Oryza Vol. 56 (Special Issue) 2019 (156-163)
DOI https://doi.org/10.35709/ory.2019.56.spl.8

Profitability in rice cultivation across Indian States

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Received : 21 May 2019 Accepted: 27 May 2019 Published : 29 May 2019

ABSTRACT

The paper discusses the profitability in rice farming using secondary data for the period 1980-81 to 2014-15. The average costs and profits were computed and it was found that cost of cultivation has increased over years, but profit has not increased commensurately. The irrigated states like Punjab, Haryana and Andhra Pradesh have maintained or increased profits over years, but not the rainfed states. There were losses in rice farming in rainfed states like Assam, Bihar, Odisha, West Bengal and Maharashtra, when total cost of cultivation was considered. Promotional measures and investment by state and central governments are needed to make rice production profitable.

Key words: *Rice, profitability, Indian states*
JEL Codes: *O13, Q12, Q18*

INTRODUCTION

Foodgrains production is the most important activity in India, which provides income and employment to a larger section of Indian population. Analysis of data across the Indian states revealed a high degree of correlation between the extent of poverty and yield in foodgrain production. Poverty is more acute in states like Odisha, Bihar and Madhya Pradesh, where foodgrain yield has remained low and growth has been slower than in progressive states such as Punjab and Haryana (Hossain, 1995). It has been inferred by many studies that agricultural sector has the largest poverty reducing effect than any other sector of the economy (Fan et al., 1998; Hazell and Ramasamy, 1991; Ravallion and Dutt, 1996; World Bank, 2007).

Among the foodgrain crops, rice is most important in terms of area coverage (35%), contribution to total foodgrains production (41%) and supplies of calories in the diet. It is the staple food of more than two-thirds of Indian population. Rice provides about 30% of total calories in the Indian diet (Mclean et al., 2002). However, the profit margin in rice cultivation has eroded making rice cultivation unattractive (Samal et al., 2018). Given that the country still has about 37% of its population below poverty line (Government of India, 2009), the growth in rice production, productivity and profitability is critical to the well-being of millions of consumers as well producers. Further, the Indian rice production accounts for about 21% of global rice production, thus, contributing largely to global food security. Therefore, increase in production, productivity and profitability of rice is a major concern to the policy makers and other stakeholders in the development process.

Growth in population and economic prosperity are the two driving forces for increasing rice demand in India. According to the estimates of the Population Foundation of India, India's population will be 1824 million in 2050. It is estimated that the requirement of rice will be 137.3 million tonnes by the year 2050 (Central Rice Research Institute, 2013) to feed its population. In addition to this, India is exporting more than four million tonnes of basmati and about 8 million tonnes of non-basmati rice per year, which earns valuable foreign exchange for the country. In order to achieve this target, the productivity of rice has to be brought to the level of 3.4 tonnes per ha, which is 2.5 tonnes presently.

Against this backdrop, this study attempts to analyze the trends in profitability in rice cultivation across Indian states, which will help in targeting appropriate

policies to boost rice productivity and profitability in poorly performing states, so that future requirement of rice will be met.

