Comparative Analysis of Open v/s Protected Cut Flower Rose Farming in Karnataka

Abstract:

In India, the floriculture industry is the second largest in the world, trailing only China. The total area under flower crops during 2023-24 was 285,000 hectares; production of loose flowers was estimated to be 21.52 lakh metric tons, and cut-flowers were 645 metric tons. Both fresh and dried cut flowers lead floriculture exports from India. (NHB, 2023-24). Among the plethora of flowers, the rose stands out as a plant with hundreds of species and thousands of cultivars, many of which are native to Asia. These roses are not only extensively used in commercial perfumery and pharmaceuticals but also as commercial cut flower crops. In the current era of commercialization, rose cultivation has expanded to both protected and open-field methods. Therefore, this study was undertaken to analyze the Comparative Analysis of Open vs. Protected Cut Flower Rose Farming in Karnataka. The study was based on primary data collected from 40 farmers each from both the districts, *namely* Chikkaballapura and Bengaluru Rural.

The data were analysed using cost and return analysis and capital budgeting techniques. The results obtained from this study indicated that the cultivation of roses was profitable under open and protected fields. But comparatively, the rate of return obtained from protected cultivation was higher, i.e., 54 per cent with a 1.58 B:C ratio, than open-field cultivation, i.e., 47 per cent with a 1.21 B:C ratio. Therefore, efforts should be made to educate the traditional rose farmers to adopt a better package of practices followed by protected farms and encourage them by providing cheaper institutional credit and subsidies.

Keywords: Open field cultivation, protected cultivation, Benefit: Cost ratio, Net present value and Internal Rate of Return.

1. INTRODUCTION

As an agricultural country, India is bestowed with diversified soil and climatic conditions favourable for growing large crops. The climatic conditions are favourable not only for cultivating food crops but also for cultivating horticultural crops. These crops play a significant role in improving farmers' livelihood security and nutritional security. (Anonymous, 2016). Over

the years, horticulture has emerged as an essential part of agriculture. The horticulture sector encompasses fruits, vegetables, ornamentals, flowers, spices, plantations, and medicinal and aromatic crops. It is the fastest growing sector within agriculture today because it not only offers a wide range of options to the farmers for crop diversification but also provides ample scope for sustaining many agro-industries, which generate huge employment opportunities. As the days passed, horticulture became one of the potential agricultural enterprises that accelerated the growth of the economy, with the floriculture industry in India showing promising signs of economic potential and robust growth. (Palanisingh V., 2022)

Among different branches of horticulture, floriculture occupies a significant position because of its immense scope for expansion. Today, flower plants are no longer meant for only window gardens but play an essential role in decorating living houses and office establishments. Flowers augment the quality of life and influence human feelings more than words or other gifts. Areas near big cities have emerged as significant flower-growing centres. Small farmers near these major cities concentrate on loose flower cultivation, which satisfies local demand. (Patil S. N., 2022),

On the other hand, growing cut flowers has arisen as an important industry mainly to satisfy the needs of the overseas market and satisfy the demand of corporate houses, hotels, restaurants, etc. There has been a remarkable transformation in our floriculture sector, mainly due to the entry of the corporate sector, which produces cut flowers to meet the amplifying demands for floricultural products in developed countries. The Government of India, recognising the potential of the floriculture industry, has identified it as a niche area with vast export potential and provides numerous incentives for setting up floricultural units, mainly through Export Oriented Units (EOUs), ensuring the stability and growth of the industry. Most of the flowers have been cultivated in open-field conditions; the rose has been the most significantly cultivated. It is also among the most chosen cut flower species internationally. (Agoramoorthy, G., and Hsu, J. M. (2012).

Rose, the "Queen of flowers", symbolises elegant beauty, purity, love, friendship and sympathy. It belongs to the genus *Rosa* and family *Rosaceae*. It is a woody perennial plant with hundreds of species and thousands of cultivars, among which a maximum number of species are

native to Asia. Flowers vary in size, shape, and fascinating colours and are widely grown for beauty and fragrance. They have acquired cultural significance and become integral in almost all of India's religious or spiritual ceremonies, a testament to our rich cultural heritage and deep-rooted traditions. (Mangal Singh, P. K., 2014,) They are extensively used in commercial perfumery, pharmaceuticals and also as commercial cut flower crops. Some species are used for hedging, such as landscape plants and slope stabilisation. Scented flowers are valued for worship, making garlands, and preparing rose oil, rose water, gulkhand, rose attar, rose otto, etc. (Parmar, K.M. et al., 2015)

Rose oil is one of the oldest and most valuable perfumery raw materials, which imparts characteristic fragrance to perfumes. Rose hips (fruits of rose) are occasionally made into jam, jelly, marmalade, and soup or are brewed for tea, as this possesses high vitamin C content. Flowers are also used to prepare rose water, herbal tea, rose syrup, ice cream, kulfi, etc. Roses are divided into three main categories: species roses, old garden roses, and modern roses. (Satpathy *et.al.*, 2015). A protected condition may be defined as a growing condition where plants are grown under an inflated structure covered with a transparent or translucent material in which the ever-increasing environment is wholly or partially controlled. By erecting a greenhouse, a greenhouse protects plants from adverse climatic conditions such as wind, cold, precipitation, excessive radiation, extreme temperature, insect diseases, etc. (Senthilkumar R., 2017).

