

# **INCUBATION**

## **CAPACITY BUILDING IN FARMER & STUDENTS FOR PROTECTED CROP CULTIVATION**



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## Introduction

India is famous for its agro-climatic region. It ranges from extreme temperate to extreme tropical region between these sub-tropical parts exist in our country meaning that we have all the types of climate. That results in free to grow all types of crops with suitable climatic conditions. As far as vegetables are concerned, we have diverse groups of vegetables that could be grown from extreme



hot to extreme cold climate. The majority of cultivation practices occur in the plain area, but there is vast scope for the cultivation at the hilly regions. India is a leading country in area and production after China in many crops in the world, but when we talk about the leader in all crops, we see that we are far behind. Vegetable production is much lower than the present requirement to feed the people of India. The reason is predominantly the use of years back technology and cultivation practices is also traditional leading to low productivity. Also, there is a lack of good management practices for the biotic and abiotic stress. There are different ways to revive from this situation. Bringing additional area under vegetable cultivation, use of hybrid seeds and use of improved agro-techniques are some of the important ways to increase the vegetable production. Another approach is cultivation under protected environment. Uncontrolled availability of harsh climate like high wind, hot and humid climate, an extreme cool to extreme hot forces the farmer and scientist to develop a technology for cultivation of crops under prevailing adverse climate conditions.

## Protected Cultivation

Protective cultivation practices can be defined as cropping techniques wherein the micro climate surrounding the plant body is controlled partially/fully, as per the requirement of the plant species grown, during their period of growth. The various types of protective cultivation practices have been adopted based upon the prevailing climatic conditions. Among them, greenhouse/polyhouse is extremely useful for round-the-year vegetable cultivation in temperate conditions. Protected cultivation also known as controlled environment agriculture (CEA) is highly productive, conservative of water and land and also protective of the environment.

## **Why Protected Cultivation?**

The open field production of vegetable encounter with many production constrains like heavy rain, thunderstorms, excessive solar radiation, temperatures and humidity levels above plant growth optima, high insect pest infestation pressure and fungal diseases. Environment is the most determinate factor in horticultural crop. Protected cultivation is being used to control the effect of environment effect. Protected cultivation is the sustainable approach toward the vegetable production under adverse climate. Besides, from protection to adverse climatic condition, the vegetable under protected production yield high quality vegetable in terms of shape, size and colors. The micro climate can be changed inside the poly house. Certain insect require UV light their vision purpose, the UV opaque covering material for poly house helps to restrict the insect to enter the house. Consequently, there is minimum use of insecticide. The production of vegetable is higher than the open field condition due to congenial inside microclimate and that provided better price.

## **Technology for protective cultivation**

The protected cultivation comprises different devices and technologies namely windbreaks, irrigation soil mulches etc. and the structures which are greenhouse, tunnel, row covers made the production throughout the year by modifying the natural environment. It will further prolong the harvest period, increase yield, quality improvement, and keep the availability of commodities frequently.

## **Conventional Production and greenhouse production**

It is the conventional production system, which is based upon the control over the nature of root media through tillage, manure, fertilizer application and irrigation scheduling. It is not a matter of care about light, temperature, air quality, relative humidity affect the crop production in the open field condition. Greenhouse production can be used as one of the solution for above parameters.

## **Classification Criteria of Crop for Protected Cultivation**

A high value, short duration and small size vegetable crops are being mostly suitable under protected cultivation. In India, especially in hill the sweet pepper, tomato and cucumber are being raised. However the leafy vegetables are also suitable for protected cultivation.

Cabbage, cauliflower, tomato, brinjal, capsicum, beans, pea, and coriander can be successfully grown under protected conditions at high altitudinal region.

**Design, Construction and Operation of protected cultivation are shown in following figures.**



### **Production System for Vegetable Crops under Protected Cultivation**

**Geoponics or soil system:-**In this system crops are grown in natural soil under protected cultivation. It has some demerits such as more disease and insect incidence in soil. Flood irrigation water cause high water table which reduce aeration, there by root growth.

