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Profitability and economic performance of horticulture-based farming systems: Evidence from Dharwad district, Karnataka, India

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Abstract

Horticulture has emerged as an important component of agricultural diversification in India, contributing significantly to farm income, employment generation, and nutritional security. The present study examines the economic performance of horticulture-based farming systems in Dharwad district of Karnataka. Primary data collected from selected farmers representing major horticulture-based farming systems were analyzed using cost and return measures. The study identified five dominant horticulture-based farming systems comprising combinations of fruit crops, field crops, and livestock enterprises. The results indicate that integrated farming systems generated higher gross and net returns compared to specialized crop enterprises. Farming systems integrating horticultural crops with dairy activities exhibited greater profitability and income stability. The findings suggest that diversification through horticulture and an allied enterprise enhances resource utilization and improves farm profitability. The study recommends strengthening infrastructure, extension services, and market support to promote sustainable horticulture-based farming systems in Karnataka.

Keywords: Horticulture, Farming Systems, Profitability, Farm Income, Karnataka, Agricultural Diversification

1. Introduction

Agriculture continues to play a pivotal role in the Indian economy by providing employment and livelihood opportunities to a large proportion of the rural population. In recent decades, diversification towards horticultural crops has gained momentum due to increasing demand, higher returns, and greater export potential. Horticulture-based farming systems integrate fruit crops with livestock and other complementary enterprises, thereby enhancing farm productivity and income.

Karnataka is one of the leading horticultural states in India, possessing favorable agro-climatic conditions for the cultivation of mango, sapota, guava, banana, and other fruit crops. Dharwad district occupies an important position in the state's horticultural economy. The integration of horticultural enterprises with crop and livestock activities offers opportunities for increasing profitability while reducing production risks. An assessment of the economic performance of these systems is essential for designing appropriate agricultural development strategies.

2. Review of Literature

Several studies have reported that integrated farming systems generate higher income and employment compared to conventional crop-based agriculture. Rangaswamy *et al.* (1992) ^[4] observed that integrated farming systems enhanced farm profitability and employment generation. Kandasamy (1998) ^[3] reported that dairy-based integrated systems were more profitable than sole cropping systems. Channabasavanna and Biradar (2007) ^[2] found that integrated crop-livestock systems improved productivity and net returns.

Previous studies indicate that diversification through horticulture and livestock enterprises contributes significantly to farm income and sustainability. However, empirical evidence on the comparative economic performance of horticulture-based farming systems in Northern Karnataka remains limited. The present study attempts to fill this gap.

3. Objectives of the Study

1. To identify major horticulture-based farming systems in Dharwad district.
2. To estimate the costs and returns of different horticulture-based farming systems.
3. To compare profitability across farming systems.

$$BCR = \frac{\text{Gross Returns}}{\text{Total Cost}} \quad BCR = \frac{\text{Total Cost}}{\text{Gross Returns}}$$

Farming System	BCR
FS-I	1.60
FS-II	1.77
FS-III	1.58
FS-IV	1.76
FS-V	1.87

Interpretation

The Benefit-Cost Ratio (BCR) analysis indicates that all five farming systems are economically viable, as their BCR values exceed unity. Among them, FS-V recorded the highest BCR of 1.87, demonstrating superior economic

To suggest policy measures for improving farm income and sustainability.

4. Methodology

- **Study Area:** The study was conducted in Dharwad district of Karnataka, which is characterized by diversified agricultural production and significant horticultural activity.
- **Data Source:** The study is based on primary data collected from sample farmers representing different horticulture-based farming systems.

5. Results and Discussion

1. Benefit-Cost Ratio (BCR)

efficiency and profitability. This implies that every ₹1 invested in FS-V generated a return of ₹1.87, making it the most remunerative farming system. FS-II (1.77) and FS-IV (1.76) also exhibited strong economic performance, indicating efficient resource utilization and higher returns. In contrast, FS-III registered the lowest BCR of 1.58, suggesting comparatively lower profitability. Overall, the results reveal that diversified farming systems, particularly FS-V, offer better economic returns and sustainability to farm households.

2. Net Return Ratio (NRR)

$$NRR = \frac{\text{Net Returns}}{\text{Total Cost}} \quad NRR = \frac{\text{Total Cost}}{\text{Net Returns}}$$

Farming System	NRR
FS-I	0.60
FS-II	0.77
FS-III	0.58
FS-IV	0.76
FS-V	0.87

The Net Returns Ratio (NRR) analysis reveals that all farming systems generated positive net returns, indicating their economic feasibility. Among the systems, FS-V recorded the highest NRR of 0.87, implying that every ₹1 invested yielded a net profit of ₹0.87. This highlights FS-V

as the most profitable and economically efficient farming system among the five categories. FS-II (0.77) and FS-IV (0.76) also demonstrated relatively high profitability, reflecting effective resource utilization and income generation. In contrast, FS-III registered the lowest NRR of 0.58, indicating comparatively lower net returns. Overall, the findings suggest that FS-V offers the greatest economic advantage to farmers, while all farming systems remain financially viable and contribute positively to farm income.

