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Comparative economic analysis of paddy cultivation in Shivalik foothills of Haryana

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Abstract
The present study was carried out with the objectives to work out costs and returns in cultivation of Paddy in shivalik foothills of Haryana during 2023. The study was based on primary data. Panchkula and Yamunanagar districts were consciously selected. From both districts, four village from each district) were selected purposively i.e., Batour, Bagwala, Tharwa and Behbalpur from Panchkula district and Jhiwerher, Pabni kalan Mustafabad, and Sabilpur jatan from Yamunanagar district. Finally, 80 farmers were selected randomly from all the selected eight villages were interviewed to gather all the desired information. The per hectare cost of Paddy cultivation was found to be Rs. 112629 and Rs. 123111 in Panchkula and Yamunanagar district, respectively. On an average, the per hectare yield, gross returns and net returns obtained from the cultivation of Paddy in Panchkula district were 68.7 quintals, Rs.153819 and Rs.41190, respectively. The corresponding figures for Yamunanagar district were worked out to be 69.4 quintals, Rs.155333 and Rs.32222, respectively. The B:C ratio and B:C ratio over variable cost of Paddy cultivation was worked out to be 1:1.36 and 1:1.26, 1:2.65 and 1:2.65 respectively for Panchkula & Yamunanagar district which found to be comparatively lower in Yamunanagar district, high cost of labour and rental value of land was the major reason for this.

Keywords: Cost, returns, cultivation, B-C Ratio, B-C ratio over variable cost

Introduction

Rice (*Oryza sativa*) is one of the most important food crop of India and second of the World. It feeds more than 50 percent of the World population. It is the staple food of most of the people of South East Asia and Africa. Asia accounts for about 90 percent and 91 percent of World's rice area and production respectively. Among the rice growing countries, India having the largest area under rice in the World and in case of production it is next to China. However productivity of India is much lower than that of China, Japan, USA and Indonesia. It contributes 42 percent of total food grains production and 45 percent of cereal production in the country (Directorate of Rice Development, GOI, 2009). Rice also provides more than 50 percent of the daily calories ingested [1]. Rice is grown in all six continents of the world where field crop production is practiced except the icy continent of Antarctica, where no crop are grown [2]. Global rice production has been on a snowballing trend since the sixties and has risen from 605 million tonnes in 2005 [3] to 518.14 million metric tonnes in 2023 [4]. In 2023, China and India produced 149 and 132 million tonnes of rice respectively [4]. The top five rice producers in the world in the year 2012-2023 are China, India, Indonesia, Bangladesh and Vietnam [4, 5]. In 2022-23, over 46 million ha (22% of total national cultivated area) was dedicated to rice cultivation which resulted into total output of 120 million tonnes of rice reported that India contributed about 20 percent share of global rice production. India rice has made its mark all over the world and it is famous for Basmati rice, which has penetrated all nooks and crannies of the world. Despite the devastating Covid-19 challenges in 2020, India exported rice worth USD 8 billion, making it by far, the leading rice exporter in the world [4]. India also ranked second only to China in rice consumption. Consumption estimates of rice has gone up steadily from 95.4 million tonnes in 2016- 17 to about 109 million tonnes in 2022-23.
The stronghold of India in rice and other important crops should not come as a surprise as the nation is endowed with diverse agro-ecological conditions. This variability makes it favourable for the cultivation of diverse agricultural products and the reinforcement of its food

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and nutritional security for the ever-teeming population through steady production and distribution, particularly in the recent past. Haryana is one of rice producing state contributing large share in national food stock and 60 percent in export of basmati rice from India. At present in Haryana, rice is cultivated on about 1.51 million ha with production of 5.46 million tonnes contributing 4.09 percent of rice production in the country. In this study, an effort has been made to examine the growth and economic profitability of rice value chain in Haryana. Findings of this study will be relevant to stakeholders at all levels, particularly agricultural development planners and policy makers, farmers, processors, marketers and exporters. The study will further be useful to researchers, extension functionaries and also serve as a basis for expanded research in this area.

