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POLICY PAPER



A brief preamble on protected cultivation

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Abstract

Introduction of protected cultivation in horticulture has brought prosperity to farmers across the nation. Indian economy is principally influenced by agriculture and allied activities. Several new biotic and abiotic stress has emerged as a great challenge in the country. Protected cultivation technique reduces these stresses by providing complete controlled condition. The increasing food demand compels to think for protected cultivation. Greenhouse is that the most functional methodology for achieving the objectives of protected cultivation. Poly house based cultivation has become a vital policy of Indian Agriculture. Since, vegetables are treated as high value crops and their regular supply in the market fresh condition is essentiality. Also the importance of vegetables as being a protective food increases its consumption. The growing of off season vegetables in protected cultivation has also increased the farmer's income.

Keywords: Green house, protected cultivation, horticulture, nutrient film technique, controlled environment.

Introduction

Protected cultivation is a cropping technique in which crops are growing in a controlled environment. In this method, all the essential factors such as temperature, humidity, light, and others, are regulated as per the crop's growth need. All the farming conditions are easily controlled as per requirement. The farming method is healthier and provides large production without any diverse conditions. The method of protected cultivation plants controlled fully, partially or modified to protect the crop from adverse weather. There are many types of protected agriculture available such as forced ventilated, greenhouse, naturally ventilated polyhouse, insect-proof net house, shade net house, plastic tunnel and mulching, raised beds, trellising and drip irrigation. These protected

cultivation types provide two processes: one is independent, and the second is a combination. Both processes provide favourable environments that protect the plants from harsh climate and extend the duration of cultivation or off-season crop production. India is the second largest producer of vegetables in the world, next to China. It produces 193.61 million ones of vegetables from an area of 9.2 million hectares (NHB, 2020). The utility of protected cultivation has been found maximum with respect to the crop need. Presently in India, around 25,000ha area is under all forms of protected cultivation, and this technology is suitable for different parts of the country. In spite of all these achievements, per capita consumption of vegetables in India is very low against WHO standards (180 g/day/capita against 300 g/day capita recommended by FAO).

Greenhouse is the most practical method of achieving the objectives of protected agriculture, where natural environment is modified by the use of sound engineering principles to achieve optimum plant growth and yield (more produce per unit area) with increased input use efficiency. The green house is generally covered by transparent or translucent material such as glass or plastic. The green house covered with simple plastic sheet is termed as poly house. The green house generally reflects back about 43% of the net solar radiation incident upon it allowing the transmittance of the “photosynthetically active solar radiation” in the range of 400-700 nm wave length. The sunlight admitted to the protected environment is absorbed by the crops, floor, and other objects. These objects in turn emit long wave thermal radiation in the infra red region for which the glazing material has lower transparency. As a result the solar energy remains trapped in the protected environment, thus raising its temperature. This phenomenon is called the “Green house Effect”. Greenhouse is the most practical method of accomplishing the objectives of protected cultivation (Nagarajan et al., 2002). Tomato, Capsicum and cucumber are the most extensively grown vegetables under green houses and give higher returns (Chandra et al., 2000). New features added to these structures have cut down the requirement of water and energy in such cultivation through novel means like micro irrigation-cum-fertilization (fertigation) and rainwater harvesting.

Area under Protected Cultivation in India & Worldwide

In the last decade, India has greatly accepted this new technique, and today this farming method done by almost every Indian state. As per the report, by the end of the 20th-century area under the protected cultivation was about 110 ha in India and the world over 275,000 hectares. With time, this area increased by 10%. States that have continuously expanded the area under protected farming for 2007-2020 are Gujarat, Andhra Pradesh, West Bengal, Tamil Nadu, Punjab, Haryana, and Maharashtra. Maharashtra and Gujarat had a wide area of 5,730.23 hectares and 4,720.72 hectares, respectively, under the protected cultivation till 2020.

There are more than 55 countries now in the world where cultivation of crops is undertaken on a commercial scale under cover and it is continuously growing at a fast rate internationally. China is the largest users of greenhouses. The development of greenhouse technology in China has been faster than in any other country in the world.

With a modest beginning in late seventies, the area under greenhouses in China has increased tremendously. The world scenario of greenhouse production is given in Table-1.

Table-1 Worldwide Total Area in Major Greenhouse Production Countries

Country	Greenhouse Area (Ha)
China	2,760,000
Korea	57,444
Spain	52,170
Japan	49,049
Turkey	33,515
Italy	26,500
Mexico	11,759
Netherlands	10,370
France	9,620
United States	8,425

Source: Kacira (2011)

Importance of Protected Cultivation

Agriculture has been the backbone of India's economy for ages. Apart from the economy, it is also a big employment source as agriculture provides jobs to 90%. India is self-sufficient in agriculture which provides proper food security and also exports high-quality fruits and vegetables. Still, the demand for quality agricultural production has increased over the last decade and not completed by India. So, to complete the market demand, Indian agriculture needs new and effective production technologies that can continuously improve the agricultural sector's productivity, profitability, and respectability.

Climate change is becoming an increasingly significant global problem that can no longer be ignored. The main underlying cause is anthropogenic, i.e., unsustainable use of fossil fuels, forest degradation for industrialization, and rapid urbanization with an overpopulation (Mukherjee et al., 2016).

