PERFORMANCE OF HORTICULTURE CROP GROWERS UNDER PROTECTED CULTIVATION IN CHIKKABALLAPUR DISTRICT

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UNIVERSITY OF AGRICULTURAL SCIENCES

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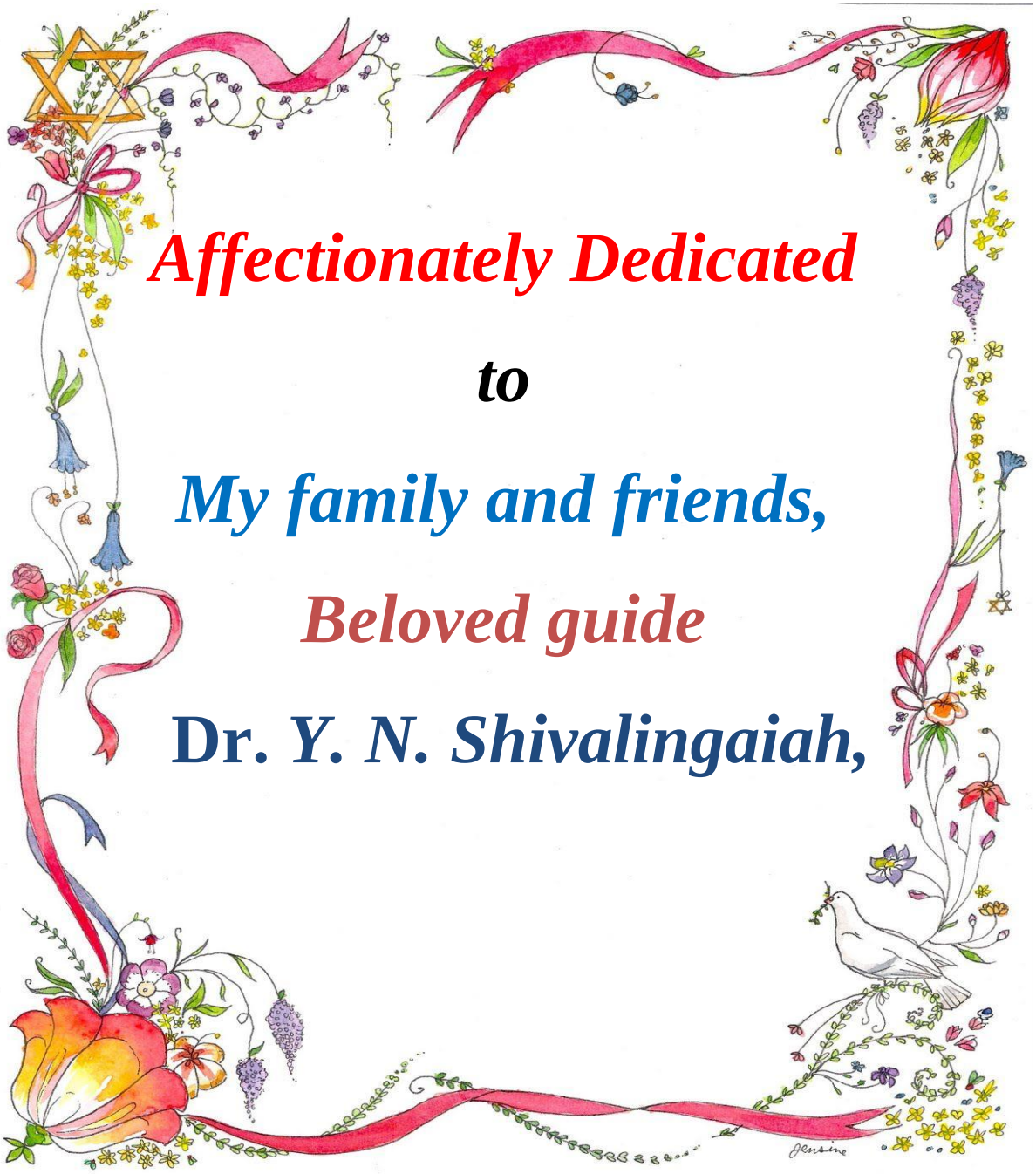

Affectionately Dedicated

to

My family and friends,

Beloved guide

Dr. *Y. N. Shivalingaiah,*

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CERTIFICATE

This is to certify that the thesis entitled "**PERFORMANCE OF HORTICULTURE CROP GROWERS UNDER PROTECTED CULTIVATION IN CHIKKABALLAPUR DISTRICT**" submitted by **Mr. RAJESH C M,** ID No. **PALB 8159** for the degree of **MASTER OF SCIENCE (AGRICULTURE)** in **AGRICULTURAL EXTENSION** to the University of Agricultural Sciences, Bangalore is a record of *bona - fide* research work done by him during the period of his study in the University under my guidance and supervision and the thesis has not previously formed the basis for the award of any other degree, diploma, associateship, fellowship or other similar titles.

Bengaluru
October, 2020

Y. N. SHIVALINGAIAH
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3. _____
(MOHAN KUMAR T.L.)

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"Gratitude turns what we have into enough, and more. It turns denial into acceptance, chaos into order, confusion into clarity...it makes sense of our past, brings peace for today, and creates a vision for tomorrow"

With the grace of God,

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Bengaluru

October, 2020 **(RAJESH C M)**

PERFORMANCE OF HORTICULTURE CROP GROWERS UNDER PROTECTED CULTIVATION IN CHIKKABALLAPUR DISTRICT

RAJESH, C. M.

ABSTRACT

The study was conducted in Chikkaballapur district of Karnataka during 2019-20 to analyse the performance of horticulture crop growers under protected cultivation. Fifty each capsicum and chrysanthemum growers were selected by simple random sampling technique from Sidlaghatta and Chikkaballapur taluks. Thus, making total sample size of 100. The findings revealed that 45.00 per cent of the growers belonged to medium production performance category, more than two-fifth (43.00%) of the growers comes under medium economic performance group and more than two-fifth of the growers (42.00%) belonged to medium social performance group. Regarding overall performance, more than two-fifth of the (43.00%) horticulture crop growers had medium overall performance level. The B:C ratio of capsicum and chrysanthemum under protected cultivation was found to be 2.80 and 2.49, respectively per acre. The variables education, farming experience, extension participation, management orientation, scientific orientation, accessibility to subsidy, accessibility to credit, risk bearing ability were found to have significant association between growers with respect to their performance. More than half of the capsicum (52.00%) and chrysanthemum growers (56.00%) followed channel I (Producer→Commission agent→Wholesaler→Retailer→ Consumer) for marketing of produce. The major constraints faced by respondents were perishable nature of flowers/vegetables, high initial investment, scarcity of water for irrigation, high cost of skilled labour and market price fluctuation. Intervention of government in price policy mechanism, increasing the amount of subsidy for protected cultivation, reducing the high initial investment, promotion of direct marketing were the major suggestions offered by growers to improve the returns from protected cultivation.

October, 2020

Department of Agricultural Extension
UAS, Bangalore

(Y.N. SHIVALINGAIAH)
Major advisor

ಸಂರಕ್ಷಿತ ಬೇಸಾಯ ಪದ್ಧತಿಯಡಿಯಲ್ಲಿ ಚಿಕ್ಕಬಳ್ಳಾಪುರ ಜಿಲ್ಲೆಯ ತೋಟಗಾರಿಕಾ ಬೆಳೆಗಾರರ ಕಾರ್ಯಕ್ಷಮತೆ

ರಾಜೇಶ್, ಸಿ. ಎಂ.

ಸಾರಾಂಶ

ಸಂರಕ್ಷಿತ ಬೇಸಾಯ ಪದ್ಧತಿಯಡಿಯಲ್ಲಿ ಚಿಕ್ಕಬಳ್ಳಾಪುರ ಜಿಲ್ಲೆಯ ತೋಟಗಾರಿಕಾ ಬೆಳೆಗಾರರ ಕಾರ್ಯಕ್ಷಮತೆಯನ್ನು ವಿಶ್ಲೇಷಿಸಲು ಪ್ರಸ್ತುತ ಅಧ್ಯಯನವನ್ನು 2019–20 ಸಾಲಿನಲ್ಲಿ ನಡೆಸಲಾಯಿತು. ಶಿಡ್ಲಘಟ್ಟ ಹಾಗೂ ಚಿಕ್ಕಬಳ್ಳಾಪುರ ತಾಲ್ಲೂಕುಗಳಿಂದ ತಲಾ 50 ದೊಣ್ಣೆ ಮೆಣಸಿನಕಾಯಿ ಮತ್ತು ಸಾವಂತಿಗೆ ಬೆಳೆಗಾರರನ್ನು ಸರಳ ಯಾದೃಚ್ಛಿಕ ಮಾದರಿ ತಂತ್ರವನ್ನು ಬಳಸಿ ಆಯ್ಕೆ ಮಾಡಲಾಯಿತು. ಈ ಅಧ್ಯಯನದ ಫಲಿತಾಂಶದಿಂದ ತಿಳಿದುಬರುವುದೇನೆಂದರೆ, ಶೇಖಡ 45.00 ರಷ್ಟು ತೋಟಗಾರಿಕಾ ಬೆಳೆಗಾರರ ಉತ್ಪಾದನಾ ಕಾರ್ಯಕ್ಷಮತೆಯು, ಶೇಖಡ 43.00 ರಷ್ಟು ತೋಟಗಾರಿಕಾ ಬೆಳೆಗಾರರ ಆರ್ಥಿಕ ಕಾರ್ಯಕ್ಷಮತೆಯು ಹಾಗೂ ಶೇಖಡ 42.00 ರಷ್ಟು ಸಂರಕ್ಷಿತ ಬೇಸಾಯಗಾರರ ಸಾಮಾಜಿಕ ಕಾರ್ಯಕ್ಷಮತೆಯು ಮಧ್ಯಮ ಮಟ್ಟದಲ್ಲಿದ್ದು, ಶೇಖಡ 43.00 ರಷ್ಟು ಸಂರಕ್ಷಿತ ಬೇಸಾಯಗಾರರ ಒಟ್ಟಾರೆ ಕಾರ್ಯಕ್ಷಮತೆಯು ಮಧ್ಯಮ ಮಟ್ಟದಲ್ಲಿರುತ್ತದೆ. ದೊಣ್ಣೆ ಮೆಣಸಿನಕಾಯಿ ಮತ್ತು ಸಾವಂತಿಗೆ ಬೆಳೆಗಾರರ ಲಾಭ ವೆಚ್ಚ ಅನುಪಾತವು ಕ್ರಮವಾಗಿ ಪ್ರತಿ ಎಕರೆಗೆ 2.80 ಮತ್ತು 2.49 ಅಗಿರುತ್ತದೆ. ಸಂರಕ್ಷಿತ ದೊಣ್ಣೆ ಮೆಣಸಿನಕಾಯಿ ಮತ್ತು ಸಾವಂತಿಗೆ ಬೆಳೆಗಾರರ ಶಿಕ್ಷಣ, ಕೃಷಿಯಲ್ಲಿನ ಅನುಭವ, ವಿಸ್ತರಣಾ ಚಟುವಟಿಕೆಗಳಲ್ಲಿ ಭಾಗವಹಿಸುವಿಕೆ, ನಿರ್ವಹಣಾ ಮತ್ತು ವೈಜ್ಞಾನಿಕ ದೃಷ್ಟಿಕೋನ, ಧನಸಹಾಯ ಹಾಗೂ ಸಾಲ ಸೌಲಭ್ಯದ ಲಭ್ಯತೆ ಹಾಗೂ ಕಷ್ಟ–ನಷ್ಟ ಸಹಿಸುವ ಸಾಮರ್ಥ್ಯದ ಅಂಶಗಳು ಅವರ ಕಾರ್ಯಕ್ಷಮತೆಯೊಂದಿಗೆ ಗಮನಾರ್ಹವಾದ ಸಂಬಂಧವನ್ನು ಹೊಂದಿವೆ. ಅರ್ಧಕ್ಕಿಂತ ಹೆಚ್ಚು ದೊಣ್ಣೆ ಮೆಣಸಿನಕಾಯಿ ಬೆಳೆಗಾರರು (52.00 %) ಮತ್ತು ಸಾವಂತಿಗೆ ಬೆಳೆಗಾರರು (56.00 %) 'ಉತ್ಪಾದಕ– ಮಧ್ಯವರ್ತಿ– ಸಗಟು ವ್ಯಾಪಾರಿ– ಚಿಲ್ಲರೆ ವ್ಯಾಪಾರಿ– ಗ್ರಾಹಕ' ಮಾರುಕಟ್ಟೆ ಮಾಧ್ಯಮವನ್ನು ಅನುಸರಿಸುತ್ತಿದ್ದಾರೆ. ತರಕಾರಿ ಮತ್ತು ಹೂವುಗಳ ಬೇಗ ಕೊಳೆಯುವ ಗುಣ, ಅಧಿಕ ಆರಂಭಿಕ ಹೂಡಿಕೆ, ನೀರಿನ ಅಭಾವ, ನುರಿತ ಕೂಲಿ ಕಾರ್ಮಿಕರ ಅಧಿಕ ವೆಚ್ಚ ಮತ್ತು ಮಾರುಕಟ್ಟೆ ದರಗಳ ಏರಿಳಿತ ಇವು ಸಂರಕ್ಷಿತ ಬೇಸಾಯಗಾರರು ಎದುರಿಸುತ್ತಿರುವ ಪ್ರಮುಖ ಸಮಸ್ಯೆಗಳಾಗಿವೆ. ಬೆಲೆ ನೀತಿ ರೂಪಿಸುವಲ್ಲಿ ಸರ್ಕಾರದ ಹಸ್ತಕ್ಷೇಪ/ಪಾತ್ರ , ಸಂರಕ್ಷಿತ ಬೇಸಾಯಕ್ಕೆ ನೀಡುವ ಧನಸಹಾಯವನ್ನು ಹೆಚ್ಚಿಸುವುದು, ಆರಂಭಿಕ ಹೂಡಿಕೆಯನ್ನು ಕಡಿಮೆ ಮಾಡುವುದು ಮತ್ತು ನೇರ ಮಾರಾಟಕ್ಕೆ ಉತ್ತೇಜನ ನೀಡುವುದು ಇವು ಸಂರಕ್ಷಿತ ಬೇಸಾಯದ ಮೂಲಕ ಪಡೆಯುವ ಆದಾಯವು ಸುಧಾರಿಸಲು ನೀಡುವ ಪ್ರಮುಖ ಸಲಹೆಗಳಾಗಿವೆ.

ಅಕ್ಟೋಬರ್, 2020

ಕೃಷಿ ವಿಸ್ತರಣಾ ವಿಭಾಗ
ಕೃವಿವಿ, ಬೆಂಗಳೂರು

(ವೈ. ಎನ್. ಶಿವಲಿಂಗಯ್ಯ)
ಪ್ರಧಾನ ಸಲಹೆಗಾರರು

Performance of Horticulture Crop Growers Under Protected Cultivation in Chikkaballapur District.

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Introduction

Agriculture plays a vital role in India's economy. Over 58.00 per cent of the rural households depend on agriculture as their principal means of livelihood. The current agricultural scenario in the country is a mix of outstanding achievements and blow off opportunities. India is in urgent need of new and effective technologies which can continuously improve the productivity, profitability and sustainability of our farming systems. In this context, the most important technology is the Protected Cultivation. Protected cultivation provides favorable environment conditions to the plants. It is used to protect the plants from the adverse climatic conditions such as wind, cold, precipitation, excessive radiation, extreme temperature, insects and diseases also create an ideal micro climate around the plants.

Karnataka occupies a predominant place in the Horticultural map of our country. Horticulture generates 40.00 per cent of the total income of the state. This accounts for 17.00 per cent of the GDP of the state. As a result, there is an increasing trend in the area under horticulture crops. The total area covered under protected cultivation in our country is approx. 60,000 hectares. The area under polyhouse in Chikkaballapur district is 161.75 ha out of which 21.00 ha under capsicum, 16.00 ha under chrysanthemum in Chikkaballapur taluk and 28.00 ha under capsicum, 17.00 ha under chrysanthemum in Shidlaghatta taluk.

Performance of Horticulture crop growers was operationally defined, as extent to which the Horticulture crop growers perform over Production, economical, and social performance under protected cultivation

Objective

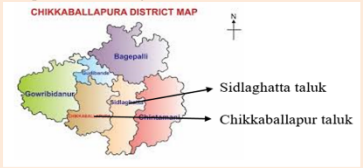
1. To assess the Performance of horticulture crop growers under protected cultivation.

Materials and Methods

Research design: Ex-post-facto research design.

Locale of the study: Chickaballapur district of Karnataka State.

Selection of Respondents: The total sample size comprises 100, of which, 50 growers (25 Chrysanthemum and 25 Capsicum) were randomly selected from Chickaballapur taluk. Similarly, 50 growers (25 Chrysanthemum and 25 Capsicum) were randomly selected from Shidlaghatta taluk. Thus, the total sample for the study was 100 farmers.



Map Showing the study area

Results

Table 1. Overall Performance of Horticulture crop growers under protected cultivation

Sl. No.	Indicators	Category	Capsicum growers		Chrysanthemum growers		Horticulture crop growers	
			f	%	f	%	f	%
1	**Production performance level**	Low (<15.17)	11	22.00	16	32.00	27	27.00
		Medium (15.17-17.47)	23	46.00	22	44.00	45	45.00
		High (>17.47)	16	32.00	12	24.00	28	28.00
2	**Economic performance level**	Low (<4.77)	12	24.00	19	38.00	29	29.00
		Medium (4.77-6.31)	20	40.00	21	42.00	43	43.00
		High (>6.31)	18	36.00	10	20.00	28	28.00
3	**Social performance level**	Low (<3.57)	10	20.00	16	32.00	26	26.00
		Medium (3.57-4.35)	22	44.00	20	40.00	42	42.00
		High (>4.35)	18	36.00	14	28.00	32	32.00

Discussion

A cursory glance from Table 1inidctes production performance of the growers belongs to medium. The probable reason for medium production performance may be that, their education level, participation in more extension activities and contact with extension agents and their willingness to gather more information be the scientific orientation, prone towards modernization and commercialization, access to credit and subsidy results in better production performance. Regarding economic performance more than two-fifth (43.00%) of the horticulture crop growers belongs to medium economic performance this may due to production and productivity per unit of area, quality production, high water and fertilizer use efficacy, subsidy provision, round year employment to the farmers. With respect to social performance more than two-fifth (42.00%) of horticulture crop growers belongs to medium this might due to as production and economic performance improves growers social performance also improved in terms of serving as a resource person, getting recognition and respect in the society, seeking higher education for children, purchasing power.

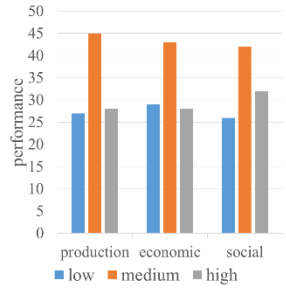


Fig 1. performance of Horticulture crop growers

Glimpse of data collection

Summary

Opportunity for horizontal expansion is very little and the only available option is vertical expansion through increased productivity using protected cultivation. Protected farming is economically more rewarding in production of high value, low volume crops, seeds and planting materials, off season fruits and vegetables. High initial investment, lack of availability of quantity planting materials and inputs, poor post-harvest infrastructure and absence of price policy have led to very limited adoption of this technology by few farmers.

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I INTRODUCTION

India is predominantly an agriculture-based country. More than two third of the population in India depends on agriculture for their livelihood. It has become the main source of income. In rural India, it is the largest provider for the livelihood of people. Agriculture is providing employment for half of the country's workforce and it is considered as the single largest private sector occupation. On the one hand, the availability of land area for agriculture is shrinking because of expanding urbanization; while on the other hand, the demand is being increasing rapidly for the higher productivity and returns from the cultivable land. All these factors have paved path for major trends towards diversification, particularly in favour of horticultural crops like flowers, fruits, vegetables, plantation crops, spices, and ornamental crops.

Horticultural crops cultivation has improved economic condition of farmers because of higher returns from many perennial flower crops, plantation crops, seasonal availability of fruits and vegetables throughout the year. Growing horticultural crops has been recognized as an ideal option for the improvement of livelihood security, attaining income and food security, enhancing employment generation and increasing income through value addition. It has also played a crucial role in women empowerment, as it provides employment opportunities in vegetable, floriculture, mushroom cultivation etc.

The present agricultural scenario in our country is a mixture of outstanding achievements and missed opportunities. If India has to emerge as the world's economic power, our agricultural productivity should be a benchmark with those of other countries that are currently classed as the world's economic powers. India needs new and effective technologies that can continuously improve the productivity, profitability and sustainability of our farming systems. Lately, there has been a noticeable change in cropping pattern towards high-value horticulture and commercial crops. In order to make horticulture viable and competitive, the emphasis should be on improving the efficiency of resource use in order to improve relative profitability. Success in horticulture is more technology driven compared to other crops. India is blessed with diverse agro-climatic conditions that helps to grow all kinds of horticultural crops, almost across the year, in one

region of the country or the other. However, but the product quality under open-field conditions, especially in the case of high-value flowers and vegetables, is generally below than the domestic and international market standards. Further, sometimes no guarantee of consistent production from opened cultivation, because the crop is exposed to a variety of frequently changing environmental factors. Therefore, to meet the demand of quality-conscious consumers, it is vital to increase the productivity and quality of the produce. A revolution in production technology which incorporates market-driven quality parameters with the production system, in addition to ensuring a vertical productivity growth is needed.

The most significant technology in this context is the Controlled Environmental Agriculture (CEA) i.e. Protected Cultivation Technologies (PCT) such as greenhouse, net house, polyhouse and glasshouse. Man has been studying how to grow plants under natural environmental conditions since time immemorial, and mankind has been aware that a wise environmental change could increase crop productivity.

In fact, the CEA concept has not been a novel idea, and has been in use for a long time. In some of the temperate regions where the weather conditions are extremely adverse and no crops can be grown, man has developed methods of continuously growing some high-value crops by providing protection from the excessive cold, which is commonly that known as PCT, provides favorable conditions for the plants. Alternatively, it is used to protect plants against extreme weather conditions such as wind, cold, precipitation, excessive radiation, high temperature, insects and diseases. Having an ideal micro environment around the plants is also vitally important. This can be achieved by erecting a greenhouse / glasshouse / net house / polyhouse, where the environmental conditions are so changed that any plant can be grown anywhere at any time with supplying minimal labour and sufficient environmental conditions.

Greenhouses have existed in different parts of the world for more than one and a half centuries. They have not become common in India because our focus had been on achieving self-sufficiency in the production of food grain. Nevertheless, the demand for greenhouse technology has been stimulated in recent years in view of the globalization of

the international market and the tremendous support and massive boost provided for the export of agricultural produce.

The technologies embedded in Hi-tech horticulture are: genetically modified crop varieties derived from bio-technology and genetic engineering, micro-propagation, protected cultivation, micro-irrigation and fertilization, high-density planting, horticultural organic farming, integrated fertilizer management, pest and disease control, post-harvest management, etc.

In India, the use of PCT started only during 1980's and was mainly used for research activities. However, China started protected cultivation in 1990's and today the area under protected cultivation in China is more than 2.5 m ha and 90 per cent of area is under vegetables. In China, low-cost protected technology, viz. plastic mulches, plastic low tunnels and walk-in tunnels are being used on 80 per cent of the total area under protected cultivation and perhaps this is the basic reason that today China is the largest producer of vegetables in the world (Paroda, 2015). However, in recent years in view of the globalization of international market, tremendous boost and incentive that is being given for export of agricultural produce, there has been a spurt in the demand for PCT in India (Gowda, 2009). India is the second largest producer of Fruits and Vegetables globally, during 2017-18 the production of vegetables is 184 million MT and fruits is 97 Million MT and that of flowers is 2.4 Million MT. The salient features of commercial horticulture are perishability, intense technology, high Profitability accompanied with high investment and high Risks including vulnerability to post-harvest losses. Indian floriculture market was worth Rs 130 billion in year 2017 it has been projected to reach 394 billion by 2023 at Compound annual growth rate of 20 per cent during 2018-2023. Owing to steady increase in demand commercial floriculture and vegetable production has emerged as Hi-Tech activity taking place under controlled climatic conditions inside greenhouse.

Karnataka occupies a predominant place in the Horticultural map of our country. Horticulture generates 40.00 per cent of the total income of the state. This accounts for 17.00 per cent of the GDP of the state. Horticulture has taken a front-line position in Karnataka agriculture and the sector is growing at a rapid pace. As a result, there is an

increasing trend in the area under horticulture crops. During the year 2017-18, an area of 20.63 lakh hectares was covered by horticultural crops and production was 195.8 lakh tones (Anonymous 2019). The total area covered under protected cultivation in our country is approx. 40,000 hectares. The leading states in the area of protected cultivation are Maharashtra, Karnataka, Himachal Pradesh, and North-eastern states, Uttarakhand, Tamilnadu and Punjab (Shwetha *et al.* 2016). The area under polyhouse in Chikkaballapur district is 161.75 ha out of which 21.00 ha under capsicum, 16.00 ha under chrysanthemum in Chikkaballapur taluk and 28.00 ha under capsicum, 17.00 ha under chrysanthemum in Sidlaghatta taluk.

In India, PCT is more suited to vegetable crops (such as tomato, brinjal, cauliflower, capsicum, cabbage, chilies, okra, spinach *etc.)*, cut flowers (like chrysanthemum rose, gerbera, carnation, *etc*.) and nursery for all vegetable crops, because of their short life span. This technology is mainly suitable for commercial faming as it requires large investment in setting up the entire framework.

1.1 Principle of crop production within protected cultivation.

A crop's productivity is not only determined by its genetic composition but also by the microclimate that surrounds it. Microclimate crop components are sun, temperature, air composition and the essence of the root and soil medium, tillage, irrigation, application of fertilizer, etc. Also, the structure of the root medium is modified according to requirements. Despite its closed borders, a greenhouse enables regulation of some or more of the micro-climate components. The greenhouse cover allows for a small fraction of sunlight, depending on its transparency. The sunlight falling on the greenhouse is absorbed by the greenhouse crop, floor and other objects. These objects in the greenhouse, in turn emit long wave thermal radiation, for which, the cover material has lower transparency. This phenomenon is generally known as greenhouse effect. It is this natural rise in the greenhouse air temperature under conditions, which is utilized under cold climates to raise the seedlings and to grow successful crops. The same natural phenomenon during summers requires greenhouse cooling to maintain favorable temperatures

There are mainly two approaches to increase productivity namely, improvement in genetic base and by maintenance of favorable environment. In a given genetic material, the yield potential is fully exploited only when a favorable growing environment is provided. Environment refers to light, temperature, air composition and nature of root medium. Traditionally it is possible to control only nature of root medium by way of tillage, nutrition, irrigation, etc. Protected cultivation is one which has control over growing environmental conditions. Under greenhouse conditions, productivity and quality of produce increases since near-to-optimum growing conditions will be maintained as per the requirement of the crops. To promote PCTs in the country on a large scale, both Central and State Governments have come up with various programme and policies including subsidies. National Horticulture Mission is emphasizing on promotion of PCT by providing 50 per cent subsidy to farmers practicing greenhouse, net house, polyhouse and glasshouse. In this context, there is an urgent need to undertake research study on various aspects related to growth and development of PCT in India. PCT provides many fold advantages over open field cultivation. This technology is highly productive, amenable to automation and helps in effective utilization of resources. It is also eco-friendly and does not require much sophistication. In this century, protected cultivation is likely to be a common commercial practice, not because of its potential but out of its sheer necessity. This provides an opportunity to directly increase the income of farmers with very small landholdings. Keeping all these in view, the study has been taken up with following specific objectives

1.2 Specific objectives of the study are as follows

1. To assess the Performance of horticulture crop growers under protected cultivation.
2. To study the personal, socio-economical and psychological characteristics of the horticulture crop growers under protected cultivation.
3. To study the association between personal, socio-economical and psychological characteristics of horticulture crop growers with their performance under protected cultivation.

