

Research Paper

Varying the Profitability and Cost of Cultivation: A Spatio-Temporal Economic Analysis

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ABSTRACT

The several policies and initiatives has been taken to cope up the problem of agrarian distress, farmer suicides and to increase the farm employment across the different size classes of farming community. The government of India (2016-17 budget) has set a policy target of doubling farmers' income by 2022 by ensuring the food security and income. The present study has explored the trend and pattern of cost of cultivation of paddy and wheat crop across some major producing states over the time period as cost of cultivation is treated one side of the coin while farmers' income is the other side of the coin. The trend and pattern of different cost, profit, growth rate and efficiency of inputs have estimated across states over time. The descriptive analysis has been done using the CCS data published by CACP. There exists spatio-temporal variation in different costs, profit and growth. Thus a detailed review is needed to identify the state-wise important determinants (inputs) for the cultivation and after identifying the inputs supportive action is required through public policies.

Highlights

- It focuses the trend and pattern of different costs of paddy and wheat across major producing states over selected years.

Keywords: Doubling farmers' income, cost of cultivation, compound annual growth rate

Agriculture plays a pivotal role in overall economy by providing food and employment and achieved a tremendous growth in production and productivity of crops after Independence. However, the GDP share of agriculture and employment has been shrinking over the time period. This paradoxical phenomenon implies the decline in agricultural GDP has been much faster than employment share at the national level. Bathla and Kumar (2019) suggest that the share of agricultural rural income has declined from 57 percent to 39 percent and the share in rural employment has decreased from 78 percent to 64 percent. The agricultural households' net income has witnessed low to high growth during 1983-84 to 2011-12. It has been revealed that farm income per cultivator increased by 2.74 percent during 1983-84 to 1993-94 and it dropped to

2 percent from 1993-94 to 2004-05 and further from 2004-05 to 2010-11 the magnitude has increased to 7.3 percent (Chand *et al.* 2015).

The National Commission on Farmers (NCF) have recommended several strategies on land reform measures, irrigation, agricultural productivity, credit & crop insurance, food security, prevention in farmers' suicides, competitiveness of farmers, employment and bio-resources in agriculture. Due to short-term agrarian distress or crisis and long-term structural problems of Indian agriculture, the farm waiver scheme has been announced in 2007-08 by Government of India as "Debt Waiver

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and Debt Relief Scheme" for the farmers to boost the agricultural sector by providing increased level of income and to reduce the farmer suicides across the states. The "Situation Assessment of Farmers" (70th round in 2013) indicates that 60% of total income of agricultural household has been derived from farm activities and rest income has received from non-farm sector. The growing distress, farmer suicides and limited non-farm employment across the different size classes of farming community, government of India (2016-17 budget) has set a policy target of doubling farmers' income by 2022 by ensuring the food security.

In this perspective it is very like to estimates income from the cost of cultivation of paddy and wheat as takes major crops in India. The objectives of the study is to find out the profit, ratio of gross value of output and different costs, compound growth rate of inputs which reflects the feasibility of agriculture. The present study estimates the profit over different costs of paddy and wheat crops across the highest producing states during 2004-05 to 2014-15. The average ratio of gross value of output (GVO) and different cost has also been estimated. Further, the compound annual growth rate of operational cost (OC), fixed cost (FC) and total cost (TC) has been estimated. The efficiency of inputs and compound annual growth rate of major inputs have been estimated across the states.

The present study has been divided into four sections. In second section, the data and methodology of the study has been discussed. The third explore the results and discussion of the data analysis followed by conclusion in fourth section.

DATA SOURCE AND METHODOLOGY

The two major crops i.e. Paddy & Wheat has been selected for the study. The major producing states of paddy are West Bengal (WB), Andhra Pradesh (AP), Uttar Pradesh (UP), Odisha (OR), Bihar (BR), Punjab (PB) and Chhattisgarh (CG). The seven states have accounted about 66 percent of area and 67 percent of production of national level in 2014-15. The major producing states of wheat are Punjab (PB), Haryana (HR), Uttar Pradesh (UP), Madhya Pradesh (MP) and Rajasthan (RJ). These five states have occupied 81 percent of area and 86.5 percent production in 2014-15 (GoI, 2015-16).

The secondary data has been collected from the Comprehensive Scheme on Cost of Cultivation by Commission for Agricultural Cost and Price (CACP). The time frame of the study is 11 years i.e. from 2004-05 to 2014-15. The four cost concepts C2, C3, A2 and A2 + FL given by CACP has been used. The cost C2 indicates the all actual expenses in cash and kind in the production process excluding land while cost C3 comprises all the factor of cost C2 with additional 10 percent of managerial cost performed by farmer. The cost A2 reflects all actual expenses in cash and kind in process of production including the rent paid for lease-in land and the cost A2 + FL includes the cost of A2 plus imputed value for family labour. The gross value of output (GVO) has been estimated which is sum of value of main and by product. The farm profit has estimated by deducting GVO over cost C2 and cost C3. The compound annual growth rate (CAGR) has been calculated of operational cost (OC), fixed cost (FC) and total cost (TC) in three time period (introduction of waiver scheme in 2008-09).

It is obvious fact that high productive region would use inputs efficiently (Narayanamoorthy, 2017). The efficiency of inputs have calculated by dividing the value of output (Rs/ha) with the major cost (Rs/ha) for 11 time periods across the states. This implies amount of income generated from per unit of cost for different inputs and crops across time points.

RESULTS AND DISCUSSION

Varying Cost of Cultivation and Profit of Paddy

Paddy is an important food grain crops in terms of economically and profitably cultivated throughout India. It is noted that there exists variation among these states in terms of production and the variation may be due to different agro-climatic region, quality of soil, average size of land, significant expansion in the irrigated area, technological progress, use of chemical fertilizers and commercialization (Datt and Joshi, 1992; Chand and Haque, 1998; Singh and Singh, 1998; Haque, 2006; Jha *et al.* 2012).

It is also important for the development of the agricultural sector by reinvesting the revenue or profit accelerated by the cultivation. It is now very likely to analysis the profitability or revenue generated from the paddy cultivation across these

seven states where more than 66 percent production is generated (Table 1).

