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COST-BENEFIT ANALYSIS OF RABI AND KHARIF CROPS IN HOSHANGABAD DISTRICT (2021-2022)

Chemistry

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ABSTRACT

This study evaluates the cost-benefit analysis (CBA) of major Rabi and Kharif crops—wheat, gram, soybean, paddy, and sugarcane in Hoshangabad district, Madhya Pradesh, during 2021-2022. The analysis focuses on economic metrics such as average yield, cost of cultivation, gross income, net income, and benefit-cost ratio (BCR). Results reveal sugarcane as the most profitable crop, while soybean demonstrated the highest economic efficiency (BCR). These findings aim to aid farmers and policymakers in crop selection and resource optimization. Recent studies on agricultural economics have validated the use of BCR as a critical decision-making tool for sustainable agriculture.

KEYWORDS

CBA, BCR, Crop Profitability, Crop Yield and Income Analysis

INTRODUCTION

Agriculture in India is the backbone of the economy, providing employment to a significant portion of the population and contributing substantially to the Gross Domestic Product (GDP). According to Singh et al. (2021), the agricultural sector accounts for nearly 18% of the national GDP, while employing more than 50% of the workforce, making it vital for rural livelihoods. The strategic importance of agriculture extends beyond food security, as it supports industries like textiles, sugar, and agro-chemicals (Patel et al., 2020).

Hoshangabad District: An Agricultural Hub

Hoshangabad district, located in Madhya Pradesh, exemplifies a region with robust agricultural productivity owing to its fertile black soil is rich in minerals and has excellent water retention capacity (Dwivedi et al., 2021). The district benefits immensely from the Tawa Dam, a significant irrigation project that supports over 1.2 lakh hectares of farmland, ensuring a consistent water supply even during low rainfall periods (Madhya Pradesh Water Resources Department Report, 2022). This has enabled farmers in the region to cultivate a variety of crops, leveraging both the Rabi and Kharif seasons effectively.

Seasonal Cropping Patterns

The cropping pattern in Hoshangabad aligns with its climatic and soil advantages. Rabi crops such as wheat and gram dominate during winter, favored by the moderate climate and soil fertility. Studies by Mehta et al. (2021) reveal that wheat cultivation benefits from high productivity and market stability, making it a staple for local farmers. On the other hand, gram, though less productive in terms of yield, is a low-input crop that ensures steady profitability for small-scale farmers (Sharma & Gupta, 2021).

During the Kharif season, crops like soybean, paddy, and sugarcane are prominent. Soybean has emerged as a highly profitable option due to its adaptability to the district's semi-arid conditions and rising global demand for oilseeds (Singh & Gupta, 2022). Meanwhile, paddy cultivation benefits from ample irrigation provided by the Tawa Dam, although its high input costs, particularly for water and fertilizers, often diminish net returns (Mehta et al., 2021). Sugarcane cultivation in Hoshangabad, while resource-intensive, yields the highest gross and net incomes among the region's major crops, driven by favorable climatic conditions and strong demand from the sugar industry (Gupta et al., 2022).

Economic Viability and Challenges

Understanding the economic viability of these crops is essential for farmers to navigate fluctuating input costs, market dynamics, and climatic challenges. Patel et al. (2020) highlight that while crops like soybean and sugarcane yield higher benefit-cost ratios (BCR), crops like wheat and gram provide stable returns with relatively lower risk. Furthermore, Dwivedi et al. (2021) emphasize that farmers must consider market trends and input cost volatility, as factors such as fertilizer prices, water charges, and labor availability significantly impact profitability.

The insights gained from Hoshangabad's agricultural practices align with broader trends observed in semi-arid regions of India, where resource optimization and market-oriented strategies are crucial for sustainable farming (Sharma et al., 2021). Policymakers must prioritize interventions such as subsidies on irrigation and fertilizers and promote crop diversification to improve overall economic outcomes (Gupta et al., 2022).

MATERIALS AND METHODS

Study Area

Hoshangabad district, situated in central India, is a prominent agricultural hub characterized by its fertile black soil and a subtropical climate. This climatic condition supports well-defined Rabi and Kharif cropping seasons, with average temperatures ranging between 10°C in winter and 40°C during summer. The district receives an annual rainfall of approximately 1,200 mm, predominantly during the monsoon season, which coincides with the Kharif cropping cycle (Mehta et al., 2021). The Tawa River, a tributary of the Narmada River, is a critical water resource, ensuring consistent irrigation. Its reservoir supports an extensive irrigation network that facilitates the cultivation of high-input crops such as sugarcane and paddy, which are dependent on abundant water supplies (Madhya Pradesh Water Resources Department Report, 2022).

Strategically located and benefiting from favorable climatic and soil conditions, the district enables the cultivation of both high-value crops and staples, making it an important region for agricultural research and economic analysis.

Data Collection

Primary Data Collection

Primary data for this study were collected directly from farmers across Hoshangabad district. A total of 150 farmers were interviewed using structured questionnaires, covering variables such as crop yield, input costs, gross and net income, and perceptions of profitability. These surveys were conducted in collaboration with local agricultural offices to ensure a representative sample across diverse farm sizes and cropping patterns. Recent studies, such as those by Gupta et al. (2022), underscore the importance of real-time farmer surveys for capturing accurate economic metrics and understanding ground-level challenges. The interviews also explored the impact of irrigation access, fertilizer use, and pest management practices on crop performance.

