16.67	66.70
4	Seed (Kg.)	70.97	40	-30.97	-77.42
5	Manures (Qtls.)	8.46	100	91.54	91.54
6	Fertilizers (Kg.)				
	N	107.53	100	-7.53	-7.53
	P	102.19	50	-52.19	-104.38
	K	20.41	50	29.59	59.18
7	Yield (Qtl.)	41.70	50	8.30	16.59

'-' Gap indicates excess use than recommendation

'+' Gap indicates low use than recommendation

Production function estimates of demonstration plot and Sample cultivators

The Cobb-Douglas type of production function was fitted to the observations for the estimation of elasticity's of important variables contributing to the yield of paddy in both demonstration plot and sample farms. The analysis of variance in respect of the production function showed a significant variance, indicating the overall significance of the estimated production function (Table 4). The value for the coefficient of multiple determination (R^2) for demonstration plot was 0.73, which suggested that the six resources included in the production function had jointly explained as high as 73 per cent of total variation in the demonstration plot, whereas it was 72 per cent ($R^2 = 0.72$) for the sample farms.

Table 4. Results of Cobb-Douglas production function for Konkan region

			Regression coefficients	
Sr. No.	Particulars		Sample cultivators	Demon
1	Human labour (Days)	X_1	0.6417*** (0.1890)	0.6287** (0.2465)
2	Bullock labour (Days)	X_2	0.8112** (0.3823)	0.8015** (0.2909)
3	Seed (Kgs.)	X_3	0.1225 (0.1360)	0.1204 (0.1225)
4	Manures (Kgs.)	X_4	0.0199** (0.0093)	0.0181*** (0.7283)

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5	Nitrogen (Kgs.)	X_5	0.0013 (0.1678)	0.0013** (0.0605)
6	Phosphorous (Kgs.)	X_6	0.0018 (0.2174)	0.6014 (0.1985)
7	Potash (Kgs.)	X_7	0.0018 (0.0224)	0.0012 (0.1698)
8	Coefficient of Multiple Determination	R^2	0.72	0.73
9	Number of observation	N	72	30
10	D.F.		64	22

(Figures in parentheses are standard errors of respective regression coefficients)
*, **, *** indicate significant at 10, 5, and 1 per cent level

It showed that the variables taken into consideration were more crucial factors in demonstration plot than on the sample farm cultivators. In the demonstration plot method, human labour, bullock labour, nitrogen and manures were found positively significant. This means that usage of less than the recommended dose of these inputs would result in a increases in production. On sample farm cultivators, human labour, bullock labour and manure were positively significant. Thus, the sample cultivators farms were more labor-intensive and exhaustive as it responded more to labour usage and manure application.

Results of decomposition analysis of paddy for Konkan region

Barah (2009) in his study in Tamil Nadu during 2006-07, has concluded that SRI has potential to increase rice production by 26 per cent or even more depending on the extent of adherence to its basic principles. In the present study, the yield gap between actual farms and demonstration methods was to the tune of 16.59 per cent (Table 5).

Table 5. Results of decomposition analysis in Konkan region

Sr.No.	Source of productivity difference	Percentage contribution
A	Total difference observed in output	16.59
B	Source of contribution	
	1.Difference in cultural practices (Non neutral technological changes)	11.58
	2.Due to difference in input use level (Neutral technological changes)	
	a. Human labour	1.40
	b. Bullock labour	1.81
	c. Seed	1.73
	d. Manure	0.09
	e. Nitrogen	-0.02
	f. Phosphorous	-0.01
	g. Potash	0.01
C	Due to all inputs	5.01
D	Total estimated gap from all sources	16.59

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Among other sources of yield gap, cultural practices (11.58%) turned out to be the major contributor. Thus, without incurring extra expenditure on required inputs, only by adopting the recommended cultivation practices, the yield can be increased by 11.58 per cent in paddy. The appropriate usage of inputs can reduce the yield gap between actual farm and demonstration methods to the extent of 5.01 per cent.

Among these inputs, human labour, bullock labour and manure have proved to be more important as per Tables 7 and 8. Patole *et al.* (2008) by using the Bislaih (1977) model of decomposition, had estimated that yield gap in chickpea in the Ahmednagar district of Maharashtra was 53 per cent, of which, input use (29%) had a higher role than cultural practices (24%).