It is observed Punjab¹ ranks first in terms of average profit over cost C2 and C3 with the magnitude of 19.8 thousand (₹/ha) and 14.9 thousand (₹/ha), respectively reflecting positive profit in each year. It is observed that the situation is extremely shoddier for West Bengal² showing 9 times negative profit out of 11 times in case of cost C2 while for cost C3 each and every year showing negative profit. Similarly, it is observed that the average profit is negative in both cost C2 and C3 in Odisha³. Andhra Pradesh, Chhattisgarh and Uttar Pradesh⁴ have maintained positive average profit over cost C2 and C3. The average profit is negative in some eastern states⁵ of India while some states have shown a positive profit over cost C2 but when it comes to C3 it becomes negative. The proportionate change in GVO is much

higher compared to cost C2 and C3 in Punjab. In case of West Bengal and Odisha, the cost C2 and C3 are huge compared to GVO which reduces the margin of profit.

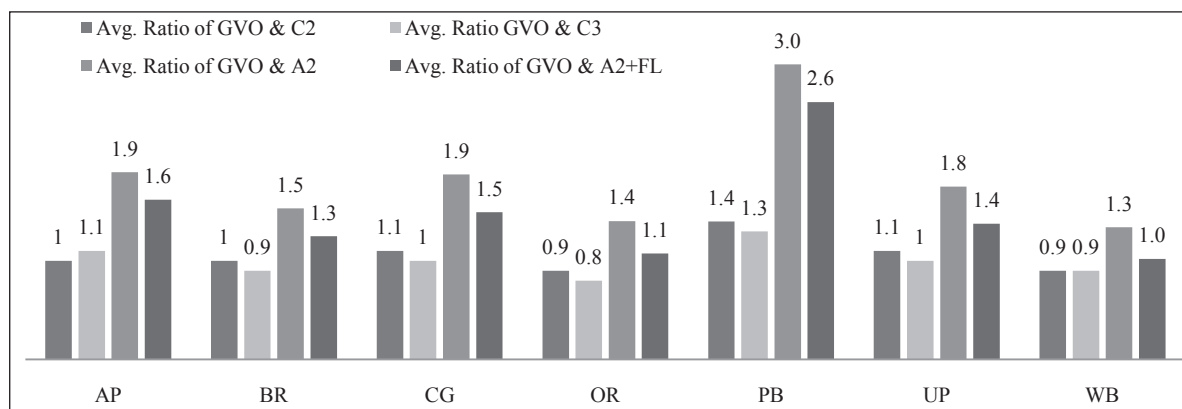
The ratio of GVO and cost C2 & C3 has been estimated (Fig. 1). It is revealed that the average ratio⁶ of GVO, cost C2 & C3, A2 and A2 + FL is very impressive in Punjab over the time.

It is observed that the average ratios of GVO and A2 & A2 + FL are impressive most of the states excepting West Bengal, Bihar and Odisha. The farmers of eastern region are reaping normal profit in case of operational cost i.e. A2 and A2 + FL. At the same time, Andhra Pradesh, Chhattisgarh, Uttar Pradesh have made profit at a higher rate over operational cost including family labour cost. In eastern states the average ratio of GVO and cost C2 & C3 have becoming worsening. In case of cost C3,

Table 1: Farm Profit for Paddy over Cost C2 and C3 across the states (₹ '000 per ha)

	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	Avg.	
Over C2	AP	5	2.9	3.8	7.2	10	11.1	3.4	5	12.9	9	5	6.8
	BR	-1.3	-0.6	0.4	6.8	4.4	-0.8	1	-1	-2.9	-1.8	3.4	0.7
	CG	1.9	2.2	2.8	5.9	2.6	2.5	3.8	3.8	7.1	4.2	-0.5	3.3
	OR	-0.7	-1.7	-1.5	2.7	2.7	2.6	-1.1	-7.4	-3.4	-9.8	-9.8	-2.5
	PB	10.6	7.4	11.8	21.9	21.7	20.8	15.9	16.2	27	30.8	33.6	19.8
	UP	-1	0.2	0.5	5.4	7.2	6.8	6.6	1.4	7	16.3	-8.6	3.8
	WB	-1.9	-1.8	-1.6	0.5	-0.4	3	-1.3	-8.6	-7.1	-3.6	-12.9	-3.2
Over C3	AP	2	-0.3	0.6	3.3	5	5.2	-1.9	-0.9	6.1	1.5	-3.6	1.5
	BR	-2.7	-2.1	-2.5	4.4	2.4	-4.5	-2.6	-3.8	-6	-5.8	-0.6	-2.2
	CG	0.1	0.5	1.1	3.7	0.4	0.4	1.3	0.3	3.7	-0.3	-5.4	0.5
	OR	-2.6	-3.6	-3.5	-0.9	-0.2	-1.1	-4.6	-11.1	-8.2	-14.8	-15.5	-6.0
	PB	7.5	4.4	8.7	18.4	17.2	15.8	10.8	10.7	20.5	24	26.2	14.9
	UP	-3.3	-2.2	-1.5	3.2	2.4	2.5	3.4	-2.8	2.6	11.5	-14.5	0.1
	WB	-4.5	-4.3	-4.3	-2.4	-3.7	-0.8	-5.6	-13.5	-12.7	-9.7	-20.1	-7.4

Source: Author's own calculation based on CACP data.



Source: Author's own calculation based on CACP data

Fig. 1: Average Ratio of GVO and C2, C3, A2 and A2 + FL

the magnitude is negative for all the eastern region states. It has been reported that predominantly paddy is cultivated in irrigated area where the incidence of crop failure is rare (Narayanamoorthy, 2013; Ghuman, 2017). The average ratio of GVO and cost C2 & C3 is exasperation in these states.

