Water, Nutrition and Plant Disease

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September 23, 2008

- Effect of water and nutrition on plants

  - direct: water vs plants
    nutrients vs plants

  - indirect: water vs plant disease
    nutrients vs plant disease

Nutrient

- **Macronutrient:**

  - nutrients that are needed in relatively large amounts: nitrogen, potassium, phosphorus, calcium, sulfur and magnesium.

- **Micronutrient:**

  - a handful of additional nutrients that are required for plant growth, but in much smaller quantities: boron, copper, iron, manganese, molybdenum and zinc.

Macronutrient

- Excessive nutrients:
  - reduce profit
  - reduce water quality
  - tend to make the plant susceptible to pathogens

N: - plants grow too fast (excessive growth), look overly green
- more susceptible to pathogens
- increase disease

- Nutrient deficiencies cause disorder in plants

  - yellowing, stunting: reduced growth and yield

  - increase disease: e.g. early blight of tomato

Micronutrient deficiency

- Most common symptom: reduced growth

  Others: changes in coloration

- Difficult to diagnose:

  similar to those caused by 1) soil saturation (too wet, drained poorly) or soil that is too compacted; 2) extreme cold or heat; 3) too much fertilizers (salt injury)

Manganese deficiency

Boron deficiency causes stunted seedlings (at right), small, crinkled, discolored leaves on tomato plants.

Boron deficiency

Potassium deficiency

A zinc deficiency can cause stunting, with white spotting between veins, in tomatoes.

Zinc deficiency

Iron deficiency in beans causes yellowing between veins on older leaves, overall yellowing in young ones.

Iron deficiency

Mineral nutrient toxicity

Boron toxicity

Aluminum toxicity

Manganese toxicity

Water

Cat facing

Water stress

Cracks of squash fruit

Disorder by water and dry

Cracks of palm tree caused
by repeated flooding and dry

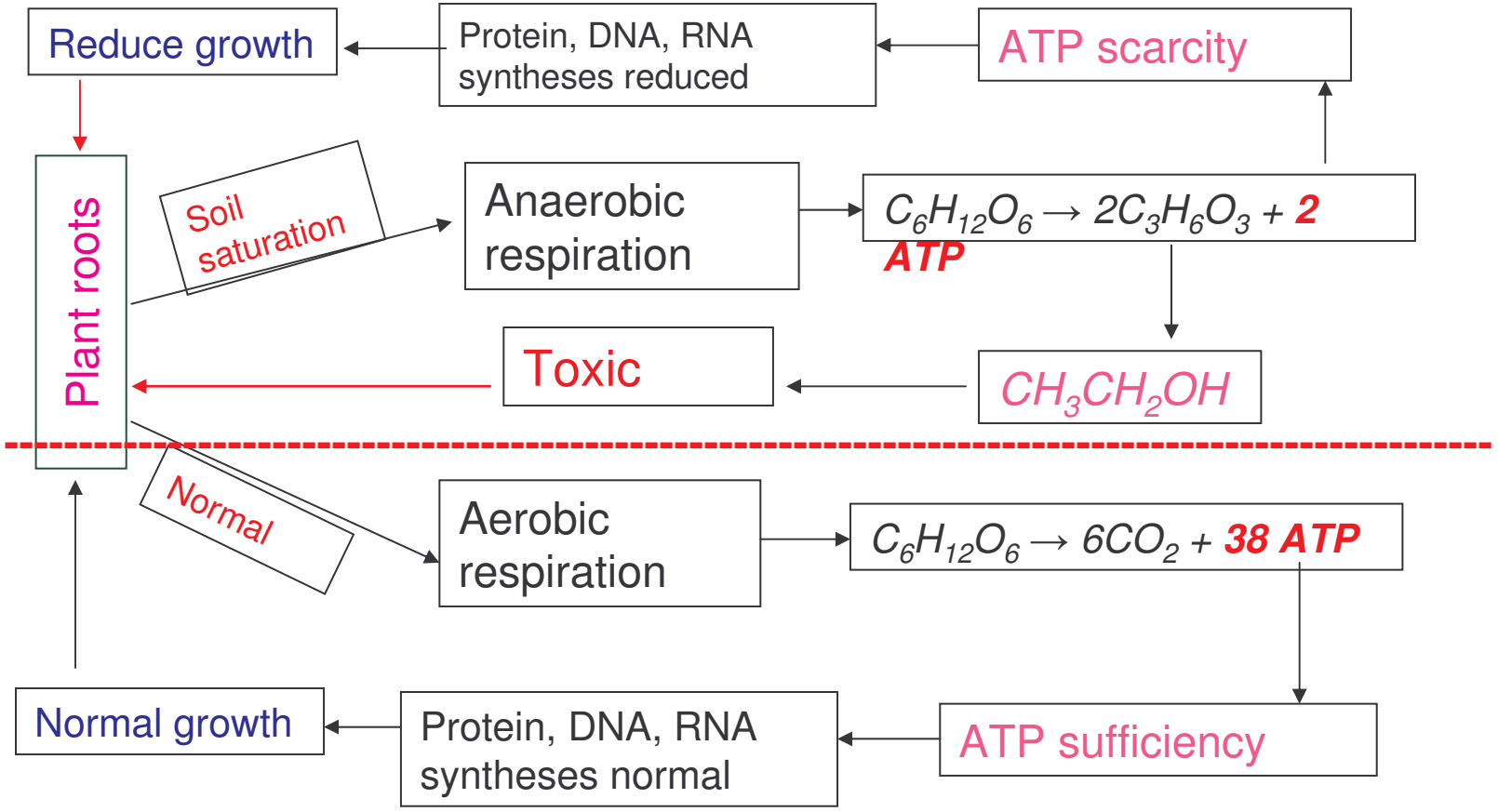
(Courtesy of A. Palmateer)