**Soilless cultivation:-**In recent decades use of the soilless cultivation method has increased significantly due to the use of methyl bromide as a soil disinfectant between crop cycles is or will be banned soon. New types of substrates are increasing in the same way with the objective of increasing yield and quality with respect to the plants grown in the soil. Several types of substrates are used as soil less media and it protect the crops from different soil infections like coconut fiber, perlite, vermiculite, rock wool, peanut hulls, rice hulls and coco peat etc.

**Hydroponics:-**In this system plants are grown in nutrient and water solution without soil. Terrestrial may be grown with their roots in the mineral solution only or in an inter medium, such as perlite or gravel.

**Aeroponics:-**Plants are grown in troughs, tubes or other type of chambers and roots are hung in air sprayed with nutrient mist. So, it easily absorbs nutrients and oxygen. This technique has less chance of root diseases.

**Temperature maintenance:**-The several crops can be grown in a wide range of temperature, but for better growth and development individual crops requires a specific range of temperature. It is possible under protected cultivation.

**Climate control system:**-Production of vegetable crops during unfavorable climatic conditions, such as high temperature, flooding, and strong winds suffered from incidence of diseases high. It needs to control for the successful crop production. Greenhouse production system is one of the most suitable systems, most efficient mean to obtain high quality fresh vegetables for both domestic and export markets. It is suitable in rainy and cold climate. Inside, the house there is gradually increased in temperature due to heating effect of high irradiation. Actually the incidence light get trap inside the greenhouse and not escape out leading to temperature rise. Several methods are available for cooling greenhouses like evaporative cooling, shading and natural ventilation.

**Water management:**-Water is the most important factor that affect the production system of vegetable crops. It is not possible to grow the vegetable crop during the high rainfall, as vegetable are succulent and tender in nature, high rainfall will drops the quality of vegetable crops. To reduce the consequences of high rainfall and high wind, the protected cultivation are the most suitable technique. It will produce the high quality of vegetable throughout the year.

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**Pest and disease control:**-To control the insect pest inside the house, insect-proof screens have been used to cover the ventilation openings. By keeping away the vector (insect), we could control the viral disease. Singh et al. (2015) observed, that under the poly-houses and shade net house (35%), though the pest like the aphid and white fly were able to enter the shade-net but not caused any serious infestation.

**Higher yield:**-Poly-houses (PHs) and shade-net houses SNHs (35%) were found fairly useful to create favorable microclimate for plant growth and higher yield and also for minimization of pest infestation.

## **Response of Individual Crops to Protected Cultivation**

**Tomato:**-Tomato requires a relatively cool, dry climate for high yield and premium quality. When the temperature falls below the 10°C, it causes problem with the pollen bursting, while the higher temperature causes premature fruit drops in tomato. Mostly the lower in temperature affected the crop production as there is problem with fertilization and less fruit yield. A high temperatures fruits are often badly damaged or misshaped and not marketable, while the red varieties tend to become more orange. These problems can be overcome with the maintained of temperature in protected cultivation. The temperature when rises above the 30°C, both the pollen grain and stigma may dry out, which causes poor fruit set.

**Coriander:**-Coriander establishes and grow well with higher biomass production in naturally ventilated polyhouse.

**Cucumber:**-Cucumber production cultivated in PE bags using perlite, sand and volcanic scoria as substrates was better than soil production. Low-cost, naturally ventilated greenhouses were the most suitable and economical for year-round cucumber cultivation on the northern plains of India.

**Sweet pepper:**-It can be successfully grown under zero energy naturally ventilated greenhouse condition.

**Capsicum:**-Capsicum is a most extensively grown vegetable under green houses and gives higher returns.

**Brinjal:**-With the development of parthenocarpic hybrids in brinjal, now it is possible to grow it under the protected conditions.

## **Conclusion**

The protected cultivation of vegetable crops is an advantageous technology for farming community because is cost effective technique. Vegetables grown by this method is safe to consume due to less use of chemicals. This technique also provides congenial environment to off season cultivation as well as high and quality production. Therefore, increasing demand of vegetables for growing population can be fulfilled by this technology.