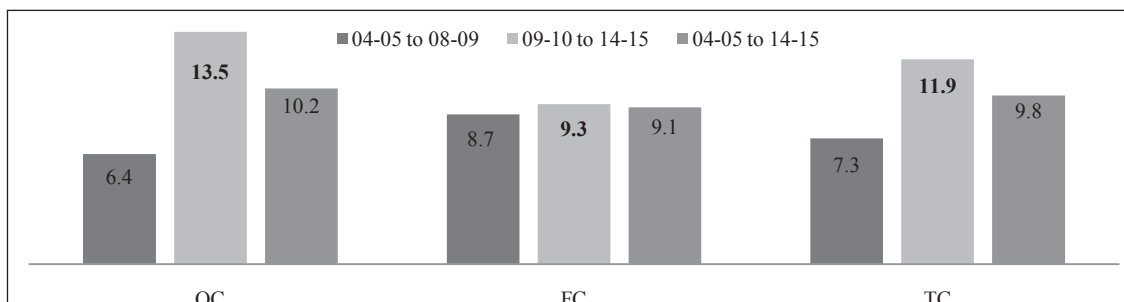
The CAGR of OC, FC and TC has been in three time period based on the Government announcement of waiver scheme (2008-09). First period includes from 2004-05 to 2008-09, secondly from 2009-10 to 2014-15 (Fig. 2). Then the distribution of OC, FC and TC has been presented in Fig. 3.

It has observed that the magnitude of CAGR of OC, FC and TC is the highest in period 1 compared to previous period. It is revealed the extra expenditure on inputs have generated by money from waiver scheme in later year. The eastern states West Bengal, Bihar and Odisha have shown a smaller amount of expenditure on fixed cost in first period and it has increased impressively after 2009-10. The OC have also increased after 2008-09 and the inducement is larger compared to period 1.

The efficiency of inputs have calculated by dividing the value of output (₹/ha) with the major cost

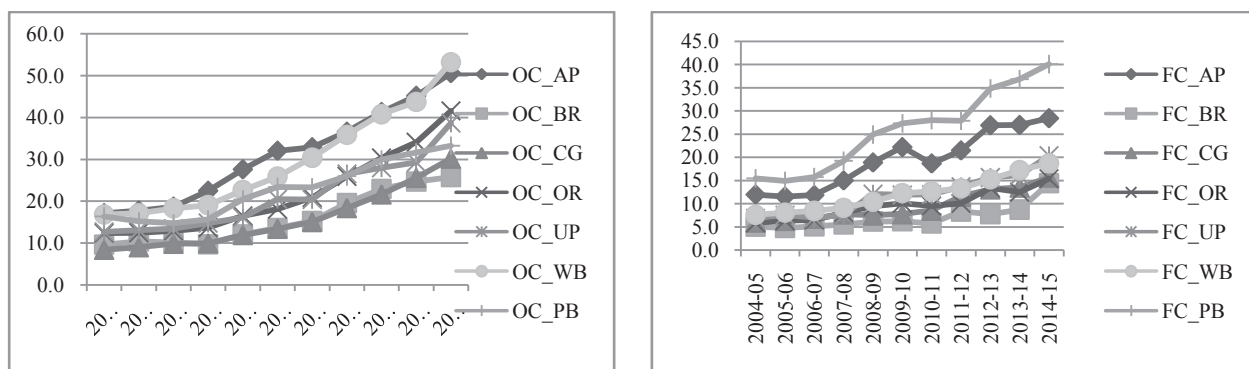
(₹/ha) for 11 time periods across the states. This will explain the average output in terms of rupees in each different time period (Table 2). Secondly, compound annual growth rate has been calculated to see the changes in use of inputs across the states and during three time period (Table 3).

The use of inputs (₹/ha) have increased in all the states over the time and further it increased rapidly after 2009-10. The casual labour cost has increased in almost all states but the enhancement is much faster in eastern states. The fertilizer and pesticides cost have shown unusual trend. In Punjab, the pesticides cost is higher compared to fertilizer cost and it increased in the period 2. It is found that casual labour is efficiently used in Bihar, West Bengal, Odisha and Andhra Pradesh while Uttar Pradesh, Chhattisgarh and Punjab has not using inputs efficiently. The CAGR suggests that it decreased in Andhra Pradesh and Punjab while it increased in Bihar, Chhattisgarh, Odisha, Uttar Pradesh and West Bengal in period 2. It has found that all the states are efficiently using fixed cost while Punjab is exceptionally efficient. In nutshell, it has found that labour cost is very important in some eastern



Source: Same as table 1

Fig. 2: Compound Annual Growth Rate (CAGR) of OC, FC and TC



Source: Source: Author's own calculation based on CACP data

Fig. 3: State wise variation in average Operational and Fixed Cost (₹ '000 per ha)

Table 2: Distribution of Input Efficiency (value of crop output in rupees per unit of cost)

