
Greenhouse Common Sense
Patrick Steppuhn
Hummert International

Greenhouse Common Sense

- Greenhouse Basics
- Nutrition
- Water
- Soil
- Pests

Greenhouse Basics

- Keep it CLEAN = Save Money
- Know your market = What to grow
- Know your crop and crop experts = Quality
- Organize & educate your workers = TEAM
- Set a goal = the future
- Know your greenhouse = Efficiency
- Satisfy your customers = winner

Plant Nutrition

- Reading fertilizer bag
- Deficiency symptoms
- pH

Reading Fertilizer Bags

Nitrogen (N)

Phosphate (P_2O_5)

Potash (K_2O)

N:P:K

Deficiency Symptoms

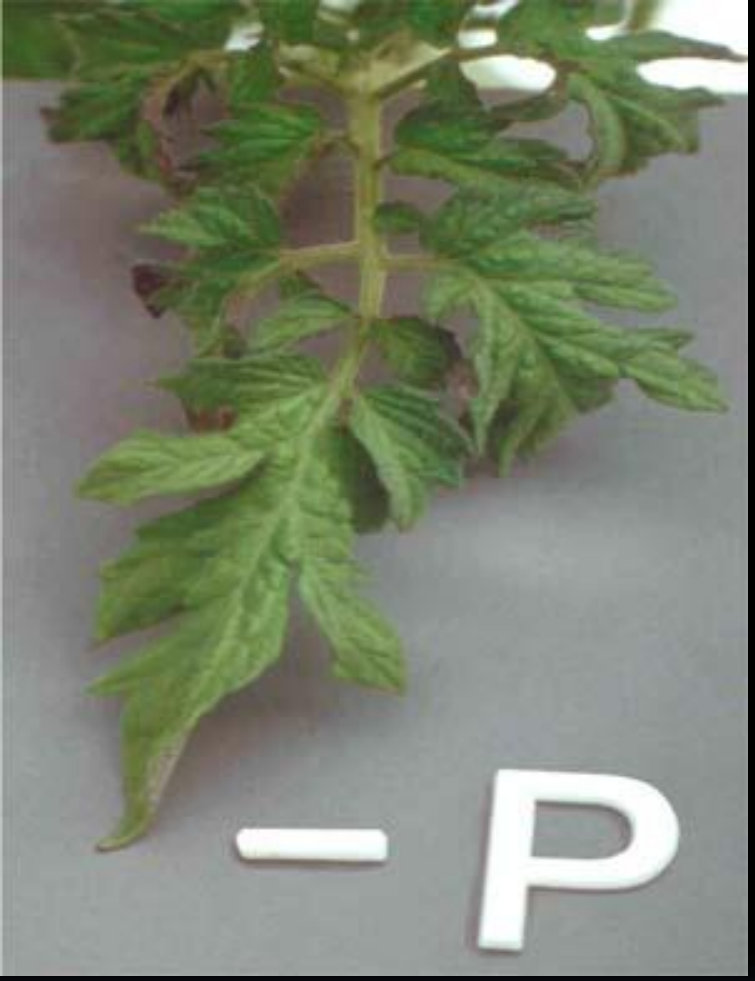
- Vary with plant species
- Color
- Pattern
- Growth response
- Location & History
- New or old plant parts

