**Lecture 29 Classification of Greenhouse**

Greenhouses are frames of inflated structure covered with a transparent material in which crops are grown under controlled environment conditions. 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. The primary environmental parameter traditionally controlled is temperature, usually providing heat to overcome extreme cold conditions. However, environmental control can also include cooling to mitigate excessive temperatures, light control either shading or adding supplemental light, carbon dioxide levels, relative humidity, water, plant nutrients and pest control.

**29.1 Types of Greenhouse**

Greenhouses are a technology based investment. The higher the level of technology used the greater potential for achieving tightly controlled growing conditions. This capacity to tightly control the conditions in which the crop is grown is strongly related to the health and productivity of the crop.  The following three categories of greenhouse have been defined to assist people in selecting the most appropriate investment for their needs and budget.

**Low technology greenhouses**

These greenhouses are less than 3 m in total height. Tunnel houses, are the most common type. They do not have vertical walls. They have poor ventilation. This type of structure is relatively inexpensive and easy to erect. Little or no automation is used. While this sort of structure provides basic advantages over field production, crop potential is still limited by the growing environment and crop management is relatively difficult. Low level greenhouses generally result in a suboptimal growing environment which restricts yields and does little to reduce the incidence of pests and diseases. Pest and disease control, as a result, is normally structured around a chemical spray program.



**(Source:**[**http://www.agritech.tnau.ac.in/horticulture/horti\_Greenhouse%20cultivation\_clip\_image002\_0000.jpg**](http://www.agritech.tnau.ac.in/horticulture/horti_Greenhouse%20cultivation_clip_image002_0000.jpg)**)**

Low technology greenhouses have significant production and environmental limitations, but they offer a cost effective entry to the industry.

**Medium technology greenhouses**

Medium level greenhouses are typically characterized by vertical walls more than 2m but less than 4 m tall and a total height usually less than 5.5 m. They may have roof or side wall ventilation or both. Medium level greenhouses are usually clad with either single or double skin plastic film or glass and use varying degrees of automation.

Medium level greenhouses offer a compromise between cost and productivity and represent a reasonable economic and environmental basis for the industry. Production in medium level greenhouses can be more efficient than field production. Hydroponic systems increase the efficiency of water use. There is greater opportunity to use non-chemical pest and disease management strategies but overall the full potential of greenhouse horticulture is difficult to attain.

**High technology greenhouses**

High level greenhouses have a wall height of at least 4 m with the roof peak being up to 8 m above ground level. These structures offer superior crop and environmental performance. High technology structures will have roof ventilation and may also have side wall vents. Cladding may be plastic film (single or double), polycarbonate sheeting or glass. Environmental controls are almost always automated. These structures offer enormous opportunities for economic and environmental sustainability. Use of pesticides can be significantly reduced. High technology structures provide a generally impressive sight and, internationally, are increasingly being involved in agribusiness opportunities. Although these greenhouses are capital intensive, they offer a highly productive, environmentally sustainable opportunity for an advanced fresh produce industry. Investment decisions should, wherever possible, look to install high technology greenhouses.

Greenhouses vary in style, size and materials that are used to build it in order to fulfill any requirements and to suit any type of crop. The materials used to build the main structure of a greenhouse are timber, aluminum or steel. Timber frames are the traditional choice for garden greenhouses and hardwoods require low maintenance. Aluminum alloy frames are more lightly, need only minimum maintenance but are extremely sturdy. Steel frames are very strong but must be treated regularly to prevent them from rust, but they are also cheaper than timber or aluminum frames. For glazing you can use glass or plastic panels. Size may also vary according to your necessities.

Many styles of greenhouses are available on the market, every one of them with specific qualities: some provide optimum ventilation, or best use of space, or conserve heat well or allow better light penetration but all of them are made in order to fulfill your personal preferences.

Greenhouses types can be split into two main categories: conventional greenhouses and specialist greenhouses. Conventional greenhouses include: traditional span, Dutch light, three-quarter span, lean-to and mansard or curvilinear greenhouses. Specialist greenhouses include: Dome-shaped, polygonal, alpine house, conservation, mini and poly-tunnel greenhouses.

In the next lines we will try to describe every of those types and see what are their main qualities to help you choose the most suitable greenhouse for your garden.

**Traditional span**

This type of greenhouse is practical in terms of growing space and headroom by its vertical sides and even span roof. It provides the best use of space for the least cost for raising seedlings and growing border crops. Its lower part stop the heat lost over the winter.

**Dutch light**

This type of greenhouse is designed in order to allow in maximum light through the sloping sides. It is suitable to grow border crops, preferably low-growing ones. The panes of glass on the roof overlap slightly to keep out rain but also to increase the rigidity of the structure.

