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A Economic Viability and Resource Use Efficiency of Paddy Cultivation in Buxar Block, Bihar, India

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Abstract

This study examines the economic viability of paddy cultivation across different farm sizes in Buxar Block, Buxar District, Bihar, India. Using primary data collected from 45 farmers categorized into three groups based on land holdings (below 1 ha, 1-2 ha, and 2+ ha), the research analyzes cost structures, returns, and profitability patterns for the agricultural year 2024-25. A three-stage stratified random sampling technique was employed to select farmers from three villages: Majharia, Sonbarsa, and Dalsagar. The study reveals that average paddy yield was 53 quintals per hectare, with gross income averaging ₹131,300 per hectare. Cost of cultivation averaged ₹45,058 per hectare across all farm categories. Net income showed significant variation across farm sizes, ranging from ₹40,967 per hectare for marginal farms to ₹128,082 per hectare for large farms. The overall output- input ratios were 3.61, 3.02, and 2.89 for Cost A, Cost B, and Cost C respectively, indicating profitable cultivation across all farm categories. The study demonstrates that paddy cultivation is economically viable in the region, with larger farms showing higher absolute profits due to economies of scale.

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Paddy cultivation, economic analysis, farm profitability, Bihar agriculture, cost-benefit analysis

Introduction

Paddy (*Oryza sativa*) belonging to the Gramineae family represents one of the most crucial food crops globally and holds paramount importance in India's agricultural economy. Rice was first domesticated in the Yangtze River basin in China 9,000 years ago, and through cultivation, migration, and trade, it spread worldwide, establishing itself as the staple food for over 60% of the global population (Abirami, *et al.*, 2004).

India occupies a unique position in global rice production, holding the largest area under paddy cultivation worldwide while ranking second in production after China. The country has emerged as both a major rice producer and consumer, with rice providing 32-39% of

dietary energy and 25-44% of dietary protein to the population. At the national level, rice supplies 31% of calories, making it indispensable for food security.

According to recent statistics, India cultivates paddy on 43.95 million hectares with an annual production of 119.93 million tons during the 2024-25 Kharif season. Bihar, as one of India's major rice-producing states, contributes significantly to national production with 3.3 million hectares under cultivation, accounting for 60% of the state's net cropped area. The total rice production in Bihar is approximately 8.09 million tons with a productivity of 2,447 kg/ha.

In Buxar district, paddy occupies 109,392 hectares with production of 304,437,936 quintals, achieving

productivity of 27.83 quintals per hectare. Despite substantial area and production, paddy farmers in the region face challenges in obtaining remunerative prices for their produce, leading to various economic difficulties and market-related problems.

The present study focuses on Buxar Block in Buxar District, which represents a significant paddy-producing area in southwestern Bihar. Agriculture and allied activities occupy an important place in the district's economy, with 54.6% of the labor force engaged in agricultural activities according to the 2011 census. This research aims to provide comprehensive insights into the economic aspects of paddy cultivation in the region.

Extensive research has been conducted on the economics of paddy cultivation across various regions of India, providing valuable insights into production costs, returns, and efficiency parameters.

Krishna et al. (2004) analyzed rice production data from 120 farmers in Ballia district, Uttar Pradesh, revealing an average input-output ratio of 1:1.67 in rice production. The study found that input-output ratios were highest on medium farms (1:1.72), followed by small farms (1:1.68) and large farms (1:1.62).

Suresh (2006) conducted a comprehensive study in the Peach command area of Thrissur district, Kerala, examining resource productivity and allocative efficiency in paddy production. The research utilized primary data from 71 rice farmers and found the cost of cultivation to be ₹21,603 per hectare. The study identified chemical fertilizers, farmyard manure, and human labor as having significant positive impacts on production, with average technical efficiency of paddy farmers at 66.8%.

Bhakar et al. (2007) examined factor productivity and economic profitability of rice cultivation in Chhattisgarh using data from 68 rice growers for 2002-03. Their findings suggested the need for readjusting the proportion of various factors of production to realize higher returns, noting that rice was comparatively more profitable for medium and large farms compared to small farms.

Kumar et al. (2008) studied socio-economic attributes of paddy growers in Sitamarhi district, Bihar, surveying 210 farmers. The study revealed that 64.29% of respondent paddy growers were in the middle age group (36-50 years), with 33.81% educated up to secondary school

level. High labor wages emerged as a major constraint faced by 76.67% of respondent paddy growers.

Singh et al. (2010) investigated adoption of rice production technology in Jabalpur district, Madhya Pradesh, finding that 44% of respondents were medium-level adopters. The study identified non-availability of high-yielding varieties, high labor costs, lack of conviction in new technology, and weak extension activities as major constraints.

Prakash and Singh (2013) conducted an economic analysis of rice production in Jhansi district, Uttar Pradesh, covering five villages and 100 farmers. Their research showed overall input-output ratios of 1:3.37, 1:2.56, 1:1.77, 1:1.96, and 1:1.46 for different cost categories, with financial problems (44%) and technical problems (40%) being major constraints.

