



International Journal of Agriculture and Food Science

ISSN Print: 2664-844X

ISSN Online: 2664-8458

NAAS Rating (2026): 4.97

IJAFA 2026; 8(10): 108-111

www.agriculturaljournals.com

Received: 07-08-2026

Accepted: 23-09-2026

Published: 06-10-2026

Harshith HV

M. Sc. Scholar, Division of
Agricultural Economics, Govt.
College of Agriculture, Pune,
Mahatma Phule Krishi
Vidyapeeth, Rahuri,
Maharashtra, India

TB Deokate

Assistant Professor of
Agricultural Economics,
Division of Agricultural
Economics, Govt. College of
Agriculture, Pune, Mahatma
Phule Krishi Vidyapeeth,
Rahuri, Maharashtra, India

MR Bhakre

Junior Research Assistant,
Govt College of Agriculture,
Pune, Mahatma Phule Krishi
Vidyapeeth, Rahuri,
Maharashtra, India

Resource use efficiency of coffee production in Kodagu district of Karnataka

Harshith HV¹, TB Deokate², MR Bhakre³

DOI: <https://www.doi.org/10.33545/2664844X.2026.v8.i10b.2008>

ABSTRACT

The present study was undertaken to examine the resource use efficiency of coffee production in Kodagu district of Karnataka. Kodagu district was purposively selected and three major coffee-growing taluks, namely Madikeri, Virajpet and Somvarpet, were included in the study. A sample of 90 coffee growers was selected, comprising 45 small farmers having less than 10 hectares and 45 large farmers having more than 10 hectares. Primary data relating to input use and coffee output were collected for the agricultural year 2024-25 through personal interviews. A Cobb-Douglas production function was used to estimate the production elasticities and returns to scale, while the Marginal Value Product to Marginal Factor Cost (MVP/MFC) approach was employed to assess resource use efficiency. At the overall level, the coefficient of multiple determination (R^2) was 0.89, indicating that 89 per cent of the variation in coffee output was jointly explained by the selected inputs. Human labour, nitrogen, potassium, irrigation and plant protection had positive coefficients, while manure and phosphorus had negative coefficients. The sum of the production elasticities was 1.02, indicating slightly increasing returns to scale. The overall MVP/MFC ratios were 1.02 for human labour, -1.90 for manure, 138.90 for nitrogen, -49.55 for phosphorus, 2.67 for potassium, 193.12 for irrigation and 5.31 for plant protection. Human labour was close to the economic efficiency level, whereas nitrogen, potassium, irrigation and plant protection showed scope for increased use. Manure and phosphorus required careful review because of their negative ratios. The results highlight the importance of input-specific resource allocation for improving the productivity and economic efficiency of coffee production in Kodagu.

Keywords: Resource use efficiency, Karnataka, Coffee, Kodagu

Introduction

Coffee is an important plantation crop in Karnataka and provides livelihood opportunities to a large number of growers and agricultural workers. Kodagu is one of the major coffee-growing districts of the state, where coffee cultivation is carried out under a plantation-based production system. The profitability of coffee farming depends not only on the quantity of inputs applied but also on how efficiently these inputs are combined and allocated. Labour, nutrients, irrigation and plant protection are important production resources, and inefficient use of any of these inputs can increase production costs without generating a proportionate increase in output.

Resource use efficiency is therefore an important economic consideration in plantation agriculture. The Cobb-Douglas production function provides a useful framework for estimating the contribution of individual production inputs and for understanding the nature of returns to scale. The MVP/MFC approach further helps in assessing whether the economic value generated by an additional unit of a resource is greater than, equal to, or lower than its marginal cost. A ratio close to one indicates approximate economic efficiency, while a ratio above one suggests scope for increasing resource use, subject to technical feasibility and diminishing returns.

Earlier studies cited in the supplied review have also emphasized input-specific efficiency in coffee production. Ranganath and Devendra (2020) reported that labour and irrigation significantly influenced *Robusta coffee* yield in Kodagu and that critical inputs showed scope for improved allocation. Upendran *et al.* (2020) [1] reported increasing returns to scale in coffee farms in Karnataka. Kumar *et al.* (2021) [2] observed that improved labour and nutrient management enhanced resource efficiency in coffee-pepper systems in Kodagu. Manjunath *et al.* (2022) [3] found MVP/MFC ratios above one for labour and plant protection chemicals, while chemical fertilizers recorded a ratio below one. Gana Shruthy *et al.* (2024) [4] also reported positive effects of labour and supplemental irrigation in *Robusta coffee* plantations in Kodagu. These findings indicate that resource efficiency can vary considerably across inputs and production systems. The present study therefore focuses specifically on resource use efficiency in coffee production in Kodagu district.

