GREENHOUSE GARDENING FOR THE HOMEOWNER

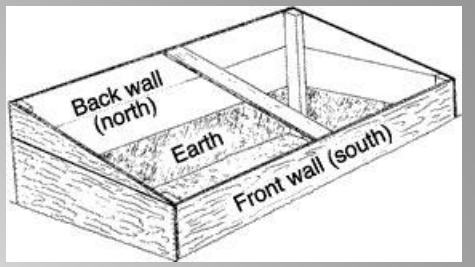
HOME AWAY FROM HOME

Aluminum

CEDAR or REDWOOD

PLASTIC

COLD FRAME



- Bottomless
- Higher back than front to capture slanting winter sun
- Facing South
- Vent (Univent control auto)
- Thermometer – keep at 60 degrees
  - Shield from direct sun

vegetablegardener.com

OTHER GREENHOUSE CHOICES

- 1 gal. Plastic Bag
- Plastic containers
- Tray with dome

FLOORING MATERIAL

- Gravel
- DG (decomposed granite)
- Dirt

the above will cause excess moisture

- Concrete slab

SITE SELECTION

- Adequate natural light
- Drainage –rain and irrigation runs away from greenhouse
- Direction of wind for ventilation- install roof vents on opposite side of winds
- Facing south or southeast
- Natural ventilation – open space

GLAZING
IT'S WHAT MAKES THE GREENHOUSE

- Glazing = Cover, Walls, Roof Material
- Influences the amount of intensity and the direct/diffuse spectrum of the sun that reaches the plant
- Affects plant growth - water movement through the plant for transpiration and photosynthesis (food).

PLASTIC FILM

- Less costly
- Light transmission will decrease over time due to aging = yellowing, dirt and dust accumulation (10% loss within 3-4 years)
- High heat loss
  - Can be prevented by tightly sealing plastic to prevent air leaks
    - Will cause high humidity/condensation – not good

GLASS

Advantages:

- Long life
- High light transmission
- High solar energy gain during daytime hours
- Most importantly, it’s PRETTY

Disadvantages:

- Breaking during extreme weather conditions
- Low humidity in our region
- Expensive
- High light intensity during summer
- High energy loss

FIBERGLASS

- Readily available at all box office stores
- Flat panels can be used as walls
- Corrugated sheets as the roofing material
- Inexpensive
- Expect 8-10 years of life
- Main drawback is yellowing, brittle, lack of energy efficiency

ACRYLIC

Pros:

- Long-term clarity
- Light transmission up to 86%
- 7 times stronger than glass

Cons:

- The most expensive of all glazing materials
- Will not withstand fire
- Expands and contracts with temperature change

POLYETHYLENE FILM

- Known in the industry as poly film or double poly
- Most popular glazing material used by commercial growers
- Similar to plastic bags or food wrap but thicker
- Low cost
- Short life span of 1-5 years
  - Trade off between low initial cost to install and limited life

POLYCARBONATE

- Unbreakable – stronger than glass, fiberglass, acrylic
- High insulation
- Flexible – easy to work
- Will not yellow or become brittle
- More expensive than fiberglass but less expensive than acrylic

LIGHT ENTRY AND HEAT LOSS

	Light Entry	Heat Loss (BTU*)
Polycarbonate corrugated	90%	0.6
Corrugated Fiberglass	87%	0.7
Single poly film	91%	1.1
Double poly film	83%	0.7
Acrylic	86%	0.6
Glass double	89%	1.1
Plastic single	91%	1.1
Use of Energy Curtain		.3

*BTU-raise temperature of 1 pound of water by 1 degree

CURTAINS

(Shade Curtains, Energy Curtains, Screens, Blankets)

- An energy curtain is a fabric or plastic barrier used to help hold warm air inside while reducing the amount of air that needs to be heated.
- Energy curtains can cut heating costs between 30%-60%
- Curtains are used for heat retention, shade and cooling.
- Can be automatic or manual
- One drawback - cold air is trapped between the curtain and wall/roof and when opened, the cold air drops into the warm space potentially stressing or damaging plants. Open slowly.

