

Fertilizer Technology and Use SWS 6117

Credits: 3.0 hours

Spring Semester

Distance Education Mode

Instructor: Kelly Morgan

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Office hours: Tuesdays and Thursday 9-11 am

Course location: This course will be both asynchronous (i.e., recorded weekly lectures on Canvas) and synchronous (i.e., required online evening chat session on Wednesdays at 7pm – 8pm)

Meeting times: Two Weekly lectures on Canvas; weekly chat session online

COURSE DESCRIPTION FOR GRADUATE CATALOG: The course presents the basic concepts of fertilizer technology as tools for effective agricultural crop nutrient management. Provides information on a wide range of fertilizer technologies and application methods from national and internationally known researchers and industry experts. Detailed understanding of how to produce different fertilizer components and how to use them properly to improve plant use efficiency.

EXPANDED COURSE DESCRIPTION: This course is designed to provide updated information on fertilizer production and use technology. Students of all agricultural production majors will benefit from the knowledge gained through this course in present and future employment in production agriculture and fertilizer sales and research. This team-taught course will provide information on a wide range of fertilizer technology and application methods from national and internationally known researchers and industry experts. Upon successfully completing this course, students will gain a broad, detailed understanding of how to produce different fertilizer components and how to use them properly to improve plant use efficiency. The course will culminate with calculations of various fertilizer rates for formulations discussed and economics associated with improved fertilizer management.

COURSE LEARNING OBJECTIVES: The course will summarize and present the basic concepts of fertilizer technology as tools for effective agricultural crop nutrient management. After completing this course, students will be able to:

- Describe how fertilizer materials are produced and formulated, choose appropriate fertilizer application methods, and calculate fertilizer rates to provide crop specific nutrient requirements.
- Discuss and summarize the sources and production processes of commercially available fertilizers
- Discuss different types of fertilizers produced by industry today and specific precautions in the use of these crop nutrient sources
- Identify the use of fertilizer sources to improve plant nutrient availability and improved crop plant uptake efficiency
- Develop and apply knowledge on fertilizer rate calculations and economics of improved nutrient use efficiency
- Describe knowledge of fertilizer environmental and climate effects

DELIVERY METHOD: Online. Online recorded lectures with once-a-week chat sessions
Online lectures (powerpoint presentations) and other course materials delivered through the Canvas E-Learning System.

PRE-REQUISITES/CO-REQUISITES:

None

COURSE SCHEDULE

Week 1

Course introduction: Course scope; nutrient uptake and efficiency; historic overview; evolution of chemical fertilizers including soluble, slow/controlled release, and liquid forms

Week 2

Nitrogen I: N Cycle, transformations, sources and production raw materials

Paper Review 1

Week 3

Nitrogen II: Fertilizer production processes, N leaching and application impact on production and environmental fate

Quiz 1 (modules 1-3)

Week 4

Phosphorus I: Phosphorus-use history, fertilizer production, sources, reactions in the soil, application methods

Review Paper 2

Week 5

Phosphorus II: leaching potential, soil phosphorus storage capacity, legacy sources, and environmental fate

Quiz 2 (modules 4-5)

Week 6

Potassium: Mined sources, production technology, soil fixation, and uptake characteristics

Review Paper 3

Week 7

Secondary Macronutrients: Source, uptake, and production of Ca, Mg, and S. Soil cation exchange capacity and Base saturation concepts related to fertilizer recommendations and use

Quiz 3 (modules 6-7)

Exam 1 (modules 1-7)

Week 8

Micronutrients: Fertilizer source, production impacts, application considerations and uptake of Fe, Mn, Zn, Si, B and others

Review Paper 4

Week 9

Fertilizer Formulation: Effect of granulation, blending and chemical compatibility on fertilizer use. Effect of salt index, particle size/ segregation, bulk density, and moisture absorption in fertilizer application considerations. Discussion of coating technology, methods of release, and release rates

Quiz 4 (modules 8-9)

Week 10

Fertilizer Rate Calculations: The fundamentals of calculating the amount of nutrient element applied from a fertilizer. Examples will be provided with solutions.

Review Paper 5

Homework 1

Week 11

Soil pH Management: Selection of fertilizer formulations based on soil pH, leachability, and salinity and crop uptake parameters. Calculations of lime requirements based on base saturation will be provided.

