Green House Technology-Meaning, Types Advantages, Disadvantages, and Components

this article, we have described the meaning, important objectives, types, advantages, disadvantages, and key components of greenhouse technology which is known as protected cultivation practices or controlled environment agriculture (CEA).

In this technology the environmental conditions are controlled by using greenhouse or glasshouse technology so that we can grow any plants in any place or time by providing suitable environmental conditions, So it's also called smart farming technology.

Introduction of Green House Technology:

Greenhouse technology is the process of growing plants/crops in a controlled environment and extreme adverse climatic conditions. This means that the temperature, humidity, light, and other factors can be regulated as per the requirement of the crops which is called greenhouse technology or climate controlled greenhouse.

Greenhouse technology is the method of establishing an ideal environment for plants. This technique protects plants from severe environmental conditions such as wind, excessive radiation, cold, precipitation, extreme temperatures, insects, and diseases.

What is Green House?

A greenhouse is a framed or covered, structure with walls and a roof primarily made of transparent materials like glass or plastic, which ample sunlight for crop production and has provisions for at least partial design to create a controlled environment for plant growth.

Green house technology also known as Protected cultivation, Controlled environment agriculture, Indoor farming systems, Climate-controlled greenhouses and Smart farming technology.

A greenhouse depending upon the transparency of glazing materials admits the sunlight which is absorbed by the plant equipment, structure, and floor. As a result of this, a part of the solar energy is continuously retained in the greenhouse, leading to a temperature increase.

Importance Objectives of Greenhouse:

The main objective of a greenhouse is to enable create the specific environment for the needs of your plants and establish a technologically advanced, automated, and sustainable greenhouse system for the production of high-quality crops. Green house technology aims to facilitates agricultural research and development, testing new crops, techniques, and technologies in a controlled setting. Given below are some important objectives of green house technology.

- The purpose of a greenhouse is to provide optimal conditions for growing plants by regulating temperature, humidity, and light.
- It is used to create a microclimate that suits the specific requirements of different plants.
- To raise crops more quickly, effectively, and under nearly any situation.
- To optimize the use of water, fertilizers, and other resources, reducing waste and environmental impact.
- To optimize growing conditions.
- To Enhance crop quality.
- To increase yields per unit areas.
- To protects plants from adverse weather, pests, and diseases, extending growing seasons.
- To promote of high value, and quality horticultural crops.
- To production of off-season vegetables, flowers and fruits, etc.

Classification/ Types of Greenhouse:

There are various types of greenhouses based on cost, shape, utility, construction, covering materials, and climate control mechanisms.

Some of the most used greenhouses are forced-ventilated greenhouses, lean-to-type greenhouses, even span greenhouses, uneven span greenhouses, ridge saw tooth greenhouses, and Quonset greenhouses.

Greenhouses are classified based on cost, shape, utility, construction, covering materials, and climate control mechanisms which are described as given below:

1. Classification of greenhouse based on cost:

Greenhouses based on cost are classified into three types low, medium, and high cost.

a. Low-cost greenhouse:

- It is fabricated mainly using local and low-cost available materials like wooden logs or bamboo.
- These structure are small in size and have a short life span.
- The height of low-cost greenhouse structure is less then medium and high greenhouse.
- The protection of wooden structures from insects and termites are major challenge.

b. Medium-cost greenhouse:

- It is generally fabricated using galvanized iron square or rectangular or round pipes or lipped channels or their combination.
- This structure is firmly fixed in the ground to withstand high speed wind up-to 140km/hr.
- The normal height of these structures ranges between 6.5-7m and these are mostly naturally ventilated.

c. High-cost greenhouse:

- For the production of sensitive, off-season, exotic, or quality crops.
- Sometimes medium-cost greenhouses cannot deliver the requisite quality.
- Therefore, high-cost greenhouse structures, which can precisely regulate the climatic and nutritional needs of the plants are required.
- The approximate cost of these greenhouse ranges between Rs. 1500-2500 per sqm depending upon the size of the structure.