Excessive irrigation

- Prolonged **soil saturation** (water-logging) negatively affects crop growth and yield

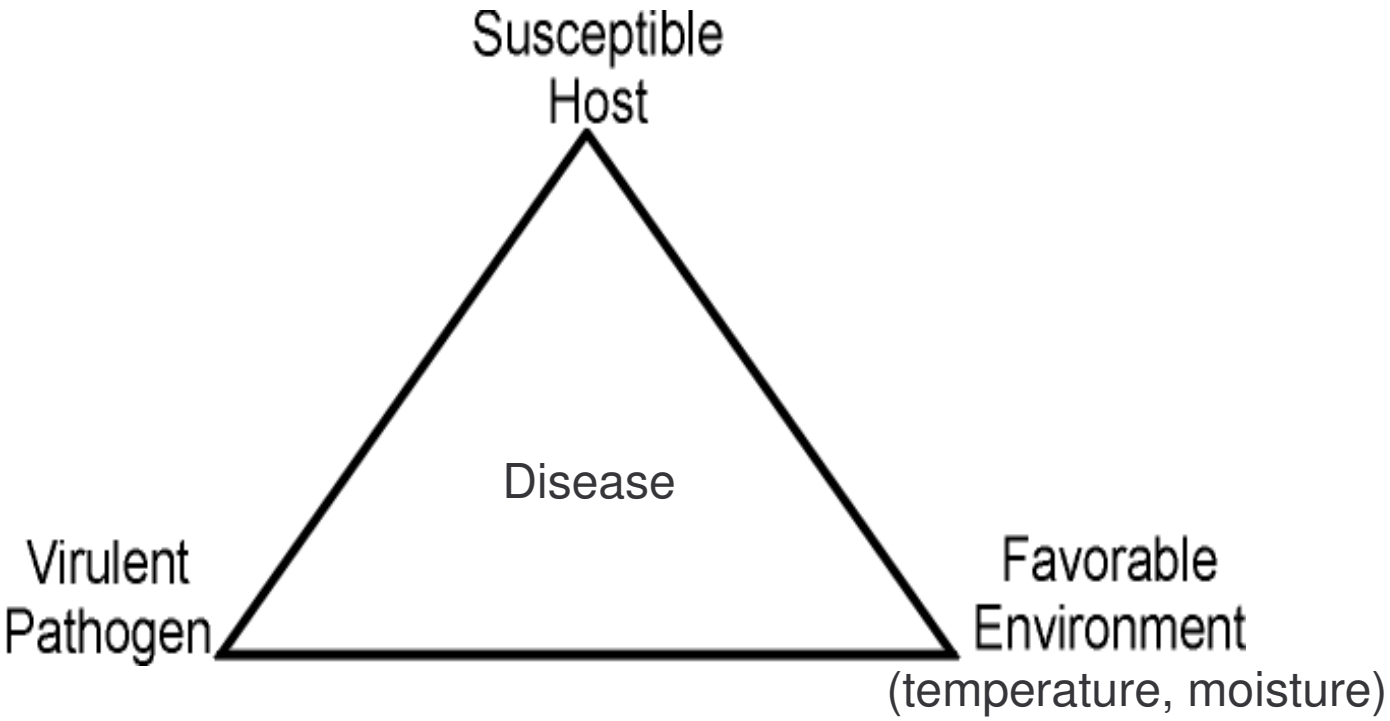
  a) a rapid depletion of oxygen required for plant growth and development (lack of oxygen)

  b) change in nutrient status either by leaching or changing their availability to the plant



Courtesy of G. Liu

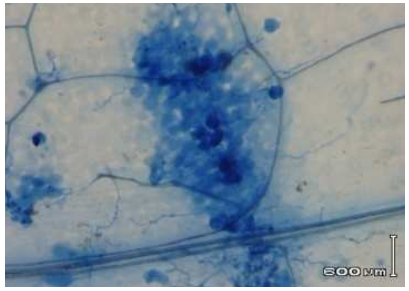
Disease triangle

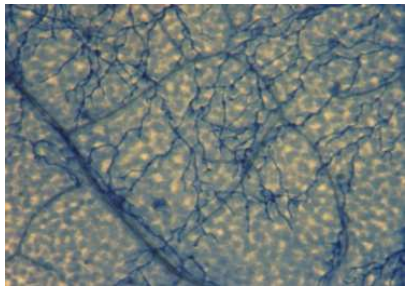


- Too much water floods the air pores in the soil depriving roots of oxygen

  - Roots will then rot

  - Disease-causing fungi reproduce by spores (like seeds) need water to germinate





- Spread pathogens via excessive water:

  Pythium, Phytophthora, Rhizoctonia, Fusarium, etc.