Quiz 5 (modules 10-11)

Homework 2

Week 12

Class Project work time (two days prior to Thanksgiving)

Week 13

Nutrient Management: selection of fertilizer source, rate, application timing, and placement known as the 4Rs and best management practices

Review Paper 6

Week 14

Alternative Fertilizer Technologies: Organic Fertilizer Availability and Efficiency: Consideration of manure types and sources, nutrient release rates. Use and efficiencies of soil amendments (including humates), microbial inhibitors, and bacterial inoculants. Foliar Fertilizers: Uptake responses, sources, efficiency, application methods

Quiz 6 (modules 12-13)

Class Project due

Week 15

Economics: Basics of risk management in agricultural production will be discussed in terms of fertilizer use. The effect Improved fertilizer use efficiency on farm-based income will be examined. Evaluation of form, formulation, and nutrient use efficiency in cost of crop production

Review Paper 7

Week 16

Exam 2 (modules 8-14)

Review Papers: Summaries of peer review papers (total of 7) relevant to the discussion in topics for the week are assigned approximately every two weeks during the course term. Students are asked summarize the materials presented in the papers and how they relate to nutrient management, 4R concepts, and nutrient management plans.

Quizzes: A total of six quizzes on the past two weeks lectures will be administered in weeks between review paper assignments.

Exams: Two exams will be administered at mid-term (modules 1-7) and a final (modules 8-14)

Homework: Two homework assignments will consist of calculation of 1) fertilizer rates, and 2) Cation Exchange Capacity and Base Saturation.

Class Project: Each student will be instructed on scope of a class project to be presented at the end of the term. The project will consist of information on developing a crop fertilizer recommendation, a season-long fertilizer plan, formulation of fertilizers used in the fertilizer plan, calculation of fertilizer application rates, production practices used to limit environmental implications, and expected crop goals or outcomes of the fertilizer plan.

REQUIRED BOOK:

Soil Fertility and Fertilizers, An Introduction to Nutrient Management Eighth Edition. 2016. (John L. Havlin, Samuel L. Tisdale, Werner L. Nelson, and James D. Beaton) ISBN: 978-93-325-7034-4
Handouts of research and extension journal articles on various topics

RECOMMENDED BOOKS: Additional texts that may be useful include:

Fertilizer Technology and Application (John J. Mortvedt, 1999), *Plant Nutrition and Soil Fertility Manual* (Jones, 2012),

Soils and Soil Fertility (Troeh and Thompson, 2016) and

Handbook of Plant Nutrition (Edited by Allen Barker and David Pilbeam, 2007)

STUDENT EVALUATION:

Students are expected to attend lectures and be prepared to participate in all chat sessions. A portion of the grade is based on meaningful participation in the chat sessions, demonstrated student interest, and overall student dedication.

Assessments are based on exams, project report and participation. Three quizzes will be administered during the term. A written report is required describing a fertilizer recommendation of a crop chosen by the student. The report must provide amounts of both macro- and micronutrients amounts based on published recommendations, split applications, pH moderation requirements, and application methods. An oral report with illustrations will be provided at the end of the term. A comprehensive final example covering all materials discussed during the term will be administered at the end on the term.

Course grades will be determined as follows (%):

Graduate students

Evaluation endpoint	Frequency	% of total grade
Review Paper Summary (total of 7 during term)	Biweekly	20
Quizzes (total of 6 during term)	Biweekly	20
Homework (total of 2 during term)	2	20
Class Project	1	20
Exams	2 – Mid-term and final	20 (10 each)

Grading Scale

A	93.0% and above
A-	90.0-92.99%
B+	87.0-89.99%
B	83.0-86.99%
B-	80.0-82.99%
C	73.0-76.99%
C-	70.0-72.99%
D+	67.0-69.99%
D	63.0-66.99%
D-	60.0-62.99%
E	Below 60.0

Grades and Grade Points

For information on current UF policies for assigning grade points, see

<https://catalog.ufl.edu/UGRD/academic-regulations/grades-grading-policies/>.

ATTENDANCE AND MAKE-UP WORK: Students should be ready to begin class as soon as the scheduled start time is reached (i.e. arrive early). Requirements for class attendance and make-up exams, assignments and other work are consistent with university policies that can be found at:

<https://catalog.ufl.edu/UGRD/academic-regulations/attendance-policies/>

PRIVACY STATEMENTS FOR ONLINE COURSES

Our class sessions may be audio visually recorded for students in the class to refer back and for enrolled students who are unable to attend live. Students who participate with their camera engaged or utilize a profile image are agreeing to have their video or image recorded. If you are unwilling to consent to have your profile or video image recorded, be sure to keep your camera off and do not use a profile image.