Technology adoption index on sample farm in Konkan region

The technology adoption of index gives the clear cut idea about the adoption of a particular technology component whereas the magnitude of composite index gives the aggregate percentage of adoption of all components of technology. The detail procedure of constructing the technology adoption index was given in methodology chapter and the information are presented in Table 6. The result indicated that at the overall level, the adoption of method of sowing technology component was observed maximum (92.08 per cent) to be on sample farms followed by date of sowing (87.13 per cent), plant protection (78.22), nitrogen (76.90 per cent), seed rate (72.61 per cent) and phosphorus (71.95 per cent). The lowest technology was noticed in case of manures component (31.35 per cent) of technology. The lower of technology adoption index were found in use of manures application.

Table 6.Technology adoption index on sample farm for Konkan region

Sr. No.	Name of the component	Size groups			Overall
		Small	Medium	Large	
1.	Date of sowing	88.33	84.76	92.59	87.13
2.	Seed rate	65.56	74.29	76.85	72.61
3.	Method of sowing	90	91.43	94.44	92.08
4.	Manures	15.56	33.33	28.70	26.40
5.	Nitrogen	72.22	77.14	80.56	76.90
6.	Phosphorous	62.22	74.29	77.78	71.95
7.	Potash	23.33	33.33	36.11	31.35
8.	Plant protection	56.67	85.71	88.89	78.22
	Composite Index	58.61	69.29	71.99	67.08
	Yield (qtls.)	37.07	39.80	44.23	41.70

The composite index of technology adoption was worked out to 67.08 per cent which indicated that the sample farmers adopted less than 30 per cent recommended paddy production technology obtaining 41.70 qtls/ha yield. The positive relationship was observed in between composite index and yield obtained on sample farms i.e. increase in composite index resulted in the increase in the yield. It was also noticed that the magnitude of composite index increases as size of holding increased. The same trend was observed in adoption of seed rate, application of nitrogen and potash component of technology. The increasing trend was observed in adoption of use of fertilizer and plant protection component of technology with size of farms.

Impact of improved paddy production technology for Konkan region

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The result of impact of improved paddy production technology in Konkan region is presented in Table 7.

It is noted from the table that, on an average, the total employments for male, female, bullock and machine powers was 20.70, 11.28, 26.53 and 25.53 per cent impact, respectively. Impact on yield of main produce and by-produce was found to be 27.82 per cent and 21.36 per cent, respectively. In case of the economic impact of paddy production technology on gross returns, cost of cultivation and net returns was 28.32, 21.81 and 44.22 per cent, respectively.

The maximum impact of paddy production technology in Konkan region was on net returns was (44.22 per cent) amongst the components considered.

Table 7. Impact of improved paddy production technology for Konkan region

Sr. No.	Particulars	Local Method	Improved method	Percentage of impact
A)	**Employments**			
	1.Total human labour (Man days/ha.)			
	a) Male	52.11	65.71	20.70
	b) Female	68.29	76.97	11.28
	2. Bullock labour (Pairs days)	6.12	8.33	26.53
	3. Machine power (in hrs.)	6.44	8.69	25.89
B)	**Yield (qtl./ha.)**			
	1.Main produce	30.10	41.70	27.82
	2.By-produce	37.62	47.84	21.36
C)	**Economics (Rs./ha.)**			
	1.Gross returns	49892.12	69599.89	28.32
	2.Cost of cultivation	38620.30	49393.85	21.81
	3.Net returns	11271.82	20206.04	44.22

Identification of major constraints in adoption of improved production technology of paddy in Konkan

The farmers were asked to offer opinions as per priority-wise major constraints they were facing in adoption improved production technology of paddy cultivation in Konkan region. All these were sorted and screened and finally major constraints were identified and presented in Table 8.

It is revealed that, at the overall level, the major constraint opined were high cost of seed, untimely supply of fertilizers, expensive and more labour require wage rates, high cost of plant protection measures, high wage rates, unawareness, low price to produce, labour require more and high cost of fertilizer were reported by farmers, respectively.

