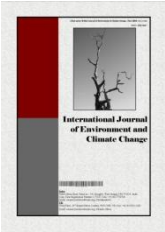

International Journal of Environment and Climate Change

12(9): 111-118, 2022; Article no.IJECC.85547
ISSN: 2581-8627
(Past name: British Journal of Environment & Climate Change, Past ISSN: 2231–4784)

Comparative Economics of Different Size of Polyhouse Units in Ranga Reddy District of Telangana

V. V. D. Manisha [a*#], T. Lavanya [a¥], R. Vijaya Kumari [aπ] and K. Supriya [b¥]

[a] Department of Agricultural Economics, PJTSAU, Rajendranagar, India.
[b] Department of Mathematics and Statistics, PJTSAU, Rajendranagar, India.

Authors' contributions

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

Article Information

DOI: 10.9734/IJECC/2022/v12i930743

Open Peer Review History:
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://www.sdiarticle5.com/review-history/85547

Original Research Article

Received 24 January 2022
Accepted 02 April 2022
Published 14 April 2022

ABSTRACT

Aims: The study aims in analyzing the trend, utilization pattern and comparative evaluation of different size of polyhouse units in Ranga Reddy district of Telangana (2019-20).
Study Design: Purposive random sampling technique was employed in this study. Districts, mandals and villages were selected purposively as the polyhouse cultivation was confined to only a particular part of the district and polyhouse units from the villages were selected randomly. The selected sample polyhouse units (90) were further classified into small, medium & large size units.
Methodology: Compound Annual Growth Rate (CAGR), Tabular analysis and Project appraisal techniques were the different tools employed in this study.
Results: The area under polyhouses (2009-19) increased by 64.37% and 18.34 % per annum in State and district respectively. The average area utilised for crop cultivation(Gerbera) constituted 89.81%, 90.01% and 91.79% in small, medium and large polyhouse units respectively.
The total investment costs for small, medium and large units were ₹1429148, ₹2322360 and ₹4364336 respectively & gross returns were found to be ₹940235, ₹1412208 and ₹2535652 for small, medium and large polyhouse units respectively.
The Payback Period was 2.49, 2.89 and 3.90 years with subsidy and 6.58, 8.02 and 9.65 years without subsidy for small, medium and large polyhouse units respectively. The Benefit Cost Ratio

[#] PhD Scholar
[¥] Associate professor
[π] Professor
**Corresponding author: E-mail: manishav598@gmail.com;*

were 1.26,1.22 and 1.21 in small, medium and large size polyhouse units with subsidy and 1.10,1.05 and 1.02 without subsidy respectively. Net Present Value was found to be ₹13.31 lakhs, ₹17.45 lakhs and ₹29.79 lakhs for small, medium and large units with subsidy and it was low for units without subsidy. Internal Rate of Return was found to be 73%,56% and 50% in small, medium and large polyhouse units respectively provided with subsidy and low for units without subsidy.
Conclusion: Increasing trend reveals that there is scope for expansion of polyhouse cultivation. Investment and returns were found to increase with increase in size of the unit. Polyhouse cultivation is found to be highly feasible when provided with subsidy.

Keywords: Polyhouse units; gerbera; subsidy; project appraisal techniques; trend; utilization pattern.

ABBREVIATIONS

PBP : PAY BACK PERIOD;
BCR : BENEFIT COST RATIO;
NPV : NET PRESENTVALUE;
IRR : INTERNAL RATE OF RETURN;
W.S : WITH SUBSIDY;
WOS : WITH OUT SUBSIDY.

1. INTRODUCTION

India has been predominantly agriculture based country, where majority of farmers use the traditional farming techniques. Traditional farming has always been risky due to unpredictable climatic conditions and exposure to pests and diseases. Climate change is becoming an increasingly significant global problem that can no longer be ignored. The main underlying cause is anthropogenic, i.e., unsustainable use of fossil fuels, forest degradation for industrialization, and rapid urbanization with an overpopulation [1].

