Economic Efficiency of Banana Production in Uttara Kannada district of Karnataka

ABSTRACT

Aim: Banana cultivation holds significant agricultural importance, contributing substantially to global dietary staples. This study Examines the economic efficiency of banana production in Uttara Kannada district.

Sampling design: Employed purposive and multistage sampling, the study focuses on Sirsi and Siddapur taluks, selecting 80 farmers through random sampling.

Methodology: The research examines resource utilization by employing the Cobb-Douglas production functionandevaluate efficiency levelsby Data Envelopment Analysis (DEA).

Results: Allocative efficiency in banana cultivation is apparent through positive MVP/MFC ratios for inputs like suckers (15.89), manure (1.91), fertilizers (7.21), machine labor (1.75), and propping material (6.66), indicating underutilization. Conversely, plant protection chemicals (-22.35) and human labor (-1.20) show negative ratios, signifying overutilization. The ratio of MVP to MFC was differed from unity indicating scope for reallocation of expenditure among various resources.Using Data Envelopment Analysis, individual farm technical and economic efficiency was assessed. Banana, Crop I had a mean technical efficiency of 70.30, while Crop II had 49.40. The results highlight room for improvement, especially in Crop II, emphasizing the need for better resource allocation. Major production constraints include labour scarcity, poor planting material, and pest issues. Marketing hurdles encompass price fluctuations, limited storage, and distant markets.

Conclusion: The study emphasizes optimizing resource use and addressing production challenges in Uttara Kannada's banana cultivation. Recommendations aim to foster sustainable and economically viable farming in the region.

Keywords: Banana, Cobb-Douglas production, Resources,Technical efficiency, DEA analysis

1. INTRODUCTION

India's economic landscape thrives on diverse agricultural pursuits, including farming, horticulture, forestry and fisheries, which contributed an impressive Rs. 39.80 lakh crore to Gross Value Added (GVA) in financial year 2022. At present agricultural and allied sectors account for 18.60 per cent of India's GVA in fiscal year 2021-22 (Anon, 2023a). India with a recorded production of 107.24 million metric tonnes of fruits and 204.84 million metric tonnes of vegetables emerged as the second leading producer of fruits and vegetables in the world after China (APEDA, 2022). The area under cultivation of fruits stood at 7.05 million hectares while vegetables were cultivated in an 11.35 million hectares.

Banana (*Musa sp.)* is the second most important commercial fruit crop in India. Banana is the fifth largest agricultural commodity in world trade after cereals, sugar, coffee and cocoa (Rani, 2023). It is basically a tropical crop, grows well in a temperature range of 15ºC-35ºC with relative humidity of 75-85 per cent mainly in tropical and subtropical regions (Sharma and Kispotta,2017). Bananas are the world's fourth dietary staple after rice, wheat and corn. Hundreds of millions of people eat them(Van hung, 2022; Ghimire *et al*., 2019; Hazarika et al., 2021). Presently this crop with over 1000 varieties is being cultivated in more than 140 countries in tropical and sub-tropical regions globally. In 2021, banana production for World was 124 million tonnes. Among the countries, India is the global leader in banana production it contributes 19.37 per cent world banana production with the production of 33.06 million tons in an area of 0.924 million hectares (Annon, 2021a). In recent years, horticultural sector received considerable attention as it is recognized as a potentially important source of growth, employment generation and foreign exchange earnings (Singh, 2015).During 2021-22 among the fruit's mango was the most widely cultivated crop covering 2.35 mha, followed by Citrus (1.09 mha) and Banana (0.96 mha). In which production of banana accounts for 34.52 million tonnes, followed by Mango (20.77 mt) and Citrus (14.75 mt) (Anon, 2023a). The major banana producing states of India are Andhra Pradesh followed by Maharashtra, Gujarat, Tamil Nadu and Karnataka. The other major banana producing states are Uttara Pradesh, Bihar, Kerala, West Bengal and Assam (NHB, 2021).

Karnataka is one of the India's most progressive states, with its ten agro-climate zones having tremendous potential for fruits production, it stands at sixth place in India, produced 7.91 million metric tonne of fruit crops with an area of 0.42 mha.Mango ranked first in terms of total area under fruits crops in Karnataka, with 16.6 lakh hectares, followed by banana (12.9 lakh hectares), grapes (3.65 lakh hectares) and pomegranate (2.84) lakh hectares). The area and production of banana in Karnataka during 2021–22 was 0.13mha and 3.43mt, respectively. (Annon, 2021b).

