

AGRY 515: Plant Mineral Nutrition

Ca, Mg, Fe...

Powerpoint file: CaMgFeEtc_Assim&Funct_Slides_2008

Calcium (Fig. 1 – 3)

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 1)

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 2)

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 3, 4)

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 5)

Deficiency never observed

Function: Urease only known Ni containing enzyme

Symptoms

Chloride (Table 6)

130 compounds w/ unknown functions

Functions

Water splitting in PSII

Stomatal opening

Deficiency / Toxicity Symptoms