		2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15
AP	Casual labour Cost	16.3	20.5	19.3	19.7	19.7	17.7	24.0	22.7	19.7	21.0	19.3
	Total Labour Cost	33.2	38.2	37.9	36.5	37.0	34.8	46.5	43.8	37.5	40.7	42.6
	Seed Cost	2.4	2.8	2.6	2.2	2.0	4.8	2.9	2.3	2.0	2.2	2.7
	Fertilizer Cost	8.4	9.2	9.2	7.9	6.0	5.4	6.3	8.1	7.8	9.0	10.0
	Pesticides Cost	3.3	2.8	2.8	2.4	2.7	2.7	2.9	2.4	2.2	2.5	3.2
	Irrigation Cost	2.8	2.1	1.8	1.3	1.0	1.2	1.1	1.5	1.3	1.2	1.7
	Fixed Cost	35.2	35.9	34.5	33.6	33.5	34.0	34.0	34.1	33.2	33.3	33.9
BR	Casual labour Cost	24.8	24.4	24.2	17.5	21.1	25.2	22.9	23.6	32.6	25.9	19.8
	Total Labour Cost	54.3	51.7	49.1	34.1	42.1	53.4	52.8	60.8	66.4	57.6	44.0
	Seed Cost	6.0	5.6	4.9	3.7	5.3	6.3	6.2	4.4	4.6	4.3	4.1
	Fertilizer Cost	8.5	8.0	7.6	5.7	5.7	6.1	5.3	7.0	9.1	8.5	7.1
	Pesticides Cost	0.0	0.1	0.1	0.1	0.2	0.0	0.0	0.0	0.0	0.0	0.0
	Irrigation Cost	3.2	6.0	3.1	0.5	0.0	5.9	4.9	0.5	2.5	7.9	3.9
	Fixed Cost	37.5	32.6	32.6	25.0	27.2	32.6	26.2	30.9	27.9	27.6	33.1
CG	Casual labour Cost	9.7	8.8	9.1	8.4	10.1	10.4	10.3	7.9	6.6	10.1	13.4
	Total Labour Cost	36.8	36.8	34.7	31.3	39.6	42.3	41.9	38.1	35.3	42.3	48.1
	Seed Cost	4.8	4.6	4.4	3.5	4.7	5.3	5.0	4.2	4.8	4.9	4.0
	Fertilizer Cost	9.2	8.8	10.4	6.6	6.9	6.8	6.3	8.7	9.0	9.3	10.4
	Pesticides Cost	0.4	0.7	0.8	0.4	1.2	1.0	0.9	2.6	1.9	2.1	2.3
	Irrigation Cost	0.5	0.3	0.3	0.4	1.8	1.1	1.0	0.8	0.6	0.4	1.1
	Fixed Cost	36.7	36.0	35.2	32.8	34.0	32.7	31.2	34.3	31.3	31.2	34.5
OR	Casual labour Cost	20.0	20.4	20.2	15.0	19.4	19.5	25.2	25.5	21.5	26.2	24.1
	Total Labour Cost	55.9	57.4	56.7	44.3	46.4	48.1	59.8	75.9	62.4	78.6	74.7
	Seed Cost	3.4	3.6	3.5	2.7	2.7	2.7	3.0	3.6	2.6	3.0	2.4
	Fertilizer Cost	10.2	10.7	10.5	8.0	7.7	7.1	7.9	10.2	9.7	10.9	10.1
	Pesticides Cost	0.6	0.6	0.8	0.5	0.4	0.4	0.3	0.2	0.1	0.1	0.6
	Irrigation Cost	0.6	0.7	0.5	0.4	0.4	0.3	0.3	0.6	0.2	0.2	0.3
	Fixed Cost	33.5	37.0	36.1	32.9	33.0	32.8	32.5	35.3	33.3	34.0	32.6
PB	Casual labour Cost	4.6	6.1	5.9	4.6	6.4	7.3	9.0	9.3	7.4	7.6	6.7
	Total Labour Cost	20.1	21.3	19.7	16.2	19.5	21.3	22.6	23.6	20.1	20.0	19.8
	Seed Cost	1.4	1.8	1.5	1.3	1.3	1.6	1.9	1.9	1.6	1.6	1.7
	Fertilizer Cost	6.0	6.5	5.9	4.4	4.6	4.1	4.6	4.8	4.5	4.3	3.5
	Pesticides Cost	3.1	3.8	3.0	2.6	3.0	2.9	3.4	3.8	3.4	3.7	3.7
	Irrigation Cost	7.9	6.9	4.8	2.9	2.1	2.8	2.2	2.9	2.9	2.2	2.5
	Fixed Cost	36.4	39.8	37.2	33.9	37.1	38.2	41.7	39.8	37.9	37.1	37.5
UP	Casual labour Cost	13.4	13.0	13.3	10.0	9.6	10.1	10.9	11.6	10.5	9.4	17.6
	Total Labour Cost	43.0	39.1	40.0	35.5	30.6	33.3	35.1	42.1	36.3	32.1	49.8
	Seed Cost	6.2	6.7	7.1	5.4	4.5	4.9	5.2	6.6	5.1	4.9	7.1
	Fertilizer Cost	8.9	8.8	8.4	7.2	6.3	7.1	6.7	8.5	7.5	6.3	8.6
	Pesticides Cost	0.4	0.3	0.2	0.3	0.7	0.5	0.5	0.4	0.5	0.4	0.4
	Irrigation Cost	10.1	7.8	8.5	4.9	3.3	6.6	4.7	6.2	5.8	3.7	10.8
	Fixed Cost	37.1	36.4	33.3	27.3	34.1	30.4	30.7	33.0	30.9	26.1	40.4
WB	Casual labour Cost	18.8	20.2	20.8	19.8	21.9	19.1	23.0	31.9	26.6	25.8	29.8
	Total Labour Cost	55.8	57.1	55.8	50.9	52.1	46.8	55.8	68.9	64.2	59.5	69.5
	Seed Cost	3.1	2.9	2.9	2.6	2.7	2.5	3.0	3.4	3.4	3.2	3.1
	Fertilizer Cost	9.0	8.2	8.8	8.0	8.6	7.8	8.1	9.5	10.5	9.2	10.2
	Pesticides Cost	0.8	1.2	1.3	1.1	1.0	1.0	1.3	1.7	1.2	1.2	2.4
	Irrigation Cost	6.0	3.6	3.8	3.7	5.0	4.8	4.5	4.7	4.1	3.2	4.9
	Fixed Cost	33.7	34.4	33.5	31.7	31.9	29.8	30.3	32.9	31.1	30.0	31.7

Source: Source: Author's own calculation based on CACP data.