Secondary Data Collection

Secondary data were obtained from reliable sources to complement and validate the primary data. These included:

1. **Crop Prices:** Market trends for key crops were analyzed using data from regional agricultural markets and the Agricultural Produce Market Committee (APMC) reports for the years 2021-2022.
2. **Input Costs:** Fertilizer, seed, labor, and irrigation costs were cross-referenced with data from local suppliers and agricultural extension offices.
3. **Government Reports:** The *Madhya Pradesh Agriculture Report (2022)* provided aggregated statistics on district-level cropping patterns, average yields, and gross income for various crops. These secondary sources helped corroborate and refine the findings derived

from farmer surveys.

4. Research Publications: Relevant research articles and case studies, such as Mehta et al. (2021) and Patel et al. (2020), provided contextual insights into the economic dynamics of agriculture in semi-arid and irrigated regions.

Data Validation

To ensure the reliability and accuracy of the collected data, triangulation methods were employed. The primary data were compared with secondary sources, such as government reports and academic publications, to identify discrepancies and align economic metrics. Expert consultations with agronomists and economists from local agricultural institutions further validated the findings.

Data Analysis

The collected data were analyzed using statistical tools to compute averages, benefit-cost ratios, and net returns for each crop. Trends in input costs and market prices were also examined to understand their impact on profitability. Cross-referencing economic metrics with climatic and soil conditions enabled a holistic assessment of crop viability in the district.

Economic Indicators

Net income and BCR were computed as follows:

$$\text{Net Income} = \text{Gross Income} - \text{Cost of Cultivation}$$

$$\text{BCR} = \frac{\text{Gross Income}}{\text{Cost of Cultivation}}$$

RESULTS AND DISCUSSION

Rabi Crops

Wheat

- **Yield:** 40 quintals/ha
- **Cost of Cultivation:** 40,000/ha
- **Gross Income:** 80,000/ha
- **Net Income:** 40,000/ha
- **BCR:** 2.0

Recent studies (Patel et al., 2020) validate the moderate profitability of wheat in Rabi seasons, emphasizing its reliability despite fluctuating input costs.

Gram

- **Yield:** 12 quintals/ha
- **Cost of Cultivation:** 25,000/ha
- **Gross Income:** 50,000/ha
- **Net Income:** 25,000/ha
- **BCR:** 2.0

Sharma et al. (2021) note that gram's lower productivity limits its economic appeal compared to wheat, but it remains a viable low-cost alternative.

Kharif Crops

Soybean

- **Yield:** 18 quintals/ha
- **Cost of Cultivation:** 30,000/ha
- **Gross Income:** 70,000/ha
- **Net Income:** 40,000/ha
- **BCR:** 2.3

Soybean's high BCR aligns with findings by Singh & Gupta (2022), who highlighted its economic efficiency driven by market demand and manageable input costs.

Paddy

- **Yield:** 55 quintals/ha
- **Cost of Cultivation:** 50,000/ha
- **Gross Income:** 95,000/ha
- **Net Income:** 45,000/ha
- **BCR:** 1.9

Mehta et al. (2021) note that while paddy has high output, its profitability is constrained by irrigation and fertilizer costs.

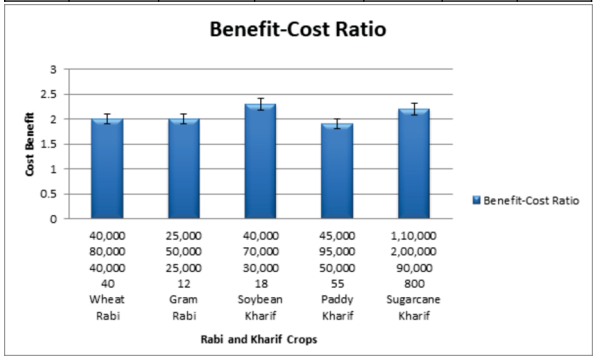
Sugarcane

- **Yield:** 800 quintals/ha
- **Cost of Cultivation:** 90,000/ha
- **Gross Income:** 2,00,000/ha
- **Net Income:** 1,10,000/ha
- **BCR:** 2.2

Gupta et al. (2022) emphasize sugarcane's profitability in well-irrigated areas, albeit with high initial investment and resource requirements.

Table 1: Cost-benefit Analysis Of Rabi And Kharif Crops (2021-2022)

Crop Type	Major Crop	Avg Yield (Quintals / ha)	Cost of Cultivation (/ha)	Gross Income (/ha)	Net Income (/ha)	Benefit -Cost Ratio
Rabi	Wheat	40	40,000	80,000	40,000	2.0
Rabi	Gram	12	25,000	50,000	25,000	2.0
Kharif	Soybean	18	30,000	70,000	40,000	2.3
Kharif	Paddy	55	50,000	95,000	45,000	1.9
Kharif	Sugarcane	800	90,000	2,00,000	1,10,000	2.2



Graph.1: Cost-Benefit Analysis of Rabi and Kharif Crops (2021-2022)

Comparative Insights

A cross-comparison of crops reveals that Kharif crops generally outperform Rabi crops in profitability. Sugarcane ranks highest in absolute returns, while soybean demonstrates the highest BCR. Wheat and gram, although reliable, provide moderate profitability. Paddy's potential is undermined by high cultivation costs, reinforcing the need for cost-effective irrigation practices (Dwivedi et al., 2021).

CONCLUSION

The study underscores the need for data-driven crop selection based on profitability and economic efficiency. Sugarcane and soybean are optimal choices for high returns, while strategies to reduce paddy cultivation costs could improve its viability. Policymakers should focus on subsidizing irrigation and fertilizers, particularly for high-input crops. Future studies should integrate environmental and social impacts for a comprehensive understanding of agricultural sustainability (Patel et al., 2020; Sharma et al., 2021).

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