

CURRENT STATUS, FUTURE PROSPECTS, AND OBSTACLES FOR PROTECTED CULTIVATION IN INDIA

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ABSTRACT

Protected cultivation is an important and innovative approach. However, the high cost of the structure and lack of knowledge about these technologies are the major challenges or barriers in the path of adaptation of protected cultivation for the farmers. With the innovations and ongoing developmental projects in polymer science, the protected cultivation technology will become modernized gradually. The current global and local demand for off-season products is the major driving force in adopting protected cultivation technologies. Supportive initiatives from the Government are helping advance the techniques and awareness related to protected agriculture.



INTRODUCTION

Protected cultivation is the cultivation of crops under a controlled environment suitable for optimum plant growth and production. These structures can significantly improve crop yield in areas where the climate is a major problem. Protected cultivation is a new alternative to cultivating seasonal and mainly off-season vegetables (Jadhav & Rosentrater, 2017). Farmers can substantially maximize their profit by producing seasonal vegetables under a controlled environment in greenhouse technology, as they do not get a remarkable return after producing vegetables in their regular season for the larger availability of seasonal vegetables in the market. For example, cucurbits can be grown in the off-season using low-plastic tunnel technology in the northern plains of India.

The last two decades intimates a familiarity between the new agricultural practices or technologies and the growth, i.e., economic enhancement. The aptitude for agricultural improvement strategies is generally a mixture of growth and failure. If there is an appreciative achievement on the one hand, then the other will be fulfilled with missing opportunities (Nimbrayan et al., 2018). India needs new and developed production technologies to remain a self-sufficient country or provide the ultimate surety of feeding all the individual natives. Besides this, to become an exporter of good quality vegetables and fruits, farmers should

adopt the greenhouse technology required to continuously improve productivity, profitability and respectability of the Indian agricultural sector. Economic return from high-quality agricultural produce under protected conditions can be maximized substantially through protected cultivation by reducing the residues of chemical insecticides and pesticides on the crop grown in a greenhouse environment.

PRESENT STATUS OF PROTECTED CULTIVATION IN INDIA

Being a diversified climatic country, India has to show a tremendous increment in the field of protected cultivation for the growth of the Indian agriculture sector. However, depending upon various climatic conditions, the success rate of protected cultivation in this country varies significantly. Like in the northern part of the country, this type of technology is facing big challenges due to severe climatic conditions. Whereas areas like Bengaluru and Pune, the mild climatic condition becomes easily adaptive to this controlled cultivation technology. So, it is too tough to succeed in greenhouse cultivation all over India. Nearly 30,000 hectares of areas are under protected cultivation till now in India (Somasundaram et al., 2020).

Table1: Area under protected cultivation in different countries

Country	Area (ha)
China	27,60,000
Korea	57,444
Spain	52,170
Japan	49,049
Turkey	33,515
India	30,000
Italy	26,500
Mexico	11,579
Netherland	10,370
France	9,620
USA	8,425

The technical knowledge for adapting protected cultivation techniques is not remarkable now. Different Indian public sector now collaborates with institutions of developed countries for research and development project which contains technical designs and suitable modification of different greenhouse structure ideal for Indian climatic conditions, mainly specific region based. Protected cultivation techniques need careful planning, full attention and knowledge about the timing of crop production and, the most vital part, harvesting time for getting good market prices, selection of varieties which can easily adapt to the off-season conditions and produce higher economic yields of good quality produce.

Generally, the basic growth of protected cultivation depends on the different government policies which provide this country with a handsome amount of subsidies. There are various government institutions like NHM (National Horticulture Mission), RKVY (Rashtriya Krishi Vikas Yojana), NHB (National Horticulture Board) etc., who have launched several schemes to encourage the farmers to adopt this new technology.

