Plant Nutrition

Online Course Syllabus

Horticulture 5514, Fall 2017

I. Catalogue Description

Fundamentals of plant nutrient availability, uptake, assimilation, transport, function, and deficiencies. Influence of plant root environment and root physiology on plant nutrient status and subsequent effect on plant growth, crop yield, and relationship to plant diseases and pests. Pre: Graduate standing (3H, 3C)

II. Instructor

Linda L. Taylor, Ph.D., lltaylor@vt.edu

III. Learning Objectives

Upon completion of this course students will be able to:

A. Demonstrate knowledge of plant nutrient forms in the soil and describe how these forms are affected by soil chemical, physical, and biological properties.

B. Demonstrate knowledge of basic root anatomy, morphology, architecture, and physiology, and describe how roots modify surrounding soil.

C. Describe plant nutrient uptake mechanisms, transport, and function.

D. Diagnose common plant nutrient deficiencies and toxicities.

E. Explain how plant nutritional status influences plant growth and crop yield.

F. Explain the relationship between plant nutritional status and plant diseases and pests.

IV. Prerequisites

Graduate standing

V. Textbooks

A. Required: Marschner, Petra (ed). MARSCHNER'S MINERAL NUTRITION OF HIGHER PLANTS. Third edition. Amsterdam: Elsevier, 2012, 651 pages.

B. Recommended: Mengel, Konrad and Ernest A. Kirkby (eds.). PRINCIPLES OF PLANT NUTRITION. Fifth edition. Dordrecht: Kluwer Academic Publishers, 2001, 849 pages.

VI. Teaching Format

Online presentations will be posted at the beginning of each week. PDF handouts of the presentations will be available online, also, for students to print out for note-taking during the presentations. Each presentation has an associated **short quiz**. After watching a presentation, students will complete the corresponding quiz. Each quiz will be available all semester, but it is usually most effective to take the quiz immediately after listening to the presentation. Once the quiz is opened, students will have 30 minutes to complete and submit it. There is only one submission allowed, but it is essentially an open note quiz. Presentations, notes pages, and quizzes will all be under the "Modules" tab, organized by week.

Communication will be asynchronous through email and the "Discussions" tab on Canvas.

Students will write and submit a **paper.** The student will select one nutrient of interest from those listed as essential, and a topic (e.g., nutrient availability, nutrient uptake, nutrient assimilation, nutrient transport, nutrient function, nutrient deficiency). The paper will be composed of information from three original research articles dealing with the nutrient and topic chosen. These articles must be from peer-reviewed journals. The student's paper should be a unified and cohesive discussion of the pertinent results given in these articles, not just individual summaries of the journal articles. Selection of the three articles, therefore, should be done carefully. Literature cited is to be in American Society for Horticultural Science (ASHS) format found online at the ASHS website. Go to ASHS.org, Publications, About Publications, HortScience, and select Author Guidelines. Scroll to the middle of the page to ASHS Publications Style Manual and select.

Further instructions will be given under the "Assignments" tab under the entry for submission of nutrient, topic, and pdfs of three articles.

The timeline for work on this paper is:

Submission of nutrient, topic, and pdfs of three articles by September 29, 2017
Draft submission by November 4, 2017
Final submission by December 4, 2017

The student's choice of articles will be reviewed by the instructor and comments or suggestions will be given at least two to three weeks before the draft is due. The draft will also be reviewed and sent back to the student with suggestions and comments. All submissions and assignment information will be under the "Assignments" tab.

VII. Assessment

There will be four open book **exams**. Exams are not cumulative and each exam covers only the material noted below. Exams will be posted on the dates given below and students will have 3 days in which to access the scheduled exam. Once "opened", students will have 2 hours to complete the exam. Test format will be given a few days before the exam becomes available.

Exam 1: Sept. 25 (covering Presentations 1 through 9)
Exam 2: Oct. 26 (covering Presentations 10 through 17)
Exam 3: Nov. 27 (covering Presentations 18 through 25)
Exam 4: Dec. 15 (covering Presentations 26 through 29)

Each exam will be worth 100 points.
The submitted paper will be worth 150 points.
Presentation quizzes will be worth 5 points each for a total of 145 points.

Total points for the class – 695.

VIII. Honor Code

Students will abide by the Virginia Tech Graduate Honor Code which can be found at http://graduateschool.vt.edu/academics/expectations/graduate-honor-system/ghs-constitution.html Truth and honesty in fulfilling the obligations of this course are expected and essential.

Students are encouraged to read the Graduate Honor System Constitution and become familiar with the section on violations, especially the information on plagiarism.

Course Schedule:

Week of:	**Presentations:**
	Course Overview Presentation
August 28	(1) Introduction to Plant Nutrition (Chapter 1) (2) The Soil as a Plant Root Medium (Chapter 17 pp. 418-424) (3) Nutrient Availability (Chapter 12, Chapter 11 pp. 299-300)
September 4	(4) The Root (Chapter 13) (5) The Rhizosphere (Chapters 14 and 15)
September 11	(6) Nutrient Uptake (Chapter 2) (7) Water Relations and Long Distance Transport in the Xylem and Phloem (Chapter 3)
September 18	(8) Uptake and Release of Nutrients by Aerial Plant Parts (Chapter 4) (9) Photosynthesis and Assimilation of Carbon Dioxide (Chapter 5 pp. 85-95)
September 25	**SEPTEMBER 25 EXAM 1 AVAILABLE (8:00 a.m.)** (10) Yield and Source-Sink Relationships (Chapter 5 pp. 95-133) **September 29 Student submission of nutrient, topic, and pdfs of articles for paper**
October 2	(11) Nitrogen (Chapter 6 pp. 135-142, Chapter 16) (12) Nitrogen (cont.) (Chapter 6 pp. 142-151)
October 9	(13) Sulfur (Chapter 6 pp. 151-158) (14) Phosphorus (Chapter 6 pp. 158-165)

October 16	(15) Potassium (Chapter 6 pp. 178-189) (16) Calcium (Chapter 6 pp. 171-178
October 23	(17) Magnesium (Chapter 6 pp. 165-171) **OCTOBER 26 EXAM 2 AVAILABLE (8:00 a.m.)**
October 30	(18) Iron (Chapter 7 pp. 191-200) (19) Manganese (Chapter 7 pp. 200-205) **NOVEMBER 4 PAPER DRAFT DUE**
November 6	(20) Zinc (Chapter 7 pp. 212-223) (21) Copper (Chapter 7 pp. 206-212) (22) Molybdenum (Chapter 7 pp. 226-233)
November 13	(23) Boron (Chapter 7 pp. 233-243) (24) Nickel (Chapter 7 pp. 223-226) (25) Chlorine (Chapter 7 pp. 243-248)
November 27	**NOVEMBER 27 EXAM 3 AVAILABLE (8:00 a.m.)** (26) Beneficial Nutrients – Sodium, Silicon, and Cobalt (Chapter 8 pp. 249-263)
December 4	**DECEMBER 4 FINAL PAPER DUE** (27) Diagnosis of Nutrient Deficiencies and Toxicities (Chapter 11) (28) Nutrition and Plant Quality (Chapter 9)
December 11	(29) Plant Nutritional Status and Plant Diseases and Pests (Chapter 10) **DECEMBER 15 EXAM 4 AVAILABLE (8:00 a.m.)**