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Economics of potato cultivation in Hooghly district, West Bengal

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Abstract

This study was conducted in the Dhaniakhali block of Hooghly district in West Bengal to examine the economics of potato cultivation. A survey of 40 farmers was conducted in the year 2018-19. Data were analyzed using conventional cost (Cost A1, A2, B and C) and economic parameters (gross return, net return and benefit-cost ratio). The findings showed that the average yield of potato was 31.78 t ha⁻¹, which was very high as it was cultivated intensively. The cost of seed was the highest (37.27%) followed by labour and fertilizers. Chandramukhi variety was found to be the most profitable in terms of gross return, net return and benefit-cost ratio (1.49). The study revealed that potato was more beneficial than other crops (mustard and wheat). But the incidence of diseases, cost of production and market price variability was reported. The study suggests potato production is a profitable crop in the study region, but it needs better management and market intervention for its sustainability.

Keywords: benefit-cost ratio, cost of cultivation, cropping intensity, smallholder farmers, *Solanum tuberosum*

1. Introduction

Potato (*Solanum tuberosum* L.) is a major food crop, fourth in production and consumption, after rice, wheat and maize (Ahmadu *et al.*, 2021) [3]. With its high productivity, short growing period and adaptability, it is a key crop for food and nutritional security, especially in developing nations (Devaux *et al.*, 2014) [6]. Potato is also well known as a staple and cash crop having high nutritional value, with carbohydrates, vitamins and minerals, also adds to its significance in human nutrition. Worldwide potato cultivation has grown, with a focus on its contribution to sustainable food security and climate-smart production.

With a growth in acreage, production, and productivity, India is now the world's second-largest producer of potatoes (Das *et al.*, 2025) [7]. The most recent statistics reveal the importance of India in the world potato production and its productivity is improving with the use of technology and varieties (Singh *et al.*, 2022) [20]. West Bengal, being one of the largest potato-producing states, contributes to the total potato production in India (Das *et al.*, 2025) [7]. Hooghly is the potato belt of the state due to its fertile alluvial soil and favorable agroclimatic conditions. The Dhaniakhali block is now an intensive potato-growing zone, and the potato is an important crop in the rabi cropping system and economy of the region.

Potato production is capital-intensive and risky, the cost of seed alone accounts for a large part of the cost of cultivation making this a capital-intensive crop (Almekinders *et al.*, 2009) [1]. Additionally, farmers must deal with risks related to production and marketing, such as pests and diseases (particularly late blight), price fluctuations, inadequate institutional support, and lack of storage (Belay *et al.*, 2021) [4]. The profitability and management of potato-based systems, as well as post-harvest losses, have been found to be significantly impacted by growing input prices and price uncertainties in recent years (Haverkort *et al.*, 2023) [10]. The primary barrier to completely reaping the benefits is still a lack of marketing infrastructure (Supriatna *et al.*, 2026) [21].

Several studies have been conducted to investigate the economic aspects of potato production in different parts of India, but they are either aggregate or regional. The absence of micro economic studies for intensively cultivated regions like Dhaniakhali block of Hooghly district need to be

filled in. Such region-specific studies are critical in a dynamic environment where rates of input use, variety preferences and market realities are continuously changing, to determine the profitability and sustainability of potato cultivation (Mishra *et al.*, 2026) ^[15].

In this regard, this study attempts to assess the economics of potato cultivation in Dhaniakhali block of Hooghly district, West Bengal. In particular, the study aims to assess land use and cropping intensity, cost of cultivation under different cost concepts, returns and profitability of potato cultivation for major varieties and economic comparison with other competing crops. The results will offer empirical evidence for supporting farm-level decision-making and policymaking.

2. Materials and Methods

2.1 Study area

The study was carried out in Dhaniakhali block of Hooghly district in West Bengal, India. The block was purposively chosen for the study because it is one of the largest potato-growing areas in the state (Bhattacharyya *et al.*, 2014) ^[5]. The area has fertile alluvial soils, suitable agroclimatic conditions and relatively good irrigation network, facilitating intensive farming. Potato cultivation is very popular in the rabi season and forms an integral part of the cropping system, making this region appropriate for the study of the economics of potato production (Patel *et al.*, 2025) ^[16].

