

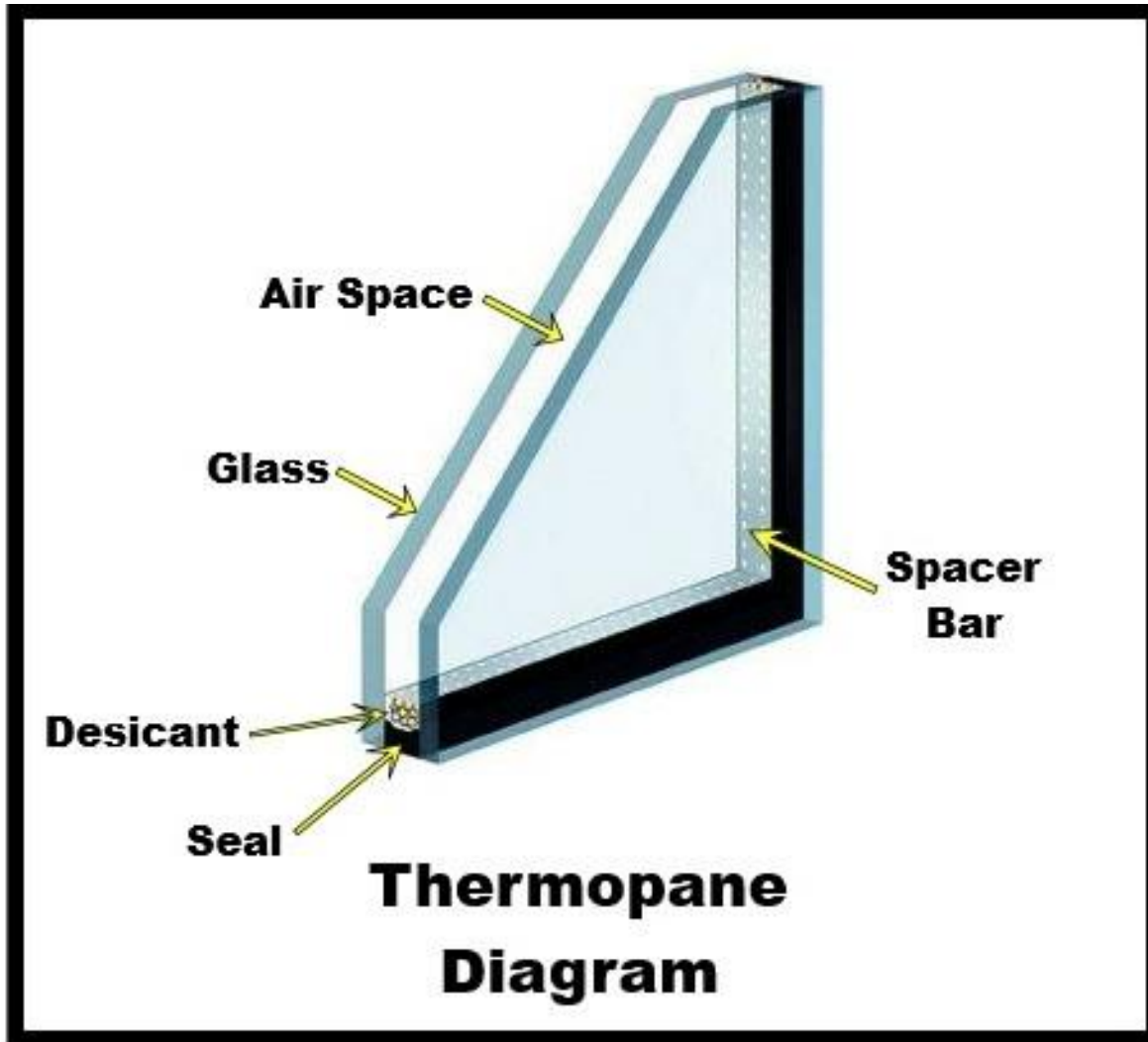
# **Greenhouse Type Based on Utility**

**PROTECTED CULTIVATION AND  
POST HARVEST TECHNOLOGY  
(ASAE3204)**

- Classification can be made depending on the functions or utilities.
- Of the different utilities, artificial cooling and heating are more expensive and elaborate.
- Hence based on this, they are classified in to two types.
  1. Greenhouses for active heating.
  2. Greenhouses for active cooling.