Chamarajanagar district of Karnataka leads in area and production with 13.65 thousand hectares and 307.52 thousand metric tonnes, respectively. After Chamarajanagar, Uttara Kannada district has the Fourth-highest area and production of bananas in the state of Karnataka. Banana cultivation is done on a commercial scale in the Uttara Kannada district of Karnataka owing to 8,939 hectares, 2,13,244 mt, 23.85 t/ha of area, production and productivity during 2021- 22.(DES, 2021). The present study was undertaken to study economic efficiency of banana production in Uttara Kannada district of Karnataka.

2. METHODOLOGY

2.1. Sampling Design

Adopted multistage purposive sampling design, purposively selected Uttara Kannada district for the study in first stage because Uttara Kannada was fourth largest producer of banana in Karnataka. (DES, 2021). In the second stage focuses on Sirsi and Siddapur taluks purposively because of these two taluks are predominately banana-growing taluks were selected based on the highest area. In the third phase, four villages were selected from each taluk based on the convenience of the researcher. In the fourth phase, ten sample farmers from each village were selected randomly and the total sample size constituted 80 farmers.

The data for the study were collected from the respondents by personal interview method by using pre-tested schedule. Data were based on the entire operations in establishing and maintaining the banana plantation and the consequent cost and returns. Data pertaining to constraints in production and marketing were collected through opinion survey of the respective respondents with help of structured pre-tested schedule.

During the calculation of the cost of cultivating banana, we categorized the expenses into two crops: Crop I and Crop II, based on the age of the banana plants. Crop I (main crop) encompass all the costs incurred up to the first harvest, which occurs between 10 to 12 months after planting. On the other hand, Crop II (ratoon crop) includes all the costs incurred up to the second harvest, which takes place between 8 to 10 months after the first harvest. The cost calculation is done separately for each Crop I and Crop II to track the expenses accurately.

2.2. Analytical tools and techniques employed:

2.2.1. Cob-Douglas's production function

In order to analyse the resource use efficiency of banana Cobb-Douglas production function was employed.In statistics, the Cobb-Douglas functional form of production functions is widely used to represent the relationship of output to inputs. It was proposed by Knut Wick Sell (1851 - 1926), and tested against statistical evidence by Charles Cobb and Paul Douglas in 1928.

$$Y = AX_1^{b1}\, X_2^{b2}\, X_3^{b3} X_4^{b4} X_5^{b5}\, X_6^{b6}\, X_7^{b7} \ldots U$$

Y = Yield (t/acre)

A = Intercept

X_1 = suckers (No./acre)

X_2 =FYM (t/acre)

X_3 =Fertilizer (kg/acre)

X_4 = Human labour (Mandays/acre)

X_5= Machine labour (hrs /acre)

X_6 = Plant protection chemicals (l/acre)

X_7 = Propping material (Rs. /acre)

U = Error term

b_i = (i = 1 to 7) regression coefficient of factor inputs.

The function was translated into a linear form by making a logarithmic transformation on all the variables as follows.

$$\text{Log } Y = \log A + b1 \log X_1 + b2 \log X_2 + b3 \log X_3 + b4 \log X_4 + b5 \log X_5 + b6 \log X_6 + b7 \log X_7 + \log U.$$

The results of the analysis were subjected to a test by the coefficient of multiple determination and the relevant t-test was carried out. The regression coefficients (b_i) were tested for their significance usingt-test at the chosen level of significance.

2.2.2. Marginal valve Product (MVP)

The estimated coefficients were used to compute the MVP. We can assess the relative importance of factors of production by studying the marginal value product. Marginal Value Product of X_i, *i.e.,* for the i^{th} input is estimated by the following formula,

$$MVP = b_i \times ((GM(Y)) / (GM(Xi)) \times P_y \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (5)$$

GM (Y) and GM (X_i) represent the geometric means of output and input, respectively, b_i is the regression coefficient of i^{th} input and P_y is price of output per ton.