Protected cultivation being a beneficial technology is adopted by developing countries including India. This farming method is a new farming method that allows variations in the climatic conditions and many cropping patterns. India has a big problem of climatic extremes such as floods, droughts and other climatic abnormalities that cause crop losses regularly or damages resulting in economic losses. So, to avoid these all harmful conditions, the protected cultivation method was founded, which provides better opportunities for the Indian farmers. The adoption of protected cultivation technology can take Indian agriculture to the new successful way. Through this method, farmers can easily complete the high market demands without any extra effort. The greenhouse is one of the best examples of protected cultivation which commercially used for the production of non-native and off-season vegetables, flowers and quality seedlings. Through the greenhouse method, the economic returns of high-

value agriculture products increased substantially. It used as a rain shelter, and suitable regions for the greenhouse are high rainfall, like North-eastern states and coastal regions. In the protected cultivation, the less use of chemical pesticides and insecticides avoid their residues on the crop production.

Benefits of Protected Cultivation

The benefits which can be derived from the protected cultivation are as follows:

- ✓ Environment control allows raising plants anywhere in the world at any time of the year i.e. crops could be grown under the inclement climatic conditions when it would not be otherwise possible to grow crops under the open field conditions.
- ✓ The crop yields are at the maximum level per unit area, per unit volume and per unit input basis.
- ✓ The control of the microcosm allows the production of higher quality products which are free from insect attack, pathogens and chemical residue.
- ✓ High value and high quality crops could be grown for export markets.
- ✓ Income from the small and the marginal land holdings maintained by the farmer can be increased by producing crops meant for the export markets.
- ✓ It can be used to generate self employment for the educated rural youth in the farm sector.

Kind of Protected cultivation

- Glass House
- Poly House
- Shade Net House
- Poly tunnel

Glass House: Evaporative cooling and heaters are used to maintain required temperature inside glass house. Popular for Netherland. Maintained the water and nutrient supply by the mist and drip irrigation system with fertigation. High value blemish free crops of Tomato, Cauliflower, Cherry tomato, Sweet pepper, musk melon and Cucumber for long period.






<p>Poly House: Naturally Ventilated Poly houses Maintained the water and nutrient supply by the drip irrigation system with fustigation provided to maintain a favorable temperature and humidity during summer. Mainly being used in Turkey and Japan.</p>	
<p>Shade Net (Greenhouse): The greenhouse is covered Top with side walls has insect proof nets from ground to height of 5-6 feet with manually rollable net cover. Mainly used for production of cucumber, muskmelon, tomato. In Japan Israel and Turkey.</p>	
<p>Poly tunnels: Poly tunnels and small walk-in tunnels are actually miniature greenhouses. Row Cover materials, clear (non-perforated) – too hot, clear (perforated) – hot, white (perforated) – warm, green (perforated) – warm, woven – warm.</p>	

Table 2: Crops grown under protected cultivation

Flowers	Chrysanthemum, Carnation, Gerbera, Gladiolus, Lilium, Rose, Orchid, etc.
Vegetables	Tomato, Capsicum (red and yellow bell peppers), Cucumber, Red cabbage, Broccoli, Radish, Leafy vegetables, etc.
Fruits	Strawberry.
Seedling and nurseries	Flowers, vegetables, tissue culture, clonal for forestry, fruit grafting (like lemon, citrus, mango, pomegranate, guava, litchi, etc.)

Components of Green house

Protected cultivation has two major components of technology. One is the infrastructure involving frames, cladding materials, irrigation system, tools, implements, other engineering inputs and another is crop production technology. Infrastructural inputs ensure optimal light, air temperature, water and plant growth requirements. This

optimal aspect of climatic parameters involves simple to most advanced engineering inputs such as automation, etc. to regulate several parameters such as ventilation which is one of the most important components in a successful greenhouse production. A major problem with conventional designs of greenhouses is the concentration of heat within the covered structures, which needs to be either expelled or neutralized through energy-intensive cooling facilities. This problem has been overcome by designing naturally ventilated greenhouses where the temperature can be maintained at the desirable level without consuming any energy. Importance of cladding materials in protected cultivation can hardly be overemphasized. Their quality and cost are important besides certification. Micro irrigation and fertigation involves a lot of science and technology, demanding research for continuous improvement. It is the engineering aspect of the protected structure which provides plants optimal conditions to grow normally. Another aspect of protected cultivation is crop production technology which involves development of high-yielding varieties and hybrids of crops suitable for protected cultivation.

Common types of greenhouses being used in India

1. Plastic greenhouses with natural ventilation
2. Greenhouses with fan and pad cooling system
3. Solar greenhouses (Leh design)
4. Walk-in tunnels (Dry temperate areas in HP)
5. Plastic low tunnels
6. Net houses and Anti-insect cages
7. Underground trenches (Leh and Ladakh region)

Government Subsidy policy

Government of India has been providing subsidy to the farmers @ 50% of the total cost indicated below in Table-3 with a maximum ceiling upto 4000 m² per beneficiary under National Horticulture Mission (NHM) and Horticulture Mission for North East and Himalayan States (HMNEH).

Table-3: Subsidy given by Government to farmers

Items	Pattern of Assistance (Rs/m ²) upto 4000 m ² per beneficiary		
	Tubular structure	Wooden Structure	Bamboo Structure
Greenhouse with Fan and Pad system	1465	-	-
Naturally ventilated green- house	935	515	375

Source: Iyengar et al. (2011)

Conclusion

Greenhouse is still in its initial stage in India and efforts are required from all concerned agencies to bring it at par with the global standards. Greenhouses are being commercially used for production of exotic (non-native) and off-season

vegetables, export-quality cut flowers and also for raising quality seedlings. Economic returns from the high value agricultural produce can be increased substantially when grown under greenhouse conditions

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