SC 540 (Soil-Plant-Nutrient Relations) – Spring, 2012

Course objectives:

1) Gain a detailed understanding of the processes controlling plant nutrition and soil nutrient dynamics
2) Learn about techniques for assessing/quantifying nutrient dynamics for research and management
3) Gain an understanding of impacts of nutrient use on the environment
4) Develop testable hypotheses and research designs relating to soil-plant-nutrient interactions

Schedule: 3-4 PM: Mon, Wed – lecture and discussion; (most) Fri – Recitation

(If you already have the 2nd addition, H. Marschner 2002. Mineral Nutrition of Higher Plants, you can use that and I’ve given the alternative reading sections for the 2nd addition, in italics)

Exams: 1) Two mid-term with short answer/essay questions
2) Class project – Develop and present research proposal on relevant topic (2-3 person team)
3) Final exam – proposal panel duty and proposal evaluation

Handouts and lecture notes will be posted on RamCT

Grading: Traditional letter – Midterm 1 15%, Midterm 2 10%, Project 40%, Final 25%, Class participation 10%

Instructor: Keith Paustian

W, Jan 18 Course schedule, discuss exams, grading, proposal project, participant introductions

F, Jan 20 Conceptual and historical background on soil-plant-nutrient relationships (Russell, Chapter 1 pdf, handouts)

M, Jan 23 Functional characteristics of plant nutrients, macro- and micronutrients, key functions in biomolecules and metabolism. (3rd addition: pp 3-5; read introductory sections for each nutrient element (ca. ½-1 pg for each element, pp 135-269). (2nd addition: 3-5; ca. ½-1 pg for each element pp 229-404)

W, Jan 25 Root cell anatomy, solute pathways, membranes (3rd addition: pp 7-12, 21-25) (2nd addition: pp 6-18)


M, Jan 30 Cation-anion interactions, concentration dependency on uptake (3rd addition: pp 25-47, handout) (2nd addition: 31-78)

W, Feb 1 Root morphology and nutrient foraging (3rd addition: pp 322-346) (2nd addition: pp 494-500, 508-518)

F, Feb 3 Recitation
M, Feb 6  Mycorrhizae and nutrient uptake (3rd addition: pp 369-388) (2nd addition: pp 561-594)  
W, Feb 8  Foliar uptake (3rd addition: pp 71-84) (2nd addition: pp 116-128)  
F, Feb 10  Recitation  
M, Feb 13  Nutrient controls on photosynthesis/C assimilation (3rd addition: pp 85-107) (2nd addition: pp 131-144)  
W, Feb 15  Nutrient control on plant growth I (3rd addition: pp 108-133) (2nd addition: pp 144-183)  
F, Feb 17  Recitation  
M, Feb 20  Nutrient control on plant growth II (3rd addition: pp 108-133) (2nd addition: pp 144-183)  
W, Feb 22  Nutrient supply – Introduction (handouts)  
F, Feb 24  Recitation  
M, Feb 27  Nitrogen cycling and plant-soil relations (handouts)  
W, Feb 29  Phosphorus cycling and plant-soil relations (handouts)  
F, Mar 2  Recitation  
M, Mar 5  N mineralization-immobilization – general (handouts)  
W, Mar 7  Rhizosphere chemistry and plant nutrition (handouts, 3rd addition: pp 347-368) (2nd addition: pp 537-560)  
F, Mar 9  Mid-term exam (take home) & deadline for ‘preproposal approval’  
Spring Break  
M, Mar 19  N fixation (3rd addition: pp 389-408) (2nd addition: pp 201-228)  
W, Mar 21  Soil organic matter I (handouts)  
F, Mar 23  Recitation  
M, Mar 26  Soil organic matter II (handouts)  
W, Mar 28  Nutrient deficiencies and toxicity (3rd addition, pp 299-312) (2nd addition: pp 461-478)  
F, Mar 30  Recitation  
M, Apr 2  Adaptation of plants to adverse chemical soil conditions I (3rd addition: pp 409-472) (2nd addition: pp 605-680)  
W, Apr 4  Adaptation of plants to adverse chemical soil conditions II (3rd addition: pp 409-472) (2nd addition: pp 605-680)
F, Apr 6  Recitation

M, Apr 9  N availability/N requirement assays (handouts)

W, Apr 11  Soil diagnostics, urban soils (handouts)

F, Apr 13  Recitation

M, Apr 16  Isotope methods and application I (handouts)

W, Apr 18  Isotope methods and application II (handouts)

F, Apr 20  2nd midterm exam (in class) and written proposals due

M, Apr 23  Case study – Radionuclides in soils (handouts)

W, Apr 25  Case study – Hypoxia and nutrient loading from agriculture (handouts)

F, Apr 27  Case study – Agriculture and N₂O emissions (handouts)

M, Apr 30  Class proposal presentations/panel

W, May 2  Class proposal presentations/panel

F, May 4  Class proposal presentations/panel

Finals  Submit written proposal reviews (Wed, May 8)