3. Profitability Index

$$PI = \frac{\text{Net Returns}}{\text{Gross Returns}} \quad PI = \frac{\text{Gross Returns}}{\text{Net Returns}}$$

Farming System	PI
FS-I	0.377
FS-II	0.434
FS-III	0.368
FS-IV	0.431
FS-V	0.466

The Profitability Index (PI) measures the proportion of gross returns that is converted into net profit. The results indicate that FS-V achieved the highest PI value of 0.466, suggesting that approximately 46.6% of its gross revenue was retained as profit after meeting all production costs. This reflects the superior profit-generating capacity and operational efficiency of FS-V compared to the other farming systems. FS-II (0.434) and FS-IV (0.431) also

exhibited relatively high profit conversion efficiency, indicating effective cost management. In contrast, FS-III recorded the lowest PI value of 0.368, implying that only 36.8% of gross returns were realized as profit. Overall, the findings demonstrate that FS-V is the most profitable farming system, while FS-III exhibits comparatively lower efficiency in converting gross income into net earnings.

4. Ranking of Farming Systems

Rank	Farming System	Net Returns (₹)
1	FS-IV	1,62,533
2	FS-II	1,48,611
3	FS-V	1,32,356

4	FS-III	1,14,187
5	FS-I	87,505

The ranking of farming systems based on net returns indicates that FS-IV generated the highest absolute income of ₹1,62,533 per farm, followed by FS-II (₹1,48,611) and FS-V (₹1,32,356). FS-III and FS-I occupied the fourth and fifth positions, respectively, with net returns of ₹1,14,187 and ₹87,505. The results suggest that FS-IV is the most successful farming system in terms of total income generation, making it attractive for farmers seeking higher absolute earnings. However, despite ranking third in net returns, FS-V recorded the highest Benefit-Cost Ratio and Net Returns Ratio, indicating superior efficiency in utilizing resources. Thus, while FS-IV maximizes total income, FS-V offers the highest return per rupee invested, reflecting better economic efficiency and profitability.

5. Econometric Model for Publication: For a stronger

journal paper, use the original farm-level data (120 farmers) and estimate:

$$\begin{aligned}
 NR_i &= \beta_0 + \beta_1 FS_2 + \beta_2 FS_3 + \beta_3 FS_4 + \beta_4 FS_5 + \varepsilon_i NR_i \\
 &= \beta_0 + \beta_{1FS2} + \beta_{2FS3} + \beta_{3FS4} + \beta_{4FS5} + \varepsilon_{iNRi} \\
 &= \beta_0 + \beta_1 FS_2 + \beta_2 FS_3 + \beta_3 FS_4 + \beta_4 FS_5 + \varepsilon_i
 \end{aligned}$$

Where:

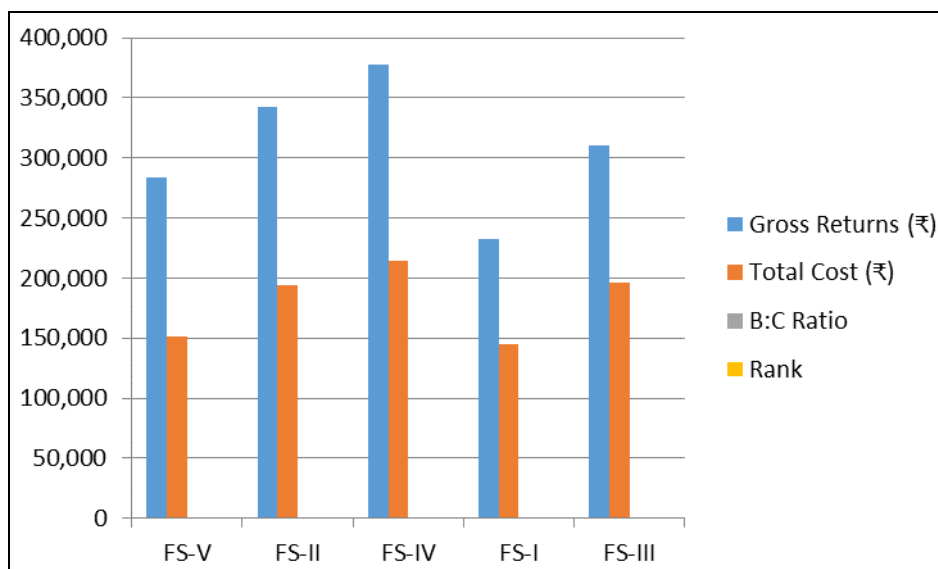
- NR_i = Net returns of *ith* farmer
- FS1 = Base category
- FS2, FS3, FS4, FS5 = Dummy variables for farming systems

This will statistically test whether differences in profitability among farming systems are significant.