- High moisture
  - increase severity of most diseases: foliar & root

Water-mold pathogens (Oomycetes):

Phytophthora, Pythium, Peronospora

Fungi: *Fusarium, Rhizoctonia, Colletotrichum*

Bacteria: *Xanthomonas campestris pv. vesicatoria*

X. campestris pv. *phaseoli*,

Bacterial spot of tomato

Common bacterial blight of snap bean

Bacteria are readily transmitted mechanically, especially when field plants are **wet**

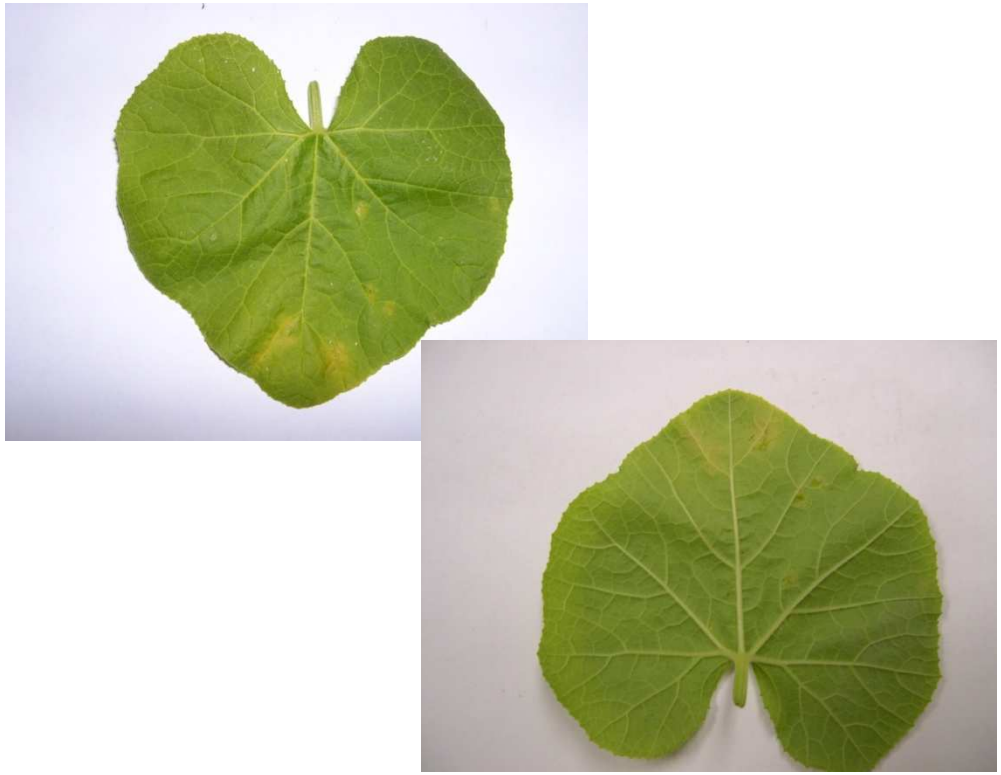
- Avoid movement through and work in fields when **wet**

Root rot *(Rhizoctonia* sp.) of snap bean

Phytophthora blight of squash

Damping-Off off on okra
(*Pythium* spp., *Rhizoctonia* spp.)

Downy mildew on squash



Downy mildew of basil

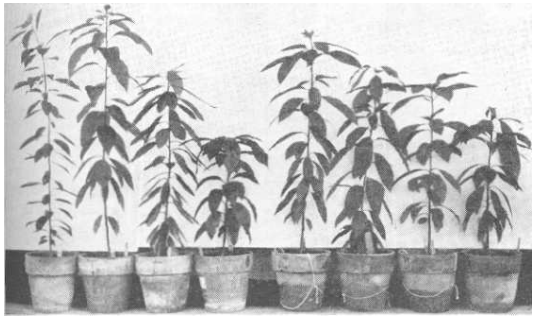
http://pestalert.ifas.ufl.edu/pdr-1029.htm

Anthracnose on piper betel

Phytophthora root rot on avocadoes

- Root rot is most severe in water-logged or poorly drained soil
- **A strong synergism** exists between PRR and flooding

- avocados that are not affected by this pathogen are tolerant of flooding, for 9 days with no apparent ill effect
- trees infected with *P. cinnamomi* died rapidly under flooding conditions (when flooded for 2 days)



Maintain crop healthy

Consult extension specialists

- Avoid overwatering
- Well drainage
- Planting into raised beds
- Balance of N, P, K etc.
- Apply adequate minerals

Water timing

- Water early in the day, so the plants will dry quickly.
- Night watering after dew appears may help with water conservation, but is not recommended on hot, humid nights because it can increase some diseases, especially *Pythium* spp.
- Avoid light, frequent sprinklings and do not water in the late afternoon or early evening.

Thank you !

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