**Syllabus**

**CSS 215** **- Soil Nutrients and Plant Fertilization  - Winter 2019**

**Course Numbers**:  CSS 215  -  CRN:  30929

**Course Credits:** 3 credits

**Meeting Time & Room:** Lectures:  MW  11:00-11:50 -  WOH 122

Lab:  W 1:00-2:50 - WOH 122

**Instructor:**

Eric Vukicevich

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**Office Hours:** Monday 12:00-1:30 or by appointment Monday/Wednesday

**Course Description**

Introduces the essential soil nutrients and their use in agronomic and horticultural crops. Processes in soil nutrient supply and plant nutrient uptake are discussed. Students become familiar with common synthetic and organic fertilizers and soil amendments and learn how to apply fertilizers using various application methods. Environmentally sound use and holistic management of agricultural nutrients are emphasized.

**Course Materials:**

Better Soil for Better Crops, (3rd Edition), SARE, 2010 (required - free ebook)

Elements of Nature and Properties of Soil, (3rd Edition), Prentice-Hall, 2009 (recommended)

Additional readings in the Moodle course management system, on-line, on reserve in the library, or from class handouts will be announced in class. Students have to be enrolled in Moodle (http://elearning.linnbenton.edu).

**Course Outcomes**

Upon the successful completion of this course students will be able to:

* Describe the function and cycling of essential plant nutrients.
* Determine nutrient requirements based on crop needs, soil properties and environmental situation.
* Establish appropriate fertilizer and soil amendment types and rates for common agronomic and horticultural crops.

**Waitlist Policy**

If the class is full, registered students not attending the first session without advance notice to the instructor will be dropped from the class and students from the wait list will take their spots. Waitlisted students must attend class and get instructor approval to become registered students.

**Course Evaluation**

You will be evaluated through quizzes, exams, lab reports, and a portfolio project. You have to **let the instructor know ahead of time** (via phone, email, or in person) if you are unable to meet the due dates of assignments or if you are unable to take exams on the designated dates and times due to an emergency or illness. Only students following this procedure will receive make-up exams. Labs require your presence and can not be made up. Keep track of your grades in exams, quizzes and assignments.

***Grades:*** The grading system for the course is “A-F”. Final grades will be based on the percentage of total points earned.

 A = 90% and above - B = 80 to 89% - C = 70 to 79%- D = 60 to 69%. - F = 59% and below

- Quizzes 10 % (x2) > 20 %

- Mid-term Exam 20 % > 20%

- Lab Participation  4% (x10) > 40%\*

- Portfolio Project 20 % > 20%

*\*Note:* Missing more than two labs will result in 0 % in the lab portion of the grade.

**Student Integrity:**All students are expected to take exams with integrity, jeopardizing neither their own honesty nor that of other students.  *Plagiarism* will result in 0 points for the assignment and may result in further disciplinary action. Plagiarism is turning in some else’s work as your own or using sources without proper credit. Do not copy material from the internet or from any other source and present it as your own.  Work you present as your work must be original to you. Ask your instructor or a librarian for help when in doubt.

**Accessibility resources**:  Students who may need accommodations due to documented disabilities, who have medical information which the instructor should know, or who need special arrangements in an emergency, should speak with the instructor during the first week of class.  If you have not accessed services and think you may need them, please contact the [Center for Accessibility Resources (CFAR](https://www.linnbenton.edu/current-students/student-support/center-for-accessibility-resources/)) in RCH 105 (917-4789).

**LBCC Comprehensive Statement of Nondiscrimination:**LBCC prohibits unlawful discrimination based on race, color, religion, ethnicity, use of native language, national origin, sex, sexual orientation, marital status, disability, veteran status, age, or any other status protected under applicable federal, state, or local laws.  (For further information <http://po.linnbenton.edu/BPsandARs/> )

**Single stop financial guidance:** Any student who has difficulty affording groceries or accessing sufficient food to eat every day, or who lacks a safe and stable place to live, and believes this may affect their performance in the course, is urged to contact the Single Stop Office for support ([SinglestopatLBCC@linnbenton.edu](mailto:SinglestopatLBCC@linnbenton.edu) [,](mailto:stanlea@linnbenton.edu) 541-917- 4877, or visit us on the web [www.linnbenton.edu](http://www.linnbenton.edu) under student services for current students). Our office can help students get connected to resources to help.

**Classroom Guidelines**

This is your course. You will learn the most if you actively participate in classroom discussions and share your experience and questions. At the same time, respect other students’ desire to learn while listening attentively and appreciating other points of view.

Get to know your classmates and help one another learn.

**Turn off cell phones** before you enter the classroom.

This is your classroom. Take responsibility for it by straightening up tables and chairs when you leave. Clean up the lab and put away equipment at the end of class. Pick up and remove litter.

Arrive promptly before class begins. If late, enter quietly.

**No food or drink** is allowed in the classroom during class time. No tobacco products may be used in the classroom at any time.

Know basic safety rules and report any accidents, injuries, or problems immediately.

Do not come to class when you are ill and are likely to infect others.

Minor children will not be allowed in the classroom or lab areas for safety reasons. Check the LBCC family resource center for day care options

Security is a primary concern on campus. Be responsible for your things and considerate of other students’ belongings.