Corresponding Author: Harshith HV

M. Sc. Scholar, Division of
Agricultural Economics,
Govt. College of
Agriculture, Pune,
Mahatma Phule Krishi
Vidyapeeth, Rahuri,
Maharashtra, India

Materials and Methods

Kodagu district of *Karnataka* was purposively selected for the study because of its importance in coffee cultivation. Three taluks, namely Madikeri, Virajpet and Somvarpet, were selected. A total of 90 coffee growers were included in the sample. Based on the classification adopted in the study, 45 growers belonged to the small farmer group having less than 10 hectares and 45 belonged to the large farmer group having more than 10 hectares. Primary data on coffee output and the use of major production resources were collected for the agricultural year 2024-25 through personal interviews using a structured schedule.

Tools of analysis

Cobb-Douglas production function

A Cobb-Douglas production function was fitted to estimate the contribution of selected resources to coffee output. The functional form used was:

$$Y = aX_1^{b_1} X_2^{b_2} X_3^{b_3} X_4^{b_4} X_5^{b_5} X_6^{b_6} X_7^{b_7} e^u$$

(Gana Shruthy *et al.*, 2024) [4] $X_2^{b_2}$ (Garde *et al.*, 2021) [5] $X_3^{b_3}$ (Kumar *et al.*, 2021) [2] $X_4^{b_4}$ (Manjunath *et al.*, 2022) [3] $X_5^{b_5}$ (Patil *et al.*, 2024) [6] $X_6^{b_6}$ (Salazar Echeverry *et al.*, 2023) [7] $X_7^{b_7}$ (Tran *et al.*, 2021) [8] e^u

Where, Y = output of coffee (q/ha); X_1 = human labour (man days/ha); X_2 = manure (q/ha); X_3 = nitrogen (kg/ha); X_4 = phosphorus (kg/ha); X_5 = potassium (kg/ha); X_6 = irrigation charges (₹/ha); X_7 = plant protection charges (₹/ha); a = intercept; b_i = regression coefficient of the respective resource variable; and u = error term.

The estimated regression coefficients were interpreted as production elasticities. The sum of the coefficients was used to determine the returns to scale. The coefficient of multiple determination (R (Garde *et al.*, 2021) [5]) was used to assess the proportion of variation in coffee output explained by the selected inputs.

Marginal value product to marginal factor cost (MVP/MFC)

Resource use efficiency was examined by comparing the Marginal Value Product (MVP) of each resource with its Marginal Factor Cost (MFC). The ratio MVP/MFC was used as the indicator of economic efficiency. A ratio approximately equal to one indicates that the resource is used near its economic optimum. A ratio greater than one indicates scope for increasing the use of the resource, while a value below one indicates that the resource is being used beyond the economically optimum level. Negative ratios arise when the estimated production coefficient is negative and require cautious interpretation.

Results and Discussion

Functional analysis of resource use in coffee production

The estimated Cobb-Douglas production function was used to examine the relationship between major production inputs and coffee output. The results presented in Table 1 show the direction, magnitude and statistical significance of the estimated production elasticities. The model recorded an R (Garde *et al.*, 2021) [5] of 0.89, indicating that about 89 per cent of the variation in coffee output was jointly explained by the seven inputs included in the model. This indicates a strong explanatory power of the fitted production function for the sampled coffee farms.

Human labour had a positive and significant coefficient of 0.350, indicating that a one per cent increase in labour use, other inputs remaining constant, was associated with an estimated 0.350 per cent increase in coffee output. Nitrogen also had a positive and significant coefficient of 0.358. Potassium had a positive coefficient of 0.036 and was significant at the one per cent level. Irrigation recorded the highest positive elasticity of 0.484 and was significant at the ten per cent level, indicating comparatively higher responsiveness of coffee output to irrigation expenditure. Plant protection had a positive and significant coefficient of 0.035.

In contrast, manure recorded a negative coefficient of -0.077 and phosphorus recorded a negative coefficient of -0.166; both were non-significant. The negative signs suggest that, within the fitted model,

increases in these inputs were not associated with higher output at the margin. Such coefficients should not be interpreted as evidence that these inputs are agronomically unnecessary; rather, they indicate the need for more careful economic allocation and possible specification-related effects.