VENTILATION

- Maintain ideal temperatures (65-70)
- Reduces diseases and insects
- Maintain humidity
  - High humidity = condensation on glazing material
  - Over 80% = diseases, leaf mold
  - Water early in a.m.

  Low humidity in Summer, water the floor

FANS

- Stirs up the air to help plants make better use of carbon dioxide
- Consistent airflow
- Builds girth to growing plants
- Reduces diseases and insects
- Removes warm air, if needed
- Place on timer
- Fan on plants, recommended 10 minutes per day – forget that – 6-8 HOURS EVERY DAY
- Oscillating or recirculation fans

Automatic Vents

Bayliss Automatic Vent Openers Model MK7

GigaVent Solar Vent Opener

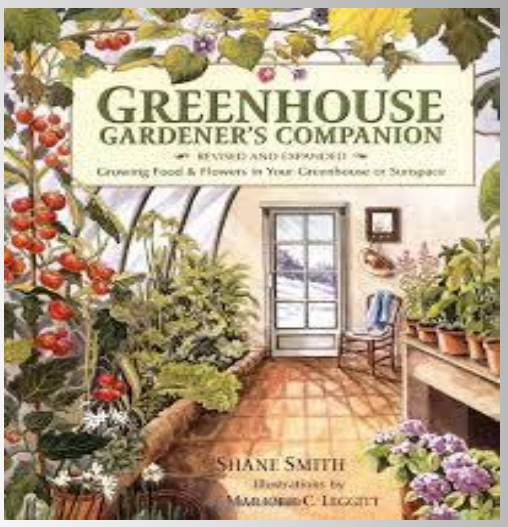
HOW TO DECIDE WHICH GREENHOUSE

1. What do you plan to grow? This will help in choosing glazing material. Plants with minimal light, use poly film greenhouse. If your plants require maximum light, glass would be a better option.
2. Where do you plan to build? If in a shady area, choose a higher light transmission glazing material. If sunnier, can be a lower light transmission glazing material.
3. How much do you want to spend? If money is no object, glass is the best choice because you can always add subsystems (curtains) to obtain the desired environment.
4. What's your style? Glass is the prettiest and focuses on smaller details. Poly film house material is more forgiving and with fewer factors impacting the environment.

GREENHOUSE BOOKS

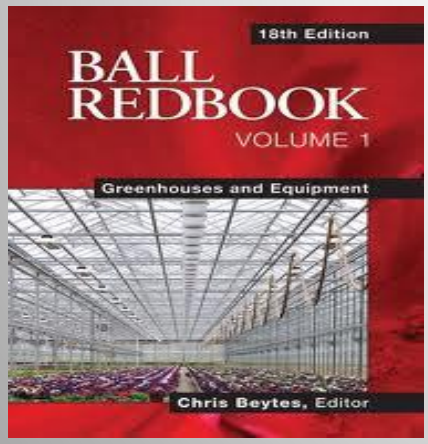
Greenhouse Gardener's Companion

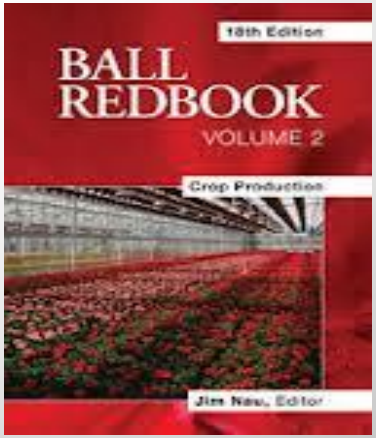
Author: Shane Smith



Greenhouse & Equipment 18th Edition

Crop Production 18th Edition





LIGHT (SUN)

What is light?

- Light is energy that makes food (carbohydrates) in a process called photosynthesis which fuels plant growth.
- Light tells the plant what time of year it is by measuring the length of day and night.
- Light contains all the colors of the rainbow, and the specific colors (red and blue spectrums) can affect plant growth and flowering.
- Light intensity is the amount of light delivered and absorbed by the plant at any given second.
- Only 35-70% of light outside the greenhouse actually reaches the plant.

