Comparative Analysis of Open and Protected Cultivation of Cut Flower Rose Farming in Karnataka

Abstract:

In India, floriculture is second largest in the world next to China. The total area under flower crops during 2016-17 was 309.70 thousand hectares; production of loose flowers was estimated to be 1653 metric ton and of cut-flowers was 593 metric ton Both fresh and dried cut-flowers lead floriculture exports from India. Among different flowers "Rose" is the one flower plant with hundreds of species and thousands of cultivars among which maximum number of species are native to Asia which are extensively used in commercial perfumery, pharmaceuticals and also as commercial cut flower crops and in the present era of commercialization, the rose cultivating both protected and open field cultivation. Hence, the present study was undertaken to analyze the Comparative Analysis of Open and Protected Cultivation of Cut Flower Rose Farming in Karnataka. This study was based on primary data which were collected from the 80 sample farmers (40 each of both protected and open field cultivation) from two districts *i.e.,* Chikkaballapura and Bengaluru rural (collected from two taluks each). The data were analysed using Cost and return analysis, Net present value, Benefit: Cost Ratio and Internal Rate of Return. The results obtained from this study indicated that that the cultivation of rose was found profitable under both open field and protected cultivation. But comparatively, the rate of return obtained from protected cultivation was higher i.e., 54 per cent with 1.58 B:C ratio than open-field cultivation i.e., 47 per cent with 1.21 B:C ratio. Therefore, it can be suggested that efforts should be made to educate the traditional rose farmers to adopt 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.

INTRODUCTION

India being an agricultural country is bestowed with diversified soil and climatic conditions favorable for growing large variety of crops. The climatic condition is not only favorable for cultivating food crops but also the horticultural crops. These crops play major role in improving livelihood security and nutritional security of farmers.

Over the years, horticulture has emerged as an essential part of agriculture. The horticulture sector encompasses fruits, vegetables, ornamentals, flowers, spices, plantations, medicinal and aromatic crops. It is the fastest growing sector within agriculture today, because this sector not only offers a wide range of options to the farmers for crop diversification, but also provides ample scope for sustaining large number of agro-industries which generate huge employment opportunities. As the days passed, horticulture has become one of the potential agricultural enterprises in accelerating the growth of our economy.

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 garden but play an important role in the decoration of the living houses and office establishments. Flowers augment the quality of life and influence human feelings more than words or other gifts. Near big cities, areas have emerged as major flower growing centers. Small farmers near these major cities are concentrating on loose flower cultivation which greatly satisfies the local demand; On the other hand, growing of cut-flowers has arose as an important industry mainly to furnish the needs of the overseas market and also to satisfy the demand of corporate houses, hotels, restaurant etc. There is a remarkable transformation in our floriculture sector mainly due to the entry of corporate sector which are producing cut-flowers to meet the amplifying demands in the developed countries for floricultural products. The Government of India has identified floriculture as a niche area with vast potential for export and is giving numerous incentives for setting up of floricultural units especially through Export Oriented Units (EOUs). Most of the flowers have been cultivated in open-field conditions and among them rose has been the most significantly cultivated one. It is also one among the most chosen species of cut-flowers in the international market.

Rose, the “Queen of flowers” is the symbol of elegant beauty, purity, love, friendship and sympathy. It belongs to the genus *Rosa* and family *Rosaceae*. It is the woody perennial plant with hundreds of species and thousands of cultivars among which maximum number of species are native to Asia. Flowers vary in their size, shape and fascinating colors which are widely grown for their beauty and fragrance. They have acquired cultural significance and became integral in almost all the religious or spiritual ceremonies in India.

They are extensively used in commercial perfumery, pharmaceuticals and also as commercial cut flower crops. Some of the species are used for hedging, as landscape plants and

for slope stabilization. Scented flowers are valued for worship, making garlands and preparation of rose oil, rose water, gulkhand, rose attar, rose otto, etc,. Rose oil is one of the oldest and most valuable perfumery raw material 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 in the preparation of rose water, herbal tea, rose syrup, ice cream, kulfi, etc. Roses are divided into three main categories; they are species roses, old garden roses and modern roses.

Protected condition may be defined as growing condition where in plants are grown under inflated structure covered with a transparent or translucent material in which growing environment is fully or partially controlled. It is used to protect the plants from the adverse climatic conditions such as wind, cold, precipitation, excessive radiation, extreme temperature, insects and diseases etc., by erecting a greenhouse (glasshouse/ nethouse/ poly house etc.)

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

In India, floriculture industry encompasses trading of fresh flowers, production and sale of nursery and potted plants, seed and bulb production, micro propagation, extraction of essential oils, etc. Total area under floriculture in India is second largest in the world next to China. The total area under flower crops during 2016-17 was 309.70 thousand hectares; production of loose flowers was estimated to be 1653 metric ton and of cut-flowers was 593 metric ton. Both fresh and dried cut-flowers lead floriculture exports from India (Amarnath and Vendhan, 2017).

