

# Greenhouse Horticulture Lesson

## 3

# **Heating**

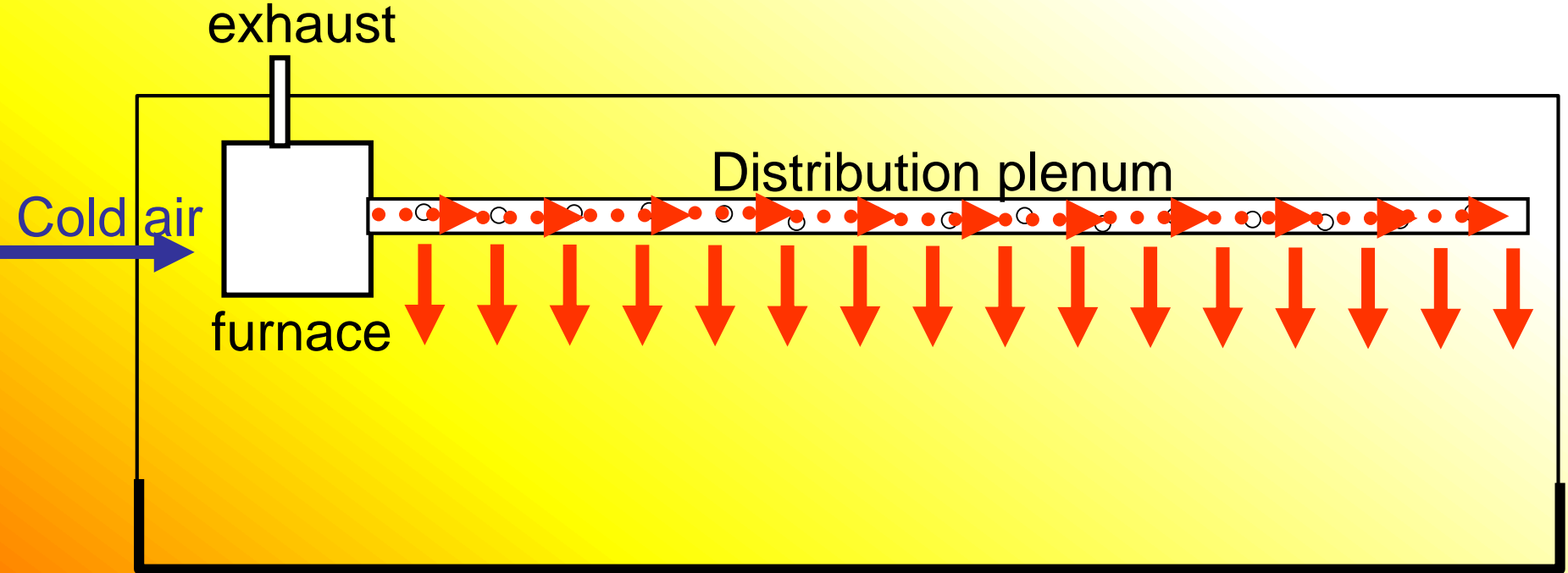
- Sun not enough (cold weather, night, cloudy days).
- 2<sup>nd</sup> largest expense (labour #1)