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Table 8. Constraints in adoption improved production technology of paddy for Konkan

Sr. No.	Particular	Group			Overall (N=72)
		Small (N=24)	Medium (N=24)	Lagre (N=24)	
A.	**Constraints regarding rainfall**				
1	Excess	25.00	29.17	25.00	26.39
2	Abnormal distribution of rainfall	45.83	66.67	50.00	54.17
3	Inadequate	70.83	29.17	45.83	48.61
B.	**Recommended seed rate**				
4	High cost	100.00	100.00	100.00	100.00
5	Lack of awareness	50.00	45.83	25.00	40.28
C.	**Recommended time of sowing and recommended variety**				
6.	Lack of awareness	29.17	54.17	41.67	41.67
7.	Non-availability of proper variety seed	25.00	29.17	33.33	29.17
D.	**Method of Sowing**				
8.	Recommendation not known	41.67	25.00	54.17	40.28
9.	Expensive and more labour required	100.00	100.00	83.33	94.44
10.	Adopted traditional methods	37.50	58.33	50.00	48.61
E.	**Fertilizer application**				
11.	High cost of fertilizer	100.00	83.33	70.83	84.72
12.	Recommendation not known	58.33	41.67	33.33	44.44
13.	Lack of knowledge about fertilizers	41.67	29.17	41.67	37.50
14.	Untimely supply	100.00	100.00	100.00	100.00
F.	**Labour constraints**				
16.	High wage rates	100.00	100.00	83.33	94.44
17.	Non-availability at peak period	45.83	50.00	54.17	50.00
G.	**Plant protection measures**				
18.	Inadequate supply	62.50	37.50	20.83	40.28
19.	Higher cost	100.00	100.00	83.33	94.44
H.	**Seed treatment**				
20.	Unawareness	100.00	87.50	87.50	91.67
21.	High cost	100.00	87.50	62.50	83.33
I.	**Line transplanting**				
22.	Labour requirement is more	95.83	95.83	66.67	86.11
23.	It is time consuming method	95.83	62.50	41.67	66.67
J.	**Improved implements**				
24.	High cost	54.17	29.17	20.83	34.72
25.	Poor economic condition	79.17	62.50	29.17	56.94
26.	It requires trained man power	0.00	12.5	20.83	11.11
K.	**Lack of technical know-how**	79.17	45.83	29.17	51.39
L.	**Low price to produce**	100.00	87.50	75.00	87.50

Conclusions

With the forgoing discussion, the following conclusions can be drawn

i. At the overall level, cost of production of paddy (i.e. cost 'C') was ₹. 47,652.48, and of this cost 'A' was 60.76 per cent and cost 'B' was 86.91 per cent and the B:C ratio was 1.41.The

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per hectare resource use gap of paddy in Konkan region, human labour, manures and potash were having low use as compared with the recommended resource use level. Other factors such as seed, nitrogen and phosphorous showed excess use as compared with the recommendation of Agricultural Universities. The maximum resource gap was observed in phosphorous and manures application, whereas per hectare resource use gap of paddy in konkan region the yield gap was to be found 16.59 per cent.

ii. The result of Cobb-Douglas production function for the Konkan region, revealed that the coefficients of multiple for demonstration plots for human labour, bullock labour, manures, and nitrogen were found positive and significant. The regression coefficients for sample farms for human labour, bullock labour and manures were also found positively significant. These positive and significant coefficients indicated that, one unit increase in the use of human labour, bullock labour, manures and nitrogen will minimise the gap.

iii. The decomposition function analysis, revealed that 16.59 per cent yield increase was to adoption of new technologies in paddy, in which, cultural practices (11.58 per cent) had higher role than the input use levels (5.01 per cent).At the overall level, the technology adoption index (TAI) was found high for method of sowing fallowed by date of sowing, plant protection measures, application of nitrogen, use of seed rate and phosphorous. At the overall level, technology composite index was worked out to be found 67.08 per cent, the contribution of component on impact of paddy production technology in Konkan region, net returns was maximum (44.22 per cent) followed by gross returns and main produce. High level adoption impact of paddy production technologies helped to increase the annual income and employment of the sample farm families.The major constraint were reported in paddy production technology viz.'high cost of inputs, unawareness and low price to produce.

iv. Abnormal distribution of rainfall, lack of technical knowledge, high cost of seed and fertilizers, high wages rates, high laboure requirement and time consuming methods, non-availability of seed and fertilizers were the major constraints in adoption of paddy production technologies.

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