Nitrogen

- Amino acids, proteins, nucleic acids, nucleotides and enzymes

Cholorosis on lower leaves

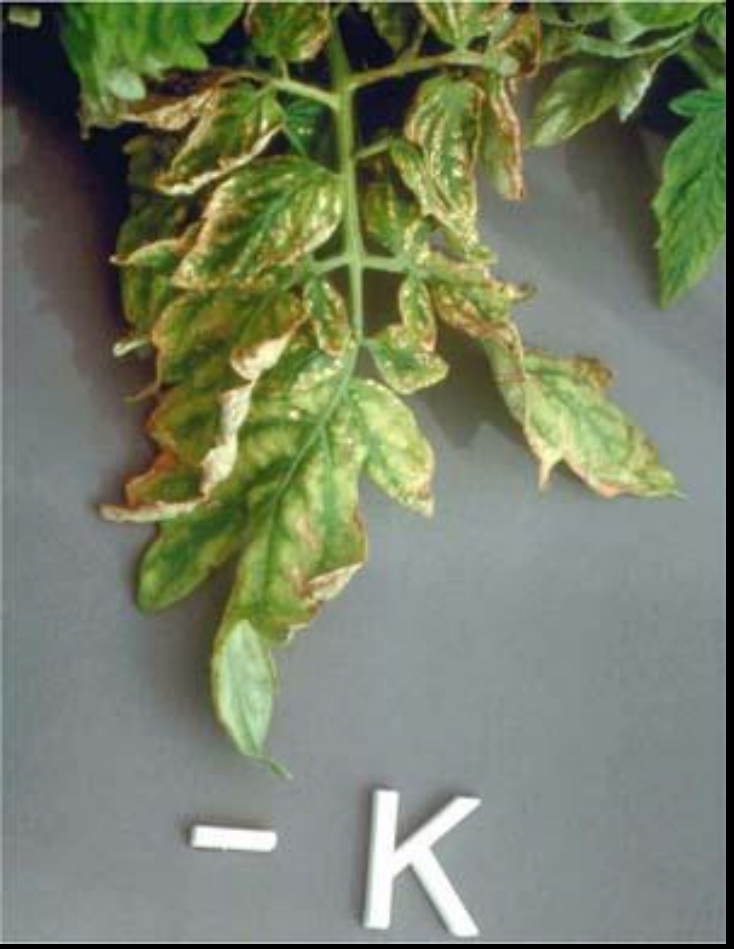
Light green rest of plant



Phosphorus

- Energy functions
- Nucleic acids - DNA

Purpling of lower leaves



Potassium

- Enzymes & membranes

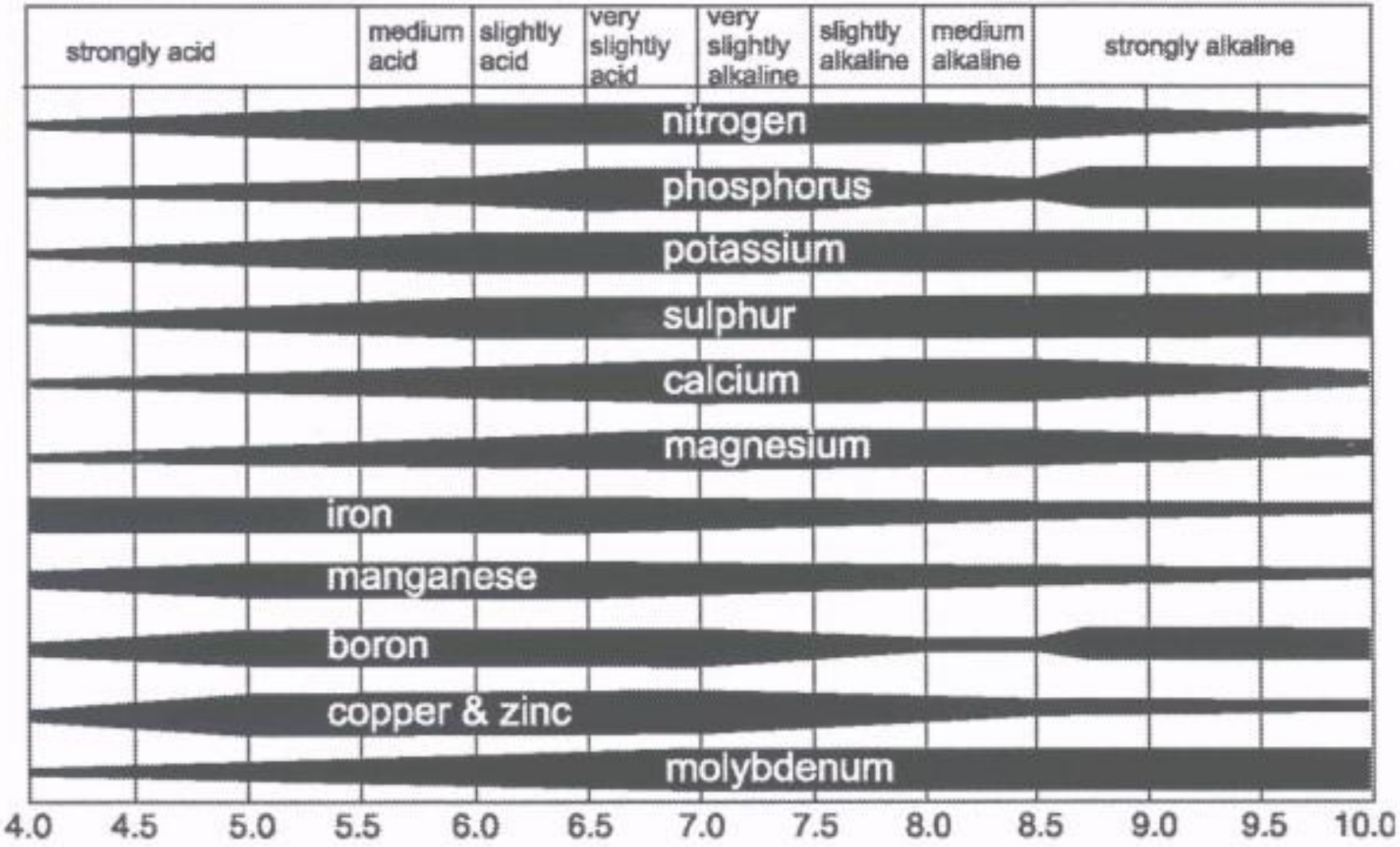
Chlorosis, necrosis on edge of lower leaves