Table 3: Compound Annual Growth Rate of Input in Different Period

State	Period	Casual labour Cost	Total Labour Cost	Seed Cost	Fertilizer Cost	Pesticides Cost	Irrigation Cost	Fixed Cost
AP	Period 1	14.8	13.1	7.1	3.4	6.7	-10.1	9.5
	Period 2	5.8	7.8	-5.1	15.3	7.3	11.1	4.1
	Over All	10.2	11.0	9.9	10.1	8.3	3.8	8.2
BR	Period 1	7.5	5.5	8.0	2.5	66.1	-52.6	4.1
	Period 2	10.3	11.1	6.9	17.9	17.1	7.2	15.1
	Over All	9.1	9.2	7.4	9.4	16.2	13.5	10.1
CG	Period 1	7.1	7.8	5.9	0.3	34.1	41.7	4.6
	Period 2	16.1	13.8	5.9	19.6	26.6	10.4	12.4
	Over All	13.1	12.5	7.9	11.0	29.4	19.3	9.2
OR	Period 1	9.7	6.2	5.1	4.3	3.7	1.7	10.1
	Period 2	11.2	15.5	5.2	13.8	12.9	2.8	7.3
	Over All	11.3	12.3	6.2	9.4	9.4	1.5	9.2
PB	Period 1	17.0	8.8	6.9	3.8	8.7	-15.8	10.0
	Period 2	5.4	5.6	8.1	4.1	11.0	4.6	6.6
	Over All	12.6	8.5	10.3	3.4	10.5	-2.1	9.1
UP	Period 1	6.4	6.4	6.8	6.9	27.9	-9.1	12.0
	Period 2	14.4	11.5	11.1	7.7	0.0	13.3	9.4
	Over All	12.2	11.0	10.9	9.2	8.7	10.2	10.4
WB	Period 1	10.9	6.2	5.2	6.7	13.4	3.7	6.5
	Period 2	14.3	13.4	9.8	11.2	23.1	6.8	7.2
	Over All	13.8	11.3	9.1	10.4	21.1	7.2	8.6

Source: Same as table 1, period 1 indicates from 2004-05 to 2007-08 and period 2 represents from 2008-09 to 2014-15.

Table 4: Farm Profit for Wheat over Cost C2 and C3 across the states (₹ '000 per ha)

		2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	Avg.
Profit over C2	HR	5.5	5.6	12.9	15.7	19.0	13.1	21.6	26.1	16.1	21.0	10.2	15.2
	MP	2.3	4.3	7.4	10.0	9.3	9.4	14.2	17.9	18.3	16.8	11.3	11.0
	PB	6.8	6.9	11.3	17.9	12.7	13.3	15.1	21.9	19.0	24.8	17.9	15.2
	RJ	10.0	12.2	15.8	15.1	18.2	21.0	21.9	18.9	27.9	26.4	12.9	18.2
	UP	0.8	2.5	9.1	13.7	9.7	7.6	12.1	9.6	10.5	13.7	-4.5	7.7
Profit over C3	HR	2.7	2.1	9.6	11.8	14.4	7.5	16.3	20.0	10.3	14.6	3.9	10.3
	MP	0.8	2.4	5.5	7.8	6.9	7.0	11.4	14.5	14.6	12.9	6.5	8.2
	PB	4.2	3.9	7.9	14.0	8.9	9.0	10.4	16.5	13.6	18.9	12.1	10.9
	RJ	8.0	9.7	13.3	12.5	15.0	17.1	17.6	14.2	22.8	19.1	6.5	14.2
	UP	-1.4	-0.1	6.2	10.7	5.9	3.8	7.8	4.6	5.4	8.2	-10.2	3.7

Source: Author's own calculation based on CACP data.

region states where pesticides and irrigation cost are very important for the states like Punjab and Andhra Pradesh.

Varying Cost of Cultivation and Profit of Wheat

Wheat is second largest producing food grain in India. The percentage of area of wheat to total food grains is 25 percent at the national level in 2014-15. With the introduction of Green revolution, the area and production have increased all the Northern and Western states of India. The area of wheat has

increased from 9.7 million ha to 30.9 million ha while production has increased from 6.46 million tonnes to 88.94 million tonnes during 1950-51 to 2014-15.

The farm profit of wheat is extremely impressive in the selected states over the time period (Table 4).

The highest average profitable state is Rajasthan over cost C2 (18.2 thousand ₹/ha) and C3 (14.2 thousand ₹/ha) followed by Punjab. The difference between states have happened due to intervened minimum support price (MSP) & open market

price and high level of marketed surplus (Chand, 2012; Sharma and Wardhan, 2015; Chatterjee and Kapur, 2016). Further, the procurement of wheat is very high in the state of Punjab and Haryana. It is revealed that the percentage change in GVO is higher compared to cost C2 and C3 in Punjab and Madhya Pradesh which induce the higher rate of profit.

In order to find the relationship and variation of different costs (cost C2, C3, A2 and A2 + FL) with GVO, the estimated average ratio of these costs has been estimated (Fig. 4).

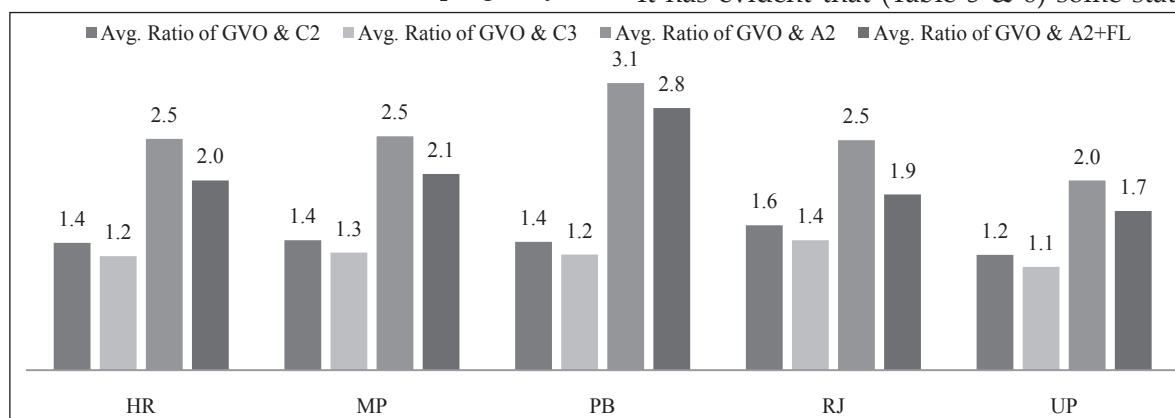
The ratio of operational cost with GVO is very impressive across all the states. The ratio of GVO and cost C2 and C3, then the results is extremely low for all the states indicating the minimum level of profit. In this situation farmers are reaping only

the normal profit. The situation is in favor for Haryana, Punjab, Madhya Pradesh and Rajasthan by considering cost C2 and the situation become worse if we consider cost C3. Further, the ratio in Uttar Pradesh is significantly low both in cost C2 & C3 indicating low level of profit.