## **Heat energy from:**

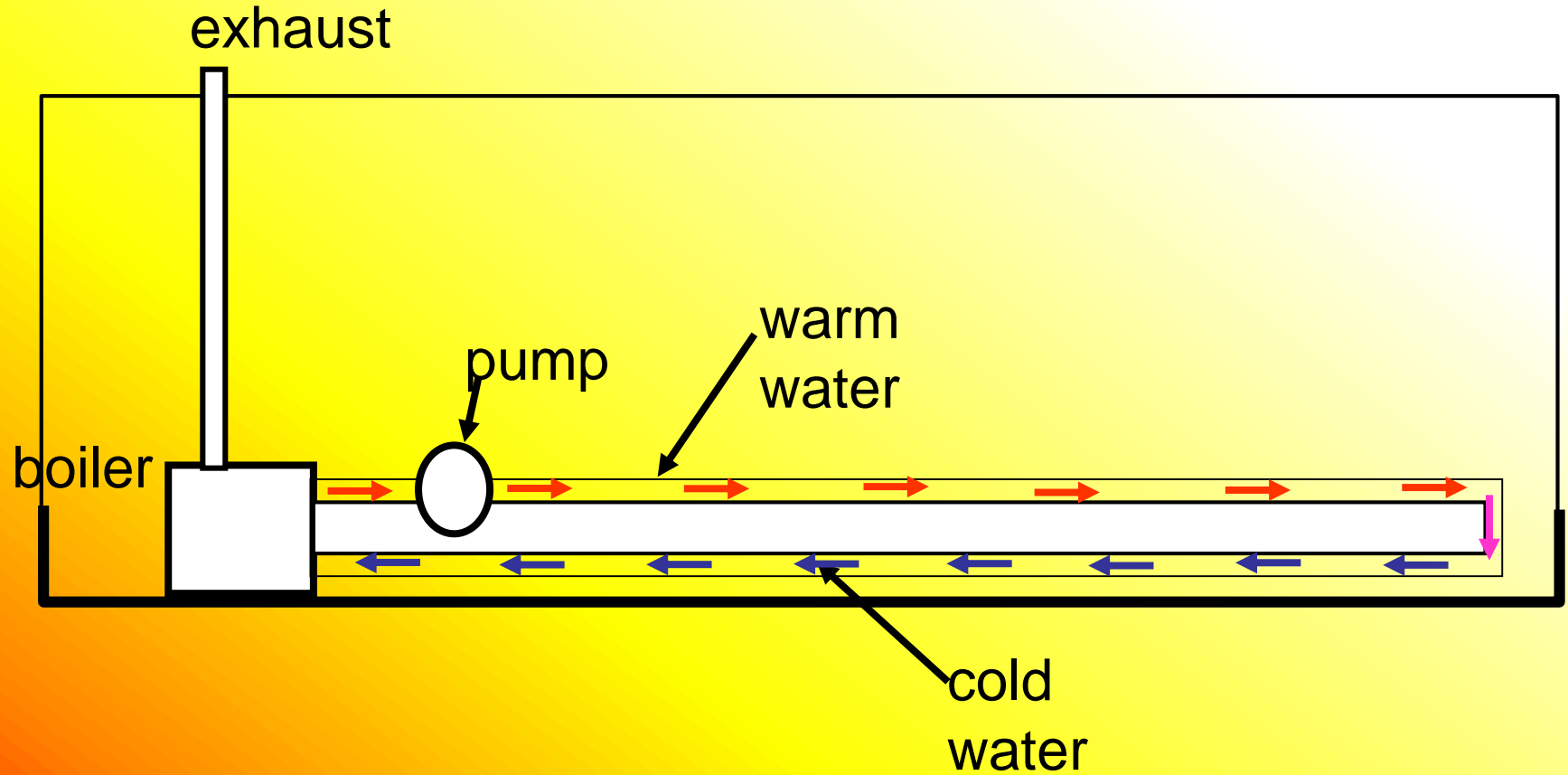
wood waste (hog fuel), coal, diesel, natural gas, or waste heat from thermo-generating plants

# Heating Systems:

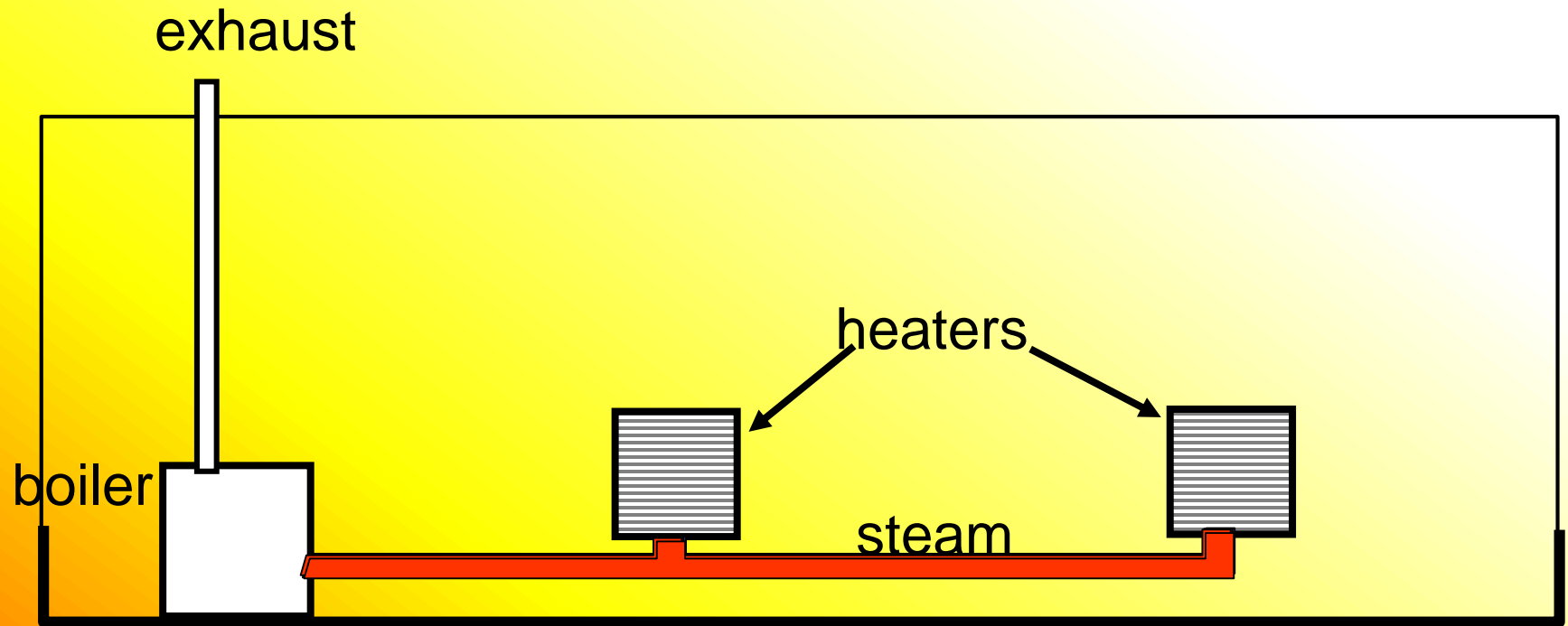
## 1. Forced air (ours)



