

Environmental Crop Nutrition - Web

AGR 6422C (3 Credits) – Fall 2025

Professor: Dr. William M. Hammond

Agronomy Department

Phone: 352-294-3792 (office)

Email: williamhammond@ufl.edu

Course description: Study of environmentally sound nutrient management strategies. During this course, the effects of environmental conditions and nutrient management on crop production and environmental quality will be outlined. This course is intended to bridge theoretical aspects of plant mineral nutrition and practical applicability of basic principles of fertilization.

General course objectives: 1) Discuss root growth and nutrient uptake dynamics; 2) Outline the function of nutrients in plants; 3) Present methods for assessment of crop nutrient status and diagnosis of plant deficiency and toxicity symptoms; 4) Discuss the use of irrigation and nutrient budgets for agricultural crops; 5) Outline crop nutrient concentrations and requirements for selected crops; 6) Describe interactive environmental and biological processes that control crop nutrient uptake and potential nutrient losses; 7) Develop nutrient related Best Management Practices (BMP's) and/or crop nutrient management plans for cropping systems.

Class Schedule: Course content is delivered in E-learning Canvas and is typically available asynchronously, except for potential discussion/chat sessions.

Office Hours: As this course is online and asynchronous, students are encouraged to contact the instructor by email (williamhammond@ufl.edu) or by phone (office: 352-294-3792) as needed to address questions regarding course content and management. Interactive video conference sessions (Zoom, Teams) are also available!

Instructional approach: This course has been constructed based off course material previously taught by Dr. John Erickson. If you are having any problems with the course or need assistance, don't wait until late in the semester to contact the instructor. The sooner we begin to address the problem, the more likely you will achieve a satisfactory outcome.

This is a fully online course delivered in E-Learning Canvas, the centrally supported course management system at UF. Canvas is the online source for the majority of your learning resources, assignments, and grades in this course. It can also be used for

interacting with the professor and other students in the course. For a tutorial regarding E-Learning Canvas functionality, go to <https://lss.at.ufl.edu/>. ([Links to an external site.](#))[Links to an external site.](#) If you need help resolving any other technical issues that can't be resolved by contacting the instructor, you can contact the UF help desk at <http://helpdesk.ufl.edu>.

Students enrolled in the course (note: you must be enrolled in the course to access course materials) should login to Canvas on the first day of the semester at the address above. You will need your gatorlink username and password to login to Canvas.

There will be **no required textbook**. I will use a number of textbooks, including those listed below. Excerpts from these texts and other additional readings from the primary literature for the course will be provided through Canvas.

- Fageria, NK. 2009. *The use of nutrients in crop plants*. CRC Press. Boca Raton, FL.
- Barker, AV and DJ Pilbeam. 2007. *Handbook of Plant Nutrition*. CRC Press, Boca Raton, FL.
- Marschner, P. 2012. *Mineral Nutrition of Higher Plants*. Elsevier, Waltham, MA.

All learning modules, assigned readings, video lectures, and other course content will be posted in Canvas. Assignments and discussion questions will be provided in the "Assignments" and "Discussions" section of Canvas, but can also be linked to from the modules.

Assignments and discussion questions will be posted with an expected due date. Any quizzes or exams will be available in Canvas for about a 48-hr period as scheduled in your syllabus and once started you will have a fixed amount of time to complete the quiz or exam. The quizzes will emphasize the material covered in the preceding section, but some material will be comprehensive. The Exam at the end of the course will cover all course content. Quizzes and exams will be closed book (any necessary formulas/equations will be provided in the exam) and you have to finish within the allotted time. You will not receive any credit for unanswered questions so plan your time well.

