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An analysis cost of cultivation of banana (*Musa.* spp) in Kabirdham district of Chhattisgarh

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Abstract
The current research took place in the Kabirdham district of Chhattisgarh, covering four blocks: Kawardha, Bodla, Sahaspur Lohara, and Pandariya. A total of 108 farmers were selected from 15 villages using probability proportional to size techniques, divided into small, medium, and large landholding categories. Key results showed that the typical family size of respondents was 5.74 members, and the literacy rate was notably high at 93.54 percent. The typical landholding size was noted at 3.24 hectares, with a cropping intensity of 241.92 percent, demonstrating effective land use in the area. Examination of the compound growth rate (CGR) for bananas in Kabirdham revealed a statistically non-significant increase in both area and production, whereas productivity demonstrated significant growth. In contrast, Chhattisgarh experienced a notable rise in both the area and production of banana cultivation at the state level, although growth in productivity was not statistically significant. The mean expense for banana cultivation was determined to be 203176.64 rupees per hectare, while the production cost per quintal was assessed at 260.08 rupees. The input-output ratio was determined to be 2.23, signifying profitability in banana farming.

Keywords: Banana, cost of cultivation and cost concept

Introduction
Banana (*Musa paradisiaca* L.), originating from Southeast Asia, is among the most significant fruit crops worldwide, placing seventh in the ranking of internationally traded agricultural goods. Its cost-effectiveness, nutritional benefits, and year-round accessibility establish it as a global dietary essential. Bananas are eaten as both ripe fruits and cooking plantains. Although it has the ability to be processed, more than 90 percent of bananas are eaten fresh. In terms of nutrition, ripe bananas are high in carbohydrates (up to 22 percent), fiber, potassium, manganese, and vitamins B6 and C. In India, they are commonly eaten by all income levels and are frequently referred to as the "poor man's apple." They are the leaders in fruit production and hold the third position in cultivation area, representing roughly 14 percent of the land used for growing fruit and accounting for approximately 32 percent of overall fruit production. In 2017-18, 884, 000 hectares produced 30.81 million metric tonnes, and Andhra Pradesh, Gujarat, and Maharashtra ranked as the leading producers. For the year 2023-24, India's overall horticulture output is projected to be around 352.23 million tonnes, representing a 1.15 percent rise from the prior year. As per the National Horticulture Database published by the National Horticulture Board, the nation generated approximately 112.62 million metric tonnes of fruits, which included 14.2 million tonnes of bananas, and 204.96 million metric tonnes of vegetables during this timeframe. Chhattisgarh's overall fruit output reaches 2429.838 metric tonnes, while the area dedicated to fruit farming spans 219.351 hectares. Banana cultivation in Chhattisgarh covers 23.963 hectares. And Production 577, 529 metric tons. Fruits are cultivated in nearly every district of the state

Collection of data
Primary data has been gathered from chosen and classified banana farmers into small, medium, and large categories. Data were gathered using the personal interview approach with the assistance of pre-tested questionnaires. The secondary data was obtained from various government departments, including the Department of Agriculture, Department of

Horticulture, Department of Economics and Statistics, Chhattisgarh government, and other reliable sources.

Research Methodology

Selection of study area

The current research was conducted in Kabirdham district of Chhattisgarh, covering four blocks: Kawardha, Bodla, Sahaspur Lohara, and Pandariya. Farmers who grow bananas on an industrial scale were identified as banana cultivators. From a total of 200 banana growers in chosen villages, a sample of 54 percent of respondents, or 108 farmers, was selected utilizing probability proportional to size techniques, with the stipulation that a minimum of 10 percent of respondents must be represented from each farm category. The research classified farmers into categories: small (1-2 ha), medium (2-4 ha), and large (above 4 ha)

Cost concept

The cost and return were estimated with the help of cost concept given by Commission on Agricultural Costs and Price (CACP). The detailed cost concept used in present study is as below. Cost A1: All actual expenses in cash and kind incurred in production. Consist of following items of costs.