2. Greenhouse type based on shape:

Greenhouses can be classified based on their shape or style. The commonly followed types of greenhouse on shape are:

a. Lean-to-type greenhouse:

- A lean-to greenhouse design is used when a greenhouse is placed against the side of an existing building.
- It is built against a building, using the existing for one or more of it's sides.
- lean-to-type greenhouse is limited to single or double roe plat benches with total width 7-12 feet.

b. Even span type greenhouse:

Even span type greenhouse is the standard type and full size structure, the two roofs slopes are equal pitch and width. This design is used for the greenhouse of small size and constructed on ground level. The cost of even span type greenhouse is more than lean-to-type.

c. Uneven span type greenhouse:

This type of greenhouse is constructed on hilly terrain. The roofs are of unequal width make the structure adoptable to the side slopes of hill. This type of greenhouse is seldom used now a days as it is not adoptable for automation.

d. Ridge and Furrow type greenhouse:

This type of greenhouse use of two or more a frame greenhouse connected to another along the length of the eave. The eave serves as furrow or gutter to heavy rain and melted snow away.

e. Saw tooth type greenhouse:

These are also similar to ridge and furrow type greenhouse expect that, there is provision for natural ventilation in this type specific natural ventilation flow path develops in a saw-tooth type greenhouse.

f. Quonset greenhouse:

This is a greenhouse, where the pipe arches or trasses are supported by pipe purling running along the length of greenhouse. This types of greenhouse general covering materials us Polyethylene used.

3. Greenhouse type based on utility:

Greenhouse type based on the utility are classified under two types active heating and active cooling.

a. Greenhouse for active heating:

During the night time, air temperature inside greenhouse decrease. To avoid the cold bite to plants due to freezing, some amount of heat has to be supplied. The requirements for heating greenhouse depends on the rate at which the heat is cost to the outside environment.

b. Greenhouse for active cooling:

During the summer season active cooling is desirable to reduce the temperature of green house than the ambient temperature for effective crop growth.

4. Greenhouse type based on construction:

a. Wooden framed structure:

In general, for the greenhouse with span less than 6 m, only wooden framed structures are used. Side parts and columns are constructed of wood without use of a truss.

b. Pipe framed structure:

Pipes are used for construction of greenhouse, when the clear span is around 12m. In general, the side posts, columns, cross ties, and purlins are constructed using pipes. In this type the trusses are not used.

c. Truss framed structure:

If the greenhouse span is greater than or equal to 15m, truss frames are used. Flat steel, tubular steel or angular iron is welded together to form a truss encompassing rafters, chords and truss.

5. Greenhouse type based on covering materials:

There are four types of green house based on covering materials.

a. Glass greenhouse:

These greenhouse have higher air infiltration rate which leads to lower interior humidity and better disease prevention.

b. Plastic firm greenhouse:

In this greenhouse flexible plastic firms including polyethylene, polyester, and polyvinyl chloride are used.

c. Rigid panel greenhouse:

Polyvinyl chloride rigid panels, fiber glass, rain forced plastic, and the polycarbonate rigid panels are employed as the covering material in the Quonset type frames or ridge and furrow type frame.

d. Shading nets:

Shade netting are designed to protect the crops and plants from UV radiation, but they also provides protection from climate conditions, such as temperature variation, intensive rain and winds.

6. Greenhouse type based on climate control mechanisms:

Greenhouse type based on climate control mechanisms are classified into two types naturally ventilated and forced ventilated greenhouse.

a. Naturally ventilated greenhouse:

The climatic parameters such as temperature, humidity, Co2 in these polyhouse are maintained and controlled through natural air convection without using any additional systems, but operated manually.

b. Forced ventilated greenhouse:

The climatic parameters such as temperature, humidity, Co2 in these polyhouse are maintained and controlled through forced air convection using fan and pad system, and foggers.

Advantages of Greenhouse:

Greenhouse technology has transformed modern agriculture, offering numerous benefits that significantly enhance crop production and sustainability. By providing a controlled environment, greenhouses enable year-round cultivation, protecting plants from adverse weather conditions and pests.

This advanced agricultural method not only boosts yields and improves the quality of produce but also optimizes resource use, making it a sustainable choice for farmers.

In given below, we will explore the key advantages of greenhouse technology, emphasizing the reasons it is essential for increasing farming's productivity and profitability.

1. The main advantages of greenhouse technology is off-season cultivation of crops is possible in around the year.

2. Greenhouse technology helps to provide excellent opportunity to produce export quality crop.

3. It improved quality and quantity of produce crops with long shelf-life extend.

4. The another benefits of greenhouse technology is effective utilization of inputs.

5. Another significant of greenhouse is to controlled condition there is better plant growth, germination and crops mature faster.

