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ECONOMIC FEASIBILITY AND PROFITABILITY OF CARNATION (*Dianthus caryophyllus* L.) CULTIVATION UNDER PROTECTED CONDITION

[1]Tarannum, [2]Hemla Naik B. & [3]Zaheer Ahamed, B.
[1]Department of Floriculture and Landscape Architecture, College of Horticulture, UHS campus, GKVK (P), Bangalore-560 065, Karnataka, INDIA
[2]Department of Horticulture, PPM Cell, UAHS, Navile, SHIMOGA-577 204,
[3]Departmentof Plant Pathology, UAS, Raichur, Karnataka

ABSTRACT
The demand for Carnation cut flower is gaining momentum with increasing aesthetic sense and higher socio-economic standard of the people. Owing to its ever increasing demand every year at a galloping speed has now created enough opportunities for economic growth potential in future. Hence, to evaluate economic viability of cultivation as a commercial cut flower crop the present investigation was carried out under naturally ventilated polyhouse. Carnation being a perennial crop with an economic life span of 3-5 years, the annual establishment and maintenance cost worked out to Rs. 1, 39,657/560 m^2. Among the different genotypes studied highest gross returns were obtained from genotype Soto (Rs. 4,90,140.00/ 560 m^2), followed by Dona (Rs. 4,20,00.00/560 m2) and White Dona (Rs. 3,99,000.00/560 m^2) with a net return of Rs. 3,50,483.00, 2,80,343.00, and Rs. 2,59,43.00/560 m^2, respectively compared to other genotypes grown under polyhouse. The investment in Carnation crop was found to be economically sound and highly remunerative as these genotypes produce highest yield (flower stalks) per unit area resulted in maximum B:C ratio of 2.50, 2.00 and 1.85 respectively, hence the same can be exploited for commercial cultivation to meet the increasing global demand.

KEY WORDS: Carnation, Genotypes, Economics, B: C ratio, Protected cultivation.

INTRODUCTION
Colourful flowers with pleasant fragrance have been a source of attraction to mankind. Flowers provide pleasure through enlightening colours and spreading fragrance. Therefore, man has always taken support of flowers as a token of expression of kind sentiments on number of occasions and consequently, ever increasing demand of flowers has made the floriculture of paramount importance for conducting economic evaluation and marketing investigation.Floriculture is fast emerging as a major venture in the world scene. Carnation is one of the most popular cut flowers in the world and the highest economic importance in the floriculture industry. In recent years, demand for Carnation cut flower is gaining momentum with increasing aesthetic sense and higher socio-economic standard of the people. This was reflected much earlier in Europe, USA and Japan and very recently in India also. In India, the floriculture industry got an appreciable boost during the last two decades due to active patronage from the Government of India. Carnations are excellent for cut flowers, bedding, pots, borders, edging and rock gardens. As long lasting flowers, Carnations are very popular as boutonnieres, in corsages, bouquets and in a wide range of floral arrangements. These are preferred to Roses and Chrysanthemums in several exporting countries, due to its excellent keeping quality, wide range of colours, forms, ability to withstand long distance transportation and remarkable ability to rehydrate after continuous shipping. Carnations are popularly favored on special occasions, especially Mother's Day, Valentine's Day, Easter, weddings and Christmas. Carnation (*Dianthus caryophyllus*) is also known as the divine flower. It belongs to the family of Caryophyllaceae, occupying the esteemed position among top ten flowers of the world for more than five decades. The development of Standard (Sim) type of Carnation revolutionized the trade and spray types are also fast catching up. It is grown on large scale in South Africa, Colombia, Kenya, Morocco, Turkey, Italy, Spain, Columbia, Srilanka, Canary Islands, France, Holland, USA, Germany etc. were the pioneer countries in commercial cultivation of Carnation for export purpose. While the major importers of Carnation are France, United Kingdom, Holland, Israel, Italy, Spain, Peru, Greece, Mexico and Eucador. In India the major production regions are in and around Kodaikanal, Bengaluru, Kolkata, Delhi, Nasik, Himachal Pradesh, Ooty, Shimla, Ludhiana, Hyderabad, Uttarakhand. are suitable for Carnation cultivation. It is estimated that more than 6000 ha of land is under Carnation cultivation in the world. In India, it is common practice to have the plants growing in greenhouses for the cut flower production resulting in increased crop production covering more than 600 hectares of area. While in Karnataka, it is grown in an area of 40 ha with the production of 51 lakh cut flowers accounting Rs. 85 lakh per annum during 2008-09 (Anon, 2009). In a country like India, which is bestowed with diverse geographical locations, varied type of climate, besides the availability of vast land and labour force, there exist a great potential for the production of Carnation on commercial scale in protected structure *viz.*, polyhouse, glasshouse etc. Polyhouse, a framed structure, is normally covered with transparent, high density

