

Resource Use Efficiency of Cut Roses Farming in Karnataka

ABSTRACT:

The flowers represent the most sensitive, delicate and loving feelings that our words cannot portray. In India, roses are an essential and popular flower. It is an ornamental herb planted for its visually appealing and long-lasting blossoms. India has ample sunshine, plenty of land and the availability of skilled labour, all of which contribute to our ability to cultivate flowers in various locations. As a result, a study was conducted to determine the resource use efficiency of rose farming in Karnataka using the Cobb-Douglas function. Results showed that land, FYM, fertilizer and labour contributed positively to flower production, while farmers followed closer spacing and used more PPC. FYM and human labour were the most significantly influencing variables in protected rose cultivation. However, PPC was negative but non-significant.

The ratio of MVP to MFC (Mean Value to Cost) showed that FYM, fertilizers and human labour were under-utilized in open-field cultivation, suggesting potential for higher use. In protected conditions, there is a scope to increase FYM, fertilizers and human labour to optimize returns from rose production. However, land use, planting materials and plant protection chemicals should be reduced to optimize returns in protected conditions. Reorganizing expenditure among resources based on MVP to MFC ratios is necessary to optimize rose production. This includes reducing the use of PPC and following wider spacing in open-field cultivation. India's rose farming industry can benefit from increased efficiency and resource utilization.

Keywords: ~~R~~ose, ~~R~~esources, ~~L~~abour, MVP and MFC.

1. INTRODUCTION

India is an agricultural country with diverse soil and climatic conditions favourable for growing various crops. Climatic conditions are favourable not only for growing food crops but also for growing flower crops. These crops play an important role in improving farmers' livelihood security and nutritional security.

Over the years, horticulture has become an essential part of agriculture. The horticulture sector includes fruits, vegetables, ornamental plants, flowers, spices, plantations, medicinal

plants and aromatic plants. This is the fastest-growing agricultural sector today because it provides many options for farmers to diversify their crops and offers great opportunities to support many innovative agricultural industries and job opportunities. As time passes, horticulture has become one of the potential agricultural businesses to accelerate the growth of our economy.

Among the various horticultural professions, floriculture is important because of its enormous expandability. Nowadays, flowering plants are no longer just for window gardens but also play an important role in decorating homes and offices. Flowers improve the quality of life and influence human emotions more than words or other gifts. Near major cities, the areas have become major flower-growing centres. These small farmers near major cities focus on growing large quantities of flowers to largely meet local demand.

On the other hand, growing cut flowers has become an important industry, mainly meeting the needs of foreign markets while also meeting the needs of businesses, hotels and restaurants. There is a transformation noticeable in our floriculture sector, mainly due to the entry of cut flower companies to meet the growing demand for floriculture products in developed countries. The government of India has identified floriculture as a niche industry with great export potential and is providing various incentives for setting up floriculture units, including through export-oriented units (EOU). Most flowers are grown in open fields; among them, they are the most widely grown flowers. This is also among the most chosen cut flowers in the international market.

Rose, “Queen of Flowers”, symbolises elegance, purity, love, friendship and sympathy. It belongs to the genus *Rosa* and family Rosaceae. This is a perennial woody plant with hundreds of species and thousands of cultivars, most originating from Asia. The flowers vary in size, shape and attractive colour and are widely grown for beauty and fragrance. They have acquired cultural significance and become integral to almost every religious or spiritual ceremony in India.

They are widely used in commercial perfumery and pharmaceuticals and also as commercial cut flowers. Some species are used as hedges, ornamentals and slope stabilisers. The fragrant flowers are popular for worship, making garlands and preparing rose oil, rose water, gel hand, rose essential oil, rose otto, etc. Rose oil is one of the oldest and most valuable perfume ingredients that give the perfume its characteristic scent. Rosehips (rosehip berries) are sometimes made into jams, jellies, marmalades and soups or tea because they are high in vitamin C. The flowers also prepare rose water, herbal tea, rose syrup, cream, kulfi, etc.

Roses are divided into three main types: roses, old garden roses and modern roses. A protected condition can be defined as a growing condition in which plants are grown in an inflated structure covered with transparent or opaque material in which the growing environment is completely controlled or partial. It protects plants from adverse climatic conditions such as wind, cold, rain, excessive radiation, extreme temperatures, insects, diseases, etc., by constructing green houses (Glass houses /screenhouse/polyethenehouse,etc.).