Research Methodology

Study Area

Buxar district, located in southwestern Bihar, was selected for this study due to its significant contribution to paddy production in the region. The district covers an area of 1,624 km² with a population of 1,706,352 according to the 2011 census. The district is bounded by Ballia district of Uttar Pradesh to the north, Rohtas to the south, Ghazipur to the west, and Bhojpur to the east.

Buxar Block, the specific study area, has a population of 291,189 with 132 villages and 16 panchayats spread across 174 km². The block is characterized by fertile alluvial soil, primarily deposited by the Ganga and Sone rivers, making it suitable for paddy cultivation.

Sampling Design

A three-stage stratified random sampling technique was employed for the study:

Stage 1 - Selection of Block: Buxar Block was purposively selected due to its importance in paddy cultivation and proximity to major food grain markets.

Stage 2 - Selection of Villages: From 132 villages in the block, three villages were randomly selected: Majharia, Sonbarsa, and Dalsagar.

Stage 3 - Selection of Farmers: Cultivators from each village were listed in ascending order of their cultivated area and classified into three size groups:

- Group 1: Below 1 hectare (marginal farms)
- Group 2: 1-2 hectares (small farms)
- Group 3: 2+ hectares (large farms)

Five farmers were selected from each size group in each village, totaling 45 farmers (15 from each size group).

Data Collection

Primary data was collected through personal interviews using pre-structured and pre-tested schedules for the agricultural year 2024-25. Secondary data was obtained from the Agriculture Department, block headquarters, journals, reports, and other published sources.

Analytical Framework

The study employed various cost concepts for economic analysis:

Cost A: Variable input costs excluding family labor + interest on working capital

Cost B: Cost A + interest on fixed capital + rental value of owned land

Cost C: Cost B + family labor cost Returns were calculated as:

Gross Return (GR): Market value of main and by-products

Net Income: Gross Return - Cost C

Family Labor Income: Gross Return - Cost B

Farm Business Income: Gross Return - Cost A

Results and Discussion

Farm Structure and Characteristics

The analysis of farm family composition revealed that the average family size across all categories was 7.0 members, with marginal farms having 6.5 members, small farms 7.3 members, and large farms 6.9 members. The gender distribution was approximately equal across all farm categories, with a 50:50 male-female ratio.

Land Holdings and Cropping Pattern

The average size of holding across sample farms was 1.70 hectares, with marginal farms averaging 0.49 hectares, small farms 1.21 hectares, and large farms 3.40 hectares. All cultivated area received irrigation, primarily through tube wells, ensuring 100% irrigation coverage.

Table.1 Farm Family Composition of Sample Farmers

Size Group	Number of Farmers	Male	Female	Family Size
Below 1 Ha	15	3.7	2.8	6.5
1-2 Ha	15	3.4	3.6	7.0
2+ Ha	15	4.4	2.9	7.3
Total	45	3.8	3.1	6.9

Literacy levels showed a positive correlation with farm size, with 76.82% literacy on marginal farms, 79.44% on small farms, and 83.59% on large farms, averaging 79.95% across all categories.

Table.2 Size of Holdings and Irrigation

Size Group	Holdings	Net Cultivated Area (ha)	Irrigated Area (ha)	% Irrigat
Below 1 Ha	15	0.49	0.49	100
1-2 Ha	15	1.21	1.21	100
2+ Ha	15	3.40	3.40	100
Average	45	1.70	1.70	100

The cropping pattern was uniform across all farm categories, with paddy-wheat rotation being the predominant system. The cropping intensity was consistently 200% across all farm sizes, indicating double cropping on all cultivated land.

Cost Structure Analysis

The detailed analysis of input costs revealed significant variations in cost components across farm sizes. The overall average cost of paddy cultivation was ₹45,058 per hectare, with marginal differences between farm categories.

Yield and Income Analysis

Paddy yields showed substantial variation across farm sizes, with larger farms achieving significantly higher productivity. The average yield was 53 quintals per hectare, ranging from 35 quintals on marginal farms to 70 quintals on large farms.

Profitability Analysis

The profitability analysis across different cost concepts revealed positive returns for all farm categories, with higher absolute profits for larger farms due to superior yields and economies of scale.

Input-Output Efficiency

The input-output ratios demonstrated the economic efficiency of paddy cultivation across different cost concepts and farm sizes.

Table.3 Per Hectare Input Cost Structure for Paddy (₹/ha)

Cost Component	Below 1ha	1-2ha	2+ ha	Average
Hired Human Labor	19,650	21,355	22,365	20,790
Machinery	4,949	4,724	4,799	4,790
Seed/Plants	1,150	980	824	984
Fertilizer	7,456	6,690	6,850	6,965
Irrigation	290	200	140	210
Interest on Working Capital	1,608	1,965	2,100	2,024
Cost A	35,103	35,914	37,078	35,763
Rental Value of Land	7,000	7,000	7,000	7,000
Interest on Fixed Capital	140	140	140	140
Cost B	42,233	43,054	44,218	42,903
Family Human Labor	3,400	1,865	1,200	2,155
Cost C	45,633	44,919	45,418	45,058

Hired human labor constituted the largest cost component, accounting for 46.1% of total costs on average. This was followed by machinery costs (10.6%), fertilizers (15.5%), and seeds (2.2%). The analysis revealed that labor costs increased with farm size, while seed costs per hectare decreased due to better procurement and economies of scale.

