Abiotic Plant Stress

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Abiotic stress is any change in the physical or chemical environment that plants grow in that has a negative impact on plant growth and development.

Examples of Abiotic Stress

<u>Physical</u>

- Too much/too little water
- Compaction
- Low or high light conditions
- Ice, wind, snow

<u>Chemical</u>

- Nutrient deficiency/toxicity
- pH high or low
- salinity
- air pollution
- pesticides

Water Stress

- Water keeps plants turgid and transports nutrients, cools plant

- Too much water is a bad thing
  - Reduces oxygen which creates anaerobic environment
  - Creates acidic conditions
  - Increases ethylene which reduces growth and causes wilting

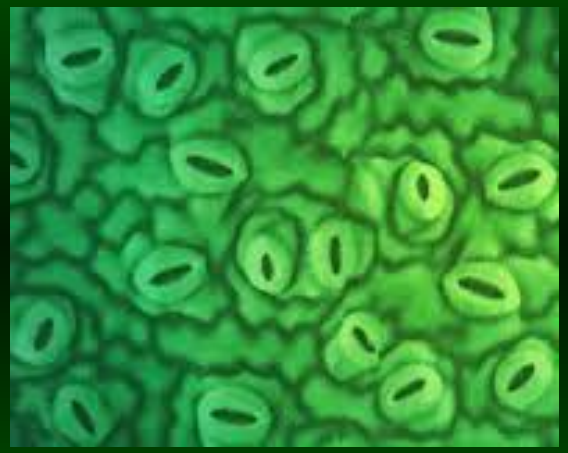
- Plants may produce adventitious roots or edema

adventitious roots

Edema

Drought Stress

- Can be caused by heat, low humidity, wind, no water
- Plants lose water through stomates
- Plants adapted to low water conditions
  - open stomata at night
  - have more stomata on bottom
  - thick cuticle
  - straight leaves



Drought Stress

- Symptoms can appear as wilting or scorching
- Longer plants are in stress the harder it is to reverse
- May be manifested as a nutrient defieciency

Wilting

Scorching

Blossom end rot = water deficiency causes Ca deficiency

Soil Compaction

The most common issue related to soil structure is compaction, which results in inadequate pore space for root growth. Clay soils, with their smaller particle size, have naturally smaller pore space and are at high risk for becoming severely compacted.

Repetitious traffic from farm equipment and vehicle movement over the same area can lead to compaction.