- Value of hired human labor
- Imputed value of owned bullock labor
- Value of hired bullock labor
- Charged of hired machinery
- Imputed value of owned machinery
- Imputed value of owned seed
- Value of fertilizers
- Value of insecticide and fungicide
- Value of irrigation
- Land revenue, chess and other taxes
- Depreciation on farm implement
- Interest on working capital
- Cost A2 = Cost A1+ Rent paid for leased-in-land
- Cost B1 = A1+ Interest on value of owned fixed capital (excluding land)
- Cost B2 = B1+ Rental Value of owned land and rent paid for leased land
- Cost C1 = B1+imputed value of family labour
- Cost C2 = B2+ imputed value of family labour
- Cost C3 = C2+ managerial cost of 10% of cost C2 on account of managerial function performed by farmer

Income measures

(a) Gross income

Gross income = Net income + cost C

(b) Net income

Net income = Gross income-cost C

(c) Input-output ratio

It can be expressed as the ratio of output to input. The ratio was calculated:

Input-output ratio = O/I

Where,

O = Total output

I = Total input

Results and Discussion

From Table 1, it can be noted that the typical cultivation cost for the sampled farmers was Rs. Rs. 196124.20 for small-scale farmers. 206821.44 for medium-sized farmers, and Rs. 218507.72 for major agricultural producers. Large farmers faced the highest cultivation costs in comparison to small and medium-sized farmers. The total average expense of farming in all sectors was Rs. 203176.64. The table clearly shows that the most significant portion of the overall cultivation cost came from planting material, totaling Rs.

Table 1: Cost of cultivation of banana (Rs. /ha)

S. No.	Particulars	Small	Medium	Large	Overall
Variable cost (A)					
1	Family labour	10700.00 (5.45)	7400.00 (3.57)	4800.00 (2.19)	8645.37 (4.29)
2	Hired human labour	21200.00 (10.80)	25800.00 (12.47)	28900.00 (13.22)	24000.92 (11.77)
3	Machine charge	6700.00 (3.41)	7500.00 (3.62)	9500.00 (4.34)	7362.96 (3.61)
4	Planting materials	45000.00 (22.94)	46500.00 (22.48)	48000.00 (21.96)	45972.22 (22.63)
5	Manure	9626.00 (4.90)	10230.00 (4.94)	12026.00 (5.50)	10160.96 (4.99)
6	Fertilizer	20276.00 (10.33)	23670.00 (11.44)	25736.00 (11.77)	22315.96 (10.96)
7	Plant protection chemicals and herbicides	8801.00 (4.48)	9136.00 (4.41)	9525.00 (4.35)	9024.62 (4.44)
8	Irrigation	6800.00 (3.46)	7600.00 (3.67)	8700.00 (3.98)	7354.62 (3.61)
9	Propping	10300.00 (5.25)	11300.00 (5.46)	12340.00 (5.64)	10952.96 (5.38)
10	Interest on working capital	11152.24 (5.68)	11930.88 (5.76)	12762.16 (5.84)	11663.16 (5.73)
	Total variable cost (A)	150555.24 (76.76)	161066.88 (77.87)	172289.16 (78.84)	157453.88 (77.46)
Fixed cost (B)					
11	Land revenue	13 (0.0066)	13 (0.0063)	13 (0.0059)	13 (0.0064)
12	Depreciation on implements	670.00 (0.34)	750.00 (0.36)	950.00 (0.43)	736.29 (0.36)
13	Rental value of owned land	44000.00 (22.43)	44000.00 (21.27)	44000.00 (20.13)	44000.00 (21.68)
14	Interest on fixed capital	885.96 (0.48)	991.56 (0.47)	1255.56 (0.57)	973.47 (0.47)
	Total fixed cost (B)	45568.96 (23.23)	45757.56 (22.12)	46218.56 (21.15)	45722.76 (22.53)
	Total cost (A+B)	196124.20 (100)	206821.44 (100)	218507.72 (100)	203176.64 (100)

Note: Source-Primary data (Year 2024-25) Figures in parentheses are percentage to total.