Globally, the floriculture trade was US$ 17 billion, increasing 10-15 per cent annually and is expected to reach US$ 25 billion by 2025. Central flower-producing countries in the global market are the Netherlands (52%), Columbia (15%), Ecuador, Kenya, Belgium, Ethiopia, etc. Further, the export of flowers has increased phenomenally from 8 billion US dollars in 2006 to 13 billion US dollars in 2015 (Chawla *et al.*, 2016). India has exported 22,086 metric tons of flowers to the world for the worth of 549 crore rupees during 2022-23 (Anonymous, 2023)

In India, the floriculture industry encompasses trading fresh flowers, Production and sale of nursery and potted plants, seed and bulb Production, micro propagation, extraction of essential oils, etc. India's total area under floriculture is the second largest in the world, next to China. The total area under flower crops during 2016-17 was 309.70 thousand hectares; the Production of

loose flowers was estimated to be 1653 metric tons, and of cut flowers was 593 metric tons. Both fresh and dried cut flowers lead to floriculture exports from India. The economic impact of this industry is substantial, with the sector contributing a significant portion of India's GDP and employing a large number of people (Amarnath & Vendhan, 2017).

The essential flower crops occupying a place in the international cut flower trade are diverse, including rose, gerbera, gladiolus, carnation, chrysanthemum, orchids, tulips, anthurium and lilies. India's Commercial floriculture is now viewed as a fast-growing industry, particularly under protected conditions. However, there are several challenges that need to be addressed, such as cost of the protected structure, lack of skilled labour etc. The country exported 22,000 MT of floriculture products worth Rs.547 crore during 2022-23 (Bhosale *et al.*, 2023). Major export destinations were the United States, Germany, the United Kingdom, the Netherlands and the United Arab Emirates.

The area under rose cultivation in India has been almost constant from 2011-12 to 2016-17, but there has been a significant increase in the Production of both loose and cut flower roses. During 2022-23, the area under rose cultivation was around 29,570 ha. The total Production of loose flowers was around 1,13,190 MT, and of cut flowers, it was around 1,88,760 Metric tons. The area under rose production is highest in Uttar Pradesh, *i.e.*, around 10,390 ha; Production of loose flowers was highest in Gujarat, *i.e.*, 39,700 metric tons (MT), and Production of cut flower Roses was highest in West Bengal (63,320 MT) followed by Karnataka (50,120 MT) from an area of around 28,000 ha (Soumya & Harisha, 2024).

Karnataka is second in flower production after Tamil Nadu, which accounts for 19 per cent of the total Indian floriculture market share. The area under flower production in Karnataka is around 32.92 thousand hectares. The Production of loose flowers was 221.56 thousand MT, and the Production of cut flowers was 59.36 thousand MT (*Harisha B.N,2017).* The area and Production of roses in Karnataka have remained almost the same for the last few years. The area under rose cultivation in Karnataka during 2016-17 was 2.80 thousand hectares; the Production of loose flowers was 0.60 thousand MT, and cut flowers was 50.12 thousand MT (Soumya & Harisha, 2024). Central districts contributing to rose production in Karnataka are Bangalore Rural, Bengaluru Urban, Kolar, Chikkaballapura and Haveri (Majumdar & Lahiri, 2012). These

areas have perfect congenial conditions for growing cut flowers, and these locations do not require a cooling or heating system. As a result, a maximum number of export-oriented floriculture units has been established in these locations. (*Patil S. N.,2022)*

Floriculture is blossoming in India, but there are numerous challenges to its sustainable growth. For any country to expand its agricultural base geared toward export, the ornamental crop industry becomes a boon and one of the most exciting and feasible options. Rose is the most preferred species of cut flower in the overseas market. Therefore, the present study attempts to estimate the comparative economics of rose cultivation in open fields and protected conditions using farm-level data. The scientific estimation of costs and returns in rose cultivation would be valuable information for all the stakeholders and policymakers and serve as helpful information in helping our country stand on a solid position in the World Floriculture platform. (*Aditi et.al., 2022)*

2. Objectives

1. To estimate the economics of rose cultivation under the protected and open-field conditions.
2. To analyze the financial feasibility of rose cultivation

Hypotheses

1. B:C ratio is more under protected cultivation than open field cultivation of rose.
2. Protected cultivation technology is capital intensive but profitable.

3. METHODOLOGY:

3.1 Sampling technique and procedure adopted

The study mainly compared every aspect of rose cultivation under protected and open-field conditions. Hence, care was taken while selecting the sample respondents cultivating roses using both methods of cultivation, which are from the same area, to have uniformity for comparison. 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 roses under protected conditions and ten 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 collecting primary data on the establishment and cultivation of rose gardens, constituting 80 sample farmers.

Table 1: Sampling design

Districts	**Taluks**	**Open-field**	**Protected conditions**
Bengaluru rural	Devanahalli	10	10
	Hosakote	10	10
Chikkaballapura	Chikkaballapura	10	10
	Shidlaghatta	10	10
Total		**40**	**40**

Table 2: Classification of sample respondents

Growing conditions	**Categories**	**Area taken into account for classification**	**Number of farmers**
Open-field conditions	Small	< 1 acre	16
	Medium	1 to 2 acre	13
	Large	> 2 acres	11
Protected conditions	Small	< 0.5 acre	20
	Medium	0.5 to 1 acre	13
	Large	> 1 acre	7
Total			**80**

Sample respondents were classified into small, medium, and large farmers based on the area allocated for the rose. Per acre, total cost and returns were calculated for each category of farmers, and the number of farmers in each category was used to calculate the weighted average for all the terms used in accounting for cost and returns. Major rose varieties grown in open-field conditions in the study region are Mirabel, mango yellow, starlight, and charisma. In protected conditions, Tajmahal, first red, corvette, noblesse, avalanche white, gold strike, etc., were major varieties grown (Gamanagatti, 2014).

Selection of marketing middlemen

Five wholesalers, five commission agents and ten retailers involved in marketing roses grown under protected conditions and open field conditions (a total of 20 market middlemen) were chosen randomly in the respective markets for collecting information on the marketing of roses.