The CAGR and state-wise variation of OC, FC and TC has been estimated in Fig. 5 & 6. The FC have not increased in the second period (09-10 to 14-15) while the OC have increased during this time across the states.

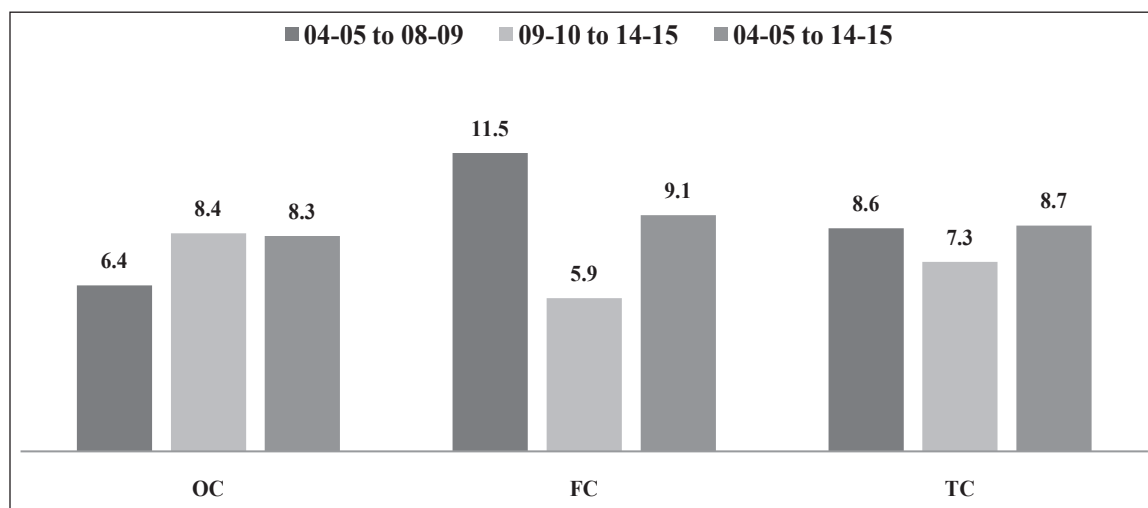
The value of owned land in the villages did not increase in one hand and stagnation in fixed capital cost (Raghavan, 2008). It is clear that the decline in FC is much higher than increase in OC during two periods.

It has evident that (Table 5 & 6) some states have



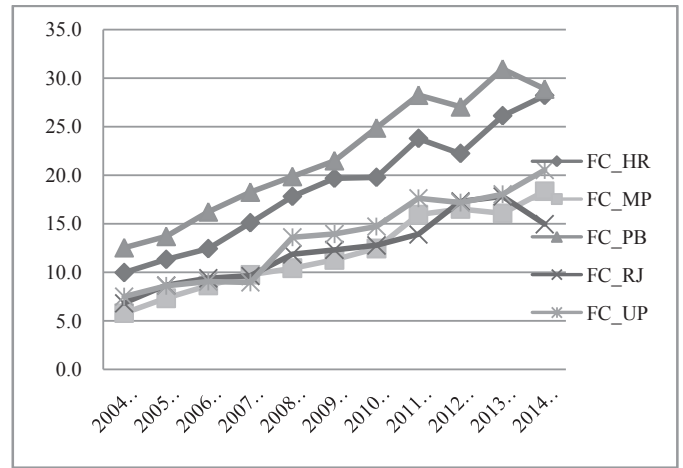
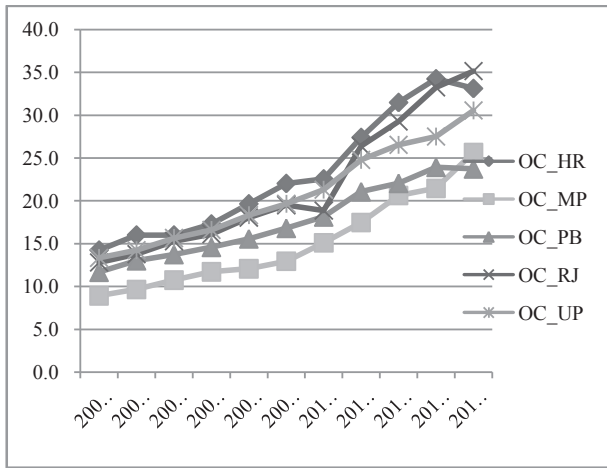
Source: Author's own calculation based on CACP data

Fig. 4: Average Ratio of GVO to C2, C3, A2 and A2 + FL



Source: Author's own calculation based on CACP data

Fig. 5: Compound Annual Growth Rate (CAGR) of OC, FC and TC



Source: Author's own calculation based on CACP data

Fig. 6: State wise variation in average Operational and Fixed Cost (₹ '000 per ha)

Table 5: Percentage Distribution of Input Efficiency (value of crop output in rupees per unit of cost)