polyethylene film (HDPE), strong enough to grow crops under partial or fully controlled environmental conditions to obtain optimum growth and maximum productivity. The low cost polyhouse, which needs less investment when compared to atomized high cost greenhouses, can be utilized successfully for producing high quality flowers under ideal climatic conditions, besides protection of crop from extreme climatic conditions, pest and diseases; it is possible to cultivate the crop round the year. Also diversification of genotypes in the hilly region of our country is very meager. There is a need of suitable cultivars for hilly region to cultivate under protected conditions, as always there is a demand for novel types having improved growth, quality and yield parameters. Hence, there is an immense need to evaluate new genotypes for their quantitative and qualitative parameters which decides the significance of suitability of the particular genotypes. There was not any in depth study regarding the economics and marketing of floriculture. However, some researchers have conducted economics and marketing studies of floriculture including Koelemeijer (1991). Since Carnation cultivation is an upcoming business opportunity especially in India, it is essential to work out the economics, which ultimately reflects on cost of cultivation and finally to recommend the suitable genotypes to produce desired quantity and quality of flowers for domestic as well as export market is of greater importance. Keeping all these point in view the present investigation was carried out to work out the economics of Carnation cultivation under low cost naturally ventilated polyhouse of 560 meter square for one year, at Department of Floriculture and Landscape Architecture, College of Horticulture, Mudigere, University of Horticultural Sciences, Bagalkot.

MATERIALS & METHODS

The present investigation was carried out during 2011-2012 at Department of Floriculture and Landscape Architecture, College of Horticulture, Mudigere, under naturally ventilated poly house of 560 m^2 area is oriented in North-South direction. Its frame is made up of galvanized iron pipe and covered with 200 micron UV stabilized polyethylene film. Two sides are covered with insect proof net of 60 meshes for natural ventilation and protection against entry of insect pests. Besides this, to regulate the requirements of temperature and humidity depending on the season and weather conditions rollable flap of polyethylene sheet were provided outside the insect net. The shade net with 50 per cent shade was laid out above the headspace inside the polyhouse to manage the light intensity and temperature during summer. The experiment was laid out in Randomized Complete Block Design (RCBD) and replicated thrice. Eight different genotypes of Carnation *viz.*, Dona, White Dona, Harish, Big Mama, Soto, Liber, Golem and Big Net were procured from the M/S Florence Flora Ltd. Bengaluru and were grown on raised beds of 30 cm height, one meter width at a distance of 20 cm between the rows and 15 cm between plants by following standard cultivation practices like soil sterilization, soil excavation, bed preparation, irrigation, nutrition, pinching, netting, disbudding, harvesting etc. as per the UAS, Bengaluru package of practice. The benefit-cost ratio was obtained when the present worth of the benefit stream was divided by the present worth of the cost stream (Kothari *et al.*, 2006).Cost components were categorized as Non-Recurring Contingency (NRC) and Recurring Contingency (RC) cost. Non-Recurring contingency includes polyhouse construction cost, supporting with galvanized iron (GI) nets (for ten years), cladding material, shade nets, and planting material (for three years) whereas, recurring cost includes soil sterilization, bed preparation charges, fertilizers and plant protection cost, supervision, maintenance and harvesting, transportation charges etc. Total cost includes total recurring costs, depreciation charges and interest on capital cost. Benefit Cost Ratio (BCR) was worked for all the genotypes under naturally ventilated polyhouse (560 m^2) and were evaluated to assess the economic viability of Carnation production.