PRESENT STATUS OF PROTECTED CULTIVATION IN THE WORLD

Nowadays, crop production in the greenhouse is a flourishing reality throughout the world, with a calculable amount of 405,000 hectares of greenhouses present all over the continents (Patel *et al.*, 2017). More than 55 countries in modern times are associated with this technology. The protected cultivation was started in China during the nineties. As a result, they are the most advanced and developed in agriculture. Until now, the area that comes under greenhouse cultivation is more than 2.5 m ha, and 90 per cent area is under vegetables only (Jain *et al.*, 2021). Israel also made their agriculture sector more advanced by adopting protected cultivation technology. The advantage of greenhouse techniques for producing high-quality vegetables, flowers, and fruits has been taken in desert areas where water is a limiting factor. A thousand acres of areas are under glass houses now in the United States, and comparatively larger areas can be found in England and Holland. Horticulture was practised under glasshouses over a century ago. India is now associated with international countries like Israel to adopt their protected cultivation technologies, which is expected to boost agricultural productivity significantly.

POTENTIAL AND STRATEGIES

Under different climatic environments, protected cultivation technique has remarkable potential over the country. In the protected farming method, farmers can provide suitable conditions to the plants for optimum growth and artificially increase production amount. A wide scale of interventions has been required for the highest potential areas like-

- ✓ The potential of plug tray nurseries nowadays can be used for cultivating horticultural crops on a commercial scale which can rise up as a profitable business.
- ✓ Uses of the insect-proof net house in large-scale units for hybrid seeds and vegetable production. This type of net house is also used for hybrid seed production in vegetables to maximize the farmer's overall return. In addition, fruit crops like pomegranate and papaya are also cultivated on a large scale.
- ✓ In arid and semi-arid regions under harsh environments, naturally ventilated poly houses are used on a large scale.
- ✓ Plastic mulches are practised on a large scale for commercial cultivation of vegetables in open fields, under the greenhouse and in net houses.

- ✓ Micrografted techniques on a medium scale can be used to increase the resistance of plant material against soil-borne pathogens.
- ✓ Protected cultivation is the only solution for every issue regarding farming. With this technique, farmers can solve all the problematic and uncertain climatic conditions, climate change, inappropriate uses and minimum productivity or availability of natural substances, nutritional security and activity in topography, environmental pollution because of pesticide uses, etc.
- ✓ Covering plant-protected cultivation controls different problematic climatic conditions but never disturbs the incoming and outgoing sunlight. As a result, plants get sufficient light required for photosynthesis, proper fertilization, optimum watering, and other productive factors.

SCOPE OF PROTECTED CULTIVATION IN INDIA

Protected cultivation has a tremendous scope to make elite the Indian horticulture sector. If it is organized popularly, there will be an extensive scope to protect the farmers from economic losses.

- ✓ In India, different problematic conditions like uncultivated or unproductive fallow lands, barren lands and desert areas are the major problems in terms of the utilization of uncultivated space. So, if these unproductive areas come under protected cultivation, it will be great for the inhabitants, who can yield substantial returns.
- ✓ High-quality vegetables and ornamentals have a massive demand throughout the year in technically developed cities. Also, cities' demand for off-season vegetables and high-priced fresh crops remains. Therefore, greenhouse production is mainly promoted to accomplish urban needs.
- ✓ There are adequate international demands for farming produce, mainly ornamental like cut flowers.
- ✓ Many healthful herbs and a wide range of orchids are generally cultivated on a large scale in India. So, a greenhouse can be the proper style for cultivating those rear plants in a controlled environment.