2.2 Sampling procedure and respondents

Multistage sampling design was used to select the respondents. In the first stage, the block of Dhaniakhali was purposively identified based on the extent of potato cultivation. In the second stage, villages from the block were selected based on the area under potato cultivation. In the third stage, 40 potato cultivators were selected using Simple Random Sampling Without Replacement (SRSWOR) to get a representation of potato growers. The farmers were sub-classified into marginal, small and semi-medium groups according to the size of land they were operating to facilitate comparative study between the farm size categories.

2.3 Data collection

Primary data were collected for the crop year 2018-19. Data were collected via face-to-face interviews with a pre-tested and structured schedule to obtain information on socio-economic profile, pattern of land use, intensity of cropping, input use, cost structure, yield and return on potato farming. To ensure the quality and accuracy of the data, revisits to the respondents were made for verification. Data from secondary sources such as government publications, reports and other reliable sources were gathered to support primary data.

2.4 Analytical framework

The economics of potato farming was analyzed using the standard cost concepts used in farm management (Zangeneh *et al.*, 2010) ^[24]. Cost A1 comprised all cash expenses for the human labour, seed, fertilizers, plant protection products, machinery, irrigation and miscellaneous items. Cost A2 was calculated by including the rent paid for leased-in land to Cost A1. Cost B was obtained by adding the imputed rent of owned land (i.e. opportunity cost of land) to Cost A2. Finally, Cost C was obtained by adding the imputed value of family labour to Cost B, thus representing the total cost of cultivation. To ensure clarity and reproducibility, the cost concepts used in the study are expressed mathematically as follows:

$$\text{Cost A1} = \sum (C_{\text{labour}} + C_{\text{seed}} + C_{\text{fertilizer}} + C_{\text{plant protection}} + C_{\text{machinery}} + C_{\text{irrigation}} + C_{\text{misc}})$$

$$\text{Cost A2} = \text{Cost A1} + C_{\text{leased land}}$$

$$\text{Cost B} = \text{Cost A2} + R_{\text{owned land}}$$

$$\text{Cost C} = \text{Cost B} + C_{\text{family labour}}$$

2.5 Economic indicators

Gross return was estimated by multiplying the total output with the market price received by farmers. Net return was calculated by subtracting the different level of cost from the gross return. The benefit-cost ratio (BCR) was calculated as the gross return per total cost, which was an indicator of economic efficiency and profitability. The higher the BCR, the more profitable was the potato farming (Lepcha *et al.*, 2021) ^[13]. The economic performance of potato cultivation was evaluated using the indicators:

$$\text{Gross return (GR)} = Y \times P$$

$$\text{Net Return (NR)} = \text{GR} - \text{TC}$$

$$\text{Benefit-Cost Ratio (BCR)} = \frac{\text{GR}}{\text{TC}}$$

Where 'Y' is yield (ton hectare⁻¹), 'P' is price (₹ ton⁻¹), and TC is total cost at different cost levels (A1, A2, B, C).

2.6 Cropping intensity and comparative analysis

Cropping intensity was determined to evaluate the land use practice in the region. This represented the percentage of gross cropped area to net sown area. Further, an economic comparison of potato production with its substitutes (mustard and wheat) grown in similar production environments was conducted to assess the economic advantage of potato (Holka *et al.*, 2025) ^[11]. This helped to understand the comparative advantage of potato.

$$\text{Cropping intensity (\%)} = \left(\frac{\text{Gross cropped area}}{\text{Net sown area}} \right) \times 100$$

2.7 Data analysis

Data were tabulated and analyzed by using R (Version 4.5.1; R Core Team, 2025) tools like average, percentage and ratio for meaningful interpretation. The findings were systematically tabulated to compare across different farm types and potato varieties. This method allowed a detailed assessment of the cost, return and profitability of potato cultivation in the region.

3. Results

3.1 Farm size and cropping pattern

Most farmers in this study were marginal (72.5%), small (17.5%), and semi-medium (10%). Potato holds a large share of land that was planted during the rabi season, which means it was the most common crop. The average cropping intensity of marginal farmers was 276%, with 290% for marginal farmers, 271% for small farmers, and 259% for semi-medium farmers demonstrating effective land use (Table 1, Table 2).