MATERIALS AND METHODS

The information on state wise cost of cultivation and returns was collected from various issues of the publication 'Cost of Cultivation of Principal Crops of India' published by the Directorate of Economics and Statistics (DES), Ministry of Agriculture and Farmers' Welfare, Government of India. Cost of cultivation for the recent years (2004-05 to 2014-15) has been compiled for 18 states (Andhra Pradesh, Assam, Bihar, Chhatisgarh, Gujarat, Haryana, Himachal Pradesh, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Odisha, Punjab, Tamil Nadu, Uttar Pradesh, Uttarakhand and West Bengal) and the data (cost of cultivation and returns) for the newly formed states like Jharkhand, Chhatisgarh and Uttarakhand has been merged with Bihar, Madhya Pradesh and Uttar Pradesh respectively for comparison over years. Interpolation was done to fill the gap for the years, where cost of cultivation, returns and inputs data was not available. The cost of cultivation, returns and expenditure on inputs like machine labour and pesticides for 35 years were converted into constant prices of 2014-15 using state specific consumer price index for computation and comparison. Five year average figures of inputs, cost of cultivation and returns for the year ending 1984-85, 1989-90, 1994-95, 1999-2000, 2004-05 and 2014-15 were computed to take into account variability in data due to biotic and abiotic stresses encountered during some years. Similarly, profits over total cost (C_2) and operational cost (A_2+FL) were also computed. Cost and return data for Kerala state was available from the year 1997-98 onwards and for three other states *viz*. Himachal Pradesh, Maharashtra and Gujarat the data is available since 2005-06. The trends in costs of cultivation and profit in rice cultivation across 15 erstwhile states were studied using the data for 35 years period.

The secondary data on area, production and yield of rice for the study was collected from various issues of the publication 'Agricultural Statistics at a Glance' published by the DES. The average decadal figures on area, production and yield for 1970s (1970-71 to 1979-80), 1980s (1980-81 to 1989-90), 1990s (1990-91 to 1999-2000), 2000s (2000-01 to 2009-10) and most recent period (2010-11 to 2017-18) were calculated. The year 1970-71 was selected as the base year because the high yielding varieties of rice were introduced into the country during mid-1960s and it takes some lag period for their testing and spread. The term yield and productivity was used interchangeably throughout the paper. The production and yield reported in the paper are in terms of milled rice.

RESULTS AND DISCUSSION

Growth in area, production and yield of rice

Presently, rice is grown in about 43.8 m ha area in India with production of 110 million tones and productivity of 2.5 tonnes per ha. Decade wise, the growth experience over the last 48 years (1970-71 to 2017-18) at all India level shows that maximum absolute production and yield increase has occurred during 1990s (Table 1). The production increase per year was 2 million tonnes during that period which was mainly due to yield growth (387 kg per year). This observation corroborates the findings

Table 1. Increase in average area, production and yield of rice in India. (1970-71 to 2017-18)

Period	Production (million tons)		Yield (kg/ha)		Area (million ha)	
	Average production	Additional production over the previous period	Average yield	Additional yield over the previous period	Average Area	Additional area over the previous period
1970s	45.26		1173		38.61	
1980s	59.74	14.48	1465	292	40.69	2.08
1990s	80.04	20.30	1852	387	43.19	2.50
2000s	89.19	9.15	2052	200	43.41	0.22
2010-17	105.37	16.41	2416	370	43.64	0.23

Note: 1970s refers to average of data for the period 1970-71 to 1979-80 and so on. 2010-17 refers to the period 2010-11 to 2017-18.

of Kannan et al. (2017). The addition to area increase was also maximum during 1990s (0.25 m ha per year) and contributed to the production increase. During subsequent periods (2000s and 2010-17), the area growth was insignificant.

Rice is grown in two major seasons in India i.e. during *kharif* in all the states and *rabi*/summer in some of the states. Presently, *kharif* and *rabi*/summer rice accounts for 90.7% and 9.3% of total rice area and 87.3% and 12.7% of total rice production respectively at all India level. The *kharif* area varied from 35.07 m ha (1972-73) to 40.95 m ha during 1999-2000, when data for the period 1970-71 to 2016-17 (47 years) was considered. The area trend has plateaued in both the seasons during the last decade and depicted in Fig. 1. Due to diversification policies of various state and central governments, the area is likely to decline further in future. The production growth during the last two decades was mainly due to increase in yield (Fig. 2). The yield has increased from one tonne per ha to 2.4 tonnes per ha during *kharif*, when the above 47 years was considered. However, the yield has plateaued during recent years in some irrigates states. The *rabi*/summer season yield has plateaued in recent years. The above discussion points to the general finding that the scope of area growth for rice production has been exhausted in India. Future growth in rice production has to come from yield growth through technological advancement.