2.2.3. Allocative efficiency

The Allocative efficiency (AE) is the ratio between MVP and MFC of resources calculated using the following relationship.

$$r = MVP/MFC \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (6)$$

Where,

EE = Economic efficiency/allocative efficiency

MVP = Marginal value product of variable inputs (₹)

MFC = Marginal factor cost (price per unit of inputs) (₹)

Based on economic theory, a firm maximizes profits in input use when the ratio of its marginal value product to its marginal cost is unity. Thus, if

r <1: indicates excess use or overuse indicating the need to reduce its use.

r >1: indicates the resource is underutilized hence increasing its present use levelwould increase profit.

r = 1: shows the optimum utilization of resource and point of profit maximization.

Marginal factor cost was also worked out by taking the unit cost of input to produce an additional unit of output. Resource use efficiency was studied by comparing the marginal value products of each resource with corresponding factor costs at which each resource could be procured. Wherever the ratio of MVP to MFC was found to be more, then the resource was assumed to be advantageously used.

2.2.4. Data Envelopment Analysis

Technical efficiency (TE) refers to the ability of a farm to produce the maximum feasible output from a given bundle of inputs, or the minimum feasible amounts of inputs to produce a given level of output. Allocative efficiency (AE) refers to the ability of a technically efficient farm to use inputs in proportions that minimize production costs given input prices. Allocative efficiency is calculated as the ratio of the minimum costs required by the farm to produce a given level of outputs and the actual costs of the farm adjusted for TE. Economic efficiency (EE) is the product of TE and AE. Thus, a farm is economically efficient if it is both technically and allocative efficient. The popular method of estimating the maximum possible output has been the data envelopment analysis(DEA) advocated by Charnes *et al* (1978). The details are given below.

Data Envelopment Analysis: The DEA method is a frontier method that does not require the specification of a functional form or a distributional form, and can accommodate scale issues. DEA was applied by using both classic models CRS (constant returns to scale) with input orientation, in which one seeks input minimization to obtain a particular product level. Under the assumption of constant returns to scale, the linear programming models for measuring the efficiency of farms are (Coelli*et al.* 1998).

Estimation of technical efficiency

$$\text{Min } \theta\ \lambda\ \theta$$
$$\text{Subject to } \ -y_i + Y_\lambda \geq 0$$
$$\theta X_i - X_\lambda \geq 0$$
$$\lambda \geq 0$$

Where,

y_i is a vector (m×1) of output of the i^{th} Producing Farms (TPF)

xi is a vector (k×1) of inputs of the i^{th}TPF

Y is an output matrix (n×m) for n TPFs

X is an input matrix (n× k) for n TPFs

θ is the efficiency score, a scalar whose value will be the efficiency measure for the i^{th}TPF.

If θ=1, TPF (Total productivity factor) will be efficient; otherwise, it will be inefficient.

λ is a vector (*nx1*) whose values are calculated to obtain the optimum solution. For an inefficient TPF, the λ values will be the weights used in the linear combination of other, efficient, TPFs which influence the projection of the inefficient TPF on the calculated frontier.

2.2.5. Estimation of Allocative efficiency and cost efficiency (economic efficiency)

If one has price information and is willing to consider a behavioural objective, such as cost minimization or revenue maximization, then one can measure both technical and allocative efficiencies. One would run the following cost minimization DEA for estimation of cost efficiency (or economic efficiency) as follows:

$$\text{Min}_{\lambda,\ Xi^*}\ W_i X_i^*,$$
$$\text{Subject to } \ -y_i + Y_\lambda \geq 0,$$
$$X_i^* - X_\lambda \geq 0,$$
$$N_1\ \lambda \geq 1$$
$$\lambda \geq 0,$$

Where,

W_i is a vector of input prices for the i^{th} Total Productivity Factor (TPF),

X_i is the cost-minimizing vector of input quantities for the i^{th} TPF (which is calculated by the LP),

Given the input prices Wi and the output levels Yi. The total cost efficiency (CE) or economic efficiency of the i^{th} TPF would be calculated as

$$\mathbf{CE = W_iX_i^* / W_iX_i} \ldots\ldots\ldots\ldots..(7)$$

i.e., the ratio of minimum cost to observed cost. One can then use equation 3 to calculate the allocative efficiency residually as

$$\mathbf{AE= CE/TE} \ldots\ldots\ldots\ldots\ldots(8)$$

Note: This procedure will include any slacks into the allocative efficiency measure. This is often justified on the ground that slack reflects an appropriate input mix.

