

**COURSE SYLLABUS**  
**ENVIRONMENTAL NUTRIENT MANAGEMENT**

**SOS 4116 / 5116**

**3 Credits**

**0225 NSC, 2-3 Periods T R, Spring 2006**

**I. COURSE DESCRIPTION:**

Prerequisite: SOS 3022

Consumption, manufacture, properties and reserves of fertilizer materials are discussed in order to familiarize the student with the fertilizers in general. The methods of application, effects on soil reactions and plant requirements of fertilizer nutrients are discussed in order to inform students relative to specific fertilizer materials.

**II. COURSE OBJECTIVES:**

A. To familiarize the student with the levels of consumption and existing reserves of fertilizer materials.

B. To familiarize the student with the source of materials, fertilizer terminology, formulation, chemical and physical properties and manufacture of commercial fertilizers.

C. To acquaint the student with the basic chemical reactions of fertilizer materials with the soil and the fate of the nutritional elements whether it be loss by leaching, plant uptake, fixation or soil retention.

D. To acquaint the student with the overall environmental impact of fertilizing crops to enhance production while limiting environmental consequences.

**III. COURSE FORMAT:** Three hours lecture per week, Tuesday & Thursday, 2nd & 3rd Period, 1hr & 15 minutes each day.

**IV. INSTRUCTOR:** J.B. Sartain, 414 Newell Hall, 392-7271 ext. 330

E-mail; jbs@ifas.ufl.edu

Office Hours: 8-9 M-F, or anytime you drop by and I am in without guests.

**V. TEXTBOOK:**

Soil Fertility and Fertilizers. 1999. Havlin, Beaton, Tisdale and Nelson. 6<sup>th</sup> Edition.

**VI. CLASS ATTENDANCE:**

Not mandatory -- The student is responsible for all material presented in class as well as the assigned material.

**VII. GRADING SYSTEM:**

	<b>SOS 4116</b>	<b>SOS 5116</b>
Mid-term Exam	30%	30%
Final Exam	30%	30%
Assignments		
Problem sets	20%	10%
Special Problem	<u>20%</u>	<u>30%</u>
	100%	100%

Final Grade Determination:

A	90-100
B <sup>+</sup>	89-87
B	80-86
C <sup>+</sup>	79-77
C	70-76
D <sup>+</sup>	69-67
D	60-66
E	< 60

**VIII. SPECIAL PROBLEM FOR SOS 4116**

A literature review or an experimental problem on a mutually agreed upon subject between the instructor and the student is required. Hopefully the topic is one that is of great interest to the student and one that will aid the individual in the future. The topic or experimental objectives will be presented in writing to the instructor by January 26<sup>th</sup>. There is no required length of the paper but it should include at least 5 references if it is an experimental problem and 10 references if it is a literature review and cover the topic completely. A written literature review or report on special problem will be submitted on the last day of class.

**IX. RESEARCH PROBLEM FOR SOS 5116**

Students taking SOS 5116 will be required to conduct an experimental problem on a mutually agreed upon subject between the instructor and the student. You must choose your experimental topic and submit a set of objectives by January 26<sup>th</sup>.

A scientifically valid experimental research problem is required for SOS 5116. This problem will involve additional class meetings to instruct the students in the scientific method and the execution of an experimental research problem. After approval of the title and objectives the research problem will be initiated and completed according to the objectives and based on the scientific principles of the scientific method. The results of the research problem will be written up in a scientific paper format and presented to the class as an oral report. At least 10 citations relative to other research on the subject will be required. A complete record of all activities involved in the project will be recorded in a laboratory notebook which will be turned in as part of the project requirement. The topic and objectives of the special experimental problem will be submitted to the instructor by January 26th. Hopefully, the experimental problem will be on a subject that is of great interest to you and one that will benefit you in your graduate studies. On occasions in the past these research problems have become a part of the students graduate research project for their graduate degrees. If you can design a study that relates to your graduate research project that will serve the objectives of this class project, I encourage you to do so. The intent of this experimental research project is to train you in the concepts of scientifically valid research and for it to be of benefit to you as a graduate student. Hopefully, it will not be just an additional requirement that you have to meet.

## **X. UNIVERSITY POLICIES**

**A. STUDENTS REQUIRING SPECIAL ASSISTANCE:** Students requesting classroom accommodations must first register with the Dean of Students Office. The Dean of Students will provide documentation to the student who must then provide this documentation to the Instructor when requesting accommodations.

**B. CLASS DEMEANOR:** If you are unavoidably late, try to find you a seat with a little disruption to the class as possible. Please do not pass in front of the class room unless it is absolutely necessary. Please turn off all cell phones prior to coming to class.