Trends in input use in rice

The state-wise average input use including irrigation coverage are presented in Table 2. The increase/decrease in input use between two periods (quinquennium ending 1984-85 and 2014-15) are also presented in the table for six important inputs. The human labour and animal labour use has decreased by 19 and 73 per cent respectively at all India level due to increase in wage rates, increasing cost of maintenance of bullocks and availability of machines for various agricultural operations in rice. The machine labour use has increased by 811 per cent at all India level. The fertilizer and pesticides use has also increased by 174 and 289 per cent, respectively. However, manure use has decreased by 54 per cent, thus, threatening soil quality and sustainability of soil fertility in the long run.

State-wise, the similar trend was observed in most of the states with maximum reduction in human labour and animal labour use in northern and southern states. They have been replaced by machine labour and thus, helped in reduction in cost of production per quintal of paddy. The bullock labour use has drastically reduced in northern states and computed to be 97%. It was observed to be only one hour per ha in the states of Punjab and Haryana in the recent period. Among the southern states, the bullock labour use was observed to be 1, 5, 10 and 48 pair hours per ha in the state of Kerala, Tamil Nadu, Andhra Pradesh and Karnataka respectively. The reduction in the bullock labour use during the period was computed to be 95, 97, 94 and 72 per cent, respectively in the above mentioned states in that order. The rate of reduction was faster in southern

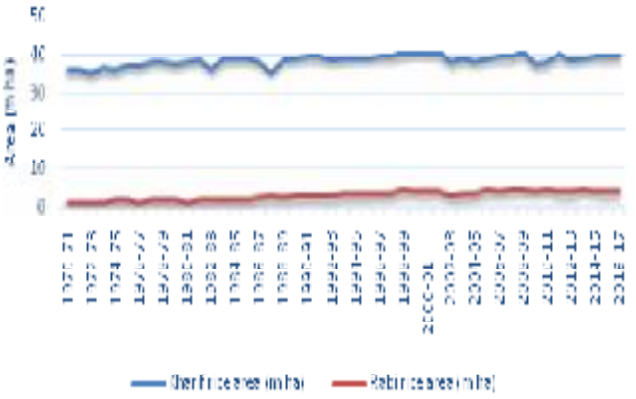

Fig. 1. Seasonwise trend in rice area in India (1970-71 to 2016-17).

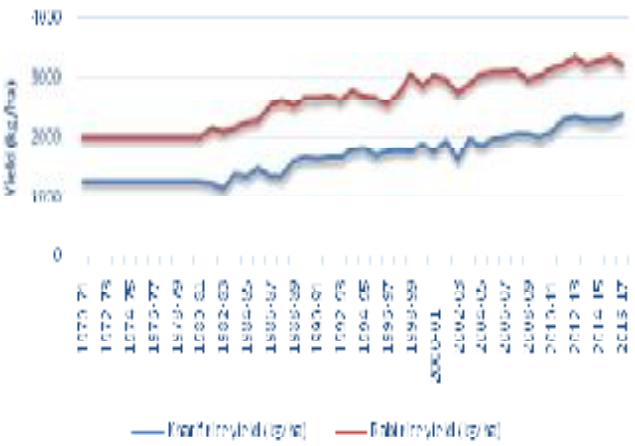

Fig. 2. Seasonwise trend in rice yield in India (1970-71 to 2016-17).

Table 2. Changes in input use in rice cultivation (1980-2014) in different states of India.