The important flower crops occupied place in the international cut flower trade are rose, gerbera, gladiolus, carnation, chrysanthemum, orchids, tulip, anthurium and lilies. Commercial floriculture in India is now being viewed as a fast-growing industry, particularly under the protected conditions. The country has exported 22,000 MT of floriculture products worth Rs.547 crore ($ 82 m) during 2016-17 (Bhosale *etal*., 2017) Major export destinations were the United States, Germany, United Kingdom, Netherlands and the United Arab Emirates.

The area under rose cultivation in India is almost constant over the years from 2011-12 to 2016-17 but there was a significant increase in production of both loose flower and cut flower roses. During 2016-17, the area under rose cultivation was around 29,570 ha. Total production of loose flowers was around 1,13,190 MT and of cut flowers was around 1,88,760 Metric ton. 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 ton (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 and Harisha, 2024).

Karnataka stands second in flower production next to Tamil Nadu which covers 19 per cent of total Indian floriculture market share. Area under flower production in Karnataka is around 32.92 thousand hectares; Production of loose flowers was 221.56 thousand MT and production of cut flowers was 59.36 thousand MT (Soumya and Harisha, 2024).

Area and production of rose in Karnataka remained almost same for last few years. Area under rose cultivation in Karnataka during 2016-17 was 2.80 thousand hectares; Production of loose flowers was 0.60 thousand MT and of cut flowers was 50.12 thousand MT (Soumya and Harisha, 2024). Major districts contributing to rose production in Karnataka are Bangalore Rural, Bengaluru urban, Kolar, Chikkaballapura and Haveri (Majumdhar and Lahiri, 2012). These areas have very good congenial condition for growing of cut flowers as if not require these locations do not require either cooling or heating system. As a result, maximum number of export oriented floriculture units has been established in these locations.

The floriculture is blossoming in India, but there are numerous challenges for its sustainable growth. For any country to expand its agricultural base geared in the direction of export, the ornamental crop industry becomes a boon and one of the most interesting and feasible options. Rose is the most preferred species of cut-flower in the overseas market and therefore, present study is an attempt to estimate the comparative economics of rose cultivation in open field and protected condition using the farm level data. The scientific estimation of costs and returns in rose cultivation would be valuable information for all the stakeholders and policy makers and serve as valuable information in helping our country stand on a strong position in World floriculture platform.

1. OBJECTIVES

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

Hypotheses.

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

2. METHODOLOGY:

3.1 Sampling technique and procedure adopted

Study mainly concentrated on comparing each and every aspects of rose cultivation under protected and open-field conditions. Hence, care was taken while selecting the sample respondents cultivating rose using both the methods of cultivation 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 of the 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 farmers growing rose under protected condition and 10 farmers growing rose in open-field condition). Thus totally, 40 farmers growing rose under protected condition and 40 farmers growing rose under open field condition were selected for collection of primary data on establishment and cultivation of rose garden which constitutes 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 post classified into small, medium and large farmers on the basis of area allocated for 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 weighted average for all the terms used in accounting cost and returns.

Major rose varieties grown in open-field condition in the study region are Mirabel, mango yellow, starlight and charishma. While in case of protected condition, tajmahal, first red, carvette, noblesse, avlanch 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 of roses grown under protected condition and open field condition (totally 20 market middlemen) were chosen randomly in the respective markets for collecting information on marketing of rose.

3.2 Nature and sources of data

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

The needed primary data on socio-economic characters of the respondents, establishment cost of protected structure, cost on establishment of rose garden, cost incurred in cultivation, production and marketing practices followed by farmers for rose under both the 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 being a perennial crop with establishment period of minimum six months, total cost of rose cultivation is divided into cost incurred during establishment period and cost incurred during bearing period. 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 establishment period and rental value of land. While in case of protected condition, along with above said components subsidized expenditure made on construction of protected structure, cold storage, grading and packing units were also included to arrive at 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.

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

3. 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 economic benefits derived by the farmer from that enterprise. In the present era of commercialization, it has become necessary for a farmer to take up agriculture as commercial and business enterprise. This cannot be achieved unless the farmer become conscious about cost of production, net profit gained or loss incurred. By knowing all these things he tries to minimize the costs in order to 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 rose garden was found to be six months. The average per acre resource utilization during establishment period of rose is analysed and presented in the 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 other inputs were used extensively by small sized rose farms especially oil cakes (611.45 kg) fertilizers (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 oilcakes, fertilizers and micronutrients were used to an extent of 507.94 Kg, 1044.38 kg and 23.48 Kg, respectively for the pooled data.