Gastric acid 1.5 – 2.0
Lemon juice 2.4
Cola 2.5
Vinegar 2.9
Orange Juice 3.5
Tomato Juice 4.0
Beer 4.5
Acid Rain <5.0
Coffee 5.0
Urine 6.0
Milk 6.5
Pure Water 7.0
Blood 7.34 – 7.45
Seawater 7.7 – 8.3
Hand soap 9.0 – 10.0
Household ammonia 11.5
Bleach 12.5

pH

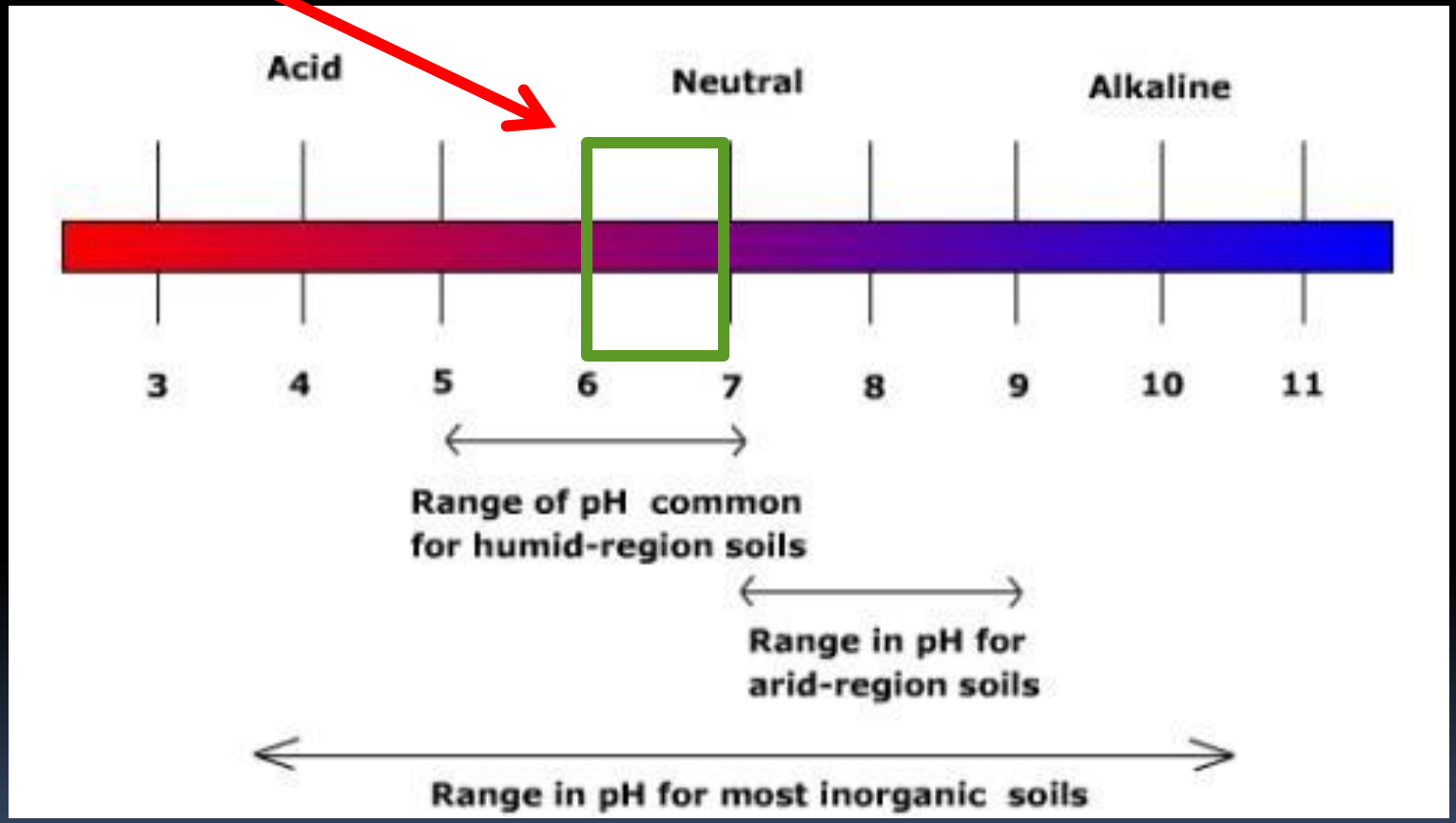
- Drives chemical reactions & nutrient uptake
- Optimum media pH containers = 5.8 to 6.4
- Water pH affects microbes, pesticides & hormones