4. To identify and analyse the different marketing channels used by growers under protected cultivation.
5. To document constraints faced by growers under protected cultivation and to seek their suggestions to enhance the productivity under protected cultivation.

1.3 Scope of the study

Protected cultivation offers immense promise and opportunities to Indian farmers and the country to address the challenges of increasing productivity of agriculture and income of farmers. The declining land size of Indian farmers has further necessitated the adoption of these technologies. In this context, the study was conducted to assess the adoption level of protected cultivation technologies by farmers in India with focus on performance of various crops under polyhouse. Performance of growers under protected cultivation and constraints in adoption along with strategies for removal of constraints will result in extending the area under Protected Cultivation. Thus, the results of the study are of immense importance to all the stakeholders interested in development and promotion of Protected cultivation including agricultural scientists, private R&D, students, and policy makers in particular and those associated with agriculture in general.

1.4 Limitations of the study

The ex-post-facto research design was followed which has its own limitations as the cause and effects have already occurred before conducting the study. Therefore, an in-depth study of this nature is very much required to analyze the bottlenecks. The research has its own limitation, as it is only a part of M.Sc. programme and the researcher could not devote full time to undertake an in-depth analysis. Most of the data collected were based on the expressed opinion of the selected respondents, which may not give the clear picture of the existing situation. As the study area is limited to two taluks in the state of Karnataka, generalization of the findings to the whole state and country would be a difficult task. This study is based on primary data collected from a small sample of farmers and other stakeholders. As most of the information provided by the respondents are from their own experiences there may be chances of human bias.

1.5 Presentation of the study

The thesis is divided into six chapters. The first chapter deals with the introduction wherein the importance, statement of the problem, specific objectives, the scope and limitations of the study are detailed. The second chapter deals with the review of literature and related studies in light of present investigation. The third chapter devoted to the details of methodology used in the process of investigation, followed by presentation of results and findings of study have been discussed in fourth chapter and the fifth chapter summarizes the study followed by references in sixth chapter and appendices.

1.6 Hypothesis of the study

The study was conducted with the following hypothesis

- There is no difference in the performance of Horticulture crop growers under protected cultivation.
- There is no association between independent variables and performance of Horticulture crop growers under protected cultivation.
- There are no constraints faced by horticulture crop growers.

1.7 Operational definition

Performance: Performance of horticulture crop growers is operationally defined as extent to which the horticulture crop growers perform over production, economical, and social aspects under protected cultivation.

II REVIEW OF LITERATURE

The purpose of this chapter is to report the findings and reviews undertaken by previous investigators on different aspects of the study in the light of the objectives set forth. In accordance with the objectives of the study, the review of literature has been chronologically organized and presented under different heads as given below.

2.1. Concept of protected cultivation.

2.2. Performance of horticulture crop growers under protected cultivation.

2.3. The personal, socio-economical and psychological characteristics of the horticulture crop growers.

2.4. Association between personal, socio-economical and psychological characteristics of Horticulture crop growers with their performance under protected cultivation.

2.5. Marketing channels used by growers.

2.6. Constraints as perceived by farmers under protected cultivation.

2.7. Suggestions as expressed by farmers to overcome the constraints.

2.1 Concept of protected cultivation

Janick *et al.* (2007) defined protected cultivation as a cropping technique wherein plants are grown under a controlled environment. The idea of growing plants in environmentally controlled condition has emerged since Roman times.

Bhatnagar (2014) defined protected cultivation as one of the interventions of plasticulture which is highly promising to provide solution to most of the burning problems faced by agriculture all over the world.

Shilpa Kaushal and Singh (2018) said that protected cultivation is the concept of growing potential crops in the modified natural environment for ensuring optimum growth of the crop plants without any or least stress and offers great scope to harness this potential of growing the high value crops by achieving independence of climate and weather, and to grow these crops during off -season and in marginal environments.

2.2 Performance of horticulture crop growers under protected cultivation

Kumar *et al*. (2006) found that agro-ecological situation of the hills offers great potential for off-season vegetable cultivation and increases farm income through the adoption of protected cultivation, wherein the microclimate surrounding the plant body is controlled fully/partially as per the requirement of the plant species grown.

Murthy *et al*. (2009) found that round the year production of high-value vegetables, like capsicum, especially, during the off-season in protected cultivation.

Harish (2010) concluded that more than half (54.00 %) of the cossandra growers were belonged to medium category of economic performance.

Singh *et al*. (2011) found that the highest number of fruit weight and yield were achieved in poly houses as compared to open field conditions. Different protected technologies exhibited greater net return and B: C in poly house while it was lowest in open field Condition.

Rao *et al*. (2013) found that under shade net the crop yield was increased by 80 per cent over open field cultivation along with water saving of about 40 per cent in covered cultivation.

Ghanghas *et al*. (2015) observed that Polyhouse increased production and productivity per unit of land, water, energy and labour, high quality and clean products, high water and fertilizer use efficiency, subsidy provision for establishment of high cost infrastructure, round the year employment to the farmers were the major prospective aspects perceived by poly house farmers.

Choudhary (2016) reported that in protected cultivation, high-value cash crops, vegetables, and flowers are grown and managed under controlled conditions with higher per unit productivity and profitability.

Kumar *et al*. (2016) found that gross returns over variable cost and net return were also higher in case of poly house as compared to open field conditions.

Parveen Kumar (2018) found that in protected structures, production of vegetables and flowers are higher than open field conditions and productivity is also higher. Gross and net return were higher in these structures as compared to open conditions.

2.3 The personal, socio-economical and psychological characteristics of the horticulture crop growers

2.3.1 Age

Sunil Kumar (2004) indicated that more than half (53.30 %) of tomato growers belonged to middle age group.

Kamaraddi (2011) revealed that majority (70.00 %) of pomegranate growers belonged to middle age followed by young age (19.17 %) and old age (10.83%) category.

Naveen Kumar (2012) observed that majority (42.50 %) of the pomegranate growers belonged to middle age group followed by 30.83 and 26.67 per cent of the respondents belonged to young and old age group, respectively.

Doddamani (2014) indicted that majority (90.00%) of the grape growers belonged to middle age category.

Mubeena (2017) indicated that majority of (64.16%) of grape growers were middle aged followed by old (15.84%) and young age (20.00%) groups respectively.

Shreekanth and Jahagirdar (2017) studied that a majority (72.50%) of grape growers were of middle aged, while 21.67 and only 05.83 per cent of them were old and young aged, respectively.

Sumana (2017) concluded that nearly two fifth (38.88%) of grape growers were of middle aged, while 32.22 and 28.90 per cent of them were young and old aged respectively.

Shanabhoga (2017) revealed in the study that majority (55.00%) of the respondents belonged to middle-age group, followed by young age (25.00%) and old age (12.00%) in case of public extension, whereas in private extension, less than half of the respondents

(48.33%) belonged to middle age, followed by old age (30.00%) and young age (21.67%). It was revealed from the pooled data that little more than half (51.67%) of the respondents belonged to middle age, whereas 25 and 23.33% of the respondents belonged to old and young ages, respectively

It could be revealed from the above reviews that majority of farmers belonged to middle age group.

2.3.2 Education

Dhamodharan and Vasanthkumar (2001) found that more than one-third of the sugarcane growers (35.00 %) had high school education followed by middle school (25.00 %), primary (6.17 %) and collegiate level (15.00 %) education.

Patil (2007) observed that nearly one-third (30.00 %) of the farmers under watershed programme had higher secondary education followed by graduates (24.00 %), high school (16.00%), primary school (12.00 %) and illiterate (4.00 %).

Sharma *et al.* (2014) found that 67.78 per cent of potato growers belongs to middle school to P. U. level of education, followed by 18.89 per cent had primary level of education and the remaining 13.33 per cent of them were graduates and above level of education.

Potale (2016) observed that two-fifth (40.00 %) of the flower growers were educated up to college level followed by (27.5 %) educated up to higher secondary and secondary level and 5.00 percent respondents were educated up to primary level.

Mubeena (2017) reported that two-fifth (40.00 %) of grape growers were educated up to high school level followed by intermediate (35.00%), primary school (l2.50%), college level (07.50%) and functionally literate (04.16%) and there were no illiterates.

From the above reviews of literature regarding education level of respondents, it could be inferred that, majority of the farmers had better education level.

2.3.3 Farming experience

Prabhu (2006) noticed that nearly half (47.50%) of the chrysanthemum growers belonged to medium farming experience category (2.62 – 3.74 years). Whereas, 27.5 per cent of them had high experience (>3.74 years) and 25.00 per cent belonged to low farming experience category.

Mamathalakshmi (2010) observed that more than half of the chrysanthemum growers (53.33 %) had medium farming experience. While, 26.67 per cent had high experience and 20.00 per cent of them had low experience.

Chouhan *et al.* (2013) revealed that 65.00 per cent of the sugarcane growers had medium farming experience followed by 22.50 per cent and 12.50 per cent of the sugarcane growers had low and high farming experience, respectively.

Meena (2014) revealed that 55.84 per cent of pigeon pea growers were from medium farming experience followed by low (24.16 %) and high (20.00 %) farming experience.

Sarvesh Kumar *et al*. (2014) revealed that farming experience of the farmers had a significant and positive relationship with their knowledge.

Sharma *et al.* (2014) revealed that more than three-fifth (66.67 %) of potato growers belonged to the medium range of farm experience (5 to 9 years), followed by 21.11 per cent of them in high range of farm experience (above 9 years) and the remaining 12.22 per cent of them having low range of farm experience (below 5 years).

Ekhande (2016) revealed that nearly three fifth (58.34 %) of the sweet orange growers belonged to medium level of farming experience, while 25.00 and 16.66 per cent of farmers belonged to low and high level of farming experience, respectively.

Wanole *et al.* (2017) reported that two third (67.50 %) of banana farmers had medium farming experience whereas, 23.33 per cent of farmers had low farming experience and only 09.17 per cent farmers had high farming experience.

In a nut shell, it was observed that most of the farmers had medium range of farming experience.

2.3.4 Land holding

Nagesh (2006) revealed that nearly two-third (66.66 %) of pomegranate growers belonged to medium farmer category. Whereas, 24.17 per cent and 09.17 per cent of the respondents fell under semi-medium and big farmer's category, respectively.

Sowmya (2009) reported that more than half (56.67 %) of the rural women belonged to marginal size of land holding followed by 35.00 per cent who possessed small land holding and 08.33 per cent of rural women families were having big land holding.

Kamaraddi (2011) reported nearly two-third (64.16%) of pomegranate growers belonged to medium land holding category followed by small (24.17%) and big (11.67%) farmer's categories, respectively.

Ekhande (2016) found out that three fifth (60.00 %) of the banana growers belonged to medium level of land holding, while 24.16 and 15.84 per cent of farmers possessed small and big land holdings, respectively.

Sumana (2017) identified that more than half (56.67 %) of the grape growers were small farmers, whereas nearly one-third (32.22%) of them were marginal farmers and the remaining numbers of respondents were big farmers (11.11 %).

On perusal of the above studies it is clear that, majority of the farmers had medium size of land holding, followed by small and big size of land holding.

2.3.5 Mass media exposure

Bheemappa (2006) indicated that 54.16 per cent of the gram panchayat chairpersons had medium level of mass media participation, whereas, 25.00 per cent of respondents had low level of mass media participation and 20.84 per cent of respondents had high level of mass media participation.

Hinge (2009) reported that a higher proportion of the wine grapes growers (38.75%) had medium mass media participation and nearly one third of them (32.50%) belonged to low mass media participation category. Whereas, 28.75 per cent of them belonging to high mass media participation category.

Mahatabali (2010) found that 40.00 per cent of the aerobic rice growers had high level of mass media participation followed by 37.78 per cent of respondents had medium level of mass media participation and 22.22 per cent of respondents had low level of mass media participation.

Nayak (2014) revealed that about 49.17 per cent of the arecanut growers belonged to medium category of mass media participation followed by 29.16 per cent of respondents belonged to high category of mass media participation and 21.67 per cent of respondents belonged to low category of mass media participation.

Mubeena (2017) found out nearly three-fourth (73.34%) of grape growers had medium level of mass media exposure followed by low (19.16%) and high (07.50%) levels of mass media exposure.

Sumana (2017) indicated that 36.67 percent of grape growers exhibited medium level of mass media participation, whereas 35.56 and 27.77 per cent of them exhibited low and high level of mass media participation, respectively.

2.3.6 Scientific orientation

Palaniswamy and Sriram (2001) observed that more than two-third (70.75%) of sugarcane growers belonged to medium level of scientific orientation category, whereas, 17.01 per cent and 12.24 per cent of respondents belonged to high and low level of scientific orientation category, respectively.

Sharma *et al.* (2014) noted that more than three-fifth (64.44 %) of the potato growers were observed to have medium level of technical-cum-scientific orientation. While, 20.00 per cent of the growers got high range of technical-cum scientific orientation

and only 15.56 per cent of them belonged to low level of technical-cum scientific orientation category.

Shanabhoga (2016) noticed that two-fifth (40.00%) of the pomegranate growers had medium level of scientific orientation followed by low (32.30 %) and high (27.50 %) level of scientific orientation respectively.

Shreekanth and Jahagirdar (2017) found out that more than half (54.27 %) of the dry grape producers fell under medium category of scientific orientation followed by 24.26and 21.67 per cent of them having high and low level of scientific orientation, respectively.

In a nutshell, the overall vision of the findings discloses that most of the respondents possessed medium level of scientific orientation.

2.3.7 Achievement motivation

Maraddi (2006) reported that incidence of medium level of achievement motivation was seen with 59.45 per cent of sugarcane growers, followed by low achievement motivation with 27.22 per cent of farmers and only 13.33 per cent of famers had high achievement motivation.

Mamathalakshmi (2010) noticed that majority of the chrysanthemum growers (71.43 %) belongs to high achievement motivation category which is followed by medium (22.86 %) and low (5.71 %) achievement motivation categories.

Bennur (2011) revealed that 50.83 per cent of the banana growers had medium achievement motivation, followed by 40.00 per cent and 9.17 per cent of respondents having high and low achievement motivation, respectively.

Patel *et al.* (2014) identified that nearly half (48.75 %) of the dairy farmers got medium level of achievement motivation. Whereas, more than one-fourth of (27.50 %) them got low level of achievement motivation and only 23.75 per cent got high achievement motivation level.

Wanole (2016) indicated that more than two third (67.50 %) of the banana growers belonged to medium level of achievement motivation, while 18.33 and 14.17 per cent belonged to low and high level of achievement motivation, respectively.

Shreekanth and Jahagirdar (2017) found out that more than half (52.50 %) of the dry grape producers belonged to medium level of achievement motivation, while 38.33 and only 09.17 per cent belonged to low and low level of achievement motivation, respectively.

From the findings of the above-mentioned studies it can be concluded that, majority of the respondents got medium level of achievement motivation.

2.3.8 Extension participation

Sunil Kumar (2004) revealed that nearly 23.00 per cent of tomato growers participated regularly in agricultural exhibition followed by 20.83 per cent in demonstrations. Majority of them never attended in activities like field visits (92.05 %), educational tour (94.17 %) and training (66.67 %).

Nagesh (2006) identified that more than three-fifth (65.83 %) of the farmers had medium participation in extension activities. Whereas, 20.83 and 13.33 per cent of farmers had high and low extension participation, respectively.

Doddamani (2014) noted that two third (66.66 %) of the grape growers had medium level of extension participation, while equal percentage (16.67%) of respondents had high and low levels of extension participation.

Shalini (2017) revealed that more than one-third (38.33 %) of the hybrid paddy growers belonged to medium extension participation followed by low (35.00 %) and high (26.66 %) extension participation.

It was apparent from the studies that majority of farmers had medium extension participation.

2.3.9 Management orientation

Nagesh (2006) revealed that more than three-fifth (62.50 %) of the pomegranate growers exhibited medium level of management orientation, whereas 21.66 per cent and only 15.84 per cent of them exhibited high and low level of management orientation, respectively.

Kamareddi (2011) reported that nearly three-fifth (58.33 %) of pomegranate growers had medium management orientation followed by high (27.50 %) and low (14.17 %) level of management orientation.

Naveen (2012) observed that less than half (46.67 %) of the pomegranate growers belonged to medium category of management orientation, followed by 30.00 and 23.33 per cent of respondents having high and low level of management orientation, respectively.

Mubeena (2017) inferred that more than three-fifth (62.50 %) of the grape growers had medium level of management orientation followed by high (20.84 %) and low (16.66 %) management orientation, respectively.

Sumana (2017) found that more than two-fifth of the grape growers (44.45 %) exhibited medium level of management orientation, whereas 34.44 and 22.11 per cent of respondents exhibited high and low level of management orientation, respectively.

Kolgane *et al.* (2018) concluded that majority (70.13 %) of pomegranate growers had medium level of management orientation, followed by 17.37 and 12.50 per cent of the respondents having high and low management orientation, respectively.

It is apparent from the above quoted studies that majority of the respondents had medium level of management orientation.

2.3.10 Accessibility to subsidy

Halmandage, (2009) stated that subsidies are among the most powerful instrument for manipulating or balancing the growth rate of production and trade in various sectors for an equitable distribution of income for protection of the weaker sections of the society.

Salunkhe and Deshmuk (2014) indicated that India between 1950-51 and 1995-96 increased irrigated area to 70.25 million hectares, produced 11.703 million tons of fertilizers, established 6836 regulated wholesale markets, generated 380 billion kwh power, constructed 28,84,000 km of roads and added 2.221 million commercial vehicles, which modestly improved farm productivity and output and the process continues. The major things behind this development of agriculture infrastructure possible with help of government role & subsidy to agriculture sector.

Patel (2014) said that, the standard of living of farmers improved through yield in crops with the help of government agriculture subsidies.

Itigi (2015) opined that accessibility to credit and subsidy facilities of Government schemes had significant bearing on adoption of polyhouse technology in both in Karnataka and Maharashtra.

Sanjeev Kumar *et al.* (2018) concluded that the establishment cost of polyhouse and cost of cultivation of capsicum in polyhouse for the area of 1000 m^2 was less with 65 per cent and 75per cent subsidy. Net return obtained without subsidy of capsicum cultivation in polyhouse was less as compared to net return obtained with 65 per cent and 75 per cent subsidy.

2.3.11 Accessibility to credit

Golait (2007) found that increased supply and administered pricing of credit help in the increase in agricultural productivity and the well-being of agriculturists as credit is a sub-component of the total investments made in agriculture.

Abhiman Das (2009) indicated that direct agriculture credit amount has a positive and statistically significant impact on agriculture output and its effect is immediate.

Jayaraj (2009) states that the institutional credit is not exploitative and the basic motive is always to help the farmers to raise their productivity and maximize their income. The study also states that the credit facility extended by the bank has improved the status of farmers by way of improvement in the agricultural output during the study period.

Radhakrishnan (2015) states that increase in the target of agricultural credit from 8 lakh crores in 2014-15 to 8.5 lakh crores for the year 2015-16 is a healthy sign.

Sudha Narayanan (2015) analyzed the productivity of agricultural credit in India it indicates that the ability of credit to engineer growth in agricultural GDP is impeded by a problem of productivity and efficiency where the increase in input use adjustments in the pattern of input use are not yet translating in to higher agricultural GDP. Therefore, credit seems to be an enabling input, but whose effectiveness is undermined by low productivity and technical efficiency.

2.3.12 Risk bearing ability

Subramanyam (2002) pointed out that, three-fourth (75.00%) of the trained farmers got medium risk preference, followed by high (13.34 %) level and low (11.66 %) level of risk preference.

Sharma *et al.* (2014) indicated that, more than two-fifth (46.67 %) of the potato growers possessed medium level of risk and uncertainty of production pattern. Whereas, 27.78 per cent of them got high level of risk and uncertainty of production pattern and only 25.56 per cent of them got low level of risk and uncertainty of production pattern.

Wanole (2016) revealed that 61.67 percent of the banana growers belonged to medium level of risk orientation, while 25.00 and 13.33 per cent belonged to high and low level of risk orientation, respectively.

Kolgane *et al.* (2018) reported that majority 60.42 per cent of the pomegranate farmers had medium risk bearing ability and 20.83 and 18.75 per cent of the respondents had low and high-risk orientation, respectively.

It is perceived from the findings of the above declared studies that, majority of the respondents possessed medium risk bearing ability.

2.4 Association between personal, socio-economical and psychological characteristics of Horticulture growers with their performance under protected cultivation

Thorat (2013) revealed that, education, extension participation, risk orientation, economic motivation, sources of information extension contact and management orientation were positive and significantly association with adoption of improved production technology of sunflower.

Itigi (2015) revealed that, education, irrigation, scientific orientation, were found to have positive and significant association with extent of adoption of protected cultivation at 5 per cent level of significance. The variables Accessibility to subsidy, accessibility to credit were found to have positive and significant association with extent of adoption of protected cultivation at 1 per cent level of significance.

Wankhade (2018) noticed that, education, annual income, source of information and farming experience were found to have positive and significant association with adoption of protected cultivation technology by capsicum growers at 5 per cent level of significance. Whereas, age, land holding is not significant.

Chigadolli (2018) noticed that, profile characteristics indicating variables such as education, annual income, achievement motivation, economic motivation and scientific orientation were found to have significant association with extent of adoption of improved practices by turmeric growers at 5 per cent level of significance. The variables landholding, extension contact, extension participation, risk orientation, market orientation, farming experience, and innovativeness were found significant relationship with the extent of adoption by turmeric growers at 1 per cent level of significance. Whereas other remaining variables like age, social participation and deferred gratification were found non-significant.

Pavan kumar (2018) revealed that, independent variables like education, farming experience, mass media participation, extension participation, extension contact and scientific orientation shown positive significant association with adoption level of

pomegranate growers at one per cent level of significance. The independent variables such as annual income, social participation, cosmopoliteness, risk orientation and market orientation exhibited significant relationship with the adoption level at five per cent level of significance and variables like age, family type, land holding and innovative proneness exhibited non-significant relationship with the adoption level of pomegranate growers.

2.5 Marketing channels used by grower's horticulture crops which grown under protected cultivation

Ingle *et al.* (2009) found that the consumer paid price was Rs. 100.00 per quintal in channel-I (Producer-Retailer-Consumer) in which producer share in consumer rupee was 64.51 per cent. Price spread was found to be Rs. 35.50. in channel II (Producer-Wholesaler-Retailer-Consumer) price paid by the consumer was Rs. 150 per quintal, in which producer's share in consumer's rupee was 42.45 per cent. Price spread found to be 86.32 per quintal.

Singh and Toppo (2010) observed that cent percent of marginal farmer sold their produce through Channel I. and 40 per cent of small farmers sold their through channel III.

Channel I: Producer → Consumer.

Channel II: Producer → Wholesaler → Consumer.

Channel III: Producer → Wholesaler →retailer → Consumer.

Bahirat and Jadhav (2011) revealed that majority of the rose growers sold their flowers through retailers of Satara and KoregaonTahsils in the local market. The marketing efficiency is largely affected by the increase in the market cost (Channel III then Channel II). Less marketing cost, higher is the marketing efficiency found in (Channel I).

Channel I: Producer → Consumer.

Channel II: Producer → Florist → Consumer.

Channel III: Producer → Wholesaler cum commission agent → Florist → Consumer.

Joshi (2011) observed that the producers share in consumer's rupee is high and also less number of intermediaries observed in channel III. The marketing cost incurred by the wholesaler in different channels were estimated 5.01 per cent, 6.39 per cent and 7.88 per cent of the consumer price respectively and their corresponding net margins were 9.68 per cent, 9.61 per cent and 10.23 per cent of the price paid by the consumer

Channel I: Producer → Village trader → Commission Agents/Wholesaler → Retailer→ Consumers.

Channel II: Producer → Commission agents → Wholesaler → Retailer→ Consumer.

Channel III: Producer → Wholesaler → Retailer → Consumer.

Bishnoi *et al.* (2017) found that producers obtained maximum share in consumer rupee from direct marketing of capsicum i.e. more than 90 per cent which may be due to non-existence of market intermediaries between producers and consumers. Whereas least share in consumer's rupee were observed in Channel-IV (Distant market)

Gunabhagya and Rajur (2017) found that producer's share in consumer's rupee was higher in Channel-I of Sira (68.24%), Tumkur (69.30%) and Bangalore market (70.27%) than the channel II of Tumkur (68.09%) and Bangalore market (65.76%).

Channel-I: Producer → Commission agent cum-Wholesaler → Retailer → Consumer.

Channel-II: Producer → Pre-harvest contractor → Commission agent cum-Wholesaler→ Retailer → Consumer

The study conducted by Patil (2017) revealed that there are various channels of grapes distribution. However, Producer→ Commission agent/Wholesaler→ Retailer→ Consumer is the major channel of distribution followed by direct marketing by farmers to consumers. From the price spread, it could be seen that the producer's share in consumer rupee was 40.00 per cent. It means that the producers get the maximum share in the consumer rupee.

2.6 Constraints as perceived by farmers under protected cultivation

Vijayakumar (1997) indicated that the problems faced by rose growers of Bangalore district were lack of storage facilities, inadequate local markets and exploitation by wholesalers.

Mutkule *et al.* (2001) observed that majority of the chilli growers (93.33%) experienced insecticides and pesticides were costly followed by fluctuation of prices of chilly (86.0%) as major constraints.

Nagar (2002) revealed that lack of technical guidance, lack of marketing facilities and other malpractices such as monopoly of contractors, exploitation by middlemen were the main problems expressed by 72.00 percent of the vegetable growers followed by fluctuation in price at the time of peak season and high cost (65.00%), and low quality of inputs such as seed, insecticides, pesticides (57.00%).

Verma (2003) found that the high price of seed, fertilizers, pesticides and fungicides were the main problems expressed by 85 per cent of the vegetable growers followed by non- availability of funds from institutional sources (81.25 %) high wage rate of labour (71.25 %) and non-availability of good quality seed (65 %).

Vasava and Pandya (2003) reported that the majority of the tomato growers (92.00%) faced problems of high price of farm yard manure (FYM), chemical fertilizers, followed by lack of knowledge regarding plant protection measures and fertilizer application, lack of storage facilities, lack of processing units, lack of knowledge about storage (82.00%).

Ilyas and Goyal (2004) found that shorter shelf life and higher post-harvest losses in vegetables were critical constraints in vegetable demand-supply scenario.

Singh *et al.* (2004) revealed that price fluctuations, lack of proper storage facilities and non-availability of credit were the major constraints in production of onion, tomato, okra and chilly in Pune district.

Sunil kumar (2004) reported that, majority of the farmers (75.83%) faced the problem of lack of technical knowledge and guidance about improved cultivation practices as well as post-harvest technology.