3.2 Nature and sources of data

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

The needed primary data on the socio-economic characters of the respondents, the establishment cost of a protected structure, the establishment cost of the rose garden, the cost incurred in cultivation, and the production and marketing practices followed by farmers for roses under both protected and open field conditions were collected by survey method using the pre-tested schedules.

3.3 Analytical tools and techniques used

3.3.1 Establishment cost for cultivation of rose

Rose is a perennial crop with an establishment period of a minimum of six months; the total cost of rose cultivation is divided into the cost incurred during the establishment period and the cost incurred during the bearing period. The total cost incurred to establish a rose garden under open-field conditions was worked out, including all the components such as cost of planting material, expenditure on irrigation structures, manures, fertilizers, plant protection chemicals, human labour and machine labour during the establishment period and rental value of land. In the case of the protected condition and the components mentioned above, subsidized expenditures on constructing a protected structure, cold storage, grading and packing units were also included to arrive at the total establishment cost.

3.3.2 Cost and returns of rose cultivation

Total cost and returns

Summation of cost of all variable inputs and interest on variable cost gives Total Variable Cost (TVC) and summation of cost of all fixed components gives Total Fixed Cost (TFC). Totaling of TFC and TVC gave Total Cost (TC). Gross Returns (GR) was accounted by multiplying total quantity of output (Kg in case loose flowers and bunches in case of cut-flowers) with an average price realized per unit. Difference between GR and TC gives Net returns.

3.3.3Financial feasibility Analysis

The investment analysis based on annual production costs and receipts, given the opportunity cost of credit was made to test whether the investment is worthwhile or not using the following standard measures:

a. Net Present Value (NPV)

Net present value is the difference between the present value of cash inflows and the present value of cash outflows over project time period and was estimated using the following formula;

$$\sum_{t=1}^{n} \boldsymbol{B_t(1+i)^{-1} - C}$$

Where,

B_t = Net cash flow of the project during its economic life time

n = Economic life of the project

i = Discount rate

C = Initial investment

t = Time period

b. Benefit Cost Ratio (BCR)

It is to compare present worth of costs with present worth of benefits and is calculated using formula

$$\frac{\sum_{t=1}^{n} \frac{B_t}{(1+i)^t}}{\sum_{t=1}^{n} \frac{C_t}{(1+i)^t}}$$

Where,

B_t= Incremental net cash flow of the project during the n^{th} year

n = Economic life of the project

i = Discount rate

C = Initial investment

t = Time period

c. Internal rate of returns (IRR)

It is the discount rate at which present values of net cash flows are just equal to zero i.e., NPV=Zero. It was calculated through interpolation method using the following expression.

$$\begin{bmatrix}\text{Internal}\\ \text{Rate}\\ \text{ofreturn}\end{bmatrix} = \begin{bmatrix}\text{Lower}\\ \text{discount}\\ \text{rate}\end{bmatrix} + \begin{bmatrix}\text{Difference}\\ \text{between two}\\ \text{discount rates}\end{bmatrix} \times \begin{bmatrix}\text{Net present worth of cash}\\ \underline{\text{flow at the lower discount rate}}\\ \text{Absolute sum of Net}\\ \text{Present worth of cashflow}\\ \text{at the two discount rates}\end{bmatrix}$$

4. RESULTS AND DISCUSSION

4.1 Costs, returns and investment analysis of rose cultivation under open-field and protected conditions

The success of any enterprise in agriculture can be judged based on the economic benefits of the farmer from that enterprise. In the present era of commercialization, it has become necessary for a farmer to take up agriculture as a commercial and business enterprise. This can only be achieved if the farmer becomes conscious of the cost of production, the net profit gained or loss incurred. Knowing all these things, he tries to minimize the costs and maximize the returns.

4.1.2 Average input use and establishment cost for open-field rose cultivation

Generally, farmers use more quantities of inputs than recommended (10:10:10 g NPK per plant) in rose cultivation as this is input responsive.

Table 3: Inputs use pattern in rose cultivation under open-field condition during establishment period (Per acre)

Sl. No.	Particulars		Units	Small farms	Medium farms	Large farms	Over all farms
1.	Sample size			16	13	11	40
2.	Planting materials		No.	2063.86	1812.90	1951.02	1951.27
3.	FYM		Tonnes	17.80	18.19	15.92	17.41
4.	Oil cakes		Kg	611.45	458.06	416.33	507.94
5.	Fertilizers		Kg	1265.06	922.58	867.35	1044.38
6.	Micronutrients		Kg	18.73	22.26	31.84	23.48
7.	Plant Protection Chemicals (PPC)	Liquid	Litres	36.42	29.42	33.30	33.28
		Powder	Kg	2.05	2.45	3.10	2.47
8.	Human labour		Mandays	357.39	289.61	274.98	312.70

The establishment period of the rose garden was found to be six months. The average per acre resource utilisation during the establishment period of Rose is analysed and presented in Table 3. For the overall farms, planting materials used per acre was 1,951, and usage was more

on small-sized farms. Not only planting materials but other inputs were also used extensively by small-sized rose farms, especially oil cakes (611.45 kg), fertilisers (1,265 Kg), and human labour (357.39 man days). The FYM was used in more quantity on medium-sized farms (18.19 tonnes) compared to small-sized farms (17.80 tonnes) and large-sized farms (15.92 tonnes). Inputs such as oilcake, fertilisers, and micronutrients were used to the extent of 507.94 Kg, 1044.38 kg, and 23.48 Kg, respectively, for the pooled data.