Different cost on the basis of cost concept at sample farms in the study area

Table 2 shows the varying costs based on the cost concept at example farms in the study region. The total quantity of different cultivation cost elements. The above table clearly shows that the highest cost is at C3, which amounted to Rs. 223494.31 succeeded by expenses C2, B2, C1, B1, and A1, A2 with the sum of Rs. 203176.64, 194531.27, 159176.64, 150531.27 et 149557.80 respectivement. Cost A2 was identical to cost A1 since no rent was paid for the leased land. The overall maximum and minimum costs were greater for large farms, followed by medium-sized and small

farms. The highest cost is noted at cost C3, which encompasses cost C2 plus 10 percent of cost C2 for the managerial tasks carried out by the farmer, while the lowest cost is found at cost A1, covering all actual expenses. It illustrates the rising patterns with the growth in farm size.

Table 2: Cost of cultivation of banana as per cost concept at sample farm in the study area. (Rs/ha)

S. No.	Cost	Size of land holdings			
		Small	Medium	Large	Overall
1	Cost A_1	140538.24	154429.88	168452.16	149557.80
2	Cost A_2	140538.24	154429.88	168452.16	149557.80
3	Cost B_1	141424.20	155421.44	169707.72	150531.27
4	Cost B_2	185424.20	199421.44	213707.72	194531.27
5	Cost C_1	152124.20	162821.44	174507.72	159176.64
6	Cost C_2	196124.20	206821.44	218507.72	203176.64
7	Cost C_3	215736.62	227503.58	240358.49	223494.31

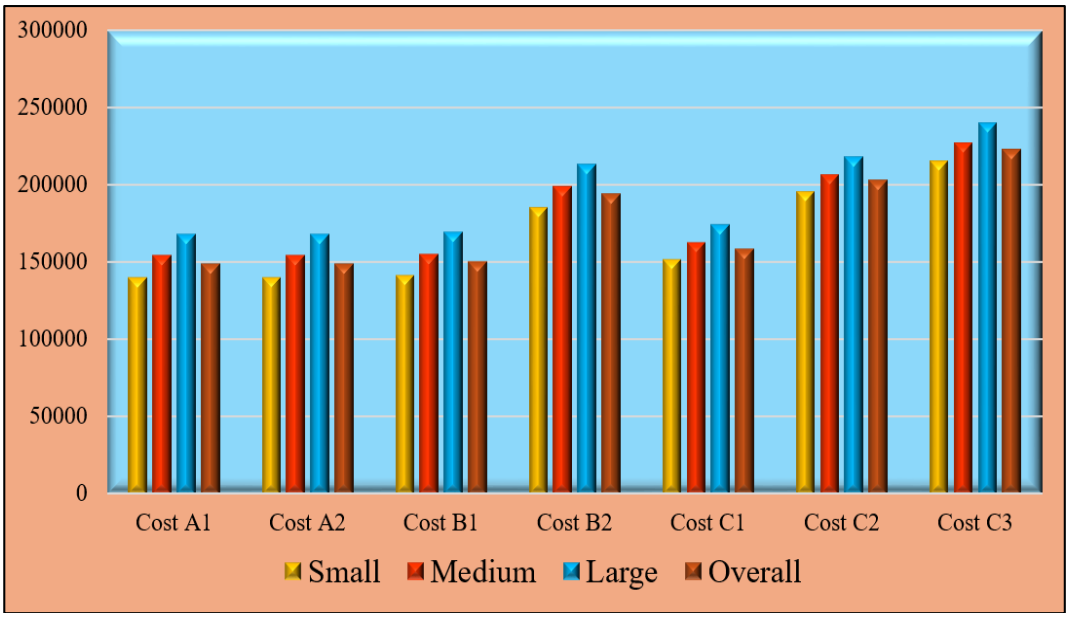

Fig 1: Cost concept of banana cultivation as per cost concept of sample households in the study area