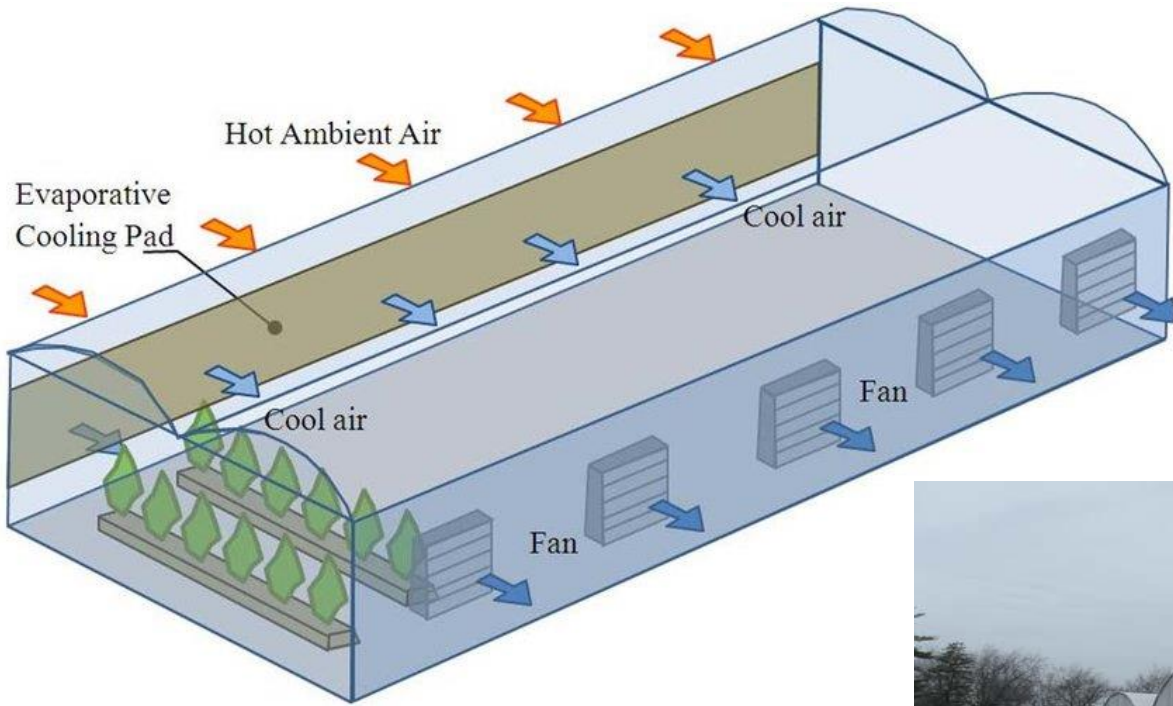
# Greenhouses for active heating

- During the night time, **air temperature inside greenhouse decreases.**
- The requirements for heating greenhouse depend on the rate at which the heat is lost to the outside environment.
- Various methods are adopted to reduce the heat losses, viz., using
  1. **Double layer polyethylene,**
  2. **Thermo pane glasses** (two layers of factory sealed glass with dead air space) or
  3. **Heating systems,** such as unit heaters, central heat, radiant heat and solar heating system.



# Greenhouses for active cooling

- During summer season, it is **desirable to reduce the temperatures of greenhouse** than the ambient temperatures, for effective crop growth.
- This type of greenhouse either consists of **evaporative cooling pad with fan or fog cooling** .
- This greenhouse is designed in such a way that it permits a **roof opening of 40%-100%**.



# **Greenhouse Type Based on Construction**



- The type of construction is **influenced by structural material**, though the covering material also influences the type.
- *Higher the span, stronger should be the material.*
- So based on construction, greenhouses can be classified as:
  1. Wooden framed structure.
  2. Pipe framed structure.
  3. Truss framed structure.

# Wooden framed structures

- The span of green house is less than 6 m.
- Side posts and columns are constructed of wood without the use of a truss.
- **Pine wood** is commonly used as it is inexpensive and possesses the required strength.
- **Timber** locally available, with good strength, durability and machinability also can be used for the construction.

# Wooden framed structures



# Pipe framed structures

- Pipes are used for construction of greenhouses, when the clear span is around 5-12m.
- In general, the side posts, columns, cross ties and purlins are constructed using pipes. In this type, the trusses are not used.

# Pipe framed structures



# Truss framed structures

- 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 struts.
- **Struts** are support members **under compression** and **chords** are support members **under tension**.

- Angle iron purlins running throughout the length of greenhouse are bolted to each truss.
- Columns are used only in very wide truss frame houses of 21.3 m or more.
- Most of the glass houses are of truss frame type, as these frames are best suited for pre-fabrication.