The main purpose of protected cultivation is to create a favourable environment for the sustained growth of plant so as to realize its maximum potential even in adverse climatic conditions. The polyhouse farming technique gives an absolute assurance to the farmers for the timely production of commodities despite unpredictable environment [2].

The favorable environment can be created by protective structures such as polyhouses, rain shelters, plastic tunnels, mulches, insect-proof net houses, shade nets etc. depending on the requirements and cost-effectiveness. These structures help in the augmentation of income for small and marginal farmers in producing crops meant for the export markets with high value and high quality.

The world underneath greenhouse cultivation reportable by the tip of twentieth century was regarding one hundred 10 ha in Asian nation and world over 275000 area unit [3]. In order to bring larger areas under protected cultivation the Government of India initiated a number of schemes such as the National Horticulture Mission (NHM), Horticulture Mission for North East and Himalayan States (HMNEH), support from National Horticulture Board (NHB) and Rashtriya Krishi Vikas Yojana (RKVY) for promotion and development of protected cultivation of horticulture sector. Realizing the importance of protected cultivation, The Government of Telangana has also initiated a flagship Programme of polyhouse during 2014-15. Under this Programme 75 per cent subsidy was given to promote the cultivation of high value vegetables and flowers under polyhouses. During 2016-17, the subsidy has been enhanced to 95 per cent for SC/ST farmers (Commissionerate of Horticulture, Ranga Reddy district).

Ranga Reddy is the leading district in area under polyhouse cultivation in Telangana (Secondary data: Commissionerate of Horticulture, Ranga Reddy district). There is enormous potential to increase the area under polyhouse cultivation. The produce cultivated under polyhouse also has both domestic and good export market. Hence, the present study was under taken to study the trend, utilization pattern and economic viability of cultivation across different sizes of poly house units.

2. MATERIALS AND METHODS

Ranga Reddy District of Telangana state was formed on 15th August, 1978 by carving out some portion of Hyderabad Urban Taluk and the merger of the entire Rural and Urban Areas of the remaining Taluks of Erstwhile Hyderabad District. This District is primarily the Rural hinterland for Hyderabad City feeding the powerful commercial Centre with various raw Materials, agriculture produce and finished

products. Ranga Reddy district is located at the heart of the Deccan plateau of the Indian subcontinent. It lies between 16° 19' and 18° 20' north latitude and between 77° 30' and 78° 40' east longitude.

Purposive random sampling technique was adopted for selection of district, mandals, villages and farmers required for the study. Three mandals namely Chevella, Moinabad and Shamshabad were selected based on the highest area under polyhouse cultivation. From the selected mandals, 13 villages were identified based on the same criteria. From these selected villages, ninety farmers were chosen randomly. Based on size of polyhouse unit they were classified into small (17) with a unit size of up to 2000 m^2, medium (50) with a unit size of 2000-4000 m^2 and large (23) with a unit size of greater than 4000 m^2 to find out the economic viability of each size unit.

The study was under taken during 2019-2020. Primary and secondary data were used in the study. Primary data was collected with the help of a pretested schedule through interview method and secondary data on number of poly house farmers and area under the polyhouses from 2009-19 was obtained from the Commissionerate of horticulture, Ranga Reddy district.

2.1 Analytical Techniques

2.1.1 Functional analysis

To analyze trends in coverage of polyhouses, growth rates of area under polyhouses in Ranga Reddy district and as well as for Telangana state were calculated by fitting exponential function of the form.

$$Y_t = ab^t \quad \text{……(1)}$$

In the log form the above function was formulated as

$$\log Y_t = \log a + t \log \quad \text{.....(2)}$$

Where,

Y_t = Area under cultivation
t = time element which takes the values 1, 2, 3…….n
a = Intercept
b = Regression coefficient

Compound Annual Growth Rate = (Antilog of b-1) * 100 …..**(3)**

2.1.2 Tabular analysis

The collected data was compiled and tabulated to draw valid inferences from the study. Simple percentages and averages were used to compute and compare the results of the study.