		2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15
HR	Casual labour Cost	3.3	4.0	3.6	3.1	4.4	4.3	4.7	4.0	6.7	6.2	4.7
	Total Labour Cost	26.2	28.0	22.7	21.9	21.2	25.5	22.1	21.2	28.4	26.9	29.3
	Seed Cost	3.4	3.3	3.2	3.0	2.7	3.1	2.9	2.3	2.9	2.9	3.3
	Fertilizer Cost	8.1	7.8	6.2	5.3	4.6	4.5	4.3	5.0	6.3	5.4	6.0
	Pesticides Cost	2.7	2.0	1.4	1.1	1.3	1.3	1.1	0.8	1.0	0.9	1.2
	Irrigation Cost	6.4	6.3	4.3	3.8	4.2	4.8	4.1	5.3	5.5	5.0	5.4
	Fixed Cost	33.6	34.4	30.0	31.4	31.6	35.9	30.9	30.7	31.8	32.1	39.4
MP	Casual labour Cost	4.6	4.6	4.2	3.8	4.2	4.2	3.6	3.2	3.1	3.7	4.5
	Total Labour Cost	26.3	25.2	21.6	19.9	21.5	23.0	21.7	20.1	21.7	23.6	28.7
	Seed Cost	5.9	5.5	5.9	5.0	5.3	5.6	4.6	3.7	4.1	4.9	4.7
	Fertilizer Cost	7.4	5.8	4.6	4.5	4.2	4.0	3.6	4.3	5.1	4.7	5.2
	Pesticides Cost	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.1	0.1
	Irrigation Cost	11.6	7.8	7.0	6.8	5.8	4.9	5.3	5.0	5.3	5.2	6.6
	Fixed Cost	34.0	34.4	32.1	30.9	32.8	33.5	29.8	31.1	29.8	29.6	33.2
PB	Casual labour Cost	3.2	4.4	4.8	2.8	4.1	3.9	4.1	3.4	2.8	2.8	3.0
	Total Labour Cost	19.0	21.1	19.1	16.7	19.5	19.0	18.9	17.0	18.0	17.4	19.5
	Seed Cost	2.8	2.8	2.6	2.4	2.8	3.5	2.7	2.5	2.7	2.6	2.8
	Fertilizer Cost	9.4	8.6	6.9	5.8	6.1	5.9	5.6	6.3	7.7	6.6	7.4
	Pesticides Cost	3.8	3.2	2.4	2.0	2.2	2.2	2.3	2.1	2.4	2.1	2.2
	Irrigation Cost	1.5	1.7	1.2	0.9	0.6	1.0	0.6	0.7	0.6	0.4	0.7
	Fixed Cost	40.4	40.7	39.3	36.0	41.3	41.7	42.8	39.7	39.7	38.8	41.0
RJ	Casual labour Cost	3.0	2.5	2.0	1.9	2.1	2.9	2.9	3.6	3.7	3.9	5.0
	Total Labour Cost	23.7	21.5	20.1	21.1	20.7	20.8	22.4	29.0	24.8	27.6	36.4
	Seed Cost	4.5	4.3	4.7	4.9	4.3	5.0	4.4	3.7	3.9	4.2	5.4
	Fertilizer Cost	6.0	5.3	4.7	4.7	4.4	3.8	3.9	4.8	4.7	4.5	5.9
	Pesticides Cost	0.1	0.2	0.2	0.2	0.2	0.0	0.0	0.1	0.1	0.0	0.2
	Irrigation Cost	8.1	7.5	7.3	7.6	7.0	6.4	3.8	6.2	5.1	5.8	6.8
	Fixed Cost	23.0	25.0	23.2	23.6	24.7	23.3	23.9	23.5	23.2	23.0	23.7
UP	Casual labour Cost	6.0	5.1	4.5	4.5	4.0	4.8	5.0	6.0	5.5	5.7	7.9
	Total Labour Cost	32.2	30.0	25.6	23.6	24.5	26.8	25.4	26.9	27.4	27.5	38.2
	Seed Cost	5.7	5.5	5.2	4.7	4.6	5.3	4.6	4.5	4.9	4.7	6.8
	Fertilizer Cost	9.9	8.3	6.6	5.4	5.9	6.2	5.7	7.2	8.1	7.3	10.4
	Pesticides Cost	0.2	0.1	0.1	0.1	0.1	0.2	0.1	0.1	0.3	0.2	0.1
	Irrigation Cost	12.2	10.9	7.6	7.5	7.8	8.0	7.4	7.9	7.0	5.6	8.5
	Fixed Cost	34.6	33.9	26.7	22.8	32.7	33.9	30.6	33.9	31.7	30.4	44.1

Source: Author's own calculation based on CACP data.

Table 6: Compound Annual Growth Rate of Input in Different Period

State	Period	Casual labour Cost	Total Labour Cost	Seed Cost	Fertilizer Cost	Pesticides Cost	Irrigation Cost	Fixed Cost
HR	Period 1	20.5	8.9	8.8	1.3	-2.9	4.6	12.3
	Period 2	6.3	6.9	5.4	9.8	4.0	6.7	6.1
	Over All	12.0	9.4	8.0	5.4	1.0	6.7	9.9
MP	Period 1	11.2	8.9	11.0	1.3	31.9	-1.0	12.4
	Period 2	9.9	12.7	5.3	13.6	4.9	13.9	8.4
	Over All	11.1	12.2	9.0	7.8	13.4	5.7	11.0
PB	Period 1	14.7	9.7	9.5	0.1	-2.4	-8.1	9.6
	Period 2	0.8	5.8	1.2	9.5	5.5	-0.3	5.0
	Over All	7.1	8.0	7.6	5.5	2.5	0.8	7.8
RJ	Period 1	3.0	7.3	9.3	3.4	40.6	7.1	11.7
	Period 2	12.9	13.0	4.3	10.7	30.7	3.9	3.2
	Over All	12.3	11.3	9.0	6.9	15.7	5.5	7.4
UP	Period 1	4.8	7.9	9.4	2.8	10.7	4.3	12.6
	Period 2	11.1	8.2	6.4	11.3	-12.6	3.2	6.6
	Over All	9.8	8.9	9.0	7.8	2.6	3.8	9.6

Source: Author's own calculation based on CACP data, period 1 indicates from 2004-05 to 2007-08 and period 2 represents from 2008-09 to 2014-15.

shown efficient use of inputs while some states could not achieved it. On the other hand, according to compound annual growth rate some inputs have shown a steady increase in period 2 while some costs have declined in period 2.

The casual labour cost has efficiently used in Haryana, Madhya Pradesh and Punjab while Rajasthan and Uttar Pradesh, the use of input is not efficient. The CAGR have decreased in period 2 in Haryana, Madhya Pradesh and Punjab and other two states have shown an increasing trend in period 2. It has found that seed is efficiently used in Madhya Pradesh, Uttar Pradesh and Rajasthan while in Punjab and Haryana, seed cost are not efficiently used. The CAGR has decreased in all the states in period 2 compared to period 1. The efficient fertilizer cost has decreasing in period 1 and in period 2 the fertilizer cost has efficiently used across all the states. The CAGR also suggests that it increased steeply in period 2. The use of pesticides cost is most volatile in all the states. It is found that Haryana and Punjab are only the two states where farmers are using it efficiently. The states Uttar Pradesh, Rajasthan and Madhya Pradesh are using irrigation cost efficiently while Punjab and Haryana are not using it efficiently. Apart from operational cost, fixed cost is very important for the farmers. It is efficiently used in all the states but CAGR suggests that it decreased in period 2.