Table 4: Establishment cost of rose under open-field condition (Rs./acre)

Sl. No	Particulars	Small farms		Medium farms		Large farms		Overall farms	
		Value	Per cent	Value	Per cent	Value	Per cent	Value	Per cent
1.	Sample size	16	-	13	-	11	-	40	-
2.	Area under Rose (ac)	0.51	-	1.19	-	2.22	-	1.20	-
3.	Drip irrigation structures	33025	10.18	31368	11.04	29908	11.00	31629	10.65
4.	Planting materials	29331	9.04	25378	8.93	27375	10.07	27508	9.27
5.	FYM	44369	13.67	43833	15.43	37260	13.71	42240	14.23
6.	Oil cakes	10177	3.14	9752	3.43	6937	2.55	9148	3.08
7.	Fertilizers	35776	11.02	25467	8.96	23943	8.81	29171	9.83
8.	Micronutrients	772	0.24	679	0.24	880	0.32	772	0.26
9.	PPC (wet + dry formulations)	33283	10.25	31802	11.19	33846	12.45	32957	11.10
10.	Machine labour Charges	1985	0.61	1803	0.63	1876	0.69	1896	0.64
11.	Human labour charges	109056	33.60	87052	30.64	82765	30.45	94675	31.89
12.	Rental value of land	26800	8.26	26960	9.49	26990	9.93	26904	9.06
	Total	**324574**	**100**	**284094**	**100**	**271781**	**100**	**296900**	**100**

The above table shows that almost all inputs, except micronutrients, were used in greater quantity on small farms. This may be because small farmers might be applying more inputs to earn a profit. However, as the size of the farm increases, expenditure on inputs also decreases, making farmers use the resources more efficiently.

The per acre establishment cost was worked out for all three groups of rose farms, which was amortised and accounted for in calculating the annual cost of cultivation. This is depicted in

Table 4. The overall establishment cost per acre was Rs.2,96,900, and the primary share was labour charges (31.89 %), followed by the FYM cost (14.23 %) and irrigation structures (10.65 %). Among the different farm size categories, per acre establishment cost was higher on small-sized farms (Rs.3 24,574) than their other counterpart, large farms.

Results from the table on the composition of cost reveal that the per-acre expenditure on almost all inputs has decreased with the increase in garden size except for plant protection chemicals. Since the quality of flowers in later stages depends on healthy plants in the early stages, farmers are applying more PPC at the early stages of plant growth.

4.1.3 Input use and establishment cost for rose cultivation under protected condition

In protected conditions, rose seedlings also take six months for proper establishment. Until then, the buds were clipped off to promote vegetative growth. During this period, the plants need intensive care. Physical quantities of inputs used during the establishment period by different size groups are presented in Table 5. Farmers used 30,451 planting materials per acre, with slight variation among all size groups. The use of chemical fertilizers and PPC was slightly higher (1242.42 Kg and 43.67 litres, respectively) in small-size farms than in large-size groups.

The protected cultivation of roses is labour-intensive, and the labour requirement is almost double that of field rose garden establishments. This is because it consumes more labour for bed preparation and seedling planting, managing higher yields. The requirement of planting material is also very high as the varieties grown in protected conditions are erect-growing and require less spacing (1ft × 0.6 ft) compared to field rose cultivation.

The establishment cost of a rose garden under protected conditions is presented in Table 6. Initial investment is very high in this case. For the overall category of sample farmers, the total establishment cost amounted to Rs.42,52,578 per acre, in which a significant share goes for the protected cultivation structure itself (69.75 %), followed by creating irrigation structures (7.66 %). Small and medium groups do not have cold storage units, but in large-size groups, it accounted for 13.40 per cent of the total establishment cost. Besides these, labour charges also considerably add to establishment costs (5.94%) compared to other inputs.

Table 5: Inputs utilization in rose cultivation under protected condition during establishment period (Per acre)

Sl.No	Particulars	Units	Small farms	Medium farms	Large farms	Overall farms
1.	Sample size (n)		20	13	7	40
2.	Planting materials	No.	30788	30462	29467	30451
3.	Farm Yard Manure	Tonnes	46.64	44.77	44.60	45.67
4.	Oil cakes & other manures	Tonnes	4.15	5.57	4.53	4.68
5.	Fertilizers	Kg	1242.42	1145.19	1086.67	1183.57
6.	PPC	Litres	43.67	39.92	33.80	40.72
		Kg	3.27	2.58	2.43	2.90
7.	Human labour	Mandays	716.80	702.65	684.64	706.57

The results presented in the table show that the total establishment cost in the case of large-sized farms was higher because some farmers have cold storage units to take advantage of seasonal demand and price movements, which adds to the establishment cost in a more significant proportion. Apart from this use, almost all the inputs are in the same proportion among all the size groups of farmers. However, in the case of plant protection chemicals, it is decreased with an increase in land area, which may be because a larger group of farmers are using that input in a much more judicious way than other farmers, as some of them are exporting and need to observe SPS measure very strictly.