RESULTS & DISCUSSION

Flower quality parameter decides the significance of suitability of the particular genotypes, for commercial cultivation. The important biometric characters deciding the size and nature of flowers are stalk length, stalk girth, bud and flower diameter, number of petals per flower, flower stalk weight, flower yield/plant (no.) and vase life. Significant differences were observed among the genotypes for these flower quality parameters and the same is depicted in Table 1.

TABLE 1: Flower yield and quality parameters in different genotypes of Carnation grown under protected cultivation

Sl. No.	Genotypes	Length of Flower stalk (cm)	Girth of Flower stalk (mm)	Flower diameter (cm)	No. of petals/ flower	Flower stalk weight (g)	Flower Yield/ plant (No's)	Vase life (days)
1.	Dona	84.50	4.60	5.43	64.67	39.35	10.00	9.50
2.	White Dona	84.27	5.70	5.62	73.33	52.12	9.50	9.33
3.	Harish	86.20	4.23	5.69	71.33	36.69	7.70	7.33
4.	Big Mama	88.33	3.67	5.69	74.00	48.00	7.00	6.17
5.	Soto	93.57	4.99	5.86	76.00	53.37	11.67	10.00
6.	Liber	51.37	4.36	4.70	54.00	26.44	8.50	8.67
7.	Golem	57.57	4.22	5.20	56.00	35.56	7.80	9.17
8.	Big Net	77.32	4.39	5.03	67.33	35.46	6.33	7.33
S. Em±		0.75	0.12	0.09	2.68	1.30	0.24	0.27
CD @ 5%		2.28	0.38	0.26	8.13	3.93	0.74	0.80

Agronomic practice followed for establishment and management of Carnation crop under 560 meter square polyhouse was analyzed and rents are given in Table 2. Different cost components of Carnation production were evaluated and found that total cost of Carnation cultivation was Rs. 1, 39,657/560 m^2 for a span of one year including polyhouse construction cost (Rs. 19,600), cladding material (Rs. 12,333), GI nets (Rs. 7,500), planting material (Rs. 36,000) and recurring contingency costs like soil sterilization, bed preparation, irrigation, nutrition, pinching, netting, disbudding, maintenance, harvesting etc. were Rs. 64,424. The economic returns was computed by deducting total cost and the cost incurred for flower production from the gross receipts obtained from the sale of flowers. The economic analysis revealed that, the maximum gross returns (Rs. 4,90,140.00/560 m^2) were obtained from genotype Soto, followed by Dona (Rs. 4,20,00.00/560 m^2) and White Dona (Rs. 3,99,000.00/560 m^2) with a net return of Rs. 3,50,483.00, 2,80,343.00, and Rs. 2,59,43.00/560 m^2, respectively compared to other genotypes grown under polyhouse (Table 3).