Table.4 Yield and Gross Income Analysis

Size Group	Grain Yield (q/ha)	Straw Yield (q/ha)	Value of Main Product (₹)	Value of By-product (₹)	Gross Income (₹/ha)
Below 1 ha	35	32	77,000	9,600	86,600
1-2 ha	54	50	118,800	15,000	133,800
2+ ha	70	65	154,000	19,500	173,500
Average	53	49	116,600	14,700	131,300

Note: Main product valued at ₹2,200/quintal, by-product at ₹300/quintal

The gross income per hectare varied significantly, from ₹86,600 on marginal farms to ₹173,500 on large farms, with an overall average of ₹131,300 per hectare.

Table.5 Returns Over Different Cost Categories (₹/ha)

Particulars	Below 1ha	1-2 ha	2+ ha	Average
Gross Return	86,600	133,800	173,500	131,300
Cost A	35,103	35,914	37,078	36,031
Cost B	42,233	43,054	44,218	43,168
Cost C	45,633	44,919	45,418	45,323
Return Over Cost C (Net Income)	40,967	88,881	128,082	85,977
Return Over Cost B (Family Labor Income)	44,367	90,746	129,282	88,132
Return Over Cost A (Farm Business)	51,497	97,886	136,422	95,269

Net income ranged from ₹40,967 on marginal farms to ₹128,082 on large farms, averaging ₹85,977 per hectare. Family labor income and farm business income followed similar patterns, indicating consistent profitability across all farm sizes.

Table.6 Input-Output Ratios

Cost Category	Below 1 ha	1-2 ha	2+ ha	Average
Ratio Over Cost A	2.46	3.72	4.67	3.61
Ratio Over Cost B	2.05	3.10	3.92	3.02
Ratio Over Cost C	1.89	2.97	3.82	2.89

The ratios consistently showed higher efficiency for larger farms, with the overall average ratios of 3.61, 3.02, and 2.89 for Cost A, Cost B, and Cost C respectively, indicating profitable cultivation across all categories.

The study reveals several important insights into the economics of paddy cultivation in Buxar Block. The significant variation in yields across farm sizes (35-70 q/ha) suggests that scale economies and better resource management on larger farms contribute to higher productivity. This finding aligns with Bhakar et al. (2007) who noted that rice was more profitable for medium and large farms.

The dominance of labor costs (46.1% of total costs) reflects the labor-intensive nature of paddy cultivation in the region. This finding is consistent with Kumar et al. (2008) who identified high labor wages as a major constraint for paddy growers in Bihar. The uniform irrigation coverage (100%) across all farm categories indicates well-developed water infrastructure, which is crucial for consistent paddy production.

The positive input-output ratios across all farm sizes demonstrate the economic viability of paddy cultivation in the region. However, the substantial difference in net income between marginal farms (₹40,967/ha) and large farms (₹128,082/ha) highlights the income disparity challenges faced by small-scale farmers.

The study's findings on cost structure are comparable to national patterns, where labor constitutes the major cost component in rice production. The average productivity of 53 q/ha in the study area is higher than Bihar's state average of 24.47 q/ha, indicating the favorable agro-climatic conditions and better management practices in the region.

Conclusion

The economic analysis of paddy cultivation in Buxar Block demonstrates that rice production is economically viable across all farm sizes, with larger farms showing superior economic performance due to higher yields and economies of scale. The study reveals an average net income of ₹85,977 per hectare, with input-output ratios indicating profitable cultivation.

Key findings include:

- Average paddy yield of 53 q/ha with significant variation across farm sizes
- Total cultivation cost averaging ₹45,058 per hectare
- Labor costs constitute the largest expense component (46.1%)

- Positive profitability across all farm categories with higher returns on larger farms
- Input-output ratios of 2.89 to 3.61 indicating economic efficiency

Recommendations

Based on the study findings, the following recommendations are proposed:

1. **Technology Adoption:** Development and promotion of high-yielding varieties with early maturity suited to local conditions
2. **Extension Services:** Large-scale demonstrations should be undertaken to convince farmers about improved technologies
3. **Input Management:** Adequate supply of fertilizers and modern inputs at reasonable prices
4. **Mechanization:** Encouragement of appropriate mechanization to reduce labor dependency
5. **Training Programs:** Comprehensive extension training for field workers to transfer existing production technology.

The study contributes valuable insights into the economic dynamics of paddy cultivation in Bihar and provides a foundation for policy interventions aimed at enhancing farmer profitability and sustainable rice production in the region.

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