Influence of Soil pH on Nutrient Availability

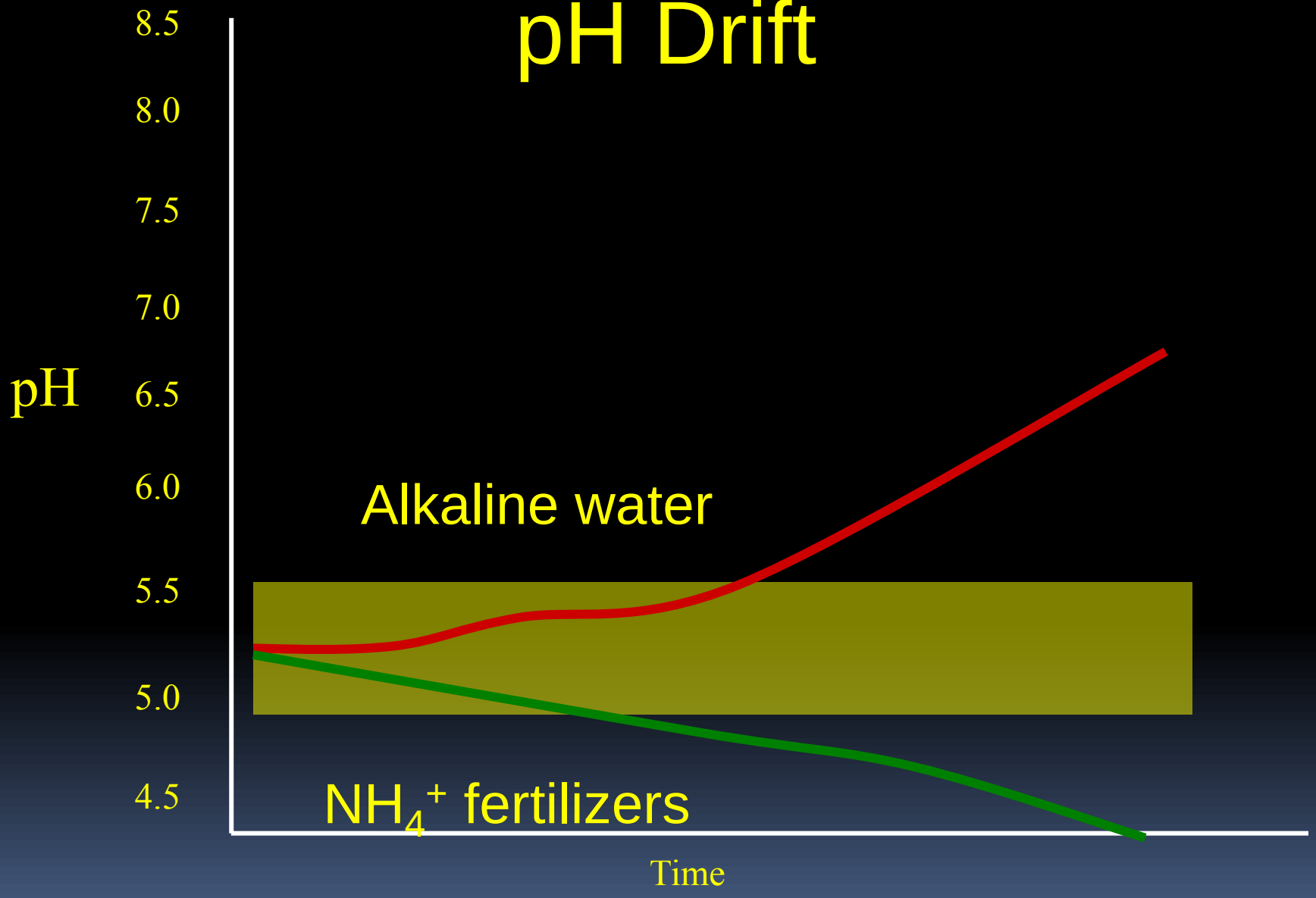


Soil pH Range

"General Plant Preference"



pH Drift


8.5
8.0
7.5
7.0
pH
6.5
6.0
5.5
5.0
4.5
Alkaline water
NH4+ fertilizers
Time


Calibrochoa

Water

- Responsible for leaf expansion
- Responsible for Stem elongation
- Wet – Dry Cycles
- Get a good water breaker