State	Period	Inputs						
		HL	AL	ML	Fert	Manu	Pest	IRR
Assam	1980-84	636	261	9	0.1	2	0.1	11.0 (2.4)
	2010-14	676	180	2271	18	5	16	
	% change	6	-31	25133	17900	150	15900	
Bihar	1980-84	867	241	32	26	7	2	65.0 (1.5)
	2010-14	728	36	2376	74	3	5	
	% change	-16	-85	2247	185	-65	150	
MP	1980-84	578	146	21	19	8	32	34.2 (2.0)
	2010-14	484	49	4514	112	9	814	
	% change	-16	-66	21395	489	13	2444	
Odisha	1980-84	1008	275	43	17	25	60	33.3 (2.0)
	2010-14	1019	171	2003	87	21	122	
	% change	1	-38	4558	412	-16	103	
UP	1980-84	867	123	539	43	26	43	86.7 (2.6)
	2010-14	745	17	4074	164	3	288	
	% change	-14	-86	656	281	-88	570	
WB	1980-84	1123	231	36	29	35	102	46.9 (2.7)
	2010-14	1132	58	2996	144	19	862	
	% change	1	-75	8222	397	-46	745	
AP	1980-84	1201	164	1529	131	64	857	97.1 (3.7)
	2010-14	651	10	8601	226	16	2246	
	% change	-46	-94	463	73	-75	162	
TN	1980-84	1237	193	1140	147	34	744	94.4 (3.4)
	2010-14	667	5	10548	240	33	1490	
	% change	-46	-97	825	63	-3	100	
Karnataka	1980-84	1056	170	266	84	74	355	76.0 (3.3)
	2010-14	818	48	7962	277	13	1856	
	% change	-23	-72	2893	230	-82	423	
Kerala	1997-2001	871	19	3763	111	23	524	77.2 (2.9)
	2010-14	486	1	11218	168	11	1494	
	% change	-44	-95	198	51	-52	185	
Punjab	1980-84	845	32	4010	181	60	1298	99.7 (4.3)
	2010-14	371	1	5986	206	23	3598	
	% change	-56	-97	49	14	-62	177	
Haryana	1980-84	701	32	3285	135	8	958	99.9 (3.0)
	2010-14	566	1	4610	208	0.4	2572	
	% change	-19	-97	40	54	-95	168	
India	1980-84	928	190	479	53	28	224	60.1 (2.4)
	2010-14	752	52	4365	145	13	871	
	% change	-19	-73	811	174	-54	289	

HL: Human labor (hrs/ha), AL: Animal labor (pair hrs/ha), ML: Machine labor (Rs/ha), Fert: Fertilizers (kg nutrients/ha), Manu: Manures (q/ha), Pest: Pesticides (Rs. /ha). IRR: Irrigated rice area in percent and refers to the year 2014-15. Bihar, Madhya Pradesh and Uttar Pradesh include Jharkhand, Chhatisgarh and Uttarakhand respectively. Figures in parentheses indicate yield levels (milled rice) in tonnes per ha.

states than northern states as northern states have already reduced bullock labour use by the agricultural year 1980-81, due to mechanization of various operations. Though the bullock labour use has reduced in eastern states (Assam, Bihar, Madhya Pradesh, Odisha, Uttar Pradesh and West Bengal), the rate was slower in states like Assam and Odisha, and the reduction was computed to be 31 and 33 per cent, respectively. The human labour use has reduced in most of the states except Assam, Odisha and West Bengal due to progressive intensification of various operations in rice. The labour use was minimum in the states of Punjab, Madhya Pradesh, Kerala and Haryana and computed to be 371, 484, 486 and 566 man hours per ha, respectively. The maximum human labour use was in the states of West Bengal, Odisha, Karnataka and

Uttar Pradesh and computed to be 1132, 1019, 818 and 745 man hours per ha. Progressive mechanization of various operations in rice has reduced the use of human and bullock labour use in general. The per cent increase in machine labour use is exceptionally higher in all the states except Punjab and Haryana. This is due to the fact that Punjab and Haryana have reached high level of mechanization by the year 1980-81.