It was observed from the above table that almost all the inputs were used in more quantity on small sized farms except micronutrients. This may be because of the fact that small farmers with a view to earn much profit, they might be applying more inputs but as the size of the farm increases expenditure on inputs also mostly decreases which makes farmers to use the resources more efficiently.

The per acre establishment cost was worked out for all the three groups of rose farms, which was amortized and accounted in calculation of annual cost of cultivation. This was depicted in the Table 4. Overall establishment cost per acre was Rs.2,96,900 in which major share was labour charges (31.89 %) followed by cost on FYM (14.23 %) and irrigation structures (10.65 %). Among the different categories of farm size, per acre establishment cost was more on small sized farms (Rs.3, 24,574) than their other counterpart large farms.

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

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**

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

In protected condition also rose seedlings take six months for proper establishment, till then the buds were clipped off to promote the vegetative growth. During this period the plants need intensive care. Physical quantities of inputs used during establishment period by different size groups are presented in the Table 5.

Farmers used 30,451 numbers of planting materials per acre with not much variation among all the size groups. Use of chemical fertilizers and PPC was slightly more (1242.42 Kg and 43.67 litres, respectively) on small size group farms than large size groups.

Protected cultivation of rose is labour intensive and labour requirement is almost double than field rose garden establishment as it consumes more labour for bed preparation and planting of seedlings, managing higher yields. Requirement of planting material is also very high as the varieties grown in protected condition are erect growing and require less spacing (1ft × 0.6 ft) compared to field rose cultivation.

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

The results presented in the table shows that total establishment cost in case of large sized farms was more, which is because of the fact that some farmers are having cold storage units to take advantage of seasonal demand and price movements, which adds to the establishment cost in greater proportion. Apart from this use of almost all the inputs are in the same proportion among all the size group of farmers but in case of plant protection chemicals, it is decreased with increase in land area which may be because larger size group farmers are using that input in a much 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 structure					625834	13.40	109521	2.58
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.

The input use pattern in open-field rose cultivation during bearing period is presented in the Table 7. On the overall farm category farms, total quantity of FYM and oil cakes applied were 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 mandays) compared to their other two counterparts.

Farmers in each size group of farms have experienced input responsiveness of flowers and hence they are using higher doses of fertilizers than recommended rate. Since large sized farms are facing a problem of labour scarcity they are utilizing less labour per acre when compared to other two farm groups, while the idle labour available on the small size families found 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 on estimated cost of cultivation for rose under open-field condition are depicted in the Table 8. The total cost comprised of variable cost and fixed cost components. Total cost of cultivation for pooled farm category was found to be Rs.8,64,873 and was decreased with farm size. Total cost of cultivation for small, medium and large farm size was found to be Rs.9,07,118, Rs.8,48,032 and Rs.8,23,329, respectively. In the total cost, variable cost accounted for 82.18 per cent and remaining 17.82 per cent was accounted by total fixed cost.

Among variable cost components, for the overall farm size, major share was accounted by marketing charges, followed by expenditure on PPC, fertilizers and labours, which contributed to an extent of 19.14 per cent, 18.52 per cent, 18.39 per cent and 15.58 percent, respectively. Apportioned establishment cost was calculated by using formula stated in methodology and at overall level it was found to be Rs.57,017 and it accounted for 5.91 per cent of total cost. Among fixed cost components major contributor was managerial cost (7.68 %).

The analysis of results gave clear statements for expenditure pattern among different size groups during bearing period. Share of marketing charges found to be very high among different components of variable costs. This is because of high rate of commission (10%) and high transportation charges (Rs.100/bag). Apart from this, as already mentioned farmers are well aware

of input responsiveness of the crop and were using very large 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								18.39
	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 different size farms under open filed condition are presented in the Table 9. Per acre average yield obtained was slightly more in the case of small sized farms (30,608.77 Kg) than medium (30,314.03 Kg) and

large farms (28,882.48 Kg). But, net returns realized were more in case of large farms (Rs. 2,29,638.69) than 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**

It can be observed from the above table that net returns obtained from rose cultivation on large size farms was more than other groups because total cost was less and this could be attributable to better utilization of resources and realization of benefits of economies of scale on large size 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 condition are presented in the Table 10. It can be noted that almost all the inputs were used in greater amount by small sized farm groups except calcium and plant protection chemicals. Farmers were using oilcakes and other manures such as sheep manure, poultry manure, vermicompost *etc.*, in greater quantities *i.e.*, 1.32 tonnes at the overall level. Labour was utilized extensively in protected condition 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 rose in protected condition are very much conscious about the quality of flowers since better quality flowers fetch more price. They want to ensure complete absence of incidence 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 total cost incurred per annum in rose cultivation under protected condition are shown in the Table 11. Total cost for the pooled data of all farm size groups was found to be Rs.19,03,587 per acre in which total variable cost accounted for 63.80 per cent and total fixed cost accounted for 36.20 per cent. Total variable cost per acre was found to be increasing with increase in size of the farms and for overall category of farms it stood at Rs.12,14,406.