DRAMM AL400 Water Breaker

Growing Media

- Buy the best
- pH 5.8 to 6.5
- Some growers use composted pine bark


EDI EARTH PLUG & SEEDLING
8 CU FT
$ 19.50
METRO-MIX 350
$ 21.00
METRO-MIX 702
$ 18.80
REMIER PRO-MIX PGX LOOSE
8 CU FT
$ 22.20
PRO-MIX PGX PLUG&GERM MIX
8 CU FT
$ 41.60
DIFFERENT MIXES FOR
DIFFERENT PURPOSES

Substrate Components

- Usually 30 to 60 % peat moss alone or in combination with pine bark, vermiculite, perlite, etc.
- Quality of peat is important
- Fiber size is important (retail vs. commercial)

Peat Moss

Drained, harrowed, dried, harvested

Composted Bark

- **Former waste product**
- **Improves aeration**
- **Reduces cost**
- **May reduce efficacy of pesticides**

Composts

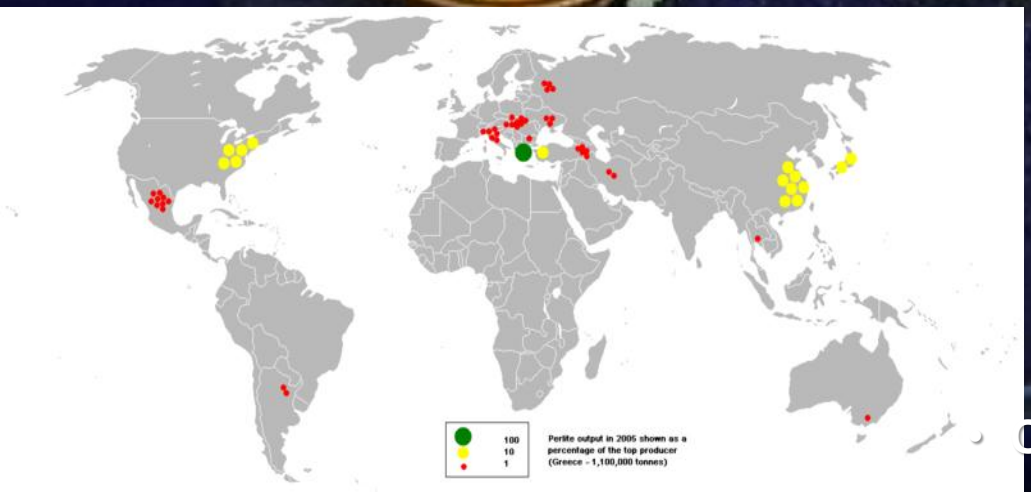
- Landfill reduction efforts
- More suitable for landscape

Coir

May contain high soluble salts

Rice Hulls

- Former waste product
- Inexpensive alternative to perlite
- No difference in GH trials
- AR, TX, LA, MS, CA, MO
- Can save $2 per cubic foot media



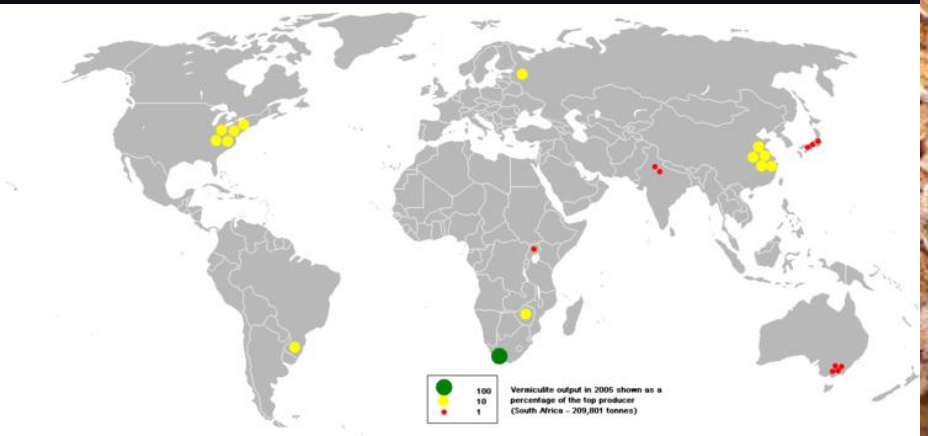
Perlite

- Volcanic rock
- Mined, crushed, heated
- May contain fluoride

Can damage dracaena & chlorophytum

Vermiculite

- **Mined micalike ore**
- **Al-Fe-Mg silicate**
- **Mined, graded, heated**
- **Fine to coarse**