Required readings: (note, additional optional readings are provided in each module of the course)

- [Long-distance Transport in the Xylem and Phloem](#), chapter 3 from Marschner's *Mineral Nutrition of Higher Plants* is required reading. This is excellent reading that covers the movement of nutrients within the plant in detail. However, don't get bogged down in the biochemical detail, such as transporter families, but focus on a deeper, conceptual understanding of how transport and movement of nutrients in the plant occurs

- [Effect of Internal and External Factors on Root Growth and Development](#), Chapter 13 in Marschner's Mineral Nutrition of Plants (3rd Edition) is required reading.
- [Nickel](#), chapter 14 from Handbook of Plant Nutrition by Fageria (2001) is required reading.
- [Improving N use efficiency for cereal production](#), by Raun and Johnson (1999), is required reading and presents a nice easy to read discussion regarding efficient nutrient use in cereal crop production.
- [Fertilizer application](#), Chapter 6 in the Principles of Plant Nutrition text by Mengel and Kirkby (2001) is required reading.

Use of AI (artificial intelligence, including large language models like ChatGPT, Claude, *et al.*, but also Grammarly, Apple Intelligence, or other AI-assisted writing tools):

This course is strictly **No AI**

The learning that takes place in this course requires your unique perspective and human experience. Use of AI would make it harder to evaluate your work. It is not permitted to use any generative AI tools in this course, and the use of AI will be treated as an academic integrity issue.

Interactive Literature Discussion Assignment:

During Section 7 of the course (November 12th - December 4th), there will be a literature discussion held via Zoom. Dr. Hammond will organize the date and time of this interactive discussion during the first weeks of class, and will update the Home Page and send a message via Canvas to all students regarding the time. The paper to be discussed will be assigned October 28th, to provide students time to read the article prior to the interactive discussion, so they may come prepared to contribute to the discussion. This literature discussion counts as a 25-point assignment, and will be graded on participation.

Interactive Discussion Replies:

Discussions begin in Section 3, through Section 7. As this is an online asynchronous class, the Discussion board is an important opportunity to interact with your classmates. Each student is responsible for posting a substantive original response to the week's discussion, to earn up to 5 points per discussion. Students are highly encouraged to post substantive replies (expand on the provided solutions, recommend additional steps, provide an alternate solution / point of view). Each substantive reply (note, "I like this post", "great post!", "I agree" are not substantive) will result in 1 **extra credit** point, and students may earn up to 4 extra credit points per discussion by replying to up to 4

classmates. Thus, if a student replied substantively to 4 discussion posts during each of the 5 discussions, they **may earn up to a total of 20 extra credit points** in the class.

Course Schedule:

Dates open:	Modules, Assignments, and Quizzes:	Important Dates:
<u>Section 1</u> 21 Aug – 30 Aug	Read the Syllabus! Introduction to Crop Nutrition Introduce yourself! Nitrogen (N) Copper (Cu) Section 1 Quiz (opens August 29th)	Introduce yourself on discussion board by August 30 th Quiz 1 due August 30 th
<u>Section 2</u> 02 Sept – 13 Sept	Phosphorous (P) Chlorine (Cl) Nutrient Uptake I: In the Soil Nutrient Uptake II: In the Plant Section 2 Quiz (opens September 12th) Nutrient Management Plan	Section 2 quiz due September 13 th
<u>Section 3</u> 15 Sept – 27 Sept	Potassium (K) Plant Root Systems Nickel (Ni) Discussion Question #1 Section 3 Quiz (opens September 26th)	Section 3 quiz due September 27 th Discussion Question #1 due September 27th