2.1.3 Economic analysis

For the Economic analysis, cash flow statement was worked out for a period of 10 years. Cash out flow comprises, all the cash that goes out of the farm business which includes structure costs, land preparation costs, annual maintenance costs, interest etc. Cash inflows include all the cash that comes in to the farm business from sale of the produce (Gross returns). The cash flows were projected for a period of 10 years as the average life span of polyhouse structure was assumed to be 10 years. The life span of its poly cover and the planting material was assumed to be 5 years and they need to be replaced after 5 years of establishment.

The sum of structure cost, land preparation and annual maintenance costs were considered as the cash out flow for the first year. For the subsequent years' annual maintenance costs along with the interest were considered as cash out flow. The costs and returns were calculated for the first year and for the remaining nine years they were assumed to inflate at the rate of 2 per cent per annum.

The economic viability of different sizes of polyhouse units was assessed by using project appraisal techniques for both situations namely with and without subsidy. Discount rate of 12 Per cent was used to work out Pay Back Period, Net Present Value, Benefit Cost Ratio and Internal Rate of Return (Gamanagatti et al.)

2.1.3.1 Pay Back Period (PBP)

Pay Back Period refers to the amount of time it takes to recover the initial cost or investment. To overcome the problem of uneven returns discounted Pay Back Period technique was used.

$$\text{Discounted PBP} = \text{Year before discounted PBP occurs} + \frac{\text{Cumilative cash flow in the year before recovery}}{\text{Discounted cash flow in the year after recovery}} \quad \text{….(4)}$$

The project with lower PBP is preferred compared to higher PBP.

2.1.3.2 Benefit Cost Ratio (BCR)

It is one of the discounted measures that is used to assess the credit-worthiness of the project. Here, we compare the present worth of costs with present worth of benefits. This ratio is obtained by dividing the sum of the present worth of benefits stream of the project with the sum of the present worth of cost stream. The mathematical formula for working out the ratio is as follows.

$$BCR=\frac{\sum_{i}^{t}\frac{B^t}{(1+i)^t}}{\sum_{i}^{t}\frac{C^t}{(1+i)^t}} \quad \text{.....(5)}$$

The project with higher BCR is preferred when compared with lower BCR.

2.1.3.3 Net Present Value (NPV)

NPV is also called Net Present Worth (NPW) of the cash flows of the project at a particular time period. The cash flow is the difference between cash inflows and cash out flows. The investment made in the project is treated as cash outflow of the project. The returns obtained from projects at different time periods are termed as cash inflows or gross benefits of the project. The cash flows are discounted with an appropriate discount rate, to obtain NPV.

In the present study, a discount factor of 12 per cent was used to discount the net cash inflows representing the opportunity cost of capital. It can be represented by

$$NPV=\sum_{i=1}^{n}\frac{B_t-C_t}{(1+i)^t} \quad \text{.....(6)}$$

2.1.3.4 Internal Rate of Return (IRR)

The rate at which the Net Present Value of the project is equal to zero is called Internal Rate of Return (IRR) to the project. The net cash inflows were discounted to determine the present worth by the following interpolation technique.

$$IRR = LDR + (Difference\ between\ two\ discount\ rates)\text{X}\frac{Present\ worth\ of\ cash\ flows\ at\ LDR}{\begin{array}{c}Absolute\ difference\ between\ present\ worth\ of\ cash\ flows\ at\ the\ two\ discount\ rates\end{array}} \quad \text{.....(7)}$$

where,

LDR – Lower Discount Rate.

3. RESULTS AND DISCUSSION

3.1 Trend Analysis

To analyze the trends in area under polyhouses, Compound Annual Growth Rate was worked out for a period of 10 years i.e., from 2009 to 2019 for both Ranga Reddy district and as well as for the Telangana state. The details are presented in Table 1.

Table 1. Compound annual growth rate of area under polyhouses

S.No.	Particulars	CAGR
1	Telangana State	64.37**
2	Ranga Reddy District	18.34

***significant at 5 per cent probability level*

It is observed from the Table 1, that area under polyhouses in Telangana state has increased by 64.37 per cent per annum over last 10 years and found statistically significant at 5 per cent level. In Ranga Reddy district the area under polyhouses has increased by 18.34 per cent per annum in last 10 years. Thus, area under polyhouses both in the state of Telangana as well as in Ranga Reddy district has shown positive and increasing trend during last 10 years due to provision of financial assistance through many schemes.

