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An Analysis of Constraints in Adoption and Strategies to Promote the Protected Cultivation among the Horticulture Crop Growers

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ABSTRACT: In order to better understand the barriers to protected cultivation among growers of horticultural crops for the agricultural year 2019–20, a study was undertaken in Karnataka. Survey was conducted by well-designed questionnaires. 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 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. The perishable nature of vegetables, lack of irrigation water, lack of scientific knowledge of advanced production techniques, lack of planting material availability at the right time, high cost of skilled labour, labour shortages during peak seasons, high initial investment in construction of poly houses, high cost of planting material, market price volatility, and lack of marketing facilities at local locations were the main obstacles for farmers in harnessing this technology. All parties involved concurred that research and development projects were necessary to provide low-cost designs and lower the price of cultivation in polyhouse. Its profitability and sustainability would also depend on how well farmers could adapt this technology to their socioeconomic and agroecological circumstances.

Keywords: Horticulture, Protected cultivation, Constraints, Suggestions, Karnataka.

INTRODUCTION

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 (Kaushal and Singh 2018).

Since ancient times, agriculture has served as the foundation of India's economy. However, our experience over the past 50 years suggests a correlation between agricultural practises and the expansion of the sector's economy. The trend of agricultural growth indicates a combination of notable accomplishments and squandered chances. New and efficient production technologies are essential to consistently increase the productivity, profitability, and respectability of the agricultural industry if India is to maintain food security for the poor, remain self-sufficient, and export high-quality fruits and vegetables.

One such field is protected cultivation technology, which is used extensively in wealthy nations but only sporadically in India. Numerous cropping patterns are possible because to the considerable variances in meteorological conditions and various topography throughout the country. India also endures climate extremes like floods, droughts, and other climatic anomalies that routinely result in agricultural losses or damages, which costs farmers money. Over the past ten years, the demand for high-quality agricultural products has grown concurrently. This gives Indian farmers better options to employ protected agriculture techniques according to their region and the compatibility of the crops.

Growing crops in a regulated environment is a practise known as protected farming. As a result, it is possible to control the temperature, humidity, light, and other variables according to the needs of the crop. This contributes to a larger, healthier crop. Different protected cultivation techniques exist. Some of the methods that are frequently employed are mulching,

raised beds, trellising, drip irrigation, insect proof net houses, forced ventilated greenhouses, naturally ventilated poly houses, insect proof net houses, and shade net houses. These techniques can be employed singly or in combination to create a hospitable environment that will protect plants from harsh weather and lengthen the period of cultivation or agricultural production in the off-season.

The genetic make-up of a crop affects its productivity, but so does the environment in which it grows. Sun, temperature, air quality, the nature of the root and soil media, tillage, irrigation, fertilizer application, etc. are microclimate crop components. Additionally, the root medium's structure is adjusted in accordance with needs. A greenhouse can regulate one or more aspects of the microclimate despite having closed borders. Depending on its transparency, the greenhouse cover allows a tiny amount of sunlight to get through. The crop, floor, and other elements of the greenhouse absorb the sunlight that falls on it. Because the cover material is less transparent for long wave heat radiation, which is produced by these greenhouse objects. This occurrence is widely recognized.

The greenhouse effect is the name given to this phenomena. This naturally occurring increase in greenhouse air temperature is used in frigid locations to nurture seedlings and produce good crops.The similar natural occurrence in the summer requires greenhouse cooling to keep temperatures comfortable. To boost productivity, there are primarily two methods: improving the genetic foundation and maintaining a favourable environment. Only when a favourable growing environment is offered will a genetic material's yield potential be fully realised. Environment includes things like air quality, temperature, light, and root medium type. Traditionally, only the characteristics of the root media could be controlled through tillage, nutrition, irrigation, etc. Keeping all these in view, the study has been taken up with following specific objective

— To analyse constraints faced by growers under protected cultivation and to seek their suggestions to enhance the productivity under protected cultivation.

Protected farming holds great promise for Indian farmers and the nation as a whole in addressing the issues of raising agricultural production and farmer income. The adoption of these technologies has become even more necessary since Indian farmers' lands have become smaller. In this respect, a study was carried out to evaluate the extent of protected agriculture technology adoption by Indian farmers, with an emphasis on the performance of various crops in polyhouses. Extending the area under protected cultivation will be the consequence of producers' performance under protected cultivation, limitations in adoption, and initiatives for removing limitations. Therefore, all parties involved in the creation and promotion of Protected farming, including as agricultural experts, private R&D, students, and others, must take the study's findings very seriously.

MATERIAL AND METHODS

Selection of respondents. The study was carried out in 2020 in the Chikkaballapur district of Karnataka, which is located in the eastern dry zone (Zone-V). The Chikkaballapur district has five taluks; Sidlaghatta and Chikkaballapur were specifically chosen for the study because they have more protected agricultural land than the other taluks. 50 growers (25 chrysanthemum and 25 capsicum) were randomly chosen from the Chikkaballapur taluk out of a total sample size of 100. Similarly, 50 growers from Sidlaghatta taluk (25 Chrysanthemum and 25 Capsicum) were chosen as random.

