



**COURSE SYLLABUS FOR
SOILS/PLANT SCI 4313/7313 - SOIL FERTILITY AND PLANT NUTRITION**

Instructor: Peter Motavalli	Semester:
Associate Professor	Lecture:
School of Natural Resources	No. of credit hours: 3
333 ABNR Building	Web address for course:
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COURSE DESCRIPTION AND PHILOSOPHY:

Covers the principles and management of soil as a medium for plant growth. Among the topics addressed will be soil-plant relationships, plant nutrition, nutrient availability and cycling in the environment, soil and plant testing, and sustainable management of soil fertility and soil amendments. An optional laboratory course, Soils 4314/7314 Soil Fertility and Plant Nutrition Laboratory is recommended to be taken to supplement this course and it will next be offered in spring semester of 2011.

The philosophy of this course will be to stimulate your interest in soil fertility and plant nutrition by providing an understanding of important principles in the subject area and by class discussion of relevant issues. In addition, we will develop practical problem-solving and communication skills that will draw upon your powers of reasoning and creativity.

OBJECTIVES:

- A. To learn how soil chemical, biological, and physical factors interact to affect the soil as a medium for plant growth.
- B. To understand the role of plant nutrients in plant growth and composition and the physiological processes affecting nutrient utilization under different environmental conditions.
- C. To identify nutrient management practices, including the use of soil amendments, that maximize plant productivity and profitability while conserving or enhancing environmental quality.
- D. To develop practical problem-solving and communication skills.

OFFICE HOURS:

Tues. and Thurs., 3:30 to 5:00 PM in Room 333 (3rd floor), Anheuser-Busch Natural Resources Building or by appointment.

COURSE REQUIREMENTS AND RESOURCES:

1. **Required textbooks:** John Havlin, James Beaton, Samuel Tisdale, and Werner Nelson, Soil Fertility and Fertilizers: An Introduction to Nutrient Management, 7th Edition, Prentice Hall, 2005.

Gene Stevens, Peter Motavalli, Peter Scharf, Manjula Nathan, and David Dunn. 2002. Crop nutrient deficiencies and toxicities. MU IPM Extension booklet 1016. University of Missouri, Columbia, MO.

2. **Additional references on reserve in the library (references marked with a * are part of assigned readings:**

*C.A. Black. 1993. Soil fertility evaluation and control. Lewis Publishers, Boca Raton, FL.

J.W. Doran et al. (ed.) 1994. Defining Soil Quality for a Sustainable Environment. SSSA Special Publication No. 35. Soil Sci. Soc. of Am., Madison, WI.

*N.K. Fageria, V.C. Baligar and C.A. Jones. 1997. Growth and mineral nutrition of field crops. 2nd ed., Marcel Dekker, Inc., New York, NY

*Roy H. Follett, L.S. Murphy, and R.L. Donahue. 1981. Fertilizers and soil amendments. Prentice Hall, Englewood Cliffs, NJ.

*R.F. Follett and J.L. Hatfield. 2001. Nitrogen in the Environment: Sources, Problems, and Management. Elsevier, Amsterdam, The Netherlands.

*Henry D. Foth and Boyd Ellis. 1997. Soil Fertility, 2nd Edition. CRC Press, Boca Raton, FL.

J. Benton Jones, Jr, Benjamin Wolf, and Harry Mills. 1991. Plant Analysis Handbook. Micro Macro Publishing, Jefferson City, MO.

*Horst Marschner. 1998. Mineral Nutrition of Higher Plants, 2nd Edition, Academic Press. New York, NY.

Rajendra Prasad and James Power. 1997. Soil Fertility Management for Sustainable Agriculture, CRC Press, Boca Raton, FL.

*F.J. Stevenson. 1994. Humus chemistry: Genesis, composition, reactions. 2nd ed. John Wiley & Sons, New York, NY.

*Samule Tisdale, Werner Nelson, and James Beaton. 1985. 4th ed., Soil Fertility and Fertilizers. MacMillan Publishing Company, New York, NY

*United Nations Industrial Development Organization and the International FertilizerDevelopment Center. 1998. Fertilizer manual. Kluwer Academic Publishers, Dordrecht, The Netherlands.

*R.L. Westerman (ed.). 1990. Soil Testing and Plant Analysis, 3rd Edition, Soil Sci. Soc. of Am., Madison, WI.

3. **Web resources:**

We will be using Blackboard interactive web software to enhance your learning experience and improve communication of information and ideas related to soil fertility and plant nutrition. Please check on the web site for this course periodically to learn of course information, upcoming events, web links, and to communicate with me or among yourselves. You may access it at <https://blackboard.missouri.edu/> from any of the computer labs on campus or on your home computer if you have a modem. To log on, you use your pawprint and password. If you have any questions, click on “Student Help” at the Online Courses home page at <https://courses.missouri.edu>. Please let me know if you have any problems with or suggestions for improving the web site. I would like to make this web site not only informative but also fun, a site where you can explore soil fertility and plant nutrition issues and be creative.

Blackboard Discussion

The following issues are suggested relevant topics for discussion in the bulletin board of the Blackboard site for this course and a suggested timetable. **All students will be graded on their participation in the Blackboard discussions. In addition, graduate students in the course will be required to provide a short written introduction and selected web site links to initiate one discussion of a topic.** Please let me know if you have any other topics you would like to discuss or if you have trouble posting your message.

