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

Text: **P. Marschner (ed) 2012. Marschner's Mineral Nutrition of Higher Plants. 3nd ed., Acad. Press**
(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 – Midterm1 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)***
F, Jan 27	**Membrane transport, uptake kinetics, rate controls (3rd addition: pp 13-21, 315-322)** ***(2nd addition: pp 18-30, 484-494).***
M, Jan 30	Cation-anion interactions, concentration dependency on uptake (3rd addition: pp 25-47, handout) *(2nd addition: 31-78)* [redacted]
W, Feb 1	Root morphology and nutrient foraging (3rd addition: pp 322-346) *(2nd addition: pp 494-500, 508-518)* [redacted]
F, Feb 3	Recitation [redacted]

M, Feb 6 Mycorrhizae and nutrient uptake (3rd addition: pp 369-388) *(2nd addition: pp 561-594)* Stromberger

W, Feb 8 Foliar uptake (3rd addition: pp 71-84) *(2nd addition: pp116-128)*

F, Feb 10 Recitation

M, Feb 13 Nutrient controls on photosynthesis/C assimilation (3rd addition: pp 85-107) *(2nd addition: pp131-144)*

W, Feb 15 Nutrient control on plant growth I (3rd addition: pp 108-133) *(2nd addition: pp144-183)*

F, Feb 17 Recitation

M, Feb 20 Nutrient control on plant growth II (3rd addition: pp 108-133) *(2nd addition: pp144-183)*

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) Kelly

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)* Stromberger

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)** Reeder
F, Apr 13	**Recitation**
M, Apr 16	Isotope methods and application I (handouts) Cotrufo
W, Apr 18	Isotope methods and application II (handouts) Cotrufo
F, Apr 20	2nd midterm exam (in class) and written proposals **due**
M, Apr 23	**Case study – Radionuclides in soils (handouts)** Borch
W, Apr 25	**Case study – Hypoxia and nutrient loading from agriculture (handouts)**
F, Apr 27	**Case study – Agriculture and N_2O 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)