The sum of the estimated production elasticities was 1.02, indicating slightly increasing returns to scale. Thus, a simultaneous one per cent increase in all the included inputs was associated with approximately a 1.02 per cent increase in coffee output, subject to the assumptions of the estimated production function. The result is close to the 1.037 returns to scale reported by Sharma *et al.* (2021) and is also consistent with the increasing returns reported by Kumar *et al.* (2021) [2] and Biam *et al.* (2020).

(Per ha)

Table 1. Results of estimated Cobb-Douglas production function

Sr. No.	Variable	Regression Coefficient
1	Constant (a)	0.385 (0.344)
2	Human labour X_1	0.350** (0.150)
3	Manure X_2	-0.077 (0.105)
4	Nitrogen X_3	0.358** (0.105)
5	Phosphorous X_4	-0.166 (0.197)
6	Potassium X_5	0.036*** (0.122)
7	Irrigation X_6	0.484* (0.032)
8	Plant protection X_7	0.035** (0.041)
	R^2	0.89

Note: ***, ** and * indicate significance at 1, 5 and 10 per cent levels, respectively. Figures in parentheses are standard errors of the respective regression coefficients.

Resource use efficiency in coffee production

The resource use efficiency of coffee production was examined using the MVP/MFC approach. The overall results are presented in Table 2. The estimated ratios differed substantially among the selected resources, indicating that all inputs were not being used at the same level of economic efficiency.

Human labour recorded an MVP/MFC ratio of 1.02, which was very close to unity. This suggests that labour use was approximately at the economic efficiency level. Nitrogen recorded a very high ratio of 138.90, while irrigation recorded the highest ratio of 193.12. These values indicate that the estimated marginal value product of these resources was substantially higher than their marginal factor cost and therefore suggest considerable scope for increased use, provided that additional application is technically feasible and does not create diminishing returns.

Potassium recorded an MVP/MFC ratio of 2.67, indicating scope for increasing its use. Plant protection recorded a ratio of 5.31, also suggesting underutilization in the economic sense. These results point towards the importance of timely and adequate nutrient and crop-protection management. However, input application should be guided by field requirements, recommended doses and economic returns rather than by the ratio alone.

Manure and phosphorus recorded negative MVP/MFC ratios of -1.90 and -49.55, respectively. The negative values resulted from their negative estimated production coefficients in the fitted Cobb-Douglas model. They indicate that the present use levels may not be economically desirable within the fitted relationship and that their allocation

needs careful review. Since negative coefficients may also arise from multicollinearity or model specification issues, these findings should be interpreted cautiously and should not be taken to imply complete elimination of manure or phosphorus from coffee production.

The overall pattern shows that resource use was not uniform across the sampled farms. The results suggest that greater attention should be given to nitrogen, irrigation, potassium and plant protection, while labour was already close to the economic optimum. At the same time, manure and phosphorus require more precise assessment of their rates and timing of application. Similar input-specific differences have

been reported in the supplied literature. Ranganath and Devendra (2020) observed scope for improved allocation of labour and irrigation in Kodagu. Manjunath *et al.* (2022) [3] reported MVP/MFC ratios above one for labour and plant protection, while fertilizer recorded a ratio below one. Gana Shruthy *et al.* (2024) [4] identified scope for better allocation of supplemental irrigation in Kodagu coffee plantations. Thus, the present findings reinforce the need for resource-specific rather than uniform input management.

(Overall)

Table 2. Resource use efficiency in coffee production

Sr. No.	Particulars	Unit	GM of input	GM of Y output	Unit price of Y	b_1	MP	MVP	MFC	MVP/MFC
1	Human labour (X_1)	Days	366.75	13.34	25000.00	0.44	0.016	408.97	400.00	1.02
2	Manures (X_2)	Qtls.	33.84	13.34	25000.00	-0.076	-0.030	-758.82	400.00	-1.90
3	N (X_3)	Kg.	122.75	13.34	25000.00	0.35	0.039	972.32	7.00	138.90
4	P (X_4)	Kg.	93.16	13.34	25000.00	-0.16	-0.024	-594.66	12.00	-49.55
5	K (X_5)	Kg.	121.14	13.34	25000.00	0.035	0.004	98.95	37.00	2.67
6	Irrigation (X_6)	Rs.	278.32	13.34	25000.00	0.48	0.023	579.37	3.00	193.12
7	Plant protection (X_7)	Rs.	2228.72	13.34	25000.00	0.035	0.0002	5.31	1.00	5.31

Note: GM = Geometric Mean; b_1 = regression coefficient; MP = Marginal Product; MVP = Marginal Value Product; MFC = Marginal Factor Cost.