Table 6: Establishment cost of rose under protected condition (Rs./acre)

Sl. N.	Particulars	Small farms (20)		Medium farms (13)		Large farms (7)		Overall farms (40)	
		Value	Per cent	Value	Per cent	Value	Per cent	Value	Per cent
1	Sample size	20	-	13	-	7	-	40	-
2	Area (Acre)	0.41	-	0.98	-	2.14	-	0.90	-
3	Protected cultivation structure	2981707	71.64	2969231	71.24	2917223	62.48	2966368	69.75
4	Cold storage					62583	13.40	10952	2.58

	structure					4		1	
5	Grading and packing unit	149024	3.58	165769	3.98	153872	3.30	155315	3.65
6	Irrigation Structures	332317	7.98	328846	7.89	300401	6.43	325604	7.66
7	Planting materials	214213	5.15	204692	4.91	200768	4.30	208766	4.91
8	FYM	110091	2.65	111877	2.68	102937	2.20	109420	2.57
9	Oil cakes & other manures	36513	0.88	66327	1.59	52503	1.12	49001	1.15
10	Fertilizers	39962	0.96	37429	0.90	36963	0.79	38614	0.91
11	Plant Protection Chemicals	39136	0.94	32349	0.78	28556	0.61	35078	0.82
12	Machine labour Charges	2588	0.06	2366	0.06	2176	0.05	2444	0.06
13	Human labour charges	256403	6.16	248949	5.97	247646	5.30	252448	5.94
14	Rental value of land	35120	0.84	36200	0.87	37300	0.80	35853	0.84
	Total	**4161955**	**100.00**	**4167835**	**100.00**	**4668880**	**100.00**	**4252578**	**100.00**

4.1.4 Average input use and cost of cultivation of rose in open-filed condition.

Table 7 presents the input use pattern in open-field rose cultivation during the bearing period. The total quantity of FYM and oil cakes applied on the farm category farms was 12.43 tonnes and 513.76 Kg, respectively. All components of fertilizers (N, P, K and Ca) were used at high rates (849.97 Kg, 1505.58 Kg, 669.27 Kg and 176.24 Kg, respectively) on small-sized farms, including labour utilization (435.29 man-days), compared to their other two counterparts.

Farmers in each size group of farms have experienced input responsiveness of flowers; hence, they are using higher doses of fertilizers than the recommended rate. Since large-sized farms face a problem of labour scarcity, they utilize less labour per acre than the other two farm groups. In contrast, the idle labour available to small families was used in rose cultivation.

Table 7: Inputs utilization in Rose cultivation under open-field condition during bearing period (Per acre/annum)

Sl. No.	Particulars	Units	Small farms	Medium farms	Large farms	Overall farms
1	Sample size		16	13	11	40
2	Planting materials for gap filling	No.	25.31	29.35	25.31	26.62
3	FYM	Tonnes	12.66	12.00	12.61	12.43
4	Oil cakes	Kg	602.70	467.74	438.78	513.76
5	Fertilizers					
	Nitrogen	Kg	849.97	677.50	703.21	753.56
	Phosphorus	Kg	1505.58	1147.55	1205.16	1306.61
	Potash	Kg	669.27	554.00	609.98	615.50
	Calcium	Kg	176.24	156.44	125.20	155.77
6	Micro nutrients	Kg	69.31	64.52	65.71	66.76
7	PPC	Litres	143.80	155.87	124.26	142.35
		Kg	10.34	12.56	13.43	11.91
8	Labour	Mandays	435.29	417.35	392.34	417.65

The results of the estimated cost of cultivation for roses under open-field conditions are depicted in Table 8. The total cost is comprised of variable cost and fixed cost components. The total cost of cultivation for the pooled farm category was found to be Rs.8,64,873 and was decreased with farm size. The total cost of cultivation for small, medium and large farm sizes was Rs.9,07,118, Rs.8,48,032 and Rs.8,23,329, respectively. Variable cost accounted for 82.18 per cent, and the remaining 17.82 per cent was accounted for by total fixed cost.

Among variable cost components, for the overall farm size, the significant share was accounted by marketing charges, followed by expenditure on PPC, fertilizers and labour, which contributed to the extent of 19.14 per cent, 18.52 per cent, 18.39 per cent and 15.58 per cent, respectively. Apportioned establishment cost was calculated using the formula stated in the

methodology. Overall, it was found to be Rs.57,017 and accounted for 5.91 per cent of the total cost. Among fixed cost components, the major contributor was managerial cost (7.68 %).

The analysis of results gave clear statements for expenditure patterns among different size groups during the bearing period. The share of marketing charges was found to be very high among different components of variable costs. This is because of the high rate of commission (10%) and high transportation charges (Rs.100/bag). Apart from this, as already mentioned, farmers are well aware of the crop's input responsiveness and use vast amounts of chemical fertilizers and plant protection chemicals.

Table 8: Cost of cultivation of rose under open-field condition (Rs./acre/annum)

Sl. No.	Particulars	Small farms (16)		Medium farms (13)		Large farms (11)		Overall farms (40)	
		Value	Per cent	Value	Per cent	Value	Per cent	Value	Per cent
I	Variable cost								
1	Planting materials for gap filling	353	0.04	416	0.05	348	0.04	372	0.04
2	FYM	31412	3.46	29164	3.44	29011	3.52	30021	3.47
3	Oil cakes	8409	0.93	8326	0.98	7126	0.87	8029	0.93
4	Fertilizers								
	Nitrogen	48197	5.31	39746	4.69	37866	4.60	42610	4.93
	Phosphorus	81118	8.94	51071	6.02	48324	5.87	62334	7.21
	Potash	26633	2.94	22155	2.61	24080	2.92	24476	2.83
	Calcium	28693	3.16	25784	3.04	20507	2.49	25496	2.95
	Micronutrients	3341	0.37	4561	0.54	4685	0.57	4107	0.47
5	PPC	166207	18.32	154606	18.23	157830	19.17	160133	18.52
6	Irrigation Charges	2351	0.26	2364	0.28	2343	0.28	2353	0.27
7	Labour charges	140544	15.49	136721	16.12	124137	15.08	134789	15.58
8	Pruning cost	4695	0.52	3047	0.36	3897	0.47	3940	0.46
9	Marketing charges	154052	16.98	173908	20.51	172449	20.95	165564	19.14
10	Interest on working capital	48720	5.37	45631	5.38	44282	5.38	46496	5.38