Output and return in the cultivation of Banana Crop

Table 2 displays the yield and return of bananas. The highest yield per hectare was recorded in large farms at 810.00 q, followed by medium farms at 785.00 q and small farms at 770.00 q, with an overall average yield of 780.92 q observed. The typical price of bananas stood at 840 Rs. for all types of banana growers. The highest cultivation cost was seen in large farms, which amounted to Rs. 218507.72 succeeded by medium and small agriculture as Rs. 206821.44 and Rs. 196124.20 per hectare correspondingly. Consequently, the production cost per quintal was lowest for small farms, which amounted to Rs. 254.70 succeeded by medium farms at Rs263.46 and large farms at Rs. 269.76. This occurred due to the large size of farms allowing greater expenditure on input applications and the use of external labor instead of family labor, which ultimately raised production costs. Gross income may appear elevated in the case of large farms, which is Rs. 680400 succeeded by medium and small farms with the Rs. of 659400 and Rs. 646800 correspondingly. The highest net return noted is Rs 450675.80 for small farms, with medium farms following at Rs. 452578.56 and the lowest for large farms with the Rs. 461892.28, which occurred due to a higher cost C in large farms and lower in small farms. The Input-output Ratio was highest for small farms at 2.29, next for medium farms at 2.18, and lowest for large farms at 2.11. The rise in return from input is highest for small farms because of the productivity boost resulting from lower costs. Additionally, on small farms, family labor is more engaged and farm tasks are performed more efficiently, while on medium and large farms, the role of family labor diminishes as the farm size increases

Table 2: Yield, cost and return of banana at the sample farms in the study area. (Rs/ha).

S. No.	Particulars	Small	Medium	Large	Overall
1	Main yield (q/ha)	770	785	810	780.92
2	Price (Rs/q)	840	840	840	840
3	Gross income	646800	659400	680400	655977.77
4	Cost of production (Rs/q)	254.70	263.46	269.76	260.08
5	Cost of cultivation (Rs/q)	196124.20	206821.44	218507.72	203176.64
6	Net income	450675.80	452578.56	461892.28	452801.13
7	Input-output ratio	2.29	2.18	2.11	2.23

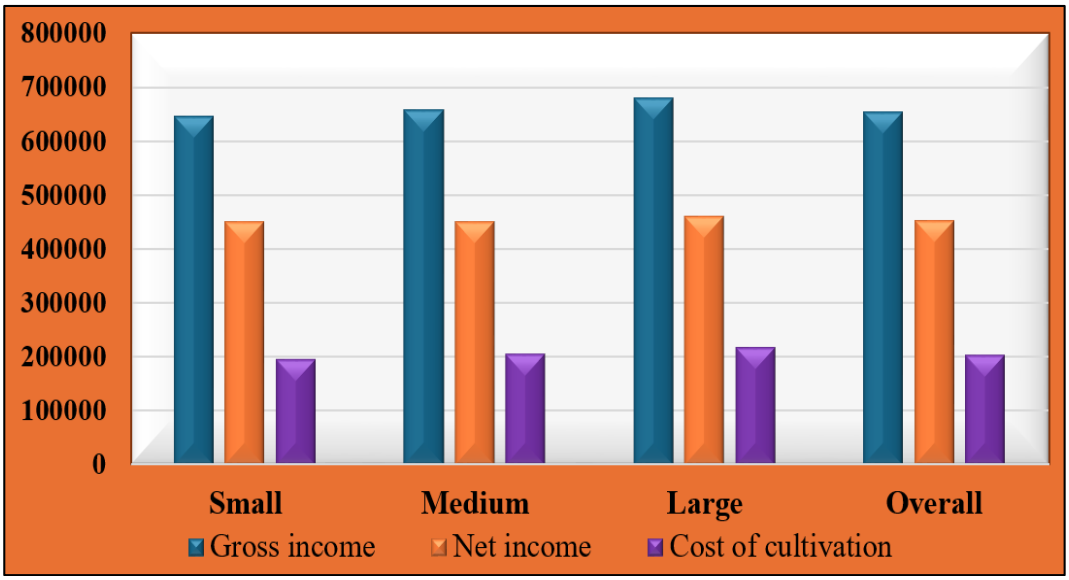

Fig 2: Gross income, Net income and Cost of Cultivation of banana at sample farms in the study area.