## 2. Hot water (most popular)



### 3. Steam

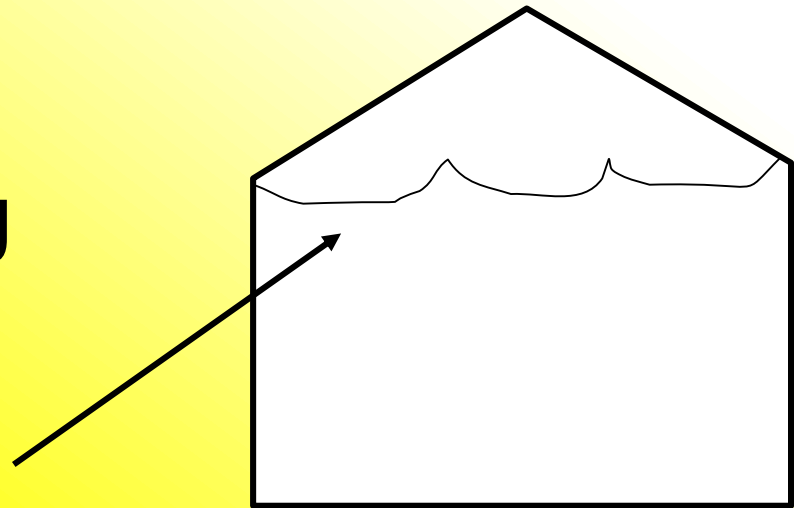


# Insulation:

Reduces heat transfer

## a) Roof:

1. double glazing
2. double plastic
3. interior ceiling



## b) Curtain wall:

1. styrofoam



# **Ventilation & Cooling**

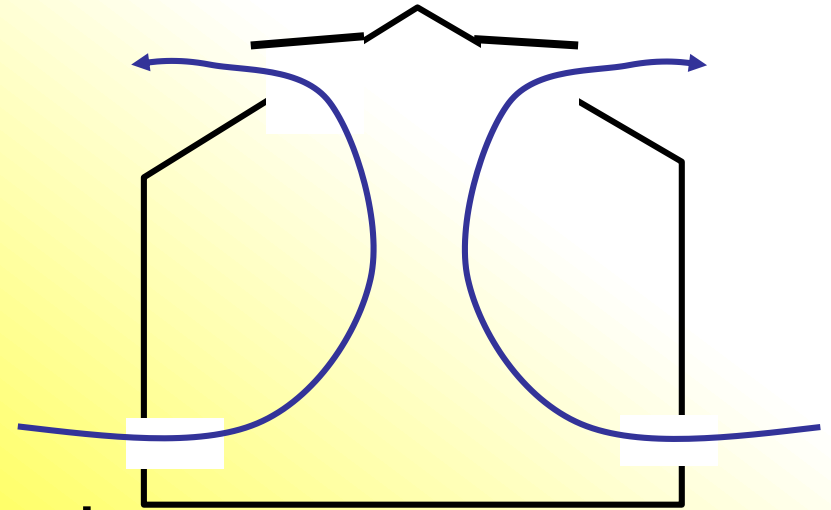
3 reasons why

1. increase CO<sub>2</sub> supply
2. lower humidity (threat of fungus attack)
3. lower temperature

