

**BASICS OF GREENHOUSES
AND
CROP PRODUCTION**


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Objectives

- Describe greenhouse styles and greenhouse construction materials
- Describe common coverings
- List common components of greenhouses
- Discuss propagation – as a major user of greenhouse space

Why use greenhouses?

- Field production vs. Greenhouse production
 - Open field – no control over environmental factors (i.e. temperature, light, relative humidity)
 - Greenhouse production – precisely control environment
 - Best microclimate
 - Quick turnaround/time to saleable plant
 - Extend growing seasons
 - Control pests relatively easily
 - Grow rare ornamental plants

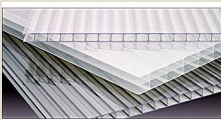


Structure

- Designed for growing plants with controlled conditions
- Coverings/Glazing
 - Glass
 - Plastic
 - Polycarbonate / acrylic / fiberglass
- Designed to withstand the load on the covering material
- *Structure type is location specific and crop specific*



Polycarbonate



Basic Types of Greenhouses



Lean-to



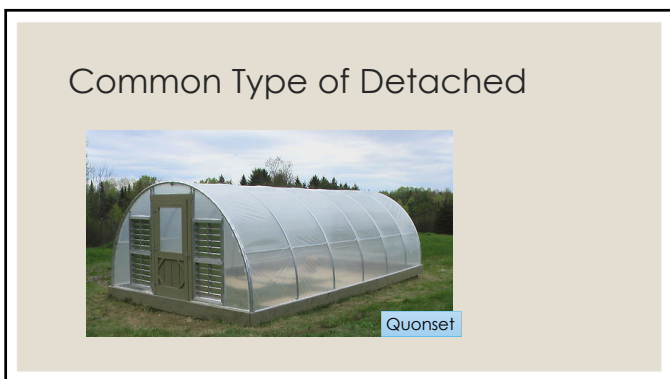
Detached



Ridge-and-furrow or gutter-connected

EXAMPLES OF
VARIOUS
GREENHOUSES





Common Type of Detached



Barrel Vault



Single Gable



Ridge and Furrow



GREENHOUSE STRUCTURAL COMPONENTS

Basic structural components of a greenhouse

- Rafter (A)
- End walls (B)
- Side post (C)
- Side wall (D)
- Purlin (E)

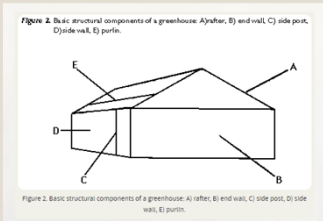


Figure 2. Basic structural components of a greenhouse: A) rafter, B) end wall, C) side post, D) side wall, E) purlin.

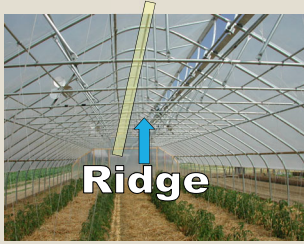
Greenhouse Structural components



TRUSS

RAFTER

Greenhouse Structural components



Greenhouse Structural components



Greenhouse Structural components





Framing

Two photographs illustrating greenhouse framing. The left image shows a perspective view of the metal structure over rows of plants. The right image shows a close-up of the roof and side wall framing.

Other Greenhouse components

- Heating
- Cooling
- Air flow fans
- Benches
- Water lines
- Lights

Two photographs showing interior components of a greenhouse. The left photo shows a network of pipes and lights. The right photo shows a large industrial fan.



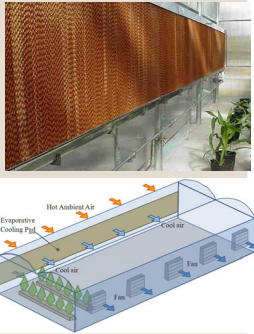
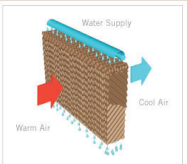
Heating

- Burning fuel/furnace (wood chips)
- Modine heaters (natural gas, propane, oil)
- Hot water/steam
- Radiant bench or floor warmers



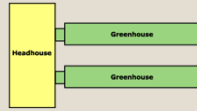
Cooling

- Natural ventilation
- Evaporative cooling (cooling pads, wet pads)
- Fans, air circulation



Greenhouse Ranges

- If your operation has more than a couple greenhouses, a headhouse should be a key part of the plan
- Headhouse provides:
 - Area for potting, transplanting and shipping (work space)
 - Support facilities – growth chambers, coolers, offices, storage
 - A tie between the greenhouses without having to go outside



Greenhouse Ranges



FIGURE 5. This headhouse includes material storage, restrooms, offices, a potting room, and an area to package plants for shipment.