The use of material inputs like fertilizers and pesticides have increased in all the states and maximum fertilizer use was observed in the states of Karnataka, Tamil Nadu, Andhra Pradesh, Haryana and Punjab, where it has exceeded 200 kg/ha. Minimum fertilizer use was observed to be in the state of Assam (18 kg/ha). It was also observed that the per cent increase in fertilizer use was faster in eastern states than the other regions. This observation corroborates the finding of Jain (2018). In general, pesticides expenditure has increased in all the states. It was minimum in eastern states than northern and southern states. Minimum pesticide expenditure was observed in the states of Bihar (Rs. 5/ha) and Assam (Rs. 16/ha). The manure use has decreased in majority of the states except Assam and Madhya Pradesh and the reduction varied from 31 to 95 per cent in different states. This trend in manure use will lead to deficiency of soil nutrients.

The above discussion leads to the general finding that human labour and bullock labour use has decreased and machine labour use has increased significantly in rice cultivation in different states. Among

Table 3. Average cost of cultivation (C_2) of rice farming in major rice growing states. (Figures in Rs. per ha)

State	1980-84	1985-89	1990-94	1995-99	2000-04	2005-09	2010-14	Percent Increase*
Assam	18318 (11474)	20522 (13811)	22121 (14295)	26675 (17290)	32306 (22050)	33196 (22643)	41073 (29532)	124
Bihar$	22483 (12366)	25220 (15162)	26976 (16130)	27193 (17097)	31583 (21416)	28503 (19654)	34320 (24684)	53
MP$	15890 (9190)	20355 (12331)	23956 (14291)	27229 (17032)	28485 (18357)	30794 (18679)	40750 (24336)	156
Odisha	20140 (12469)	24759 (16077)	30301 (18864)	33369 (21669)	41954 (29089)	42701 (28264)	50306 (36599)	150
UP$	28944 (18541)	32098 (21110)	35116 (21684)	33465 (21267)	42055 (27879)	43965 (27293)	51735 (33231)	79
WB	31865 (20882)	36801 (23776)	44533 (28693)	49674 (33033)	54844 (39837)	55893 (38885)	63990 (47362)	101
AP	47109 (30394)	58799 (37237)	64415 (40494)	66373 (42664)	72345 (45558)	76150 (46842)	77457 (49863)	64
TN	57035 (37135)	66827 (45128)	66153 (46259)	68805 (49034)	74591 (52118)	76280 (53164)	77461 (58480)	36
Karnataka	41686 (20027)	40961 (25112)	54647 (34334)	59731 (39475)	78868 (57835)	68952 (47056)	69835 (49157)	68
Kerala@	-	-	-	63170 (49854)	64468 (50665)	66896 (50062)	72979 (52837)	-
Punjab	60761 (39223)	56156 (33101)	55062 (30127)	57095 (30984)	70135 (38311)	70290 (33841)	71666 (33994)	18
Haryana	44431 (30144)	40746 (28643)	51461 (33861)	58977 (36601)	72660 (45098)	74456 (42553)	72613 (43143)	63
HP	-	-	-	-	-	27982 (18051)	30443 (20783)	-
Gujarat	-	-	-	-	-	42730 (30083)	51626 (37241)	-
Maharashtra	-	-	-	-	-	61783 (48406)	62548 (48162)	-

Note: The costs have been computed at constant 2014-15 prices; @ Data available from 1997-98. $ Bihar, MP and UP includes Jharkhand, Chhatisgarh and Uttarakhand respectively. Figures in parentheses indicate operational cost in Rs/ha. * Percent increase in cost of cultivation during the quinquennium ending 2014-15 over 1984-85.

material inputs, fertilizers and pesticides use has increased in all the states and that of manures decreased in majority of the states.

