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## **An economic analysis of traditional and hi-tech rose (*Rosa spp.*) cultivation**

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### **ABSTRACT**

**Rose is grown under traditional and hi-tech cultivation in India. There exists wide difference in the capital investment, variable costs incurred and returns realized in the both production systems. Therefore, the study was undertaken to examine the investments, costs, yields, returns and employment under traditional versus hi-tech cultivation. It was observed that although, the hi-tech farms were capital intensive, require huge initial investment and applied very high doses of inputs such as plant protection chemicals and fertilizers, they performed much better in terms of realization of returns and employment generation in comparison to traditional farms. Regarding gender equity, there was a discrimination against female casual labour working at both the types of farm. To enhance the profitability of rose cultivation, research should be prioritized for developing long-stalked, better shaded and pests and diseases resistant varieties, cost reduction in greenhouse structures and proper market intelligence.**

**Key words:** Rose, hi-tech, economics, resource use, returns, employment

Floriculture is one of the fastest growing industries in India owing to the rapid rise in the economy in recent times. During 2006-07, the total area under flower crops in India was 0.146 million ha with a production of about 0.778 million tonnes of loose flowers and about 3650 million cut flowers (Anonymous, 2006). Although, the loose flowers constitute majority of India's flower production, cut flowers such as rose, carnation, gladiolus, and anthurium, have come in big way since last decade. Presently, there are more than 300 export-oriented units in India. (APEDA, 2008). The proportion of area under protected cultivation to total floricultural area was 0.56 per cent in India (Thippaiah, 2005).

Rose is the largest traded flower in the world. India ranked 16<sup>th</sup> in rose exports during 2006 with a turnover of about US \$ 1.4 million, which constitutes 1.05 percent of world trade (Anonymous, 2008). In India, rose is grown under open field condition

using traditional technologies and under greenhouses (hi-tech) using advanced technologies. In the traditional method of rose production, mostly loose flowers were produced catering to the local markets. These flowers were graded according to stalk length into *Stems*. The harvested flowers were sold to traders through pre-harvest deal at the fixed price transferring the risk of price fluctuations to the traders (Sivaramane, 1998).

Although the hi-tech cut flowers are grown mainly for the export market, their consumption was also on the rise in the domestic market as well which provides greater revenue leverage to these hi-tech units. This hi-tech cultivation method has grown sizably around Bangalore since 1990s. There exists wide difference in the capital employed, variable cost incurred and returns between the two systems of rose production. Therefore, examining investment, costs, yields, returns and employment generation potential of traditional and hi-tech rose production systems may help in drawing useful conclusions for formulating policy prescriptions to enhance rose economy of India.

#### **MATERIALS AND METHODS**

This study was based on primary data collected from rose growing farms around Bangalore during 1997-98. The area was purposively chosen, as both methods of cultivation exists side-by-side. A random sample of 44 traditional farms growing roses under open field condition and 11 hi-tech farms growing rose under greenhouse were selected. However, firms with extreme technologies like growing plants on artificial medium such as rock wool and employing fully automated system of control using computers for applying irrigation, fertilizers, drainage, controlling temperature, humidity, ventilation, etc. were excluded while sampling to maintain homogeneity among hi-tech units. Tabular analysis was used extensively for this study.

To estimate the cost and returns, various methods were followed along with some plausible assumptions. The existing lease rates in the study area were used as the imputed rental value of the land. For the computation of depreciation, certain assumptions were made regarding the expected life of the assets. For greenhouses and implements, the depreciation charges were calculated based on straight-line method, that is, by dividing the original cost less junk value of the asset by its expected life in years. This was apportioned to individual crops in proportion of their acreage. The annual repairs and maintenance charges were added to the depreciation costs. For other investments such as packaging units, office buildings and other investments, the

actual interest rate charged by the commercial banks at the rate of 13.5 per cent and 16 per cent per annum for traditional and hi-tech rose cultivation respectively, was considered in the analysis. The amortization of establishment cost was done using the compound growth rate formula and considering the gestation life of the garden. For other inputs, such as plant materials, fertilizers, manures, plant protection chemicals, sprayers, bore wells, etc., the actual costs (minus subsidies) was used. Since, the traditional and hi-tech cultivators were growing roses throughout the year and realised returns periodically, the interest on working capital was not considered.