# Truss framed structures





# **Greenhouse type based on covering materials**

- **Covering materials** are the major and important component of the greenhouse structure.
- Covering materials have **direct influence on the greenhouse effect inside the structure** and they **alter the air temperature inside the house.**
- The **types of frames and method of fixing** also **varies** with the covering material.
- Based on the **type of covering materials**, the greenhouses are classified as:
  - 1. Glass,**
  - 2. Plastic Film And**
  - 3. Rigid Panel Greenhouses.**

# Glass greenhouses

- Glass as covering material has the advantage of **greater interior light intensity**.
- These greenhouses have **higher air infiltration rate** which leads to **lower interior humidity** and **better disease prevention**.
- **Lean-to type, even span, ridge and furrow type of designs are used for construction of glass greenhouse.**

# Glass greenhouses



# Plastic film greenhouses

- Flexible plastic films including *polyethylene*, *polyester* and *polyvinyl chloride* are used as covering material in this type of greenhouses.
- **Plastics** as covering material for greenhouses have become **popular**, as they are **cheap** and the **cost of heating is less** when compared to glass greenhouses.
- The main *disadvantage* with plastic films is its *short life*.

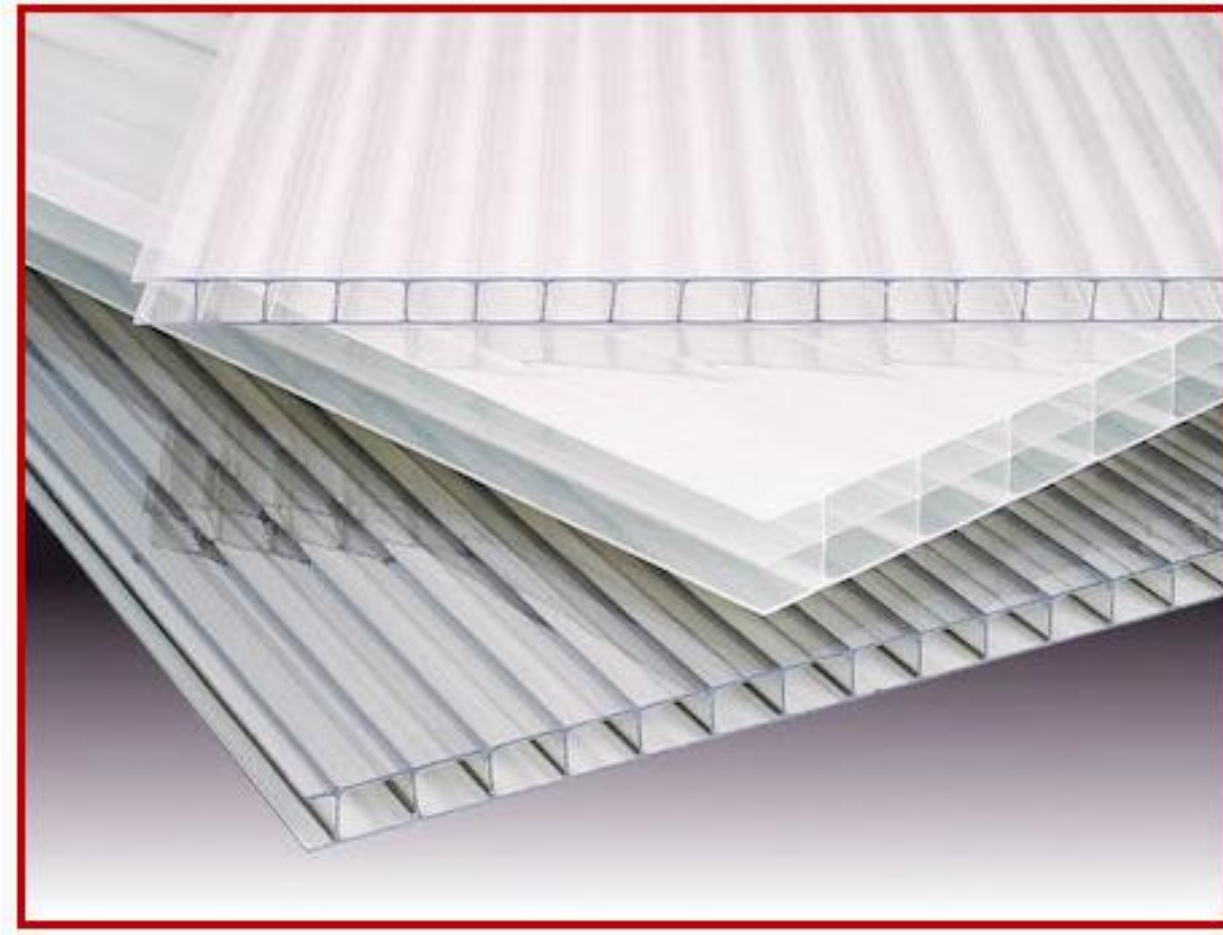
- For example, the best quality ultraviolet (UV) stabilized film can last for 4 years only.
- Polycarbonate has a life span of 15-20 years.
- Polycarbonate is better than glass.
- *Quonset design as well as gutter-connected design is suitable for using this covering material.*