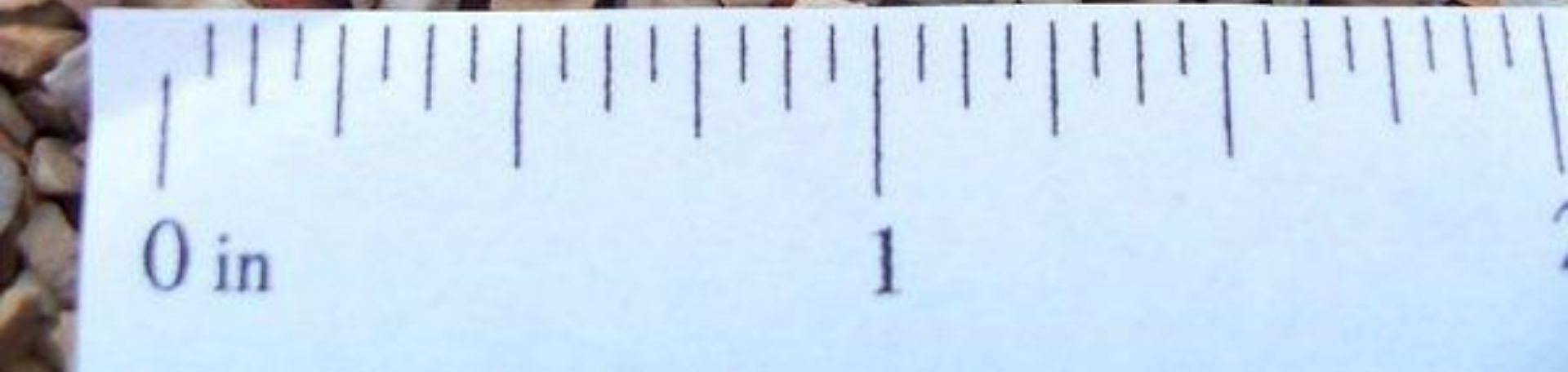


Rock Wool

- Made by spinning molten rock – cotton candy
- High natural pH - condition before use
- Used in hydroponics
- Long-term exposure leads to health risks

Calcined Clay

- Calcined montmorillonite (thermal process)
- Porous
- Used as soil conditioner in athletic fields
- Arabidopsis research
- Bonsai



Commercial Formulations

- Mix of peat moss, vermiculite, perlite
- High porosity & water retention
- Nutrient charge
- pH adjusted to ~6.0
- Non-ionic wetting agent
- Hydrophobic below 40% moisture


Fafard
SUPER FINE
GERMINATING
MIX
2.8 CU. FT. (79 L)


Fafard
3B
MIX
2.8 CU. FT. (79 L)

Fafard


Fafard
52
MIX
2.8 CU. FT. (79 L)
Fafard
CANADIAN
Growing Mix
2
3.8 CU FT (107L)

Premier Pro-Mix

Pest Management

Grant at Cold Harbor battle, VA 1864

"The art of war is simple enough. Find out where your enemy is. Get at him as soon as you can. Strike him as hard as you can, and keep moving."

Ulysses S. Grant

What is greenhouse IPM?

* System utilizing multiple methods
* Decision making process
* Risk reduction system
* Information intensive
* Biologically based
* Cost effective
* Site specific
* Multiple tactics:
    cultural, physical,
    genetic, biological, chemical

What is greenhouse IPM?

- Know what pests you have
- Learn about the pest
- Be able to identify damage
- Monitor for the pests
- Determine threshold levels
- At low densities, use biological control and biorational pesticides
- High pest densities use conventional pesticides
- Use sparingly to protect beneficials

4,400 species of aphids

IPM For Aphids

DAMAGE

- Honeydew
- Black Sooty Mold
- Chlorosis stunting
- Vectors of viruses

Aphid Aerosol Method

Day 1	Day 7	Day 14
Space Mix Preclude TR & Duraplex TR	Preclude TR, Duraguard ME (drench) or Ultra-Pure Oil	Repeat Day 1 or Day 7

Prescription Treatment
DuraGuard ME
Microencapsulated Insecticide

1 can per 1,500 sq ft.
Repeat as necessary
Don't apply oil to blooms

Aphid Pesticides

Pymetrozine (Endeavor)
Ultra-Fine Oil, Suffoil X
Imidacloprid (Marathon, Mantra)
Potassium Salts of Fatty Acids (M-pede)
Beauvaria (BotaniGard)
Pyrethrum
Azadiractin (Azatin)
Pyriproxyfen (Distance)
S-Kinoprene (Enstar AQ)
Neem (Triact 70)
Acephate
Chloropyrifos (Duragard)
Chloropyrifos & Cyfluthrin (Duraplex)
Bifenthrin (Talstar, Menace)
Cyfluthrin (Decathalon)
Fluvalinate (Mavrik AQ)

Rotate pesticides!