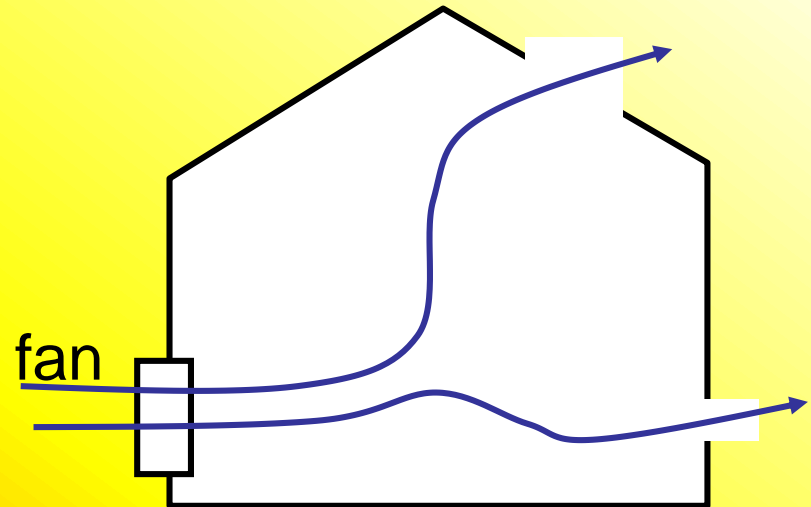


# Ventilation Types:

1. Natural ventilation:

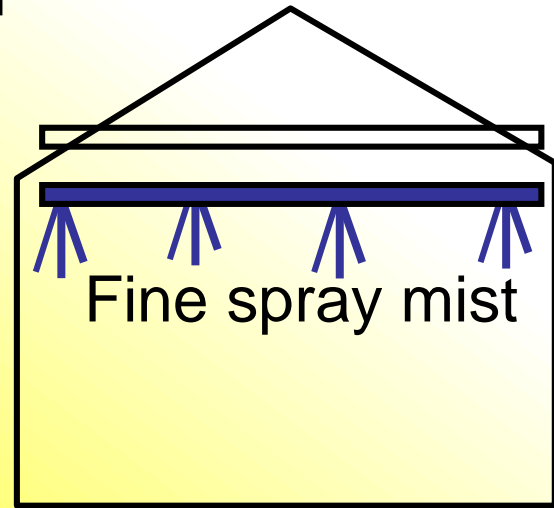


2. Fans to draw in fresh air

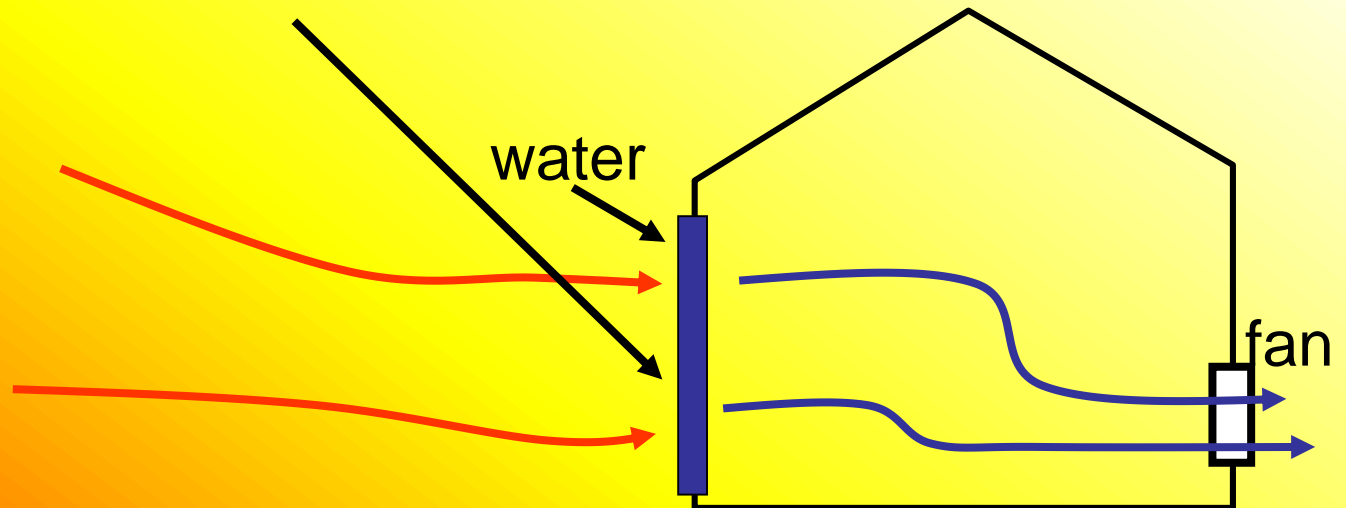


# Cooling Types

## 1. Fog Cooling

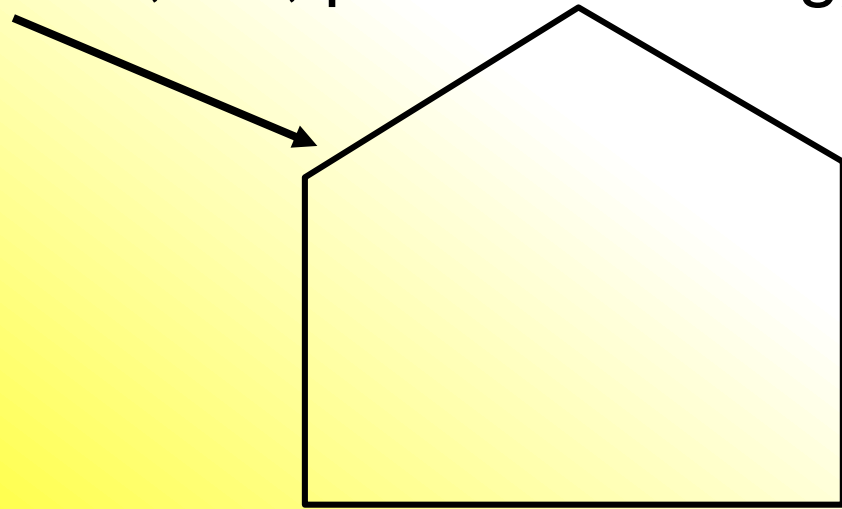


## 2. Evaporative pads

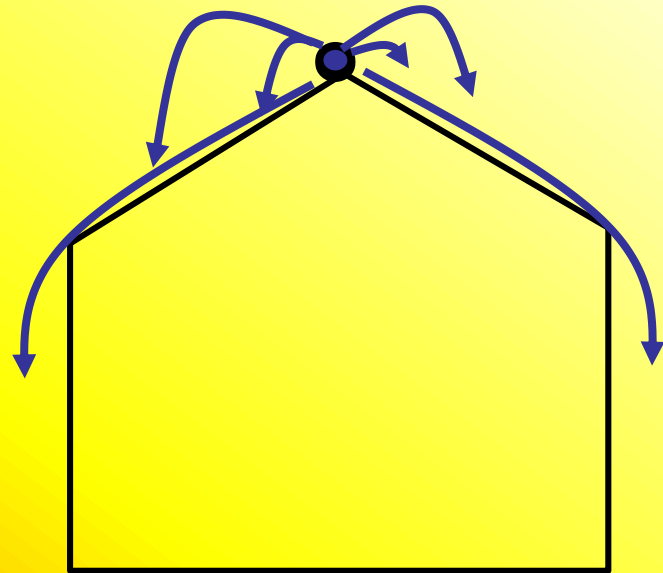




