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Unlocking prosperity: Economic viability and returns from paddy cultivation in Haryana's Shivalik foothills

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Abstract

The present study was undertaken to estimate the costs and returns of paddy cultivation in the Shivalik foothills of Haryana during 2024. The analysis was based on primary data. The districts of Panchkula district and Yamunanagar district were purposively selected for the study. From each district, four villages were chosen: Tabar, Rehore, Tharwa, and Batour from Panchkula district, and Harnoul, Pabni Kalan, Kazibans, and Sagri from Yamunanagar district. A total of 80 farmers were randomly selected from these eight villages and interviewed to collect the required information. The per hectare cost of paddy cultivation was estimated at ₹1,25,810 in Panchkula district and ₹1,34,010 in Yamunanagar district. In Panchkula district, the average per hectare yield was 66.5 quintals, with gross returns of ₹1,56,780 and net returns of ₹30,970. In Yamunanagar district, the corresponding figures were 71.1 quintals for yield, ₹1,67,510 for gross returns, and ₹33,500 for net returns. The benefit-cost (B:C) ratio for paddy cultivation was calculated as 1:1.24 in both Panchkula and Yamunanagar districts. The B:C ratio over variable cost was found to be 1:2.58 in Panchkula and 1:2.74 in Yamunanagar district.

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

Introduction

Rice (*Oryza sativa*) is one of the most significant food crops in the world and plays a central role in ensuring global food security. It serves as the staple diet for more than half of the world's population, particularly in Asia and parts of Africa. Asia dominates global rice cultivation, accounting for nearly 90 percent of the world's rice area and production. The crop's adaptability to diverse climatic and soil conditions has enabled its cultivation across almost all continents, except Antarctica [Prasad, 2016] ^[8]. The top five rice producers in the world in the year 2023-2024 are China, India, Indonesia, Bangladesh and Vietnam [FAOSTAT, 2020] ^[3]. Over the decades, global rice production has steadily increased due to technological advancements, improved seed varieties, irrigation expansion, and supportive government policies.

India holds a prominent position in the global rice economy. It has the largest area under rice cultivation in the world and ranks second in production after China. It contributes 42 percent of total food grains production and 45 percent of cereal production in the country (Directorate of Rice Development, GOI, 2009) ^[12]. Rice also provides more than 50 percent of the daily calories ingested [Braun, 2006] ^[1]. It is also a critical component of the Public Distribution System (PDS), ensuring food security for millions of households under the National Food Security Act. India is also the world's leading exporter of rice. In recent years, the country has consistently maintained a dominant position in global rice trade, particularly in basmati rice exports. Indian basmati rice is widely appreciated for its aroma, grain length, and cooking quality, and it commands a premium price in international markets. Despite global disruptions, including the COVID-19 pandemic and trade uncertainties, India's rice exports have remained strong, contributing significantly to agricultural export earnings [USDA, 2020] ^[10]. Domestic consumption of rice has also shown a steady upward trend, driven by population growth and sustained demand through welfare schemes.

The strength of India's rice sector can largely be attributed to its diverse agro-ecological conditions, which allow rice cultivation under irrigated, rainfed, upland, and lowland systems

Continuous improvements in high-yielding varieties, hybrid rice technology, mechanization, and extension services have helped enhance productivity. Government initiatives such as minimum support prices (MSP), assured procurement by agencies like the Food Corporation of India (FCI), and input subsidies have further encouraged farmers to continue rice cultivation.

Within the national framework, Haryana occupies an important place among rice-producing states. Although traditionally known for wheat production, Haryana has emerged as a significant contributor to the country's rice output, particularly in basmati rice. As per recent state agricultural statistics, rice is cultivated on approximately 1.5 million hectares in Haryana, with total production exceeding 5 million tonnes. The state contributes a notable share to the central procurement pool and plays a crucial role in India's basmati rice exports. Districts located in the Shivalik foothills and irrigated plains benefit from well-developed irrigation infrastructure, favourable soil conditions, and access to markets, which support rice cultivation.

Rice cultivation in Haryana is not only important for food security but also for farm incomes, employment generation, and agro-based industries such as milling, processing, and export logistics. However, the sector also faces challenges including rising input costs, groundwater depletion, and the need for sustainable resource management. In this context, evaluating the economic performance and profitability of rice cultivation becomes essential for informed policymaking.

