OVERVIEW OF ABIOTIC DISEASES

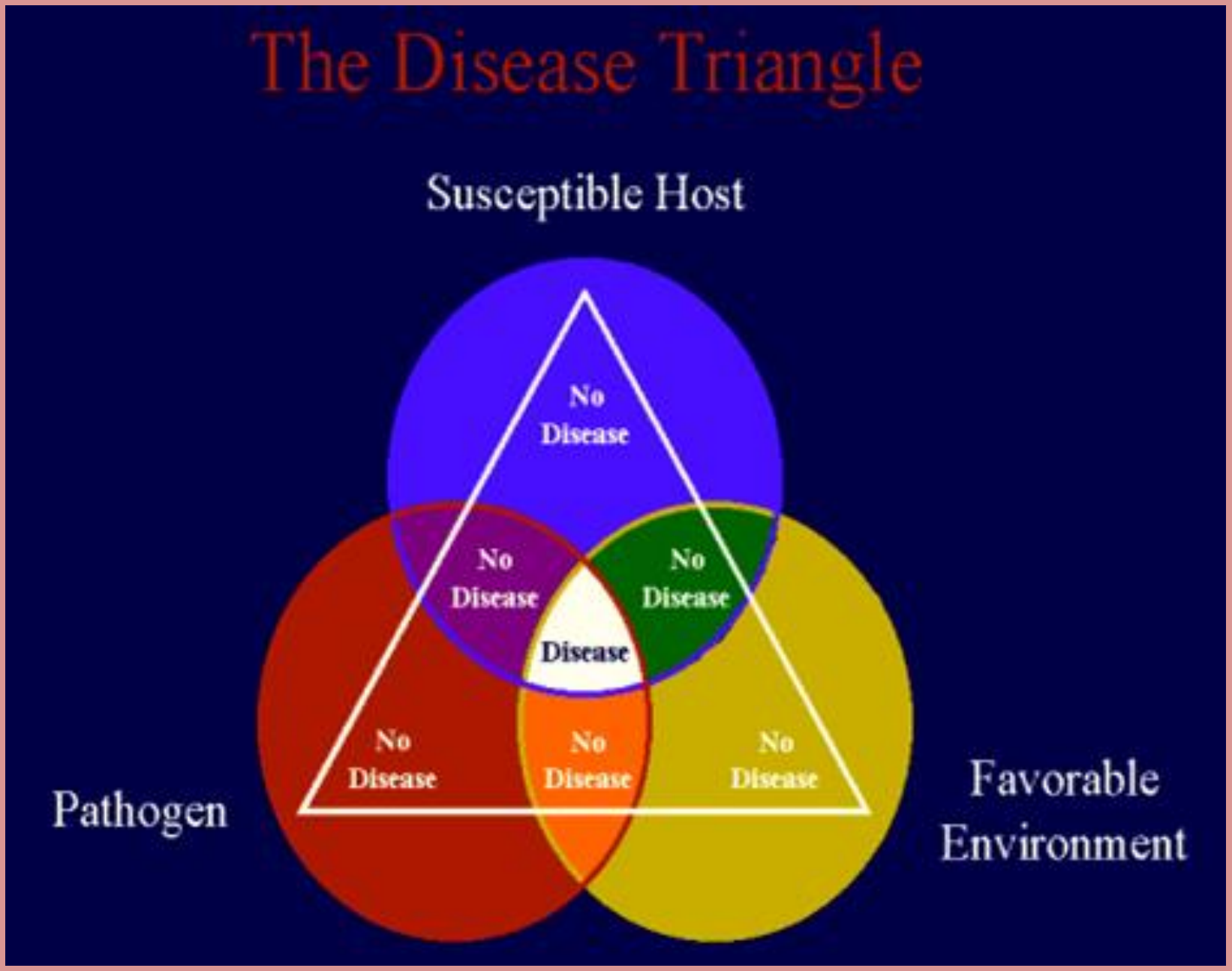
SOIL AND PLANT NUTRIENTS

CHEMICAL DAMAGE

ENVIRONMENTAL FACTORS

CULTURAL PRACTICES

The Disease Triangle



BIOLOGICAL AND BOTANICAL PROBLEMS THAT MIMIC ABIOTIC DISORDERS

- **Genetic mutations and reversions**
  - Albino seedlings that lack chlorophyll
  - Mutant cultivars may revert back to species type
    - Alberta spruce, Norway maple, Callery pear
- **Chimeras** – botanical abnormalities often confused with nutritional or chemical disorders
  - Bumald spiraea
- **Chimera** – single plant with two genetically different tissue types
  - Leaf variegation