CONCLUSION

The past several strategies of Indian agriculture have focused to raise the agricultural production and to maintain food security. With the growing agrarian distress, farmer suicides and limited non-farm employment across the different size classes of farming community, government of India has set a policy target of doubling farmers' income by 2022 by ensuring the food security. The present study has explored the cost of cultivation of paddy and wheat crop across some major producing states over the time period as cost of cultivation one side of the coin while farmers' income is the other side of the coin.

It is revealed that the average profit is negative in some eastern states of India while some states have shown a positive profit over cost C2 but when it comes to C3 it becomes negative for paddy crop. The proportionate change in GVO is much higher compared to cost C2 and C3 in Punjab against other selected states. In case of West Bengal and Odisha, the cost C2 and C3 are huge compared to GVO which reduces the margin of profit and it's become negative. The average ratio of GVO and A2 & A2 + FL is impressive most of the states excepting West Bengal, Bihar and Odisha. It has observed that in eastern states the average ratio of GVO and cost C2 & C3 have becoming worsening. It has observed that the magnitude of CAGR is the highest during

2009-10 to 2014-15 in OC, FC and TC compared to previous period. The use of inputs (Rs/ha) have increased in all the states over the time and further it increased rapidly after 2009-10. In nutshell, it has found that labour cost is very important in some eastern region states where pesticides and irrigation cost are very important for the states like Punjab and Andhra Pradesh.

The highest average profitable state is Rajasthan over cost C2 and C3 followed by Punjab in wheat crop. This is results of high minimum support price (MSP) & open market price and high level of marketed surplus. It has revealed that the percentage change in GVO is higher compared to cost C2 and C3 in Punjab and Madhya Pradesh which induce the higher rate of profit. The ratio of operational cost with GVO is very impressive across all the states. It has evident that some states have shown efficient use of inputs while some states could not achieved it. On the other hand, according to compound annual growth rate some inputs have shown a steady increase in period 2 while some costs have declined in period 2. The casual labour cost has efficiently used in Haryana, Madhya Pradesh and Punjab while Rajasthan and Uttar Pradesh, the use of input is not efficient. The efficient fertilizer cost has decreasing in period 1 and in period 2 the fertilizer cost has efficiently used across all the states. The CAGR also suggests that it increased steeply in period 2. The use of pesticides cost is most volatile in all the states. It is found that Haryana and Punjab are only the two states where farmers are using it efficiently.

The National Commission on Farmers (NCF) recommended that the MSP should be at least 50 percent more than the weighted average cost of production. Thus a detailed review is needed to identify the state-wise important determinants (inputs) for the cultivation and after identifying the inputs supportive action is required through public policies.

FOOT NOTES

- 1 It is observed that the average land holding is highest in PB (3.77 ha), the process of procurement of paddy is highest in PB (with 33 percent, Department of Food and Public Distribution, GoI and Narayanamoorthy & Suresh, 2012), low rate of Farmer Indebtedness (2.8 %, Report No. 498(59/33/1), NSSO), highest consumption of NPK (Department of Agriculture and Cooperation, INM

division, GoI). It is also observed that the percentage area under basmati rice is highest in PB which has the higher price compared to other rice. Several literatures (Binswanger & Braun, 1991; Mellor, 1995) highlight commercialization of PB agriculture that induces the productivity. This also augments the level of farm profit.

- 2 The average profit over cost C2 and C3 are -3.2 and -7.4 (Rs/ha) respectively.
- 3 The maximum number of negative profit in C2 in OR is less than WB while for C3 the numbers of times are same both in OR and WB. In WB, BR and OR (major states in Eastern India), the percentage of marginal and small farmers are 94.6 percent, 91.0 and 91.3 percent respectively (Agricultural Census, GoI). In recent time farmers are shifting their agriculture from traditional crop to the high value crop with moderate level of investment (Birthal *et al.* 2007; Dasgupta and Bhaumik, 2014; De and Chattopadhyay, 2010 etc.). Now, the small and marginal farmers not in a position to investment on the traditional crop where there is a steep rise in diesel prices, high flat-rate of electricity in recent years that led to the contraction of water markets (Mukherjee, 2007; Mukherjee *et al.* 2009). On the other hand, the distributional impact, agrarian crisis and stagnation also step back the agriculture of WB (Bhattacharya and Bhattacharya, 2007; Chattopadhyay, 2005; Rogaly, 1993; Rawal and Swaminathan, 2004 etc.). This has lowering the margin of profit.
- 4 On the other hand, AP and UP, the role of cooperative society, commercial bank and RRB (Department of Agriculture and Cooperation, Credit Division) is very active for which they maintained a positive average profit and each year also. It is noted that farmers in AP have shifted traditional rain-fed cereal crops to cash crop (Kumar and Gupta, 2015; Sridhar, 2006; Sarma, 2004; Mancini, 2008) which induce the profit indirectly. The average size of land is 1.04 ha and 0.76 ha in AP and UP respectively.
- 5 The numbers of highest negative profit is in WB (9 out of 11) followed by OR (8 times), and BR (6 times) over cost C2. And in cost C3, the negative profit prevails each in WB and OR at 11 times where BR has 9 times.
- 6 It is observed that the proportionate change in C2 is much more higher compared to the proportionate change in value of output for these states and the magnitude is worsening for WB, BR and OR. If the ratio of GVO and the costs (particularly, C2) are more than 1.30 times it means the farmers are reaping good profit over the cost. If the ratio is in between 1 to 1.30, then farmers are reaping moderate profit but if the value is less than 1 then farmers are not in a position to get the profit or incur losses (Sen & Bhatia, 2004; Bhatia, 2006; Reddy, 1997).

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