Research design. A study design known as ex-post facto was employed in the current investigation. Because it is a systematic empirical investigation for quantifying the phenomena, which has already occurred and is continuing, this design was deemed appropriate. Independent variables are those that the researcher cannot influence because they already exist or because they are inherent and uncontrollable. The restrictions or issues that farmers encounter while cultivating are referred to as constraints. Apart from open-ended questions, the farmers were asked to indicate the limits they were facing, and their replies were collected for the current study on a two-point continuum of "yes" or "no". For a "yes" response, a score of one was given, and for a "no," a score of zero. Aside from open-ended questions, some of the proposals were stated, and the farmers were asked to identify which ones they agreed with. The replies of the farmers were gathered for the current study on a two-point continuum, "yes" or "no." For a "yes" response, a score of one was given, and for a "no," a score of zero.

RESULTS AND DISCUSSION

Table 1 lists the production limitations that growers of horticulture crops must deal with. The vast majority of respondents saw the perishable nature of flowers and vegetables (97.00%), a lack of irrigation water (94.00%), the presence of pests and diseases (93.00%), and inadequate soil fertility (71.00%) and poor soil drainage (52.00%) as additional barriers to crop production. Vegetables and flowers cultivated in polyhouses have a short shelf life. Access to the market and effective supply chain management are also essential for the success and efficiency of polyhouse technologies. For polyhouse agriculture to be successful, irrigation is also essential.

Lack of irrigation during critical stages of crop growth will have a negative impact on yields, and excessive irrigation use under polyhouse conditions can lead to poor drainage in the soil and imbalances in soil fertility status. Additionally, the incidence of pests and diseases inside the polyhouse can occasionally outweigh that of

open cultivation due to favourable climate conditions. In addition to the likelihood of pest and disease outbreaks in crops grown under protection, this could result in product deformity and low market value. Their loss of fertility is a result of the overuse of soil nutrients.

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.

Table 1: Production constraints as perceived by horticulture crop growers under protected cultivation (n=100).

Sr. 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

Table 2: Technical constraints as perceived by horticulture crop growers under protected cultivation (n=100).

Sr. No.	Constraints	Number	Per cent	Rank
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 atlocal 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

The technical limitations are listed in Table 2, where it is stated that a large majority of growers believed that there was a lack of scientific knowledge about advanced crop production technologies under protected cultivation (95.00%), a lack of planting materials in the required quantity and quality (88.00%), a lack of quality inputs like pesticides and insecticides at the appropriate time (85.00%), and a lack of quality protected cultivation equipment at local markets. Crop production in polyhouses requires a significant investment in both capital and technology. Therefore, for acceptance and its success, proper scientific understanding and training on a variety of topics linked to polyhouse growing are essential.

However, farmers find it challenging to get the most recent knowledge and methods for polyhouse crop production, particularly in their native languages. Planting material is one of the essential inputs in polyhouse cultivation. Finding high-quality planting material at an affordable price is a difficult undertaking, indicating that the adoption of polyhouse technology is still in its early stages and that access to high-quality inputs is still a problem. Farmers are totally dependent on them as a result of the limited number of private players who supply planting material. Additionally, farmers are entirely on private companies for other inputs like machinery, equipment, growth regulators, herbicides, and insecticides for use in polyhouse crops.

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.

Table 3: Labour constraints as perceived by horticulture crop growers under protected cultivation (n=100).

Sr. No.	Constraints	Number	Per cent	Rank
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

The labour shortages experienced by growers were shown in Table 3; the majority of growers cited high labour costs (95.00%) as their main issue, along with labour shortages during peak seasons (99.00%) and a lack of skilled labour (83.00%). Because polyhouse cultivation requires a lot of labour, skilled labour is always needed. It should come as no surprise that finding skilled labour is a major problem for farmers who grow chrysanthemums and capsicums. In contrast to chrysanthemum, capsicum demands more competent labourers. There is a severe scarcity of competent labour, particularly during peak seasons like planting and sowing, as a result of rural residents moving to metropolitan regions in search of better employment possibilities, village-level alternative employment opportunities, and youth's lack of interest in agriculture.As a result, the wage rates for the skilled labour needed for polyhouse cultivation have increased naturally. In the study area, the average daily wage rates for sowing/planting and harvesting were Rs. 150 for women and Rs. 200 for men. In contrast, daily wage rates in the polyhouse ranged from Rs. 250 to 300 for women and Rs. 300 to 400 for men. They cited high costs and a lack of labour as the main constraints.

Table 4: Economical constraints as perceived by horticulture crop growers under protected cultivation (n=100).