BIOLOGICAL AND BOTANICAL PROBLEMS THAT MIMIC ABIOTIC DISORDERS

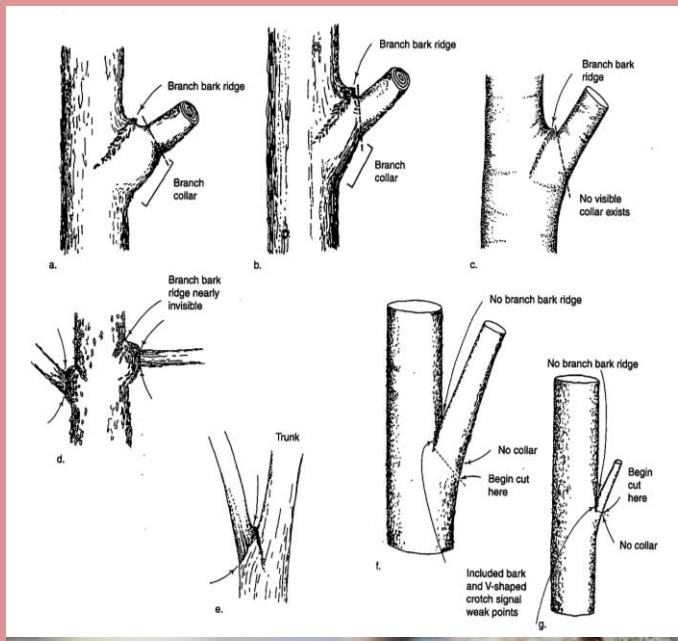
- **Leaf abscission and retention**
  - Normal plant function for both deciduous and evergreen species
  - Triggered by daylength
  - Chlorophyll degrades and other leaf pigments are expressed
  - Needle shed in interior of tree
  - Early killing fall frost/freeze may cause leaves to be retained until the following spring
  - **Marcescent leaves** – leaves retained by oaks and beeches until spring

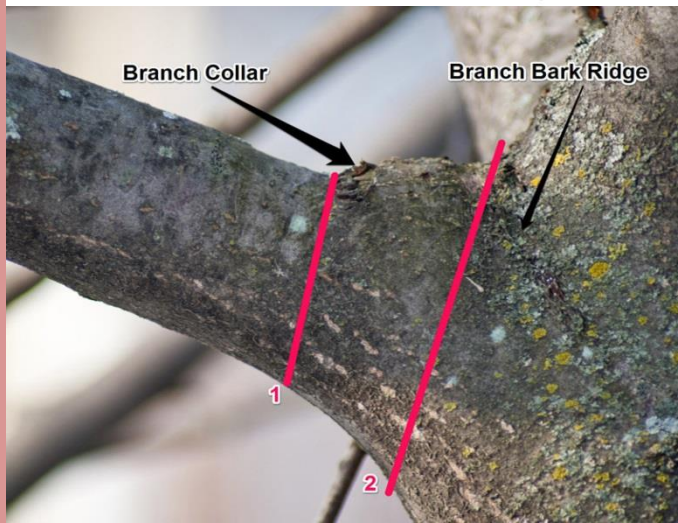
BIOLOGICAL AND BOTANICAL PROBLEMS THAT MIMIC ABIOTIC DISORDERS

- **Graft incompatibility** – failure of bud or graft union between scion and understock
  - Disrupts vascular system
  - Abnormal fall color intensity (Acer rubrum)
  - Problem in fruit tree production
  - Tree may snap off at graft union
  - Differences in growth rate between scion and rootstock
- **Galls and burls**
  - Abnormal growths on branches, trunks, roots
  - May be caused by pathogens, insects, mites