LIGHT SUBSTITUTES

"I can grow you a big crop of bananas above the Arctic Circle in Winter…if you give me enough money"

Two reasons for using artificial lighting:

1. Additional lights/lamps is used to increase the quantity of light thereby increasing photosynthesis and plant growth.
2. Extend the photoperiod perceived by the plants which is often used for flowering or vegetative plants well into the night which means for every 30 minutes, 5 minutes of additional light.

LIGHTING PRODUCTS
(NO HEAT – JUST LIGHT!!!!!)

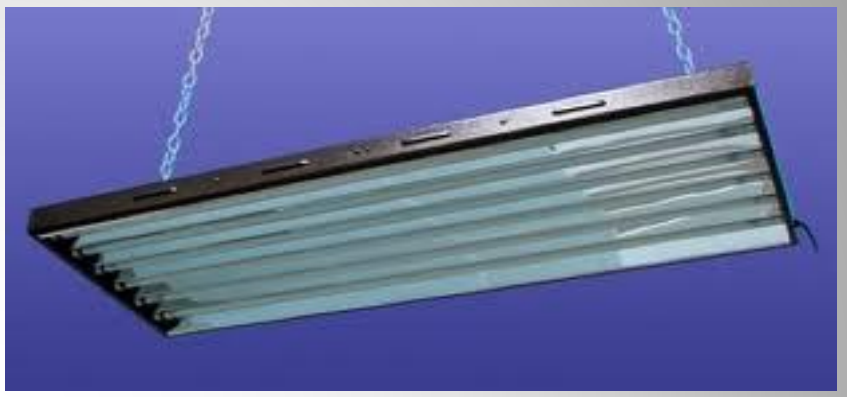
Led Lights

Pros:

- More efficient than incandescent lights
- More cover
- Use to be expensive

Cons:

FLUORESCENT LIGHTS



Pros:

- Inexpensive
- Readily available
- Germinate seeds only
- Place bulbs 2” above container allowing enough light to spread over growing area

Cons:

- Placement too close to containers difficult to work

INCANDESCENT GROW LIGHTS

Pros:

- Found at specialty stores – hydroponics or greenhouse supply stores
- Broad range of coverage
- Red and blue spectrum

Cons:

- High energy use (expensive)
- High heat output

HID
HIGH INTENSITY DISCHARGE LAMPS

High Pressure Sodium (HPS)

Pros:

- Best light source if used with natural light
- Promotes budding and flowering
- Bulbs last longer up to 24,000 hours

Cons:

- Give off a sickly yellow glow at night
- Expensive but bulbs lasts longer than MH

HID
HIGH INTENSITY DISCHARGE LAMPS

Metal Halide

Pros:

- Best light source if no or little natural light
- Promotes vegetative plants
- Light is more pleasing to the eye
- Better seedling growth

Cons:

- Not as energy efficient as HPS but equal to fluorescent bulbs
- Life of time is 7,500 hours
- Not installed properly, can explode, install protective cover

TOO MUCH LIGHT

- Change in leaf orientation and shape. Leaf tends to curl to avoid light interception and grow more vertical.
- Heat stress or sunburn.
- Plant water use and evaporation increases.
- Root death due to excessive high soil temperature.

NOTE: use shade cloth from late Spring to early Fall to reduce heat in greenhouse due to high levels of light

TOO LITTLE LIGHT

Myth: Low light does not always cause an increase in plant height (spindly or stretch).

SHOCKING, I KNOW

- Tightly spaced plants (as in too many seedlings packed together in one cell)
- Leaf size may increase
- Leaves are thinner
- Flower buds are reduced

BENCHES

Why?

- Airflow: circulating around containers; less risk of excessive moisture on foliage and soil; reducing insects and diseases to thrive
- Weeds: up off the floor; decreasing insects and diseases that weeds can host
- Water: prevents water accumulating near containers; extra moisture equals insects and diseases

BENCH MATERIALS
Metal

- Aluminum or steel side railings

WOOD

- Rot resistant woods – pressure treated lumber, cedar, redwood

Galvanized welded wire coated with PVC

Redwood or cedar

Plastic

QUALITY OFWATER

Important factor in the quality water is electrical conductivity (EC), a measure of total soluble salts.