It is to state here that all the models presented above should be solved *n* times*, i.e*., the model is solved for each TPF in the sample. The input variables are human labour (Man-days), bullock labour (Pair days), machine labour (hours), suckers (No.), fertilizers (Kg) FYM (tons), and PPC (liters). These are inputs used to analyze technical efficiency. Similar inputs with their cost were considered to check the allocative and cost efficiency using data envelopment analysis. The models were solved using the DEAP version 2.1 taking an input orientation to obtain the efficiency levels.

2.2.6. Garrett's ranking technique

The constraints faced by the sample farmer with respect to banana production and marketing were ranked using Garrett's ranking technique. The order of the merit given by the respondents was changed into ranks using the formula given below.

$$\mathbf{Per\ cent\ position = 100\ (R_{ij}-0.50)/N_j} \ldots\ldots\ldots\ldots..(4)$$

Where,

R_{ij} = Rank given for i^{th} factor by j^{th} respondent

N_j = Number of factors ranked by j^{th} respondent

The percent position of each rank was converted to scores by referring to the table given by Garrett and Woodsworth (1969). Then for each factor, the scores of individual respondents were summed up and divided by the total number of respondents for whom scores were gathered. These mean scores for all the factors were ranked following the decision criterion as the higher the score the more important the factor.

3. Results and discussion

3.1. Production function estimates for banana cultivation

In the present study, Cobb-Douglas production function was used toestimate the parameters for various resources used in banana cultivation. The estimates of production elasticity are presented in Table 1. The outcomes of the production function analysis highlighted that certain coefficient, specifically suckers (0.3710), fertilizers (0.4042) and plant protection chemical (0.2240) were statistically significant at one, and five per cent level of probability, respectively. These results indicated that, one per cent increase in the utilization of suckers, fertilizers and plant protection chemical above their geometric mean levels would correspondingly result in a 0.3710, 0.4042 and 0.2240 per cent increase in the yield of banana. However, the variables of farm yard manure, human labour machine labour and propping material did not exhibit a significant impact on banana production.

The coefficient of multiple determination (R^2) was 0.83, which means that the variables included in the model explained 83 per cent of the variation in banana cultivation. Notably, the sum of elasticities (0.85) was nearly unity, suggesting that banana cultivators operating within a regime of constant returns to scale. In practical terms, this signifies that a one per cent increment in the utilization of all independent variables would result in a proportionate one per cent increase in gross returns.

Table 1: Estimates of the Cobb-Douglas production function in banana cultivation

(Per acre)

Sl. No	Particulars	Units	Parameter	Coefficient	Standard error	t-valve
1	Intercept		Ln A	-0.5878	2.085	-0.282
2	Suckers	No.	X1	0.3710***	0.104	3.565
3	FYM	t	X2	0.0732	0.131	0.559
4	Fertilizers	Kg	X3	0.4042**	0.180	2.249
5	Human labour	man days	X4	-0.1563	0.336	-0.466
6	PPC	l	X5	0.2240**	0.093	-2.446
7	Machine labour	hrs.	X6	0.0398	0.103	0.386
8	Propping material	Rs.	X8	-0.1057	0.328	-0.323
9	Coefficient of multiple determination	R^2		0.83		
10	Returns to scale	∑bi		0.85		
11	Number of samples	N		80		

Note: ***and ** indicates significant at one per cent and five per cent level of probability.

3.2. Allocative efficiency in banana cultivation

Allocative (price) efficiency refers to the ability of the firm to combine inputs and outputs in optimal proportions in the light of prevailing prices and is measured in terms of behavioral goal of the production unit like observed vs optimum cost or observed profit vs optimum profit. The allocative efficiency was estimated using the geometric mean levels of the output as well as inputs. The ratio of marginal value product to marginal factor cost indicated that resource use efficiency.

The estimated MVP/MFC ratio (Table 2) for different inputs used in production *i.e*., suckers (15.89), farm yard manure (1.91), fertilizers (7.21), machine labour (1.75) and propping material (6.66) were positive and greater than zero indicating their underutilization, except for plant protection chemicals (-22.35) and human labour (-1.20), where it was found to be negative indicating their over utilization. This observation indicated an underutilization of resources, suggesting that enhancing their application could lead to increased yields. Conversely, the efficiency for FYM was slightly lesser than unity, suggesting the overutilization of these resources.These findings are in line with those of Sakamma*et al*., 2018; Samarpitha*et al*., 2017, who found that most resources were underutilized in banana production in Karnataka.