BIOLOGICAL AND BOTANICAL PROBLEMS THAT MIMIC ABIOTIC DISORDERS

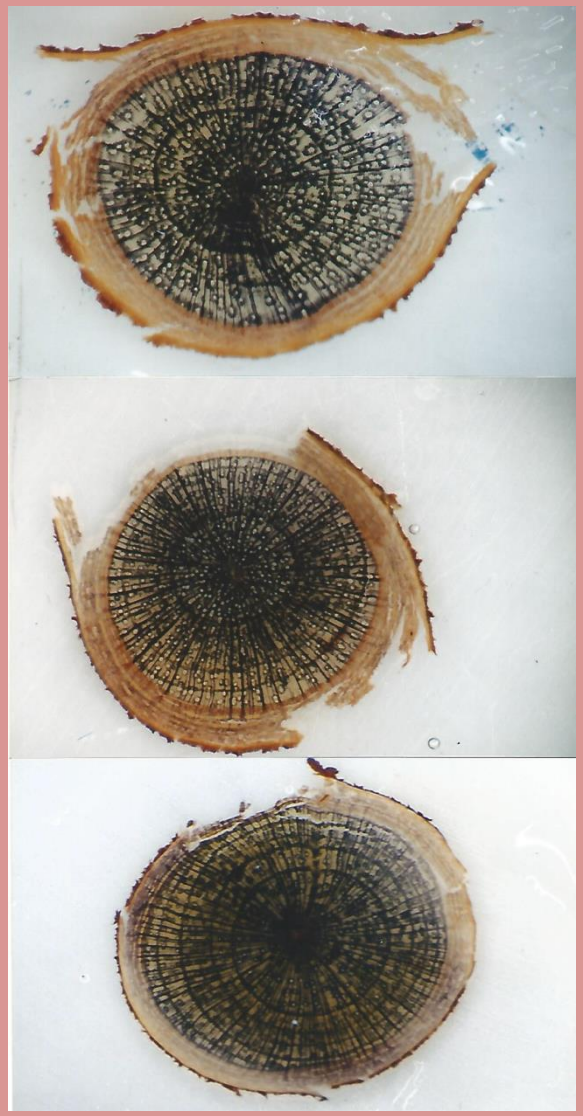
- **Branch architecture**
  - Narrow branch angles are weaker and prone to storm damage. (i.e. Callary pear)
  - Horizontal branch angles are stronger
- **Proper pruning** is important to insure good branch structure
- **Cabling and/or bracing** may be used where pruning is not possible





ENVIRONMENT
(Climate and Weather)

- **Cold hardening is a 3 stage process**
  - Growth ceases, terminal bud forms, food is stored
  - Acclimation begins
  - Deepest level of cold hardiness (i.e. early January)



ENVIRONMENT
(Climate and Weather)

- **Low temperature injury**
  - **Chilling** – sudden drop in temperature during active plant growth or development
  - **Freezing** – caused by sub-freezing temperatures
  - Intracellular or intercellular ice formation may occur