Pepijn *et al.* (2009) revealed that the econometric model suggested that access to credit is an important constraint to greenhouse adoption.

Shiralasetti and Mahesh (2016) reported that most of the grape growers faced the problem of non-availability of skilled labour in time (83.33 %), non-availability of fertilisers in time (66.66 %), shortage of water during summer coupled with irregular and insufficient power supply for irrigation (63.33 %), and non-availability of planting material in time (20.00 5) were the other constraints in grape production.

Jadhav and Rosentrater (2017) revealed that cent percent of the vegetable growers expressed that the high initial cost is one the greatest worry in the adoption of the technology by the farmers.

Malik (2017). found that higher initial investment is the major constraint (91.00%), followed by lack of technical guidance and the high cost of pesticides (84.00%) were the major productions related problems faced by cucumber growers in protected cultivation.

Praveen kumar *et al.* (2018) found that more than three-fourth of the vegetable growers (78.00%) faced the problem of greenhouse and different structures plan for various agro climatic regions are not standardized. Lack of awareness among farmers relating to potentials of protected vegetable production (70.00%) and lack of significant research programme on protected vegetable farming are other limiting factors (66.00%).

Based on analysis of various review of literatures, it could be concluded that protected agriculture cannot completely substitute the present traditional/ open cultivation, but it has immense potentials to increase the productivity of various horticultural crops. Protected agriculture in India still in the infant stage and restricted to few horticultural crops only.

2.7 Suggestions as expressed by farmers to overcome the constraints

Kolte (2002) observed that a majority of the respondent's suggestions included the reasonable selling price for chilli (75.00 %), providing fertilizers and pesticides at reasonable rates (69.50 %) and establishment of storage facilities (55.50 %).

Shinde (2004) reported that practical knowledge regarding plant protection measures (71.00 %) was one of the important suggestions. The other suggestions were financial assistance in the form of subsidy (65.00 %), making available good quality seed at reasonable rate (63.50 %), easy availability of loan facilities (61.00 %) and timely supply of seeds (57.00 %), fertilizers (53.00 %) and pesticides (51.50 %).

Jadhav (2004) in his study observed the suggestions like availing of greenhouse erection at reasonable rate (92.98 %), availing loan timely and adequately (82.46 %), reasonable rate of interest (87.71 %), organizing training on greenhouse for growers (80.70 %) and skilled labour (70.18 %), providing adequate subsidy (73.68 %), arranging guidance of scientists of Agriculture University (71.93 %) and providing plant protection chemicals at reasonable rate (64.00 %).

Maghade (2007) observed the major suggestions viz., government should fix the minimum support price for onion (78.33 %) stable market price for onion (74.16 %), cooperative marketing societies to be established (60.83 %), positive responses of NAFED to purchase onion at reasonable rate (58.33 %), effective and efficient marketing system (57.50 %), provision of quality seed and planting material with technical know-how (53.33 %).

Jadhav (2009) studied the major suggestions reported by the respondents, they were Government should fix the minimum support price for onion (72.30 %), stable market price for onion (68.46 %), establishment of co-operative societies for marketing (56.15 %) and effective and efficient marketing system (53.07 %). The other suggestions include the provision of good seed and planting material with technical know-how (49.23 %) and establishment of storage facilities for onion (43.84 %).

Pepijn *et al.* (2009) suggested that only households with transferable land titles had access to credit to invest in greenhouses. Whereas, contractor farmer is not eligible for access to credit. While in the alternative scenario, all farm households were given access to credit.

Mamathalakshmi (2010) found that cent per cent of the respondents suggested that ensuring availability of quality inputs at right time and proper irrigation facilities followed by inadequate power supply (98.33 %) providing appropriate storage facilities (93.33 %), proper market infrastructure facilities (92.50 %) and financial assistance (90.83 %) were some of the suggestions expressed by chrysanthemum growers.

Sujantha (2013) suggested that, the reduction of interest rates on working capital, fixed capital, seed capital and period for processing of loans. Provision of subsidy, setting up of fair price shops to supply quality raw materials, conducting training for counteracting the constraints faced by farmers in taking up enterprise of their interest.

Nayak (2014) listed the major suggestions expressed by the arecanut growers were provision for suitable market infrastructure (I rank), provision for interest free loan (II rank), provision for timely and adequate supply of inputs (III rank), provision for timely and adequate credit (IV rank), loan waiver (V rank), provision for longer repayment period for credit (VI rank), provision for timely and adequate information (VII rank), need for improved variety (VIII rank), protection from exploitation by middlemen (IX rank) and provision for timely and adequate payment of produce (X rank) in order of priority.

Tengli (2015) recommended that, the major suggestions given against each constraints by the young farmers were; "Subsidy amount should be raised" which stood first followed by "Mediators/Middle men should be eliminated by stringent entrepreneurial policy" as second, "Adequate loan amount should be provided" as third, "Market facility should be made in proximity" as fourth, "Skill development programmes regarding different agricultural enterprises need to be organized" as fifth.

Itigi (2015) listed the major suggestions expressed by the vegetable and flower growers under polyhouse *viz.*, intervention of Government in price policy mechanism

(Rank I), providing regular power supply (Rank II), availability of quality planting material in required quantity at right time in local market (Rank III), increasing the amount of subsidy for protected cultivation under polyhouse (Rank IV).

Singh (2016) identified the major suggestions given by the vegetable growers like; APMC and district panchayat should be involved for direct marketing, followed by storage facility i.e. rural godown facility should be provided on cluster base at village level, training on value addition and preservation should be organized, for long distance marketing, group based refrigerated vehicles should be provided by APMC or government either on rent base or ownership, organic manures and biological control measures should be available at taluka place, involvement of extension personnel from government should be more, then latest technology and physical facilities for mitigating climate change should be provided.

Rajendra Prasad (2016) indicated the major suggestions expressed by the sugarcane growers viz. provision for timely and adequate payment from the sugar factories (Rank I), provision for in time permit and cutting orders from the sugar factories (Rank II), need for mechanization (Rank III), need for improved variety (Rank IV), timely and adequate supply of inputs (Rank V), timely and adequate provision of information regarding availability of inputs, prices, arrivals etc. (Rank VI), provision for timely and adequate credit (Rank VII), provision for suitable market infrastructure viz. transportation, storage etc. (Rank VIII), longer repayment period for credit (Rank IX), protection from exploitation by middlemen (Rank X), providing interest free credit (Rank XI) in order of priority.

III METHODOLOGY

The study was conducted in Chikkaballapur district of Karnataka state during 2020. The details of methodology adopted for the present investigation are presented in this chapter under the following subheadings:

3.1 Locale of the study

3.2 Description of the study area

3.3 Research design

3.4 Selection of villages and respondents

3.5 Methods used for measurement of dependent variables

3.6 Methods used for measurement of independent variables

3.7 Instruments used for data collection

3.8 Statistical methods used for data analysis

3.9 Conceptual model of the study

3.1 Locale of the study

The study was conducted during 2020 in Chikkaballapur district which comes under eastern dry zone (Zone-V) of Karnataka. In Chikkaballapur district, two taluks i.e. Sidlaghatta and Chikkaballapur taluks were purposefully selected for the stud, since this taluk are having more area under protected cultivation technology.

3.2 Description of study area

The Chickaballapura District includes six taluks which are Chikkaballapur, Gouribidanur, Bagepalli, Sidlaghatta, Gudibande and Chintamani. The Longitude and Latitude of Chickaballapura is 130 19” to 130 39” latitude and 770 35” to 770 52” East latitude. The district has geographical area of 404501 hectares. As of 2011 India census, Chickaballapura had a population of 1,254,377 of which males constitute 51 per cent of the population and females 49 per cent. Chickaballapura has an average literacy rate of 64 percent, higher than the national average of 59.5percent.

The Zone-V is primarily agrarian in character with about 47.17 percent of its population depend on agriculture and related activities for their livelihood. The mean temperature of district is lies at 32^{o}C (Max), 21^{o}C (Min) and Average Rainfall is 750.3 mm. Gross District Domestic Product (Rs. in Lakhs) of district is 1278603. Major agriculture crop of the district is Ragi, Maize, Red gram, Cowpea, Pulses, Groundnut, Other Oil Seeds and important horticulture crops are Mango, Grapes, Cashew, Sapota, Potato, Tomato, Cole crops, Carrot, capsicum, Beetroot, Onion, Beans, Rose, Chrysanthemum, Marry Gold. The major horticulture crops grown under protected cultivation in the districts are Capsicum, Chrysanthemum, Rose, and Cucumber. The soil type of the region can be classified into three types – clay loam, red and laterite. Some black soil patches are also seen frequently. The red loam region extends from south to north comprising Chikkaballapur taluk, major parts of Sidlaghatta taluks. Water table in the red loam region is between 12m and 15m. Red loam is easy for cultivation and responds well to manure and other treatments.

3.3 Research design

In the present investigation, ex-post facto research design was used. This design was considered appropriate, as it is a systematic empirical enquiry for measuring the phenomenon, which has already occurred and is continuing. The researcher has no control on independent variables as their manifestation has already occurred or they are inherent and non-manipulative.

3.4 Selection of Respondents

The study was conducted in Chikkaballapur district of Karnataka. Out of five taluks, Sidlaghatta and Chikkaballapur are purposively selected for the study since these taluks have more area under protected cultivation compared to other taluks. The total sample size comprises 100 of which, 50 growers (25 Chrysanthemum and 25 Capsicum) were selected randomly from Chikkaballapur taluk. Similarly, 50 growers (25 Chrysanthemum and 25 Capsicum) were selected randomly from Sidlaghatta taluk.

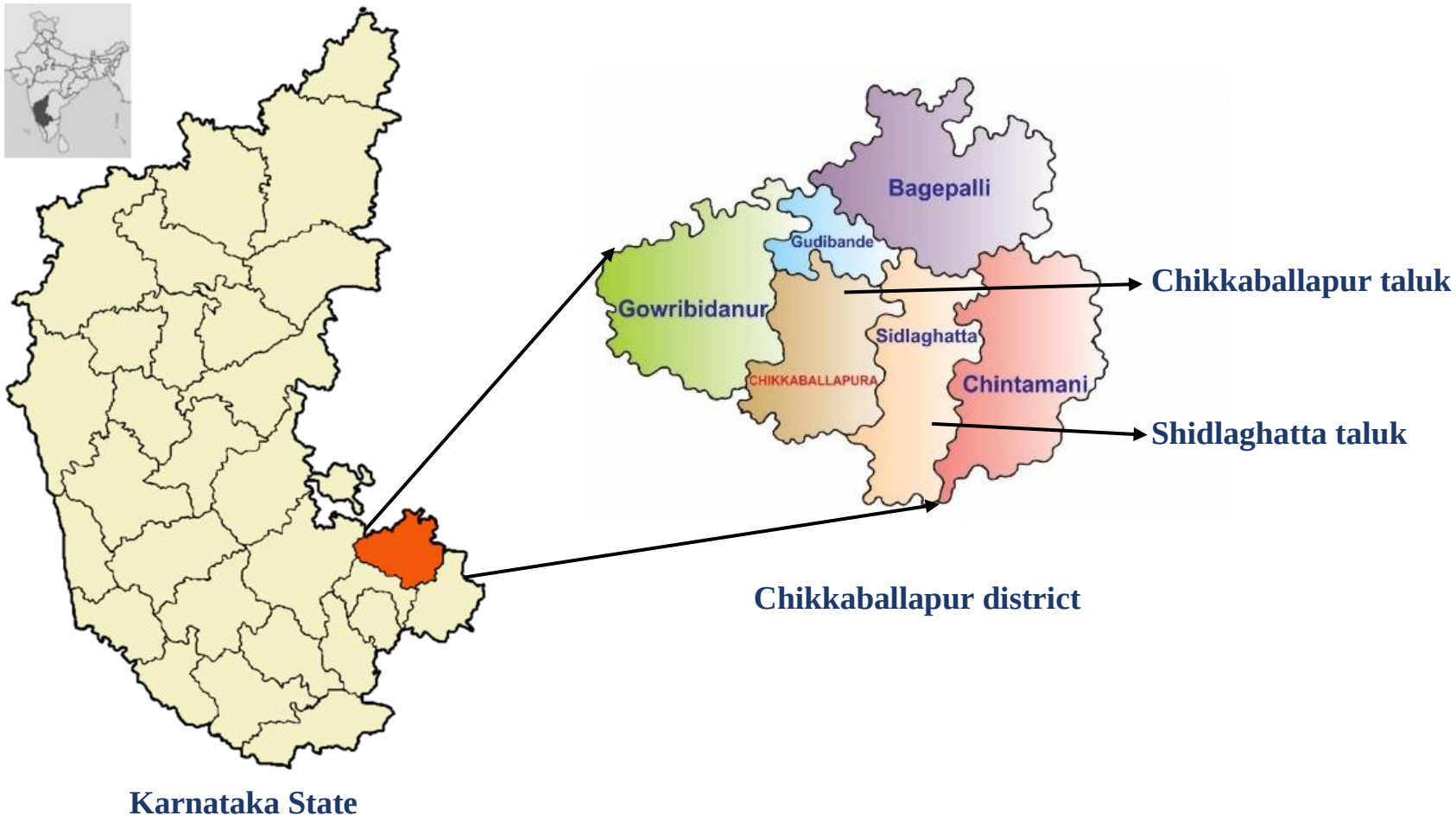

Fig. 1: Map of the study area

3.5 Methods used for measurement of dependent variables

The dependent variables for the study was performance of horticulture crop growers under protected cultivation. To measure performance, the procedure developed by Shwetha (2016) was used.

3.5.1 Quantifying the performance of horticulture crop growers under protected cultivation

3.5.1.1 Production performance: An item pool of production performance was prepared by reviewing literatures like package of practices, journals and other publications. After identifying the items that comprises production performance, responses were collected from the farmers selected for the study on three-point continuum namely full adoption, partial adoption and no adoption. Scoring of these respondents was in the order of 2 for full adoption, 1 for partial adoption and 0 for no adoption. The production performance items included in the study are given in appendices.

Thus, after computing the production score, the respondents were grouped into low, medium and high categories by taking mean and standard deviation as a measure of check.

Category	Criteria
Low	< (Mean- ½ SD)
Medium	(Mean $\pm$ ½ SD)
High	> (Mean + ½ SD)

3.5.1.2 Economic performance: Items of activities on economic performance which includes gross income, net income, B:C ratio etc. were prepared by reviewing related literatures. After identifying the items that comprises economic performance, responses were collected from the farmers selected for the study. Gross, net income and B:C ratio was worked out for the data. Following scoring pattern was followed to workout B:C ratio.

B:C ratio

Sl. No.	B:C ratio	Scoring pattern
1	1:1.50	1
2	1:1.75	2
3	1:2.00	3
4	1:2.25	4
5	1:2.50	5
6	1:2.75	6
7	1:3.00	7
8	1:3.25	8
9	1:3.50	9

Thus, after computing the economic performance score, the respondents were grouped into low, medium and high categories by taking mean and standard deviation as a measure of check.

Category	Criteria
Low	< (Mean- ½ SD)
Medium	(Mean $\pm$ ½ SD)
High	> (Mean + ½ SD)

3.5.1.3 Social performance: An item pool of social performance was prepared by reviewing literatures like package of practices, journals and other publications. After identifying the items that comprises social performance, responses were collected from the farmers selected for the study on two-point continuum namely 'Yes' and 'No'. Scoring of the respondents in the order of 1 for 'Yes' and 0 for 'No'. The items on social performance included in the study are given in appendices. The aggregate score of each respondent was obtained by adding the respective score for each item.

Thus, after computing the social performance score, the respondents were grouped into low, medium and high categories by taking mean and standard deviation as a measure of check.

Category	Criteria
Low	< (Mean- ½ SD)
Medium	(Mean ± ½ SD)
High	> (Mean + ½ SD)

3.5.1.4 Overall performance of farmers

Overall performance was calculated by adding observed scores of production, economic status and social status performance of farmers. Thus, after computing the overall performance level score, the respondents were grouped into low, medium and high categories by taking mean and standard deviation as a measure of check.

Category	Criteria
Low	< (Mean- ½ SD)
Medium	(Mean ± ½ SD)
High	> (Mean + ½ SD)

3.6 Operationalization and measurement of independent variables

Sl. No.	Variables	Empirical measurements
1	Age	Chronological age was followed
2	Education	Scale developed by Trivedi (1963) was used
3	Land holding	Procedure followed by Karnataka Land Reforms Act of 1966.
4	Farming experience	Procedure followed Lakshminarayana (1997) was used
5	Mass media use	Procedure followed by Shwetha (2016) was used
6	Scientific orientation	Scale developed by Supe (1969) was used
7	Achievement motivation	Procedure fallowed by Sushma (2007) was used
8	Extension participation	Procedure followed by Hiremath (2000) was used
9	Management orientation	Scale developed by Samantha (1977) was used
10	Accessibility to subsidy	Procedure followed by Itigi Prabhakar(2015) was used
11	Accessibility to credit	Procedure followed by Itigi Prabhakar(2015) was used
12	Risk bearing ability	Scale developed by Supe (1969) was used

3.6.1 Age

It is referred to the number of chronological years of the respondents. Age was measured as the number of calendar years completed by the respondent at the time of enquiry. Based on the completed years, the respondents were classified as follows.

Category	Age (in years)
Young	35 years and below
Middle	36-55 years
Old	Above 55 years

3.6.2 Education

Education is the process of producing desirable changes in the behavior of the individual. In this study, this variable referred to the amount of formal schooling undergone by the farmers in terms of number of years of formal standards attained. The respondents were asked to indicate the level of education they had, later they were classified into following categories. The scores assigned to each category were given as below for computing the educational status of the respondents.

Category	Education	Score
Illiterate	Can't read and write	1
Primary school	1^{st} – 7^{th} standard	2
High school	8^{th} -10^{th} standard	3
Pre university	11^{th} -12^{th} standard	4
Graduation and above	Above 12^{th} standard	5

3.6.3 Land holding

The extent of land actually possessed by the farmers was recorded and this was converted into standard acres based on Karnataka Land Reforms Act 38 of 1996. According to this act, one acre of wet or garden land was considered and equated to 2.50 acres of dry land.

It is taken as the total number of standard acres a farmer-owned at the time of data collection including land leased. The conversion of different kinds of land holding into standard dry land acre was done. The extent of land owned by each category of farmers is given below.

Category	Extent of area
Marginal farmers	Below 2.5acres
Small farmers	2.5 to 5.0acres
Big farmers	Above 5.0 acres

3.6.4 Farming experience

It refers to a total number of years of experience in agriculture. The procedure adopted by Lakshminarayana (1997) was used to categorize this variable.

Category	Years of farming experience
Low	<10
Medium	Between 10-20
High	>20

3.6.5 Mass media use

It was operationalized as the frequency of usage of various mass media like TV, radio, newspaper and other magazines by respondents in their day to day life. In order to assess the extent of use of mass media by the respondents, different mass media were listed and respondents were asked to how often they used these mass media. The scoring pattern adopted was on the reading habit of respondents in respect of score considered in the study as well as listening habit in case of radio, listening and viewing habit in television. The total score obtained by each respondents formed the mass media score.

Subscriber / Owner	Score
Yes	1
No	0

Sl. No.	Sources	Extent of mass media use		
		Regular	Occasionally	Never
1	Radio	2	1	0
2	Television	2	1	0
3	News paper	2	1	0
4	Magazines	2	1	0

3.6.6 Scientific orientation

This is referred to the degree to which a respondent is oriented to use the scientific methods in decision making. Scientific orientation of individual respondents was measured with the help of scale developed by Supe (1969) with slight modification. The scale consists of eight statements, in which second and last statements were negative statements and rest were positive statements. The responses for each statements were rated on three-point continuum namely; strongly agree, agree and disagree with the scores of 2, 1 and 0 for positive statements and 0, 1 and 2 for negative statements respectively. The respondents were categorized into three categories taking mean and standard deviation as a measure of check.

Category	Criteria
Low	< (Mean- ½ SD)
Medium	(Mean $\pm$ ½ SD)
High	> (Mean + ½ SD)

3.6.7 Achievement motivation

Achievement motivation refers to striving to do a good work with a standard of excellence which may be task related, self-related. The variable measured by using procedure followed by Sushma (2007) with little modification, which consists of six statements to be rated on a three-point continuum namely strongly agree, agree and disagree with the scores of 3, 2 and 1 respectively.

Based on scores obtained, the respondents are grouped into three categories using mean and standard deviation as a measure of check.

Category	Criteria
Low	< (Mean- ½ SD)
Medium	(Mean ± ½ SD)
High	> (Mean + ½ SD)

3.6.8 Extension participation

Extension participation is operationalized as the extent of participation of farmers in different extension educational activities organized by extension personnel. This variable was quantified by following the procedure as followed by Hiremath (2000). In order to assess the extent of participation of the farmer in extension activities, different activities were listed and respondents were asked to indicate their participation as regularly, occasionally and never with 2, 1, and 0 scores, respectively. Then the respondents were grouped into three categories based on the mean and standard deviation.

Category	Criteria
Low	< (Mean- ½ SD)
Medium	(Mean ± ½ SD)
High	> (Mean + ½ SD)

3.6.9 Management orientation

Management orientation was operationally defined as the degree to which a farmer is oriented towards scientific management of farm comprising planning, production and marketing functions. The scale developed by Samantha (1977) was used to measure the management orientation.

The scale consisted of fifteen statements. There are five statements each for planning, production and marketing orientation. In each group, positive and negative statements were kept mixed with a more or less psychological order of the statements. The positive statements were given a score of five for “strongly agree”, four for “agree”, three

for "undecided", two for "disagree" and one for "strongly disagree". In the case of negative statements, the scoring procedure was reversed. The total score was obtained by summation of scores awarded for each statement based on the response category. The 15 management orientation statements are given in the appendix. By considering the total score obtained by each respondent they were divided into three groups viz., low, medium and high.

Category	Criteria
Low	< (Mean- ½ SD)
Medium	(Mean $\pm$ ½ SD)
High	> (Mean + ½ SD)

3.6.10 Accessibility to subsidy

This referred to Government financial transfers that reduce costs and/or increase revenues of producers. The variable measured by using procedure followed by Itagi Prabhakar (2015). This was measured on a nominal scale as to whether farmers had assured subsidy on his farm or not. Scoring was done based on yes (1) and No (0). It is an open end question type.

Category	Criteria
No	0
Yes	1

3.6.11 Accessibility to Credit

This referred to as a contractual agreement in which a borrower receives something of value now and agrees to repay the lender at a later date generally with interest. The variable measured by using procedure followed by Itagi Prabhakar (2015). This was measured on a nominal scale as to whether farmers had assured Credit on his farm or not. Scoring was done based on yes (1) and No (0). It is an open end question type.

Category	Criteria
No	0
Yes	1

3.6.11 Risk bearing ability

Risk bearing ability is the degree to which a farmer is oriented towards risks and uncertainty in agriculture and has the courage to face the various risks involved in agriculture. The scale developed by Supe (1969) is used for measuring risk orientation of farmers. The scale contained 5 statements. The same scale was used in the present study with slight modifications. The fourth statement was negatively scored and all others were positively scored. In case of positive statements, a score of one was assigned for the 'agree' response and zero score for 'disagree' statement. Scoring pattern was reverse in case of negative statement.

Based on scores obtained, the respondents are grouped into three categories using mean and standard deviation as a measure of check.

Category	Criteria
Low	< (Mean- ½ SD)
Medium	(Mean $\pm$ ½ SD)
High	> (Mean + ½ SD)

3.7 Constraints and suggestions as perceived by the horticulture crop growers under protected cultivation

Constraints are the restrictions or problems faced by the farmers in the process of cultivation. Some of the common constraints were listed and the farmers were asked to indicate the constraints faced by them apart from open ended questions the responses of the farmers were collected for present study on a two-point continuum 'yes' or 'no'. A score of 'one' was assigned for 'yes' response and '0' for no response. Some of the suggestions were listed and the farmers were asked to indicate the suggestions them apart from open ended questions the responses of the farmers were collected for present study on a two-point continuum 'yes' or 'no'. A score of 'one' was assigned for 'yes' response and '0' for no response.

3.8 Instruments used for data collection

Keeping the objectives of the study in view, a structured schedule was prepared with the help of experts in the field of Agricultural Extension, Agricultural economics and marketing which included all the variables in the study. The minor ambiguous items were re-constructed by the suggestions given by the experts and the final interview schedule was prepared. Data collection was done by personal interview method with the help of the structured interview schedule. The data collection was undertaken during the month of February 2020.

3.9 Statistical tools used for data analysis

Appropriate statistical tools were used for analyzing the data of investigation. The data collected from the respondents were scored, tabulated and analyzed using the following statistical tools and techniques.

3.9.1 Percentage

Percentage was used to make the simple comparison of different groups whereever needed.

3.9.2 Mean

Mean is the sum of the observed values of a set divided by the number of observations in the set is called a mean or an average. The calculated mean was used for grouping the respondents.

3.9.3 Standard deviation

The positive square root of the variance is called standard deviation. It explains the average amount of variation on either side of the mean. The mean and standard deviation were used to classify the farmers into three following categories.

Category	Criteria
Low	< (Mean- ½ SD)
Medium	(Mean $\pm$ ½ SD)
High	> (Mean + ½ SD)

3.9.4 Frequencies

A frequency distribution was used to quantify the different personal, social, psychological and economic characteristics of the farmers. It was also used in the response analysis of constraints and suggestion statements.

3.9.5 Chi-square test

It is a non-parametric test used to know the association between the dependent and independent variables.

3.9.6 Conceptual model of the study

Conceptually the variables under the study and the assumed relationship between dependent and independent variables are presented in Figure 2. It is conceived that the dependent variables i.e. performance influenced by the independent variables like age, education, land holding, farming experience, mass media participation, scientific orientation, achievement motivation, extension participation, management orientation, accessibility to subsidy, accessibility to credit, risk bearing ability.