	Total variable cost	**744725**	**82.10**	**697498**	**82.25**	**676887**	**82.21**	**710721**	**82.18**
II	**Fixed cost**								
1	Apportioned establishment cost	62234	6.86	54569	6.43	52320	6.35	57017	5.91
2	Depreciation	980	0.11	1020	0.12	1066	0.13	1017	0.12
3	Rental value of land	26800	2.95	26960	3.18	26990	3.28	26904	3.11
4	Managerial cost	69601	7.67	65187	7.69	63260	7.68	66423	7.68
5	Interest on Fixed capital	2778	0.31	2798	0.33	2806	0.34	2792	0.32
	Total fixed cost	**162393**	**17.90**	**150534**	**17.75**	**146442**	**17.79**	**154152**	**17.82**
	Total cost	**907118**	**100.00**	**848032**	**100.0**	**823329**	**100.00**	**864873**	**100.0**

4.1.5 Production and returns from rose cultivation under open-filed condition.

The details on yield, prices, gross returns, and net returns realized from rose cultivation on farms of different sizes under open field conditions are presented in Table 9. The per acre average yield obtained was slightly higher in the case of small farms (30,608.77 Kg) than in medium farms (30,314.03 Kg) and large farms (28,882.48 Kg). But, net returns realized were more in the case of large farms (Rs. 2,29,638.69) than the other two groups of farms.

Table9: Production and returns from rose cultivation under open-field condition

(Per acre/annum)

Sl No	**Particulars**	**Small farms**	**Medium Farms**	**Large Farms**	**Overall farms**
1	Flower yield (Kg)	30608.77	30314.03	28882.48	30038.25
2	Price realized (Rs./Kg)	36.29	35.50	36.46	36.08
3	Gross returns (Rs.)	1110817.92	1076261.02	1052967.65	1083678.10
4	Total cost (Rs.)	907118.30	848031.86	823328.96	864873.14
5	**Net Returns (Rs.)**	**203699.62**	**228229.16**	**229638.69**	**218804.97**

The above table shows that net returns obtained from rose cultivation on large-scale farms were higher than those obtained from other groups because the total cost was lower. This

could be attributable to better resource utilisation and realising the benefits of economies of scale on large-scale farms.

4.1.6 Input use pattern and cost of cultivation of rose under protected condition.

Per acre, utilization of inputs by small, medium and large-size groups of rose cultivators under protected conditions are presented in Table 10. It can be noted that almost all the inputs were used in incredible amounts by small-sized farm groups except calcium and plant protection chemicals. Farmers were using oilcake and other manures, such as sheep manure, poultry manure, vermicompost, *etc.,* in more significant quantities, *i.e.,* 1.32 tonnes at the overall level. Labour was utilized extensively in protected conditions to the extent of 1,339.93 man-days, 1,215.69 man-days and 1,168.80 man-days, respectively, in the case of small, medium and large farm groups.

The farmers growing roses in protected conditions are very conscious about the quality of the flowers since better quality flowers fetch more price. They want to ensure the complete absence of any pest and disease attack, so they are using more plant protection chemicals. Oil cakes and other manures are also used in greater amounts as they supply more nutrients.

Table 10: Inputs utilization in rose cultivation under protected condition during bearing period (Rs./acre/annum)

Sl. No.	Particulars	Unit	Small farms	Medium farms	Large farms	Overall farms
1	Sample size	No.	20	13	7	40
2	Planting materials for gap filling	No.	512.12	541.54	528.00	524.46
3	FYM	Tonnes	27.27	25.38	26.80	26.58
4	Oil cakes and others	Tonnes	1.58	1.02	1.17	1.32
5.	Fertilizers					
	Nitrogen	Kg	912.17	853.18	766.60	867.52
	Phosphorus	Kg	1448.91	1226.23	989.90	1296.21
	Potash	Kg	874.61	500.85	503.83	688.25
	Calcium	Kg	180.68	234.93	224.37	205.96

	Micro nutrients	Kg	113.94	96.15	101.00	105.89
6.	PPC	Litres	160.55	165.54	175.40	164.77
		Kg	12.46	11.78	11.23	12.02
7.	Labour	Man days	1339.93	1215.69	1168.80	1269.60

The details on the total cost incurred per annum in rose cultivation under protected conditions are shown in Table 11. Total cost for the pooled data of all farm size groups was Rs.19,03,587 per acre, total variable cost accounted for 63.80 per cent, and total fixed cost accounted for 36.20 per cent. The total variable cost per acre was found to be increasing with the increase in the size of the farms, and for the overall category of farms, it stood at Rs.12,14,406.

Among variable cost components, the significant share was contributed by labour charges (22.22 %), followed by marketing charges (13.85 %), expenditure on chemical fertilizers (9.41 %) and plant protection chemicals (8.47 %). Grading and packing operations were much more expensive in terms of marketing cost under protected conditions in contrast to relatively higher commission and transportation charges in the case of roses cultivated under open field conditions. The commission charges ranged from 3 to 5 per cent. Among fixed cost components, the major share was accounted for by amortized establishment cost (28.10%) on overall farms. The per-acre amortized establishment cost for small, medium, and large-sized groups of farms was Rs.5,25,463, Rs.5,26,858, and Rs.5,76,331, respectively.