Whitefly IPM

DESCRIPTION

- Adult 0.9 to 1.1 mm
- Four wings
- Sucking mouthparts
- Powdery waxy coating
- White wings
- Seven life stages: egg, four nymphal instars, pupal stage, and adult
- Females lay eggs in circles on the undersides of leaves

Whitefly IPM

DAMAGE

- Honeydew
- Black Sooty Mold
- Stunting
- Senesce
- White stem on poinsettia

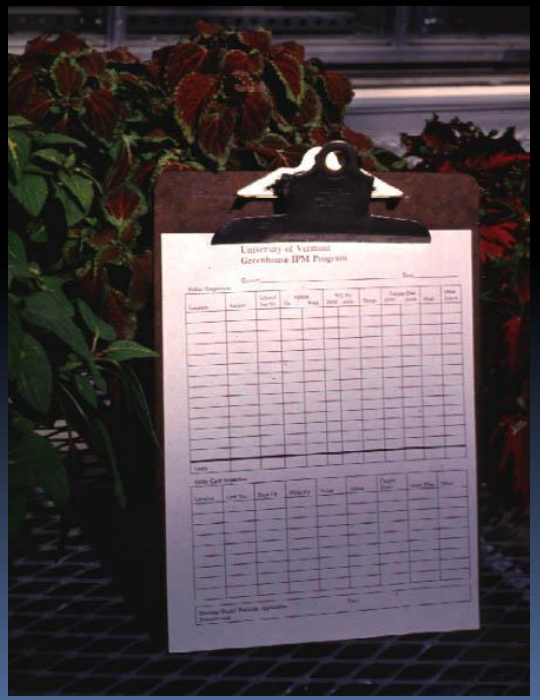
Whitefly IPM

CULTURAL CONTROL

- Weed-free
- Screens <405 microns
- Scout
- Treat or rogue infested plants

MONITORING and WHEN TO TREAT

- Yellow sticky cards
- One per 1,000 sq. ft.
- Inspect for stages
- Underside of leaves



Whitefly Aerosol Control

Stage	Day 1	Day 7	Day 14
Adults	Space Mix Preclude TR & Tame/Orthene TR	Tame/Orthene TR	Space Mix Preclude TR & Tame/Orthene TR
Immatures	Preclude TR & Ultra-Pure Oil	Ultra-Pure Oil	Preclude TR & Ultra-Pure Oil
Eggs	Ultra-Pure Oil	Ultra-Pure Oil	Ultra-Pure Oil

Don’t apply oil to blooms

Good Whitefly Rotation

1. Abemectin (Group 6) + Bifenthrin (Group 3)
Avid 0.15EC + Menace GC

2. Spiromesifen (Group 23)
Judo SC4

3. Dinotefuran (Group 4A)
Safari 20SG
Safari 2G

4. Horticultural Oil (non-classified)
Ultra-Pure Oil

Rotate pesticides!

Thrips IPM

DESCRIPTION

- Four featherlike wings
- Six stages: egg, 1st & 2nd instar, prepupa, pupa, adult
- Eggs inserted into tissue
- 1st & 2nd instars feed by piercing

Thrips IPM

DESCRIPTION

Western Flower Thrips

- WFT
  - Pale
  - Intermediate
  - Dark
- Feed on flowers, buds, or growing tips
- Prepupa and pupal stages in the soil
- Females lay
  - male eggs if unmated
  - female eggs once mated
- One generation
  - 11 days (77° to 87°F)
  - 44 days (50° to 60°F)

Thrips IPM

DAMAGE

- WFT - flowers & GHT – foliage
- Streaking, spotting, and tissue distortion
- Leaf veins - outlining of the veins.
- WFT vector of viruses
- GHT stipple the foliage – confused w/ mite

Thrips IPM

Most insecticides must be applied at least two times, 5-7 days apart, for efficacy against WFT

Thrips Aerosol Control

Stage	Day 1	Day 7	Day 30
Immatures	**DuraGard ME**	**Preclude TR & DuraGuard ME or Pyreth-It**	**DuraGuard ME**
Adults	**Preclude TR & DuraGuard ME or Pyreth-It**	**Preclude TR & DuraGuard ME or Pyreth-It**	**Preclude TR & DuraGuard ME or Pyreth-It**

Rotate pesticides!