Trends in cost of cultivation

The average cost of cultivation at constant price of 2014-15 is presented in Table 3. It is observed that total cost (C_2) and operational cost (A_2+family labour) have increased over the years in all the states. The average cost of cultivation per ha varied from Rs. 30443 (Himachal Pradesh) to Rs. 77461 (Tamil Nadu) during the recent period (2010-14) in different states. The states with relatively higher cost of cultivation were Andhra Pradesh, Kerala, Haryana, Punjab and Karnataka. Rice crop being irrigated in these states, farmers also obtained higher productivity due to intensification of inputs and other package of practices. It was less in Himachal Pradesh, Bihar, Madhya Pradesh, Assam and Odisha due to cheap labour and partial adoption of recommended package of practices. During early 1980s, the cost of cultivation per ha was highest in Punjab (Rs. 60761) due to intensification of farm operations during green revolution period and lowest in Madhya Pradesh (Rs. 15890) due to dominance of traditional farming practices and cheap labour. The cost of cultivation of other largely irrigated states was similar like Punjab. The states with higher per cent increase in cost of cultivation between early 1980s and the recent period (2010-14) were Madhya Pradesh (156%), Odisha (150%), Assam (124%) and West Bengal (101%). It was less in irrigated states like Punjab (18%) and Tamil Nadu (36%), Haryana (63%), Andhra Pradesh (64%) and Karnataka 68%), due to the fact that farmers of these states have adopted recommended package of practices in most of the rice growing areas by early 1980s. Similarly, the average operational cost per ha during early 1980s varied from Rs. 9190 to Rs. 39223 in different states. A close look at the detailed data revealed that the fixed cost (Total cost - Operational cost) was more in irrigated states of Punjab, Haryana and Andhra Pradesh due to higher land rent.

Analysis of profit across states

The average absolute profit over total cost (C_2) varied from Rs. 8393 to Rs. 35474 in different states in the recent period (2010-11 to 2014-15) and presented in Table 4. There were absolute losses in rice farming based on total cost (which includes land rent, interest on fixed capital and depreciation) in states like Assam, Bihar, Odisha, West Bengal and Maharashtra. In the states of Madhya Pradesh, Uttar Pradesh and Tamil Nadu, the profit was marginal. When the period of early 1980s and the recent period were compared, more decrease in profits was noticed in the states of West Bengal (254%), Assam (252%), and Odisha (249%). Other states, where decrease in profit was noticed were Bihar (135%), Madhya Pradesh (66%), and Tamil Nadu (36%). However, in some states profits increased like Andhra Pradesh (203%), Punjab (163%), Haryana (1997%), and Uttar Pradesh (141%). The exceptional increase in per cent profit in Haryana is due to low base figures during early 1980s. Similarly, in Uttar Pradesh, the profit has increased from Rs. 2329 per ha to Rs. 5610, which worked out to be 141%. Governments of different states extend subsidies on various inputs including irrigation and power to farm sector distorting the actual cost of production. The extent of subsidies on inputs and other services varies from state to state. The profit over total cost was significant in irrigated states like Punjab and Haryana due to better quality rice production and better price realization. The above observations contradicts the observation made by Dev and Rao (2010) that agricultural price policy has been largely successful in playing a major role in regard to providing reasonable level of margins of around 20% over total costs to the farmers. Their observation is true only for irrigated states like Punjab and Haryana.

The profit was positive in all the states when operational cost is considered, though the figures were less in comparison to northern and southern states. During 1980s and 1990s, the profit over total cost and operational cost was positive in all the states. However, during 2000s, profits became negative in states like Assam, Bihar, Madhya Pradesh, Odisha, West Bengal and Maharashtra due to less realized price and low yield levels. These results confirm the observations made by CACP reports (various years) and Samal et al. (2013). More importantly, as per the agricultural census of 2015-16, the average holding size of farmers in India is about 1.08 ha and less than one ha in eastern region. Eastern region accounts for 59% of total rice area and 52% of total rice production. Rice is a major

Table 4. Average profit (Rs. /ha) from rice farming at constant price in major rice growing states. (Figures in Rs. per ha)