The present study is therefore undertaken to examine the growth trends and economic profitability of the rice value chain in Haryana. By analysing production patterns, costs, returns, and market linkages, the study aims to generate insights that can assist policymakers, agricultural planners, researchers, and farmers in strengthening the sustainability and competitiveness of rice cultivation in the state.

Methodology

For the present research, the districts of Panchkula and Yamunanagar, located in the Shivalik foothills of Haryana, were selected. These districts were chosen because they have a relatively large area under the wheat-rice-sugarcane cropping system. From each district, four villages situated in the plains were selected randomly. In Yamunanagar district, ten farmers were chosen from each selected village for detailed study. Similarly, forty farmers from Panchkula district and forty farmers from Yamunanagar district were included in the sample. In total, 80 paddy farmers from eight villages constituted the sample for the study. A multistage random sampling technique was employed to select the respondents. Primary data for the year 2024 were collected through a survey method by conducting personal interviews with the selected farmers using a pre-tested interview schedule.

Selection of study area

The present study was undertaken in Haryana with clearly defined objectives focusing on the paddy crop. Haryana was carved out of Punjab in 1966 and has a geographical area of 44,212 square kilometres. Since its formation, the state has witnessed a significant expansion in cultivated area. The gross area sown in 1966-67 was 4,599 thousand hectares, which increased to 6,570 thousand hectares in 2023-24, reflecting an overall rise of 1,971 thousand hectares over the period. Paddy occupies a prominent place in the state's cropping pattern. In 2023-24, the crop covered about 1,837.07 thousand hectares, with a total production of 7,137.18 thousand tonnes and an

average productivity of 3,885.08 kg per hectare in Haryana. At the district level, variations in area and productivity are observed. In Panchkula district, paddy was cultivated on 14.76 thousand hectares, producing 61.70 thousand tonnes with an average yield of 4,180.80 kg per hectare. In Yamunanagar district, the crop covered a larger area of 87.60 thousand hectares, yielding a total production of 417.65 thousand tonnes with a higher average productivity of 4,767.82 kg per hectare. These statistics, sourced from the Department of Agriculture and Farmers' Welfare, Haryana (Economic and Statistical Analysis, 2023-24), highlight the importance of paddy cultivation in both the state and the selected districts.

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 primarily based on first-hand data collected from selected farmers. It was undertaken to estimate the costs and returns of paddy cultivation, examine its economic viability, and analyse production aspects in Panchkula and Yamunanagar districts of Haryana for the agricultural year 2023.

Primary data pertaining to the year 2022 were collected through a survey method. Personal interviews were conducted with the selected farmers using a well-structured and pre-tested interview schedule. The schedule was designed to obtain comprehensive information covering the following aspects:

1. General profile of the selected farmers, including socio-economic characteristics and farm-related details.
2. Detailed information on per hectare input use patterns, input prices, and various expenses incurred in paddy cultivation. This included data on seed rate, quantity of fertilizers and pesticides applied, labour use, irrigation charges, machinery expenses, and other production costs necessary for estimating the cost of cultivation.
3. Information related to crop yield and returns, including output from both main products (grain) and by-products (such as straw), to assess gross and net returns from paddy cultivation.
4. This systematic data collection helped in conducting a comprehensive economic analysis of paddy cultivation in the selected districts.

Analytical Tools

Various statistical tools such as averages, percentages, cost analysis, return analysis, and the Benefit-Cost (B:C) ratio were used to derive meaningful conclusions from the study. These tools helped in systematically analysing the data and assessing the economic performance of paddy cultivation. To estimate the cost and returns from paddy production, appropriate analytical methods and standard cost concepts were applied. The following tools and formulae were used to calculate the cost of cultivation and profitability of the paddy crop:

- 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 =

$$\text{Unit Cost} = \frac{\text{Total cost}}{\text{Main product quantity in quintals}}$$

Cost of production per quintal with by-product =

$$\text{Reduced Unit Cost} = \frac{\text{Reduced Total cost}}{\text{Main product quantity in quintals}}$$

Reduced Total cost

- 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.