**C. MAKE-UP EXAMS OR THE REQUIRED WORK:** Please use one of the methods of contact listed on the front page of this syllabus to contact the instructor regarding make-up exams or other requirements. Problem sets are due on the date stated on the critical dates sheet. Please try to make every effort to adhere to the printed schedule.

**D. ACADEMIC DISHONESTY:** As a result of completing the registration form at the University of Florida, every student has signed the following statement: "I understand that the University of Florida expects its students to be honest in all their academic work. I agree to adhere to this commitment to academic honesty and understand that my failure to comply with this commitment may result in disciplinary action up to and including expulsion from the University." I also understand that copy written material should be used only for class room purposes according to posted guidelines.

**E. UF COUNSELING SERVICES:** Resources are available on-campus for students having personal problems or lacking clear career and academic goals which interfere with their academic performance. These resources include: 1. University Counseling Center, 301 Peabody Hall, 392-1575, personal and career counseling; 2. Student Mental Health, Student Health Care Center, 392-1171, personal counseling; 3. Sexual Assault Recovery Services (SARS), Student Health Care Center, 392-1161, sexual assault counseling; and 4. Career Resource Center, Reitz Union, 392-1601, career development assistance and counseling.

**XI. COURSE OUTLINE:**

<u>Topic</u>	<u>Chapters</u>	<u>Approximate Lecture Dates</u>
A. General		
1. Course Outline, Objectives, etc		1/10
2. Special Problems		
3. Problem Sets		
4. Historical Review	1	1/12
5. Fertilizer Law		
6. Fertilizer Label		
B. Fertilizer Usage		1/17
1. Production and use of commercial fertilizers		
2. World consumption of plant nutrients		
3. US consumption of plant nutrients		
4. Florida consumption of plant nutrients		
C. Methods of Production of N Fertilizers	5	1/19
1. Nitrogen materials		
a. Chilean Nitrate of Soda		
b. Coke-oven Ammonium process		
c. Basic synthetic processes		
1. Direct oxidation		
2. Cyanamide process		
3. Claude-Haber process		
a. Synthetic ammonia		
b. Hydrogen manufacture		
c. Physical properties of NH <sub>3</sub>		
d. Ammonia derivatives		1/24
1. Nitric acid		
2. Ammonium nitrate		
3. Ammonium sulfate		
4. Urea and urea base materials		
e. Slow release N materials		1/26
1. IBDU		
2. Sulfur-coated urea		
3. Urea formaldehyde		
4. Osmocote		
5. Oxamide		
6. Thermoplastic resin coated urea		1/31
7. Nutralene		
8. Triazone and Triazine		

9. Coron		
10. N-Sure		
11. Nitrification inhibitors		
a. Nitrapyrin		
b. DCD		
f. Nitrogen Solution Fertilizers		2/2
g. Organic N sources		
D. Nitrogen Uptake by Plants		2/2
E. Soil N and Associated Soil Reactions	5	2/2
1. Organic N		
a. Composition		
b. Release of organic N Mineralization		
c. Amounts of soil organic N mineralized		
d. Availability of N from organic crop residues		
e. Amount of N in rain water		
2. Nitrification and Factors affecting nitrification		2/7
a. Supply of $\text{NH}_4^+$		
b. Population of Nitrifiers		
c. Soil Reaction (pH)		
d. Soil Aeration		
e. Soil Moisture		
f. Soil Fumigation		
3. Reactions of $\text{NH}_3$ with the soil		2/9
a. Reactions of $\text{NH}_3$ with clay		
b. Reactions of $\text{NH}_3$ with organic matter		
c. Factors affecting $\text{NH}_3$ retention by soil		
1. Texture		
2. Depth of Placement		
3. Moisture content		
4. Reactions of $\text{NH}_4^+$ with the soil		2/14
a. Cationic nature of $\text{NH}_4^+$		
b. Influence of calcareous soils		
c. Factors affecting $\text{NH}_4^+$ fixation		
1. Clay minerals		
2. pH		
3. Availability of fixed $\text{NH}_4^+$		
5. Reaction of urea with soil		2/14
a. Conversion of urea to $\text{NH}_4^+$		
b. Factors affecting loss of $\text{NH}_3$ from urea		
6. Fate of N fertilization		2/16
a. Volatilization		

