

Basics of Greenhouse in Horticulture

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Abstract—A greenhouse is a structure with walls and roof made chiefly of transparent material, such as glass, in which plants requiring regulated climatic conditions are grown. These structures range in size from small sheds to industrial-sized buildings. Greenhouse cultivation as well as other modes of controlled environment cultivation has been evolved to create favorable micro-climates, which favours the crop production could be possible all through the year or part of the year as required. Greenhouses and other technologies for controlled environment plant production are associated with the off-season production of ornamentals and foods of high value in cold climate areas where outdoor production is not possible.

Classification of greenhouse based on suitability and cost

a) Low cost greenhouse

Low cost greenhouse is a simple structure constructed with locally available materials such as bamboo, timber etc. The ultra violet (UV) film is used as cladding materials. No specific control device for regulating environmental parameters inside the greenhouse is provided. Simple techniques are, however, adopted for increasing or decreasing the temperature and humidity. The temperature can be reduced during summer by opening the side walls. Such structure is used as rain shelter for crop cultivation. This type of greenhouse is mainly suitable for cold climatic zone.

b) Medium-tech greenhouse

Greenhouse users prefers to have manually or semiautomatic control arrangement owing to minimum investment. This type of greenhouse is constructed using galvanized iron (G.I) pipes. Whole structure is firmly fixed with the ground to withstand the disturbance against wind. Exhaust fans with thermostat are provided to control the temperature. Evaporative cooling pads and misting arrangements are also made to maintain a favorable humidity inside the greenhouse. These greenhouses are suitable for dry and composite climatic zones.

c) Hi-tech greenhouse

To overcome some of the difficulties in medium-tech greenhouse, a hi-tech greenhouse where the entire device, controlling the environment parameters, are supported to function automatically.

Cost involved

1. Less expensive greenhouse without fan and pad Rs.300 to 500/m²
2. Medium cost greenhouse with pad and fan system Rs.800 to 1100/m²
3. Expensive greenhouse with fully automatic control system Rs. 2000 to 3500/m²

Classification as per type of structure

- a) Quonset type
- b) Curved roof type
- c) Gable roof type

Classification as per glazing

- a) Glass glazing
- b) Fiberglass reinforced plastic glazing
 - i) Plain sheet
 - ii) Corrugated sheet
- c) Plastic film
 - i) Ultra violet stabilized low density poly ethylene
 - ii) Silpaulin

Classification based on number of spans

- a) Single span
- b) Multispan or ridge and furrow or gutter connected

Classification based on environmental control

a) Naturally ventilated greenhouse

These greenhouse do not have any environmental control system except for the provision of adequate ventilation and fogger system to prevent basically the damage from weather and other natural agents.

b) Environmental controlled greenhouse

This type of polyhouse helps to extend the growing season or permits off-season production by way of controlling light, temperature, humidity, carbon-dioxide level and nature of root medium.

2. Orientation of greenhouse

East-west orientation is the best suited for year round greenhouse applications at all latitudes as this orientation receives greater total radiation in winter and less in summer except near the equator.

Design

The structure has to carry the following loads and is to be designed accordingly.

Wind load

The structure should be able to withstand winds of 110 kilometer per hour and at least 50 kg per square meter of wind pressure.



Strawberry under greenhouse

Wind effects

If the greenhouse is naturally ventilated, the advantage of natural wind direction has to be taken to the maximum possible. The maximum dimension (length) of greenhouse should be perpendicular to the wind direction especially in summer. For fan and pad greenhouse the natural wind direction should be same as the air blown by fan.

Size of the greenhouse

The dimension of GH should not be more than 50m x 50m. Bigger the greenhouse more will be the temperature build up due to poor ventilation.

Spacing between greenhouses

The spacing between naturally ventilated greenhouses should be 10 to 15 m so that the exhaust from one greenhouse should not enter the adjacent greenhouse.

Height of greenhouse

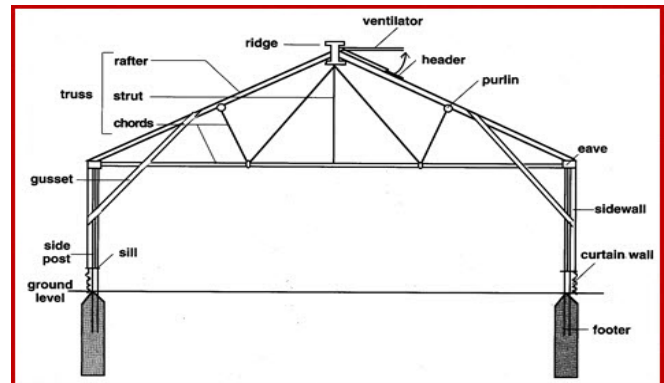
The maximum height can be up to 5m for 50m x 50m green house and this can be reduced as per the reduced size of the green house. Higher is the greenhouse more is the wind load for structure and glazing. The side ventilation can be of 2 m width and roof ventilation is 1m in width.

3. Components of greenhouse

Gutter: collects and drains rain water and snow which is place at an elevated level between two spans.

Purlin: a member who connects cladding supporting bars to the columns

Ridge: highest horizontal section in top of the roof



Cladding material

Polythene proves to be an economical cladding material. Plastics are used in tropical and sub-tropical areas compared to glass/fiberglass owing to their economical feasibility. LDPE (low density polyethylene) / LLDPE (linear low density polyethylene) will last for 3-4 years compared to polythene without UV stabilizers.

4. Uses of containers in greenhouse production

- Raising of seedlings in the nursery.
- Growing plants in greenhouses for hybrid seed production of flowers.
- Growing plants for cut flower production.
- Growing potted ornamental plants.

Advantages of containers in greenhouse production

Increase in production capacity by reducing crop time.

- High quality of the greenhouse product
- Uniformity in plant growth with good vigour.
- Provide quick take off with little or no transplanting shock.
- Easy maintenance of sanitation in greenhouse
- Easy to handle, grade and shift or for transportation.
- Better water drainage and aeration in pot media.
- Easy to monitor chemical characteristics and plant nutrition with advanced irrigation systems like drips.

Maintenance of pad

- By shading the pads and sumps
- By avoiding nutrient contamination
- By draining and disinfecting the sump regularly
- By replenishing 20% of circulating water each time to avoid scaling of minerals.

Media preparation for greenhouse production

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- A desirable medium should be a good balance between physical properties like water holding capacity and porosity.
 - The medium should be well drained.
 - Medium which is too compact creates problems of drainage and aeration which will lead to poor root growth and may harbour disease causing organisms.
 - The media reaction (pH of 5.0 to 7.0 and the soluble salt (EC) level of 0.4 to 1.4 dS/m is optimum for most of the greenhouse crops).
 - A high pH of the media can be reduced by amendments like sulphur, gypsum and Epsom salts, acidic fertilizers like urea, ammonium sulphate, ammonium nitrate, mono ammonium phosphate and aqua ammonia and acids like phosphoric and sulphuric acids.
 - It is essential to maintain a temperature of the plug mix between 70 to 75°F. Irrigation through mist is a must in plug growing. Misting for 12 seconds every 12 minutes on cloudy days and 12 seconds every 6 minutes on sunny days is desirable.
 - The pH of water and mix should be monitored regularly.