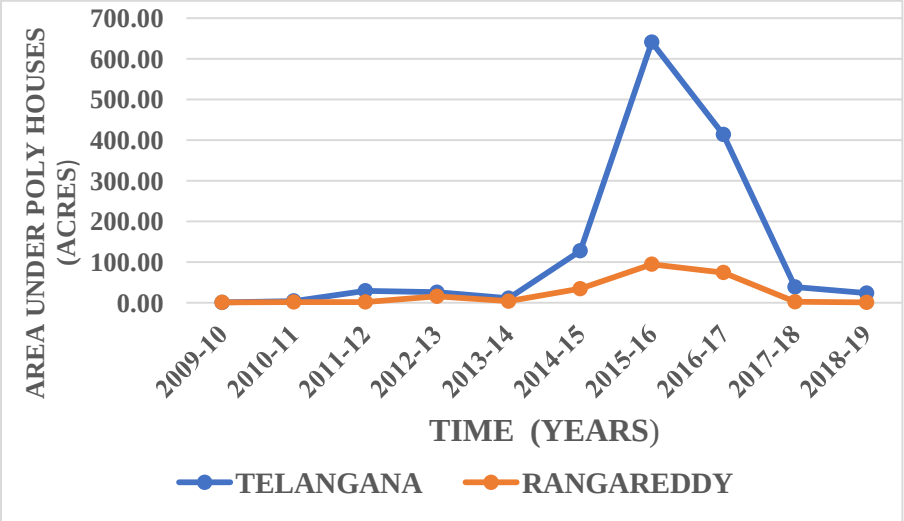

Fig. 1. Trends in area under polyhouses in Telangana state and Ranga Reddy district

3.2 Utilization Pattern of Selected Polyhouse Units

Majority of the farmers in the study area have grown Gerbera as the major crop under polyhouse and they have utilized the area under polyhouse to the maximum extent. Details regarding utilization pattern of different size units of polyhouses are furnished in Table 2, which reveals that area utilized under selected polyhouses increased with increase in unit size of the polyhouses. It increased with increase in the size of unit ranging from 89.81 per cent for the small size polyhouse unit to 91.79 per cent for the large size polyhouse unit.

3.3 Investment Pattern of Different Size of Polyhouse Units

The investment costs majorly include structure costs, establishment costs and annual maintenance costs. The details of investment costs for different size units are presented in Table 3. The average investment costs for small, medium and large size polyhouse units worked out to be ₹1429148, ₹2322360 and ₹4364336 respectively.

The structure costs include expenditure incurred on polyhouse structure frame, drip unit, foggers, motor and sprayer. These costs are one-time investment cost for entire life period (10 years) of the structure. The Government provides subsidy to the structural frame work to an extent of 50 to 60 per cent. The structure costs for small, medium and large size polyhouse units were ₹539206, ₹943930 and ₹1855098 respectively (Table 3).

The land preparation costs include expenditure incurred on labor, soil, manures, chemicals for soil drenching and planting material. The planting material can be used up to 5 years' period and need to be replaced after every 5 years. The Government provides subsidy to the planting material to an extent of 50 per cent. The land preparation costs for small, medium and large size polyhouse unit were ₹379331, ₹616940 and ₹1173028 respectively (Table 3).

Table 2. Comparison of utilization pattern of different sizes of polyhouse units (in Sq.m)

S.No.	Particulars	Small (<2000Sq.m)	Medium (2000-4000Sq.m)	Large (>4000Sq.m)
1	Average area under polyhouse	1346	2004	4000
2	Average area utilized (under crop)	1211	1804	3672
3	Average area unutilized	135	200	328
4	Percentage of area utilized	89.80 %	90.00 %	91.80%
5	Percentage of area unutilized	10.20 %	10.00%	8.20 %

The annual maintenance costs are those costs incurred for performing the various operations every year. The annual maintenance costs include costs incurred towards human labor, fertilizers, pesticides, transportation and packing & packaging. The annual maintenance costs for small, medium and large size polyhouse units worked out to be ₹510612, ₹761490 and ₹1336210 respectively (Table 3).

