LOCATION FOR FLOWER PROCESSING UNITS IN KARNATAKA : AN ECONOMETRIC ANALYSIS

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Jasmine is one of the oldest cultivated flower shrubs. It is estimated that at least 14500 kg., of cut flowers of different varieties of jasmine are sold everyday in the important cities of Madras, Bangalore, Bombay, Delhi and Calcutta. A large quantity of some species is also used for the extraction of essential oils.

Jasmine comprising of 20 genera and more than 200 species constitute a fascinating group of plants valued for their fragrance and for its concentrates. Jasmine species are either found growing wild in the nature or cultivated in the tropical and sub-tropical countries like India, China, Malaysia, Egypt, Algeria and Morocco. In India the plants found wild in northern Himalayan regions and in the regions of Western Ghats and Nilgiri hills of Tamil Nadu. The origin of this specie is believed to be in Asia.

In Karnataka, it is cultivated in an area of 1455 ha., with a production of about 6700 tones of flowers grown mainly in Mysore, Bangalore, Bellary and Dakshina Kannada districts.

Interestingly, off-late jasmine cultivation has received a great fillip after the potentialities of the south Indian jasmine were realized (especially for its extracts of essential oils). The serious limiting factor affecting the jasmine flower growers and consumers, which is likely to affect the commercial production is that the flowers are highly seasonal in nature and highly perishable. This nature of perishability affects the profit margin of the growers.

The least cost location of agricultural processing facilities within some specified geographical area has been the subject of a numerous studies. These studies have dealt with the assembling and processing of individual commodities or group of commodities for better pricing (marketing).

The main focus of the present study is to determine the number, size and location of the processing plants needed to minimize the combined cost of processing and transportation.

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- Jasmine being highly perishable, the center of production should normally be very near to the center of consumption
- Demand for flowers is not uniform and steady
- The presence of many intermediaries in the trading of flowers will affect the income of the flower cultivators ultimately

Thus the entire marketing and processing of flowers is confronted with various types of problems, which calls for an in-depth study to found out the economic aspects of the processing and marketing of flowers. Therefore this paper tries to gain an insight into the economic aspects of flower processing and marketing.

The main objective of the study is to simultaneously determine the number, size and location of plants that minimizes the combined transportation and processing costs involved in assembling and processing of any given quantity of raw material produced.

Methodology

In order to study the same, the Linear Programming (LP) technique (stollsteminer model) was used for the present study.

Potential plants sites in the region were assumed to be limited to the places where flowers were grown extensively, considering other factors like infrastructure facilities, availability of incentive, concession etc. However, the growing areas are divided into different regions based on agro-climatic conditions and quantity of raw materials.

Given the specific plant-cost relationship along with certain assumption that the plant cost function is invariant with respect to plant location. The minimum procedure is imposed on the problem using the transportation cost matrix.

The stollstemier's model used to minimize both the processing and transportation costs. The model can be algebraically stated as:

$$\text{Min. } TC = \sum_{j=1}^{J} P_j X_j L_k + \sum_{i=1}^{I} \sum_{j=1}^{J} X_{ij} C_{ij} L_k$$

Subject to:

$$\sum_{j=1}^{J} X_{ij} = X_i \quad \text{(Quantity of raw material available at origin i per production period)}$$

$$\sum_{I=1}^{I} X_{ij} = Xj \quad \text{(Quantity of material processed at point j per production period)}$$

$$\sum_{i=1}^{I}\sum_{j=1}^{I} X_{ij} = X \quad \text{(Total quantity of raw material produced and processed)}$$

$X_{ij}, X_j > 0$ & $C_{ij} > 0$

TC – Total processing and transportation cost

P_j - Unit processing costs in plant j located at Lj

X_{ij} - Quantity of raw material transported from origin i to plant j located at Lj

C_{ij} - Unit cost of transporting material from origin i to plant j located at Lj

L_k - One location pattern for j plants among the (Lj) possible combination of locations for J plants given L possible locations

L_j - A specific location for an individual plant (J= 1...J)

Assuming TPC is constant for any no. of plants

$$TPC = P \sum_{j=1}^{J}\sum_{i=1}^{I} X_{ij} = P_x$$

P – Constant unit processing cost

P_x – Total quantity of material to be assembled and processed

TPC – Total processing cost

The optimum number of plants and their location can be determined directly by solving the above formulation. A plant will be located at each potential, site when the total cost determines the size of the plant with certain assumptions.