Table 2: Resource use efficiency in banana cultivation

(Per acre)

Sl. No.	Particulars	Units	GM	MVP	MFC	AE
1	Suckers	No.	994.41	95.34	6	15.89
2	FYM	t	6.54	2858.43	1500	1.91
3	Fertilizer	kg	578.79	178.52	24.75	7.21
4	Human labour	man days	66.81	-598.11	500	-1.20
5	PPC	l	4.62	-12939.60	900	-14.38
6	Machine labour	hrs.	6.47	1573.63	900	1.75
7	Propping material	Rs.	4060.55	6.66	1	6.66

Note: GM: Geometric mean, MVP: Marginal Value Product, MFC: Marginal Factor Cost and AE/EE: Allocative Efficiency = MVP/MFC

3.3. Technical and Allocative Efficiency of Banana Farmers

The measurement of the production efficiency in agricultural production is very important since it gives useful information for making decisions, resource allocations, and for formulating agricultural policies and institutional improvement. Identifying determinants of efficiency levels is a major task in efficiency analysis. So, the objectives of this research is to estimate the individual banana farmer’s technical efficiency in Uttara Kannada district by Data envelopment analysis (DEA) by using the DEAP version 2.1 taking an input orientation to obtain the efficiency levels.

The frequency distribution of farm-specific technical, allocative and economic efficiency of banana farmers in crop I and crop IIare presented in Table 3.The mean technical efficiency in banana in crop I is 70.30, allocative efficiency (69.00), economic efficiency is (48.10). Thus, banana crop I scores impressively in both technical and allocative efficiency. In crop I, (10.00) percent of farmers operate their farms at less than (50.00) percent of technical efficiency (TE) and allocative efficiency (AE) levels and (60.00) percent operate at less than economic efficiency (EE) levels. About 5.00 per cent of farmers work at levels of technical and allocative efficiency between 90 and 100. Nine farmers operate under in the range of 100 per cent technical efficiency level.

The mean technical, allocative and economic efficiencies for crop II (the ratoon crop) were 49.40, 89.20 and 44.00, respectively. 48 farmers operate their farms at less than 50 percent of TE levels and 68.75 percent operate at less than EE levels. Thus, findings of the present study are in line with those reported by (Vinayagamoorthi*et al., 2*019; Hamsa *et al*., 2017).

Table 3: Technical and Allocative Efficiency of Banana Farmers

Sl. No.	Efficiencies	Crop I(Main crop)			Crop II (Ratoon crop)		
		TE	AE	EE	TE	AE	EE
1	<50	8 (10.00)	8 (10.00)	48 (60.00)	48 (60.00)	1 (1.25)	55 (68.75)
2	50-60	16 (20.00)	11 (13.75)	20 (25.00)	14 (17.50)	1 (1.25)	13 (16.25)
3	60-70	17 (21.25)	22 (27.50)	7 (8.75)	7 (8.75)	2 (2.50)	7 (8.75)
4	70-80	18 (22.50)	20 (25.00)	0 (0.00)	6 (7.5)	8 (10.00)	3 (3.75)
5	80-90	8 (10.00)	14 (17.50)	2 (2.50)	3 (3.75)	24 (30.00)	0 (0.00)
6	90-100	4 (5.00)	4 (5.00)	2 (2.50)	0 (0.00)	43 (53.75)	1 (1.25)
7	100	9 (11.25)	1 (1.25)	1 (1.25)	2 (2.50)	1 (1.25)	1 (1.25)
	Total	80 (100)	80 (100)	80 (100)	80 (100)	80 (100)	80 (100)
	Mean	**70.30**	**69.00**	**48.10**	**49.40**	**89.20**	**44.00**

Note: *Figures in parenthesis are percentages TE: Technical Efficiency, AE: Allocative Efficiency
CE: Cost / Economic Efficiency. Inputs Considered = Human labour, Bullock labour, Machine labour, Sucker, Fertilizers, Farm Yard Manure, Plant Protection Chemicals.

3.4. Constraints faced by farmers in Production and Marketing of Banana

Garrett scoring technique was used to analyze constraints in marketing faced by farmers and traders in the study area. The results are presented below.