Table 1: Classification of sample farmers based on operational holding

Category	Operational holding (ha)	Number of farmers	Percentage (%)
Marginal	< 1.0	29	72.5
Small	1 - 2	7	17.5
Semi-medium	2 - 4	4	10
Total	-	40	100

Table 2: Cropping intensity across farm categories

Category	Gross cropped area (ha)	Net sown area (ha)	Cropping intensity (%)
Marginal	43.91	15.13	290
Small	26.74	9.87	271
Semi-medium	26.21	10.13	259
Overall	96.85	35.13	276

3.2 Variety and input use distribution

The potato varieties Chandramukhi and Jyoti made up 46.07% and 44.73% of the total area, respectively. The level of input use was similar for all varieties, with intensive crop production reflected in the high labour and fertilizer use. The average yield was 31.78-ton hectare⁻¹, and Chandramukhi performing a little better (Table 3, Table 4).

Table 3: Distribution of potato varieties among farmers.

Variety	No. of farmers (%)	Area (ha)	Area share (%)
Jyoti	30 (75)	11.33	44.73
Chandramukhi	37 (92.5)	11.67	46.07
Others	6 (15)	2.33	9.2
Total	40 (100)	25.33	100

Table 4: Resource utilization and yield of potato (per hectare)

Parameter	Jyoti	Chandramukhi	Others	Overall
Seed (t/ha)	1.23	1.21	1.18	1.22
Manure (kg/ha)	370.70	377.03	373.39	373.86
Nitrogen (kg/ha)	230.27	235.65	233.9	233.08
Phosphorus (kg/ha)	195.06	197.09	195.28	196.01
Potassium (kg/ha)	195.06	197.09	195.28	196.01
Fungicide (kg/ha)	15.00	15.42	14.16	15.12
Insecticide (kg/ha)	1.87	1.88	1.87	1.87
Labour (man-days)	218.89	219.36	223.17	219.5
Tractor (hrs)	6.87	6.93	6.87	6.89
Irrigation (hrs)	112.09	113.54	111.59	112.71
Yield (t/ha)	31.68	31.85	31.87	31.78

3.3 Cost of cultivation

Potato production was found to be intensive in terms of inputs, with an average Cost A1 of ₹156,437 ha⁻¹. Seed was the major component (37.27%) followed by labour (23.97%) and fertilizers (16.46%). The total cost (Cost C) was ₹252,336 ha⁻¹, showing high investment in production (Table 5, Table 6).

Table 5: Cost of cultivation of potato under different cost concepts (₹/ha)

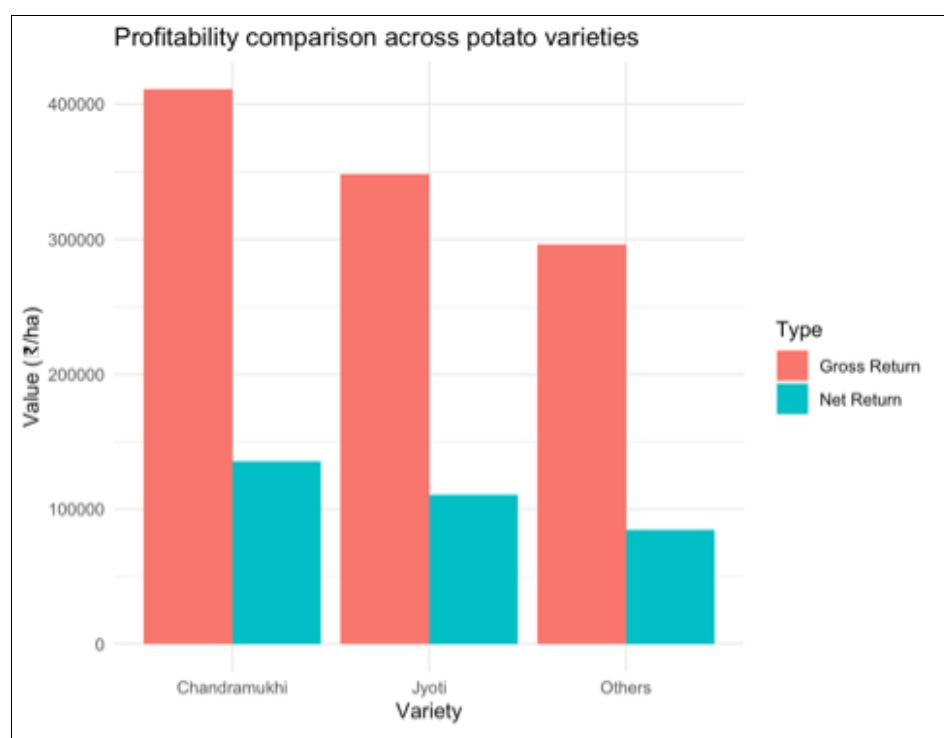
Variety	Cost A1	Cost A2	Cost B	Cost C
Jyoti	147,393.85	148,453	235,445.5	237,034.2
Chandramukhi	169,010.08	170,552.25	273,294.32	275,350.88
Others	137,437.27	137,437.27	211,471.6	211,471.6
Overall	156,437	157,621.37	250,678.02	252,336.13