Methodology
Panchkula and Yamuna Nagar District which comes under the Shivalik foothills of Haryana were selected for the present study. Panchkula and Yamunanagar District having largest area under wheat, rice & sugarcane cropping pattern were selected randomly. Four villages from each district from plains were selected at random. Ten (10) farmers from each village were selected for the study from yamunanagar. Forty (40) farmer from Panchkula and Forty (40) farmers from Yamunanagar district were selected. Thus, a total of 80 Paddy farmers from 8 villages were taken for the study. Multistage random sampling technique was used for selection of farmers. The primary data for 2023 was collected using survey method by conducting personal interviews of the selected farmers with the help of pre-tested schedule.

Selection of study area
The present study was conducted in Haryana state to achieve well-defined objectives for Paddy crop. Haryana state carved out from Punjab state in 1966 having geographical area 44,212 sq. km. The gross area sown in the state was 192 thousand hectare during 1966-67 and during 2023 it was observed to be 1519.55 thousand hectare which showed an increase 1327.55 thousand hectare from 1966-67 to 2023. Paddy crop alone occupies an area of 1519.55 thousand hectare with a total production of 5460.41 thousand tons, having average yield 3593.44 Kg. per hectare in 2022-23 in the state, In Panchkula district Paddy crop is grown an area of 13.27 thousand hectare with an average yield of 2585.22 Kgs.

per hectare having total production of 34.31 thousand tonnes where as in Yamunanagar district Paddy crop is grown an area of 86.63 thousand hectare with an average yield of 3409.31 Kgs. per hectare having total production of 295.35 thousand tonnes. (Economics and Statistical Analysis, Department of agriculture and farmers welfare Haryana 2022-23) [4].

Selection of Villages
A total of eight villages were selected randomly from both the districts that are four villages from each district.

Collection of data
The present study was based on the primary data. To work out the cost and returns in cultivation Paddy to study the economics of Paddy and to identify production of Paddy in Panchkula and Yamunanagar district of Haryana for the year 2023. The primary data from selected farmers for the year 2022 was collected by survey method through personal interview with the help of well-structured interview schedule which include the following aspects.
1. General information of the selected farmers.
2. A detailed information about the per hectare input use pattern, prices of inputs to work out cost of cultivation of Paddy crop and detailed information about Paddy seed, total quantity of fertilizer purchased and various charges incurred in production of Paddy etc.
3. Yield and returns from the crop and from the main and by-products obtained after harvesting of Paddy.

Analytical Tools
The various statistical tools like Average, Percentage, costs, returns, Benefit-Cost ratio (B:C ratio) etc. were employed to draw valid inferences from the study. Cost and returns in production of Paddy
Following tools or formulae were employed to work out the cost and returns in the cultivation of Paddy:
- Gross return = Main product value + By product value
- Return over variable cost = Gross return – Total variable cost
- Return over total cost (Net return) = Gross return – Total cost
- Benefit-cost ratio = Gross return/ Total cost
- Cost of production per quintal without by-product =

$$\text{Cost of production per quintal without by-product} = \frac{\text{Total cost}}{\text{Main product quantity in quintals}}$$

$$\text{Cost of production per quintal with by-product} = \frac{\text{Reduced Total cost}}{\text{Main product quantity in quintals}}$$

(Reduced Total Cost = Total Cost – Value of by-product)

- Working capital / variable cost = Total preparatory tillage cost + pre sowing irrigation charges + sowing value + FYM value + total fertilizer cost + irrigation value + pesticide cost + herbicide cost + manual weeding charges + Harvesting value + Threshing value + Miscellaneous charges.
- Management charges (10%) = Total variable cost *0.1
- Risk factor = Premium paid for crop insurance
- Total fixed cost = Transportation charges +Rental value of land+ Management charges+ Risk factor.