Table 1: Economic Performance of Horticulture-Based Farming Systems

Farming System	Total Cost (₹)	Gross Returns (₹)	Net Returns (₹)	B: C Ratio
FS-I	144,764	232,270	87,505	1.60
FS-II	193,976	342,587	148,611	1.77
FS-III	195,812	309,999	114,187	1.58
FS-IV	214,783	377,316	162,533	1.76
FS-V	151,621	283,977	132,356	1.87

Source: Computed data by author.



Source: Table 1

Fig 1: Comparative Analysis of Gross Returns, Total Cost, Benefit-Cost (B:C) Ratio, and Rank among Different Farming Systems (FS-I to FS-V).

Table 1 presents the comparative economic performance of five horticulture-based farming systems in terms of total cost, gross returns, net returns, and Benefit-Cost (B:C) ratio. The results reveal considerable variation in profitability across the farming systems. FS-IV incurred the highest total cost of ₹214,783 and generated the highest gross returns (₹377,316) as well as the highest net returns (₹162,533), indicating its strong income-generating potential. FS-II also performed well, recording net returns of ₹148,611 and a B: C ratio of 1.77.

In terms of economic efficiency, FS-V emerged as the most profitable system with the highest B: C ratio of 1.87,

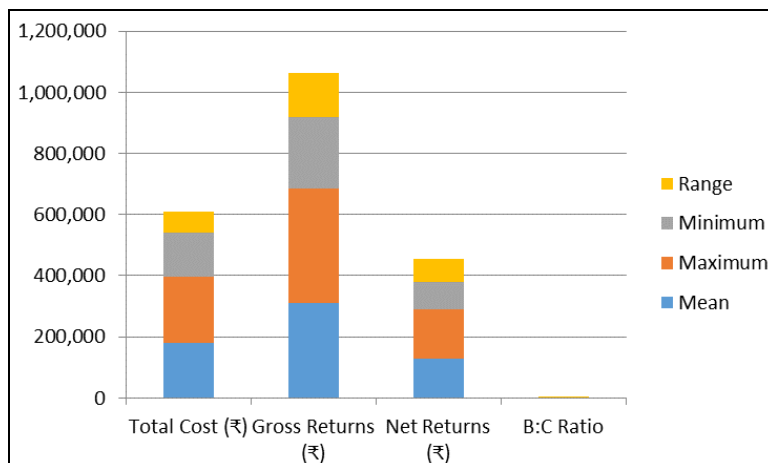
implying that every rupee invested generated ₹1.87 in returns. Despite having lower gross and net returns than FS-IV, FS-V utilized resources more efficiently and produced higher returns per unit of investment. FS-I and FS-III recorded relatively lower profitability, with B: C ratios of 1.60 and 1.58, respectively. Overall, all farming systems were economically viable as their B: C ratios exceeded unity, but FS-IV was superior in terms of absolute income generation, whereas FS-V demonstrated the highest investment efficiency and profitability. This suggests that diversified horticulture-based farming systems can significantly enhance farm income and economic

sustainability.

1. Descriptive Statistics

Table 2: Descriptive Statistics of Economic Indicators

Particulars	Total Cost (₹)	Gross Returns (₹)	Net Returns (₹)	B: C Ratio
Mean	180,191	309,230	129,038	1.72
Maximum	214,783	377,316	162,533	1.87
Minimum	144,764	232,270	87,505	1.58
Range	70,019	145,046	75,028	0.29



Source: Table 2

Fig 2: Descriptive Statistics (Mean, Maximum, Minimum, and Range) of Gross Returns, Net Returns, Total Cost, and B: C Ratio