Result and Discussion

A comparative economic analysis of paddy cultivation in the Shivalik foothills was conducted on a per hectare basis for the selected districts. The cost structure of paddy cultivation in Panchkula and Yamunanagar districts is presented in Table 1. The findings indicate that the total cost of cultivation in

Panchkula district (₹1,25,810 per hectare) was lower than that in Yamunanagar district (₹1,34,010 per hectare). The higher total cost in Yamunanagar was mainly attributed to the comparatively greater rental value of land in that district.

The total variable cost accounted for 48.2 percent (₹60,682 per hectare) of the total cost in Panchkula district and 45.6 percent (₹61,068 per hectare) in Yamunanagar district. On an overall average basis for both districts, the variable cost and total cost were estimated at ₹60,875 per hectare and ₹1,29,910 per hectare, respectively. Among the major components of variable cost, preparatory tillage, irrigation charges, and harvesting expenses were the leading contributors, accounting for 9.0 percent, 6.8 percent, and 3.5 percent of the total cost, respectively.

In terms of fixed costs, the rental value of land constituted the largest share, contributing 45.5 percent of the total cost. This was followed by management charges (4.7 percent), risk factor (1.6 percent), and transportation charges (1.4 percent).

With respect to returns, the average yield of paddy was recorded at 66.5 quintals per hectare in Panchkula district and 71.1 quintals per hectare in Yamunanagar district. The gross returns were estimated at ₹1,56,780 per hectare in Panchkula and ₹1,67,510 per hectare in Yamunanagar. Net returns were also higher in Yamunanagar (₹33,500 per hectare) compared to Panchkula (₹30,970 per hectare).

The Benefit-Cost (B:C) ratio was found to be 1:1.24 in both districts, indicating that paddy cultivation was economically viable in the selected areas of the Shivalik foothills.

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	6	11631	9.2	6	11731	8.8	6.0	11681	9.0
2	Pre-sowing Irrigation		1025	0.8		1020	0.8		1023	0.8
3	Sowing		8775	7.0		8788	6.6		8781	6.8
4	Ridging		528	0.4		577	0.4		552	0.4
5	Seed (qtl.)	8.3	3631	2.9	8.4	3541	2.6	8.4	3586	2.8
6	Seed Treatment									
7	FYM (qtl)	28.1	1125	0.9	29.7	1188	0.9	28.9	1156	0.9
8	Fertilizer nutrients									
9	(a)Nitrogen	160.2	2089	1.7	161.5	2106	1.6	160.9	2097	1.6
10	(b)Phosphatic	55.38	2968	2.4	55.4	2968	2.2	55.4	2968	2.3
11	(c) Potassic	38.1	2158	1.7	41.0	2324	1.7	39.5	2241	1.7
12	(d)Zinc Sulphate	10.3	1025	0.8	10.3	1025	0.8	10.3	1025	0.8
13	Total Ferti.Invest		8240	6.5		8422	6.3		8331	6.4
14	Fertilizer Application		657	0.5		653	0.5		655	0.5
15	Irrigation	11.5	8863	7.0	11.0	8794	6.6	11.3	8828	6.8
16	Hoeing /Weeding									
17	(a) Chemical		1581	1.3		1645	1.2		1613	1.2
18	(b) manual			0.0			0.0			0.0
19	Plant Protection		7522	6.0		7516	5.6		7519	5.8
20	Harvesting		4534	3.6		4544	3.4		4539	3.5
21	Threshing/ winnowing/Tying									
22	Miscellaneous		517	0.4		586	0.4		552	0.4
23	Total (1to 15)		58630	46.6		59003	44.0		58816	45.3
24	Interest on working Capital		2052	1.6		2065	1.5		2059	1.6
25	Variable cost		60682	48.2		61068	45.6		60875	46.9
26	Management charges		6068	4.8		6107	4.6		6087	4.7
27	Risk factor		2048	1.6		2048	1.5		2048	1.6
28	Transportation		1700	1.4		1850	1.4		1775	1.4
29	Rental value of land		55313	44.0		62938	47.0		59125	45.5
30	Total Cost		125810	100.0		134010	100.0		129910	100.0
31	Production(qtl.)									
32	(a) Main	66.5	154280		71.1	165010		68.8	159645	
33	(b)By Product		2500			2500			2500	
34	Gross return		156780			167510			162145	