Results and Discussion
Comparative economic analysis of Paddy cultivation in shivalik foothills in selected districts were made on per hectare basis. Result pertaining to cost details of Paddy in Panchkula and Yamunanagar district is shown in Table 1. The results shows that total cost spent in growing Paddy in Panchkula district (₹112629/ha) is lower than the cost incurred in Yamunanagar district (₹123111/ha) due to higher rental value in Yamunanagar as compared to Panchkula district. Total variable cost constituted for 51.5 per cent (₹58038/ha) and 47.5 per cent (₹58517/ha), in Panchkula and Yamunanagar district respectively, of variable cost incurred in the cultivation of Paddy. The overall average for both the

districts for variable cost and total cost observed to be ₹58277 and ₹117870. Overall average of principal components of variable cost in decreasing order are preparatory tillage, harvesting cost and irrigation charges contributing 9.2, 3.6 and 7.3 per cent, respectively of the total cost. While in fixed cost these were rental value of land, management charges, risk factor and transportation charges contributing 42.5, 4.9, 1.6, and 1.5 per cent, respectively. Returns from Paddy cultivation in Panchkula and Yamunanagar district shown in the table shows that yield of Paddy obtained to be 68.7 and 69.4 quintal per hectare respectively. Whereas, gross return received in Panchkula district were found to be ₹153819 and in Yamunanagar, it was obtained ₹155333 per hectare. While, net returns in Panchkula district (₹41190/ha) were estimated to be higher compared to Yamunanagar district (₹32222/ha). The benefit cost ratio (B:C ratio) for Panchkula and Yamunanagar district were recorded to be 1:1.36 and 1:1.26 respectively.

Table 1: Comparative economics of Paddy crop grown in Shivalik foothills of Haryana (₹/ha)

Sr. No.	Item	Panchkula			Yamunanagar			Overall Average		
		Qty.	Value	Percent	Qty.	Value	Percent	Qty.	Value	Percent
1	Preparatory tillage	5.85	10638	9.4	5.93	10988	8.9	5.9	10813	9.2
2	Pre-sowing Irrigation		1017	0.9		1007	0.8		1012	0.9
3	Sowing		8406	7.5		8613	7.0		8509	7.2
4	Ridiging		520	0.5		572	0.5		546	0.5
5	Seed (qtl.)	8.1	3322	2.9	8.0	3247	2.6	8.0	3284	2.8
6	Seed Treament									
7	FYM (qtl)	33.1	1325	1.2	30.3	1150	0.9	31.7	1238	1.0
8	Fertilizer nutrients									
9	(a) Nitrogen	154.9	2020	1.8	157.0	2047	1.7	156.0	2034	1.7
10	(b) Phosphatic	53.25	2854	2.5	55.4	2968	2.4	54.3	2911	2.5
11	(c) Potassic	39.1	2213	2.0	37.1	2102	1.7	38.1	2158	1.8
12	(d)Zinc Sulphate	10.9	1088	1.0	11.5	1144	0.9	11.2	1116	0.9
13	Total Ferti. Invest		8174	7.3		8262	6.7		8218	7.0
14	Fertilizer Application		614	0.5		538	0.4		576	0.5
15	Irrigation	11.55	8619	7.7	11.0	8550	6.9	11.3	8584	7.3
16	Hoeing /Weeding			0.0			0.0			0.0
17	(a) Chemical		1572	1.4		1628	1.3		1600	1.4
18	(b) manual			0.0			0.0			0.0
19	Plant Protection		7134	6.3		7103	5.8		7119	6.0
20	Harvesting		4231	3.8		4338	3.5		4284	3.6
21	Threshing/ winnowing/Tying									
22	Miscellaneous		503	0.4		544	0.4		523	0.4
23	Total(1to 15)		56076	49.8		56538	45.9		56307	47.8
24	Interest on working Capital		1963	1.7		1979	1.6		1971	1.7
25	Variable cost		58038	51.5		58517	47.5		58277	49.4
26	Management charges		5804	5.2		5852	4.8		5828	4.9
27	Risk factor		1928	1.7		1928	1.6		1928	1.6
28	Transportation		1672	1.5		1816	1.5		1744	1.5
29	Rental value of land		45188	40.1		55000	44.7		50094	42.5
30	Total Cost		112629	100.0		123111	100.0		117870	100.0
31	Production (qtl.)									
32	(a) Main	68.7	151319		69.4	152833		69.0	152076	
33	(b) By Product		2500			2500			2500	
34	Gross return		153819			155333			154576	
35	Return over variable cost		95780			96817			96298	
36	Net return		41190			32222			36706	
37	Cost of Production/(qtl.)									
38	(a) Without by Product		4113			4460			4287	
39	(b) With by Product		4075			4698			4387	
40	B:C Ratio		1:1.36			1:1.26			1:1.31	
41	Number of farmers	40			40			80		
42	Area(acre)	240.5			293			534		
43	Labour									
44	(a) Human Days	97.4			100.3			98.8		
45	(b) Bullock days									
46	(c) Tractor hours	18.63			19.5			19.1		