COLD ACCLIMATION IN WOODY PLANTS

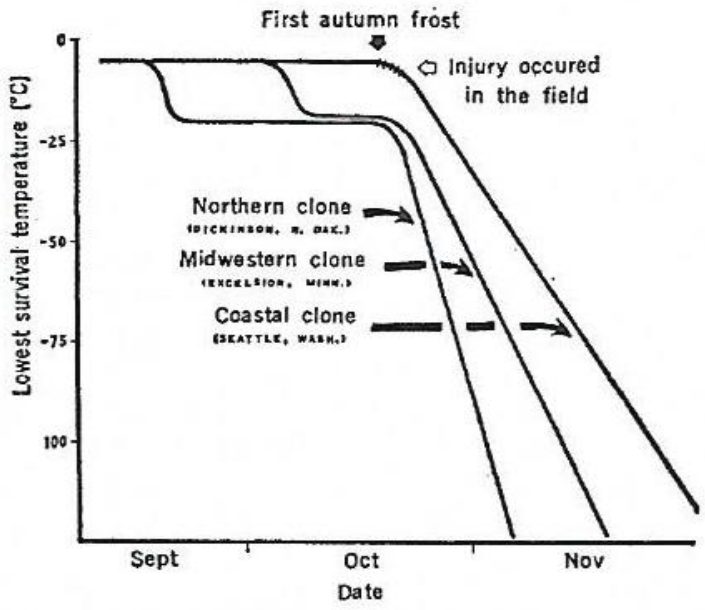


Fig. 3. Typical seasonal patterns of cold resistance in the living bark of three climatic races of *Cornus stolonifera*. The acclimation curves shown are for clones from North Dakota, Minnesota, and Washington grown in the field in Minnesota. Races from regions with mild climates and long growing seasons acclimate later and more slowly than clones from regions with severe climates and short growing seasons. Over 25 clones which have been collected from widespread locations in North America became resistant to —196°C by midwinter in Minnesota.

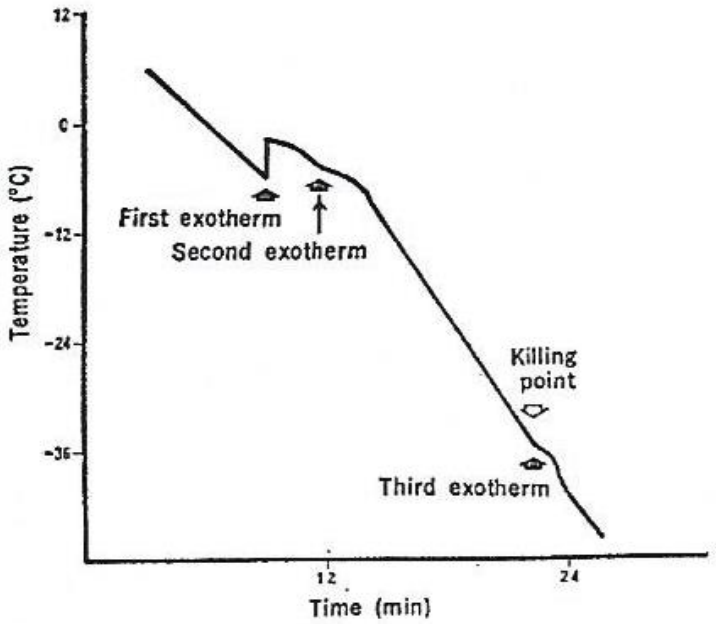


Fig. 1. A typical record of tissue temperature (freezing curve) during the controlled freezing of an acclimated stem section of a semihardy woody species. Exotherms are the points at which the heat of fusion from the freezing of water in the excised stem detectably raises the sample temperature. This figure shows the cooling curve of a stem which initially supercooled to —6°C before freezing. The third exotherm has been observed to be the killing point of stem tissues in a number of woody species.

ENVIRONMENT
(Climate and Weather)

- **Frost heaving** – caused by alternate freezing and thawing of soil
- **Snow and Ice**
  - Can cause branch splitting, breakage, and cracking
  - Especially a problem with multi-stemmed plants
- **Drought and heat**
  - Main effect is increased water loss and stress
  - Reduces growth even under moderate stress
  - Some plants may go into imposed dormancy
  - Sunburn can occur on foliage and trunk
-

ENVIRONMENT (Climate and Weather)