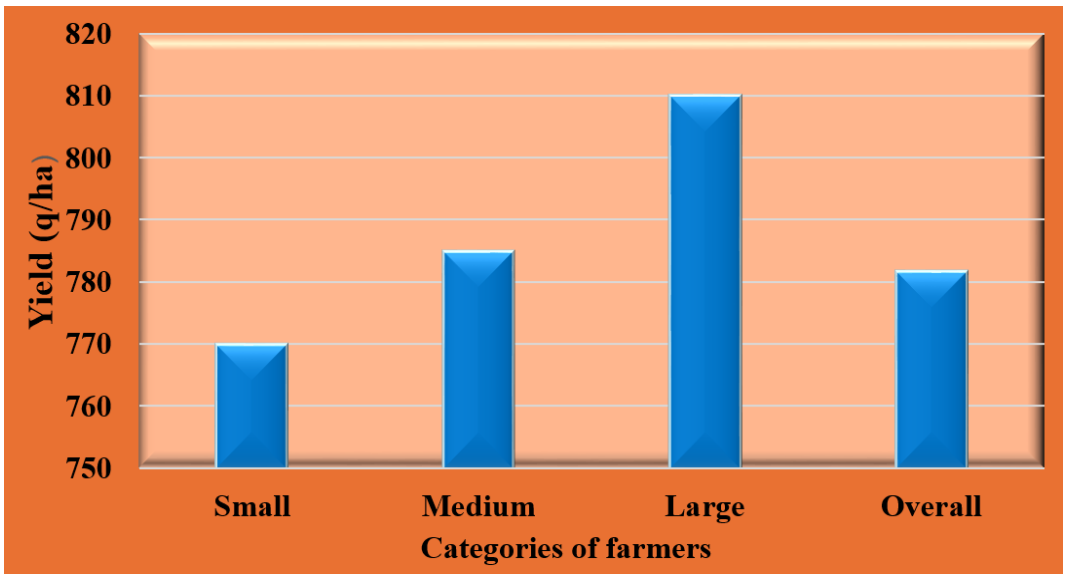

Fig 3: Yield of banana at sample farms in the study area.

Summary and Conclusion

Banana ranks among the most favored and widely eaten fruits globally, recognized for its low cost and remarkable nutritional advantages. The contemporary edible banana types have developed mainly from two wild species: Musa acuminata and Musa balbisiana. In India, worldwide banana output is estimated to be around 102.03 million tons, with India contributing roughly 29.19 percent of this figure. Bananas and plantains are grown widely in over 120 nations, with a total estimated annual worldwide output of approximately 86 million tons. In 2023-24, India's overall horticulture production is projected to be around 352.23 million tonnes, showing a 1.15 percent rise compared to the last year. As per the National Horticulture Database (2nd Advance Estimates) published by the National Horticulture Board, the nation generated approximately 112.62 million metric tonnes of fruits, comprising 14.2 million tonnes of bananas, and nearly 204.96 million metric tonnes of vegetables during this timeframe. Chhattisgarh's overall fruit production reaches 2429.838 metric tonnes, with the area designated for fruit cultivation spanning 219.351 hectares. Banana cultivation in Chhattisgarh spans 23.963 hectares. And production of 577.529 metric tons. Fruits are cultivated in nearly every district of the state. The main Banana cultivation regions are Balrampur (2.562 ha), Durg (1.894 ha), Surajpur (1.838 ha), Raigarh (1.725 ha), Bilaspur (1.061 ha), Raipur (0.926 ha), and for 2023-24, include Kabirdham (0.984 ha) area in (000ha)

The typical expense of banana farming per hectare was Rs. Rs.196124.20 for small farms, Rs.206821.44 for medium farms, and Rs.218507.72 for large farms, indicating a rise in expenses with the size of the farm. The typical yield was 770 q/ha for small farms, 785 q/ha for medium-sized farms, and 810 q/ha for large farms, showing that larger farm sizes produce greater yields. The overall income showed a comparable pattern: Rs.646800, Rs.659400, and Rs.680400 for small, medium, and large farms, respectively. Net income was Rs.450675.80 for small farms, Rs.452578.56 for medium farms, and Rs.461892.28 for large farms, indicating a downward trend in profitability as farm size increases. The input-output ratios were 2.29 for small, 2.18 for medium, and 2.11 for large, emphasizing the trend of decreasing returns with increased scale

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