<p><u>Section 4</u></p> <p>29 Sept – 11 Oct</p>	<p><u>Sulfur (S)</u></p> <p><u>Sulfur Management for Agronomic Crops</u></p> <p><u>Crop Nutrient-Use Efficiencies</u></p> <p><u>Boron (B)</u></p> <p><u>Discussion Question #2</u></p> <p><u>Section 4 Quiz (opens October 10th)</u></p>	<p><u>Section 4 quiz</u> due October 11th</p> <p><u>Discussion Question #2</u> due October 11th</p> <p><u>Sulfur Management writing reflection for extra credit</u> - due October 11th.</p>
<p><u>Section 5</u></p> <p>13 Oct – 25 Oct</p>	<p><u>Molybdenum (Mo)</u></p> <p><u>Crop Nutrient Requirement</u></p> <p><u>Calcium (Ca)</u></p> <p><u>Nutrients an Irrigation Management</u></p> <p><u>Discussion Question #3</u></p> <p><u>Section 5 Quiz</u> (opens October 24th)</p> <p><u>Study guide for Exam available here</u></p> <p>.</p>	<p><u>Section 5 quiz</u> due October 25th</p> <p><u>Discussion Question #3</u> due October 25th</p>
<p><u>Section 6</u></p> <p>27 Oct – 08 Nov</p>	<p><u>Magnesium (Mg)</u></p> <p><u>Fertilizer Application Methods</u></p> <p><u>Iron (Fe)</u></p> <p><u>Discussion Question #4</u></p> <p><u>Section 6 Quiz</u> (opens November 7th)</p> <p><u>Literature discussion</u> paper assigned.</p>	<p><u>Section 6 quiz</u> due November 8th</p> <p><u>Discussion Question #4</u> due November 8th</p> <p><u>Nutrient Management Plan</u> due November 8th</p> <p>Read assigned literature discussion paper, prepare for upcoming interactive discussion.</p>

<u>Section 7</u> 10 Nov – 03 Dec	Manganese (Mn) Nutrition and Disease Zinc (Zn) Discussion Question #5 Section 7 Quiz (opens December 2nd) Interactive Literature Discussion (dates/times listed in link for each student, based on poll results).	Literature discussion (date/time in link). Section 7 quiz due December 3rd Discussion Question #5 due December 3 rd
<u>EXAM</u> 08 December – 09 December	Final Exam (opens December 8 th)	Exam is due December 9 th .

Attendance: Students are responsible for understanding all material provided through Canvas. Students are also responsible for meeting deadlines for assignments, quizzes, exams, etc. as indicated in the course schedule. There will be no make-up quizzes, exams, or assignments except for excused absences. Make-up work should be arranged prior to the excused absence if possible (e.g., university-sanctioned events), or as soon as possible for unexpected excused absences (e.g., illness or death in the immediate family).

Student Evaluation & Grading: There will be a total of 625 points for the class. Seven quizzes available at the end of each section will count 50 points each for a total of 350 points. Assignments include the five discussion question focused on identifying nutrient deficiencies will count 10 points each for a total of 50 points. An interactive literature discussion will be worth 25 points, based on participation in the discussion. You will also be required to submit a written nutrient management plan worth 100 points and a final exam worth 100 points. Extra credit (up to 20 points) is available via discussion replies, see "Interactive Discussion Replies" section for details, above. Additional opportunities for extra credit include a reflection writing on a guest-lecture regarding Sulfur management.

Item	Points
Quizzes	350
Assignments	50
Literature Discussion	25
Nutrient Management Plan	100
Exam	100
Total:	625
Interactive Discussion Replies	up to +20 (extra credit)

Assigned discussion questions, quizzes, the interactive literature discussion, the nutrient management plan, and the exam will be graded based on completeness, conciseness, clarity, effort, organization, originality, and timeliness. Late work will not be accepted without an excused absence. Please contact instructor as soon as possible if you have an excused absence planned.

Students attaining the following percentages are guaranteed at least the following grades:

A 93 - 100%	A- 90 - 92%	B+ 87 - 89%	B 83 - 86%
B- 80 - 82%	C+ 77 - 79	C 73 - 76%	C- 70 - 72%
D+ 67 - 69%	D 63 - 66%	D- 60 - 62%	E <60%

For information on current UF policies for assigning grade points, see <https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx> (Links to an external site.)Links to an external site.

Online Course Evaluation

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/> (Links to an external site.)Links to an external site.. 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/> (Links to an external site.)Links to an external site.. Summaries of course evaluation results are available to students at <https://gatorevals.aa.ufl.edu/public-results/> (Links to an external site.)Links to an external site..

Accommodations for Students with Disabilities

Students with disabilities requesting accommodations should first register with the Disability Resource Center (352-392-8565, <https://disability.ufl.edu/> (Links to an external site.)Links to an external site.) by providing appropriate documentation. Once registered, students will receive an accommodation letter which must be presented to the instructor when requesting accommodation. Students with disabilities should follow this procedure as early as possible in the semester.