Table 6: Cost structure of potato cultivation (Cost A1 basis)

Component	Cost (₹/ha)	Share (%)
Seed	58,310.30	37.27
Manure	7,295.70	4.66
Fertilizer	25,744.18	16.46
Plant Protection Chemicals (PPC)	5,061.19	3.23
Labour	37,504.93	23.97
Tractor/Machinery	5,979.08	3.82
Irrigation	11,251.48	7.19
Interest on Working Capital	5,290.14	3.38
Total (Cost A1)	156,437.00	100

3.4 Returns and profitability

Total return was ₹372,227 ha⁻¹ with Chandramukhi having the highest (₹410,968 ha⁻¹). The net return Cost C was ₹119,890 ha⁻¹, and Chandramukhi had the highest net return at ₹135,617 ha⁻¹. The overall benefit-cost ratio was 1.47, which means that it was likely to make money. The return and profitability across varieties are presented in Table 7, while the comparative performance and cost-return relationship are illustrated in Fig. 1 and Fig 2, respectively.

**Fig 1:** Profitability comparison of potato varieties in terms of gross return and net return in Dhaniakhali block of Hooghly district.

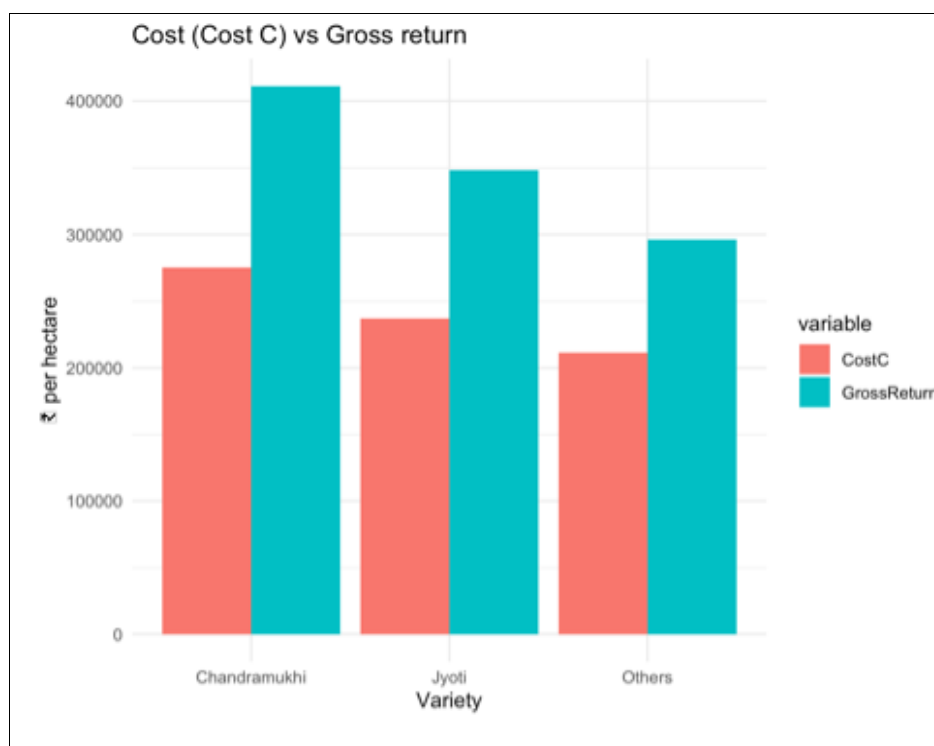


Fig 2: Comparison between cost of cultivation (Cost C) and gross return (₹/ ha) across potato varieties where the study was conducted.

Table 7: Return and profitability of potato cultivation (₹/ha)

Variety	Gross return	Cost C	Net return	BCR
Jyoti	347,970	237,034	110,936	1.46
Chandramukhi	410,968	275,351	135,617	1.49
Others	296,137	211,472	84,666	1.4
Overall	372,227	252,336	119,890	1.47

3.5 Profitability across cost concepts

The return-cost ratio fell from 2.38 at Cost A1 to 1.47 at Cost C due to imputed costs. But the ratio was greater than one throughout the range of cost estimates, indicating profitability.