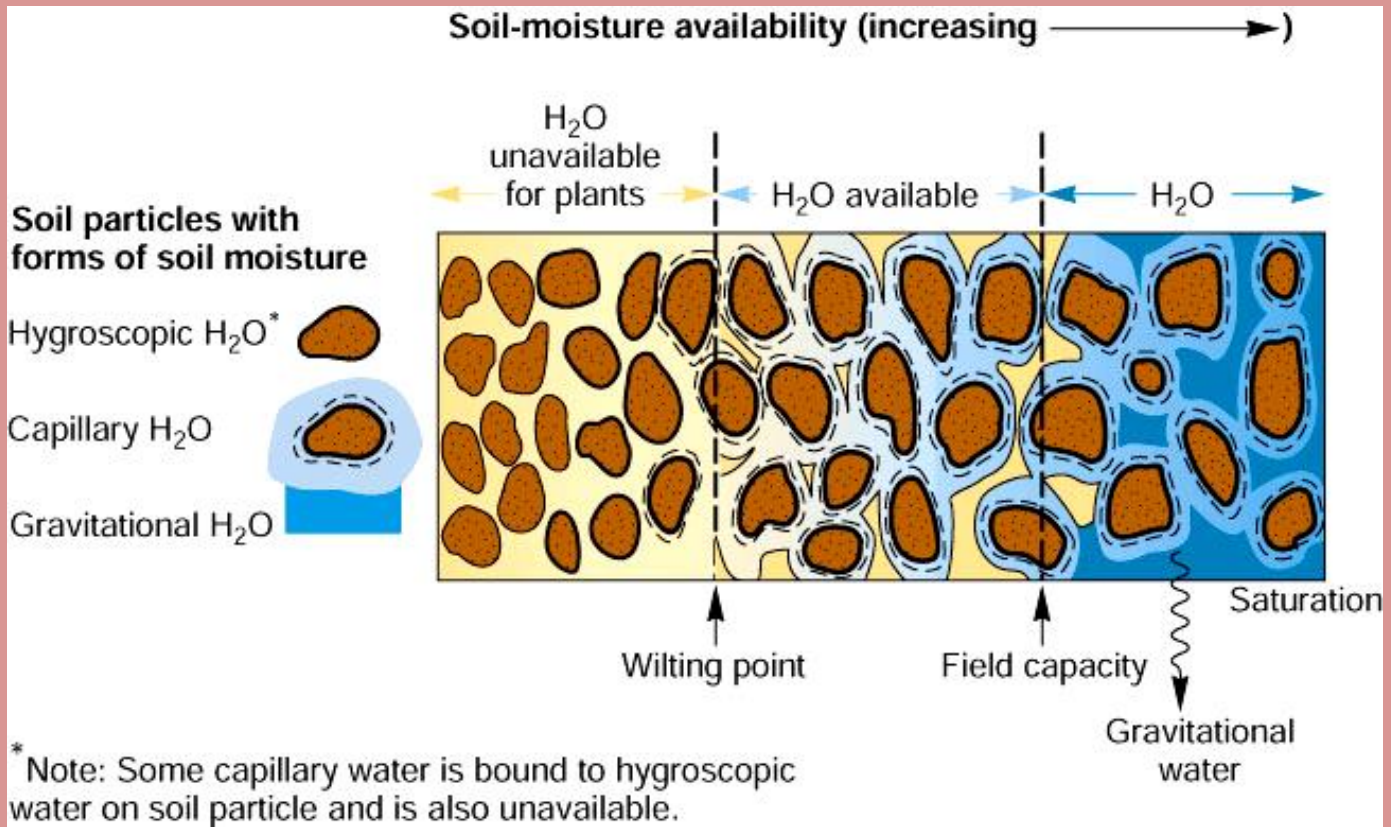
- **Flooding**
  - **Just as damaging as drought**
  - Will vary with species
  - Roots must have O_2 to respire
  - Symptoms are similar to water stress
  - **Premature fall color is a good indicator**
  - ***Euonymus alatus* 'Compactus' is a good indicator plant for moisture stress**

ENVIRONMENT
(Climate and Weather)

- **Lightning and Hail**
  - Cuts a groove in the conductive tissue and bark
  - **Damage may be hidden**
  - Hail shreds leaf tissue and bruise bark
  - **Hail damage is usually immediate and short-term**