Table 2: Resource use pattern in Paddy in Panchkula and Yamunanagar district, during 2023. (Per hectare)

	Panchkula	Yamunanagar	Overall average
Preparatory tillage (No.)	5.8	5.9	5.9
Seed (Kg)	8.1	8.0	8.0
Fertilizer nutrients (Kg)			
(a) Nitrogen	154.9	157.0	156.0
(b) Phosphatic	53.25	55.4	54.3
(c) Potassic	39.1	37.1	38.1
(d) Zinc Sulphate	10.9	11.5	11.2
FYM (qt)	33.1	30.3	31.7
Irrigation (No.)	11.5	11.0	11.3

Resource Use Pattern

The use of inputs and adoption of various cultural practices in the cultivation of Paddy crop in Panchkula and Yamunanagar district has been given in the table 2.

The field preparation for Paddy sowing in Northern Haryana starts in May month. On an average, 5.8 preparatory tillage operations in Panchkula district and 5.9 in Yamunanagar district were done to prepare the fields. Fields were prepared with the help of tractors. The per hectare seed rate used was 8.1 Kg, in Panchkula district the corresponding figures for Yamunanagar district were 8.0 Kg respectively. The quantity of FYM applied to the field in Panchkula district was 33.1 and 30.3 quintal per hectare FYM was used in Yamunanagar district respectively. Quantity of Nitrogen fertilizer used in Panchkula and Yamunanagar district was 154.9 and 157.0 kg per hectare. Quantity of Phosphate fertilizer used in Panchkula and Yamunanagar district was 53.25 and 55.4 kg per hectare respectively. The Potassic feritilizer was used 39.1 and 37.1 kg per hectare in both district respectively. The Zinc sulphate was used 10.9 and 11.5 kg per hectare in both the district. On an average, 11.5 irrigations were given to the Paddy crop in Panchkula district and 11.0 irrigations were given in Yamunanagar district by sample farmers.

Conclusion

It is concluded that Paddy grown in Shivalik foothills of the study area. The gross returns from cultivation of Paddy were worked out to be Rs. 153819 and Rs. 155333 in Panchkula and Yamunanagar district, respectively. The net returns per hectare worked out were Rs.41190 and Rs. 32222 with total cost of cultivation of Rs. 112629 and Rs. 123111 in Panchkula and Yamunanagar district, respectively. The per hectare return over variable cost and net returns from Paddy crop was found to be ₹95780 and ₹41190 respectively in the Panchkula district and it was ₹96817 and ₹32222 in the Yamunanagar district. Among various variable cost items harvesting, seed, fertilizer preparatory tillage and irrigation of Paddy have maximum share i.e., 3.8, 2.9, 7.3, 9.4 and 7.7 per cent of total expenses incurred in cultivation of Paddy in Panchkula district. While corresponding figures for Yamunanagar district were observed to be 3.5, 2.6, 6.7, 8.9 and 6.9 per cent of total expenses incurred. Total fixed cost components, the rental value of land have maximum share i.e., 40.1 and 44.7 per cent of total cost incurred in cultivation of Paddy in Panchkula and Yamunanagar district, respectively. The B:C ratio was found to be 1:1.36 and 1:1.26 in Panchkula and Yamunanagar district, respectively. The study also revealed that Benefit Cost ratio is greater than one in both the districts which indicates that Paddy grown in the Shivalik foothills to be economically viable.

Competing Interest

Authors have declared that no competing interests exist.

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