In order to solve the location model, data from 20 district of Karnataka State were analysed. These districts were aggregated to 5 regions. These regions are classified based on similar agro-climatic conditions as per below:

Region – I : Bider, Gulbarga, Raichur

Region - II : Bangalore, Bijapur, Bellary

Region - III : Mandya, Mysore, Bangalore, Chitradurga, Kolar, Tumkur

Region - IV : Dharwar, Chikkamagalore, Hassan

Region - V : Shimoga, Kodagu, Uttara Kannada

Based on the infrastructural facilities like area under flowers, power, water, transportation and productive work force etc., six locations were selected in Karnataka to set up the flower processing units. These units propose to be located at Bangalore rural, Mysore, Bellary, Shimoga, Dakshina Kannada and Bijapur. These districts fall under the 'developing areas' and get certain benefits, under the revised package of incentives and concessions for new industrial Investments in Karnataka 1993-1998.

These incentives and concessions include investment subsidy, incentives for installation of equipment for utilisation of renewable source of energy, sales tax concessions, and exemption from stamp duty and registration charges.

Optimal Plant Location

The total quantity of Champak, Jasmine and Tuberose flowers produce in the state of Karnataka during 1996-97 estimated at 21074 tones (Dept. Of Horticulture, Lalbagh, Bangalore). Out of this, it is assumed that about 40 percent of it (i.e. 8430 tone) are surplus available that could be utilized by the processing units as a raw material. In order to study the optimal location pattern of processing units, six potential areas were considered based on the consideration cited above. The proposed areas are Bangalore, Mysore, Shimoga, Bellary, Dakshina Kannada and Bijapur districts and the new industrial policy for Karnataka supports the selection of these areas. The optimal location patterns in the State of Karnataka ranging from one till six plants as specified in Table-1, shows plants of various capacities, total transportation costs (TTC), total processing costs (TPC) and optimum locations.

Findings

The result of the analysis revealed that, Mysore is the best suitable location, since the concentration of flower production is in and around the city. Therefore the location minimizes the transportation cost (Fig.1). Thus it was located in Mysore District, where both transport and processing costs together accounts to around Rs.215.03 lakes per year (Table-1)

Further analysis shows that the combination of locations put together minimizes the transportation and processing costs (Fig.2). It could be seen that total cost is minimized with two units located at Mysore and Bangalore, which worked out to Rs.213.18 lakes annually with daily processing of 14.05 tons per plant. The total cost increased marginally by Rs.213.24 lakhs per year, if the plants were to set up at Bangalore, Mysore and the third at Bellary. Each plant will have a daily processing capacity of 9.4 tones. However, by setting up plants at all the six potential lands sites proposed viz., Bangalore, Mysore, Bellary, Shimoga, Dakshina Kannada and Bijapur, the total cost works out to (Rs.252.82 lakes/year) with the processing capacity of 4.60 tonnes. The transportation costs of the raw material to these six areas were worked out to Rs. 2.14 lakh/year, Though the multiple location of these plants minimizes the transportation costs with the simultaneous increase in the processing costs.

Since the optimum plant locations have been decided, as the second best and third best location configuration of plants have also to be considered along with the same. This would further aid in decision making which takes ground condition into consideration, which the model did not explicitly consider, if were to examine in terms of next best alternatives as the total cost increases (Table-1). After scanning the transport cost matrix through Linear Programming (LP) method, the output for different capacities with minimum transport cost was obtained.

Plant Location Model

Locating Processing plant is a crucial policy decision that has to consider various factors so as to enhance the competitiveness of a firm in the market economy. It has been the prime concern to economize the transportation cost. Other considerations such as regular supply of raw material, infrastructure facilities and incentives are crucial in determining the economic viability of location of such units. Large-scale production is imperative, so that the commodity can have a market presence. Small-scale production is often vulnerable to international fluctuations in demand and price. Hence future strategy should aim at large

output, so as to establish an international market presence for processed agro-product such as aromatic oils.

The details regarding the project cost and operating costs to be incurred for setting up a processing plant to extract essential oil from flowers are presented in Table-1. For setting up such plants there are many institutions, which provides financial assistance. For instance, Karnataka State Finance Corporation provides assistance upto 75 percent of the fixed capital towards building and machinary. Machinaries include extractions, pre-concentrators, final concentrator boilers, cooling tower, support structure, hexane storage tank, steam piping, process piping with valved electrical motors and frame proof wiring etc. If the project costs exceeds Rs.20 lakhs then one should get working capital from some other sources like commercial banks. The rate of interest towards these loans is 19.5 percent per annum. Since profit margin is very high in this enterprise, high investment can be justified.