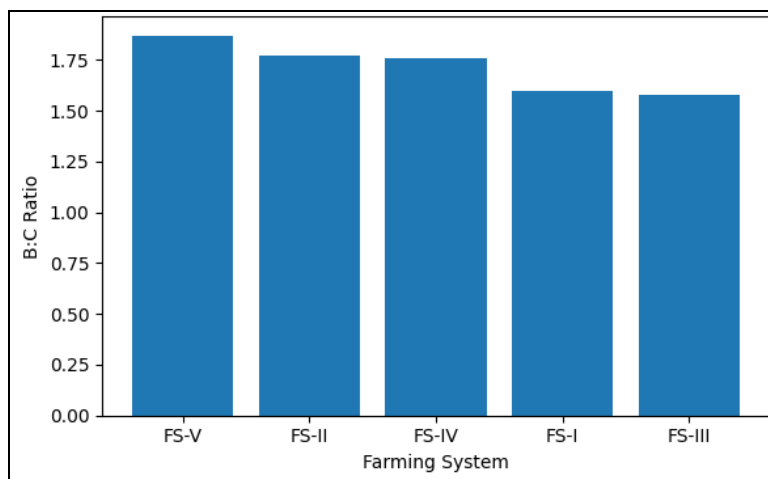
Table 2 presents the descriptive statistics of key economic indicators across the five horticulture-based farming systems. The average total cost incurred was ₹180,191, while the mean gross returns and net returns were ₹309,230 and ₹129,038, respectively. The average Benefit-Cost (B: C) ratio of 1.72 indicates that the farming systems were generally profitable, generating ₹1.72 for every rupee invested.

The maximum total cost of ₹214,783 and maximum gross returns of ₹377,316 were observed in FS-IV, reflecting its higher scale of operation and income generation. The minimum values of total cost (₹144,764), gross returns

(₹232,270), and net returns (₹87,505) were recorded in FS-I. The range values reveal substantial variation among the farming systems, particularly in gross returns (₹145,046) and net returns (₹75,028), indicating differences in enterprise combinations, productivity, and resource utilization. However, the relatively small range in the B: C ratio (0.29) suggests that all farming systems maintained a comparable level of economic viability. Overall, the descriptive statistics confirm that horticulture-based farming systems are economically rewarding, with notable differences in profitability and efficiency across the systems.2. Benefit-Cost Analysis

Table 3: Benefit-Cost Analysis and Ranking

Farming System	Gross Returns (₹)	Total Cost (₹)	B: C Ratio	Rank
FS-V	283,977	151,621	1.87	I
FS-II	342,587	193,976	1.77	II
FS-IV	377,316	214,783	1.76	III
FS-I	232,270	144,764	1.60	IV
FS-III	309,999	195,812	1.58	V



Source: Table 3

Fig 3: Benefit-Cost Ratio of Farming Systems

Table 3 presents the Benefit-Cost (B: C) ratio and ranking of the horticulture-based farming systems. The analysis shows that FS-V achieved the highest B: C ratio of 1.87 and secured the first rank, indicating superior economic efficiency. This implies that every ₹1 invested in FS-V generated ₹1.87 in gross returns, making it the most remunerative farming system in terms of investment efficiency. FS-II ranked second with a B: C ratio of 1.77, closely followed by FS-IV with a ratio of 1.76.

Although FS-IV generated the highest gross returns (₹377,316), its higher production cost reduced its relative efficiency compared to FS-V and FS-II. FS-I and FS-III recorded lower B: C ratios of 1.60 and 1.58, respectively, and were ranked fourth and fifth, indicating comparatively lower returns per unit of investment. Nevertheless, all farming systems exhibited B: C ratios greater than one, confirming their economic viability. The findings suggest that FS-V is the most efficient farming system from an investment perspective, while FS-IV remains the highest income-generating system in absolute terms. Thus, both profitability and resource-use efficiency should be considered when evaluating the performance of horticulture-based farming systems. Identification of Farming Systems

Cost and Returns Analysis

The analysis revealed considerable variation in costs and returns among the farming systems. Systems combining horticultural crops with dairy enterprises generated higher gross returns due to multiple income sources. Although integrated systems incurred relatively higher production costs, their net returns were substantially greater than those of specialized crop enterprises.

Profitability Comparison

Among the identified systems, integrated horticulture-livestock systems recorded the highest profitability. Diversification reduced dependence on a single enterprise and ensured stable income throughout the year. Fruit crops such as mango, sapota, and guava contributed significantly to farm income owing to their high market value.

Economic Implications

The findings indicate that diversification through horticulture and livestock enterprises improves farm income, employment opportunities, and resource utilization. Integrated farming systems also reduce production risks

associated with market fluctuations and climatic uncertainties.

6. Conclusion

The study concludes that horticulture-based farming systems are economically viable and contribute significantly to farm income in Dharwad district. Integrated systems involving horticultural crops and livestock enterprises were found to be more profitable than specialized crop enterprises. Promotion of diversified farming systems through infrastructure development, institutional support, and market linkages can enhance agricultural sustainability and rural livelihoods in Karnataka.

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