Table 11: Cost of cultivation of rose under protected condition (Rs./acre/annum)

Sl. No.	**Particulars**	**Small farms**		**Medium farms**		**Large farms**		**Overall farms**	
		Value	**Per cent**	**Value**	**Per cent**	**Value**	**Per cent**	**Value**	**Per cent**
I	**Variable cost**								
1	Planting materials for gap filling	3556	0.19	3660	0.19	3578	0.18	3594	0.19
2	FYM	64482	3.43	62731	3.33	61850	3.07	63452	3.33
3	Oil cakes and other manures	25619	1.36	45308	2.41	47797	2.37	35899	1.89

4	**Fertilizers**								
	Nitrogen	50342	2.68	53111	2.82	46776	2.32	50618	2.66
	Phosphorus	60203	3.20	52958	2.81	40695	2.02	54434	2.86
	Potash	34494	1.84	20720	1.10	19217	0.95	27344	1.44
	Calcium	29717	1.58	38478	2.05	36724	1.82	33791	1.78
	Micro nutrients	14415	0.77	11170	0.59	10793	0.54	12726	0.67
5	Plant protection chemicals	162044	8.62	160696	8.54	159881	7.94	161227	8.47
6	Irrigation charges	5239	0.28	5240	0.28	5240	0.26	5239	0.28
7	Labour Charges	423688	22.54	427924	22.75	411967	20.46	423013	22.22
8	Marketing cost	249385	13.27	240240	12.77	347716	17.27	263621	13.85
9	Interest on variable cost	78623	4.18	78556	4.18	83456	4.15	79447	4.17
	Total variable cost	**1201806**	**63.94**	**1200791**	**63.83**	**1275691**	**63.36**	**1214406**	**63.80**
II	**Fixed cost**								
1	Amortized establishment cost	525463	27.95	526858	28.01	576331	28.63	534819	28.10
2	Depreciation	1360	0.07	1430	0.08	1480	0.07	1404	0.07
3	Rental value of land	35120	1.87	36200	1.92	36700	1.82	35748	1.88
4	Managerial cost	112318	5.98	112223	5.97	119223	5.92	113496	5.96
5	Interest on FC	3648	0.19	3763	0.20	3818	0.19	3715	0.20
	Total fixed cost	**677910**	**36.06**	**680475**	**36.17**	**737552**	**36.64**	**689181**	**36.20**
	Total cost	**1879716**	**100**	**1881266**	**100**	**2013243**	**100**	**1903587**	**100**

It could be observed from the above table that the share of the fixed cost was more than the variable cost because of the higher initial investment in protected structures made by the farmers. Large farms are much higher than the other two groups as some of the large farm groups have cold storage units, which also contribute towards initial investment. Marketing costs are also higher in the case of large farm groups; this is attributed to higher export charges borne by some of the farmers in the peak season (especially during February). Labour charges per acre for large-sized farms were lower than those for small farms because of the benefits of economies of scale, and some of the farmers had permanent labour on the farm, which helped them keep the proportion of labour cost at a lower level.

4.1.7 Production and returns from rose cultivation under protected condition

The details on average yield obtained, gross returns and net returns realized from rose cultivation on different-size group farms under protected conditions are presented in Table 12. Per acre, the average quantity of output obtained by small- and large-size farms were 31,369 bunches and 32,295 bunches (One bunch = 20 flowers), respectively, and were sold in the domestic market. However, in the case of large farms, 32,229 bunches were sold in the domestic market, and 1,163 bunches were sold in the overseas market for a higher price (Rs.183.57). Net returns obtained from rose cultivation were found to be Rs.11,50,459 at the overall level, and returns per rupee of investment were 1.58, 1.63, and 1.63 for small, medium, and large farms, respectively.

Even though large farms had higher total costs than their counterparts, their net returns were higher because they received higher prices in the overseas market (Table 12). This clearly indicates that exports need to be encouraged to make the farmers realize better returns. Thus, the hypothesis stated (Protected cultivation technology is capital intensive but profitable) is accepted.

Table 12: Production and returns from rose cultivation under protected condition (Per acre/annum)

Particulars		**Small farms**	**Medium Farms**	**Large farms**	**Overall farms**
Total Quantity (No. of bunches)	Domestic	31369	32295	32333	31821
	Export			1163	203.50
Average price / bunch (Rs.)	Domestic	94.82	94.77	94.82	94.80
	Export	-	-	183.57	32.13
Gross returns (Rs.)		2974367	3060589	3279293	3054045
Total cost (Rs.)		1879716	1881265	2013242	1903586
Net returns (Rs.)		1094651	1179324	1266050	1150458

Note: One bunch = 20 flowers

4.2 Investment analysis of rose cultivation under open-field and protected conditions.

An investment analysis was made in this study to measure the worthiness of investments made in rose cultivation under open-field and protected conditions and to compare them. The results of these for the overall farm size category of farmers in the study area are presented in Table 13. The economic life of the garden was six years in both cases, as opined by the respondents and the horticultural experts. The discount factor considered for the estimation of NPV was 14 per cent. The details regarding cash flows of the present year and the past two years were collected from the farmers, and for the next three years, cash flows are assumed based on the past trends in input costs and yield and prices rose. The NPV of open-field and protected cultivation was Rs.2,19,384 and Rs.34,95,492, respectively. The discounted B: C ratio was found to be 1.21 and 1.58, while the Internal Rate of Returns (IRR) from rose cultivation was estimated to be 47 per cent and 54 per cent regarding open-field and protected conditions of rose cultivation. Thus, investment in rose cultivation under both situations was found to be economically viable and financially profitable.

Table 13: Financial feasibility of investment in Rose cultivation under open-field and protected conditions.

Sl No	Particulars	Open-field cultivation	Protected cultivation
1	NPV (Rs.)	219384	3495492
2	BCR	1.21	1.58
3	IRR (%)	47	54

From the result, it can be stated that protected cultivation technology in Rose was found to be more highly feasible than open-field cultivation as the values of both the benefit-cost ratio and internal rate of returns (found to be sufficiently more significant than the opportunity cost of capital,*i.e.*, prevailing bank rate of interest for long term loans) were found to be higher in protected cultivation. Similar results were observed in a study conducted by Jethendra (2007). Thus, the hypothesis (B: C ratio is more under protected cultivation than open field cultivation of rose) is accepted.