All the costs; Structure costs, land preparation costs and annual maintenance costs were found to increase with increase in size of the unit. Structure costs contribute to the major share of the total investment costs and these results are in accordance with findings of Gowda Satish et al. [4].

3.4 Returns from Gerbera Cultivation under Different Size Units of Polyhouses

Returns from Gerbera cultivation under small, medium, large size and pooled polyhouse units were worked and furnished in Table 4.

From Table 4, it can be observed that the yield from small, medium and large size of polyhouse units was 41788 bunches, 62765 bunches and 112696 bunches respectively. The cost of production per bunch in small, medium, large polyhouse units worked out to be ₹19.00, ₹19.30 and ₹19.10 respectively and the average price per bunch was worked out to be ₹22.50. Gross returns from small, medium and large size polyhouse units were ₹940235, ₹1412208 and ₹2535652 respectively. These results are in accordance with Senthilkumar et al. [5].

3.5 Economic Viability of Different Sizes of Polyhouse Units with and without Subsidy

The economic viability for different sizes of polyhouse units with and without subsidy are compared and details are presented in Table 5. Small size polyhouse units were able to recover the initial investment in a short period of time (2.49 years) compared to medium (2.89 years) and large unit farmers (3.90 years) and all size units of polyhouse farmers were able to realize higher benefits as shown by the BC ratio of 1.26, 1.22 and 1.21 in small, medium and large poly house units respectively when provided with subsidy compared to farmers without subsidy.

NPV was found to be high for large size polyhouse units (₹29.79 lakhs) followed by medium (₹17.45 lakhs) and small size units (₹13.31 lakhs) when provided with subsidy indicating the worthiness of investment in the project with subsidy compared to units without subsidy.

Table 3. Investment pattern of different sizes of polyhouse units

S.No	Particulars	Small(<2000 Sq.m)	Medium(2000-4000 Sq.m)	Large(>4000 Sq.m)
	Average unit size (Sq.m)	1345.70	2003.80	4000.00
1	Structure costs(in ₹)	539206 (37.73)	943930 (40.65)	1855098 (42.51)
2	Land preparation costs(in ₹)	379331 (26.54)	616940 (26.57)	1173028 (26.88)
3	Annual maintenance costs(in ₹)	510612 (35.73)	761490 (32.79)	1336210 (30.62)
	Total Investment costs(in ₹)	**1429148 (100)**	**2322360 (100)**	**4364336 (100)**

**Figures in parenthesis indicate percentage to total*

Table 4. Returns from Gerbera cultivation under different size units of polyhouses

S.No.	Particulars	Small unit (<2000 Sq.m)	Medium unit (2000-4000 Sq.m)	Large unit (>4000 Sq.m)
	Average unit size (Sq.m)	1345.70	2003.80	4000.00
1	Average yield (Bunches)	41788	62765	112696
2	Cost of production/bunch(₹)	19.00	19.30	19.10
3	Average price/ bunch(₹)	22.50	22.50	22.50
4	Returns(Gross)(₹)	940235	1412208	2535652

Table 5. Economic viability of different sizes of polyhouse units with and without subsidy

S.No.	Size of the unit	PBP (Years)		BCR (Ratio)		NPV (Lakhs)		IRR (percent)	
		W.S	W.O.S	W.S	W.O.S	W.S	W.O.S	W. S	W.O.S
1	Small	2.49	6.58	1.26	1.10	13.31	5.76	73	25
2	Medium	2.89	8.02	1.22	1.05	17.45	4.57	56	18
3	Large	3.90	9.65	1.21	1.02	29.79	2.58	50	14

**W.S -With subsidy*
**W.O.S-Without subsidy*

IRR was found to be high in small polyhouses units (73%) followed by medium (56%) and large size poly house units (50%). Internal Rate of Return was found to be high for all size units of polyhouse farmers indicating high earning capacity of investment in polyhouse cultivation when provided with subsidy compared to units without subsidy.