Globally, the floriculture trade is worth \$17 billion, grow in at 10 to 15% annually and is expected to reach \$25 billion by 2025 (Chawla *et al.*, 2016). The major flower-producing countries in the global market are the Netherlands (52%), Colombia (15%), Ecuador, Kenya, Belgium, Ethiopia, etc. Furthermore, flower exports have increased phenomenally from USD 8 billion in 2006 to USD 14 billion in 2021. India exported 22,086 tonnes of flowers to the world worth 549 crore rupees during 2021-22. In India, the floriculture industry includes fresh flower trade, production and sale of nursery and potted plants, seed and bulb production, micropropagation, essential oil extraction, etc.

The total area devoted to floriculture in India is the second largest in the world after China. The total flower-growing area in 2021-2022 was 309.70 thousand hectares; bulk flower production was estimated at 1,653 tons, and cut flower production was 593 tons (Anonymous, 2021).

Fresh and dried cut flowers dominate India's floriculture exports. Roses, gerberas, gladiolus, carnations, chrysanthemums, orchids, tulips, anthuriums and lilies are important flowers in the international cut flower trade. Commercial floriculture in India is now considered a fast-growing industry, especially under protected conditions. The country exported 22,000 tonnes of floriculture products worth Rs 554 crore in 2021-22 (Anonymous, 2022).

The main export destinations are the United States, Germany, the United Kingdom, the Netherlands and the United Arab Emirates. The area under rose cultivation in India remained almost constant between 2011-12 and 2021-22, but the production of bulk and cut roses significantly increased.

In 2021-2022, the rose growing area was about 30,003 hectares. The total output of loose flowers is about 1,35,190 tons and cut flowers are about 1,96,760 tons. Uttar Pradesh has the highest rose production area, with about 11,090 hectares. The highest bulk flower production is in Gujarat, with 41,700 tons and the highest cut rose production is in West Bengal (65,320 tons), followed by Karnataka (56,120 tons) on an area of about 28,600 hectares (Anonymous, 2022).

Karnataka ranks second in flower production after Tamil Nadu, accounting for 19 per cent of India's flower-growing market share. Karnataka's area under flower cultivation is about 32.92 thousand hectares; Loose flower output is 221. Fifty-six thousand tons and cut flower output is 59. Thirty-six thousand tons (Anonymous, 2017). Rose acreage and production in Karnataka has remained almost the same recently. The area under rose cultivation in Karnataka in 2016-17 was 2.80 lakh hectares; Bulk flower production was 0.60 thousand tons and cut flower production was twelve thousand tons (Indiastat).

The major districts contributing to rose production in Karnataka are Rural Bangalore, Urban Bengaluru, Kolar, Chikkaballapura and Haveri. These areas have very good conditions suitable for growing cut flowers because, these locations do not need a cooling or heating system. Accordingly, the maximum number of export-oriented flower-growing establishments has been established in these localities. Floriculture is booming in India, but its sustainable growth faces many challenges.

For any country wishing to expand its export-oriented agricultural base, the ornamental horticulture industry will become a boon and one of the most attractive and viable options. Roses are the most valuable cut flower in foreign markets. Therefore, this study attempts to estimate the comparative economic aspects of growing roses in the field and under protected conditions using farm-level data. A scientific estimate of the costs and yields of rose cultivation will be valuable information for all stakeholders and policy makers. It will help our country take a strong position in the global floriculture platform.

2. OBJECTIVES

1. To estimate the resource use efficiency under both the methods of cultivation.

Hypotheses.

1. The efficiency of resources used in the cultivation of roses under protected cultivation is higher than in open-field cultivation.

3.METHODOLOGY:

3.1 The sampling technique and procedure adopted

The study was undertaken mainly to compare every aspect of rose cultivation under protected and open-field conditions. Accordingly, Bengaluru rural and Chikkaballapura districts of Karnataka were selected. In the next stage, two taluks were chosen from each study district.

viz., Devanahalli and Hosakote from Bengaluru rural district and Chikkaballapura and Shidlagatta taluks from Chikkaballapura district based on relatively higher acreage under rose cultivation than other taluks in the respective districts. Finally, twenty farmers were selected randomly from each of the selected taluk (10 growing rose under protected conditions and 10 growing roses in open-field conditions). Thus, 40 farmers growing roses under protected conditions and 40 growing roses under open field conditions were selected for primary data collection on establishing and cultivating rose gardens.