3.6 Profitability vis-à-vis other crops

Potato cultivation was more profitable than mustard and wheat. At Cost C, the benefit-cost ratio of potato was 1.47, while that of mustard was 1.01 and wheat was 1.02, showing it was more profitable than mustard and wheat.

Table 8: Comparative profitability of potato and competing crops

Crop	BCR (Cost A1)	BCR (Cost A2)	BCR (Cost B)	BCR (Cost C)
Potato	2.38	2.36	1.48	1.47
Mustard	1.42	1.42	1.05	1.01
Wheat	1.36	1.36	1.02	1.02

3.7 Constraints in potato cultivation

Disease prevalence, high cost of cultivation, lack of irrigation and market problems (fluctuating price and lack of storage) were reported as the key constraints that affect potato profitability.

4. Discussion

The present study reveals the importance of potato farming to the economy of Dhaniakhali block, which is mainly cropped by smallholder farmers. The observed cropping intensity, particularly among smallholders, signifies intensive land utilization and dependance on potato as a cash crop. This is in line with other smallholder farming systems, where farmers

grow more crops to use the land more effectively and increase productivity (Touch *et al.*, 2024) ^[23].

The fact that Chandramukhi and Jyoti varieties are so common shows that yield and the market have a big effect on which variety people choose (Gupta *et al.*, 2015) ^[19]. Chandramukhi is the most profitable of these kinds, demonstrating the significance of variety selection for farming success (Karmakar *et al.*, 2024) ^[12]. While yield variance reveals that varieties differ in their attributes, the input consumption pattern across varieties suggests similar agronomic approaches (Diana *et al.*, 2025) ^[8].

From the cost analysis, potato farming is highly input-intensive with seed and labour as the major components. The high share of seed cost corroborates the findings of other studies and underlines the capital intensity of potato farming (Maulidiyah *et al.*, 2024) ^[14]. As the inclusion of imputed costs, such as land and family labour, reduces the profitability, farmers may be misguided by a higher profitability of potato farming if only cash costs are considered (Surjit *et al.*, 2017) ^[22].

Despite these costs potato cultivation remained profitable as the benefit-cost ratio was greater than one for all the costs. The higher profitability of Chandramukhi also proposes that appropriate varieties need to be used to increase profitability. Potato was more profitable than other crops (mustard and wheat) and it is a preferred crop in the region (Show *et al.*, 2018) ^[19].

But there are constraints on potato's profitability due to production and market factors. Disease outbreaks, especially late blight, and high prices for inputs and potato prices contribute to unstable income (Shimira *et al.*, 2020) ^[18]. Lack of storage infrastructure also leaves farmers with no choice but to market immediately after harvest at often reduced prices. These challenges suggest that while potato farming is lucrative, its long-term viability is dependent on better management of inputs, infrastructure and market (Aripong *et al.*, 2023) ^[2].

5. Conclusion

The varieties of potato vary in profitability, with Chandramukhi being the most profitable, showing the importance of variety

selection for farming profitability. The input use pattern across varieties indicates similar agronomic practices, but yield variation suggests that varieties vary in their properties. From the cost analysis, potato farming is highly input-intensive with seed and labour as the major components. The high share of seed cost corroborates the findings of other studies and underlines the capital intensity of potato farming. As the inclusion of imputed costs, such as land and family labour, reduces the profitability, farmers may be misguided by a higher profitability of potato farming if only cash costs are considered. Potato cultivation in Dhaniakhali, a block of Hooghly district is highly profitable and is a significant source of livelihood to the farmers, particularly the small farmers. In the current cropping system, potatoes were found to be a preferred crop since they are comparatively more profitable than other crops like wheat and mustard. Because of its high production and price, Chandramukhi was found to be the most profitable of the several potato cultivars. The cost analysis revealed that potato is a labour-intensive crop with seed and labour being major cost component. The imputed cost decreased profitability even if the benefit-cost ratio was positive for all cost levels, indicating the necessity for a thorough cost study. The report also highlighted the issues of illness, input costs, and storage shortages. These could be addressed by improving the region's potato output through market assistance, infrastructural development, and input.

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