Among variable cost components, major 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 expensive in marketing cost under protected condition in contrast to relatively higher commission and transportation charges in the case of rose cultivated under open field conditions. The commission charges ranged from 3 to 5 per cent.

Among fixed cost components, major share was accounted by amortized establishment cost (28.10%) on overall farms. Per acre amortized establishment cost for small, medium and large sized groups of farms it worked to be 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 share of fixed cost was more than variable cost because of higher initial investment on protected structures made by the farmers. In case of large farms it is quite higher than other two groups as some of the large farm groups of farmers are having cold storage units which also contribute towards initial investment. Marketing cost is also more in case of large farm groups, this is attributed by higher export charges borne by some of the farmers in the peak season (especially during February). Labour charges per acre for large sized farms bit lower compared to small farms because of benefits of economies of scale and some of the farmers had permanent labour on the farm, which helped them to keep proportion of labour cost at 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 condition are presented in the Table 12. Per acre average quantity of output obtained by small size farms and large size farms were 31,369 bunches and 32,295 bunches (One bunch = 20 flowers), respectively and were sold in domestic market. But in the case of large farms, 32,229 bunches were sold in domestic market and 1,163 bunches were sold in overseas market for higher price (Rs.183.57). Net returns obtained from rose cultivation was found to be Rs.11,50,459 at overall level and returns per rupee of investment was 1.58, 1.63, 1.63 for small farms, medium farms and large farms, respectively.

Even with higher total cost in the case of large farms than their counterparts, but net returns realized were more because they received higher prices in overseas market (Table 12). This gives the clear indication 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.

To measure the worthiness of investment made in rose cultivation under open-field and protected conditions and to compare them, investment analysis was made in this study. The results of these for overall farm size category of farmers in the study area are presented in Table 13. Economic life of garden taken was six years in both cases as opined by the respondents and the horticultural experts. Discount factor considered for estimation of NPV was 14 per cent. The details regarding cash flows of present year and past two years were collected from the farmers and for next three years, cash flows are assumed based on the past trends in input costs and yield and prices of rose. The NPV of open-field and protected cultivation was found to be 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 estimated to be 47 per cent and 54 per cent in respect of open-field and protected condition of rose cultivation. Thus investment in rose cultivation under both the situation 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 state that protected cultivation technology in rose found to be highly feasible than open-field cultivation as the values of both benefit-cost ratio and internal rate of returns (found to be sufficiently greater 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 stated (B:C ratio is more under protected cultivation than open field cultivation of rose) is accepted.

4. CONCLUSION:

The results of the present study indicates that the cultivation of rose was found profitable under both open field and protected cultivation. But comparatively, the rate of return obtained from protected cultivation was higher i.e., 54 per cent with 1.58 B:C ratio than open-field cultivation i.e., 47 per cent with 1.21 B:C ratio. Although the Protected cultivation is capital intensive and requires huge initial investment, they performed much better in terms of realization of returns and employment generation per unit of land. Therefore, it can be suggested that efforts should be made to educate the traditional rose farmers to adopt better package of practices followed by protected farms and encourage them by providing cheaper institutional credit and subsidies.

In addition to that, most of the varieties grown in traditional cultivation are short stalked and fetch lower price. Therefore, it could be recommended that research should be prioritized for developing long stalked and better shaded varieties, which can fetch premium price in the market and even development of transgenic varieties would facilitate growing flowers with exportable quality in the open field. And with respect to protected cultivation inputs which have major share on establishment cost (greenhouse structure and planting materials) in protected cultivation were imported, the cost could be drastically brought down

through substitution with locally produced quality structures and planting materials. This will also enhance the cost-competitiveness in the international market.

There is tremendous scope for increasing India's exports of flowers especially cut flowers including roses. There is a big sprout in export of cut flowers from India in recent times. It was observed that the rose cultivation under both the methods of cultivation were profitableAlthough both traditional and hi-tech cultivation are profitable and employment generating, the hi-tech farms were generating vesssry high returns and employment. Therefore, efforts should be made to educate the traditional rose farmers to adopt 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 price. Therefore, research should be prioritised for developing long stalked and better shaded varieties, which can fetch premium price in the market. Development of transgenic varieties would facilitate growing flowers with exportable quality in the open field. · As the major cost items (greenhouse structure and planting materials) in hitech cultivation are imported, the cost could be drastically brought down through substitution with locally produced quality structures and planting materials. This will also enhance the cost-competitiveness in the international market.

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