SOILS

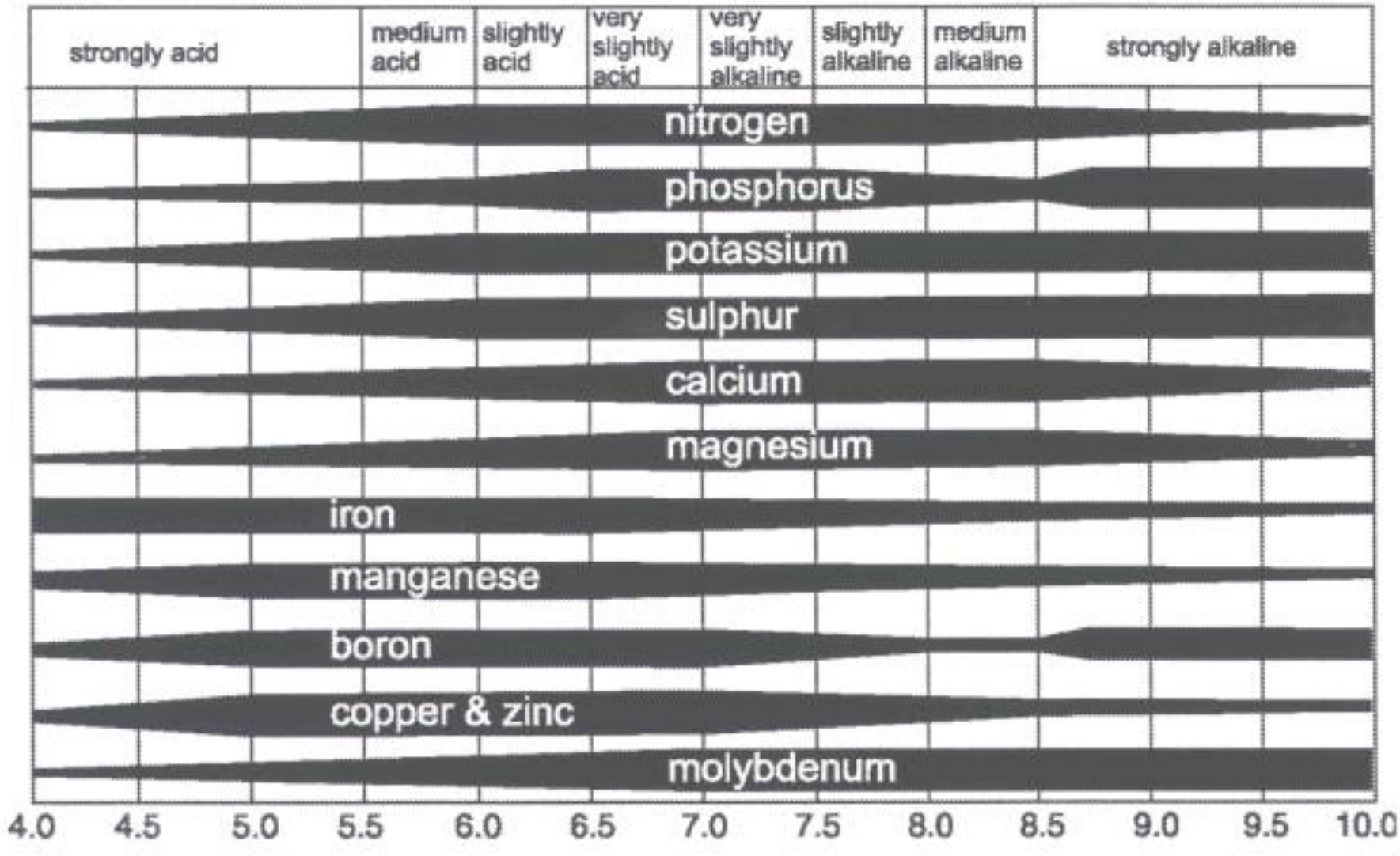
- Soil texture and structure is important
  - Clay soils slower to drain, sandy soils droughty
- Well-drained soils are critical (i.e. **field capacity**)
- Be aware of **soil interface** issues



NUTRIENT PROBLEMS

- Remember! Soil pH is the "**master variable**"
- Most nutrient issues are due to deficiencies
- Optimum soil pH is between 6.0 and 6.5 except for acid-loving plants
- **Many nutrients will become unavailable to the plant at pH above 7.0**