Benches

- Benches can be made of:
 - Expanded galvanized steel
 - Aluminum
 - Plastic
 - Rot-resistant wood
- Workers need aisles to move around, and narrow benches to reach every plant

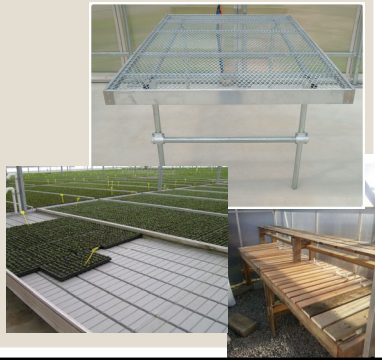


FIGURE 8. Rolling benches maximize growing space.

Benches

- Expanded galvanized steel
- Aluminum
- Plastic
- Rot-resistant wood

- Rolling benches – see GH 4
- Flood benches



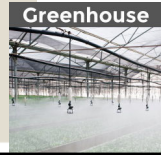
Checking Your Knowledge

1. What is a greenhouse?
2. What are the different styles of greenhouses?
3. What materials are used for the framework of greenhouses?
4. What are some considerations when selecting a glazing material?
5. What are greenhouse benches, and what materials are used for benches?

IRRIGATION

Irrigation

- Clear water
- Injector (brand – Dosatron)
 - Deliver water-soluble fertilizer
- Low-volume or drip irrigation lines
- Mist benches



Media or substrates

- Do we use soil for greenhouse growing substrates?
- No – we use soilless substrates
 - Sterile
 - Uniform
 - Light weight
 - Cation exchange capacity

Soilless substrate components

- Peat
- Perlite
- Vermiculite
- Pine bark
- Pine chips
- Biochar
- Wetting agent

Or completely soilless... hydroponics



PROPAGATION

Greenhouse propagation






- Seeds
- Cuttings
- Tissue culture
- Dividing



PEST CONTROL

Common greenhouse pests

- Aphids
- Mealy bugs
- Spider mites
- Scale
- Thrips
- Whitefly
- Fungus gnat
- Powdery mildew

Pest	Simple identification	Symptoms to look for
 Spider Mites	Young = pale with reddish-brown coloration Mature = same as adolescent, but larger Location = underside of leaves	<ul style="list-style-type: none"> • tiny yellow spots on leaves • gray or yellow leaves • brown or withering leaves • webbing on plants
 Aphids	Young = narrow and white Mature = green, sometimes with wings Location = Underside of leaves	<ul style="list-style-type: none"> • honeydew • sooty mold • ant infestation • distorted, withering, yellow leaves • silvery white exoskeletons
 Fungus Gnats	Young = larvae near rootzone. Mature = winged black fly, appearing similar to mosquitoes Location = airborne	<ul style="list-style-type: none"> • plants appear weak for no discernable reason • lower yields • slowed plant growth • plants lack vigor • plants display nutrient deficiencies
 Thrips	Young = small white worm Mature = dark or golden color, sometimes with wings Location = leaves and stems	<ul style="list-style-type: none"> • tiny black dots that are Thrips droppings • leaves and buds, especially younger ones, have brown edges • silvery or brown stains on leaves and stems
 Whiteflies	Young = eggs look like small grains of rice Mature = 2mm sized white moth Location = underside of leaves and airborne	<ul style="list-style-type: none"> • honeydew • sooty mold • ant infestation • white spots on leaves • necrosis on leaves

Greenhouse pest control

- Sticky traps
- Natural enemies:
 - Parasitic wasps
 - Ladybugs
 - Green lacewing
 - Nematodes
- Chemicals (both organic and inorganic)