TABLE 2: Cost of establishment and maintenance of naturally ventilated polyhouse (NVPH) of 560 m^2 for production of different Carnation genotypes per annum

Sl. No.	Particulars	Total cost (Rs.)	Depreciation cost (Rs./year
I.	Non-recurring contingency (NRC) (For a life span of 10 years)		
	a. Cost of polyhouse structure @ Rs. 350/m^2 for a life span of 10 years (excluding cladding material)	1,96,000	19,600
	b. Cladding material with shed net (for a life span of 3 years @ Rs. 65/ m^2)	36,400	12,133
	c. Supporting material for Carnation plants for a life span of 10 years (GI)	75,000	7,500
	d. Total of NRC		39,233
II	Recurring contingency (ORC) (For a life span of three years)		
	a. Planting materials (12000 pl./unit @ Rs. 9/plant	1,08,000	36,000
	b. Bed preparation (FYM, cocopeat, neemcake, red soil, sand excavation, labour etc.,	50,000	16,000
	c. Soil sterilization	1,500	500
	d. Management cost (For one year)		
	e. Supervision, maintenance and harvesting (01 labour/unit/ month for 01 year @ Rs. 150/day/30 days/1 year	54,000	18,000
	f. Fertilizer and plant protection	15,000	5,000
III	Interest on fixed costs*@ 6%		24,924
Total of ORC			1,00,424
Grand total (NRC + ORC)			1,39,657

TABLE 3: Economics of cut flower production of different Carnation genotypes under naturally ventilated polyhouse (NVPH) of 560 m^2 for one year

Sl. No.	Genotypes	Total cost (Rs.)	Flower yield/m^2 (No. of stalks)	Flower yield/560 m^2 (No. of stalks)	Gross returns (Rs.)*	Net returns (Rs.)	B:C Ratio
1.	Dona	1,39,657	330.00	1,40,000	4,20,000	2,80,343	2.00
2.	White Dona	1,39,657	313.50	1,33,000	3,99,000	2,59,343	1.85
3.	Harish	1,39,657	254.10	1,07,800	3,23,400	1,83,743	1.31
4.	Big Mama	1,39,657	231.00	98,000	2,94,000	1,54,343	1.10
5.	Soto	1,39,657	385.00	1,63,380	4,90,140	3,50,483	2.50
6.	Liber	1,39,657	280.50	1,19,000	3,57,000	2,17,343	1.55
7.	Golem	1,39,657	257.40	1,09,200	3,27,600	1,87,943	1.34
8.	Big Net	1,39,657	209.00	88,620	2,65,860	1,26,203	0.90

**Average price per flower Rs. 3*

These genotypes had maximum B:C ratio of 2.50, 2.00 and 1.85, respectively under protected cultivation and are highly remunerative compared to other genotypes studied whereas, some of the genotypes had less B:C ratio due to their poor performance in terms of yield, flowering behaviour and susceptibility to biotic factors. This was in accordance with the reports of Ferretto (1994), Zawaneberg (1990), Totth (1984), Lin and Chin, 1990 and Mysore *et al*. (2008). Cultivar Soto has recorded the maximum yield (385.00 flower stalks/m^2) followed by Dona and White Dona (330.00 and 313.50 flower stalks/m^2, respectively) whereas, it was least in Big Net and Big Mama (209.00 and 231.00 flower stalks/m^2). The increased yield in these cultivars might be attributed to the greater leaf area and more number of leaves and branches per plant as well as plant spread, dry matter accumulation would have resulted in production and accumulation of maximum photosynthates, resulting in the production of more number of flowers with bigger size which ultimately fetches highest returns per unit area. The results are in accordance with the findings of Ryagi (2007), Dalal *et al.* (2009) and Gharge *et al.* (2009).

CONCLUSION

Floral business is in progress though on limited scale, but every growing demand of flowers has resulted in need to explore potential for expansion of this enterprise. The study results were highly encouraging with respect to higher economic return of floriculture. The average net income of obtained from Carnation ranged from Rs. 3,50,483 to 1,26,203 per 560 meter square per year. Moreover, the return per rupee spent ranged from Rs. 0.90 to 2.50. In brief, from the study it can be concluded that, cultivation of Carnation under naturally ventilated polyhouse in hill zone of Karnataka, will be highly economical hence, these genotypes can be undertaken for commercial production to produce desired quantity and quality of flowers to meet the growing domestic as well as international market for this flower crop.

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