Likewise, students who un-mute during class and participate orally are agreeing to have their voices recorded. If you are not willing to consent to have your voice recorded during class, you will need to keep your mute button activated and communicate exclusively using the "chat" feature, which allows students to type questions and comments live. The chat will not be recorded or shared. As in all courses, unauthorized recording and unauthorized sharing of recorded materials is prohibited

ONLINE COURSE EVALUATION PROCESS: Student assessment of instruction is an important part of efforts to improve teaching and learning. At the end of the semester, students are expected to provide feedback on the quality of instruction in this course using a standard set of university and college criteria. Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at:

<https://gatorevals.aa.ufl.edu/students/>

Students will be notified when the evaluation period opens and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via <https://ufl.bluera.com/ufl/>. Summaries of course evaluation results are available to students at:

<https://gatorevals.aa.ufl.edu/public-results/>

ACADEMIC HONESTY: As a student at the University of Florida, you have committed yourself to uphold the Honor Code, which includes the following pledge: *"We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honesty and integrity."* You are expected to exhibit behavior consistent with this commitment to the UF academic community, and on all work submitted for credit at the University of Florida, the following pledge is either required or implied: *"On my honor, I have neither given nor received unauthorized aid in doing this assignment."*

It is assumed that you will complete all work independently in each course unless the instructor provides explicit permission for you to collaborate on course tasks (e.g. assignments, papers, quizzes, exams).

Furthermore, as part of your obligation to uphold the Honor Code, you should report any condition that facilitates academic misconduct to appropriate personnel. It is your individual responsibility to know and comply with all university policies and procedures regarding academic integrity and the Student Honor Code. Violations of the Honor Code at the University of Florida will not be tolerated. Violations will be reported to the Dean of Students Office for consideration of disciplinary action.

For more information regarding the Student Honor Code, please see:

<http://www.dso.ufl.edu/sccr/process/student-conduct-honor-code>.

SOFTWARE USE: All faculty, staff and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate.

SERVICES FOR STUDENTS WITH DISABILITIES: The Disability Resource Center coordinates the needed accommodations of students with disabilities. This includes registering disabilities, recommending academic accommodations within the classroom, accessing special adaptive computer equipment, providing interpretation services and mediating faculty-student disability related issues. Students requesting classroom accommodation must first register with the Dean of Students Office. The Dean of Students Office will provide documentation to the student who must then provide this documentation to the Instructor when requesting accommodation
0001 Reid Hall, 352-392-8565, <https://disability.ufl.edu>

CAMPUS HELPING RESOURCES

Students experiencing crises or personal problems that interfere with their general well-being are encouraged to utilize the university's counseling resources. The Counseling & Wellness Center provides confidential counseling services at no cost for currently enrolled students. Resources are available on campus for students having personal problems or lacking clear career or academic goals, which interfere with their academic performance.

University Counseling & Wellness Center, 3190 Radio Road, 352-392-1575,
www.counseling.ufl.edu

Counseling Services Groups and Workshops Outreach and Consultation Self-Help Library
Wellness Coaching

U Matter We Care, www.umatter.ufl.edu/

Career Connections Center, First Floor JWRU, 392-1601, <https://career.ufl.edu/>

Student Success Initiative, <http://studentsuccess.ufl.edu> Student Complaints:

Residential Course: <https://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/>

Online Course: <http://www.distance.ufl.edu/student-complaint-process>

Academic Resources

E-learning technical support

352-392-4357 (select option 2) or email to Learning-support@ufl.edu. <http://lss.at.ufl.edu/help.shtml>.

Career Resource Center

Reitz union, 392-1601. Career assistance and counseling. <http://www.crc.ufl.edu>.

Library Support

<http://cms.uflib.ufl.edu/ask>. Various ways to receive assistance with respect to using the libraries or finding resources.

Teaching Center

Broward Hall, 392-2010 or 392-6420. General skills and tutoring. <http://teachingcenter.ufl.edu>.

Writing Studio

302 Tigert Hall, 846-1138. Help brainstorming, formatting, and writing papers.

<http://writing.ufl.edu/writing-studio/>.

Student Complaints

Campus: https://www.dso.ufl.edu/documents/UF_Complaints_Policy.pdf. On-Line Students:
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Video Recording Policy

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Add statements to video recording policy that was recently revised by UF for online teaching.