3. Shading (white wash, foil, plastic sheeting)



4. Flowing water on roof (works well by lake)





# **Irrigation**

## **1. High volume**

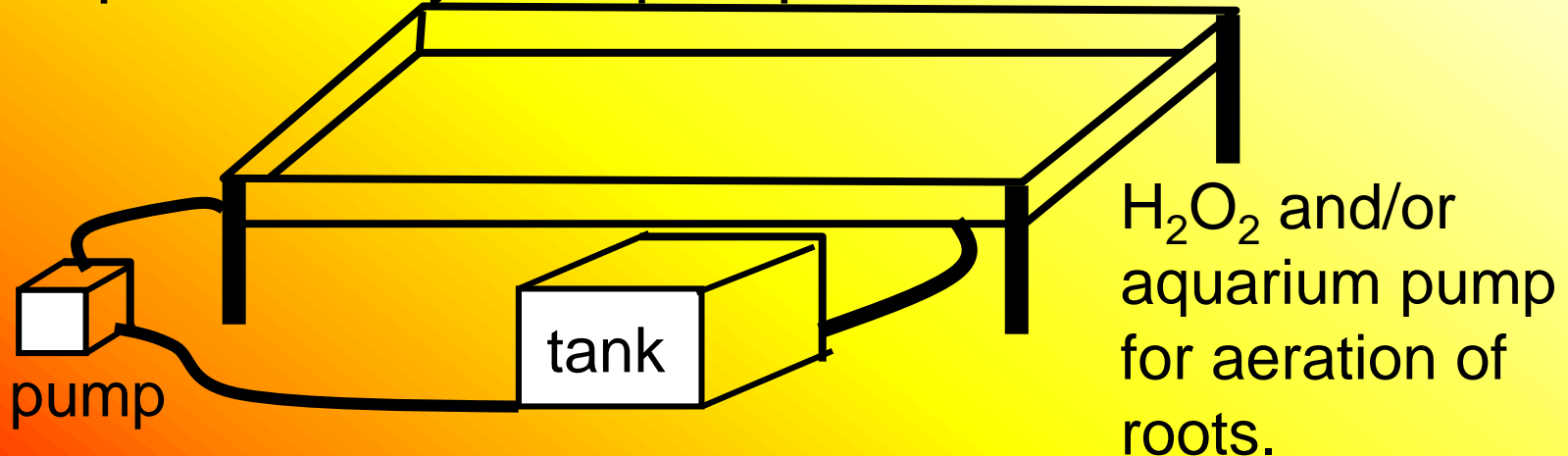
- Adv: fast, inexpensive
- Disadv: wastes water and nutrients, groundwater contamination, uneven watering
  - a) manual hose watering
  - b) overhead sprinkler
  - c) spray stakes