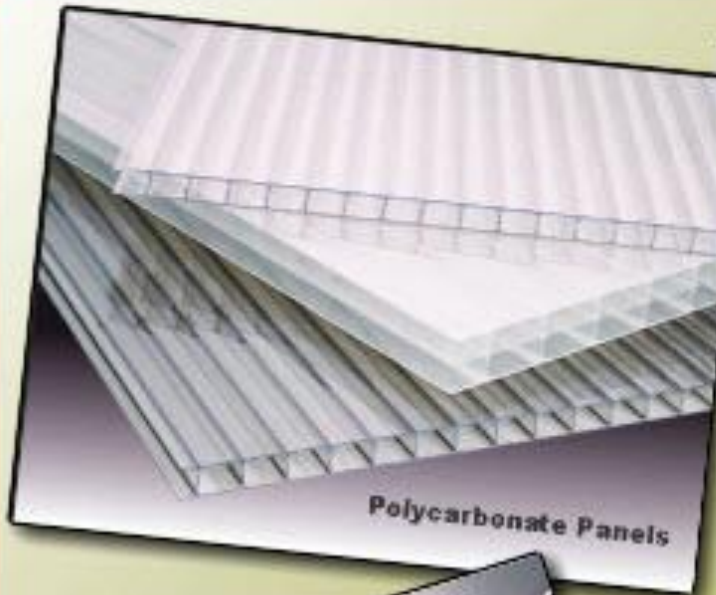
# Rigid panel greenhouses

- Polyvinyl chloride rigid panels, fibre glass-reinforced plastic, acrylic and polycarbonate rigid panels are employed as the covering material.
- This material is more resistant to breakage and the light intensity is uniform throughout the greenhouse when compared to glass or plastic.
- High grade panels have long life even up to 20 years.
- The main disadvantage is that these panels tend to collect dust as well as to harbor algae, which results in darkening of the panels and subsequent reduction in the light transmission





## **Polycarbonate Covering**



**Polycarbonate Panels**



**Acrylic panels**



# **Greenhouse type based on cost of construction**

1. High cost Green House
2. Medium cost Green House
3. Low cost Green House

# Low cost greenhouse

- These are of 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 are provided.
- Simple techniques are, however, adopted for increasing or decreasing the temperature and humidity.
- Even light intensity can be reduced by incorporating shading materials like nets.

- The temperature can be reduced during summer by opening the side walls.
- Such structure is used as rain shelter for crop cultivation.
- Otherwise, inside temperature is increased when all sidewalls are covered with plastic film.
- This type of greenhouse is mainly suitable for cold climatic zone.



# Medium cost 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**.
- The **canopy cover** is attached with structure with the help of screws.
- 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.
- As these system are semi-automatic, hence, require a lot of attention and care, and it is **very difficult** and cumbersome to **maintain** uniform environment throughout the cropping period.
- These **greenhouses are suitable for dry and composite climatic zones.**

# High cost 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**.
- There is a control system **consisting of sensor, computers and data logger ( signal receiver)**.
- All the control systems are aim to provide satisfying the condition provided by the sensor.
- The whole system is **controlled by the help of microprocessor and operator**.



# Shading net



- Shade nettings are designed to protect the crops and plants from UV radiation, and provide protection from climate conditions.
- Better growth conditions can be achieved for the crop due to the controlled micro-climate conditions “created” in the covered area, with shade netting, which results in higher crop yields.

- All nettings are UV stabilized to fulfill expected lifetime at the area of exposure.
- They are characterized of high tear resistance, low weight for easy and quick installation with a 30-90% shade value range.
- A wide range of shading nets are available in the market which are defined on the basis of the percentage of shade they deliver to the plant growing under them.