Sr. No.	Constraints	Number	Per cent	Rank
Economical constraints				
1.	High initial investment in construction of polyhouse	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

The financial limitations of the growers are listed in Table 4, which reveals that nearly all of the respondents had to deal with the issue of a high initial investment in the construction of a poly house (97.00%), followed by high planting material costs (93.00%), high plant protection chemical costs (89.00%), a lack of sufficient and prompt loan disbursement (84.00%), and complexity of the loan application process (81.00%). At every step of crop production, the polyhouse technique requires a significant investment in money. Quality planting materials, protection chemicals, fertilizers, etc. are required for polyhouse, which increases the farmers' financial burden. Farmers claimed that the application process for loans from financial institutions and commercial banks took at least eight months and was extremely complicated.

According to a large majority of respondents, market price volatility (95.00%), the existence of middlemen (90.00%), a lack of marketing infrastructure in the local area (89.00%), and the absence of exclusive markets for flowers and vegetables grown under protected cultivation (76.00%) are the biggest marketing constraints. Farmers are viewed more as price takers than price fixers when it comes to selling their produce, especially when it comes to crops like flowers and vegetables where there is no price control at all. Unfavorable market pricing can therefore result in significant financial losses.

Farmers received strong prices from January to April, while the season is often slow from September to December. However, middlemen's greed and a lack of local marketing resources limit farmers' ability to share in the profits. Accessibility to markets is also important for the success of polyhouse cultivation and its economic viability. Difficulties with transportation due to far-off markets, higher transportation costs, and price fluctuations for vegetables and flowers make farmers more likely to experience difficulty selling their goods.

Table 5: Marketing constraints as perceived by horticulture crop growers under protected cultivation (n=100).

Sr. No.	Constraints	Number	Per cent	Rank
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/ vegetablegrown under PCT	76	76.00	IV
5.	Problems of transportation means	70	70.00	V
6.	Difficulty in grading the produce at theproduction level	65	65.00	VI
7.	Distress sale due to immediate need of money	55	55.00	VII

Table 6: Government Policy initiatives suggestions expressed by horticulture crop growers to overcome the constraints (n=100).

Sr. 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

Table 6 provides information on growers' proposals for government policy measures. Creating grading, cold storage, and processing facilities at the farm gate level to reduce post-harvest losses (77.00%), providing regular power supply (three phase) (65.00%), increasing the amount of subsidy for protected cultivation under polyhouse (95.00%), and making quality planting material available in required quantities at the right time in the local market were among the suggestions made by growers in the case of g Government action is required to promote the use of this technology because it is important for government intervention in the system of price policy to prevent price fluctuation.The promotion of polyhouse technology requires a supportive policy environment, including steps to increase the subsidy amount and widen the pool of beneficiary farmers; development of infrastructure, including facilities for grading, transportation, and cold chain management; provision of high-quality.Parveenkumar*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%).

Table 7: Research and Development Initiatives suggestions expressed by horticulture crop growers to overcome the constraints (n=100).

Sr. No.	Suggestion	Number	Per cent	Rank
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

Table 7 includes proposals made by growers to lower the high initial investment (97.00%) in research and development initiatives. Farmers urged that scientists develop polyhouse technologies that demand cheap initial investment costs and minimal operating costs because the polyhouse technology is highly capital intensive at all phases of crop production. Reduce the cost of production in polyhouses (90.00%), standardise the layout and construction of inexpensive polyhouses (81.0%), create a user-friendly Package of Practices (75.00%), and standardize production technology in polyhouses (62.0%), according to farmers' additional recommendations.

Table 8: Marketing Initiatives suggestions expressed by horticulture crop growers to overcome the constraints (n=100).

Sr. No.	Suggestion	Number	Per cent	Rank
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

The suggestions made by growers for marketing initiatives are listed in Table 8 and include the following: promotion of direct marketing (91.00%), creation of separate transportation facilities for national and international markets to export the produce (65.00%), and availability of raw materials in the required quantity at local markets (93.00%). Accessibility to markets for both inputs and produced output is essential for polyhouse horticulture to be successful and economically viable. Other significant marketing obstacles include far-off marketplaces that increase transportation costs, fluctuating flower and vegetable prices, and middlemen who prey on unsuspecting consumers. Farmers in this situation argued that encouraging direct marketing and making necessary quantities of raw materials available at local markets would be helpful to them.

Table 9: Farmer level initiatives suggestions expressed by horticulture crop growers to overcome the constraints (n=100).

Sr. No.	Suggestion	Number	Per cent	Rank
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

Initiatives at the farmer level are covered by growers' recommendations in Table 9. The majority of growers (86.00%) recommended using cooperative and cluster-based ways to produce and market produce because they believe that doing so will boost farmers' negotiating power and provide them the ability to control the prices of their products in the marketplace. Another recommendation was for producers to employ appropriate and scientific measures when choosing the location and site for polyhouse growing as well as for the management of the structure (78.00%). The horticultural crop growers also suggested using a rain water collecting system to cut watering costs (73.00%) and lowering the cost of installing polyhouses by using local materials (58.00%) to address the issues. 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.

CONCLUSION

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. 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. 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. 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.

FUTURE SCOPE

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.

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