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Economic Feasibility of Carnation Cultivation in the Nilgiris District of Tamil Nadu, India

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Aim: To estimate the economics of Carnation Production under Protected cultivation, to estimate the feasibility of the protected cultivation of Carnation in the study district, and to assess the constraints faced by the farmers in scaling up the protected cultivation in the study district and to suggest suitable solutions.

Study Design: An ex-post-facto study was conducted, among the carnation cultivators of Nilgiris district of Tamil Nadu.

Place and Duration of Study: The Nilgiris district was purposively selected for the study as it possesses the largest area under carnation flower cultivation in Tamil Nadu and the study was conducted between April 2023 and June 2023.

Methodology: The present study employed a multi-stage purposive cum random sampling technique to select the district, blocks, villages, and respondents for research. The Nilgiris district

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was purposefully chosen for its significance in carnation flower cultivation within Tamil Nadu. Specifically, Kothagiri, Coonoor, and Uthagai blocks of the Nilgiris district were selected as focal areas for this investigation. Within each of these selected blocks, two villages were chosen, resulting in a total of six villages as study locations. To ensure representation, 30 farmers engaged in carnation cultivation were then selected, with a proportion of 5 farmers per village. The respondents were interviewed with a pre-structured questionnaire through a random approach. Furthermore, the study incorporated feasibility analysis, which included evaluating key financial metrics such as the Benefit-Cost Ratio, Net Present Worth, and Internal Rate of Return. These financial analyses were conducted to assess the economic viability and potential returns associated with carnation cultivation in the Nilgiris district.

Results: The results reveal that the net return/ 4000 m^2 is Rs. 16.67 lakhs. The BCR was found to be 1.40 (Financially feasible). The NPV was found to be Rs. 70.35 lakhs and the IRR was estimated to be 40.00 per cent. Major constraints encountered by the farmers include the higher cost of polyhouse material and construction, followed by the higher cost of the seedlings and the poor availability of skilled labour.

Conclusion: Protected cultivation technology unlocks the potential to produce crops with high productivity and superior quality.

Keywords: Carnation; costs and returns; benefit-cost ratio; net present worth; internal rate of return; constraints.

1. INTRODUCTION

Trade globalization and economic liberalization in India, resulted in a sizable market for the export of high-value agricultural crops from the country, in addition to supplying the growing demand in the domestic market. Floriculture is a rapidly expanding, profit-generating sector of the agricultural industry that is expanding at a moderate rate globally and has the potential to be a lucrative agricultural enterprise, particularly for developing nations [1]. The demand for cut flowers such as roses, gladiolus, gerbera, orchids, carnations, and lilies has increased. With the help of technical advice from foreign companies, the Indian floriculture sector is getting ready to strengthen its position in international trade [2]. The impact of climate change has led to a rise in average temperatures, prolonged drought or excessive rainfall, and the emergence of new pests and diseases, which have an adverse impact on agricultural production in Southeast and South Asia [3-5]. However, the farming community, particularly in developing nations, faces significant challenges due to shifting weather patterns and a changing climate. Therefore, to provide a favourable microclimate to crops, protected cultivation would be a feasible alternative, mitigating climate risk [6,7]. These challenges pose formidable obstacles, especially for those with limited capacity to adopt effective adaptation strategies [8]. Flowers are the most significant of these agricultural crops. Protected cultivation is more sustainable as the effect of climate is minimized as the environment is controlled and the inputs such as fertilizers, pesticides, and water are utilized more efficiently than open methods of cultivation [9-11], and improved productivity with better quality ensures higher returns for the produce [12-14]. Protected cultivation lets farmers produce crops off-season and fetch higher prices [15,16]. Protected cultivation can help in the reduction of greenhouse gas emissions and the overall environmental impact of food production [17]. To guarantee vertical productivity development and incorporate market-driven quality measures into the production system, a revolution in production technology is required. The floriculture sector, which is developing in Asian countries like India, has the greatest potential to generate self-employment and high earnings for both small and marginal growers [18]. Due to urbanization and rising levels of disposable income, the demand for floriculture products has significantly increased [19,20] studied the Economic Analysis of production and marketing of cut flowers in The Nilgiris District, Tamil Nadu. In India, National Horticulture Mission (NHM) is laying emphasis on the adoption of Protected Cultivation Technology (PCT) by extending a fifty per cent subsidy to the polyhouse/greenhouse growers, thereby it becomes pertinent to undertake the research study on the feasibility of the PCT adoption with particular to Carnation, with the following objectives, i) to estimate the economics of Carnation Production under Protected cultivation, ii) to estimate the feasibility of the protected cultivation of Carnation in the study district, iii) to assess the constraints faced by the farmers in scaling up the protected cultivation in the study district and to suggest suitable solutions.