**Three-quarter span**

This type of greenhouse is positioned with one of its sides against a wall, preferably beside a sunny wall because the light is a little more restricted than in a free-standing greenhouse, but this also mean that it will need some extra shading in the summer. If you will choose a house wall to position your greenhouse you will also benefit from extra warmth and insulation from this.

**Lean-to Lean**

One can use this type of greenhouse in a garden with insufficient space for a free-standing structure. Like the three-quarter span, this type of greenhouse will benefit from the warmth and insulation of the house wall. Many of those greenhouses are similar in appearance to conservatories and may be used as garden rooms. In this type of greenhouse installation of electricity, gas or water supply easier and cheaper than that of a greenhouse located at some distance from the house.

**Mansard or curvilinear**

This greenhouse has slanting sides and roof panels designed to allow in maximum light available so a best place for this type of greenhouse is an open site with no shade from the surrounding trees or buildings. This greenhouse is suitable for plants that need maximum light over the winter.

**Dome-shaped**

This type of greenhouse is offering an elegant design that is mostly useful in exposed positions. It is stable and offers less wind resistance than traditional greenhouses. It allows maximum light transmission because of its multi-angled glass panels. It might offer limited headroom around the edge.

**Polygonal**

For a focal point in the garden or for gardens where appearance is important those greenhouses are the most used. Any octagonal or polygonal greenhouse is a good choice, but they may be more expensive than traditional greenhouses of similar sizes.

**Alpine house**

Traditionally those greenhouses have timber-frame with louvre vents all along the sides. This help for most effective ventilation. Usually, these types of greenhouses are not heated and they are not closed unless the winter is too cold, so the insulation is not needed. They are used mostly for plants that just need some protection from dampness and rain and require a bright and well-ventilated place.

**Conservation**

This type of greenhouse is designed to save as much energy as possible using special features. The roof panels are angled to permit optimum light penetration. Mirrored surfaces are also used to reflect light within the greenhouse itself. With all those special features, this type of greenhouse is usually more expensive than others of the same size.

**Mini**

For a limited space in your garden, or if you only have a small number of plants to grow, this useful, low-cost greenhouse is available in different sizes and also as free-standing or wheeled versions. Made from aluminum frame and covered with plastic or glass, this greenhouse is best to be placed face SE or SW in order to get the maximum light penetration. Access may be a problem as all the work has to be done from the outside. Venting and shading in the summer are essential.

**Poly-tunnel**

For a low-cost protection, for the vegetable plot for example, a plastic poly-tunnel greenhouse is the choice. It covers a large area, is covered with heavy-duty transparent plastic sheets and offers protection from cold and wind, is easy to move where needed, so is the perfect choice for your crops, either you choose to plant them directly into the soil, in pots or in growing bags. Ventilation may be a problem and the sheets may need to be replaced every few years as they gradually become opaque.

**Source:** http://www.greenzonelife.com/greenhouses/greenhouses-types.html

**29.2   Basis for Classification of Greenhouse**

Greenhouse structures of various types are used for crop production. Although there are advantages in each type for a particular application, in general there is no single type greenhouse, which can be said as the best. Different types of greenhouses are designed to meet the specific needs. The different types of greenhouses are classified based on shape, utility, material and construction are given below:

1. Greenhouse type based on shape:

The types of greenhouses based on shape are:

a) Lean to type greenhouse

b) Even span type greenhouse

c) Uneven span type greenhouse

d) Ridge and furrow type

e) Saw tooth type

f) Quonset greenhouse

g) Interlocking ridges and furrow type Quonset greenhouse

h) Ground to ground greenhouse.

2. Greenhouse type based on utility

Greenhouse classification can be made depending on the functions or utilities. Among the different utilities, artificial cooling and heating are more expensive and elaborate. Hence based on this, they are classified into two types.

a) Greenhouses for active heating

b) Greenhouses for active cooling

3. Greenhouse type based on construction

The type of construction predominantly is influenced by structural material, though the covering material also influences the type. Higher the span, stronger should be the material and more structural members are used to make sturdy tissues. For smaller spans, simple designs like hoops can be followed. So based on construction, greenhouses can be classified as

a) Wooden framed structure

b) Pipe framed structure

c) Truss framed structure

4. Greenhouse type based on covering material

Covering materials are the important component of the greenhouse structure. They have direct influence on greenhouse effect, inside the structure and they alter the air temperature inside. The types of frames and method of fixing also varies with covering material. Hence based on the type of covering material they may be classified as

a) Glass glazing

b) Fibre glass reinforced plastic (FRP) glazing

i) Plain sheet

ii) Corrugated sheet.

c) Plastic film

i) UV stabilized LDPE film.

ii) Silpaulin type sheet.

iii) Net house.

d) Based on the cost of construction involved

i) High cost greenhouse

ii) Medium cost greenhouse

iii) Low cost greenhouse