- Low EC (0.0 – 0.5 mS/cm) is best. Prevent levels accumulating in the root zone. Less leaching is required.
- High EC levels can stunt plant growth, induce wilting and marginal leaf burn. Plant variety is limited.
- Test water for EC, pH and alkalinity. Send to lab or buy a meter.
- Well water, without a filter, may have high EC, high pH and high alkalinity levels.

IRRIGATION

The *Art* of watering is a gift.

Sowing Seeds:

- Pre-moisten soil
- Best tool? - your finger
- Shake off excess condensation on domes EVERY DAY
- Check container weight before watering
- Use a seedling sprayer or similar apparatus

HEAT

- Modine Hot Dawg HD30 (propane)
- Electric heater – fit to size, built in thermostat

PUT ON TIMER

Sowing Seeds:

- Heat mat = 24/7 (keep track of outside temp)
- Rope lighting, Christmas lights

PUT ON TIMER

SOIL

- Do not use native soil - it compacts
- Soilless – sterilize sand, vermiculite or perlite, peat moss, fir bark humus, coconut coir, or
- Potting soil - lightweight
- Lightly moisten first
- Coverage, use vermiculite or soilless mix

CONTAINERS

Sowing Seeds:

- Minimum 2” deep and wide
- Sterile – 9:1 water/bleach USE GLOVES
  15 minutes active – GET BUSY
- Drainage holes

Trays

- With or without trays – determines by irrigation method

SEEDS

- Read the seed packet
- Coverage is based on seed size - twice the size in depth
- Err on ‘less is more’
- Germination may take longer due to environmental conditions
- Install a graveyard

HOW TO SOW SEEDS

1. Sterilize container – dry out
2. Pre-moisten soil
3. Fill container with 3/4 soil
4. Sow (place) seed (the smaller the seed = less coverage)
5. Irrigate (bottom or top & mist)
6. Place dome onto tray
7. Seedlings – thin out (kill)
8. 2 sets of true leaves, pot up
9. Fertilize with fish emulsion then 10-10-10

DISEASES

Common diseases:

- Root diseases:
  - Pythium species – algae than a fungi
    - root rotters (dampening off at root) caused by poorly drained soil
  - Phytophthora species – attacks root crown or stem
  - Rhizoctonia species – soil fungus, dampening off at crown
  - Fusarium wilt – fungus, causes a systemic infection
- Foliar diseases:
  - Powdery mildew fungi
  - Alternaria leaf spot fungi
  - Xanthomonas bacterial disease (bacterial blight)
- Cultural and environmental conditions lead to disease development

MANAGEMENT OF DISEASES

- Sanitation
  - Remove dying plants
  - Clean floor, walls, benches
- Manage water
  - Wet foliage is your enemy
  - Remove standing water – apply only as needed
- Use soil with high air-pore space for drainage
- Know your seed source
- Time of year (powdery mildew)

PAY ATTENTION

PESTS
Honeymoon phase is OVER

- The major insect and mite pests are piercing-sucking mouthparts that remove plant fluids
- Higher the temperature and humidity = breeding ground
- Poor sanitation
- Reusing old containers
- Not removing old plants, debris, soil

YOUR GREENHOUSE IS NOT A STORAGE UNIT!!!!

Integrated Pest Management (IPM)

- Know your plants - symptoms
- Prevention
- Hang Yellow Sticky Traps ALL OVER

- Integrated control – releasing and/or encouraging beneficials (Rove Beetles, Ladybugs, Phytoseiulus (predatory spider mite control (see Hummert.com)
- Spot spray, if necessary, least toxic spray.
- Clean greenhouse bi-annually with Physan
- Keep clean
- Quarantine all incoming plants

WEBSITES

Greenhouses:

- Sierra Greenhouse at sierragreenhouse.com
- Harbor Freight at harborfreight.com
- Growers Supply at growerssupply.com
- Charley's Greenhouse at charleysgreenhouse.com
- Greenhouse Megastore

Tools/Materials/Seeds:

- Lee Valley Tools
- Growers Supply
- HPS Seeds
- J.L. Hudson
- Select Seeds