State	1980-84	1985-89	1990-94	1995-99	2000-04	2005-09	2010-14	Percent increase*
Assam	5510	1733	3471	3645	-2547	-2124	-8393	-252
	(11394)	(7245)	(9764)	(11107)	(5701)	(6714)	(1550)	
Bihar[$]	4603	3039	1909	3396	-3502	1324	-1610	-135
	(14243)	(12598)	(12236)	(12897)	(6000)	(9564)	(7396)	
MP[$]	4017	2342	2778	1425	-4492	-9553	1383	-66
	(10072)	(9416)	(11282)	(10560)	(3066)	(14585)	(17302)	
Odisha	4852	4201	7953	2856	-2864	1396	-7209	-249
	(11187)	(11963)	(17543)	(12893)	(8694)	(14757)	(5547)	
UP[$]	2329	6683	3913	6424	190	6708	5610	141
	(11773)	(16728)	(16443)	(17633)	(12547)	(21100)	(21088)	
WB	4853	7325	9990	4879	-7804	-475	-7479	-254
	(15000)	(19415)	(24974)	(20280)	(6107)	(14674)	(7483)	
AP	2733	4519	3538	4060	6724	13023	8282	203
	(18227)	(24863)	(25882)	(26719)	(31846)	(40459)	(35116)	
TN	8920	10781	11685	10740	2418	3292	5748	-36
	(25738)	(29830)	(29435)	(28424)	(22855)	(24430)	(23805)	
Karnataka	19510	20649	20940	22589	6522	23917	16793	-14
	(34402)	(35846)	(40661)	(42364)	(26932)	(45377)	(37121)	
Kerala[@]	-	-	-	217	719	11816	23243	-
				(13089)	(14031)	(28102)	(42776)	
Punjab	10662	12159	13589	12317	22267	30337	27895	162
	(28879)	(31210)	(34895)	(34413)	(47001)	(61165)	(58363)	
Haryana	1692	17557	19082	5380	10602	31596	35474	1997
	(15220)	(28934)	(35856)	(27033)	(34994)	(62735)	(64640)	
HP[#]	-	-	-	-	-	3864	10138	-
						(13113)	(19215)	
Gujarat[#]	-	-	-	-	-	21413	20110	-
						(33378)	(33581)	
Maharashtra[#]	-	-	-	-	-	-10379	-6319	-
						(1715)	(7162)	

Note: The profit /returns have been computed over cost C_2 at constant 2014-15 prices. * Percent increase in cost of cultivation during the quinquennium ending 2014-15 over 1984-85. @Data available from 1997-98. # Data available from 2005-06. Figures in parentheses indicate profit over operational cost (A2+FL) . $ Bihar, Madhya Pradesh and Uttar Pradesh include Jharkhand, Chhatisgarh and Uttarakhand, respectively.

crop of farmers and the level of profit obtained determines the standard of living. Any amout of profit less than Rs. 20000 per ha will not help in increasing the standard of living of small farmers. Therefore, appropriate policy measures needs to be taken to make rice farming profitable by increasing yield and reducing cost per unit area.

The above discussion leads to two observations. First, while irrigated states like Andhra Pradesh, Haryana and Punjab are able to maintain or increase profit with high level of input use, state like Tamil Nadu has failed. This may be due to declining fertility of native soils and negative yield growth during 1990s and 2000s in Tamil Nadu. This observation needs further exploration. Second, in other eight states, due to less realized price by the farmers and lesser yield level, the profits have eroded and approached either zero or have become negative. The less realized price than minimum support price was perhaps due to slow growth in yield and poor market infrastructure development in those states (Narayanmoorthy and Suresh, 2012; Samal et al., 2018). Prominent among them are the eastern states. In order to double the farmers' income by the year 2022, Government of India has signaled a significant change in policies from the earlier focus on increasing food production (Government of India, 2019). Several schemes are in place to achieve the target of raising the farm income. Promotion of Farmer Producer Organization (FPO) and market reforms will help in improving bargaining power of small farmers for getting better price for their produce. One of the major reasons

of lower yield in eastern region is dominance of rainfed rice farming leading to partial adoption of recommended package of practices. Therefore, more investment is needed to expand irrigated areas in these states.