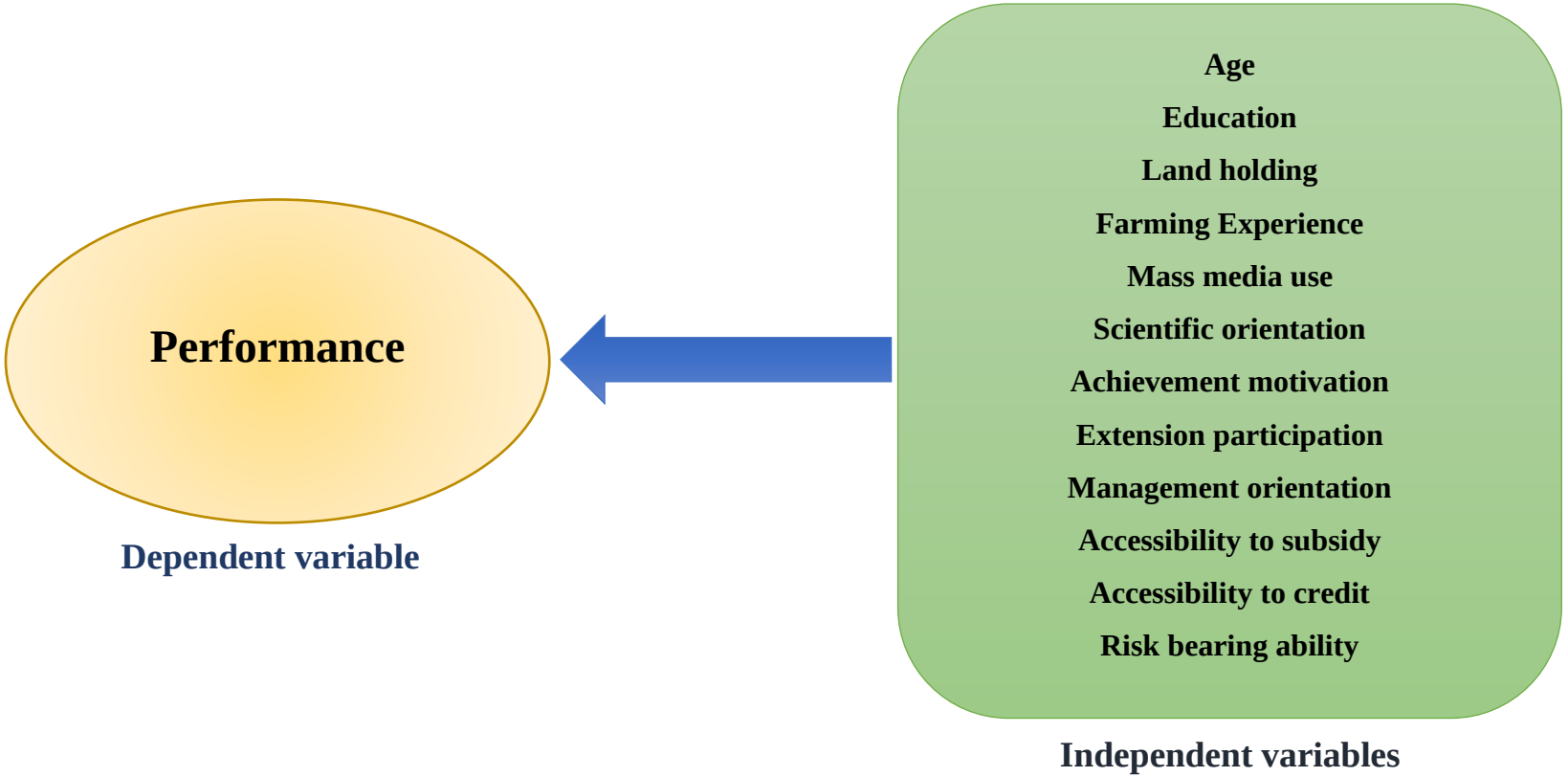

Fig. 2: Conceptual framework of the study

IV RESULTS AND DISCUSSION

The results and discussion chapter deals with the systematic presentation of the results and discussion of the study. The results and discussion on various aspects according to the objectives are presented under the following headings.

4.1 Performance of capsicum and chrysanthemum growers under protected cultivation.

4.2 The personal, socio-economic and psychological characteristics of the horticulture crop growers under Protected cultivation.

4.3 The association between personal, socio-economic and psychological characteristics of horticulture crop growers with their performance under protected cultivation.

4.4 The different marketing channels used by growers under protected cultivation.

4.5 Constraints as perceived by the growers under protected cultivation.

4.6 Suggestions expressed by the growers to overcome the constraints under protected cultivation.

4.1 Performance of capsicum growers under protected cultivation

Table 1 provides the information on production, economic and social performance of the capsicum growers under protected cultivation. The data revealed that nearly half of the capsicum growers (46.00 %) belonged to medium production performance level and 32.00 per cent of the capsicum growers belonged to high production performance group. More than one-fifth (22.00 %) of the growers come under low production performance level. The probable reason for medium to high production performance may be that, their education level, participation in more extension activities and contact with extension agents and their willingness to gather more information about protected cultivation along with better scientific orientation, access to credit and subsidy results in better production performance. The findings are line with Murthy *et al*. (2009)

Regarding economic performance, two-fifth (40.00 %) and 36.00 per cent of the capsicum growers comes under medium and high economic performance group respectively. Nearly one-fourth (24.00 %) of them had low economic performance. The

probable reason may be that, adoption of recommended scientific production practices under protected cultivation results in the higher cost benefit ratio, fruit quality, weight, less incidence of pest and diseases and yield play a major role in economic performance of the growers. With respect to social performance, more than two-fifth of capsicum growers (44.00 %) and more than one-third (36.00 %) were belonged to medium and high social performance group respectively. One-fifth of the (20.00 %) of them comes under low social performance category. The reason might be that, as the production and economic performance improves, the farmers' social performance also increases in terms of participation in the organizations, serving as resource person, getting recognition and respect in the society, seeking higher education for their children and purchasing power of growers has also improved. More than half of the (52.00 %) of the capsicum growers had medium overall performance level followed by high overall performance level (26.00 %) and low performance level (22.00 %). The findings are line with findings of Choudhary (2016)

Table 1: Performance of capsicum growers under protected cultivation.

(n_1=50)

Sl. No.	Indicators	Category	Capsicum growers		
			f	%	
1	**Production performance level**	Low (<16.47)	11	22.00	Mean=17.88 S.D.=2.81
		Medium (16.47-19.29)	23	46.00	
		High (>19.29)	16	32.00	
2	**Economic performance level**	Low (<6.53)	12	24.00	Mean=7.02 S.D.=0.98
		Medium (6.53-7.51)	20	40.00	
		High (>7.51)	18	36.00	
3	**Social performance level**	Low (<3.79)	10	20.00	Mean=4.16 S.D.=0.74
		Medium (3.79-4.53)	22	44.00	
		High (>4.53)	18	36.00	
4	**Overall performance level**	Low (<26.56)	11	22.00	Mean=28.32 S.D.=3.65
		Medium (26.56-30.20)	26	52.00	
		High (>30.20)	13	26.00	

f - Frequency, %- percentage

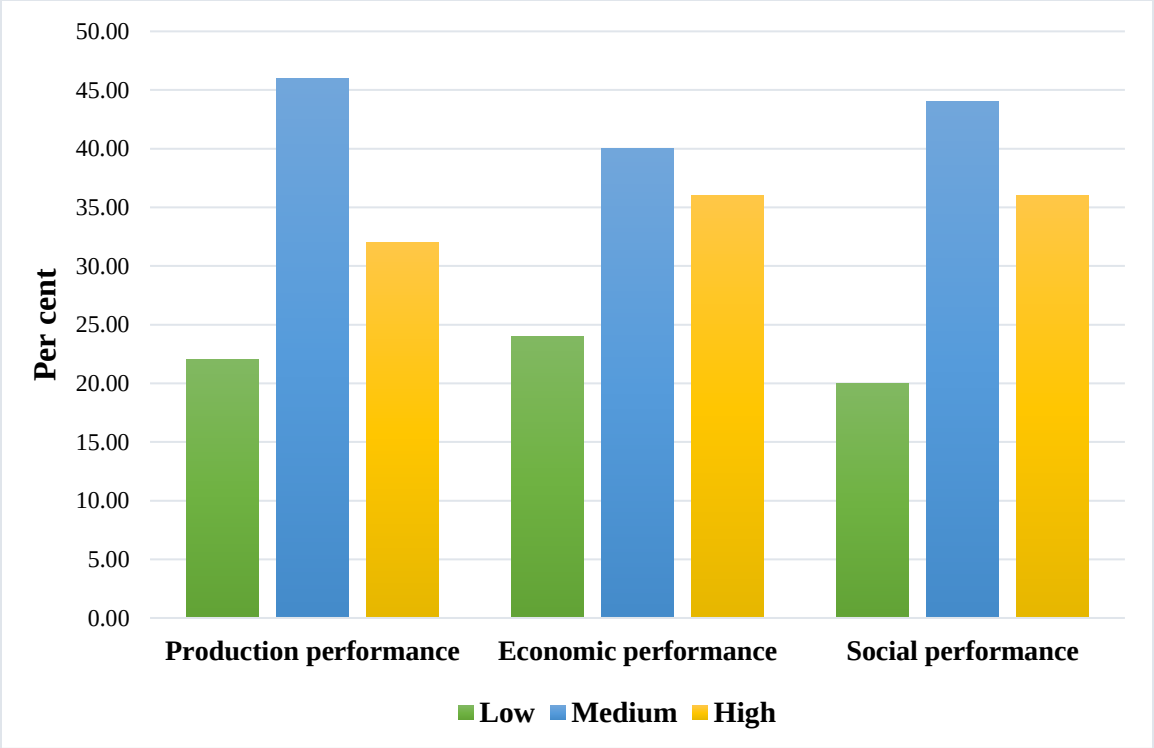

Fig. 3: Performance of capsicum growers under protected cultivation

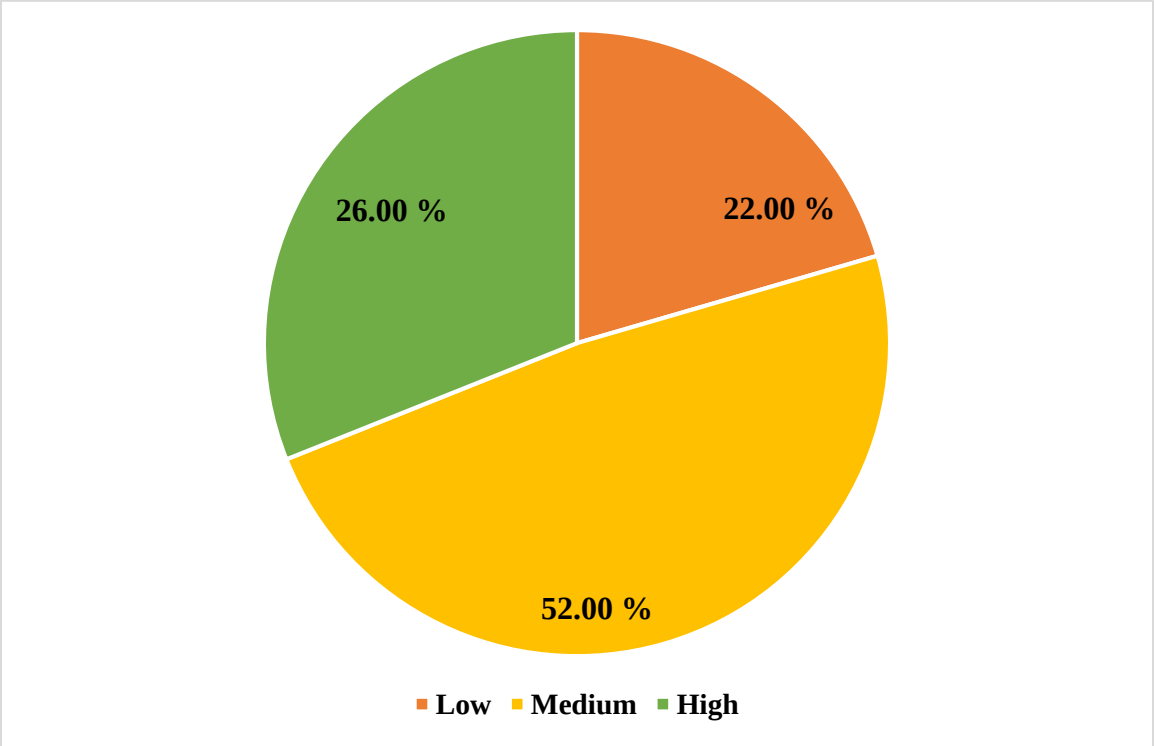

Fig. 4: Overall Performance of capsicum growers under protected cultivation

4.1.1 Performance of chrysanthemum growers under protected cultivation.

Table 2 provides the information on production, economic and social performance of the chrysanthemum growers under protected cultivation. The data showed that more than two-fifth of the chrysanthemum growers (44.00 %) belonged to medium production performance and nearly one-third (32.00 %) of the chrysanthemum growers belonged to low production performance group. Nearly one-fourth (24.00 %) of them comes under high production performance category. The probable reason may be that, growers possess adequate scientific knowledge about the cultivation practices under protected cultivation, because of their better scientific orientation, more participation in extension activities and their willingness to gather more information about protected cultivation, through extension contact and media exposure, better access to credit and subsidy. Hence, this trend was observed. The findings are in line with results of Rao *et al*. (2013)

Table 2: Performance of chrysanthemum growers under protected cultivation

(n_2=50)

Sl. No.	Indicators	Category	Chrysanthemum growers		
			f	%	
1	**Production performance**	Low (<15.17)	16	32.00	Mean=16.32 S.D.=2.31
		Medium (15.17-17.47)	22	44.00	
		High (>17.47)	12	24.00	
2	**Economic performance**	Low (<4.20)	19	38.00	Mean=4.70 S.D.=0.99
		Medium (4.20-5.20)	21	42.00	
		High (>5.20)	10	20.00	
3	**Social performance**	Low (<3.57)	16	32.00	Mean=3.96 S.D.=0.78
		Medium (3.57-4.35)	20	40.00	
		High (>4.35)	14	28.00	
4	**Overall performance**	Low (<24.90)	14	28.00	Mean=26.42 S.D.=3.04
		Medium (24.90-27.94)	21	42.00	
		High (>27.94)	15	30.00	

f - Frequency, %- percentage

Regarding economic performance, more than two-fifth of the chrysanthemum growers (42.00 %) come under medium economic performance group. The probable reason may be that protected cultivation provides higher productivity results in increased income due to better growing environment, better quality, facilities for year-round production allowing farmers to take advantage of market seasonality and higher price results to higher cost benefit ratio. With respect to social performance, two-fifth of chrysanthemum growers (40.00 %) belonged to medium social performance. Nearly one-third of the (32.00 %) growers belonged to low social performance category and more than one-fourth (28.00 %) of them come under high social performance category. The reason might be that, as the production and economic performance improves, the farmer's social performance also increases in terms of participation in the organizations, serving as resource person, getting recognition and respect in the society, seeking higher education for their children. With respect to overall performance level, more than two-fifth (42.00 %) of the growers belongs to medium overall performance category whereas 30.00 per cent of them comes under high overall performance group and 28.00 per cent of the growers had low overall performance level. The findings are line with findings of Harish (2010).

4.1.2 Overall performance of horticulture crop growers under protected cultivation

Table 3 provides the information on overall production, economic, and social performance of the horticulture crop growers under protected cultivation. The data revealed that nearly three-fourth (73.00 %) of the horticulture crop growers belonged to medium to high production performance category. The probable reason may be that, they possess adequate knowledge about the cultivation practices under protected cultivation and are prone towards the modernization and commercialization as a result farmer are enthusiastically adopting improved practices and technologies. Further their education level, participation in extension activities and contact with extension agents and their willingness to gather more information about protected cultivation results in better performance. Regarding economic performance, more than two- fifth of the horticulture crop growers (43.00 %) coming under medium economic performance group followed by low (29.00 %) and high (28.00 %) economic performance category. This may be due to increased production and productivity per unit of area, high water and fertilizer use

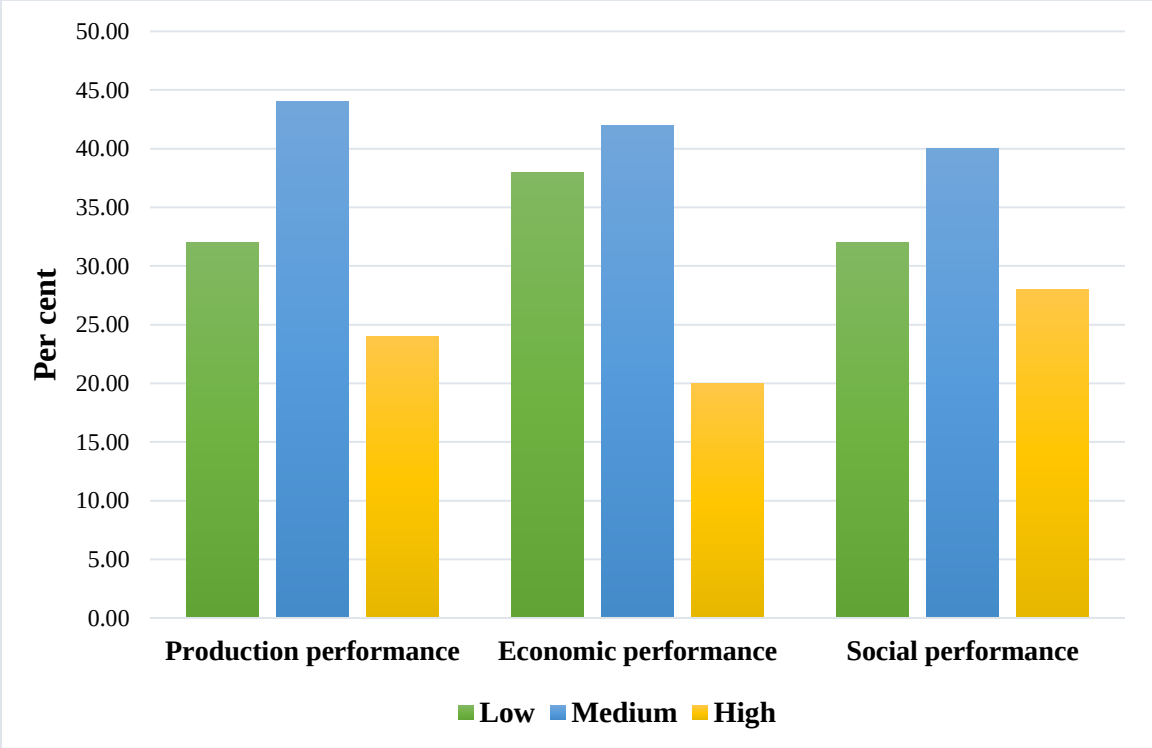

Fig. 5: Performance of chrysanthemum growers under protected cultivation

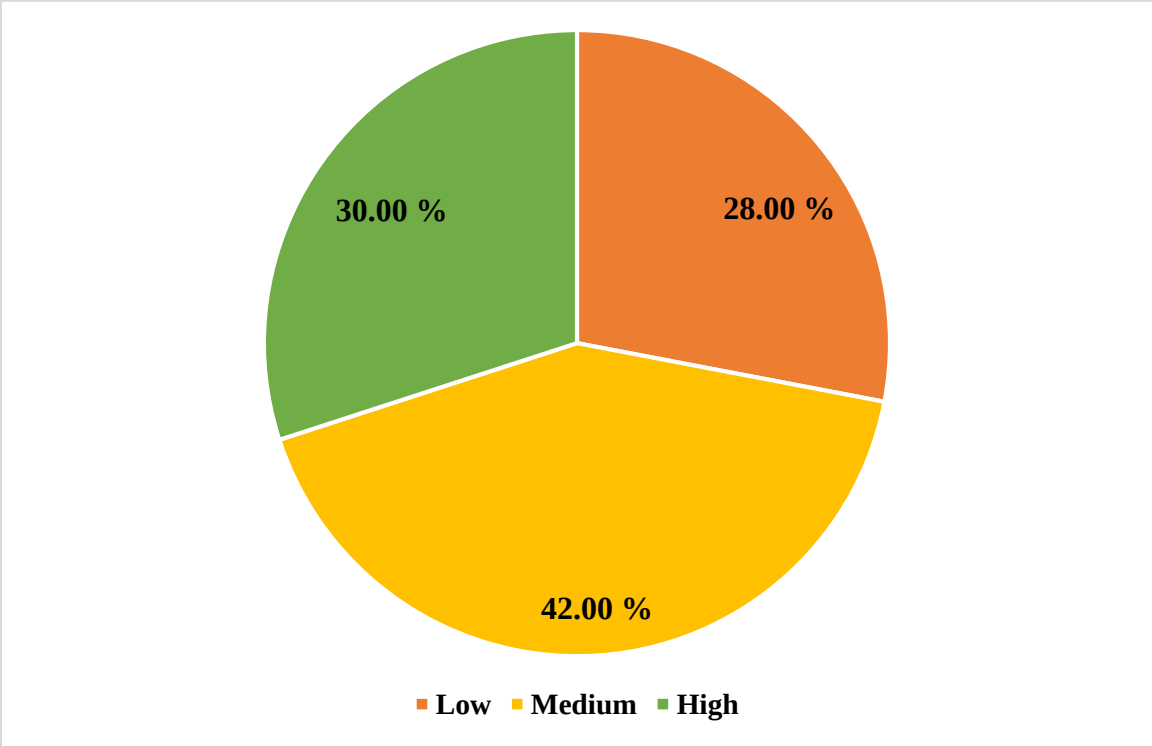

Fig. 6: Overall Performance of chrysanthemum growers under protected cultivation

efficiency, subsidy provision for establishment of high cost infrastructure, round the year employment to the farmers. With respect to social performance, more than two-fifth of horticulture crop growers (42.00 %) belonged to medium social performance. With respect to overall performance, more than two-fifth of the (43.00 %) horticulture crop growers belonged to medium overall performance level followed by high overall performance level (33.00%) and low overall performance level (24.00 %). The reason might be that, as the production and economic performance improves, the farmers' social performance also increases in terms of participation in the organizations, as resource person, getting recognition and respect in the society, seeking higher education for children. The findings are line with studies of Ghanghas *et al.* (2015).

Table 3: Overall performance of horticulture crop growers under protected cultivation

(n=100)

Sl. No.	Indicators	Category	Capsicum growers		Chrysanthemum growers		Horticulture crop growers	
			f	%	f	%	f	%
1	**Production performance** Mean=17.6 S.D.=2.73	Low (<15.17)	11	22.00	16	32.00	27	27.00
		Medium (15.17-17.47)	23	46.00	22	44.00	45	45.00
		High (>17.47)	16	32.00	12	24.00	28	28.00
2	**Economic performance** Mean=5.54 S.D.=1.54	Low (<4.77)	12	24.00	19	38.00	29	29.00
		Medium (4.77-6.31)	20	40.00	21	42.00	43	43.00
		High (>6.31)	18	36.00	10	20.00	28	28.00
3	**Social performance** Mean=4.06 S.D.=0.76	Low (<3.57)	10	20.00	16	32.00	26	26.00
		Medium (3.57-4.35)	22	44.00	20	40.00	42	42.00
		High (>4.35)	18	36.00	14	28.00	32	32.00
4	**Overall performance** Mean=27.40 S.D.=3.48	Low (<25.66)	11	22.00	14	28.00	24	24.00
		Medium (25.66-29.14)	26	52.00	21	42.00	43	43.00
		High (>29.14)	13	26.00	15	30.00	33	33.00

f - Frequency, %- percentage

4.1.3 Practice wise production performance of capsicum growers under protected cultivation.

A glance at Table 4 shows that cent per cent of the capsicum growers have fully adopted soil testing practices, irrigation and drainage, supporting system followed by more than three-fourth of growers (76.00 %) fully adopted pinching technique. More than half of the (56.00 %) growers fully adopted recommended spacing and specification of bed. Three-fifth of the growers (62.00 %) partially adopted grading in marketing of capsicum. Other practices partially adopted by more than fifty per cent of growers are harvesting method (58.00 %), using recommended growing media (56.00 %), plant protection measures (54.00 %), using recommended variety and application of recommended quantity of nutrients (52.00 %).

Table 4: Practice wise production performance of capsicum growers under protected cultivation.

(n_1=50)

Sl. No.	Practices	Full adoption		Partial adoption		No adoption	
		f	%	f	%	f	%
1	Soil testing	50	100.00	0	0.00	0	0.00
2	Recommended Variety	24	48.00	26	52.00	0	0.00
3	Using recommended growing media	22	44.00	28	56.00	0	0.00
4	Recommended spacing and specification of bed	28	56.00	22	44.00	0	0.00
5	Adoption of recommended quantity of nutrients	24	48.00	26	52.00	0	0.00
6	Irrigation and drainage	50	100.00	00	00.00	0	0.00
7	Supporting system	50	100.00	00	00.00	0	0.00
8	Pinching	38	76.00	12	24.00	0	0.00
9	Plant protection measures	23	46.00	27	54.00	0	0.00
10	Harvesting method	21	42.00	29	58.00	0	0.00
11	Grading	19	38.00	31	62.00	0	0.00

f - Frequency, %- percentage

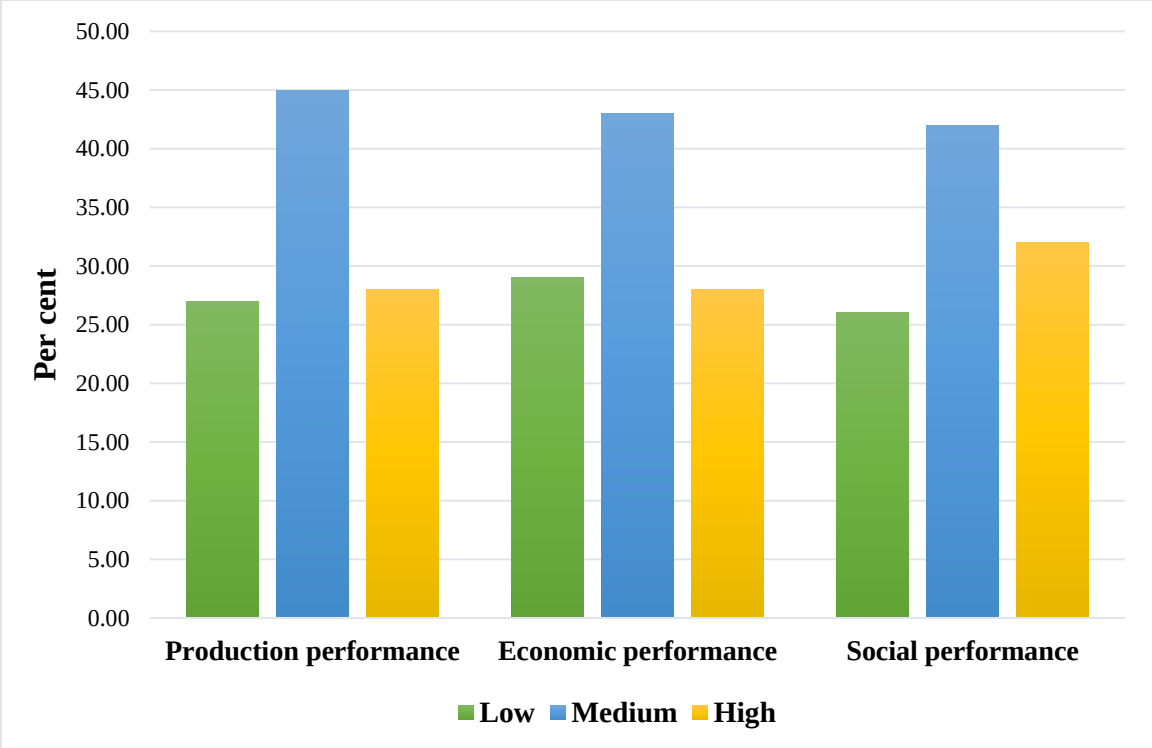

Fig. 7: Performance of horticulture crop growers under protected cultivation

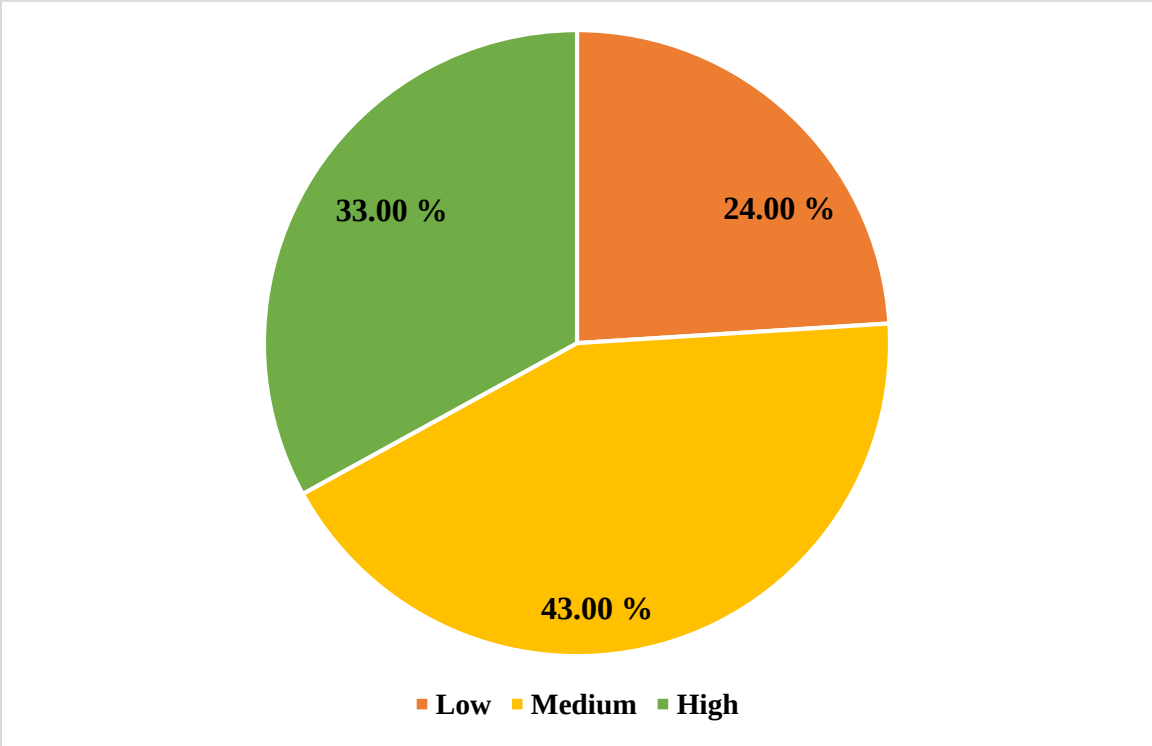

Fig. 8: Overall Performance of horticulture crop growers under protected cultivation

The probable reason may be soil testing is mandatory for getting subsidy from the department; as a result, all the farmers tested their soil. Irrigation, drainage supporting system, pinching, using recommended varieties, spacing, and nutrients are the most important and crucial operations in protected cultivation. Hence, growers have adopted these technologies for higher yield. Water scarcity is a major problem in the study area hence growers adopted the drip irrigation method of which was recommended for protected cultivation to save the water for year-round cultivation. The probable reason for adoption of these technologies may be that pinching, drainage and supporting system are more crucial operations for enhancing the yield. Hence, they adopt these technologies.