For computation of wages in case of family labour, the prevalent wage rate for the type of job involved was taken for imputation and for the hired workers, the actual wages paid were used for analysis. On hi-tech farms, the manday cost was computed by dividing the total salaries of all salaried personnel by the number of working days. The labour productivity was computed as the ratio of gross returns to the number of mandays employed. For the computation of cost of cultivation, fixed as well as the variable costs of cultivation were included. The cost of cultivation and the marketing cost together form the cost of production. The gross returns were calculated as total returns from the sale of all types of rose flowers. The net returns were calculated as the gross returns over the cost of production and the net returns to the fixed factors was calculated as the gross returns minus the variable costs (variable cultivation costs plus marketing costs).

## **RESULTS AND DISCUSSION**

Table 1 shows contrasting characteristics of traditional and hi-tech farms sampled for the study. The average area under rose cultivation was 0.91 ha on traditional and 3.68 ha on hi-tech farms. However, the intensity of planting was very high in hi-tech units with about 69 thousand plants per ha, which is 11 times more than that of traditional rose farms. The frequency of irrigation was also higher for hi-tech units and it was adjusted very frequently in order to maintain an optimal temperature and humidity inside the greenhouse. The expected economic life of rose grown under open field condition was 10 years and that of hi-tech was 5 years. However, in reality, it varies widely depending upon the variety, soil type, cultivation practices, incidence of pest and diseases, etc. In addition to these, under hi-tech cultivation, factors such as genetic breakdown of varieties and fast changing preferences of foreign customers also decide the life of a variety grown on the farm.

The average investment for a hi-tech farm was about Rs. 40.3 millions whereas that of traditional farms was only about Rs.0.097 millions. Hence, these hi-tech enterprises were taken up by industrialists on corporate lines. Even among hi-tech units, investment varies depending upon the type and extent of technology used.

### **Resource use pattern**

A perusal of Table 2 reveals that there was an intensive use of resources on hi-tech farms than that of the traditional farms. The hi-tech farms employed more labour per unit of land compared to traditional farms. The hi-tech farms were consuming huge quantities of chemical fertilizers, that is, about 45 times more than that of traditional cultivation. Further, consumption of plant protection chemicals per ha on hi-tech units was about three times more than the traditional farms. The excess use of chemicals is a cause for concern as it can possibly cause health hazards like headaches, dizziness, hand trembling, blurred vision, abortion, etc. and environmental hazards like groundwater pollution (Tenenbaum, 2002). The quantum of irrigation water used in hi-tech units was about 5 times more than that of traditional farms.

### **Capital investment**

Table 3 shows the extent of capital investment in hi-tech vis-a-vis traditional rose cultivation. The establishment cost of hi-tech farms was very high to the tune of about Rs. 12.27 million per ha as compared to that of Rs. 0.058 million per ha for traditional cultivation. Planting materials constitutes over a half of the total investment under traditional cultivation followed by manure, oilcake and labour. Under hi-tech cultivation, the major cost components are greenhouse structures (about 41 percent) followed by planting material (about 30 percent) which were mostly imported from European Countries and Israel.

### **Cost of cultivation and marketing**

The cost of hi-tech rose production was very high (Rs.12.18 million per ha per year) compared to that of traditional cultivation owing to the sophisticated (controlled/soilless) method of cultivation and marketing (Table 4). Under traditional cultivation, fixed capital accounts for about Rs. 60.3 thousand per ha and variable cost was Rs. 84.2 thousand per ha. Under traditional cultivation, labour cost was the major component among the variable cost items. On the other hand, marketing costs including freight charges form the major cost component for hi-tech roses with about Rs. 7075 thousand per ha, i.e., about 58 percent of the total production cost. The

expenditure on pesticides and chemical fertilizers for hi-tech roses were about 10 times that grown under open field condition.

### **Yield and returns**

The yield of rose under open field condition was 0.715 million flowers per ha per annum. Of the total production, the number of *Stems* per ha was only 0.12 million, which fetched a premium price of Rs. 4.50 per dozen. On the other hand, the production of pieces was 0.60 million per ha but fetched poor price of Rs. 3.00 per dozen (Table 5). There was stability in the prices realized by the traditional cultivators because prices were predetermined as per the pre-harvest agreement with local traders. Under hi-tech condition, about 2.77 million good quality cut roses were harvested per ha. Although, the prices in the international market fluctuate very widely, on an average, the cut roses fetched about Rs. 8.45 per flower. During the peak season, it climbs up to Rs. 80 per flower. The annual gross returns realised on hi-tech farms was about Rs. 17 million per ha and that of traditional farms was Rs. 0.19 million per ha. The traditional farms earned a net return of about Rs. 0.045 million per annum and a net return to the fixed factors, that is, return over variable cost of Rs. 0.105 million. On the other hand, hi-tech farms had realized a net return of Rs. 4.8 million per ha and return to the fixed factors of Rs. 8.46 million per ha.