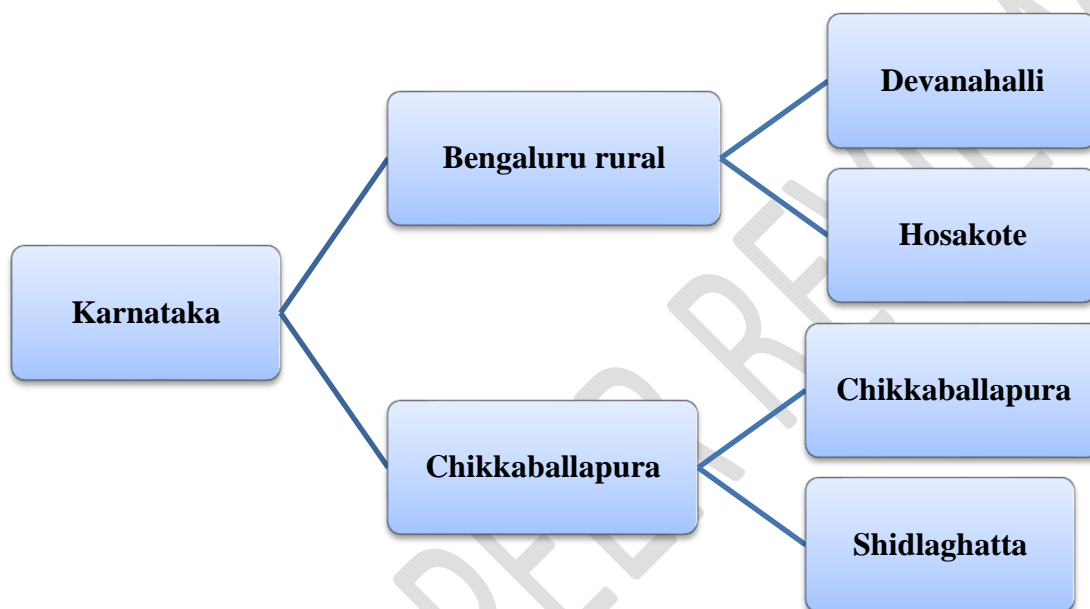


Fig 1: Sampling design

Note: 10 samples are collected from both the conditions, i.e. Open and Protected Cultivation

3.2 Nature and sources of data

Primary data on roses cultivated under protected and open-field conditions

The needed primary data on the cost of establishing the rose garden and the cost involved in cultivation were collected by pre-tested schedules and later used in Cobb-Douglas's production function to know the resource use efficiency of rose farming in the study area.

3.3 Analytical tools and techniques used

3.3.1 Resource use efficiency

The efficiency of resources used in Rose cultivation in both cultivation methods was estimated using the Cobb-Douglas type of production function. Being a homogenous function, it

provided a scale factor, which enables the direct measurement of the returns to scale. The estimated regression coefficients represent the production elasticity.

The form of the Cobb-Douglas production function used in the present study was as follows.

$$Y = a X_1^{b_1} X_2^{b_2} X_3^{b_3} X_4^{b_4} X_5^{b_5} X_6^{b_6} e^u$$

This production function was converted into log-linear form and the coefficients were estimated by using the Ordinary Least Square Technique (OLS) technique as given below,

$$\log Y = \log a + b_1 \log X_1 + b_2 \log X_2 + b_3 \log X_3 + b_4 \log X_4 + b_5 \log X_5 + b_6 \log X_6 + u \log e$$

Where,

Y = Flower production (Kg [loose flowers] or Bunches [cut-flowers])

a = Intercept

X₁ = Land area (acres)

X₂ = Planting materials used (numbers)

X₃ = Quantity of FYM applied (tonnes)

X₄ = Quantity of Fertilisers applied (Kgs)

X₅ = Quantity of plant protection chemicals applied (Litres)

X₆ = labour used (Man days)

b_i's = Output elasticity of respective factor inputs, i = 1, 2, 3, 4, 5, 6

The regression coefficients (bis) were tested using a test at the chosen level of significance.