1. Denitrification			
2. Soil reaction/liming			
3. Soil moisture			
b. Leaching			
1. Form of soluble N			
2. Slow-release N sources			
3. Influence of management			
c. Run-off			
d. Plant uptake efficiency			
1. N rate			
2. N source			
3. Other applied nutrients			
7. Effect of N source on plant growth		2/21	a.
Reactions in the plant			
b. Effect of $\text{NH}_4^+$ and $\text{NO}_3^-$ on the plant			
c. Conditions under which $\text{NH}_4^+$ may not give as good results			
F. Phosphate Rock Production	6	2/23	
1. U.S. locations			
2. Mining Process			
3. World locations			
4. Reserves			
G. Methods of Production of P Fertilizers		2/28	
1. Mining of P material			
2. Manufacture of P Fertilizers			
a. Ordinary superphosphate			
b. Triple superphosphate			
c. Phosphorus acid			
d. Furnace acid			
e. Superphosphoric acid			
f. Monoammonium phosphate			
g. Diammonium phosphate			
h. Urea-urea phosphates			
i. Urea-nitric phosphates			
H. Summary of properties of phosphate fertilizers		3/2	
***** <b><u>MID-TERM EXAMINATION</u></b> *****		3/9	
***** <b><u>SPRING BREAK</u></b> *****		3/11-3/18	

- I. Production of sulfuric acid 3/21
  
- J. Soil Phosphorus Reactions 3/23
  - 1. Phosphorus reaction and availability in soil
  - 2. Quantity and Intensity Factors
  - 3. Forms of P in soil
  - 4. Reactions of fertilizer P with soils
    - a. Definition of terms
    - b. Nature of P reactions in acid soils
    - c. Nature of P reactions in calcareous soils
    - d. Reaction of OSP/CSP in acid/calcareous soils
    - e. Reaction of MAP in acid/calcareous soil
    - f. Reaction of DAP in acid soil
    - g. Reaction of DAP in calcareous soil
  - 5. Factors influencing P retention in soils 3/28
    - a. Type of clay
    - b. Texture of soil
    - c. Time of reaction
    - d. Soil pH
    - e. Temperature
    - f. Soil organic matter
    - g. Phosphorus status of soil
  
- K. Phosphorus levels required in plant tissue
  - 1. Tissue P levels
  - 2. Contrasting effects of P fertilization on turfgrasses
  
- L. Phosphorus leaching 3/30
  - 1. Relative movement of nutrient elements
  - 2. Influence of soil type
    - a. Coated vs uncoated
    - b. Organic soils
  - 3. Influence of amendment
  - 4. Influence of soil pH
  
- M. Soil Testing for P 4/4
  - 1. Influence of extractant type
  - 2. Influence of time on P availability
  - 3. Phosphorus fertilization recommendations
  
- N. Nutrient Management Plans
  
- O. Fate of P in Agriculture

- P. Potassium- Functions, Soil Sources, and Materials 4/6
1. Functions of K in plants
  2. Sources of K for fertilizer production
  3. Mining systems
  4. Refining systems for potassium chloride
  5. Production of K fertilizer materials
  6. Sources of K in the soil
  7. Soil testing for K
  8. Amount of K in soil
  9. Plant availability of soil K
  10. Potassium fixation in soil
- Q. Reactions of Potassium Fertilizers with Soil 4/11
1. Factors affecting K availability
  2. Quantity of K required as fertilizer
  3. Potassium uptake as influenced by crop species
  4. Management practices fo reducing K losses through leaching
  5. Effect of anion associated with K in K retention in soil
  6. Effect of K fertilizer source on leaching
  7. Effect of pH on K retention
- R. Soil Acidity and Liming 4/13
1. Types of acidity
  2. Standard liming materials
  3. Liming materials required properties
  4. Lime requirement
- S. Effects of Lime and Calcium on Soils
1. Soil reactions and lime
  2. Effects of aluminum
  3. Lime response in organic soils
  4. Calcium in acid soils
  5. Effect of calcium on nodulation of legumes
  6. Effect of lime of Mo availability
  7. Effect of lime rate and particle size on soil pH
- T. Sulfur 4/18
1. Introduction
  2. Sources of S in soils
  3. Forms of S in soils
  4. Sulfate adsorption
  5. Mechanisms of sulfate retention
  6. Sulfate co-precipitation with lime
  7. Reduced inorganic S

- 8. Oxidation of elemental S in soil
- 9. Organic S
- 10. Mineralization and immobilization of organic S
- 11. Practical aspects of S transformation
- 12. Soil testing for S

U. Use of Micronutrients in Agriculture 4/18

U. Special Problem Reports 4/20 and 4/25

\*\*\*\*\* CLASSES END 4/26

**FINAL EXAM : THURSDAY, MAY 4<sup>TH</sup>, 5:30 - 7:30**