5. CONCLUSION:

The findings of our study underscore the profitability of rose cultivation, particularly under protected cultivation. The rate of return from protected cultivation was notably higher, at 54 per cent with a 1.58 B: C ratio, compared to open-field cultivation's 47 per cent with a 1.21 B: C ratio. Despite the initial capital investment required, protected cultivation outperformed in terms of returns and employment generation per unit of land. This highlights the potential for traditional rose farmers to enhance their profitability by adopting the practices of protected farms, supported by accessible institutional credit and subsidies.

One of the key findings of our study is the potential for innovation in rose cultivation. Most of the varieties grown in traditional cultivation are short-stalked and fetch lower prices. This presents a clear opportunity for research to focus on developing long-stalked and better-shaded varieties, which can command premium prices in the market. The development of transgenic varieties could also revolutionize the industry, facilitating the production of export-quality flowers in the open field. This underscores the importance of research and innovation in driving the future of rose cultivation in India.

There is tremendous scope for increasing India's exports of flowers, including cut flowers and roses. There has been a big sprout in the export of cut flowers from India recently. It was observed that rose cultivation under both cultivation methods was profitable. Although both traditional and hi-tech cultivation are profitable and employment-generating, the hi-tech farms generated very high returns and employment. Therefore, efforts should be made to educate the conventional rose farmers to adopt a better package of practices followed by hi-tech farms and encourage them by providing cheaper institutional credit and subsidies. Most of the varieties grown in traditional cultivation are short-stalked and fetch lower prices. Therefore, research should be prioritised to develop long-stalked and better-shaded varieties that can fetch a premium price in the market. Developing transgenic varieties would facilitate growing flowers with exportable quality in the open field. As the significant cost items (greenhouse structure and planting materials) in hi-tech cultivation are imported, the cost could be drastically reduced by substituting locally produced quality structures and planting materials. This will also enhance the competitiveness in the international market.

REFERENCES

ADITI J MALVIYA, MILAN VALA, ARCHANA MANKAD *(2022), Recent Floriculture in India, International Association of Development, 2(6), pp-14-24.*

AGORAMOORTHY, G., AND HSU, J. M. (2012). Impact of floriculture development enhances livelihood of India's rural women. *Journal of Agriculture and Rural Development in the Tropics and Sub Tropics*, 113: 69–76.

AMARNATH, J. S., & VENDHAN, K. (2017). An economic analysis of cut flower marketing in Tamil Nadu. *Economic Affairs*, *62*(4), 621-631.

ANONYMOUS, 2016, Climate change and agriculture in India, Department of Science & Technology, Ministry of Science & Technology Government of India, New Delhi.

BHOSALE, M. Y., SHELKE, R. D., AHER, V. K., & SHENEWAD, B. A. (2023). Production and marketing of cut-flowers. *International Research Journal of Agricultural Economics and Statistics*, 2(2), 328-331.

CHAWLA S.L., SUDHA PATIL, AHLAWAT T.R. AND ROSHNI AGNIHOTRI (2016). Present Status, Constraints and Future Potential of Floriculture in India, Commercial Horticulture, New India Publishing Agency, New Delhi, India, pp 29-38

GAMANAGATTI PAVAN KUMAR B., (2014), Protected cultivation technology in Karnataka-An economic analysis. *Ph. D. Thesis* (*Unpub*.), University of Agricultural Sciences, Dharwad.

HARISHA B.N, *(2017),* an Economic Analysis of Floriculture in India, *International Journal of Academic Research and Biological and Computational Digest,* 1(1), 210-224

MAJUMDAR, S., & LAHIRI, D. (2012). Cost-benefit and sensitivity analysis of cut flower roses and comparison with other floricultural crops. *Agricultural Situation in India*, 68(11), 609-614

MALHOTRA, S.K. 2011. Production system for quality production of seed spices. Farmer's Scientists, Interaction meet on Organic Agriculture and Horticulture, Amity Institute of Organic Agriculture, Amity University, Noida, U.P., 30, March, 2011.

MALVIYA, A., VALA, M., & MANKAD, A. (2022). Recent floriculture in India. *International Association of Biologicals and Computational Digest*, 1(1), 1-8

MANGAL SINGH, P. K., 2014, Attitude of farmers towards rose cultivation. *M.Sc. (Agri.) Thesis (Unpub.),* Anand Agricultural University, Anand, Gujurat.

PALANISINGH V, VIJAYALAKSHMI R, PALANICHAMY V, SAMUNDESWARI R., JEYAPANDIYAN N, (2022), Floriculture Exports in India-Direction and trends, *Rabindra Bharati Journal of Philosophy*. 3(6), pp-38-46.

PARMAR, K. M., PATEL, S. R., IATARPARA, A. C. AND RATHOD, D. M., 2015, Attitude of farmers towards rose cultivation, *Trends in Bioscience*, 8 (9): 2281 - 2283.

PATIL S. N., *(2022),* Floriculture Export of India and its Trends and Instability in European Zone, *International Journal of Research Publication and Reviews Journal*. Vol 3, no 4, pp 2199-2207.

SENTHILKUMAR R. *(2017),* Cultivation and Marketing of Flowers in India - An Empirical Study, *International Journal of Research in Social Sciences, 7(7) pp 22-26.*

SOWMYA AND HARISHA N., (2024), Growth and export of floriculture in India: A Review, *International Journal of Agriculture and Rural Economic Research*, Vol. 12 (2), pp 1-5