### **Employment potential, wages and labour productivity**

Regarding employment generation potential, hi-tech farms provide more employment per unit of land with about 7281 mandays per ha, which is nine times more than compared to traditional farms (Table 6). Of the total annual employment of 800 days per ha on traditional farms, the share of family and hired labours was almost same. On the other hand, on the hi-tech farms, nearly four-fifths of the labour force was casual labourers and one-fifth was salaried personnel comprising technical, managerial and other staff. The labour productivity was higher on hi-tech farms (Rs. 2333 per manday) compared to that of traditional farms (Rs. 241 per manday). The salaries of managerial, technical and clerical cadre employees on hi-tech farms varied widely with an average of Rs. 3600 per month. The average wage rate for male casual labour was Rs. 58 per day and Rs. 42 per day on traditional and hi-tech farms, respectively. On the other hand, the female casual labours were paid only Rs. 33 per day on both types of farm, for similar tasks assigned to their male counterparts. This shows the discrimination against the female casual labour practised on both the farms.

## CONCLUSION AND POLICY OPTIONS

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 profitable. Although, the hi-tech farms are capital intensive and require huge initial investment and marketing costs especially freight charges and EEC cess, they performed much better in terms of realization of returns and employment generation per unit of land. The rose cultivation, in general, and hi-tech rose cultivation, in particular, is generating more employment to rural landless labourers and small and marginal farmers. However, there was discrimination against female casual labour in terms of lower wages for the same work done under both the system of rose cultivation.

The findings of the study give some important policy options to enhance the profitability and efficiency of rose cultivation. They are as follows:

- Although both traditional and hi-tech cultivation are profitable and employment generating, the hi-tech farms were generating very 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 hi-tech 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.

- Efforts should be made to avoid excess usage of pesticides and other chemicals in hi-tech rose production by promoting environmental friendly practices such as Integrated Pest Management and Organic Farming.
- Efforts should be made to empower the women casual labour to bargain for better wage rate equal to their male counterparts for similar type of work.
- The hi-tech farms are primarily dependent on export market where demand and prices are fluctuating widely. Hence, proper market intelligence on floriculture trade should be undertaken at domestic and global level to sustain rose production and exports in the long-run.
- India should bargain through WTO settlement for a lower import tariff rates for floriculture exports especially to European Union.



**Table1. General information on sample rose farms**

<b>Particular</b>	<b>Traditional farm</b>	<b>Hi-tech farm</b>
Farm size (ha)	4.45	19.27
Area under rose (ha/farm)	0.91	3.68
Area under rose to total area (%)	20.65	19.08
Productive life of rose plant (years)	10	5
Plant density (nos./ha)	5901	69129
Frequency of irrigation (nos./week)	1.77	14
Investment (Rs. million/farm)	0.097	40.248
Greenhouse structures (nos.)	-	5.36
Area per greenhouse (sq.m)	-	6860

**Table 2. Resource use pattern in rose cultivation (Quantity/ha/yr)**

<b>Particular</b>	<b>Traditional farm</b>	<b>Hi-tech farm</b>
1 <b>Human labour (nos.)</b>	800	7281
2 <b>Natural manure</b>		
(i) Red soil or silt (tonnes)	13.23	0
(ii) FYM (tonnes)	17.0	12.9
(iii) Oilcakes (kgs)	491	735
3 Chemical fertilizers (kgs)	275	12480
4 <b>Plant Protection Chemicals</b>		
(i) Dry formulation (kgs)	26.25	70.4
(ii) Wet formulation (litres)	33.75	83.8
5 Irrigation (acre inches)	43.07	198.63
6 Ratio of FYM to fertilizers (qty)	6.94	1.04
7 Capital Labour Ratio (Rs./manday)	121	5528