PBP was found to be lower and BCR, NPV and IRR were found to be higher for polyhouse units with subsidy compared to units without subsidy. These results are in accordance with Suwalka [6] in her study on economic analysis of polyhouse cultivated crops in Jaipur district of Rajasthan.

4. CONCLUSION

The area under polyhouses (2009-19) in Telangana and Ranga Reddy district has increased by 64.37 and 18.34 per cent per annum respectively. Hence, there is scope for further increase in area under poly houses in state of Telangana and more than 90 per cent of the area under different sizes of polyhouse was utilized for cultivation of Gerbera crop in the study area.

The investment costs include structure costs, establishment costs and annual maintenance costs. The total investment costs for small, medium and large size polyhouse units worked out to be ₹1429148, ₹2322360 and ₹4364336 respectively and they were found to increase with increase in size of the unit. The average yield from small, medium and large polyhouse units was 41788, 62765 and 112696 bunches respectively and the average price per bunch was worked out to be ₹22.50. The gross returns were found higher in large units followed by medium and small units.

The Pay Back Period for small, medium, large and pooled polyhouse units with subsidy was found to be shorter as against the same without subsidy. Hence, polyhouse unit farmers can recover initial cost of investment in shorter period when provided with subsidy compared to farmers without subsidy. High Net Present Value for all sizes of polyhouses units, with subsidy indicate worthiness of investment compared to the same without subsidy and High Internal Rate of Return for all sizes of polyhouse units with subsidy indicate high earning capacity of investment compared to the same for the units without subsidy.

Among different sizes of polyhouse units, the investment in small size units found be more viable as indicated by shorter Pay Back Period, Benefit Cost Ratio of more than one and higher Internal Rate of Return with subsidy compared to the situation without subsidy.

ACKNOWLEDGEMENTS

I would like to express my sincere gratitude to my advisory committee for their constant support and guidance throughout my research work.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Mukherjee A, Rakshit S, Nag A, Ray M, Kharbikar HL, Shubha K, Burman RR. Climate change risk perception, adaptation and mitigation strategy: An extension outlook in mountain Himalaya 10. Conservation Agriculture An Approach to Combat Climate Change in Indian Himalaya. 2016:257-292.
2. Reshman A, Ayesha B, Sachin A. A proposed E-PAM System for Polyhouse Marketing. International Journal of Computer Science and Technology. 2015;6(1):90-22.
3. Kang Yunyan, Chang Yao-Chien Alex, Choi Hyun-Sug, Gu Mengmeng. Current and future status of protected cultivation techniques in Asia. Acta horticulturae. 2013; 987:33-40.

4. Gowda Sathish CS, Shivaramane N, Rani Sheela S, Kumar Mohan TL. Economics of hi-tech floriculture-A study in rose. Agric. Update. 2012;7(1&2):147-150.
5. Senthilkumar S, Ashok KR, Chinnadurai M, Ramanathan, SP. An economic analysis of capsicum production under protected cultivation in Northwest region of Tamil Nadu, India. International Journal of Current Microbiology and Applied Sciences. 2018;7(6):2276-2283.
6. Suwalka C. An economic analysis of polyhouse cultivated crops in Jaipur district of Rajasthan. M.Sc Thesis. Sri Karan Narendra Agriculture University, Jobner; 2019.
7. Gamanagatti PB, Patil BL, Yeledhalli RA. Economic evaluation of protected cultivation technology for capsicum. Green farming. 2015;6(4):824-826.
8. Secondary data on area under polyhouses and Scheme details are provided by Commissionerate of Horticulture, Ranga Reddy district. Available:https://rangareddy.telangana.gov.in/horticulture-sericulture/

Peer-review history:
The peer review history for this paper can be accessed here:
https://www.sdiarticle5.com/review-history/85547