4.1.4 Practice wise production performance of chrysanthemum growers under protected cultivation

A glance at Table 5 shows that 100 per cent of the chrysanthemum growers have fully adopted soil testing practices, irrigation and drainage, followed by pinching (64.00 %) technique. Nearly three-fourth of the growers partially adopted the grading in marketing of chrysanthemum and seventy per cent of the growers partially adopted recommended variety. Other practices partially adopted by growers were using recommended supporting system (66.00 %), growing media (64.00 %), plant protection (62.00 %), harvesting method (58.00 %). The probable reason may be soil testing is mandatory for getting subsidy from the department; as a result, all the farmers tested their soil. Water scarcity is a major problem in the study area hence growers adopted the drip irrigation method of which was recommended for protected cultivation to save water for year-round cultivation. Pinching, grading, recommended variety, supporting system, growing media, plant protection, harvesting method, using recommended varieties, spacing, and nutrients are the most important and crucial operations in protected cultivation. Hence, growers have adopted these technologies for higher yield and returns

Table 5: Practice wise production performance of chrysanthemum growers under protected cultivation.

(n_2=50)

Sl. No.	Practices	Full adoption		Partial adoption		No adoption	
		f	%	f	%	f	%
1	Soil testing	50	100.00	0	0.00	0	0.00
2	Recommended Variety	15	30.00	35	70.00	0	0.00
3	Using recommended growing media	18	36.00	32	64.00	0	0.00
4	Recommended Spacing and specification of bed	22	44.00	28	56.00	0	0.00
5	Application of recommended quantity of nutrients	24	48.00	26	52.00	0	0.00
6	Irrigation and drainage	50	100.00	00	00.00	0	0.00
7	Supporting system	17	34.00	33	66.00	0	0.00
8	Pinching	32	64.00	18	36.00	0	0.00
9	Plant protection	19	38.00	31	62.00	0	0.00
10	Harvesting method	21	42.00	29	58.00	0	0.00
11	Grading	14	28.00	36	72.00	0	0.00

f - Frequency, %- percentage

4.1.5 Economic performance of capsicum and chrysanthemum growers under protected cultivation

Table 6 provides the information on economic performance of the capsicum and chrysanthemum growers under protected cultivation. The data revealed that B:C ratio of capsicum under protected cultivation is 2.80 and 2.49 in case of chrysanthemum under protected cultivation per 4000 m^2 The B:C ratio of the chrysanthemum is lower than the capsicum due to more incidence of pest and diseases, high market price fluctuation, more labour requirement, less demand during off-festival season and more perishable nature than capsicum. Capsicum has demand round the year and can be transported easily to distant places and can be kept for 10 to 15 days, whereas, chrysanthemum has demand only in

more festival season and it is difficult to transport too far off places because of perishability of the produce. Hence, more benefit cost is found in case of capsicum.

Table 6: Economic performance of capsicum and chrysanthemum under protected cultivation

(n=100)

Crop	Operating cost of cultivation (Rs)	Gross returns (Rs)	Net returns (Rs)	B:C ratio
Capsicum (n_1=50)	3,85,000	1080000 (9000 plants per 4000m^2, average yield per plant is 4.0 kg, average price of capsicum per kg is 30)	6,95,000	**2.80**
Chrysanthemum (n_2=50)	2,15,000	535500 (average yield: 6.3tonnesper 4000m^2, average price: 85 per kg)	3,00,000	**2.49**

4.1.6 Comparative analysis of crop yield obtained under open field and protected cultivation

Table 7 reveled the information on comparative yield analysis of capsicum and chrysanthemum crops under open field and protected cultivation. The data revealed that the average yield of capsicum per acre under protected cultivation was 36,000 kg/acre, whereas, in open field cultivation it was 19,500 kg/acre. In case of chrysanthemum, the average yield was 6, 300 kg/acre under protected cultivation and it was 4,500 kg/ac in case of chrysanthemum. This may be due to micro climate surrounding the plant body is controlled fully or partially as per the requirement of the plants in protected cultivation, as a result, quantity and quality of the produce much better than open field condition. Incidence of pest and diseases and manifold increase in the resource use efficiency in crop production is possible in protected cultivation compared to open field condition. It is extremely difficult to grow vegetables and flowers in open field conditions because vegetables and flowers are very sensitive to varied climatic conditions. However, under protected cultivation favourable environmental conditions can be created to give protection

from adverse conditions. These findings are in line with studies conducted by Singh *et al*. (2011) and Rao *et al.* (2013).

Table 7: Comparative analysis of crop yield obtained under open field and protected cultivation

(n=100)

Average yield obtained (kg/ac)				
Crop	**Protected cultivation (kg/ac)**	**Open field cultivation (kg/ac)**	**Difference**	
			Kg/ac	**Per cent**
Capsicum (n_1=50)	36,000	19,500	17,000	47.22
Chrysanthemum (n_2=50)	6,300	4,500	1,800	28.57

4.1.6.1 Yield gap analysis among growers under protected cultivation.

The data in table 8 revealed that there is 13.10 per cent yield gap was observed in case of capsicum, whereas, in case of chrysanthemum it was 25.90 per cent. The yield difference in case of capsicum was 5500 kg/acre and in case of chrysanthemum it was 2200 kg/acre compared to recommended yield.

Table 8: Yield gap analysis among growers under protected cultivation

(n=100)

Crop	**Recommended yield (Kg/ac)**	**Actual yield obtained Kg/ac**	**Difference**	
			Kg/ac	**Per cent**
Capsicum (n_1=50)	42,000	36,500	5,500	13.10
Chrysanthemum (n_2=50)	8,500	6,300	2,200	25.90

This existing yield gap is mainly attributed to the partial adoption of technologies like using recommended variety, using recommended growing media, imbalance applications of nutrients, poor plant protection measures and delayed harvesting. The other reason might be non-transferable component of the technology which is developed in

research station could not be fully implemented in farmers filed due to socio-economic and resource constraints. Some of the management practices also might have contributed to the existence of yield gap. The farmer's inability to take up the recommended management practices due to production, labour, technical, economical constraints within a stipulated time could cause a noticeable decline in output.

4.1.7 Social performance of capsicum growers under protected cultivation

Table 9 provides the information on social performance of the Capsicum growers. The data showed that 82.00 per cent of growers were consulted by other farmers due to their experience and adequate knowledge under protected cultivation.

Table 9: Social performance of capsicum growers under protected cultivation.

(n_1=50)

Sl. No.	Statements	Capsicum growers			
		Yes		No	
		f	%	F	%
1	Serving as resource person in agriculture/horticulture crop production for line departments	37	74.00	13	26.00
2	Others consult for information and guidance	41	82.00	09	18.00
3	Serving as member in Village Panchayath/Taluk Panchayth /Zilla Panchayath	06	12.00	44	88.00
4	Participation in other department programmes increased	20	40.00	30	60.00
5	Recognized by villagers/neighbors because of performance in farming	33	66.00	17	34.00
6	Sent children for higher education	31	62.00	19	38.00
7	Purchasing power has been increased (constructed house/ purchased vehicle/ purchased land)	40	80.00	10	20.00

f - Frequency, %- percentage

Eighty per cent of growers increased their Purchasing power due to the high productive returns under protected cultivation, nearly three-fourth (74.00 %) of growers were served as a resource person in agriculture/horticulture crop production for line

departments and 66.00 per cent of growers were recognized by villagers/neighbors because of their performance in protected cultivation. All the social perspectives are one or the other way is correlated with the economic and production performance due to the high productive returns under protected cultivation.

4.1.8 Social performance of chrysanthemum growers under protected cultivation.

Table 10 provides the information on social performance of the Chrysanthemum growers. The data showed that more than three-fourth of the growers (80.00%) were consulted by other flower growers for information and guidance due to their farming experience and knowledge under protected cultivation.

Table 10: Social performance of chrysanthemum growers under protected cultivation.

(n_2=50)

Sl. No.	Statements	Chrysanthemum growers			
		yes		No	
		f	%	F	%
1	Serving as resource person in agriculture/horticulture crop production for line departments	35	70.00	15	30.00
2	Others consult for information and guidance	40	80.00	10	20.00
3	Serving as member in Village Panchayath/Taluk Panchayth / Zilla Panchayath	01	02.00	49	98.00
4	Participation in other department programmes increased	18	36.00	32	64.00
5	Recognized by villagers/neighbors because of performance in farming	34	68.00	16	32.00
6	Sent children for higher education	32	64.00	18	36.00
7	Purchasing power has been increased (constructed house/ purchased vehicle/ purchased land)	37	74.00	13	26.00

f - Frequency, %- percentage

Nearly three-fourth of the chrysanthemum growers (74.00%) increased their purchasing power due to the high productive returns under protected cultivation. Seventy

per cent of growers were served as resource person in agriculture/horticulture crop production for line departments due to their performance in horticulture crop production and 68.00 per cent of growers were recognized by villagers/neighbors because of their economic performance in protected cultivation.

4.2 The personal, socio-economic and psychological characteristics of the capsicum growers under protected cultivation

There is a need to analyze the profile of horticulture crop growers under Protected cultivation to understand the clear picture about their personal, socio-economic and psychological background. It will help in giving appropriate suggestions based on conclusions arrived from the study. Relevant information on the profile was collected and analyzed the profile of the Capsicum and chrysanthemum crop growers under protected cultivation are discussed in table 11 and table 12.

4.2.1.1 Age

It is observed from Table 11 that sixty-six per cent of the capsicum growers were comes under middle age category followed by young age category (24.00 %) and old age category (10.00 %). A critical observation of the above findings indicated that a considerable per cent of the capsicum growers are of middle age. The possible reason for the above trend might be the middle-aged capsicum growers were optimistic and ready to take up any new commercial crops to earn profit. Further, the middle-aged growers are enthusiastic, possess more physical vigour and have more work efficiency than older and younger capsicum growers. The results are in conformity with the results of Kamaraddi (2011), who noticed that middle aged farmers are more enthusiastic to work than old aged farmers.

4.2.1.2 Education

With regard to level of education, it can be observed from Table 11 that, thirty-four per cent of capsicum growers were educated up to high school followed by 30.00 per cent, 20.00 per cent and 10.00 per cent studied up to college, primary school and graduation respectively. The probable reason for majority of capsicum growers to be educated up to

high school and pre university education might be due to lack of facilities for college education in nearby villages, which forces them to travel to cities if at all they want to pursue college and graduation education. Similar trend was observed by Sharma *et al*. (2014).

4.2.1.3 Land holding

The data revealed in Table 11 indicates that 46.00 per cent of the capsicum growers were small famers followed by 34.00 per cent and 20.00 were belonged to marginal and big farmer's category respectively. The reason for possession of small and marginal land holding could be due to fragmentation of land because of separation of families. The findings are in conformation with the studies of Ekhande (2016).

4.2.1.4 Farming experience

It is noticed from Table 11 that, three- fourth (75.00 %) of the respondents comes under medium farming experience category followed by low experience (18.00 %) and high experience category (12.00 %), respectively. The possible reason might be due to majority of the capsicum growers belonged to medium age group of 35 to 50 years and are practicing farming after discontinuing their education. Hence, this trend was observed and relatively less numbers of respondents were also found in low farming experience category, because, they were recently started the farming profession after discontinuing their education. This is in conformity with the findings of Prabhu (2006).

4.2.1.5 Mass media exposure

It is evident from the Table 11 that, half (50.00 %) of the growers belonged to medium mass media exposure category followed by high (30.00 %) and low (20.00%) mass media exposure category respectively. Farmers in present days have more accessibility to mass media such as television and radio. They have the habit of reading newspaper and listening to radio programmes and watching television for entertainment and agricultural programmes. Hence, majority of the growers had medium to high mass media exposure. The results are in conformity with the findings of Nayak (2014).

Table 11: Personal, socio-economic and psychological characteristics of capsicum growers under protected cultivation.

(n_1=50)

Sl. No.	Characteristics	Category	Capsicum growers		
			f	%	
1	Age	Young (<35 years)	14	24.00	-
		Middle (36-55 years)	27	66.00	
		Old (>55 years)	09	10.00	
2	Education	Illiterate	03	06.00	-
		Primary school	10	20.00	
		High school	17	34.00	
		Pre-University	15	30.00	
		Graduation and above	05	10.00	
3	Land holding	Marginal farmers (<2.5.0 acres)	17	34.00	-
		Small farmers (2.5-5.0 acres)	23	46.00	
		Big farmers (>5.0 acres)	10	20.00	
4	Farming experience	Low (<10 years)	09	18.00	-
		Medium (10-20 years)	35	75.00	
		High (>20 years)	06	12.00	
5	Mass media Exposure	Low (<5.42)	10	20.00	Mean =6.28 S.D=1.73
		Medium (5.42-7.14)	25	50.00	
		High (>7.14)	15	30.00	
6	Scientific orientation	Low (<12.65)	12	24.00	Mean =13.24 S.D=1.17
		Medium (12.65-13.83)	15	30.00	
		High (>13.83)	23	46.00	
7	Achievement motivation	Low (<13.36)	13	26.00	Mean =14.06 S.D=1.41
		Medium (13.36-14.76))	21	42.00	
		High (>14.76)	16	32.00	
8	Extension Participation	Low (<4.22)	16	32.00	Mean =4.94 S.D=1.43
		Medium (4.22-5.66)	23	46.00	
		High (>5.66)	11	22.00	
9	Management orientation	Low (<23.51)	12	24.00	Mean =24.08 S.D=1.14
		Medium (23.51-24.65)	22	44.00	
		High (>24.65)	16	32.00	
10	Accessibility to subsidy	Yes	45	90.00	-
		No	05	10.00	
11	Accessibility to credit	Yes	45	90.00	-
		No	05	10.00	
12	Risk bearing ability	Low (<3.75)	10	20.00	Mean =4.20 S.D=0.90
		Medium (3.75-4.65)	24	48.00	
		High (>4.65)	16	32.00	

f - Frequency, %- percentage

4.2.1.6 Scientific orientation

It is apparent from Table 11 that, nearly half of the capsicum growers (46.00 %) had high scientific orientation. While, 30.00 per cent and 24.00 per cent of growers had medium and low scientific orientation, respectively. The trend may be due to the fact that, majority of the capsicum growers view the things scientifically with interest and had good knowledge about farming because of their better education, risk bearing ability, farming experience, mass media use and extension system link. All these factors might have contributed for taking keen interest in scientific aspects in their farming activities. The similar findings were reported by Sharma *et al*. (2014).

4.2.1.7 Achievement motivation

The results in Table 11 indicates that, more than two-fifth of the growers had medium (42.00 %) achievement motivation followed by 32.00 per cent age and 26.00 per cent had high and low achievement motivation, respectively. Majority of the capsicum growers having medium to high achievement motivation the reason may be due to organizational efforts from all the family members to achieve the determined goal apart from inner urge and drive of the growers. The findings are in accordance with the studies conducted by Bennur (2011).

4.2.1.8 Extension participation

It is clear from Table 11 that, nearly half of the (46.00%) respondents had medium extension participation followed by low (32.00 %) and high (22.00 %) extension participation, respectively. The pertinent reasons for having medium to low level extension participation was due to lack of free time, they might not find time to attend extension activities, apart from lack of awareness about extension activities organized by line departments. The other probable reasons may be that since they are actively involved in horticulture crop production under protected cultivation, they may not attend programmes related to agriculture crop production. Hence, this trend was observed. The findings of the present study were in conformity with the results reported by Nagesh (2006)

4.2.1.9 Management orientation

From the Table 11 it is found that, more than two-fifth of the capsicum growers (44.00 %) had medium level management orientation followed by high (32.00 %) and low (24.00 %) level management orientation respectively. The probable reason for the above trend may be that, growers have interactions with other capsicum growers in the area and also with the field level workers of the horticulture department to manage the production and marketing activities and to re-orient their level of management. These results are in conformity with that of Sumana (2017).

4.2.1.10 Accessibility to subsidy

The data from the Table 11 reveals that a great majority (90.00%) of the capsicum growers had access to subsidy facility and remaining 10.00 per cent of growers have not applied for the subsidy. The reason was that the establishment of polyhouse required huge initial investment which was generally beyond the limit of resource poor farmers to establish on their own. It was found by the study that majority of the growers received financial assistance from Governments sources in the form of subsidies under various programmes/schemes aimed at bringing more area under protected cultivation. These results are in conformity with that of Itigi (2015)**.**

4.2.1.11 Accessibility to credit

The data from the Table 11 reveals that 90.00 per cent of the capsicum growers had access to the credit facility and 10.00 per cent of growers have not applied for the credit. The reason was that the establishment of polyhouse required huge initial investment which was practically impossible for farmers establish on their own. It was found by the study that majority of the growers received financial assistance from banks/government sources in the form of credit. Initially farmers have to borne the entire initial investment cost after that subsidy will be provided by various programmes/schemes which are aimed at bringing more area under protected cultivation. These results are in conformity with that of Radhakrishnan (2015)**.**

4.2.1.12 Risk bearing ability

The findings in Table 11 indicates that nearly half (48.00 %) of the capsicum growers belonged to medium risk bearing ability followed by high (32.00 %) and low (20.00 %) risk bearing ability, respectively. It concludes that, the capsicum growers take moderate risk in taking up any innovations. Cultivation under protected condition requires initial investment, skill and experience of the growers, for this, growers have to take risk in taking up such activities. This may be the probable reason for growers having medium to high level risk bearing ability. The results are in conformity with the findings of Subramanyam (2002).

4.2.2 The personal, socio-economic and psychological characteristics of the chrysanthemum growers under Protected cultivation.

4.2.2.1 Age

It is observed from Table 12 that, nearly three-fifth of the chrysanthemum growers (58.00 %) come under middle age category followed by young age category (26.00 %) and old age category (16.00 %). A critical observation of the above findings indicated that a considerable per cent of the chrysanthemum growers are of middle age. The possible reason for the above trend might be the middle-aged chrysanthemum growers were optimistic and ready to take up cultivation of commercial crops to earn profit. Further, the middle-aged growers are enthusiastic, possess more physical vigour and have more work efficiency than older and younger chrysanthemum growers. The results are in conformity with the results of Doddamani (2014) who noticed that middle aged farmers are more enthusiastic to work than old aged farmers.

4.2.2.2 Education

With regard to level of education, it can be observed from Table 12 that, 32.00 per cent of chrysanthemum growers were educated up to high school followed by 28.00 per cent, 24.00per cent 10.00 per cent and 06.00 per cent studied college, primary school, illiterate and graduation respectively. The probable reasons for majority of chrysanthemum growers educated up to high school and pre university education might be due to lack of facilities for college education in nearby villages, which forces them to travel to cities if at

all they want to pursue college and graduation education and lack of interest in pursuing further education. Similar trend was observed by Dhamodaran and Vasanth kumar (2001).

4.2.2.3 Land holding

The data revealed in Table 12 indicates that 44.00 per cent of the chrysanthemum growers were small famers followed by 38.00 per cent and 18.00 were belonged to marginal and big farmers respectively. The reason for possession of small and marginal land holding could be due to fragmentation of land because of separation of families. The findings are in line with the studies of Sowmya (2009).

4.2.2.4 Farming experience

It is noticed from Table 12 that, 72.00 per cent of the respondents come under medium farming experience category followed by high experience (16.00 %) and low experience category (12.00 %), respectively. This might be due to majority of the chrysanthemum growers belonged to medium age group of 35 to 50 years and are practicing farming after discontinuing their education. Hence, this trend was observed and relatively less numbers of respondents were also found in low farming experience category because they may have recently started the farming profession after discontinuing their education. This finding is in conformity with the Ekhande (2016).

4.2.2.5 Mass media exposure

It is evident from the Table 12 that, more than two-fifth (44.00 %) of chrysanthemum growers belonged to medium mass media exposure category followed by high (30.00 %) and low (26.00 %) mass media exposure category, respectively. Farmers in present days have more accessibility to mass media such as television and radio. Further they have the habit of reading newspaper and listening to radio programmes and watching television for entertainment and agricultural programmes. Hence, majority of the growers had medium to high mass media exposure. The results are in conformity with the findings of Hinge (2009).

Table 12: Personal, socio-economic and psychological characteristics of chrysanthemum growers under protected cultivation

(n_2=50)

Sl. No.	Characteristics	Category	Chrysanthemum growers		
			f	%	
1	Age	Young (<35 years)	12	26.00	-
		Middle (36-55 years)	28	58.00	
		Old (>55 years)	10	16.00	
2	Education	Illiterate	05	10.00	-
		Primary school	12	24.00	
		High school	16	32.00	
		Pre-University	14	28.00	
		Graduation and above	03	06.00	
3	Land holding	Marginal farmers (<2.5.0 acres)	19	38.00	-
		Small farmers (2.5-5.0 acres)	22	44.00	
		Big farmers (>5.0 acres)	09	18.00	
4	Farming experience	Low (<10 years)	06	12.00	-
		Medium(10-20 years)	36	72.00	
		High(>20 years)	08	16.00	
5	Mass media exposure	Low (<5.58)	13	26.00	Mean =6.14 S.D=1.13
		Medium (5.58-6.70)	22	44.00	
		High (>6.70)	15	30.00	
6	Scientific orientation	Low (<10.84)	11	22.00	Mean =12.22 S.D=2.76
		Medium (10.84-13.60)	17	34.00	
		High (>13.60)	22	44.00	
7	Achievement motivation	Low (<13.34)	15	30.00	Mean =13.90 S.D=1.11
		Medium (13.34-14.46)	19	38.00	
		High (>14.46)	16	32.00	
8	Extension Participation	Low (<3.98)	14	28.00	Mean =4.78 S.D=1.59
		Medium (3.98-5.58)	24	48.00	
		High (>5.58)	12	24.00	
9	Management orientation	Low (<23.24)	14	28.00	Mean =23.88 S.D=1.27
		Medium (23.24-24.52)	21	42.00	
		High (>24.52)	15	30.00	
10	Accessibility to subsidy	Yes	49	98.00	
		No	01	2.00	
11	Accessibility to credit	Yes	49	98.00	
		No	01	2.00	
12	Risk bearing ability	Low (<3.69)	12	24.00	Mean =4.06 S.D=0.74
		Medium (3.69-4.43)	23	46.00	
		High (>4.43)	15	30.00	

f - Frequency, %- percentage

4.2.2.6 Scientific orientation

It is apparent from Table 12 that, 44.00 per cent of chrysanthemum growers had high scientific orientation. While 34.00 per cent and 22.00 per cent had medium and low scientific orientation, respectively. The trend may be due to the fact that, majority of the chrysanthemum growers view the things scientifically with interest and had good knowledge about farming because of their better education, risk bearing ability, farming experience, mass media use and extension system link. All these factors might have contributed for taking keen interest in scientific aspects in their farming activities. The similar findings were reported by Shanabhoga (2016)

4.2.2.7 Achievement motivation

The results in Table 12 indicate that, 38.00 per cent of the chrysanthemum growers had medium achievement motivation followed by 32.00 per cent and 30.00 per cent had high and low achievement motivation, respectively. Majority of the chrysanthemum growers having medium to high achievement motivation, the reason may be due to organizational efforts from all the family members to achieve the determined goal apart from inner urge and drive of the growers. The findings are in accordance with the studies conducted by Wanole (2016).

4.2.2.8 Extension participation

It is clear from Table 12 that, 48.00 of the respondents had medium extension participation followed by low (28.00 %) and high (24.00 %) extension participation, respectively. The pertinent reasons for having medium to low level of extension participation was due to lack of free time, to attend extension activities and lack of awareness about extension activities organized by line departments. The other probable reasons may be that since they are actively involved in horticulture crop production under protected cultivation, they may not attend programmes related to agriculture crop production. Hence, this trend was observed. The findings of the present study were in conformity with the results reported by Doddamani (2014).

4.2.2.9 Management orientation

From the Table 12 it is found that, more than two-fifth of the chrysanthemum growers (42.00 %) had medium level management orientation followed by high (30.00 %) and low (28.00 %) level management orientation, respectively. The probable reason for the above trend may be that, growers have interactions with progressive chrysanthemum growers in the area and also with the field level workers of the horticulture department to manage the production and marketing activities and to re-orient their level of management. These results are in conformity with that of Mubeena (2017).