An informal discussion with the sample farmers revealed that as such there are problems in production and marketing in banana. The goal was to understand the challenges they are dealing with in production and marketing. The outcomes of this survey were summarized in the Table 4. The primary concern raised by most banana growers in the surveyed region pertains to scarcity of labour during peak periods. This issue held the highest significance,receiving a prominent Garrett score of 75.87. Lack of quality planting material is a second importantproblem faced by farmers with a Garret score of 63.72. Several challenges contribute to this scenario, including incidenceofhighpestanddiseases, the high cost of plant protection chemicals, non- availability of credit on time, irregular electricity supply, lack of technical knowledge and tree falls due to wind with a garret score of 60.35, 55.2, 44.8, 34.85, 34.47 and 27.72, respectively.

The most significant challenge encountered by farmers in banana marketing, with a Garret score of 75.20, is the price fluctuations. Farmers reported that many factors contribute to the significant price volatility of bananas. These included the perishable nature of the produce, an unexpected influx of many fruits into the market at once, unfavorable weather, the influence of market intermediaries and perhaps even a lack of government involvement in the market and farmers' inability to adjust production to meet market demands. Lack of storage facility is the second most severe constraint, with a Garret Score of 67.87. The absence of adequate storage facilities can have a significant negative impact on marketing operations, potentially leading to product spoilage or quality deterioration. Long distant market is the third most constraint ranked by sample farmers with a Garret Score of 53.87. Many banana farmers are located in remote areas, which means that they have to transport their produce long distances to market. This can be expensive and time-consuming and it can also lead to spoilage. The absence of timely market information at the farm/village level was another significant issue in the research area. These constraints received a Garrett score of 43.76 by the farmers in the research area. Other constraints faced by farmers included high commission charges (51.47), untimely payment of sale of proceeds (35.25), lack of grading quality (36.12), and high transportation charge (33.44). These constraints collectively present significant challenges for banana farmers. These results were in similar line with the study conducted by sharma*et al.* (2020).

Table 4: Intricacies associated with the production and marketing of banana

Sl. No.	**Production Constraints**	**Garret Score**	**Ranks**
1	Scarcity of labour during peak period	75.87	I
2	Non-availability of quality planting material	63.72	II
3	High incidence of pest and disease	60.35	III
4	High cost of plant protection chemicals	55.20	IV
5	Non-Availability of credit	44.80	V
6	Inadequate power supply	34.85	VI
7	Lack of technical knowledge	34.47	VII
8	Tree falls due to wind	27.72	VIII
Sl. No	**Marketing Constraints**	**Garret Score**	**Ranks**

1	Price fluctuations	75.20	I
2	Lack of storage facility	67.87	II
3	Long distant market	53.87	III
4	Non-availability of timely market information	43.76	IV
5	High commission charges	51.47	V
6	Untimely payment after sale	35.25	VI
7	Lack of grading quality	36.12	VII
8	High transportation charge	33.44	VIII

4. CONCLUSION

From the study, it research utilizes the Cobb-Douglas production function to scrutinize resource utilization and employs Data Envelopment Analysis (DEA) to assess efficiency levels. Insights from the production function underscore the substantial impact of factors such as suckers, fertilizers, and plant protection chemicals on banana yield. Allocative efficiency becomes apparent through positive MVP/MFC ratios for inputs like suckers, manure, fertilizers, machine labour, and propping material, signifying underutilization. Conversely, plant protection chemicals and human labour display negative ratios, indicating potential overutilization. The non-unity ratio of MVP to MFC suggests the prospect of reallocating expenditures among various resources. DEA outcomes reveal a mean technical efficiency of 70.30 for Banana, Crop I, and 49.40 for Crop II, emphasizing areas for improvement, especially in Crop II. These findings underscore the necessity for enhanced resource allocation to enhance efficiency.Primary production constraints include labor scarcity, inadequate planting material, and pest challenges, while marketing obstacles encompass price fluctuations, constrained storage, and distant markets. Effectively addressing these challenges is pivotal for augmenting efficiency and profitability in banana farming. There is a need to educate farmers regarding the efficient and sustainable use of the scarce resources which helps in increasing the crop productivity there by returns. Extension activities are needed to educate the farmers regarding the optimum and timely use of scarce resources. Optimizing the use of resources reduces cost on one hand and increases returns on the other hand and sustainable production process is possible if the resources are used optimally**.**

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