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Sustainable Vegetable Production Through Use of Greenhouse Cultivation Techniques

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Protected cultivation is a cropping technique where 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**.** Greenhouse technology is the most practical way of achieving the goal of protected cultivation.

Introduction

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. With the advancement in agriculture, various types of protective cultivation practices suitable for a specific type of agroclimatic zone have emerged. Among these protective cultivation practices, greenhouse/polyhouse is extremely useful for round-the-year vegetable cultivation.

Advantages of Protected Cultivation

- Poly house give 5-6 times higher production compared to open field for round the year.
- High input use efficiencies are achieved.
- Grown under unfavorable agro climatic condition.
- Protection from excess rainfall, wind, extreme cold, birds, Animals, human activity and minimum space maximum production per unit area.
- Minimum use of water and fertilizers.
- Diseases and pests can be controlled easily.
- Quality of product is superior.
- Ideally suited for production of genetically engineered and micro propagated veg. varieties and hybrids.

Basic Requirements

The Technology of producing horticultural crops in greenhouses has been around for decades. Greenhouse production provides growers with the ability to achieve significantly higher yields than open field production. Ph meter, EC meter, Thermometer, Electronic Scale – 5 lbs. capacity, Measuring Cylinder, Relative Humidity meter, etc.

Growing Mediums

There are presently in use are soil [direct], soil with gravel in bags, coir, perlite, etc.

Water: Availability and quality of water should be checked. Access to good quality water is one of the most important inputs for greenhouse production. At their early stage, crops require at least

0.75 to 1 liter per plant, per day and this increases at the blooming, fruiting, and harvesting stages. High yielding indeterminate tomatoes before harvest may require up to 2.5 to 3.00 liters per plant per day.

Growing in the soil: The soil should be properly prepared to allow for excellent development of the root system. It is best to use Raised Beds which ensures less compaction and room for workers to manoeuvre. Beds should be 1.7 meters from centre to centre of beds. The suggested planting distance is 3 two rows per bed, 40 centimeters between plants along the bed and 50 centimeters between rows staggered for tomato and sweet pepper.

Drip Irrigation System

The Components are water tanks, water pumps – electric or gas, elevated stand of about 5 feet to support tanks for gravity feed, filter systems, pipes, drip lines or spaghetti system [Micro Tube 5/3]

Irrigation: The quantity of water used is dependent on the soil, the weather condition, growth stage of the plant and the pressure. The recommended pressure is between 8–12 psi. For the spaghetti system [Micro Tube 5/3] an electric pump is used, giving a pressure of 15 psi at the dripper. Also when using bags e.g. 6 x 11 x 14 two drippers are used per bag, with a dripper on either side of the plant.

Fertilization Program

Plants are fertilized every time water is added except once per week when the system is cleaned. It is best to use individual soluble fertilizers when available to make the mixture. This is after a chemical analysis of the soil is done.

Plant Support System

This can be made from any affordable material available e.g. bamboo, wood and metal. The wire at the top of the system should be about 2.5 meters above ground.

Trellising or Plant Training

The cord and wires should be in place immediately after transplanting. White is the recommended color of the cord. Plant training is done as required, possibly weekly.

Tomato pruning involves three operations; **(i)** Suckers – to be removed twice weekly. (**ii**) Fruits – to be removed weekly (done during (a) developmental stage (b) to facilitate marketable fruit size). (**iii**) Leaves – five days before harvest remove the lower leaves up to the lowest fruit bearing cluster.

Kind of Protected Cultivation

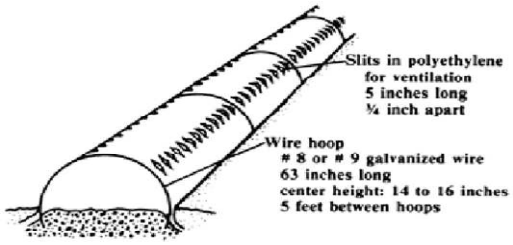
1. Glass House.
2. Poly House.
3. Shade Net House.
4. Poly tunnel.

1. Glass House (High-tech.): These types are popular in Netherland where evaporative cooling and heaters are used to maintain required temperature inside glass house and the water and nutrient supply are maintained by the mist and drip irrigation system with fertigation. It is suited for high value blemish free crops like tomato, cauliflower, cherry tomato, sweet pepper, musk melon and cucumber.

2. Poly House: These are mainly being used in Turkey and Japan where naturally Ventilated Poly houses are provided to maintain a favorable temperature and humidity during summer with water and nutrient supply by the drip irrigation system with fertigation.

3. Shade Net (Greenhouse): The greenhouse top is covered with side walls having insect proof nets from ground to height of 5-6 feet with manually foldable net cover. Mainly used for production of cucumber, muskmelon, tomato in Japan, Israel and Turkey**.**

4. Low Tunnels: Low tunnels and small walk-in tunnels are actually miniature greenhouses. These can be various types depending on material used like row cover materials, clear (non-perforated) – too hot, clear (perforated) – hot, white (perforated) – warm, green (perforated) – warm, woven – warm, etc.



Slitted Row Cover

There are five different types of environmental parameters maintained in a protected area. These are:

Light: Light is a most critical factor for poly house. PAR (Photosynthetically active radiation) between 400-700 nm is important for photosynthesis, production & crop development. UVR of 315-400 nm influence stem & leaf development. NIR – wavelength of 700-3000 nm is responsible for heating. FIR- wavelength of 3,000-100,000 nm causes the green house effect. We can reduce sunlight 30%, 50%, 75% in shed net. The 50% shed net are common in India.

Temperature: For healthy and maximum growth of vegetables, the temperature requirement is between 26'C to 30'C during day time and 15'C to 18'C in night. To control the temp inside the poly house, the ventilation as well as cooling pads and fans are used. Because of this we can have continuous quality production of vegetable throughout the year.

Carbon–Di-Oxide: In our surrounding atmosphere, there is CO_2 which is used by plants for photosynthesis. In poly house, during night time there is no photosynthesis but CO_2 is given out by respiration. It has been proved that if a poly house is having 1000-2000 ppm of CO_2, then vegetables production can increase to 4 to 5 times more compare to normal conditions.

Humidity: For vegetables, we should have proper humidity from 60% to 65%. It is because of controlled humidity, plant growth remain continue, their shelf life also increases. Humidity helps in color combination of vegetables.

Wind movement: If humidity is more in polyhouse, then chances of diseases and pest increases. Under such condition, side vents of polyhouse are opened to promote wind movement in polyhouse. Because of wind movement the humidity decreases and chances of diseases also reduced.

Comparative study between open field condition and protected condition

Protected	Open
High yield 5-6 times	Less yield
Good fruit appearance	less
All most all marketable produce	50-80 %, 30% during rainy season
Easily control insect and pest	Difficult
Duration is fixed	Not fixed
No threat of damage	Doubt

Estimation cost for 500 m^2 areas of different Polyhouses

Type of green house	Cost/m^2 (Rs)	Subsidy (%)	Ceiling Area	Ceiling Amount (Rs.)
Low cost	125	50	500	31,250
Medium cost	500	40	500	1,50,000
High cost	2000	10	500	9,00,000

Reference

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