4.2.2.10 Accessibility to subsidy

The data from the Table 12 reveals that almost all the chrysanthemum growers (98.00 %) had access to subsidy facility. The reason was that establishment of polyhouse required huge initial investment which was generally beyond the limits of resource poor farmers to establish on their own. It was found that majority of the growers received financial assistance from governments sources in the form of subsidies under various programmes/schemes like National Horticultural Mission aimed at bringing more area under protected cultivation. These results are in conformity with that of Patel (2014)**.**

4.2.2.11 Accessibility to credit

The data from the Table 12 reveals that a great majority of the (98.00 %) chrysanthemum growers had access to the credit facility. The reason was that establishment of polyhouse required huge initial investment which was practically impossible for farmers to establish on their own. It was found that majority of the growers received financial assistance from banks/government sources in the form of credit along with subsidy. Initially farmers have to borne the entire initial investment cost after that subsidy will be provided by various programmes/schemes which are aimed at bringing more area under protected cultivation. These results are in conformity with that of Jayraj (2009)**.**

4.2.2.12 Risk bearing ability

The findings in Table 12 indicates that, 46.00 per cent of the chrysanthemum growers belonged to medium risk bearing ability followed by high (30.00 %) and low

(24.00 %) risk orientation category, respectively. It concludes that, the chrysanthemum growers take moderate risk in taking up any innovations. Cultivation under protected condition requires initial investment, skill and experience of the growers, for this, growers have to take risk in taking up such activities. This may be the probable reason for growers having medium to high level risk bearing ability. The results are in conformity with the findings of Kolgane (2018).

4.2.3 Personal, socio-economical and psychological characteristics of horticulture crop growers under protected cultivation.

4.2.3.1 Age

Age is an important factor as it reveals the maturity of an individual to take decisions for achieving his needs. Results in Table 13 highlights that more than half of the respondents (55.00%) were middle age followed by 26.00 per cent young aged and 19.00 per cent of them were old. Middle aged farmers work more efficiently than older and younger ones. Further, individuals of 36 to 55 years of age have more family responsibility than the younger ones this might be the reason for above findings. Further, the middle-aged growers are enthusiastic optimistic and possess more physical vigour and are ready to take up risk to earn profit. The results are in conformity with the results of Sumana (2017).

4.2.3.2 Education

Education is another important factor that influences the adoption behavior of individuals. Education level of capsicum and chrysanthemum growers could be understood from Table 13. It was found that 33.00 per cent of the respondents had high school education followed by Pre university education (29.00 %), primary school (22.00 %) and 8.00 per cent are illiterate as well as studied up to graduation and above. The results could be attributed to the availability of free basic education and the educational facility in the village. Few of them opted higher education reflecting on their affordability and interest to learn more and gain good knowledge. The distance of higher study centres from the village might have contributed for only few being educated above college. Similar findings were reported by Sharma (2014) and Mubeena (2017).

4.2.3.3 Land holding

A glance at Table 13 indicates that, nearly half of the respondents (45.00%) were small farmers followed by marginal (36.00%) and big (19.00 %) farmers. The reason for possession of small and marginal land holding could be due to fragmentation of land because of separation of families and preference for nuclear family. Per capita land availability for farming in the study area is about only 0.016 ha availability. The findings are in confirmation with the studies of Nagesh (2006).

4.2.3.4 Farming experience

Farming experience of the growers could be glanced from Table 13. It was found that nearly three-fourth of the respondents (71.00 %) belonged to medium farming experience category followed by 15.00 per cent of respondents had low level of farming experience and 14.00 per cent of respondents had high level of farming experience. Farming experience mainly depends upon age of the farmer. Majority of horticulture crop growers belonged to medium age group of 35 to 50 years and are practicing farming after discontinuing their education. Hence, this trend is observed and relatively less numbers of respondents were also found in low farming experience category because they were recently started the farming profession after discontinuing their education. The results are in conformity with the results of Wanole (2017).

4.2.3.5 Mass media exposure

It is clear from the Table 13 that about more than two-fifth of the horticulture crop growers (43.00%) belonged to medium mass media exposure category followed by 34.00 per cent and 23.00 per cent of farmers belonged to high and low mass media exposure category, respectively. Farmers in present days have more accessibility to mass media such as television and radio. They have the habit of reading newspaper and listening to radio programmes and watching television for entertainment and agricultural programmes. Hence, majority of the growers had medium to high mass media exposure. The results are in line with the findings of Nayak (2014).

Table 13: Personal, socio-economic and psychological characteristics of horticulture crop growers under protected cultivation

(n=100)

Sl. No.	Characteristics	Category	Horticulture crop growers		
			f	%	
1	Age	Young (<35 years)	26	26.00	-
		Middle (36-55 years)	55	55.00	
		Old (>55 years)	19	19.00	
2	Education	Illiterate	08	08.00	-
		Primary school	22	22.00	
		High school	33	33.00	
		PUC	29	29.00	
		Graduation and above	08	08.00	
3	Land holding	Marginal farmers (<2.5.0 acres)	36	36.00	-
		Small farmers (2.5-5.0 acres)	45	45.00	
		Big farmers (>5.0 acres)	19	19.00	
4	Farming experience	Low (<10 years)	12	15.00	-
		Medium(10-20 years)	71	71.00	
		High(>20 years)	17	14.00	
5	Mass media exposure	Low (<5.48)	23	23.00	Mean=6.21 S.D=1.45
		Medium (5.48-6.94)	43	43.00	
		High (>6.94)	34	34.00	
6	Scientific orientation	Low (<11.64) _	16	16.00	Mean=12.73 S.D=2.17
		Medium (11.18-13.20)	39	39.00	
		High (>13.82)	45	45.00	
7	Achievement motivation	Low (<13.35)	28	28.00	Mean=13.98 S.D=1.26
		Medium(13.35-14.61)	40	40.00	
		High (>14.61)	32	32.00	
8	Extension Participation	Low (<4.10)	37	37.00	Mean=4.86 S.D=1.51
		Medium (4.10-5.62)	40	40.00	
		High (>5.62)	23	23.00	
9	Management orientation	Low (<23.38)	26	26.00	Mean=23.98 S.D=1.21
		Medium (23.38-24.58)	43	43.00	
		High (>24.58)	31	31.00	
10	Accessibility to subsidy	Yes	94	94.00	
		No	06	06.00	
11	Accessibility to credit	Yes	94	94.00	
		No	06	06.00	
12	Risk bearing ability	Low (<3.72)	22	22.00	Mean=4.13 S.D=0.82
		Medium (3.72-4.54)	47	47.00	
		High (>4.54)	31	31.00	

f - Frequency, %- per cent

4.2.3.6 Scientific orientation

A glance at Table 13 observed that nearly half of the respondents (45.00 %) were found in high scientific orientation category followed by 39.00 per cent in medium and 16.00 per cent in low scientific orientation category. The trend may be due to the fact that, majority of the growers view the things scientifically with interest and had good knowledge about farming because of their better education, risk bearing ability, farming experience, mass media use and extension system link. All these factors might have contributed for taking keen interest in protected cultivation. The similar findings were reported by Shreekanth and Jaghirdar (2017).

4.2.3.7 Achievement motivation

The data presented in Table 13 reveals that two-fifth of the respondents (40.00 %) had medium level of achievement motivation, whereas, 32.00 per cent and 28.00 per cent of them had high and low level of achievement motivation respectively. This may be due as achievement motivation is more of a psychological variable which differs from individual to individual. It is assumed that achievement motivation forces the individual towards reaching predetermined goals, which an individual set for himself. Higher the association with the individual, higher will be his efforts. This can be attributed to the social status of a respondent, who feels to keep greater goals and organizational efforts from all the family members to achieve the determined goal. The findings are in accordance with the studies conducted by Patel (2014).

4.2.3.8 Extension participation

The keen observation of Table 13, revealed the extent of extension participation of the farmers. In total, two-fifth of the respondents belonged to medium category (40.00 %) followed by low (37.00 %) and high (23.00 %) level of extension participation. The pertinent reasons for having medium level of extension participation was activities conducted by the concerned departments either less frequently or with less priority. The lack of initiation or interest on part of the respondents could also be the reason for low participation. Demonstrations are usually laid in farmer's field and many of them might have participated in it. Popularity, specified time and place of the activities conducted by

concerned departments increases the participation of the farmers. The above findings were in accordance with the findings of study conducted by Shalini (2017).

4.2.3.9 Management orientation

Table 13 presents the management orientation of horticulture crop growers. The results from the data indicated that more than two-fifth of the respondents (43.00 %) were belonged to medium management orientation category followed by high (31.00 %) and low (26.00 %) management orientation category. The probable reason for the above trend may be that, growers have interactions with other growers in the area and also with the field level functionaries of the horticulture department to manage the production and marketing activities which are most important management orientation activities. These results are in check with that of Kolgane *et al.* (2018).

4.2.3.10 Accessibility to subsidy

The data from the Table 13 reveals that 94.00 per cent of the respondents had access to the subsidy and remaining 6.00 per cent did not have access to subsidy. The reason was that establishment of polyhouse required huge initial investment which was generally beyond limits of resource poor farmers to establish on their own. It was found that majority of the growers received financial assistance from Government sources in the form of subsidies under various programmes/schemes aimed at bringing more area under protected cultivation. These results are in line with that of Itigi (2015)**.**

4.2.3.11 Accessibility to credit

The data from the Table 13 reveals that 94.00 per cent of the respondents had received the credit and reaming 6.00 per cent did not have access to the credit. The reason was that establishment of polyhouse required huge initial investment which was practically impossible for farmers to establish on their own. It was found that majority of the growers received financial assistance from banks/government sources in the form of credit. Initially farmers have to borne the entire initial investment cost after that subsidy will be provided

by various programmes/schemes which are aimed at bringing more area under protected cultivation. These results are in conformity with that of Sudha Narayanan (2015)**.**

4.2.3.12: Risk bearing ability

Table 13 reveals that nearly half of the farmers (47.00 %) were belonged to medium level of risk bearing ability category followed by 31.00 per cent of the respondents had high level of risk bearing ability category and 22.00 per cent of the farmers had low level of risk bearing ability category. It concludes that, the growers take moderate risk in taking up any innovations. Cultivation under protected condition requires initial investment, knowledge, skill and experience of the growers, for this, growers have to take risk in taking up such activities. This may be the probable reason for growers having medium to high level risk bearing ability. The results are in conformity with the findings of Sharma *et al.* (2014).

4.3 Association between personal, socio-economic and psychological characteristics with performance of capsicum growers under protected cultivation

In order to measure the association that exists between the personal, socio-economic and psychological characteristics with performance of capsicum crop growers, the chi-square test was employed and tested for its statistical significance. The data in Table 14 revealed the association between personal, socio-economical and psychological characteristics with performance of capsicum growers, farming experience, scientific orientation, accessibility to subsidy and accessibility to credit had positive and significant association with performance at one per cent level of significance. Whereas education, extension participation, management orientation and risk bearing ability had positive and significant association with performance at five per cent level of significance. However, age, land holding, mass media exposure had non-significant association with performance.

Education of the capsicum growers was found to be significantly associated with their performance. The probable reason might be the advantages that an individual gets from education through knowledge acquisition, motivation towards higher accomplishment and broadening of the vision. Literate capsicum crop growers have the

ability to gather, interpret, critically evaluate and use information in an appropriate manner. Education helps an individual in proper planning, precise decision making and managing the production, post-harvest and marketing activities. The results are in conformity with the results of Wankhade (2018).

Table 14: Association between personal, socio-economical and psychological characteristics with performance of capsicum growers under protected cultivation

(n_1=50)

Sl. No.	Independent variables	Chi-square statistic	C
1.	Age	2.34 ^{NS}	0.21
2.	Education	9.49*	0.40
3.	Land holding	5.32^{NS}	0.31
4.	Farming Experience	30.52**	0.62
5.	Mass media exposure	5.56 ^{NS}	0.32
6.	Extension participation	10.13*	0.41
7.	Scientific orientation	14.44**	0.47
8.	Achievement motivation	1.96 ^{NS}	0.19
9.	Management orientation	9.86*	0.41
10.	Accessibility to subsidy	32.00**	0.62
11.	Accessibility to credit	32.00**	0.62
12.	Risk bearing ability	10.79*	0.42

NS- Non Significant, *- Significant at 5 per cent level, **- Significant at 1 per cent level, C- Contingency coefficient

Experience of capsicum growers was found to be significantly associated with their performance. The probable reason could be that, those growers who involved in farming for many years, definitely get higher yield, income and recognition than others. They will be having good leadership quality, management orientation, ability to coordinate farm activities which they got through experience. The findings were supported by Pavan (2018).

The study also revealed that a positive and significant association between scientific orientation with performance of capsicum growers. The probable reasons for this might be that the respondents might have viewed the things scientifically with keen interest of their high-risk taking ability, achievement motivation, and frequent participation in training programmes on scientific farming they acquire more knowledge and adopted the technologies. The findings are in line with the finding of chigadolli (2018)

The study also revealed that a positive and significant association between management orientation and performance of capsicum farmers. The farmers often face new and complex situations with little resemblance to past or present situations because of the even changing environment and people around them. A major role of farmers as managers is to manage and utilize the available resources, which would provide desired results.

The study indicated that extension participation was significantly associated with performance of capsicum growers. Because, greater participation in extension activities helps the growers to gather information from different sources. Extension activities conducted in the area directly influence the awareness and knowledge among the capsicum growers about improved practices and be the earliest to adopt new technologies than others in the community. The results are in consonance with that of Thorat (2013).

The study also revealed that a positive and significant association between accessibility to subsidy and accessibility to credit with performance of capsicum growers. The probable reason for this might be that establishment of polyhouse required huge initial investment which was generally beyond the scope of resource poor farmers to establish on their own. This confirms that with easy access to subsidy and credit then the performance of capsicum growers also increases. These results are in conformity with that of Itigi (2015)**.**

The study revealed a positive and significant association between risk bearing ability and performance of capsicum growers. The possible reason for the above trend might be due to the fact that farmers having more risk bearing ability will try to gather information from different sources for recent updated information regarding production to

marketing i.e. what to grow, how to grow and where to sell the produce. Hence, the farmers having more risk bearing ability had positive association towards performance under protected cultivation as it helps them to minimize the risks in farming. This finding is in agreement with the findings of Pavan (2018).

4.3.1 Association between personal, socio-economical and psychological characteristics with performance of chrysanthemum growers under protected cultivation

In order to measure the association that exists between the personal, socio-economical and psychological characteristics with performance of chrysanthemum crop growers, the chi-square test was employed and tested for its statistical significance. The data in Table 15 revealed that farming experience, scientific orientation, accessibility to subsidy and accessibility to credit had positive and significant association with performance at one per cent level of significance. Whereas education, extension participation, management orientation and risk bearing ability had positive and significant association with performance at five per cent level of significance.

Education of the chrysanthemum growers was found to be significantly associated with their performance. The probable reason might be the advantages that an individual gets from education through knowledge acquisition, motivation towards higher accomplishment and broadening of the vision. Literate capsicum growers have the ability to gather, interpret, critically evaluate and use information in an appropriate manner. Education helps an individual in proper planning, precise decision making and managing the production, post-harvest and marketing activities. The results are in conformity with the results of Wankhade (2018).

Experience of chrysanthemum growers was found to be significantly associated with their performance. The probable reason could be that, those growers who involved in farming for many years, definitely get higher yield, income and recognition than others. They will be having good leadership quality, management orientation, ability to coordinate farm activities which they got through experience. The findings were supported by Pavan (2018).

Table 15: Association between personal, socio-economical and psychological characteristics with performance of chrysanthemum growers under protected cultivation.

(n_2=50)

Sl. No.	Independent variables	Chi-square statistic	C
1.	Age	1.20 ^{NS}	0.15
2.	Education	9.47*	0.40
3.	Land holding	3.64^{NS}	0.26
4.	Farming Experience	33.76**	0.63
5.	Mass media participation	2.68 ^{NS}	0.23
6.	Extension participation	9.59*	0.40
7.	Scientific orientation	14.13 **	0.47
8.	Achievement motivation	0.520 ^{NS}	0.10
9.	Management orientation	9.62*	0.40
10.	Accessibility to subsidy	46.08**	0.69
11.	Accessibility to credit	46.08**	0.69
12.	Risk bearing ability	10.27*	0.41

NS- Non-Significant, *- Significant at 5 per cent level, **- Significant at 1 per cent level, C- Contingency coefficient

The study also revealed that a positive and significant association between scientific orientation with performance of chrysanthemum growers. The probable reasons for this might be that the respondents might have viewed the things scientifically with keen interest with their high-risk taking ability and achievement motivation. Further, frequent participation in training programmes on scientific flower cultivation they acquire more knowledge and adopted the production technologies. The findings are in line with the finding of Chigadolli (2018)

A positive and significant association between management orientation and performance of chrysanthemum farmers was found. The farmers often face new and complex situations with little resemblance to past or present situations because of the even

changing environment and people around them. A major role of farmers as managers is to manage and utilize the available resources, which would provide desired results.

The study indicated that extension participation was significantly associated with performance of chrysanthemum growers. Greater participation in extension activities helps the growers to gather information from different sources. Extension activities conducted in the area directly influence the awareness and knowledge among the capsicum growers about improved practices and motivate them to adopt new technologies than others in the community. The results are in consonance with that of Thorat (2013).

The study also revealed a positive and significant association between accessibility to subsidy and accessibility to credit with performance of chrysanthemum growers. The probable reason for this might be that establishment of polyhouse required huge initial investment which was generally beyond the scope of farmers to establish on their own. Because of the subsidy and credit provided for the farmers under National Horticultural Mission, significant percentage of farmers started cultivating crops under protected cultivation. These results are in conformity with that of Itigi (2015)**.**

The study revealed a positive and significant association between risk bearing ability and performance of chrysanthemum growers. The possible reason for the above trend might be due to the fact that farmers having more risk bearing ability will try to gather information from different sources for recent information regarding production to marketing i.e. what to grow, how to grow and where to sell the produce. Hence, the farmers having more risk bearing ability had positive association towards performance under protected cultivation as it helps them to minimize the risks in farming. This finding is in agreement with the findings of Pavan (2018).

4.4 The different marketing channels practiced for Horticulture crops grown under protected cultivation

4.4.1 Different marketing channels used by capsicum growers

The data in Table 16 revealed that marketing channels practiced by the capsicum growers. In Channel-I, commission agents receive the produce from the producer and sell

the produce to wholesaler then wholesalers will transport the commodity to distant markets and sell to the retailers. Price fluctuation in the market, immediate requirement of money and more risk in marketing at distant places are the probable reasons for selling the produce through channel-I (52.00%), twenty-eight per cent of the growers sold their produce through channel II, in recent days the demand for the capsicum is more due to its multipurpose usage as a result many companies coming forward and buying capsicum directly from the farmers. Remaining 20.00 per cent of the respondents sold their produce through channel III farmers who are following this channel are mostly resource rich farmers.

Table 16: Different marketing channels used by capsicum growers

(n_1=50)

Sl. No.	Channels	Marketing channel	F	%
1.	I	Producer → Commission agent → Wholesaler →Retailer →Consumer	26	52.00
2.	II	Producer→ companies → Retailer → consumer	14	28.00
3.	III	Marketing at Chikkaballapur/ Sidlaghatta	10	20.00

f - Frequency, %- per cent

It was observed that price spread is highest in the channel I, lowest in channel II than channel I and least in channel III. The probable reason may be that channel I involves a greater number of intermediaries between producer and consumer as a result producer share in consumer rupee is also lowest compare to channel II and channel III. The maximum producer share in consumer rupee was observed in channel III as there were no intermediaries and price spread are also minimum.

4.4.2 Different marketing channels used by chrysanthemum growers

The data in Table 17 revealed the marketing channels practiced by the chrysanthemum growers. More than half of the growers (56.00%) chosen the channel I followed by channel III (30.00%), and channel II (14.00%).

Table 17: Different marketing channels used by chrysanthemum growers

(n_2=50)

Sl. No.	channels	Marketing channel	F	%
1	I	Producer → Commission agent→Wholesaler →Retailer →Consumer	28	56.00
2	II	Marketing at Chikkaballapur/Sidlaghatta place	15	30.00
3	III	Marketing at Bengaluru @ KR market/ flower auction	07	14.00

In Channel-I, commission agents receive the produce from the producer and sell the produce to wholesaler then wholesalers will transport the commodity to distant markets or nearby markets and sell to the consumer through retailer. More than half of the respondents (56.00%) sold their produce through this channel because price fluctuation in the market, immediate requirement of money and more risk in marketing at distant places like Bangalore are the probable reason for selling the produce through channel-I. Nearly one- third of the farmers (30.00%) sell their produce through Channel-II particularly in peak season. But, during the off-season festivals period, farmers usually sell their produce to the commission agent due to lack of demand in the local market and remaining 14.00 per cent of the growers sold their produce at Bengaluru who are following this channel are mostly big farmers.

It was observed that price spread is highest in the channel I, lower in channel II than channel I and lowest in channel III. The probable reason may be that channel I involves a greater number of intermediaries between producer and consumer as a result producer share in consumer rupee is also lowest compare to channel II and channel III. The maximum producer share in consumer rupee was observed in channel II as there were no intermediaries and nearest of the market. Hence, price spread is also minimum.

4.5 Constraints as perceived by growers under protected cultivation

4.5.1 Constraints as perceived by capsicum growers under protected cultivation

A close examination of Table 18 shows that a great majority of the capsicum growers perceived that perishable nature of vegetables (96.00 %), scarcity of water for irrigation (94.00 %), occurrence of pest and diseases (90.00 %) as major constraints followed by low soil fertility status (70.00 %) and poor drainage of soil (56.00 %) as other constraints in crop production. Technical constraints are listed in the Table 17, it is revealed that great majority of the capsicum growers perceived that lack of scientific knowledge about advanced production technologies under protected cultivation (96.00 %) as major problem followed by non-availability of required quantity and quality planting material (90.00%), non-availability of quality inputs like pesticides and insecticides at right time (86.00%), non-availability of quality protected cultivation equipment's at local market (80.00%), lack of technical guidance about production techniques(78.00%) as other constraints.

Table 18 revealed the labour constraints faced by the capsicum growers in which high cost of skilled labour as a majority problem (98.00%) followed by scarcity of labour during peak seasons (92.00%,) and non-availability of skilled labour (84.00%). Economical constraints of the capsicum growers are problem of high initial investment in construction of poly house (98.00%) followed by high cost of planting material (94.00%), high cost of plant protection chemicals (90.00%), lack of adequate and timely disbursement of loan (84.00%), complexity of loan procedure (80.00%) are other constraints. A great majority of the capsicum growers perceived that market price fluctuation (96.00%), lack of marketing facilities at local place (92.00%), exploitation by middleman (90.00%), lack of exclusive markets for vegetables grown under PCT (80.00%) as major constraints in Marketing.

Table 18: Constraints as perceived by capsicum growers under protected cultivation

(n_1=50)

Sl. No.	Constraints	Number	Per cent	Rank
Production constraints				
1.	Perishable nature of vegetables	48	96.00	I
2.	Scarcity of water for irrigation	47	94.00	II
3.	Occurrence of pest and diseases	45	90.00	III
4.	Low soil fertility status	35	70.00	IV
5.	Poor drainage of soil	28	56.00	V
Technical constraints				
1.	Lack of scientific knowledge about advanced production technologies under Protected cultivation	48	96.00	I
2.	Non-availability of required quantity and quality planting material at right time	45	90.00	II
3.	Non-availability of quality inputs like pesticides and insecticides at right time	43	86.00	III
4.	Non-availability of quality PCT equipment's at local market	40	80.00	IV
5.	Lack of technical guidance about production techniques	39	78.00	V
6.	Irregular power supply	35	70.00	VI
7.	Lack of relevant literatures in local language	28	56.00	VII
8.	Difficulties in following the recommended practices	25	50.00	VIII
Labour constraints				
1.	High cost of skilled labour	49	98.00	I
2.	Scarcity of labour during peak seasons	46	92.00	II
3.	Non availability of skilled labour	42	84.00	III
Economical constraints				
1.	High initial investment in construction of poly house	49	98.00	I
2.	High cost of planting material	47	94.00	II
3.	High cost of plant protection chemicals	45	90.00	III
4.	Lack of adequate and timely disbursement of loan	42	84.00	IV
5.	Complexity of loan procedure	40	80.00	V
6.	High cost of transportation	38	76.00	VI
7.	Crop insurance is not covered flowers/vegetables	35	70.00	VII
Marketing constraints				
1.	Market price fluctuation	48	96.00	I
2.	Lack of marketing facilities at local place	46	92.00	II
3.	Exploitation by middleman	45	90.00	III
4.	Lack of exclusive markets for flowers/ vegetable grown under PCT	40	80.00	IV
5.	Problems of transportation means	35	70.00	V
6.	Difficulty in grading the produce at the production level	33	66.00	VI
7.	Distress sale due to immediate need of money	30	60.00	VII

4.5.2 Constraints as perceived chrysanthemum growers under protected cultivation

A close examination of Table 19 shows that a great majority of the chrysanthemum growers expressed that perishable nature of flowers (98.00 %), occurrence of pest and diseases (96.00 %) and scarcity of water for irrigation (94.00 %) as major constraints followed by low soil fertility status (72.00 %) and poor drainage of soil (48.00 %) as other constraints in crop production. Technical constraints lack of scientific knowledge about advanced production technologies under protected cultivation (94.00 %), non-availability of required quantity and quality planting material (86.00%), non-availability of quality inputs like pesticides and insecticides at right time (84.00%), non-availability of quality PCT equipment's at local market(82.00%) and lack of technical guidance about production techniques (80.00%).

Further, Table 19 revealed the labour constraints faced by the chrysanthemum growers, scarcity of labour during peak season (96.00%,) as a major problem followed by high cost of skilled labour (92.00%) and lack of availability of skilled labour (82.00%). Problem of high initial investment in construction of poly house (96.00%), high cost of planting material (92.00%), high cost of plant protection chemicals (88.00%), lack of adequate and timely disbursement of loan (84.00%), complexity of loan procedure (82.00%) are economical constraints. A great majority of the chrysanthemum growers perceived that market price fluctuation (94.00%), exploitation by middleman (90.00%), lack of marketing facilities at local place (86.00%) lack of exclusive markets for flowers grown under PCT (72.00%) as major constraints in Marketing.

4.5.3 Overall Constraints faced by Horticulture crop growers under protected cultivation

The overall constraints faced by horticulture crop growers are presented in the Table 20. A great majority of the respondents perceived that perishable nature of flowers/vegetables (97.00 %), scarcity of water for irrigation (94.00 %), occurrence of pest and diseases (93.00 %) as major constraints followed by low soil fertility status (71.00 %) and Poor drainage of soil (52.00 %) as other constraints in crop production. The vegetables and flowers grown under polyhouse conditions are highly perishable.