Processing is an important activity that enables the surplus flowers, which are perishable, has to be diverted to convert into essential oils, thereby eliminating the wastage of flowers. The Government of Karnataka new Industrial policies further justifies establishment of the processing units. According to this policy, one can get maximum concession and benefits. Investment subsidies are available up to 30 percent of the value of the fixed assets for the unit, which takes up expansion, diversification and modernization programmes anywhere in the state. The most profitable combination of processing units should be located where the combined cost of transportation and processing is least. At present two processing units are located at Mysore and Bangalore. Out of the total production of 21074 tones of tuberose, jasmine and Champak, it was assumed that 40 percent (i.e. 8430 tones) of the flowers produced are available as a raw material. An attempt has been made in the study to consider the establishment of more processing units at reasonably low costs in different areas of the state using LP model. If we consider the establishment of processing units at six different locations for the better coverage by the state viz., Bangalore, Mysore, Bijapur, Bellary, Shimoga and Dakshina Kannada, the gross TTC and gross TPC would be high. Where the TTC is very low, the TPC per plant is highest because the raw material has been supplied from the neighboring areas in order to operate the plant throughout the year.

The TTC+TPC would be minimum, if the two proposed plants are located at Bangalore and Mysore. The cost of establishment of the plants worked out to Rs.273.18 lakes per plant for 4215 tons capacity annually. With a marginal

increase in the total cost, the additional two plants are proposed either at Bellary or at Shimoga, investment amounting to Rs.213 lakes per plant with 2810 tons capacity annually. This is because though the TTC is high, TPC per plant is very low because of the concentration of the flower production in these areas. Similarly because of these reasons, the TTC+TPC is very high for the plant of the lower capacities as presented in the Table 1 for regions 4,5, & 6. Therefore it is evident that the location of processing units in other areas of the state would depend to a large extent for increased quantity of flower in the coming years. The projection made for these flower crops have clearly indicated that there exits a scope to increase the quantity of flowers through increase in area and also by adopting modern technology.

Conclusion

Based on these findings, it may be inferred that direct marketing of flowers in a fresh form is comparatively less profitable to the processed form. Therefore processing facilities need to be created to encourage farmers to produce and supply the flowers to the processing plants, which will ensure the much higher and stable income. Karnataka State Financial Corporation (KSFC) while advancing the credit facilities to set up processing plants, must ensure that these plants should be established at Bangalore, Mysore, Shimoga, Bellary, Dakshina Kannada and Bijapur. Besides having better infrastructural facilities it has a comparative advantage with regard to transport and processing cost.

Table – 1 : Optimum Plant Location, Plant Size and Minimum assembling Costs in relation to Number of Plants

(Rs. in Lakh)

Sl. No.	Capacity (tons/year)	Total Transportation Cost (Rs.)	Total Processing Cost (Rs.)	Total (TTC+TPC)	Location
1	8430	5.40	209.63	215.03	Mysore
2	4215	3.55	209.64	213.19	Mysore, Bangalore
3	2810	2.87	210.37	213.24	Mysore, Bangalore, Bellary
4	2107.5	2.42	214.85	217.27	Mysore, Bangalore, Bellary, Shimoga
5	1686	2.30	220.07	222.37	Mysore, Bangalore, Bellary, Shimoga, Dakshina Kannada
6	1405	2.14	250.68	252.82	Mysore, Bangalore, Bellary, Shimoga, Dakshina Kannada, Bijapur

References

Byrkett, D.L., Muller, R.A. and Taiganides, E.P., 1976, Modeling the Optimal Location of the Cattle Feeding Industry. American Journal of Agricultural Economics, 58 (2): 236-244

Gupta, S.P. and Arora, V.P.S., 1988, Minimizing the Cost of Transportation for Soya bean Processing Industries in Uttar Pradesh. Indian Journal of Agricultural Economics, 43 (1): 56-62

Kumbhare, S.L. and Sirohi, A.S., 1981, An Application of Linear Programming in Transportation and Storage of Wheat. Agriculture Situation in India. 35 (12): 919-923

Lopez, R.A. and Henderson, N.R., 1989, The Determinants of Location Choices for Food Processing Plants. Agribusiness, 5 (2): 619-632

Oppen, M.V. and Scott, J.T., 1976, A Spatial Equilibrium Model for Plant Location and Interregional Trade. American Journal of Agricultural Economics. 58 (3): 437-446