3.3.2 Allocative efficiency:

Given the technology, allocative efficiency exists when resources are allocated within the farm according to market prices. It implies the proper level of input use in production. Its marginal value products are computed to decide whether a particular input is used rationally or irrationally. If the marginal value product of an input covers its acquisition cost, it is said to be used efficiently.

The Marginal Value Product (MVP) was calculated at the geometric mean levels of variables using the formula,

$$MVP = P_y \times \text{Marginal Physical Product (MPP)}$$

Where P_y = Price of per unit Output

$$MPP = \text{Regression coefficient of } X_i \left(\frac{\text{Geometric mean of } Y_i}{\text{Geometric mean of } X_i} \right)$$

The value of the MVP is obtained by multiplying the MPP by the price of the unit output and comparing it with its Marginal Factor Cost (MFC). A ratio of the value of MVP to MFC greater than unity implied that the resources were advantageously employed and that there was scope to use more of them than the existing use. A ratio of less than one indicates an overuse of resources and the need to reduce their usage.

The criterion for determining the optimality of resource use was,

$MVP/MFC > 1$ underutilization of resources

$MVP/MFC = 1$ optimal use of resources

$MVP/MFC < 1$ excess use of resources

4.RESULTS AND DISCUSSION

4.1 Resource use efficiency in rose cultivation under both methods of cultivation

To examine important factors determining and its relationship in rose production, the Cobb-Douglas production function was fitted to the sample of pooled data of all three category farms under open and protected cultivation. Since, the sample size and data were insufficient to fit production function for different size groups of farms to know the factors governing rose yield.

The estimates of rose production function for both situations are presented in Table 1. The coefficient of multiple determination (R^2) values was found to be 0.84 and 0.89 for open-field and protected conditions, respectively. This implied that the variables included in the production function explained about 84 per cent and 89 per cent variation in the rose production under open-field and protected conditions, respectively. The models fitted to the data were found to be a good fit, as revealed by the significant 'F' value. The summation of regression coefficients obtained indicated that slightly increasing returns to scale were found on the farms cultivating rose under open fields, *i.e.*, for each incremental use of all inputs simultaneously, farmers would get more than one unit of output. While almost constant returns to scale were observed under protected cultivation.

The regression coefficients for land, planting materials, FYM, fertilizer, PPC and labour were 0.0958, -0.4701, 0.6695, 0.3685, -0.0085 and 0.5682 on farms cultivating rose under open-field conditions. Meanwhile, the respective regression coefficients for rose cultivated under protected conditions were 0.0077, 0.0005, 0.3275, 0.0834, -0.0407 and 0.6547. In both methods

of cultivation, FYM and human labour inputs were the most significantly contributing inputs, and the coefficient of these inputs was statistically significant. The production coefficient for PPC was found to be negative but non-significant. In addition to PPC, the planting materials were also found to be negative but failed to exert any significant influence on rose yield as the coefficient was non-significant in open-field cultivation. One per cent increase in planting materials and PPC from the existing level would decrease gross returns by 0.470 per cent and 0.008 per cent, respectively.

Table 1: Estimates of Cobb-Douglas production function for rose cultivation under open-field and protected conditions (Per farm)

Sl. No.	Particulars	Parameter	Units	Open-field Cultivation	t-value	Protected cultivation	t-value
1.	Number of observations	N	No.	40		40	
2.	Intercept	Ln A		4.4590	1.0202	3.9709	0.4314
3.	Land	X ₁	Acres	0.0958	0.2410	0.0077	0.0089
4.	Planting materials	X ₂	No.	-0.4701 ^{NS}	-1.6032	0.0005	0.0007
5.	FYM	X ₃	Tonnes	0.6695*	2.1201	0.3275*	2.0928
6.	Expenditure on fertilizers	X ₄	Rupees	0.3685	1.2685	0.0834	0.2075
7.	Expenditure on PPC	X ₅	Rupees	-0.0085 ^{NS}	-0.0639	-0.0407 ^{NS}	-0.3054
8.	Human labour	X ₆	Person-days	0.5682*	2.5534	0.6547**	2.7967
9.	Coefficient of multiple determination	R ²		0.84		0.89	
10.	Adjusted R ²	\bar{R}^2		0.81		0.87	
11.	F value	F		30.27**		47.30**	
12.	Returns to scale	$\sum b_i$		1.22		1.03	

Note: ** and * indicate significant at one and five per cent probability levels, respectively, and

NS – non-significant

In the same way, if land, planting materials, FYM, fertilizers and labour under protected cultivation increase by one per cent, gross returns will increase by 0.0077, 0.0005, 0.3275, 0.0834, and 0.6547 per cent, respectively. On the other hand, with increased use of PPC by one per cent, yield decreases by 0.04 per cent.