Table 19: Constraints as perceived by chrysanthemum growers under protected cultivation

(n_2=50)

Sl. No.	Constraints	Number	Per cent	Rank
Production constraints				
1.	Perishable nature of flowers	49	98.00	I
2.	Occurrence of pest and diseases	48	96.00	II
3.	Scarcity of water for irrigation	47	94.00	III
4.	Low soil fertility status	36	72.00	IV
5.	Poor drainage of soil	24	48.00	V
Technical constraints				
1.	Lack of scientific knowledge about advanced production technologies under Protected cultivation	47	94.00	I
2.	Non-availability of required quantity planting material at right time	43	86.00	II
3.	Non-availability of quality inputs like pesticides and insecticides at right time	42	84.00	III
4.	Non-availability of quality PCT equipment's at local market	41	82.00	IV
5.	Lack of technical guidance about production techniques	40	80.00	V
6.	Irregular power supply	37	74.00	VI
7.	Lack of relevant literatures in local language	25	50.00	VII
8.	Difficulties in following the recommended practices	21	42.00	VIII
Labour constraints				
1.	Scarcity of labour during peak seasons	48	96.00	I
2.	High cost of skilled labour	46	92.00	II
3.	Non availability of skilled labour	41	82.00	III
Economical constraints				
1	High initial investment in construction of polyhouse	48	96.00	I
2	High cost of planting material	46	92.00	II
3	High cost of plant protection chemicals	44	88.00	III
4	Lack of adequate and timely disbursement of loan	42	84.00	IV
5	Complexity of loan procedure	41	82.00	V
6	High cost of transportation	37	74.00	VI
7	Crop insurance is not covered for flowers/vegetables	34	68.00	VII
Marketing constraints				
1.	Market price fluctuation	47	94.00	I
2.	Exploitation by middleman	45	90.00	II
3.	Lack of marketing facilities at local place	43	86.00	III
4.	Lack of exclusive markets for flowers/vegetable grown under PCT	36	72.00	IV
5.	Problems of transportation means	35	70.00	V
6.	Difficulty in grading the produce at the production level	32	64.00	VI
7.	Distress sale due to immediate need of money	25	50.00	VII

The success of polyhouse technologies and its efficiency also depend on the access to market and efficient supply chain management. Irrigation is also crucial for the success of polyhouse cultivation. The absorption of externally applied nutrients by plants from soil requires adequate moisture in the soil, lack of irrigation at critical stages of crop growth will affect adversely on yields, excessive use of irrigation is also a serious problem under polyhouse conditions leading to poor drainage in soil and imbalances in soil fertility status, occurrence of pest and diseases inside the polyhouse sometimes exceed when compared to open cultivation because of favourable climatic conditions (high moisture and humidity) inside the polyhouse. This may lead to malformation of capsicum which will fetch very little price in the market apart from incidence of pest and disease in crops under protected cultivation. Over-exploitation of nutrients from soil has led to their decline in fertility status.

Technical constraints are provided in the Table 20, it is stated that a great majority of the growers perceived that lack of scientific knowledge about advanced crop production technologies under protected cultivation (95.00 %), non-availability of required quantity and quality planting material (88.00%), non-availability of quality inputs like pesticides and insecticides at right time (85.00%), non-availability of quality protected cultivation equipment's at local market (81.00%), lack of technical guidance about advanced production technologies under protected cultivation (79.00%) as major constraints. Production of crops under polyhouse conditions is highly capital and technology intensive. Hence, adequate scientific knowledge and training on various issues related to polyhouse cultivation is crucial for adoption and its success. However, farmers find it difficult to get the latest information and techniques of crop production under polyhouse, especially in their local languages.

One of the crucial inputs in polyhouse cultivation is planting material. Availability of quality planting material at reasonable price is a challenging task, this shows that they are still in the first phase of polyhouse technology adoption wherein availability of quality planting material and inputs is still an issue.

Table 20: Overall constraints as perceived by growers under protected cultivation

(n=100)

Sl. No.	Constraints	Number	Per cent	Rank
	Production constraints			
1.	Perishable nature of flowers/vegetables	97	97.00	I
2.	Scarcity of water for irrigation	94	94.00	II
3.	Occurrence of pest and diseases	93	93.00	III
4.	Low soil fertility status	71	71.00	IV
5.	Poor drainage of soil	52	52.00	V
Technical constraints				
1.	Lack of scientific knowledge about advanced production technologies under Protected cultivation	95	95.00	I
2.	Non-availability of required quantity and quality planting material at right time	88	88.00	II
3.	Non-availability of quality inputs like pesticides and insecticides at right time	85	85.00	III
4.	Non-availability of quality PCT equipment's at local market	81	81.00	IV
5.	Lack of technical guidance about production techniques	79	79.00	V
6.	Irregular power supply	72	72.00	VI
7.	Lack of relevant literature in local language	53	53.00	VII
8.	Difficulties in following the recommended practices	46	46.00	VIII
Labour constraints				
1.	High cost of skilled labour	95	95.00	I
2.	Scarcity of labour during peak seasons	94	94.00	II
3.	Lack of availability of skilled labour	83	83.00	III
Economical constraints				
1.	High initial investment in construction of poly house	97	97.00	I
2.	High cost of planting material	93	93.00	II
3.	High cost of plant protection chemicals	89	89.00	III
4.	Lack of adequate and timely disbursement of loan	84	84.00	IV
5.	Complexity of loan procedure	81	81.00	V
6.	High cost of transportation	75	75.00	VI
7.	Crop insurance is not covered for flowers/vegetables	69	69.00	VII
Marketing constraints				
1.	Market price fluctuation	95	95.00	I
2.	Exploitation by middleman	90	90.00	II
3.	Lack of marketing facilities at local place	89	89.00	III
4.	Lack of exclusive markets for flowers/ vegetable grown under PCT	76	76.00	IV
5.	Problems of transportation means	70	70.00	V
6.	Difficulty in grading the produce at the production level	65	65.00	VI
8.	Distress sale due to immediate need of money	55	55.00	VII

The fact that planting material is supplied only by few private players that has resulted in farmers being completely dependent on them. Farmers are also completely dependent on private companies for other inputs such as equipment's and machines, growth regulators, pesticides and insecticides for use in polyhouse.

Table 20 also revealed the labour constraints faced by the growers, majority of the growers expressed high cost of skilled labour (95.00%) as majority problem, scarcity of labour during peak seasons (94.00%) and lack of availability of skilled labour (83.00%) as other constraints. Polyhouse cultivation is labour intensive and demands skilled labour throughout the year. Not surprisingly, availability of skilled labour is a critical issue for farmers for both capsicum and chrysanthemum cultivation. While capsicum requires a greater number of skilled labours compare to chrysanthemum. Migration of rural folk to urban areas in search of better jobs, alternative employment opportunities at the village level and indifferent attitude of youth towards agriculture has led to acute shortage of skilled labour especially in the peak seasons like planting/sowing and harvesting. This has naturally raised the wage rates of skilled labour required in polyhouse cultivation. The average per day wage rates in the peak season of sowing/planting and harvesting in the open field conditions in the study area was Rs. 150/- for women and Rs. 200/- for men, whereas in the polyhouse, the per day wage rates ranged between Rs. 250-300/- for women and Rs 300-400/- for men. Hence, they expressed high cost and scarcity of labour as major constraint.

Economical constraints of the growers are listed in Table 20, it is revealed that almost all the respondents had faced the problem of high initial investment in construction of poly house (97.00%), followed by high cost of planting material (93.00%), high cost of plant protection chemicals (89.00%) and lack of adequate and timely disbursement of loan (84.00%), complexity of loan procedure (81.00%) as other constraints. The polyhouse technology is highly capital intensive at all stages of production of crops. Polyhouse requires quality planting material, protection chemicals, inputs, etc. Which adds more economic burden to the farmers. The farmers expressed that it took minimum of eight months after application, to avail loan facilities from financial institutions and commercial banks and their procedure is very complex. Even the post-harvest operations for polyhouse

products are very costly and may lead to huge financial losses under unfavourable market conditions, distant markets leading to higher cost of transportation, absence of pricing policy such as crop insurance also increased the risk of polyhouse cultivation.

A great majority of the respondents perceived that market price fluctuation (95.00%), existence by middle men (90.00%), lack of marketing facilities at local place (89.00%) and lack of exclusive markets for flowers/ vegetable grown under protected cultivation (76.00%) are major marketing constraints. In marketing of the produce, farmers are considered as price taker and not a price fixer, it is more so in crops where price policy is completely absent as in case of flowers and vegetables. Hence, unfavourable market prices may cause huge financial losses. Farmers fetched good prices during the months of January-April and the season is generally slack during September to December but their price share is hindered by the exploitation by middleman and lack of marketing facilities at local places. The success of polyhouse cultivation and its economic viability also depends on accessibility to market, distant markets leading problems of transportation means, higher cost of transportation, fluctuation in prices of flowers and vegetables make farmers prone to distress sale of their produce.

4.6 Suggestions expressed by the horticulture crop growers to overcome the constraints under protected cultivation

4.6.1 Suggestions expressed by capsicum growers to overcome the constraints

Suggestions expressed by capsicum growers are mentioned in Table 21. Majority of the growers suggested that intervention of government in price policy mechanism (98.00%), increasing the amount of subsidy for protected cultivation under polyhouse (96.00%), availability of quality planting material in required quantity at right time in local market (90.00%), creation of grading, cold storage and processing facilities at farm gate level to reduce post-harvest losses (80.00%) Providing regular power supply (three phase) (70.00%) as major suggestion in case of government policy initiatives.

Table 21: Suggestions expressed by capsicum growers to overcome the constraints

(n_1=50)

Sl. No.	Suggestions	Number	Per cent	Rank
Government Policy initiatives				
1.	Intervention of Government in price policy mechanism	49	98.00	I
2.	Increasing the amount of subsidy for protected cultivation under polyhouse	48	96.00	II
3.	Availability of quality planting material in required quantity at right time in local market	45	90.00	III
4.	Creation of grading, cold storage and processing facilities at farm gate level to reduce post-harvest losses	40	80.00	IV
5.	Providing regular power supply (three phase)	35	70.00	V
Research and Development Initiatives				
1.	Reducing the high initial investment	48	96.00	I
2.	Reducing the production cost under polyhouse	44	88.00	II
3.	Standardization of designs and structure of low cost polyhouse	40	80.00	III
4.	Development of user-friendly Package of Practices	36	72.00	IV
5.	Standardization of production technology under polyhouse	30	60.00	V
Marketing Initiatives				
1.	Availability of raw material of required quantity at local market	46	92.00	I
2.	Promotion of direct marketing	45	90.00	II
3.	Creation of separate transportation facilities for national and international markets to export the produce	35	70.00	III
Farmer level initiatives				
1.	Cluster and cooperative based approach in production and marketing of produce	42	84.00	I
2.	Appropriate selection of site and location of polyhouse installation	40	80.00	II
3.	Installation of rain water harvesting technique to reduce irrigation cost	38	76.00	III
4.	Reducing polyhouse installment cost by using local material	30	60.00	IV

In case of research and development initiatives, suggestions as perceived by capsicum growers are Viz., reducing the high initial investment (96.00%), reducing the production cost under polyhouse (88.00%), standardization of designs and structure of low cost polyhouse (80.00%), development of user-friendly Package of Practices (72.00%) and standardization of production technology under polyhouse (60.00%).

Further, majority of the growers suggested that availability of raw material in required quantity at local market (92.00%), promotion of direct marketing (90.00%) and creation of separate transportation facilities for national and international markets to export the produce (70.00%) are the required marketing initiatives. In case of Famer level initiatives, suggestions as expressed by capsicum growers are undergoing cluster and cooperative based approach in production and marketing of produce (84.00%), appropriate selection of site and location of polyhouse installation (80.00%), installation of rain water harvesting technique to reduce irrigation cost (76.00%) and reducing polyhouse installment cost by using local material (60.00%).

4.6.2 Suggestions expressed by chrysanthemum growers to overcome the constraints

Suggestions expressed by chrysanthemum growers are presented in Table 22. Majority of the growers suggested that intervention of government in price policy mechanism (96.00 %), increasing the amount of subsidy for protected cultivation under polyhouse (94.00 %), availability of quality planting material in required quantity at right time in local market (90.00 %), creation of grading, cold storage and processing facilities at farm gate level to reduce post-harvest losses(74.00 %) and providing regular power supply (three phase) (60.00 %) are the most important suggestions to overcome the constraints in production in case of government policy initiatives. In case of research and development initiatives, suggestions as opined by chrysanthemum growers are detailed in Table 22, reducing the high initial investment (98.00 %), reducing the production cost under polyhouse (92.00 %), standardization of designs and structure of low cost polyhouse (82.00 %), development of user-friendly package of practices (78.00 %) and standardization of production technology under polyhouse (64.00 %) as major suggestions in the descending order.

Table 22: Suggestions expressed by chrysanthemum crop growers to overcome the constraints

(n_2=50)

Sl. No.	Suggestion	Number	Percentage	Rank
	Government Policy initiatives			
1.	Intervention of Government in price policy mechanism	48	96.00	I
2.	Increasing the amount of subsidy for protected cultivation under polyhouse	47	94.00	II
3.	Availability of quality planting material in required quantity at right time in local market	45	90.00	III
4.	Creation of grading, cold storage and processing facilities at farm gate level to reduce post-harvest losses	37	74.00	IV
5.	Providing regular power supply (three phase)	30	60.00	V
Research and Development Initiatives				
1.	Reducing the high initial investment	49	98.00	I
2.	Reducing the production cost under polyhouse	46	92.00	II
3.	Standardization of designs and structure of low cost polyhouse	41	82.00	III
4.	Development of user-friendly Package of Practices	39	78.00	IV
5.	Standardization of production technology under polyhouse	32	64.00	V
	Marketing Initiatives			
1.	Availability of raw material of required quantity at local market	47	94.00	I
2.	Promotion of direct marketing and forward marketing of the produce	46	92.00	II
3.	Creation of separate transportation facilities for national and international markets to export the produce	30	60.00	III
	Famer level initiatives			
1.	Undergoing cluster and cooperative based approach in production and marketing of produce	44	88.00	I
2.	Appropriate selection of site and location of polyhouse installation	38	76.00	II
3.	Installation of rain water harvesting technique to reduce irrigation cost	35	70.00	III
4.	Reducing polyhouse installment cost by using local made material	28	56.00	IV

With respect to marketing initiatives, majority of the growers suggested that availability of raw material of required quantity at local market (94.00 %), promotion of direct marketing (92.00 %), creation of specialized brand for the produce and specialized market for marketing of the produce (60.00 %) are essential for increased production and productivity. In case of farmer level initiatives, suggestions as expressed by chrysanthemum growers are undergoing cluster and cooperative based approach in production and marketing of the produce (88.00 %), appropriate selection of site and location of polyhouse installation (76.00 %), installation of rain water harvesting technique to reduce irrigation cost (70.00 %) and reducing polyhouse installment cost by using local material (56.00 %).

4.6.3 Overall suggestions expressed by horticulture crop growers to overcome the constraints

Suggestions as expressed by respondents are detailed in Table 23. Intervention of government in price policy mechanism (97.00 %), increasing the amount of subsidy for protected cultivation under polyhouse (95.00 %) availability of quality planting material in required quantity at right time in local market (90.00 %), creation of grading, cold storage and processing facilities at farm gate level to reduce post-harvest losses(77.00 %), providing regular power supply (three phase) (65.00 %) are the suggestions expressed by growers in case of government policy initiatives. Government intervention in the price policy mechanism to prevent price fluctuation is necessary and proactive role of government is a prerequisite to boost the adoption of this technology. Favourable policy environment including measures to increase the subsidy amount and expand the basket of beneficiary farmers; creation of infrastructure such as grading, transport, cold chain management facilities, supply of quality planting material and inputs at reasonable prices and provision of regular power supply are required to promote polyhouse technology.

In case of research and development initiatives, one of the suggestions expressed by growers is reducing the high initial investment (97.00 %). The polyhouse technology is highly capital intensive at all stages of production of crops, hence, farmers suggested that scientists have to develop the polyhouse technologies which require low initial investment cost and minimum operation cost.

Table 23: Overall suggestions expressed by horticulture crop growers to overcome the constraints

(n=100)

Sl. No.	Suggestion	Number	Per cent	Rank
Government Policy initiatives				
1.	Intervention of Government in price policy mechanism	97	97.00	I
2.	Increasing the amount of subsidy for protected cultivation under polyhouse	95	95.00	II
3.	Availability of quality planting material in required quantity at right time in local market	90	90.00	III
4.	Creation of grading, cold storage and processing facilities at farm gate level to reduce post-harvest losses	77	77.00	IV
5.	Providing regular power supply (three phase)	65	65.00	V
Research and Development Initiatives				
1.	Reducing the high initial investment	97	97.00	I
2.	Reducing the production cost under polyhouse	90	90.00	II
3.	Standardization of designs and structure of low cost polyhouse	81	81.00	III
4.	Development of user-friendly Package of Practices	75	75.00	IV
5.	Standardization of production technology under polyhouse	62	62.00	V
Marketing Initiatives				
1.	Availability of raw material of required quantity at local market	93	93.00	I
2.	Promotion of direct marketing and forward marketing of the produce	91	91.00	II
3.	Creation of separate transportation facilities for national and international markets to export the produce	65	65.00	III
4.	Creation of specialized brand for the produce and specialized market for marketing of the produce	56	56.00	IV
Farmer level initiatives				
1.	Undergoing cluster and cooperative based approach in production and marketing of produce	86	86.00	I
2.	Appropriate selection of site and location of polyhouse installation	78	78.00	II
3.	Installation of rain water harvesting technique to reduce irrigation cost	73	73.00	III
4.	Reducing polyhouse installment cost by using local made material	58	58.00	IV

Reducing the production cost under polyhouse (90.00 %), standardization of designs and structure of low-cost polyhouse (81.00 %), development of user-friendly Package of Practices (75.00 %) and standardization of production technology under polyhouse (62.00 %) as the other suggestions expressed by growers.

With respect to marketing initiatives, suggestions expressed by growers are availability of raw material of required quantity at local market (93.00 %), promotion of direct marketing (91.00 %) and creation of separate transportation facilities for national and international markets to export the produce (65.00 %). The success of polyhouse cultivation and its economic viability depends on accessibility to market both for inputs and produced output. Distant markets leading to higher cost of transportation, fluctuation in prices of flowers and vegetables and exploitation by middle men are the other major marketing constraints. In this context, farmers suggested that availability of raw material of required quantity at local market and promotion of direct marketing would beneficial to them

In case of Farmer level initiatives, suggestions as opined by growers are detailed in Table 23. Majority of the growers suggested that undergoing cluster and cooperative based approach in production and marketing of produce (86.00 %), this innovative marketing approaches such as cluster and cooperative based marketing will increase the bargaining capacity of farmers thereby giving them power to fix the prices of their products in the markets. Another suggestion was, appropriate selection of site and location of polyhouse installation (78.00 %) growers should take appropriate and scientific measures in selection of site and location of polyhouse cultivation and its proper management. Installation of rain water harvesting technique to reduce irrigation cost (73.00 %) and reducing polyhouse installment cost by using local material (58.00 %) are the other suggestions expressed by the horticulture crop growers to overcome the problems.

Plate 1: Interaction with capsicum grower

Plate 2: Interaction with capsicum grower

Plate 3: Interaction with chrysanthemum grower

Plate 4: Interaction with chrysanthemum grower

Plate 5: Interaction with capsicum grower

Plate 6: Grading and packing of capsicum

VI SUMMARY

The present agricultural scenario in our country is a mixture of outstanding achievements and missed opportunities. If India has to emerge as the world's economic power, our agricultural productivity should be a benchmark with those of other countries that are currently classed as the world's economic powers. India needs new and effective technologies that can continuously improve the productivity, profitability and sustainability of our farming systems. Opportunity for horizontal expansion is very little and the only available option is vertical expansion through increased productivity and cropping intensity using protected cultivation technologies by employing plant environment control measures, quality seeds, fertilizer, irrigation and plant protection. Protected farming is economically more rewarding in production of high value, low volume crops, seeds and planting materials, off season fruits and vegetables. Generally, farmers concentrate mainly on open field cultivation which is subjected to a high degree of uncertainty in income and production. In this context, it is imperative to evolve suitable strategy for augmenting the income of a farmer. Thus, the study entitled "Performance of Horticulture crop growers under protected cultivation in Chikkaballapur district" was designed with following specific objectives:

1. To assess the performance of horticulture crop growers under protected cultivation.
2. To study the personal, socio-economical and psychological characteristics of the horticulture crop growers under Protected cultivation.
3. To study the association between personal, socio-economical and psychological characteristics of horticulture crop growers with their performance under protected cultivation.
4. To identify and analyse the different marketing channels used by growers under protected cultivation.
5. To document constraints faced by growers under protected cultivation and to seek their suggestions to enhance the productivity under protected cultivation.

The study was conducted in Chikkaballapur District of Karnataka. Out of five taluks, Sidlaghatta and Chikkaballapur are purposively selected for the study. Since, these taluks have more number of polyhouses compared to other taluks. The total sample size was 100, of which, 50 growers (25 Chrysanthemum and 25 Capsicum) were randomly selected from Chikkaballapur taluk. Similarly, 50 growers (25 Chrysanthemum and 25 Capsicum) were selected from Sidlaghatta taluk. Ex-post-facto research design was used for the study.

The data was collected by personal interview technique and suitable statistical tools like mean, frequency, per centage, standard deviation, chi square test, and other tests were employed for data analysis.

5.1 Salient findings

1. The data revealed that nearly half of the capsicum growers (46.00%) belonged to medium production performance level and 32.00 per cent of the capsicum growers belonged to high production performance group. More than one-fifth (22.00%) of the growers come under low production performance level. Regarding economic performance, two-fifth (40.00%) and 36.00 per cent of the capsicum growers comes under medium and high economic performance group respectively. Nearly one-fourth (24.00%) of them had low economic performance. With respect to social performance, more than two-fifth of capsicum growers (44.00 %) and more than one-third (36.00 %) were belonged to medium and high social performance group respectively. One-fifth (20.00%) of them comes under low social performance category.

2. The data showed that more than two-fifth of the chrysanthemum growers (44.00 %) belonged to medium production performance and nearly one-third (32.00 %) of the chrysanthemum growers belonged to low production performance group. Nearly one-fourth (24.00 %) of them comes under high production performance category. Regarding economic performance, more than two-fifth of the chrysanthemum growers (42.00 %) comes under medium economic performance group and nearly two-fifth (38.00%) of the chrysanthemum growers coming under low economic performance. One- fifth (20.00%) of the chrysanthemum growers belongs to high economic

performance category. With respect to social performance, two-fifth of chrysanthemum growers (40.00 %) and nearly one-third (32.00%) were belonging to medium and low social performance level respectively. More than one-fourth (28.00%) of them comes under low social performance category.

3. Regarding overall performance, the data revealed that 45.00 per cent of the horticulture crop growers belonged to medium production performance category and 28.00 per cent of the horticulture crop growers belonged to high production performance group. More than one-fourth (27.00%) of the growers comes under low production performance level. Regarding economic performance, more than two-fifth (43.00%) and 29.00 per cent of the growers comes under medium and low economic performance group respectively. Nearly one-fourth (28.00%) of them had high economic performance. With respect to social performance, more than two-fifth of the growers (42.00 %) and nearly one-third (32.00 %) of them were belonged to medium and high social performance group respectively. More than One-fourth (26.00%) of them comes under low social performance category.

4. With respect to practice wise production performance, cent per cent of the capsicum growers have fully adopted soil testing practice, irrigation, drainage and supporting system. More than three-fourth of the growers (76.00%) and more than half of the capsicum growers (56.00%) fully adopted pinching and recommended spacing /specification of bed respectively. Practices which are partially adopted by capsicum growers were grading (62.00%), harvesting (58.00%), growing media (56.00%), recommended variety and application of recommended quantity of fertilizers (52.00%).

5. In case of practice wise production performance of chrysanthemum growers, cent per cent of chrysanthemum growers have fully adopted soil testing practice and irrigation and drainage. Nearly two-third of growers (64.00%) of the growers fully adopted pinching. Practices which are partially adopted by chrysanthemum growers were grading (72.00%), recommended variety (70.00%), supporting system (66.00%) growing media (64.00%), and plant protection (62.00%).

6. With regard to economic performance of capsicum growers the average operating cost of cultivation was Rs. 3, 85, 000, gross returns were Rs. 10, 80, 000, net returns were Rs. 6, 95, 000 and B:C ratio was 2.80 were found. In case of chrysanthemum growers, the average operating cost of cultivation was Rs. 2, 15, 000, gross returns were Rs. 5, 35, 500, net returns were Rs. 3, 00, 000 and B:C ratio was 2.49.

7. The realized crop yield of capsicum under protected cultivation was 36000 kg/ac, which is 47.22 per cent higher than the open field yield (19500 kg/ac). Whereas in case of chrysanthemum, the realized yield was 6300 kg/ac under protected cultivation, which is 28.57 per cent higher than the open field yield (4500 kg/ac) of chrysanthemum.

8. With respect to social performance of the capsicum growers, more than four-fifth (82.00%) of the growers were consulted by the others for information and guidance for cultivation of crops under protected cultivation, eighty per cent of the growers purchasing capacity was increased, 74.00 per cent of growers served as resource person in agriculture/horticulture matters for line departments, two-third (66.00%) of them were recognized by villagers/neighbours because of performance in farming, sixty two per cent of the growers sent their children for higher education and two-fifth (40.00%) of the capsicum growers increased their participation in other department programmes.

9. Regarding social performance of the chrysanthemum growers, more than 80.00 per cent of the growers were consulted by the others for information and guidance, nearly three-fourth (74.00%) of the growers increased their purchasing power capacity, seventy per cent of them served as resource person in agriculture/horticulture matters for line departments, more than two-third (68.00%) were recognized by villagers/neighbors because of performance in farming, nearly two-third (64.00%) of the growers sent their children for higher education and nearly two-fifth (36.00%) of the chrysanthemum growers increased their participation in other department programmes.

10. Nearly two- third (66.00 %) of the capsicum growers were comes under middle age category. More than one-third (34.00 %) of capsicum growers were educated up to

high school, nearly half (46.00 %) of the capsicum growers were small farmers, more than two-third (70.00 %) of the capsicum growers belonged to medium experience category, half (50.00 %) of capsicum growers belonged to medium mass media exposure category, nearly half (46.00 %) of the capsicum growers had high scientific orientation, more than two-fifth of the capsicum growers had medium (42.00 %) achievement motivation. Nearly half (46.00 %) of the capsicum growers had medium extension participation. More than two-fifth of the capsicum growers (44.00%) had medium level management orientation. Majority of the capsicum growers add accessibility to credit and subsidy (90.00%) and nearly half (48.00 %) of the capsicum growers belonged to medium risk bearing ability.

11. Nearly three-fifth (58.00 %) of the chrysanthemum growers were comes under middle age category, nearly one-third (32.00 %) of chrysanthemum growers were educated up to high school, more than two-fifth (44.00 %) of the chrysanthemum growers were small farmers, nearly three fourth (72.00 %) of the chrysanthemum growers belonged to medium experience category, more than two-fifth (44.00 %) of chrysanthemum growers belonged to medium mass media exposure category, more than two-fifth (44.00%) of chrysanthemum growers had high scientific orientation, nearly two-fifth of the chrysanthemum growers had medium (38.00 %) achievement motivation, nearly half (48.00 %) of the chrysanthemum growers had medium extension participation, more than two-fifth of the chrysanthemum growers (42.00%) had medium level management orientation, majority of the chrysanthemum growers had accessibility to credit and subsidy (98.00%). Nearly half (47.00 %) of the chrysanthemum growers belonged to medium risk bearing ability.