6. Potential for reduced pesticide and fertilizer use, It helps to lower environmental impact.

7. Another benefits of greenhouse technology is easy to management of insect, pest, and disease as compared to the open field.

8. In greenhouse quality seedling and planting materials is possible to produce early.

9. main pros of protected cultivation is to boosts yields and improves the quality of produce but also optimizes resource use, making it a sustainable choice for farmers.

10. The purpose of a greenhouse is to provide optimal conditions for growing plants by regulating temperature, humidity, and light.

Disadvantages of Greenhouse:

The key disadvantages of greenhouse technology is high initial cost, and ongoing operational costs can be significant barriers for many farmers.

The biggest drawback of greenhouse technology is that managing a controlled environment requires specialized knowledge and expertise but farmers aren't knowledgeable about these techniques.

There are many disadvantages of greenhouse technology which are explored below:

1. High cost of initial investment/infrastructure.

2. Non-availability of skilled or knowledgeable human power and their replacement locality.

3. lack of technical knowledge and skills of growing crops under greenhouse.

4. All the operations are very intensive and requires constant effort.

5. Requires close supervisions and regular monitoring.

6. A few soil borne pathogen and insects/pest are difficult to manage.

7. Repair and maintenance cost are also high and difficult.

8. Costs for heating, cooling, lighting, and other systems are also expensive.

Factor Responsible for Selection of Specific Design of Greenhouse:

The following factors are kept into consideration while selecting a specific design of greenhouse:

- Easy availability of raw materials
- Types of crop to be grown
- Local climatic conditions.
- Market demand of the produce
- Investing capacity of the farmers.
- Appreciation to the produce
- Ventilation and Heating Systems
- Sustainability and Environmental Impact
- Local Regulations and Permits
- Technological Integration.

What are the Major Components of Greenhouse:

A greenhouse is constructed with different materials and their components. In this session we will discuss the major components of green house with their features and function used in greenhouse construction.

1. Cladding Materials:

Polyethylene or other transparent materials used for walls and roof of a greenhouse for protection as well as transparency. Which simulates climatic condition inside the greenhouse is called cladding material. The materials could be made of polycarbonate, glass or poly sheets. These firms are normally UV-established, 200 micron thick and fixed with aluminum profiles using zigzag springs.

2. Polyhouse firm:

In this components there are two types of properties that is compulsory and optional properties. under the compulsory UV-establish and optional UV-blocking firms.

3. Gutter:

It is used for collecting rainwater from the roof of the greenhouse and are placed at an elevated level between two spans. Gutter are made of galvanized sheet of 2mm thickness in trapezoidal shape, It should be leak-proof.

4. Foundation Pipe:

It is connects the structure and the ground. These are galvanized iron tubular square pipe and angle. These item are used to erect stable frame to support the cladding and other system in the greenhouse.

5. Polyhouse length and width orientation:

Polyhouse width is the dimension of the polyhouse along the gutter and length is the dimension of the polyhouse in the direction of gable .

6. Micro-irrigation system:

Micro irrigation system is the best way for watering plants in a polyhouse as per the daily needs and the stage of the crops.

7. Fertigation equipment:

For providing fertilizer to the plants as per their daily needs water soluble or liquid fertilizers are injected in the irrigation mainlines feeding the greenhouse crops.

8. Spraying system:

This system used for spraying required chemicals on the crop to control pests and diseases.

9. Exhaust:

For removing hot air from the green house in forced ventilated greenhouse, cooling pads are used for cooling air entering into the greenhouse.

10. Shading nets:

These are used for controlling light intensity falling on the crops inside the greenhouse. Various shading nets with shading capacities like 35%, 50%, 75% are used for different crops and seasons.

11. Sensors and Controllers:

They are used for controlling climatic parameters automatically inside hi-tech greenhouses.

Conclusion:

I hope you understand about the green house technology. Green house technology is also known as protected cultivation practices or controlled environment agriculture (CEA).

Where plants are grown under controlled environmental conditions with provide favorable conditions.

This technique protects plants from severe environmental conditions such as wind, excessive radiation, cold, precipitation, extreme temperatures, insects, and diseases.

There are many advantages of greenhouse technology and some of the disadvantages are also included. Still, every farmer needs to improve and expand our traditional farming into modern farming because it helps to increase productivity and quality improvement of crops.