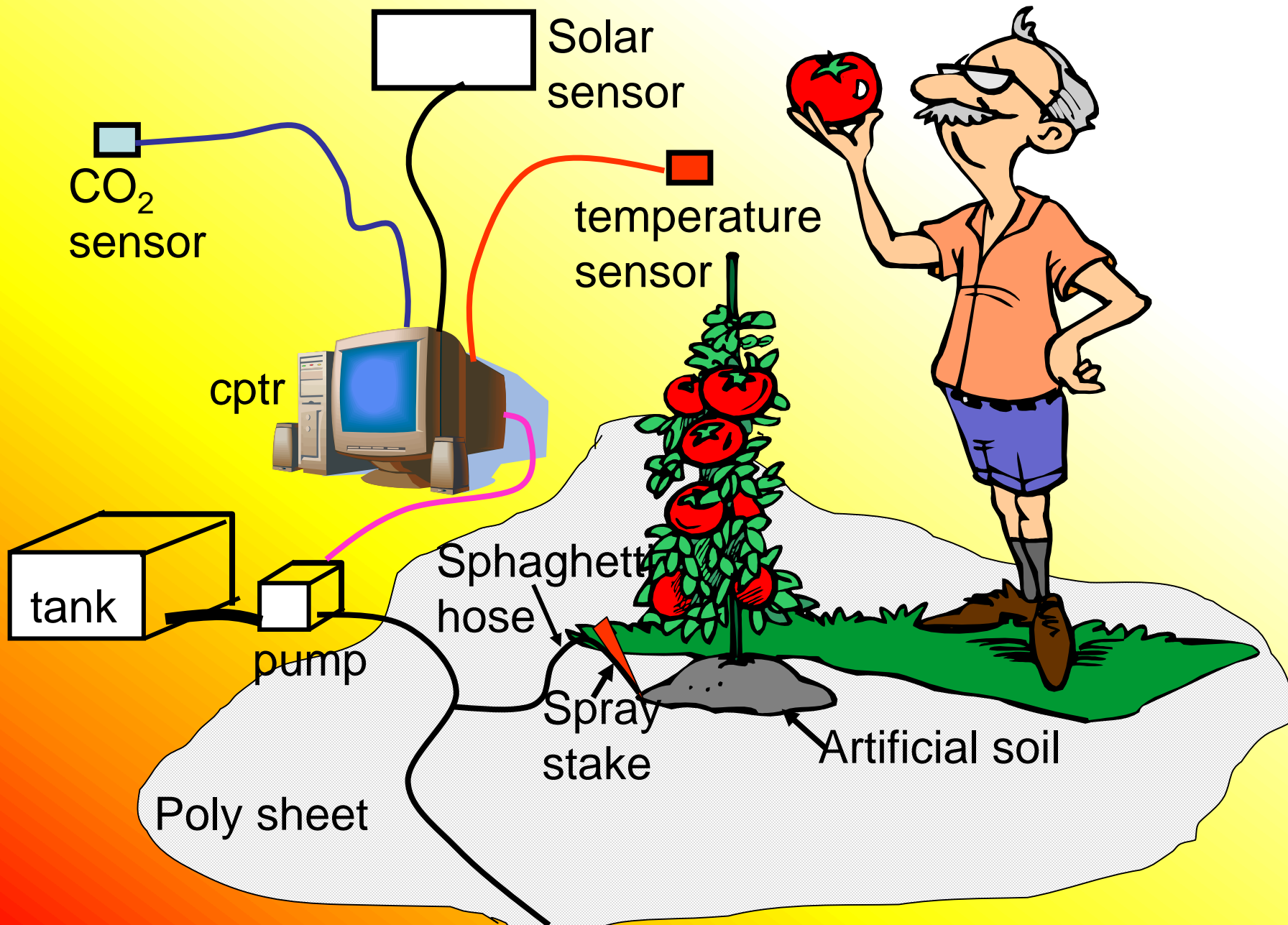
## 2. Low volume

- adv: efficient water and nutrient use
- Disadv: can be labour intensive; can be expensive to set up.
  - a) soaker hose = hose with millions of leaks that drip out water
  - b) trough/flooded bench = trough that is flooded periodically with pumped water and nutrients





## c) Computerized Spray stake





# Soil

1. Strip land
2. Artificial Soil
3. Synthetic Soil

# 1. Strip of land:

- Adv: easy
- Disadv: limited supply, disease, weeds

Soil can be sterilized eliminating weeds, pests, and disease 1 of 3 ways:

- i) bake the soil
- ii) steam the soil
- iii) chemical treatment with Chloropicrin (tear gas), Vapam, or Formalin