2. METHODOLOGY

Multi-stage purposive cum random sampling technique was employed in the present study in selecting the district, blocks, villages, and sample respondents. In the first stage of sampling, the Nilgiris district was purposively selected for the study as it possesses the largest area under carnation flower cultivation in Tamil Nadu. In the second stage of sampling three blocks namely, Kothagiri, Coonoor, and Uthagai were selected for the present study. In the third stage of sampling, two villages per block were selected randomly. Accordingly, Banahatty, Billicombai villages from Kotagiri block, Hubbathalai, Beratty villages from Coonoor block, and Thummanatty, Thuneri villages from Udhagai block were selected for the study. For the fourth stage of sampling, 5 farmers were selected randomly from the selected villages, therefore the entire sample size constitutes a sum of 30 carnation flower cultivators. The study was carried out to estimate the cost of cultivation of carnation flower crops in the Nilgiris district of Tamil Nadu. Discounted measures including Net Present Worth (NPW) and Internal Rate of Return were estimated for the crop chosen under the study. In order to estimate the constraints encountered by the farmers in carnation flower cultivation, the Garret ranking technique was employed and tabulated accordingly.

2.1 Economics of Carnation under Protected Cultivation

2.1.1 Cost Concepts

The cost of cultivation recommended by, the "Special Expert Committee on Cost Estimates, GOI, New Delhi", was used in the study. The cost concepts are as follows,

Cost A1: It includes,

1. Cost of seed material (Rs. /ac.)
2. Cost of farmyard manure (Rs/ac)
3. Cost of fertilizers (Rs. /ac.)
4. Cost of plant protection chemicals (Rs. /ac.)
5. Irrigation (no. of times/ cropping period)
6. Cost of human labour (Rs. /ac.)
7. Depreciation of farm buildings and implements (Rs.)
8. Interest on Working capital (Rs.)
9. Land revenue (Rs. /ac.)

Cost B1: It includes,

Cost A1 + interest on the value of owned fixed assets (ac)

Cost B2: It includes,

Cost B1 + rental value of owned land (Rs. /ac.)

Cost C1: It includes,

Cost B1 + imputed value of Family labour (Rs. /ac.)

Cost C2: It includes,

Cost B2 + imputed value of Family labour (Rs. /ac.)

Cost C3: It includes,

Cost C2 + 10% of cost C2 (Rs/ac)

2.2 Feasibility Analysis under Protected Cultivation of Carnation

2.2.1 Benefit-Cost Ratio (BCR)

The benefit-cost ratio of an investment is the ratio of the discounted value of all cash inflows to the discounted value of all cash outflows during the life of the project [21] and is computed as:

$$\text{B:C ratio} = \frac{\left(\sum_{j=1}^{n} \frac{B}{(1+r)^{n}}\right)}{\left(\sum_{j=1}^{n} \frac{C}{(1+r)^{n}}\right)}$$

Where,

B denotes Benefit (Cash inflow) in year n,
C denotes cost (Cash outflow) in year n,
n denotes investment lifespan,
r denotes interest rate and n denotes time measured in years.

2.2.2 Net Present Value (NPV)

NPV for flower cultivation can be calculated by estimating the present value of future cash flows (revenues from flower sales and costs associated with cultivation) and subtracting the initial investment [22]. The formula for NPV is:

$$NPV = \sum_{j=1}^{n} \frac{B}{(1+r)^n} - \sum_{j=1}^{n} \frac{C}{(1+r)}$$

Where,

B refers to the benefit stream from Protected cultivation,
C refers to the cost stream (fixed and variable cost) from Protected cultivation,
r refers to the discount rates,
n is the number of years

If the NPV is positive, it means that the flower cultivation is profitable and creates value. If the NPV is negative, it means that the investment is not profitable and destroys value.