35	Return over variable cost		96098			106442			101270	
36	Net return		30970			33500			32235	
37	Cost of Production/(qtl.)									
38	(a)Without by Product		4733			4715			4724	
39	(b)With by Product		4851			4688			4770	
40	B:C Ratio		1:1.24			1:1.24			1:1.24	
41	Number of farmers	40			40			80	40	
42	Area(acre)	240.5			293			534	240.5	
43	Labour	98.8			101.1			99.9		
44	(a) Human Days									
45	(b) Bullock days									
46	(c) Tractor hours		19.00			19.7			19.3	

Table 2: Resource use pattern in Paddy in Panchkula and Yamunanagar district, during 2024 (per hectare)

	Panchkula	Yamunanagar	Overall average
Preparatory tillage (No.)	6.0	6.0	6.0
Seed (qtls)	8.3	8.4	8.4
Fertilizer nutrients (Kg)			
(a)Nitrogen	160.2	161.5	160.9
(b)Phosphatic	55.38	55.4	55.4
(c) Potassic	38.1	41.0	39.5
(d)Zinc Sulphate	10.3	10.3	10.3
FYM (qt)	28.1	29.7	28.9
Irrigation (No.)	11.5	11.0	11.3

Resource Use Pattern

The pattern of input use and adoption of cultural practices in paddy cultivation in Panchkula and Yamunanagar districts is presented in Table 2.

In Northern Haryana, field preparation for paddy cultivation generally begins in the month of May. On average, about 6.0 preparatory tillage operations were carried out per hectare in both Panchkula and Yamunanagar districts to ensure proper land preparation. The fields were mainly prepared using tractors and other farm machinery.

The average seed rate used was 8.3 kg per hectare in Panchkula district, while it was slightly higher at 8.4 kg per hectare in Yamunanagar district. Regarding organic manure application, the quantity of farmyard manure (FYM) applied was 28.1 quintals per hectare in Panchkula and 29.7 quintals per hectare in Yamunanagar district.

In terms of chemical fertilizers, the average nitrogen application was 160.2 kg per hectare in Panchkula and 161.5 kg per hectare in Yamunanagar district. Phosphatic fertilizer use was recorded at 55.38 kg per hectare in Panchkula and 55.4 kg per hectare in Yamunanagar. Potassic fertilizer application was 38.1 kg per hectare in Panchkula and comparatively higher at 41.0 kg per hectare in Yamunanagar district. Zinc sulphate was applied at an average rate of 10.3 kg per hectare in both districts.

Irrigation is a crucial component of paddy cultivation in the region. On average, 11.5 irrigations were provided per hectare in Panchkula district, while 11.0 irrigations were given in Yamunanagar district by the sampled farmers. These input-use patterns reflect the intensive cultivation practices followed in the selected districts.

Conclusion

It may be concluded that paddy cultivation in the Shivalik foothills of the selected districts is economically feasible. The gross returns from paddy cultivation were estimated at ₹1,56,780 per hectare in Panchkula district and ₹1,67,510 per hectare in Yamunanagar district. The total cost of cultivation was ₹1,25,810 per hectare in Panchkula and ₹1,34,010 per hectare in Yamunanagar. Consequently, the net returns were

₹30,970 per hectare in Panchkula and ₹33,500 per hectare in Yamunanagar district. The per hectare return over variable cost was calculated at ₹96,098 in Panchkula and ₹1,06,442 in Yamunanagar district. The corresponding net returns from paddy cultivation were ₹30,970 and ₹33,500 per hectare, respectively. Among the various components of variable cost in Panchkula district, preparatory tillage (9.2 percent), irrigation (7.0 percent), fertilizers (6.5 percent), harvesting (3.6 percent), and seed (2.9 percent) accounted for the major share of total expenditure. In Yamunanagar district, the respective shares were 8.8 percent for preparatory tillage, 6.6 percent for irrigation, 6.3 percent for fertilizers, 3.4 percent for harvesting, and 2.6 percent for seed. With regard to fixed costs, the rental value of land constituted the largest proportion, accounting for 44.0 percent of the total cost in Panchkula and 47.0 percent in Yamunanagar district. The Benefit-Cost (B:C) ratio was found to be 1:1.24 in both districts. Since the B:C ratio is greater than one, it indicates that paddy cultivation in the Shivalik foothill region of Haryana is economically viable and profitable under the existing conditions.

Competing Interest

Authors have declared that no competing interests exist.

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