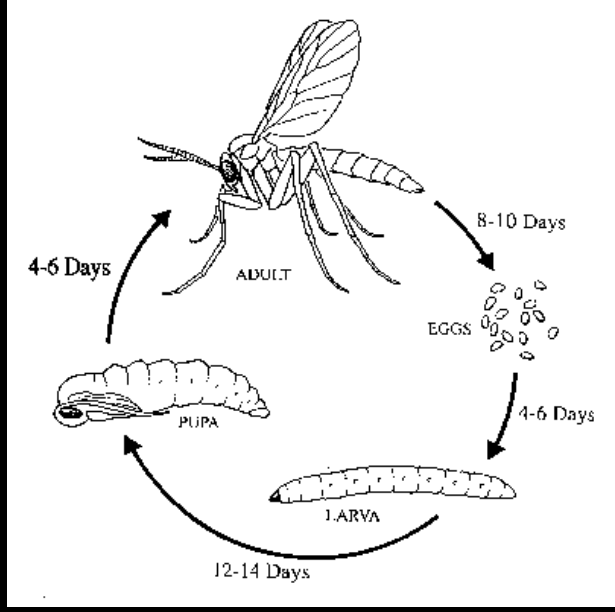
Don’t apply Pyreth-It to blooms

Thrips Rotation

1. Pyridalyl (Overture)
2. Spinosad (Conserve)
3. Abamectin (Avid)
4. Chlorfenapyr (Pylon)
5. Acephate

Rotate pesticides!

Fungus Gnat IPM



DESCRIPTION

- 2-5 mm long
- Mosquito-like flies with dark wings
- Delicate legs, and long antennae
- Lay their eggs in soil & hatch 4 days later
- Four larval instars
- Larvae are clear, with visible internal organs
- Shiny black head capsules
- Feed on root hairs and algae then insides of roots
- High populations bore into roots & stems
- One generation may in 21 (72°F) to 40 (61°F) days

Fungus Gnat IPM

DAMAGE

- **Larvae feed on roots & algae within 1 inch of surface**
- **Root feeding allows fungi to enter**
- **Wilting, necrosis**
- **Problem in propagation**

Fungus Gnat IPM

MONITORING and WHEN TO TREAT

- Yellow sticky cards
- Cubes or slices of potatoes pressed into soil
- Pyrethroids for adult knockdown
- Microencapsulated pesticides for larvae
- Apply drenches to top 1 inch of soil for larvae
- Foggers, aerosols, or sprays to control adults

Fungus Gnat Aerosol Control

Stage	Day 1	Day 2	Day 8	Day 15	Day 30
Adults		Duraplex TR or Attain TR	Duraplex TR or Attain TR	Duraplex TR or Attain TR	Drench DuraGuard ME
Immatures	Drench DuraGuard ME				Drench DuraGuard ME

Rotate pesticides!

Fungus Gnats

Bacillus thuringiensis israeliensis (Gnatrol)
Steinernema feltiae (Nemashield)
Pyrethrin
Azadirachtin (Azatin, Azaguard)
Pyriproxyfen (Distance)
S-Kinoprene (Enstar AQ)
Imidacloprid (Marathon, Mantra)
Acephate
Chlorpyrifos (Duraguard)
Bifenthrin (Menace GC)
Cyfluthrin (Decathalon)
Fenpropathrin (Tame)
Fluvalinate (Mavrik Aquaflow)
Permethrin (pyganic)

Rotate pesticides!

Spider Mite IPM

DESCRIPTION

- Web-forming mites that pierce plant cells
- Two body segments and four pairs of legs as adults
- Adults have two large dark spots on the sides
- Lay round eggs that hatch into six-legged larvae
- The subsequent stages, the protonymph and deutonymph stages, are eight-legged
- Life cycle in 8 (77° to 95°F) to 28 (50° to 68°F) days
- Many generations per year and can rapidly increase in number

Fungus Gnat IPM

DAMAGE

- Stippling
- Webbing
- Chlorosis
- Stunted

Spider Mite IPM

MONITORING and WHEN TO TREAT

- Sticky cards do not work
- Scout plants
- 10X hand lens on underside of leaves
- May need a miticide and an ovicide

Mite Rotation

1. Pylon
2. Judo
3. Floramite
4. Triact
5. Shuttle O
6. Ovation & Sanmite

Rotate pesticides!

Greenhouse Common Sense

- Greenhouse Basics
- Nutrition
- Water
- Soil
- Pests