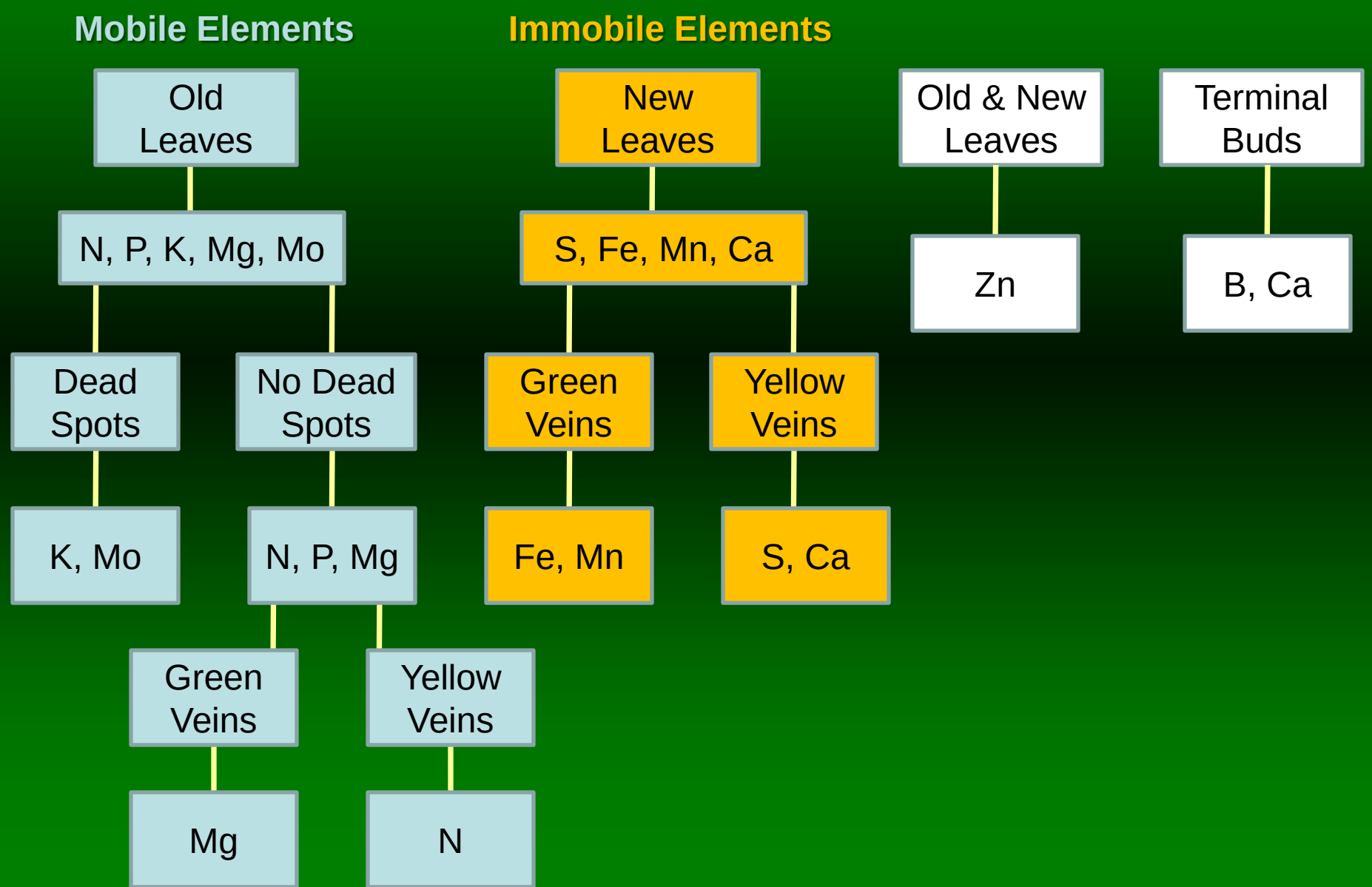
Compaction from repeated traffic.

Nutrient Deficiency

- Macros = N, P, K, … S, Ca, Mg
- Micros = Mo, Cu, Zn, Mn, Fe, B, Cl

pH can effect the availability of these, making some less available and some more available or even toxic. See graph in chapter 4.

Diagnosing Nutrient Deficiencies



Mg deficiency = mobile

Fe deficiency = immobile

Boron toxicity

Air Pollution

Mostly from nitrogen oxides, sulphur dioxide, and ozone. Ozone is most common.

Ozone is produced when components of combustion/vehicle emissions such as hydrocarbons and nitrogen oxides react with oxygen and sunlight to form ground level ozone in the atmosphere.

Ozone on Watermelon

Fig. 2 Progression of ozone damage (A=none to F=severe) on watermelon foliage.

Photo courtesy of G. J. Holmes, NCSU

Ozone on “Other” Plants

Herbicide Phytotoxicity

Obviously herbicides are toxic to plants.
Figuring out how plants get exposed is the trick.

<u>Exposure routes of herbicides</u>

- Drift and/or volatilization
- Leaching and/or soil run-off
- Soil or soil amendment application
- Misapplication

Herbicide Drift

Affects a large area and all plants in that area.

Weeds and domesticated plants may be equally damaged.

Herbicide Drift

Paraquat

Herbicide Drift

Roundup (glyphosate)

Herbicide Drift

Phenoxy (2,4-D)

Herbicide Drift

- Look at all plants in the area
- Symptoms may appear similar across species
- Typically covers a broad, general area
- Drift can come from MILES away
- Manure from grazing animals can contaminate
- Soil can be contaminated
- Keep an open mind