2.2.3 Internal Rate of Return (IRR)

IRR is the discount rate at which the NPV of cash inflows equals the NPV of cash outflows [23]. It is calculated by solving the following equation:

$$IRR = \sum_{j=1}^{n} \frac{B}{(1+i)^n} - \sum_{j=1}^{n} \frac{C}{(1+i)^n} = 0$$

Where,

i is that discount rate at which the benefit stream equals the cost stream,
n is the total life period of the protected cultivation structure,
j is the total life of protected cultivation in years ranging from 1 to n.

2.3 Garrett's Ranking Technique

Garrett's (1977) Ranking Technique was employed in the present study to examine the various constraints in the order of their importance [24]. The respondents were asked to rank the problems in Carnation cultivation. In Garrett's ranking technique, these ranks were converted into percent positions by using the formula,

$$\text{Percent position} = 100*(R_{ij} \pm 0.5)/N_j$$

Where,

R_{ij} = Ranking given to the i^{th} attribute by the j^{th} individual
N_j = Number of attributes ranked by the j^{th} individual.

The mean values thus obtained for each of the attributes were arranged in descending order. The attributes with the highest mean value were given higher importance.

3. RESULTS AND DISCUSSION

3.1 Economics of Carnation under Protected Cultivation

3.1.1 Establishment Cost for the Construction of Polyhouse

Cultivation of carnation-cut flowers under protected conditions is highly capital intensive. Table 1, shows that the capital investment in polyhouse construction depends upon the total area, quality, and quantity of steel used, labour cost, and additional facilities like shading net, support net, facility unit, and irrigation system. The average capital investment on the construction of the carnation polyhouse per acre was Rs. 43.00 lakhs without subsidy. The National Horticulture Mission scheme provides the beneficiaries of a subsidy of forty per cent for the erection of poly houses for cut flower cultivation. Thereby, the total cost of establishment per acre with subsidy stands at Rs. 26.00 lakhs. The per cent share of structural framework cost in the total capital investment of polyhouse construction was higher at 60.47 per cent. The life of the structure is about 12 to 15 years. However, the poly film, shed net and support net has to be changed once in every three years. The cost incurred for polythene sheet erection under the polyhouse condition constituted 18.60 per cent of the total cost. The capital investment incurred on drip irrigation unit was 6.98 per cent. The per cent of cost incurred on grading/storage room and shade net were 4.65 to the total cost respectively.

3.1.2 Costs and returns of carnation under protected cultivation

CACP cost estimates and returns in Carnation cut flower cultivation are tabulated in Table 2. The average yield of the carnation bunch was 54000 bunches and the average price per bunch was Rs. 97.20 The net return was recorded to be around Rs. 16.67 lakhs/ 4000 m^2 area. The gross return was recorded to be around Rs. 52.50 lakhs/4000 m^2 area.

The per cent share of cost A_1 to cost C_3 includes 53.76 per cent. Costs B_1 and B_2 constitute 87.89 and 90.68 per cent of the cost C_3. Cost C_1 and Cost C_2 constitute 88.11 and 90.90 per cent of cost C_3. The findings are in occurrence with [25,26].

Table 1. Establishment cost for the construction of polyhouse

S. No.	Particulars	Cost*	Percentage to the total cost	Life period (years)
1	Land preparation and levelling	150000	3.49	-
2	Structural framework- G. I frame	2600000	60.47	12-15
3	Polythene sheet	800000	18.60	6-8
4	Shade net	200000	4.65	4-5
5	Grading room/storage room	200000	4.65	10-20
6	Drip or Fertigation unit	300000	6.98	6-8
7	Sprayers and Equipment	50000	1.16	6-8
8	Total establishment cost without subsidy	4300000		-
9	Subsidy from NHM@40%	1700000		-
10	Total establishment cost with subsidy	2600000		-

