AGRY 515: Plant Mineral Nutrition

Ca, Mg, Fe...
Powerpoint file: CaMgFeEtc_Assim&Funct_Slides_2012

Calcium (Fig. 1 – 3, Table 1)
  Macro/Micronutrient ??
  Where is Ca?
  Why must cytoplasm Ca\(^{2+}\) concentration be so low?
Structural - Macronutrient Function
  Cell wall
  Plasma membrane
Osmotic - Macronutrient Function
Micronutrient Function
  Second messenger
  CaM
Ca Requirement / Deficiency Symptoms

Magnesium (Fig. 4, 5, Table 2)
  Metabolic / Osmotic Functions
  homeostasis
  chlorophyll molecule
  CoFactor
    Protein Synthesis
    Enzyme Activator
    ATP
Deficiency Symptoms

Iron (Fig. 6 – 10)
  Supply / Demand Problems
  Fe function
    Heme proteins
    S-Fe proteins
    Chlorophyll synthesis
Storage - phytoferritin
Root Responses to Fe Deficiency
  Morphological
  Physiological
  Strategy I & II
Deficiency Symptoms
What is lime induced chlorosis?

Manganese (Fig. 11, 12)
  Multiple oxidation states
  Importance of ionic radius
  Mn functions
    PS II
    MnSOD
    Cofactor
  Deficiency / Toxicity Symptoms
  Species specificity / Soil conditions

Zinc (Fig. 13)
  Only form in biological systems
  Metabolic functions
    Tetrahedral complexes
    Zn containing enzymes
    Zn as enzyme activator
    Membrane Integrity
  Zn-P, Zn-Cl, Zn-B interactions
  Deficiency / Toxicity Symptoms
  Species differences / Soil conditions

Copper (Table 3)
  Prevalence of complexed form
  Metabolic functions
    Cu proteins
      Carbohydrate, Lipid, N metabolism: lignification & pollen
    Cu-Fe interactions
  Deficiency / Toxicity Symptoms
  Soil & Environmental conditions

Molybdenum (Table 4, 5)
  Forms
  Metabolic functions
    Metal component of enzymes
    Cauliflower and algae: no Mo requirement?
  Deficiency / Toxicity Symptoms
  Species differences
  Soil & Environmental conditions
Boron (Fig. 14)
Least understood
Structural / metabolic functions
  Cell wall synthesis & maintenance
  Influences metabolism
  Membrane permeability
Ca-B Interactions: species differences
Deficiency / Toxicity Symptoms
Soil & Environmental conditions

Nickel (Table 6)
Deficiency never observed
Function: Urease only known Ni containing enzyme
Symptoms

Chloride (Table 7)
130 compounds w/ unknown functions
Functions
  Water splitting in PSII
  Stomatal opening
Deficiency / Toxicity Symptoms