PROSPECTS OF PROTECTED CULTIVATION IN INDIA

1. Future aspects of protected cultivation in an arid and semi-arid region

In arid and semi-arid regions, climatic extremes like temperature fluctuations, low soil fertility, high wind velocity, and high solar radiation adversely affect open land area crop cultivation. Water is also a limiting factor in this region. That's why protected cultivation is the only way to promote agricultural practices in an arid and semi-arid regions. Low vegetation cover in this area favoured the protected cultivation as it constricts the place for pathogen survival on alternative hosts in the time of the non-cropped season. The humidity is also comparatively low in the environment, which is not favourable for pest epidemics and diseases to occur (Ghanghas *et al.*,

2018). So, taking this benefit of the climate, modification of existing protected cultivation structures can happen according to the cultivated crops and availability of resources in the particular region. Since the major viral, bacterial and fungal diseases are fewer in arid and semi-arid areas, horticultural crop cultivation in protected technology becomes supportive.

2. Cost-effectiveness of protected cultivation

The profit margin always depends upon the input, for all agricultural operations and output, after selling produce crops, which is comparatively low in open field conditions. The main aspect of increasing a farmer's monetary gains is maximizing production. Product quality is not much superior in open field conditions, and chemical residues are too high because of their excessive usage. The investment in protected cultivation is comparatively low as this technology reduces chemical usage and increases crop quality. These high-quality produce crops have all the access for export to different international markets and fetch more profit than open-field production.

3. Economic opportunity and employment services:

Protected cultivation will create a spectacular opportunity for this country's agriculture students to set their skills, economic opportunities, etc. They can quickly adapt to new technologies and move forward with protected technology. The potentiality of creating new jobs will be remarkable for the current unemployment situation all over India. Agricultural universities can play a significant role in capitalizing on students to promote greenhouse technology. If this happens, there will be effective market growth and exploding of new jobs alongside opportunities for chartering new innovations of ground-level technologies. It will be a pathway for further development of our country's agricultural economy in the coming years. A vertical farming process like Cocoponics can positively impact India's rural economy. Cocoponics is a cycling process of making compost from agricultural residues and is used as a soil medium for growing crops under protected cultivation (Majid, 2020). This method can generate new revenue and income opportunities for farmers, especially those living near barren or wastelands.

CHALLENGES OF PROTECTED CULTIVATION IN INDIA

1. Lack of trained professional and skilled labour

Protected cultivation is all about technology by which adverse environmental effects can be controlled and generate a suitable environment for the optimum growth of plants. For designing and fabrication of the greenhouse structure and maintenance throughout the year, well-skilled and technically experienced human resources will be needed. Unfortunately, this sector's development rate is minimal due to the lack of trained professionals and skilled labourers.

2. Non –availability of region-specific design

The availability of protected structures for the diverse climatic condition in India is so poor that the technology can't take off to its prime. The lack of advisory committees and practical training institutions in protected cultivation is one of the biggest challenges to overcoming the current situation. Small industries are taking advantage of the fabrication of greenhouse structures as they gradually rise up as big businesses by using low-quality materials to make more profit (Kumar et al., 2017). However, they also lack knowledge about basic steel, structural materials and cladding material quality.

3. Lack of availability of crop varieties and planting material

Specific variety or planting material is needed for protected cultivation. Farmers have to choose only those varieties with high commercial value in the market. Only some private sectors are doing business with specific planting materials needed for protected cultivation, and the cost is too high. Government should look into this matter. Active government seed agencies should serve quality seeds among farmers.

4. Lack of marketing for high-priced produce

Protected cultivation produce needs a good market to sell out with high-value efficiency as farmers can't let it at a low premium price. Massive cities are a suitable market for this. People should know low chemical residue levelled and high-quality products so they can show interest in it. A proper market strategy will be needed for the proper disposal of high-quality produce.

CONCLUSION

Protected cultivation is an important and innovative approach. However, the high cost of the structure and lack of knowledge about these technologies are the major challenges or barriers in the path of adaptation of protected cultivation for the farmers. With the innovations and ongoing developmental projects in polymer science, the protected cultivation technology will become modernized gradually. The current global and local demand for off-season products is the major driving force in adopting protected cultivation technologies. Supportive initiatives from the Government are helping advance the techniques and awareness related to protected agriculture.

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