Academic Honesty

UF students are bound by The Honor Pledge which states, "We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students 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." The Honor Code (<http://www.dso.ufl.edu/sccr/process/student-conduct-honor-code/> (Links to an external site.)Links to an external site.) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor in this class.

It is assumed all work will be completed independently unless the assignment is defined as a group project, in writing by the instructor.

This policy will be vigorously upheld at all times in this course.

Campus Resources

Health and Wellness

- *U Matter, We Care*: If you or a friend is in distress, please contact umatter@ufl.edu or 352 392- 1575 so that a team member can reach out to the student.
- *Counseling and Wellness Center*: [https://counseling.ufl.edu/\(Links to an external site.\)](https://counseling.ufl.edu/(Links to an external site.))Links to an external site., 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.
- *Student Health Care Center*: Call 352-392-1161 for 24/7 information to help you find the care you need, or visit the [Student Health Care Center website](#)Links to an external site..
- *Sexual Assault Recovery Services (SARS)*: Student Health Care Center, 392-1161.
- *University Police Department*: 392-1111 (or 9-1-1 for emergencies). [http://police.ufl.edu/\(Links to an external site.\)](http://police.ufl.edu/(Links to an external site.))Links to an external site.
- *GatorWell Health Promotion Services*: For prevention services focused on optimal wellbeing, including Wellness Coaching for Academic Success, visit the [GatorWell website](#)Links to an external site. or call 352-273-4450.

Academic Resources

- *E-learning technical support*, 352-392-4357 (select option 2) or e-mail to Learning- support@ufl.edu. <https://lss.at.ufl.edu/help.shtml>(Links to an external site.)Links to an external site..
- *Career Connections Center*, Reitz Union, 392-1601. Career assistance and counseling. [https://career.ufl.edu/\(Links to an external site.\)](https://career.ufl.edu/(Links to an external site.))Links to an external site.
- *Library Support*, <http://cms.uflib.ufl.edu/ask>(Links to an external site.)Links to an external site.. Various ways to receive assistance with respect to using the libraries or finding resources.
- *Teaching Center*, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring. [http://teachingcenter.ufl.edu/\(Links to an external site.\)](http://teachingcenter.ufl.edu/(Links to an external site.))Links to an external site.
- *Writing Studio*, 302 Tigert Hall, 846-1138. Help brainstorming, formatting, and writing papers. <https://writing.ufl.edu/writing-studio/Links to an external site.>

- *Student Complaints On-Campus:* <https://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/>(Links to an external site.)Links to an external site.
- *On-Line Students Complaints:* <http://distance.ufl.edu/student-complaint-process/>Links to an external site.

In-Class Recording:

Students are allowed to record video or audio of class lectures. However, the purposes for which these recordings may be used are strictly controlled. The only allowable purposes are (1) for personal educational use, (2) in connection with a complaint to the university, or (3) as evidence in, or in preparation for, a criminal or civil proceeding. All other purposes are prohibited. Specifically, students may not publish recorded lectures without the written consent of the instructor.

A “class lecture” is an educational presentation intended to inform or teach enrolled students about a particular subject, including any instructor-led discussions that form part of the presentation, and delivered by any instructor hired or appointed by the University, or by a guest instructor, as part of a University of Florida course. A class lecture does not include lab sessions, student presentations, clinical presentations such as patient history, academic exercises involving solely student participation, assessments (quizzes, tests, exams), field trips, private conversations between students in the class or between a student and the faculty or lecturer during a class session.

Publication without permission of the instructor is prohibited. To “publish” means to share, transmit, circulate, distribute, or provide access to a recording, regardless of format or medium, to another person (or persons), including but not limited to another student within the same class section. Additionally, a recording, or transcript of a recording, is considered published if it is posted on or uploaded to, in whole or in part, any media platform, including but not limited to social media, book, magazine, newspaper, leaflet, or third party note/tutoring services. A student who publishes a recording without written consent may be subject to a civil cause of action instituted by a person injured by the publication and/or discipline under UF Regulation 4.040 Student Honor Code and Student Conduct Code.