CONCLUSION

The scope of area expansion in rice cultivation has been exhausted and future production growth in rice has to come through productivity improvement. State wise analysis of cost of cultivation data revealed that the costs per ha has increased in all the states and profits decreased in majority of the states. Profit over total cost was negative in states like Assam, Bihar, Odisha, West Bengal and Maharashtra in recent years. Some states have offset the negative profit level by providing various incentives to farmers on inputs and output. Profit per ha is reasonable only in states like Punjab and Haryana. Promotion of FPOs and bringing market reforms on priority in poorly performing states will help in increasing bargaining power of farmers in getting reasonable price for their produce. Further, more investment to increase irrigated area under rice is needed for reducing risk and increasing yield and profit in rainfed areas. This would help the farmers necessary incentives to adopt modern farming practices to raise productivity. This calls for more research and development funds to develop yield enhancing environment friendly technologies and offering better price to farmers.

REFERENCES

Central Rice Research Institute (2013). Vision 2050. Cuttack, India pp. 9

CACP (various years); Report on Price Policy for *Kharif* Crops. Commission for Agricultural Costs and Prices. Ministry of Agriculture and Farmers' Welfare, Government of India, New Delhi

Dev SM and Rao NC (2010). Agricultural price policy, farm profitability and food security.Economic and Political Weekly 45 (26): 174-182

Fan S, Hazell PBR and Thorat S (1998). Government Spending, Growth and Poverty: An Analysis of Interlinkages in Rural India. EPDS Discussion Paper No.33, Environment and Production Technology Division, International Food Policy Research Institute, Washington D.C., USA

Government of India (2009). Report of the Expert Group to Review the Methodology for Estimation of Poverty. Planning Commission, New Delhi

Government of India (2019). Union Budget of India, 2018-19. Ministry of Finance, New Delhi

Hazell PBR and Ramasamy C (1991). Green Revolution Reconsidered. The Impact of the High Yielding Rice varieties in South India.John Hopkins University Press, Baltimore, USA

Hossain M (1995). Sustaining Food Security for Fragile Environments in Asia: Achievements, Challenges and Implications for Rice Research.In: Fragile lives in Fragile Ecosystems. International Rice Research Institute, Philippines pp. 3-25

Jain A (2018). Analysis of growth and instability in area, production, yield and price of rice in India. Social Change and Development 15(2): 46-66

Kannan E, Paliwal A and Sparks A (2017). Spatial and Temporal Patterns of Rice Production and Productivity. In:Mohanty, S., Chengappa, P.G., Mruthyunjaya, J.K., Ladha, SampritiBaruah, ElumalaiKannan and Manjunatha, A.V. (Eds.).The Future Rice Strategy for India, Elsevier, London pp. 107-135

Maclean JL, Dawe D, Hardy B and Hettel GP (2002). Rice Alamanac. (3rd ed.). International Rice Research Institute, Philippines

Narayanmoorthy A and Suresh R (2012). Agricultural price policy in India: Has it benefited paddy farmers Indian Journal of Agricultural Marketing 26(3): 87-106

Ravallion M and Dutt G (1996). How important to India's poor is the sectoral composition of economic Growth. World Bank Economic Review 10 (1): 1-26

Samal P (2013). Growth in Production, Productivity, Costs and Profitability of Rice in India during 1980-2010. In: Shetty et al. (Eds.)National Institute of Advanced Studies, Bangalore pp. 35-51

Samal P (2018). State-wise analysis of growth in production and profitability of rice in India. Indian Journal of Economics and Development 14(3): 399-409

World Bank (2007). World Development Report 2008: Agriculture for Development. World Bank, Washington D.C., USA. DOI: 10.1596/978-0-8213-7233-3