4.2 Allocative efficiency of resources:

The efficiency of different resources used in rose production was judged with the help of the MVP/MFC ratio and the results of allocative efficiency are presented in Table 2. It is evident

from the table that the ratio of MVP to MFC was found to be more than unity for FYM, fertilisers and human labour, indicating that all these resources were under-utilized and there is scope for optimising returns from the rose by increasing the use of these resources. The ratio of MVP to MFC was found to be negative in the case of planting materials and plant protection chemicals, indicating these inputs were over-utilised on the farmer's field and these inputs need to be reduced to optimise returns from rose cultivation. In other words, farmers followed closer spacing of seedlings than the recommended rate. Hence, the use of planting materials should be reduced to get higher returns.

Table 2: Resource use efficiency in Rose cultivation under open-field conditions

Particulars	Regression coefficients	Geometric mean	MPP	MVP	MFC	MVP/MFC
Yield		31951.21				
Land	0.0958	0.98	3114.74	112161.82	26916.67	4.17
Planting materials	-0.4701	2040.31	-7.36	-265.09	14.00	-18.93
FYM	0.6695	13.28	1611.12	58016.59	3581.55	16.20
Fertilisers	0.3685	145345.86	0.08	2.92	1.00	2.92
PPC	-0.0085	144480.02	-0.002	-0.07	1.00	-0.07
Human labour	0.5682	461.85	39.31	1415.63	322.33	4.39

The allocative efficiency of various inputs used in rose cultivation under protected conditions is presented in Table 3. It can be noted from the table that the ratio of MVP to MFC was found to be more than unity for FYM (10.65), fertilizers (1.77) and human labour (4.46). It was found to be 0.74 for land, 0.01 for planting materials and -0.97 for plant protection chemicals. This implies that there is scope to increase FYM, fertilisers and human labour to optimise returns from rose production. However, the use of land, planting materials and plant protection chemicals should be reduced to optimise returns in the case of protected conditions, as revealed by the ratio, which is less than unity.

Table 3: Resource use efficiency in Rose cultivation under protected condition

Particulars	Regression coefficients	Geometric mean	MPP	MVP	MFC	MVP /MFC
Yield		26028.03				
Land	0.0160	0.71	283.627	26888.55	36206.67	0.74
Planting	0.0070	21431.76	0.001	0.06	7.54	0.01

materials						
FYM	0.5967	21.15	402.980	38203.46	3587.50	10.65
Fertilisers	0.1495	116567.42	0.019	1.77	1.00	1.77
PPC	-0.2522	103891.90	-0.010	-0.97	1.00	-0.97
Human labour	0.5756	1292.59	13.183	1249.80	280.00	4.46

5. CONCLUSION:

A comparison of both cultivation systems revealed that the production function analysis was carried out to study the influence of various factors on gross returns on rose farming. FYM and human labour were most significant contributing inputs for both cultivation methods.. Plant Protection Chemical (PPC) and the planting materials were also found to be negative but failed to exert any significant influence on rose yield as in open-field cultivation. So, it can be opined that farmers in the study area can increase the quantity of inputs that are influenced positively to increase the yield. This can be achieved by introducing modern technology in rose farming, **establishing rose processing units** to handle excess production during peak harvest season due to limited demand for cut flowers, minimizing wide price fluctuations and helping farmers realize better returns with due attention to quality flower production. Finally, due to indiscriminate use of PPCs, pests developed resistance mechanism to existing chemicals. Therefore, attention needs to be paid to developing new chemicals to manage pest and disease incidence and educate farmers about the judicious use of these chemicals, which also help to protect the environment and reduce the cost of cultivation by strengthening existing extension services.

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