## 2. Artificial Soil: (combination of)

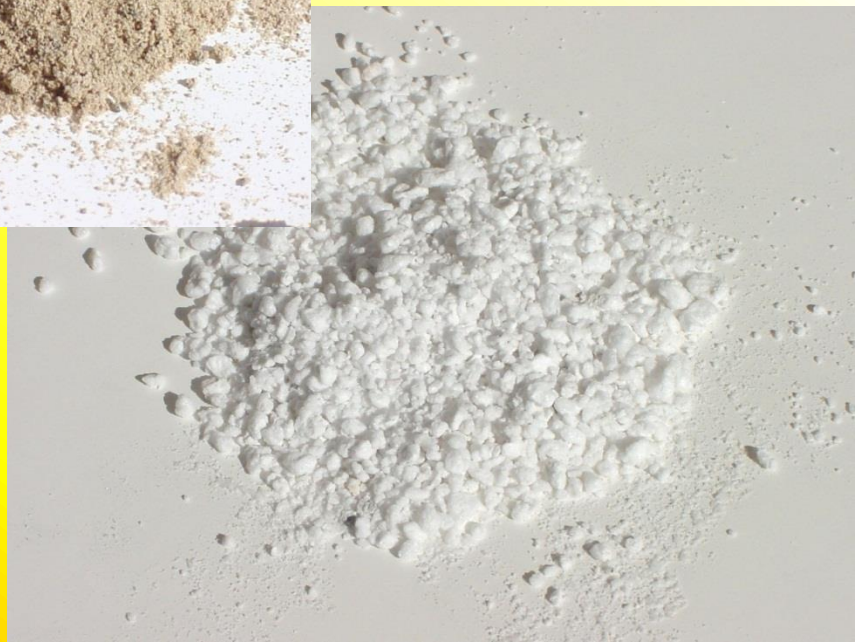
a) peat (OM)

b) sand or pebble gravel (clean)

(adds weight for stability, gives  
aeration and drainage)

c) perlite = “hard white stuff” (volcanic rock  
that is “popped” at 1000°C)

- Adv: adds aeration and drainage, hard to compress,
- Disadv: no nutrients



d) Vermiculite = “soft brown stuff”

(mica that is popped at 800°C)

- adv: improves aeration and drainage; has Ca, K, Mg; buffers pH changes
- Disadv: easy to compress

e) Nutrients

= fertilizer with **macro** and **trace** elements

N<sub>2</sub>

Fe

P

Cu

K

Mn

Ca

Zn

Mg

Mo

S

B, etc.







### 3. Synthetic Soil

Plants are transplanted into rock wool or sawdust bag

- **Hydroponics** = growing plants in sawdust, peat, or rockwool and providing aerated water and nutrients on demand artificially.
- **Aeroponics** = roots grow in air without soil and are constantly misted with water and nutrients

# Temperature:

	minimum night	ideal	maximum day
Germination	15°C	25°C	27°C
Growth	0°C	25°C	35°C

**Germination:** is the process in which a plant or fungus emerges from a seed or spore and begins growth

**Growth:** is the process in which a germinated plant continues to grow until it reproduces and dies.

- **Acclimatization**: is the process of an organism adjusting to change in its environment, for example temperature.
- Plants can be tricked into thinking its time to grow or bloom again (they think winter passed by) by:
  - a) reducing GH temp' (for tropical plants)
  - b) freezing bulbs = “forced” (for temperate plants)

# **Lighting:**

## **1. Intensity (brightness)**

- Intensity can be controlled with shading,, reflectors, and/or artificial lighting.



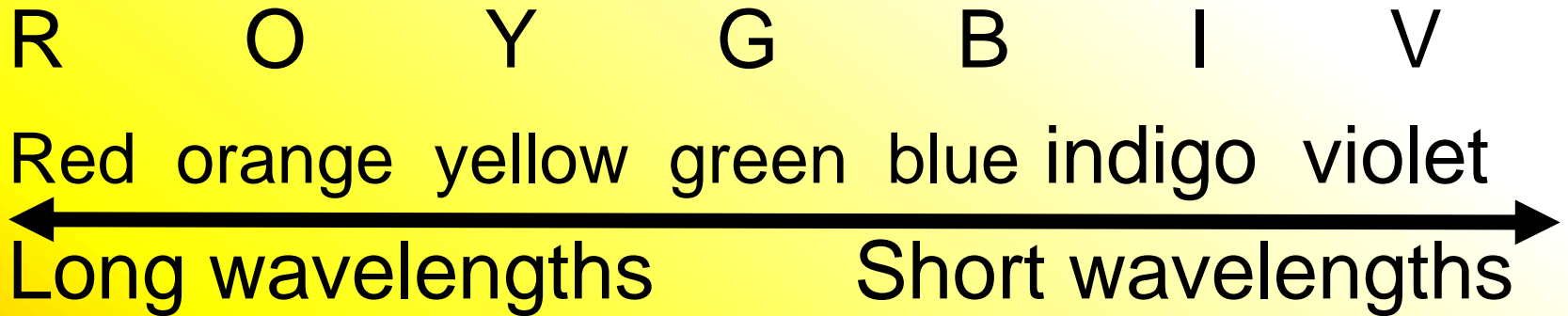
## 2. Timing or Photoperiodism = length of day

– Affects:

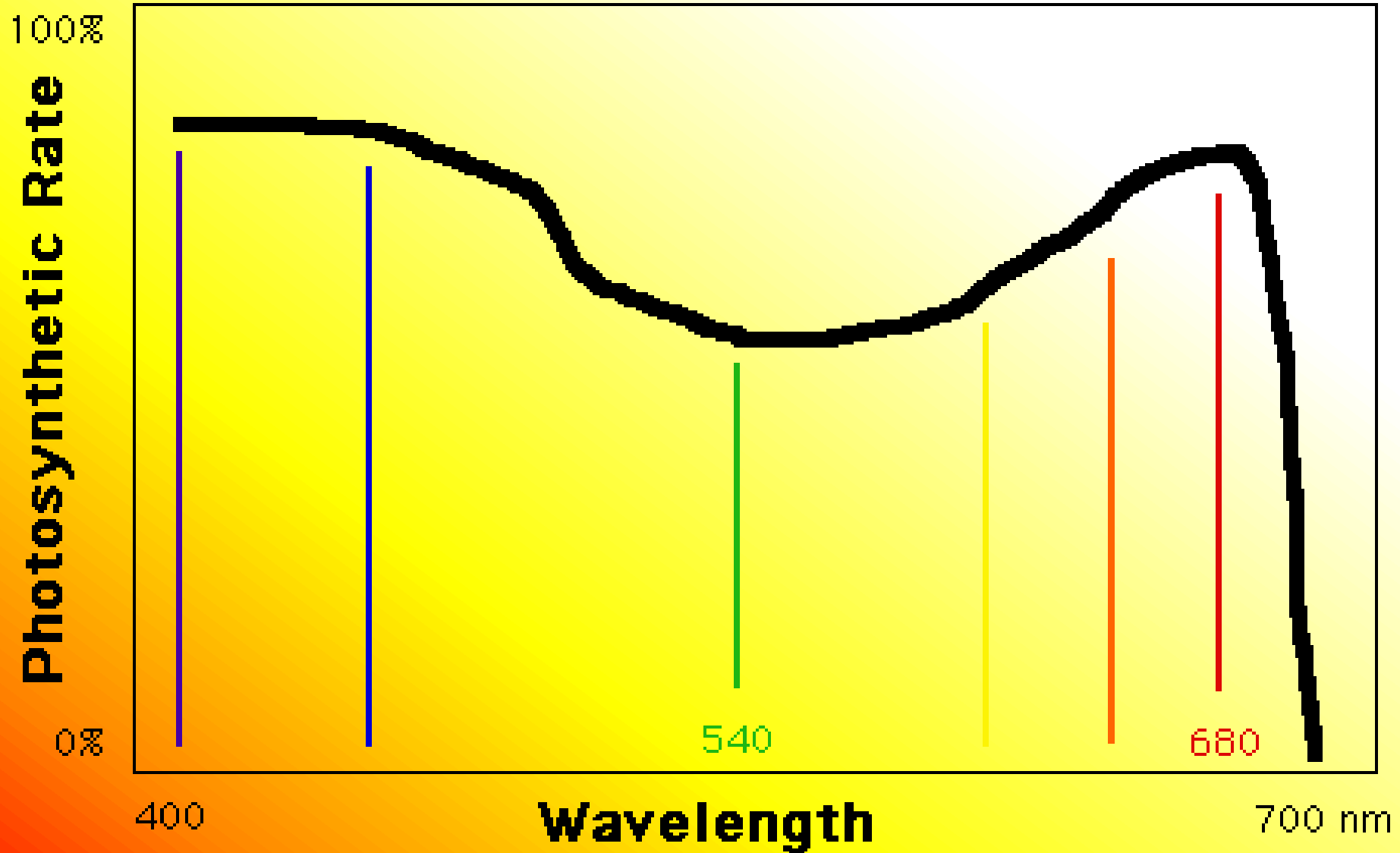
- a) growth rate (long days = spring-summer = fast growth)
- b) budding/flowering (shortening days = fall = time to flower)

– Affects only temperate plant (non-equatorial) because length of day varies over the growing season telling the plant when to grow and when to flower.


### 3. Wavelength = Action Spectrum = Colour of Light:







# How Colors Affect Plant Development

1. Growth rate  blue-UV
2. budding-flowering: prevented with red-IR
3. germination: prevented with far red; promoted with red
4. fruit maturation: red makes apples go red.

# Artificial Lighting:

- a) fluorescent (bulbs vary)
- b) mercury vapor (blue – UV)
- c) high pressure sodium (yellow)
- d) incandescent (red-yellow)

# **GH Disease and Pests**

1. **Bacterial**: blackening of the leaves
2. **Viral**: leaf mottling (spotting),
3. **Fungal**: root rot
4. **Animals (includes insects)**: aphids, earwigs, slugs, snails, whiteflies, spider mites





earwigs



L. Jesse  
Iowa State University  
Insect Diagnostic Clinic







Ladybugs eating aphids





Parasitic wasps lays eggs in the larvae of pests (i.e. hornworm)



Preda



UF/Castner







# Assignment

Greenhouse w.s. #2