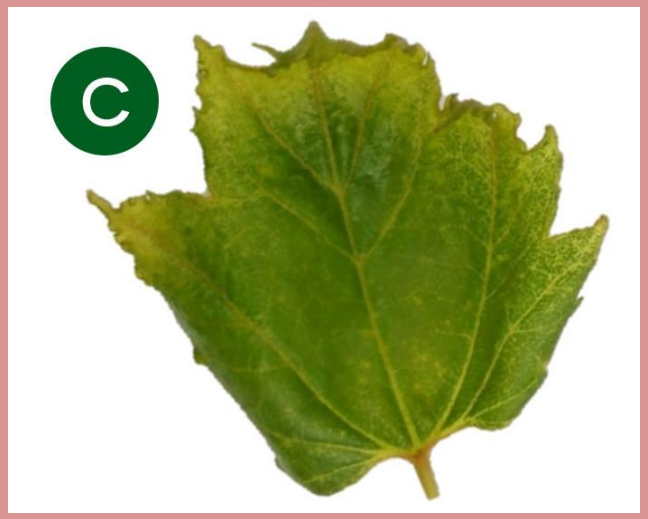
pH AND NUTRIENT AVAILABILITY



CHEMICAL DAMAGE

- **Salt injury**
  - Damage above and below ground plant parts
  - Dehydration, reduced cold hardiness, and impact soil nutrients
  - High salt levels affect soil structure
  - Symptoms: shoot dieback, bronzing of evergreen foliage, **witches' broom**, or plant death
- **Pesticides**
  - Phytotoxicity
  - Plant stage is important

Figure 3: Response of peach **(A), pin oak (B), maple (C), elm (D), and grape (E)** to 1/20th of the standard use rate of dicamba (0.025 lb ai/A) or dicamba + glyphosate (0.025 + 0.05 lb ai/A). **This rate is representative of what can occur during a physical drift event.**



PLANTS SENSITIVE TO GROWTH REGULATORS

- Apple
- Forsythia
- Horse chestnut
- Redbud
- Sycamore
- Box elder
- Grape
- Norway maple
- Rose
- Dogwood
- Honeylocust
- Petunia
- Siberian elm

PLANTS EXTREMELY SENSITIVE TO HERBICIDES

- **Extremely Sensitive**
- Grapes
- Snap bean
- **Peach**
- **Oaks**
- Lima bean
- Soybean
- Elderberry
- **Viburnum**
- Southern Pea
- Tobacco
- **Dogwood**

PLANTS VERY AND MODERATELY SENSITIVE TO HERBICIDES

- **Very Sensitive**
- Cotton
- Tomato
- Pumpkin
- Pepper
- Watermelon
- Squash

- **Moderately Sensitive**
- Cantaloupe
- **Apple**
- **Redbud**
- Cucumber
- **Maple**
- **Rose**

PLANTS WITH LOW SENSITIVITY TO HERBICIDES

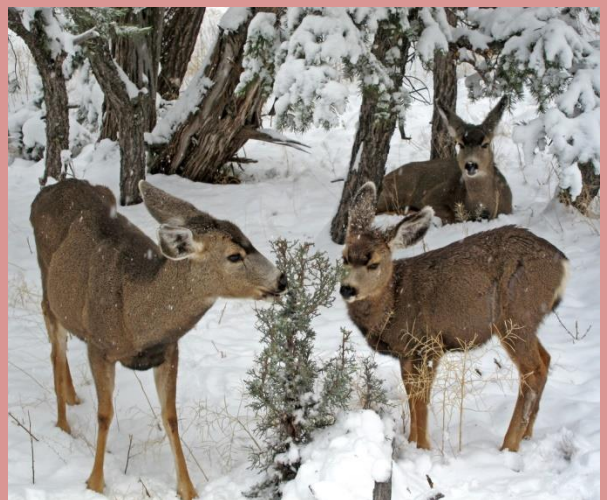
- **Low Sensitivity**
- Peanut
- Cabbage
- Mustard
- **Walnut**
- Raspberry
- **Sweetgum**
- **Hydrangea**
- Broccoli
- Kale
- Turnip
- **Pecan**
- Strawberry
- Crabapple