**Table 3. Cost of establishment of rose farms (Thousand Rs./ha)**

<b>Particular</b>	<b>Traditional farm</b>		<b>Hi-tech farm</b>
<b>1. Buildings &amp; other structures</b>			
Land	-	-	95 (0.85)
Greenhouse structure	-	-	5435 (40.62)
Cold storage structures	-	-	890 (8.08)
Packaging unit	-	-	61 (0.25)
Office buildings	-	-	148 (1.28)
<b>Sub-total</b>	-	-	<b>6628 (51.36)</b>
<b>2. Equipments</b>			
Sprayers	-	-	14 (0.13)
Fertigation unit	-	-	120 (0.91)
Bore wells	-	-	59 (0.51)
Trolleys	-	-	4 (0.03)
Grading equipments	-	-	26 (0.33)
<b>Sub-total</b>	-	-	<b>224 (1.91)</b>
<b>3. Others</b>			
Generators	-	-	96 (0.79)
Fence	-	-	42 (0.43)
Electrical installation	-	-	88 (0.79)
Office materials	-	-	17 (0.10)
AC van	-	-	292 (2.73)
Office vehicles	-	-	248 (2.05)
Head office fixed assets	-	-	63 (0.46)
Miscellaneous	-	-	463 (3.87)
<b>Sub-total</b>	-	-	<b>1310 (11.20)</b>
<b>4. Establishment of Garden</b>			
Labour	9.0	(15.33)	215 (1.75)
Material			
(i) Plant materials	32.2	(55.04)	3629 (29.53)
(ii) Manure and oilcakes	11.4	(18.73)	117 (0.95)
(iii) Fertilizer	2.4	(4.20)	78 (0.64)
(iv) PPC	2.0	(3.44)	84 (0.68)
(V) Others	1.4	(2.68)	-
<b>Sub-total</b>	<b>58.4</b>	<b>(100)</b>	<b>4123 (33.56)</b>
<b>5. Total establishment cost (1+2+3+4)</b>	<b>58.4</b>	<b>(100)</b>	<b>12286 (100)</b>

**Note:** Figures in parentheses indicate percentages to the total establishment cost.

**Table 4. Annual cost of cultivation and marketing of roses (Thousand Rs./ha)**

<b>Particular</b>	<b>Traditional farm</b>	<b>Hi-tech farm</b>
<b>1. Cost of cultivation</b>		
<b>A. Fixed Cost</b>		
Land rent & interest on capital	42.5 (28.75)	1394 (11.4)
Amortised cost of garden establishment	5.8 (3.96)	825 (6.8)
Depreciation	12.0 (8.11)	1438 (11.8)
<b>Sub-total</b>	<b>60.3 (40.8)</b>	<b>3657 (30.0)</b>
<b>B. Variable cost</b>		
Labour	37.7 (25.5)	384 (3.2)
FYM and oilcakes	6.3 (4.3)	7 (0.1)
Chemical fertilizers	22.1 (14.9)	211 (1.7)
Plant protection chemicals	18.1 (12.3)	168 (1.4)
Electricity charges	-	118 (1.0)
Office rent and stationeries	-	156 (1.3)
Contingency	-	406 (3.3)
<b>Sub-total</b>	<b>84.2 (57.0)</b>	<b>1450 (12.0)</b>
<b>Total cost of cultivation (A+B)</b>	<b>144.5 (97.8)</b>	<b>5107 (42.0)</b>
<b>2. Marketing cost</b>		
Grading and packing	-	782 (6.4)
Domestic marketing charges	3.3 (2.2)	46 (0.4)
Freight charges	-	3699 (30.4)
Commission charges	-	41 (0.3)
Export marketing charges	-	162 (1.3)
EEC cess & other charges	-	2345 (19.3)
<b>Sub-total</b>	<b>3.3 (2.2)</b>	<b>7075 (58.0)</b>
<b>3. Total annual cost (1+2)</b>	<b>147.8 (100)</b>	<b>12182 (100)</b>

Figures in parentheses indicate percentage to the total annual cost

**Table 5. Annual yield and returns on rose farms**

<b>Particular</b>	<b>Traditional farm</b>	<b>Hi-tech farm</b>
<b>1. Yield</b>		
Exported flowers (millions/ha)	-	1.850
Locally sold flowers		
-- <i>Stems</i> (millions/ha)	0.115	0.924
-- <i>Pieces</i> (millions/ha)	0.600	-
Total marketed flowers ( millions/ha)	0.715	2.774
<b>2. Prices</b>		
Exported flowers (Rs./flower)	-	8.45
<i>Stems</i> (Rs./dozen)	4.50	17.50
<i>Pieces</i> (Rs./dozen)	3.00	-
<b>3. Returns</b>		
Gross Return (thousand Rs./ha)	193	16990
Net return (thousand Rs. /ha)	45	4810
Return to fixed factors (thousand Rs. /ha)	105	8460

**Table 6. Employment, wages and labour productivity on rose farms**

<b>Particular</b>	<b>Traditional farm</b>	<b>Hi-tech farm</b>
<b>1. Employment (mandays/ha/annum)</b>		
Family labour	388	-
Hired casual labour	412	5835
Technical, managerial and clerical cadre	0	1446
Total employment	800	7281
<b>2. Wage rate (Rs./manday)</b>		
Men	58	42
Women	33	33
Managerial & others	-	120
<b>3. Labour productivity (Rs./manday)</b>	241	2333

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