**Cost indicated as Rs / acre (4000 m^2)*

Table 2. Costs and returns of carnation under protected cultivation

S. No	Particulars	Value*
1	Cost of farmyard manures	157500
2	Cost of planting material	1011000
3	Cost of fertilizers	152000
4	Cost of plant protection chemicals	127966
5	Cost of netting and others	169000
6	Cost of skilled human labour	122666
7	Cost of hired human labour	597400
8	Depreciation on fixed capital	17534.95
9	Interest on working capital	291452
10	Land revenue	140
I	**Cost A_1**	**1926453 (53.76)**
11	Interest on owned fixed capital	411195
III	**Cost B_1**	**3148948 (87.89)**
12	The rental value of owned land	100000
IV	**Cost B_2**	**3248948 (90.68)**
13	The imputed value of family labour	8118.26
V	**Cost C_1 (Cost B_1+ Imputed value of family labour)**	**3157067 (88.11)**
VI	**Cost C_2 (Cost B_2+ Imputed value of family labour)**	**3257067 (90.90)**
VII	**Cost C_3 (Cost C_2 + 10 per cent of Cost C_2)**	**3582773**
	Average yield (Bunch)	**54000**
	Average output price (Rs/bunch)	97.20
	Gross returns (Rs/ac)	**5250000**
	Net returns (Rs/ac)	**1667227**

**Cost indicated as Rs/acre (4000 m^2); Figures in parenthesis () indicate the per cent share to cost C3*

3.2 Feasibility Analysis under Protected Cultivation of Carnation

Carnation is an annual flower crop. The total of two years has been assumed as the entire project duration and the feasibility analysis has been worked out accordingly.

The results of the Benefit-Cost Ratio (BCR), Net-Present Worth, and Internal Rate of Return have been tabulated in Table 3. The results show that the BCR for the cultivation of Carnation cut flowers under protection cultivation was 1.40. A Benefit-cost ratio greater than one indicates the economic feasibility of carnation-cut flower

Table 3. Feasibility analysis under protected cultivation of carnation

Feasibility Measures	Carnation under Protected cultivation
Benefit-cost ratio	1.45
Net present worth	7035664.24
Internal rate of return (%)	40.00

Table 4. Constraints encountered by farmers in cultivating carnation under protected cultivation

S. No.	Constraints	Garret's Score	Rank
1	Higher cost of the seedlings	58.83	II
2	Higher cost of the inputs such as fertilizers	47.86	VI
3	High incidence of pest and diseases	43.23	VII
4	Lack of continued technical guidance in crop cultivation	49.57	IV
5	Inadequate availability of skilled labour	50.80	III
6	High cost of labour	48.93	V
7	Less durability of polyhouse	29.8	VIII
8	Higher cost of polyhouse material and construction	71.63	I

cultivation under polyhouse conditions. The financial feasibility analysis such as B-C Ratio, NPV, IRR were analyzed in commercial flowers and horticulture crops and presented as of [27-29].

The results show that the Net present worth was found as Rs.70.35 lakhs showing that the construction of polyhouses for Carnation cultivation is economical contributing to a substantial increase in the farmer's income in the study district and the Internal rate of return was estimated to be 40.00 per cent. The findings are in occurrence with [30-32].

3.3 Garrett's Ranking Technique

The results of Garrett's ranking technique have been tabulated in Table 4. The results indicate that the major constraints encountered by farmers in Carnation cultivation include the higher cost of polyhouse material and construction, followed by the higher cost of the seedlings and inadequate availability of skilled labour. The findings are in occurrence with [33].

4. CONCLUSION

Globally, the success of protected cultivation technology has encouraged research and projects to transfer the technologies to overcome agronomic constraints and safeguard crop production year-round in the milieu of climate change and shrinking land resources. Protected cultivation technology unlocks the potential to produce crops with high productivity and superior quality. After identifying the major constraints faced by the farmers in Carnation cultivation, some suggestive measures to manage the constraints were arrived at. They are, Higher costs of construction and seedlings could be brought down by extending subsidies to all categories of carnation cultivators. To address the deficiency in skilled labour and technical expertise, there is a need to implement skill development and capacity-building initiatives targeting both laborers and farmers. The adoption of modern technologies within protected cultivation, including artificial intelligence and robotics for tasks such as flower harvesting, precise flower harvesting stage identification, and selective flower plucking, as well as the utilization of IoT or sensor-based irrigation scheduling, has the potential to significantly boost efficiency and income for regional farmers if they embrace these technological advancements. The policy recommendations involve the development of contemporary infrastructure, a heightened focus on the application of ICT (Information and Communication Technologies), optimizing crop production while minimizing land usage, and providing institutional support to encourage the widespread adoption of technology for commercial purposes. It is essential to raise awareness among farmers about the economic viability of protected cultivation as an agri-business venture through capacity-building initiatives. Additionally, we should invest in creating cost-effective protected cultivation structures suitable for different crops and various agro-climatic conditions in India.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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