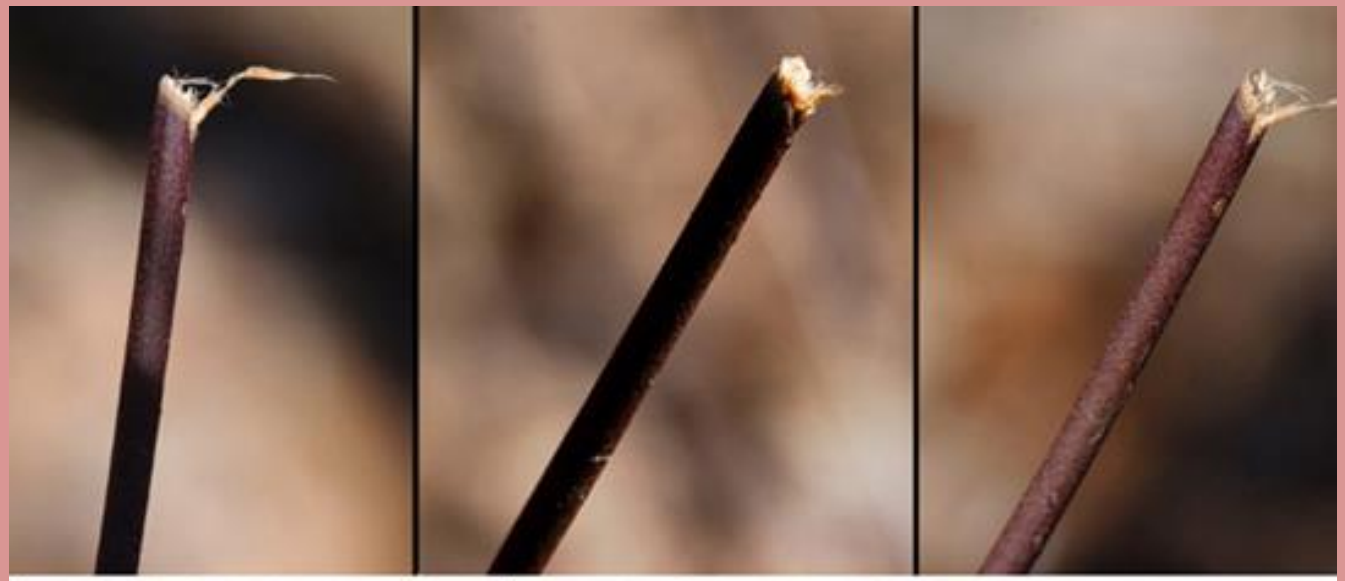
CHEMICAL DAMAGE

- **Air pollution**
  - Symptoms: interveinal chlorosis, tip necrosis, leaf flecking, and stippling
  - **Ozone**
    - Caused by photochemical reaction
    - More common in summer
  - **Sulfur dioxide**
    - Burning of coal and other fossil fuels
    - Reduced to the Clean Air Act
    - Associated with local sources of SO_2

ANIMAL DAMAGE

- **Deer**
  - Cause browse damage
- **Voles**
  - Strip the bark off young woody plants
- **Rabbits**
  - Strip the bark off young woody plants and stems





CULTURAL PRACTICES

- **Planting**
  - Planting too deep
  - Symptoms similar to drought and flooding
  - May lead to canker development
  - Roots will be darkened, rotting, slimy, and may die
- **Girdling roots** – roots that encircle themselves
- **Stem-girdling roots** – encircle the tree stem above the trunk-root collar
  - Interfere with vascular system
  - Slow process
  - If possible, cut offending roots

CULTURAL PRACTICES

- **Mulching**
  - Excessive mulch (i.e. volcano mulching) can lead to crown decay, rot, and plant decline
- **Irrigation management**
  - Symptoms are similar to flooding or poor drainage
  - Proper timing and placement is important

END OF PRESENTATION