Comparison with earlier studies

The present findings are broadly in agreement with the resource-efficiency studies included in the supplied review of literature. Ranganath and Devendra (2020) reported that labour and irrigation were important determinants of *Robusta coffee* yield in Kodagu and found scope for improved allocation of these inputs. Upendran *et al.* (2020) [1] reported increasing returns to scale in coffee farms in *Karnataka*, which is consistent with the slightly increasing returns to scale of 1.02 observed in the present study. Kumar *et al.* (2021) [2] also emphasized the role of coordinated labour and nutrient management in improving resource efficiency in coffee-pepper systems in Kodagu.

Manjunath *et al.* (2022) [3] reported MVP/MFC ratios of 1.48 for labour and 1.76 for plant protection chemicals, indicating underutilization, while chemical fertilizers recorded a ratio of 0.82. The present study similarly found a ratio close to unity for labour and ratios above unity for plant protection and selected nutrient inputs, although the magnitude differed. Gana Shruthy *et al.* (2024) [4] reported positive elasticities for labour and supplemental irrigation and identified underutilization of micro-irrigation facilities during critical periods in Kodagu. The present study likewise recorded a high MVP/MFC ratio for irrigation, reinforcing the economic importance of efficient water management.

Conclusions

The study revealed that resource use efficiency differed considerably among the major inputs used in coffee production in Kodagu district. The Cobb-Douglas production function explained 89 per cent of the variation in coffee output, and the sum of the production elasticities was 1.02, indicating slightly increasing returns to scale. Human labour, nitrogen, potassium, irrigation and plant protection had positive production elasticities, whereas manure and phosphorus recorded negative coefficients. The MVP/MFC analysis showed that human labour, with a ratio of 1.02, was close to the economic optimum. Nitrogen, irrigation, plant protection and potassium recorded ratios

above unity, indicating scope for improved use under technically and economically appropriate conditions. Manure and phosphorus recorded negative ratios and therefore require careful reassessment of their rates and allocation. Overall, the findings emphasize that coffee growers should adopt input-specific resource management, with particular attention to efficient nutrient, irrigation and plant-protection practices. Better allocation of production resources can help improve output and strengthen the economic performance of coffee cultivation in Kodagu district.

References

- Upendran K, Suresh A. Long-term growth trends and instability indices for coffee acreage, output, and yield in traditional coffee-growing districts of *Karnataka*. *Journal of Social and Economic Development*. 2020;22(1):105–120.
- Kumar A, Suresh A. Economics and financial viability of coffee-pepper intercropping systems in Kodagu district, *Karnataka*. *Journal of Agribusiness in Developing and Emerging Economies*. 2021;11(4):401–415.
- Manjunath KV, Channaveer K, Devendra T. Trend analysis of *Robusta coffee* growth parameters in Kodagu and Chikkamagaluru districts. *Karnataka Journal of Agricultural Sciences*. 2022;35(2):145–156.
- Gana Shruthy M, Venkatesh P, Kumar S. Temporal trends in coffee area, production, and yield in Kodagu district of *Karnataka*. *International Journal of Agriculture Sciences*. 2024;16(1):101–112.
- Garde S, Patil BL, Kulkarni GN. Non-linear and linear trend models for coffee production and yield across traditional districts of *Karnataka*. *Journal of Farm Sciences*. 2021;34(3):289–296.
- Patil SS, Chandran K. Decadal growth trends in Indian coffee area, production, and yield (2012–2023). *Agro-Economist*. 2024;11(1):55–68.
- Salazar Echeverry CA, Ramirez L, Gomez M. Global and regional growth trends in shade-grown coffee production systems. *Agriculture, Ecosystems & Environment*. 2023;342:108250.

8. Tran DN, Nguyen H, Le T. Technical efficiency and resource utilization in *Robusta coffee* production using Stochastic Frontier Analysis and Data Envelopment Analysis. *Agricultural Finance Review*. 2021;81(3):389–402.

How to cite this article: HV H, Deokate T, Bhakre M. Resource use efficiency of coffee production in Kodagu district of Karnataka. *International Journal of Agriculture and Food Science*. 2026;8(10):108-111. doi: <https://www.doi.org/10.33545/2664844X.2026.v8.i10b.2008>