12. With respect to pooled data more than half (55.00 %) of the horticulture crop growers were comes under middle age category, nearly one-third (33.00 %) of growers were educated up to high school, more than two-fifth (45.00 %) of the growers were small farmers, nearly one-fourth (71.00 %) of the growers belonged to medium experience category, more than two-fifth (43.00 %) of growers belonged to medium mass media exposure category. More than two-fifth (45.00%) of Horticulture crop growers had high scientific orientation. Two-fifth of the growers had medium (40.00 %)

achievement motivation. two-fifth (40.00 %) of the horticulture crop growers had medium extension participation, more than two-fifth of the growers (43.00%) had medium level management orientation, majority of the growers were accessibility to credit and subsidy (94.00%), and nearly half (46.00 %) of the growers belonged to medium risk bearing ability.

13. The association between personal, socio- economical and psychological characteristics with performance of capsicum growers found that farming experience, scientific orientation, accessibility to subsidy and accessibility to credit had positive and significant association with performance at one per cent level of significance. Whereas, education, Extension participation, management orientation, and risk bearing ability had positive and significant association with performance at five per cent level of significance.

14. The association between personal, socio- economical and psychological characteristics with performance of chrysanthemum growers found that farming experience, scientific orientation, accessibility to subsidy and accessibility to credit had positive and significant association with performance at one per cent level of significance. Whereas, education, extension participation, management orientation and risk bearing ability had positive and significant association with performance at five per cent level of significance.

15. More than half (52.00%) of the capsicum growers followed the channel I (Producer → Commission agent → Wholesaler →Retailer →Consumer) and more than one-fourth (28.00%) of the growers followed the channel II (Producer→ companies → Retailer → consumer).

16. Nearly three-fifth (56.00%) of the chrysanthemum growers followed the channel I (Producer → Commission agent → Wholesaler →Retailer →Consumer) and nearly one-third (30.00%) of the growers followed the channel II (Marketing at local market Chikkaballapur/Sidlaghatta).

17. The constraints experienced by the horticulture crop growers under protected cultivation are categorized as production, technical, labour, economical and marketing

constraints. The major production constraints faced in capsicum production were, perishable nature of flowers/vegetables (I Rank) followed by scarcity of water for irrigation (II Rank). Lack of scientific knowledge about crop production under Protected cultivation (I Rank) and non-availability of required quantity of planting material at right time (II Rank), are the major technical constraints. High cost of skilled labour (I Rank) and scarcity of labour during peak seasons (II Rank) are the constraints related to labour. The major economical constraints are high initial investment in construction of poly house (I Rank) and high cost of planting material (II Rank). Major marketing constraints are market price fluctuation (I Rank) and lack of marketing facilities at local place (II Rank).

18. In the chrysanthemum production, the major production constraints faced are, perishable nature of flowers/vegetables (I Rank) followed by occurrence of pest and diseases (II Rank). Lack of scientific knowledge about crop production under protected cultivation (I Rank) and non-availability of required quantity planting material at right time (II Rank), are major technical constraint. Scarcity of labour during peak seasons (I Rank) and high cost of skilled labour (II Rank) are on for labour constraints and the major economical constraints are high initial investment in construction of poly house (I Rank) and high cost of planting material (II Rank). Major marketing constraints are market price fluctuation (I Rank) and exploitation by middle men (II Rank).

19. With reference to the constraints faced by growers under protected cultivation, production constraints were, perishable nature of flowers/vegetables (I Rank) followed by scarcity of water for irrigation (II Rank).Lack of scientific knowledge about crop production under Protected cultivation (I Rank), and non-availability of required quantity planting material at right time (II Rank), were major technical constraint. High cost of skilled labour (I Rank), scarcity of labour during peak seasons (II Rank) were major labour constraints. The major economical constraints were high initial investment in construction of poly house (I Rank) and high cost of planting material (II Rank). Major marketing constraints were market price fluctuation (I Rank) and exploitation of middle men malpractices (II Rank).

20. With respect to capsicum production, the major suggestions expressed by the capsicum growers are intervention of government in price policy mechanism (I Rank) and increasing the amount of subsidy for protected cultivation (II Rank) in case of government policy initiatives. Reducing the high initial investment (I Rank) and reducing the production cost under polyhouse (II Rank) are major suggestions in research and development initiatives. Availability of raw material of required quantity at local market (I Rank) and promotion of direct marketing (II Rank) regarding marketing initiatives. Cluster and cooperative based approach in production and marketing of produce (I Rank) and appropriate selection of site and location of polyhouse installation (II Rank) are the suggestions in case farmer level initiatives.

21. In chrysanthemum production, the major suggestions expressed by the chrysanthemum growers were intervention of government in price policy mechanism (I Rank) and increasing the amount of subsidy for protected cultivation (II Rank) in case of government policy initiatives. Reducing the high initial investment (I Rank) and reducing the production cost under polyhouse (II Rank) were major suggestion in research and development initiatives. Availability of raw material of required quantity at local market (I Rank) and promotion of direct marketing (II Rank) are the suggestions regarding marketing initiatives. Cluster and cooperative based approach in production and marketing of produce (I Rank) and appropriate selection of site and location of polyhouse installation (II Rank) are the suggestions in case farmer level initiatives.

22. With respect to the overall suggestions offered by the growers, intervention of government in price policy mechanism (I Rank) and increasing the amount of subsidy for protected cultivation (II Rank) in case of government policy initiatives. Reducing the high initial investment (I Rank) and reducing the production cost under polyhouse (II Rank) are major suggestions in research and development initiatives. Availability of raw material of required quantity at local market (I Rank) and promotion of direct marketing (II Rank) are the suggestions regarding marketing initiatives. Cluster and cooperative based approach in production and marketing of produce (I Rank) and

appropriate selection of site and location of polyhouse installation (II Rank) are the suggestions in case farmer level initiatives.

Implications of the study

1. The study implies that the production, economic and social performance of horticulture crop growers under protected cultivation technologies is better than open field cultivation. This is a clear pointer to the planners and development organizations to develop low cost polyhouse technologies. Creating post-harvest handling, transport, storage and marketing infrastructure for protected cultivation produce, ensuring better returns to farmers and to organize outreach activities like training, demonstration, skill imparting and exposure to successful units to reduce risk in farming.

2. The farmers are dependent on private service providers for all kinds of assistance in establishing structure, crop production, post-harvest operations and even marketing. The role of government organizations has been limited to providing subsidies and credit assistance to farmers. The absence of public research institutions in development of suitable varieties required for protected cultivation has led farmers to completely depend on private sector for seed/planting materials. Research and development efforts from public research institutes are required to develop methods to reduce the cost of cultivation under polyhouse, standardization of low-cost design and structure to suit different farmer categories, particularly for resource poor farmers

3. Create post-harvest handling, transport, storage and marketing infrastructure for protected cultivation produce ensuring better returns to farmers. Policies aimed at increasing area under protected cultivation should also include strategies to ensure assured irrigation at farm level, apart from efficient utilization of water resources through rain water harvesting. The availability of labour is a critical factor for the success. Hence, employment generation schemes of the government like The Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) are to be aligned and restructured to make best use of agriculture labour. Government efforts aimed at strengthening market accessibility and price security for farm produce need to be

further consolidated and specialized to suit the requirements of high value crops grown under PCTs.

4. High initial investment, lack of availability of quality planting materials and inputs, poor post-harvest infrastructure and absence of price policy have led to limited adoption of this technology by few farmers in certain pockets of the state as well as country. Hence, proactive role of government is a prerequisite to boost the adoption of this technology.

5. The study identified that education, farm experience, extension participation, management orientation scientific orientation, accessibility to subsidy and credit, risk bearing ability had significant association with the performance of growers. Hence, the Government and other agencies should aim at manipulating these variables to their advantage for improvement performance of the growers under protected cultivation.

6. Opportunity for horizontal expansion is very little and the only available option is vertical expansion through increased productivity and cropping intensity using protected cultivation technologies employing plant environment control measures, quality seeds, fertilizer, irrigation and plant protection. Protected farming is economically more rewarding in production of high value, low volume crops, seeds and planting materials, off season fruits and vegetables.

7. It is important to create a proper supply chain for vegetables and flower crops to reduce the post-harvest losses and proper market infrastructure to curb the exploitation by middlemen. Networking of farmers/Self Help Groups (SHGs) for production, handling and marketing of produce from protected agriculture is the need of the hour for domestic as well as export markets.

Future line of work

1. The adoption of protected cultivation technologies by various categories of farmers (marginal, small, medium and large) needs to be studied carefully and thoroughly. The suitability of technology and the assistance by government in the form of credit and subsidies needs to be scientifically established based on such studies.

2. The studies can be conducted to understand the differential growth and development of protected cultivation technologies in different countries or states especially the ones which have highest area under protected cultivation. The economics of crop production under protected cultivation in different states can be studied. The financial viability and sustainability of protected cultivation technologies on the farms of different categories of farmers without the assistance of subsidy needs critical examination.

3. There is a lot of potential for increasing the area under low cost greenhouses manifold in peri-urban areas of the state as well as country for production of high value vegetables and flowers during off- season to take benefit of the high price of the produce.

4. Similar research studies can be taken up in other states as well as in other districts which are also emerging as hub for protected cultivation. The study at state level as well as at all India level would throw light on the variation in growth in adoption of protected cultivation in different states.

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INTERVIEW SCHEDULE

Title of research: **"PERFORMANCE OF HORTICULTURE CROP GROWERS UNDER PROTECTED CULTIVATION IN CHIKKABALLAPUR DISTRICT"**

Respondent number: ……..

PART – I

I. General information about the respondents

1. Name of the respondent : _____
2. Village : _____
3. Taluk : _____
4. District **:** _____

II. Personal information about the respondents

1. **Age (Completed Years) : _____**
2. **Education Level** : _____
   - **a.** Illiterate
   - **b.** Primary school
   - **c.** High school
   - **d.** PUC
   - **e.** Graduation and above

3. **Farming experience:** _____ Years

   Experience under polyhouse : _____ Years

4. **Land holding:** **a**) Dry land**:** _____Acres

   b) Irrigated: _____ Acres

   c) Garden land: _____Acres

5. **Accessibility to subsidy:** a) yes_____ b) No_____
6. **Accessibility to credit:** a) yes_____ b) No_____

7. Management orientation

Please indicate your agreement for the following with Strongly Agree (SA), Agree (A), Undecided (UD), Disagree (DA), and Strongly Disagree (SDA)

Sl. No.	Statements	Response category				
		SA	A	UD	DA	SDA
1.	**PLANNING ORIENTATION**					
a)	One should think of diversification of crops and not to depend on only one crop					
b)	It is not necessary to make prior decision about the variety of crops to be cultivated in the land					
c)	The number of buildings, quantity of manures and fertilizers, plant protection chemicals, etc., needed for raising crops should be assessed before taking up cultivation					
d)	It is necessary to think ahead about the cost involved in raising the crop					
e)	One need not consult an agricultural expert for the crop planning					
2.	**PRODUCTION ORIENTATION**					
a)	Timely and judicious irrigation of a crop ensures good yield					
b)	One should use as much fertilizer as he wishes					
c)	Determining fertilizers dose by soil testing saves money					
d)	Variety of crops should be grown as recommended by the specialists					
e)	Timely management of weeds will ensure good yield					

8. Achievement motivation

A set of statements is given below representing the achievement motivation of farmers. Please express your feelings about these statements by indicating the degree of your agreement or disagreement on the three-point continuum.

Sl. No.	Statements	Response category		
		SA	A	DA
1	Work should come first even if one cannot get proper rest in order to achieve ones goals			

2	It is better to be content with whatever little one has, than to be always struggling for more			
3	No matter what I have done I always want to do More			
4	I would like to try hard at something really difficult even if it provides that I cannot do it			
5	The way things are now-a-days discourage one to work hard			
6	One should succeed in occupation even if one has to neglect his family			

9. Scientific orientation:

Please indicate your response strongly agreement/ agreement/disagreement for the following statements

Sl. No.	Statements	Response category		
		SA	A	DA
1	A farmer who is willing to take great risk than average farmer usually does better financially			
2	It is better for a farmer not to try new farming methods unless most others have used them with success (N)			
3	New method of farming gives better result to a farmer than old method			
4	Even a farmer with lot of experience should use new method of farming			
5	Though it takes time for farmers to learn new farming methods it is worth the efforts.			
6	In order to have our lands productive and ecofriendly, the present system of farming needs to be modified			
7	A good farmer experiments with new idea in farming			
8	The way our forefathers were practicing is still is the best way follow today (N)			

10. Extension participation

How often you participated in the following extension activities?

Sl. No.	Activities	Response category		
		Regularly	Occasionally	Never
1	Group meetings			
2	Seminars/talks			
3	Demonstrations			
4	Krishimela/exhibitions			

5	Tours/ Field trips			
6	Field day / visits			
7	Training			

11. Mass media participation

Please indicate ownership or subscription and frequency of use of the following

Sl. No.	Media	Subscriber		Listening/viewing/reading of information related to agriculture		
		Yes	No	Regularly	Occasionally	Never
1	Radio					
2	Television					
3	News Paper					
4	Magazines					
5	Others(specify)					

12. Risk bearing ability

Please state your response for the following statements with Agree ('A') or Disagree ('DA')

Sl. No.	Statements	Response category	
		A	DA
1	A farmer should grow large number of crops to avoid greater risks involved in growing one or two crops		
2	A farmer who is willing to take greater risks than the average farmer usually has better financial condition		
3	It is good for a farmer to take risks when he knows his change of success is fairly high		
4	It is better for a farmer not to try new farming methods unless most other farmers have use them with success		
5	Trying on entirely new method in farming by a farmer involves risks but it is worth trying		

PART II

Performance of CAPSICUM crop growers under protected cultivation

A. Knowledge performance

Sl. No.	Statements	Recommended	Yes	No
1	Whether soil testing is recommended for Capsicum?	Yes		
2	Name the recommended varieties of Capsicum?	Inidra, Apoorva, Califonia Wonder, Arka Mothini, Arka Basanti		
3	Growing media	3:3:3:1 (red soil : FYM : Sand: Rice husk)		
4	Specification of bed	Bed width at top – 90cm Bed width at bottom – 100cm Bed height – 45cm Distance between two rows – 50cm		
5	Basal dose after bed preparation	SSP 2.5kg and neem cake 50kg per $100m^2$		
6	Sterilization of media	Use 7.5 to 10 liter formalin acid in 10lit. of of water for $100m^2$ of the greenhouse or @ Basamid 30-40g/m^2		
7	Plant spacing	60*45cm (appr.4plants/m^2)		
8	Irrigation	a) drip irrigation b) hand water supply		
9	Supporting system	After 30days of the transplanting, 3 to 4 branches of plant should be tied with the help of nylon rope or other material		
10	Pinching	Leaving 3-4 branches with 5-6 nodes, tip shoot is cut-off after 3 to 4 weeks of planting. Among new growth 50% branches should be pinched. Disbudding of side buds should be done initially.		
11	Fertigation management (kg/ha/alternate day)	**Upto flowering**: N-8.0; P_2O_5-2.8; K2O-4; Ca-2.8; Mg-0.2 **After flowering**: N-6.0; P_2O_5-3.0; K2O-15.0; Ca-3.0; Mg-0.3		
12	Plant protection	**Aphids** – Nuvan (1.5ml/lit) **Flower bud maggot** – Desis(0.5ml) or rogor (2.0ml) **Fusarium wilt** – Drenching of Bavastin(0.5gm) and Dithane M-45(2.0gm)		
13	Harvesting	After getting green color on fruit (60-70 days after transplanting)		
14	Grading	**Fruit weight** **Grade** 200-250 A 150-200 B 100-150 C 50-100 D		

Adoption performance

Sl. No.	Statements	Recommended practices	Full	Partial	No
1	Whether you are done soil testing for Capsicum?	Yes			
2	Name the Capsicum varieties you adopted?	MR-1 MR-6,GPU-28, GPU-48, ML-365			
3	What is the Growing media you have adopted	3:3:3:1 (red soil : FYM : Sand: Rice husk)			
4	What is the Specification of bed you have adopted	Bed width at top – 90cm Bed width at bottom – 100cm Bed height – 45cm Distance between two rows – 50cm			
5	Basal dose after bed preparation you adopted	SSP 2.5kg and neem cake 50kg per $100m^2$			
6	Sterilization of media you adopted	Use 7.5 to 10 liter formalin acid in 10lit. of of water for $100m^2$ of the greenhouse or @ Basamid 30-40g/m^2			
7	Plant spacing you adopted	60*45cm (appr.4plants/m^2)			
8	Irrigation method you adopted	a) drip irrigation b) hand water supply			
9	Supporting system, you adopted	After 30days of the transplanting, 3 to 4 branches of plant should be tied with the help of nylon rope or other material			
10	Pinching	Leaving 3-4 branches with 5-6 nodes, tip shoot is cut-off after 3 to 4 weeks of planting. Among new growth 50% branches should be pinched. Disbudding of side buds should be done initially.			
11	Fertigation management (kg/ha/alternate day)	**Upto flowering**: N-8.0; P_2O_5-2.8; K2O-4; Ca-2.8; Mg-0.2 **After flowering**: N-6.0; P_2O_5-3.0; K2O-15.0; Ca-3.0; Mg-0.3			
12	Plant protection	**Aphids** – Nuvan (1.5ml/lit) **Flower bud maggot** – Desis(0.5ml) or rogor (2.0ml) **Fusarium wilt** – Drenching of Bavastin(0.5gm) and Dithane M-45(2.0gm)			
13	Harvesting	After getting green color on fruit (60-70 days after transplanting)			
14	Grading	**Fruit weight** **Grade** 200-250 A 150-200 B 100-150 C 50-100 D			

Sl. No.	Statements	Recommended	Existing
1	What is the yield obtained per acre?		

D) Economic performance

a)

1. What is the cost of production per acre? ……..
2. What is the gross income per acre? ……
3. What is the net income per acre? …….

b)

1. What is the gross income obtained from Capsicum (… acres): …….
2. What is the total expenditure incurred for Capsicum (… acres): …..
3. What is the net income obtained from Capsicum (……acres): …….

Performance of CHRYSANTHEMUM crop growers under protected cultivation

A. Knowledge performance

Sl. No.	Statements	Recommended	Yes	No
1	Whether soil testing is recommended for Chrysanthemum?	Yes		
2	Ideal soil	Sandy-loam having pH 6.2-6.7		
3	Name the recommended varieties of Chrysanthemum?	Yellow: Karnool Yellagold, Jayanthi, Basanthi,. White: Chandrika, Kerthi, Himani, Red: Red Gold, Ravi Kiran.		
4	Growing media	3:3:3 (red soil : FYM : Sand:)		
5	Specification of bed	Bed width at top – 90cm Bed width at bottom – 100cm Bed height – 40cm Distance between two rows – 50cm		
6	Sterilization of media	Use 7.5 to 10 liter formalin acid in 10lit. of of water for 100m^2 of the greenhouse or @ Basamid 30-40g/m^2		
7	Propagation	Terminal stem cuttings (4-5 cm) during June-July, Suckers during February to April		
8	spacing	cut flowers: 20 x 20 cm or 30 x 30 cm (40-54 plants/m^2) Loose flowers: 30 x 20 cm (20-25 plants/m^2)		
9	FYM	FYM: 3-5 kg/ m2: FYM: 10-15 ton,		
10	N:P:K	• cut flowers: N:P:K::30:10:15g/m2 at monthly interval • Loose flowers N: 150kg, P: 100kg, K:120 kg/ ha)		

11	Irrigation	Soil should have 60-70 per cent moisture, 8-10 irrigations of 2.5-5 cm depth		
12	Staking:	Wire mesh, plastic nets, string or bamboo canes are used to support plants.		
13	Pinching	Twice after 4 and 8 weeks of transplanting		
14	Weeding:	Three-four hand weedings are sufficient. Atrazine @ 1.0 a.i. per hectare is effective before transplanting.		
15	Plant protection (Pest)	Aphids: Spray DDVP 76 EC. - 1.0 ml. /lit. water, when infestation noticed. 250 lit. spray solution required/acre. Thrips: Spray DDVP 76 EC. - 1.0 ml. /lit. water, when infestation noticed. 250 lit. spray solution required/acre. Bud borer:Spray Quinolphos 25 EC.- 2.0 ml./lit. water when infestation occurs. 250 lit. spray solution required/acre.		
16	Plant protection(disease)	Yellow virus disease: Up root virus infested plants and burn. Spray Dimethoate 30 EC. @ 1.7 ml/lit water. Root rot: Carbendazim 50Wdiv.-1.0g./lit water. Leaf spots: Spray Mancozeb75Wdiv.-2.0g./lit. water. 200lit. spray solution required/acre.		
17	Grading	Stem length (cm) Flower diameter(cm) Blue – 75 15.0 red - 75 12.5 yellow - 60 10.0 green- 60 10.0		
18	Yield	150-250 flower stems/m^2/year 8-10 tones/acre in loose flowers		

Adoption performance

Sl. No.	Statements	Recommended practices	Adopted		Not adopted
			full	partial	
1.	Whether you are done soil testing for Chrysanthemum?	Yes			
2.	Ideal soil	Sandy-loam having pH 6.2-6.7			
3.	varieties you adopted for Chrysanthemum?	Yellow: Karnool Yellagold, Jayanthi, Basanthi White: Chandrika, Kerthi, Himani, Red: Red Gold, Ravi Kiran.			
4.	Growing media you are following	3:3:3 (red soil :FYM : Sand:)			
5.	Specification of bed you adopted	Bed width at top – 90cm Bed width at bottom – 100cm Bed height – 40cm Distance between two rows – 50cm			

6.	Sterilization of media	Use 7.5 to 10 liter formalin acid in 10lit. of of water for 100$m^2$of the greenhouse or @ Basamid 30-40g/m^2			
7.	Propagation you are following	Terminal stem cuttings (4-5 cm) during June-July, Suckers during February to April			
8.	What is the Spacing you adopted?	cut flowers: 20 x 20 cm or 30 x 30 cm (40-54 plants/m^2) Loose flowers: 30 x 20 cm (20-25 plants/m^2)			
9.	FYM applying	FYM: 3-5 kg/ m2: FYM: 10-15 ton,			
10.	What is the dose of N:P:K fertilizer you used	• cut flowers: N:P:K::30:10:15g/m2 at monthly interval • Loose flowers N: 150kg, P: 100kg, K:120 kg/ ha)			
11.	Irrigation you are following	Soil should have 60-70 per cent moisture, 8-10 irrigations of 2.5-5 cm depth			
12.	Staking:	Wire mesh, plastic nets, string or bamboo canes are used to support plants.			
13.	Pinching	Twice after 4 and 8 weeks of transplanting			
14.	Weeding:	Three-four hand weedings are sufficient. Atrazine @ 1.0 a.i. per hectare is effective before transplanting.			
15.	Plant protection (Pest) measures you adopted	**Aphids**: Spray DDVP 76 EC. - 1.0 ml. /lit. water, when infestation noticed. 250 lit. spray solution required/acre. **Thrips**: Spray DDVP 76 EC. - 1.0 ml. /lit. water, when infestation noticed. 250 lit. spray solution required/acre. **Bud borer**:SprayQuinolphos 25 EC.- 2.0 ml./lit. water when infestation occurs. 250 lit. spray solution required/acre.			
16.	Plant protection (disease) Measures you adopted	**Yellow virus disease**: Up root virus infested plants and burn. Spray Dimethoate 30 EC. @ 1.7 ml/lit water. **Root rot**: Carbendazim 50Wdiv.-1.0g./lit water. **Leaf spots:** Spray Mancozeb75Wdiv.-2.0g./lit. water. 200lit. spray solution required/acre.			
17.	Grading you are following	**Stem length (cm) Flower diameter (cm)** Blue – 75 15.0 red- 75 12.5 yellow - 60 10.0 green- 60 10.0			
18.	Yield	Cut flowers: 150-250 flower stems/m^2/year Loose flowers: 8-10 tones/acre			

C) Yield performance

Sl. No.	Statements	Recommended	Existing
1	What is the yield of chrysanthemum obtained per acre?		

D) Economic performance

1.What is the cost of production per acre? ……..
2.What is the gross income per acre? ……
3.What is the net income per acre? …….

b)

1.What is the gross income obtained from Chrysanthemum (… acres): …….
2.What is the total expenditure incurred forChrysanthemum (… acres): …..
3.What is the net income obtained from Chrysanthemum (……acres): …….

E) Social performance

Sl. No.	Social contact	Yes	No
1	Serving as resource person in agriculture/horticulture matters		
2	Whether others consult you for information and for guidelines?		
3	Serving as member in VP/TP/ZP		
4	Whether your participation in other department programmes have been increased		
5	Whether you are recognized by villagers/neighbors because of your performance in farming?		
6	Sent children for higher education?		
7	Whether your purchasing power has been increased (constructed house/ purchased vehicle/purchased land)		

Marketing channel practicing for chrysanthemum.

Sl No.	Marketing channel	Yes	No
1.	Producer → Commission agent→Wholesaler →Retailer →Consumer		
2.	Producer→ Pre-harvest Contractor → Commission agent cum Wholesaler →Retailer→ Consumer		
3.	Marketing on spot/ local market		
4.	Marketing in the taluk place/ APMC		
5.	Marketing at Chikkaballapura Marketing at Bengaluru @ KR market/ flower auction		

Marketing channel practicing for Capsicum.

Sl No.	Marketing channel	Yes	No
1.	Producer → Commission agent→Wholesaler →Retailer →Consumer		
2.	Producer→ Wholesaler/companies → Retailer → consumer		
3.	Producer → local market/consumer		

Constraints faced by horticulture crop growers under protected cultivation (Vegetables/flowers)

Sl No	Particulars	Yes	No
A	**Production related constraints**		
1	Occurrence of pest and diseases		
2	Perishable nature of flowers/vegetables		
3	Highly fluctuating weather conditions		
4	Occurrence of physiological disorders		
5	Poor drainage of soil		
6	Low soil fertility status		
7	Scarcity of water for irrigation		
8	Any other		
B	**Technical related constraints**		
1	Non-availability of quality inputs like pesticides and insecticides at right time		
2	Limited and irregular power supply		
3	Lack of technical guidance about production techniques		
4	Lack of scientific knowledge about crop production under PCT		
5	Non-availability of required quantity and quality planting material at right time		
6	Difficulties in following the recommended practices		
7	Non-availability of quality PCT equipments at local market		
8	Lack of relevant literature in local language		
9	Any other		
C	**Labour related constraints**		
1	Scarcity of labour during peak seasons		
2	High cost of skilled labour		
3	Lack of availability of skilled labour		
4	Any other		
D	**Economics related constraints**		
1	High cost of planting material		
2	Crop insurance is not covered for flowers/vegetables		
3	Lack of awareness about credit and subsidy facilities		
4	High cost of plant protection chemicals		
5	Lack of adequate and timely disbursement of loan		
6	High cost of transportation		

7	Complexity of loan procedure		
8	High initial investment in construction of poly house		
9	Poor accessibility to subsidy		
10	Any other		
E	**Marketing related constraints**		
1	Market price fluctuation		
2	Difficulty in grading the produce at the production level		
3	Lack of exclusive markets for flowers/ vegetable grown under PCT		
4	Lack of marketing facilities at local place		
5	Distress sale due to immediate need of money		
6	Market price fluctuation		
7	Problems of transportation means		
8	Existence of middle men malpractices		
9	Any other		

PART V

Suggestions by the horticulture crop growers under PCT to overcome the above said constrains and challenges Suggestions

Sl. No.	Suggestions	Rank
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		