Issues

Sustainable Agriculture
Effects of Increased Biofuel Production on Soil Fertility
Precision Agriculture for Managing Soil Fertility
Plant Growth Simulation Models
Soil Quality
Nutrient Cycling and the Environment
Biotech: Benefit or Threat?
Tillage and Soil Fertility
Effects of Compaction on Soil Fertility
Conventional vs. Organic Farming
Nitrogen Fertilization and Carbon Loss
Enhanced Efficiency Fertilizers (e.g., slow release, urease and nitrification inhibitors)
Effects of Rising Fertilizer Costs on Nutrient Management
New Techniques for Soil and Plant Testing

4. Grading:	<u>Activity</u>	<u>% of Final Grade</u>
	2 midterm exams (20% each)	40
	Problem sets (take-home)	20
	1 final exam	25
	Quizzes	5
	Blackboard participation	5
	Class participation	5

On the midterm and final exams, graduate students may be required to answer additional exam questions compared to undergraduate students.

ACADEMIC HONESTY:

Academic integrity is fundamental to the activities and principles of a university. All members of the academic community must be confident that each person's work has been responsibly and honorably acquired, developed, and presented. Any effort to gain an advantage not given to all students is dishonest whether or not the effort is successful. The academic community regards breaches of the academic integrity rules as extremely serious matters. Sanctions for such a breach may include academic sanctions from the instructor, including failing the course for any violation, to disciplinary sanctions ranging from probation to expulsion. When in doubt about plagiarism, paraphrasing, quoting, collaboration, or any other form of cheating, consult the course instructor.

ADA COMPLIANCE STATEMENT:

If you need accommodations because of a disability, if you have emergency medical information to share with me, or if you need special arrangements in case the building must be evacuated, please inform me immediately. Please see me privately after class, or at my office in ABNR 333.

To request academic accommodations (for example, a notetaker), students must also register with the [Office of Disability Services](http://disabilityservices.missouri.edu), (<http://disabilityservices.missouri.edu>), S5 Memorial Union, 882-4696. It is the campus office responsible for reviewing documentation provided by students requesting academic accommodations, and for accommodations planning in cooperation with students and instructors, as needed and consistent with course requirements. For other MU resources for students with disabilities, click on "Disability Resources" on the MU homepage.

INTELLECTUAL PLURALISM

The University community welcomes intellectual diversity and respects student rights. Students who have questions concerning the quality of instruction in this class may address concerns to either the Departmental Chair (Dr. Tony Lupo) or Divisional leader (Dr. Mark Ryan) or Director of the [Office of Students Rights and Responsibilities](#)

(<http://osrr.missouri.edu/>). All students will have the opportunity to submit an anonymous evaluation of the instructor(s) at the end of the course.

POLICY REGARDING LATE ASSIGNMENTS:

I actively encourage you to be aware of assignment deadlines and hand in your homework assignments on time. I will be reminding you in class of approaching deadlines. If you anticipate you will have a problem completing an assignment then please notify me as soon as possible before the assignment is due. If an unexpected situation occurs then please talk to me as soon as possible and we will make arrangements for you to complete the assignment. Assignments handed in late without a valid excuse will not be accepted. This policy is to insure the fair treatment of all students in the class.

SCHEDULE OF LECTURES AND ASSIGNMENTS:

<u>Date</u>	<u>Topic</u>	<u>Reading Assignment*</u>	<u>Assignment Due</u>
	Introduction and Overview	Handout	
	Factors affecting plant growth	pp. 1-10 pp. 19-54 Tisdale (pp. 5-16 Tisdale, optional)	
	Essential elements in plant nutrition	pp. 10-12 pp 59-91 Tisdale	Assignment 1
	Soil properties and processes affecting nutrient availability: charge, ion exchange and adsorption	pp. 13-32 pp. 25-69 Foth	
	Movement of ions from soils to plants	pp. 32-37 pp. 484-498 Marschner	Assignment 2
	Ion absorption by plants	pp. 37-41 pp. 66-79 Fageria (pp. 6-78 Marschner, optional)	
	Soil organic matter and biological transformations	pp. 1-23 Stevenson	Assignment 3
	Soil acidity and alkalinity	pp. 45-56	
	Midterm Exam #1		
	Saline and sodic soils	pp. 81-93	
	Macronutrients: Nitrogen	pp. 97-114	
	Nitrogen	pp. 115-141 pp. 17-44 Follett and Hatfield	
	Nitrogen	pp. 141-157	Assignment 4
	Phosphorus Phosphorus	pp. 160-183 pp. 183-196	Assignment 5

*Readings are from the Havlin textbook unless otherwise noted.

Reading Assignment

<u>Date</u>	<u>Topic</u>	<u>Assignment*</u>	<u>Due</u>
	Potassium	pp. 199-217	
	Sulfur, calcium and magnesium	pp. 219-241	Assignment 6
	Midterm Exam #2		
	No class (Spring Recess)		
	No class (Spring Recess)		
	Micronutrients	pp. 244-295	
	Goals of and factors affecting nutrient management	pp. 362-372 pp. 3-4 Stevens	
	Soil fertility evaluation	pp. 298-359, pp. 45-68 Westerman pp. 4-15 Stevens	
	Lime management	pp. 56-80	
	Fertilizer management	pp. 372-392, pp. 396-404	Assignment 7
	Fertilizer management	pp. 46-51 Fertilizer Manual pp. 302-390 Follett	
	Precision agriculture	pp. 393-396 pp. 15-17 Stevens	
	Management of organic amendments	pp. 404-412	
	Management of organic amendments	pp. 458-504 Follett	Assignment 8
	Economics of nutrient management	pp. 435-445 pp. 79-144 Black (optional)	
	N Testing and GPS Lab - Sanborn Field	Lab Handout	
	Nutrients and the Environment	pp. 412-414, 447-501	

FINAL EXAM