Let faculty or staff know if you are experiencing academic difficulties. Assistance is available. The LBCC Learning Center provides students with academic support and a comfortable place to study. For available services go to <http://cf.linnbenton.edu/depts/lrc/>

Be aware of Student Rights and Responsibilities. For more information go to http://www.linnbenton.edu/studentrights/index.html

Be aware of inclement weather policy of the college during the winter term

**Course Schedule - CSS 215 Soil Nutrients**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Monday  Lecture** | **Wednesday**  **Lecture** | **Wednesday**  **Lab** | **Reading in *Better Soil for Better Crops* (required)** | **Reading in *Elements of Nature and Properties of Soils* (recommended)** |
| **1**  01-07 | Course Introduction | Intro Soil Nutrients | Cation Exchange | Ch 2: Organic Matter | Ch 1:  The Soil Around Us |
| **2**  01-14 | Intro Fertilizers | Soil Nitrogen | Soil test interpretation/  Fertilizer calc. | Ch 7: Nutrient Cycles and Flows | Ch 13: Practical Nutrient Management pp 476-483 |
| **3**  01-21 | **Holiday** | Nitrogen and Organic matter | Begin pH/nitrate experiment | Ch 19: N and P Management | Ch 12: Nutrient Cycles  pp 396-412 |
| **4**  01-28 | Soil Phosphorus | **Quiz 1**  P and the Environment | Field trip: Nutrien  **Project Draft Due** | TBA | Ch 12: Nutrient Cycles  pp 420-432 |
| **5**  02-04 | Soil Potassium | Soil Sulfur | K, S and Liquid fertilizers | Ch 21: Soil Testing | Ch 12: Nutrient Cycles  pp 412-419, 433-438  Ch 13: Nutrient Mgmt. pp 484-487 |
| **6**  02-11 | **Midterm Exam** | Fertilizing with Manure | Organic Fertilizer Applications | Ch 12: Animal Manures | Ch 13: Practical Nutrient Management  pp 466-469 |
| **7**  02-18 | **Holiday** | Compost | Cover Crop Calculator | Ch 13: Using Compost | Ch 11: Soil Organic Matter pp 391-392 |
| **8**  02-25 | Other Organic Amendments | Nutrient Management | Nutrient Calculation  Project Q and A | Reading: Alt. Soil Amendments &  Ch 18: Nutrient Mgmt. | Ch 13: Practical Nutrient Management  pp 470-75 |
| **9**  03-04 | **Quiz 2**  Micronutrients | Calcium and Magnesium | Guest lecture/activity: Liming | Ch 20: Other Nutrients, CEC and Acidity | Ch 9: Soil Acidity, Alkalinity  pp 269-297 |
| **10**  03-11 | Ecological Soil Fertility Mgmt. | TBA | Project Presentation  Group A |  |  |
| Finals Week |  | Wed. 10:00 : 11:50 Project  Group B |  |  |  |

**Dates may change depending on the progress toward learning outcomes and needs of students and the instructor.**

**Nutrient Budget Project – CSS 215**

The goal of this project is to describe the management of nutrients on a farm or in a garden. The crops that are grown may be real or hypothetical. The farm or garden, however, has to be located in a real place. This project accounts for 20% of your grade. You are expected to spend 20-30 hours on this project.

The project report should include the following elements:

**Part I – General Information and Environmental Assessment**

1.    A brief description of the farm or garden area, and it’s overall operation, including location, total acreage, area included in this project, type of operation, number and kind of livestock (if any) on the farm. Include a photo and/or map and indicate field boundaries and field ID numbers if several fields or areas are involved in your project. Identify environmentally sensitive areas such as streams, lakes or ponds and any other information relevant to nutrient management. Include physical information such as field dimensions, slope, shading on areas with crops, monthly precipitation, monthly temperature

2.    For each field or area list the previous crops and the generally practiced crop rotation. Include tillage practices for each crop.

3.    Soil information, for each field or area under consideration, including:

a.    Soil map with soil type(s) and associated soil survey information

b.     Soil test results

- Organic matter level

- Nutrient status: N, P and K, and micronutrients level if available

- Other chemical properties: pH and CEC

**Part II - Nutrient Inputs and Outputs**

4.    Nutrient needs - If annual crops are grown describe a three year crop rotation in the fields for which you will develop a nutrient budget and management plan. For a perennial crop list the crop species, variety, and age of the crops. For both annuals and perennials, describe the nutrient needs of each crop. You need to establish a realistic yield goal and base the nutrient need on that yield.

5.    Nutrient inputs/gains

a. Yearly nitrogen mineralization from soil organic matter, cover crops and crop residues decomposition.

b. Nutrient inputs from other sources such as rainfall, N-fixation, decomposition of plant residues, irrigation water, etc. Consider also nutrients other than nitrogen  (provide a rationale for no, low, medium or high other inputs) .

6.    Outputs/losses

a.    Yearly losses of major nutrients from crop harvest (describe a yield goal and show the source of your estimate. What % of the harvested crop is N,P,K, etc.?)

b.    Yearly losses from leaching, erosion, gaseous losses (provide a rationale for no, low, medium or high losses).

*Notes for points 4-6. : Show clearly how you arrived at your recommended rate. Justify your results by documenting all assumptions that you make for your calculations.*

* *Do not simply use the soil test recommendation for your application.*
* *Do not just describe how nutrients are being applied currently or in the past. The nutrient application you describe in this project must be based on the need of the crop, your soil test and the input and outputs described in points 4-6*

7. Nutrient budget for Nitrogen, Phosphorus and Potassium in table format

Use the following concept to come up with your nutrient budget:

Nutrient needs = Nutrients removed (outputs) - available nutrients already in the soil + nutrients mineralized

Example:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Nitrogen | Soil test | Inputs | Outputs | Nutrient need |
| Crop 1 |  |  |  |  |
| Crop 2 |  |  |  |  |

**Part III - Nutrient Management**

8.    Based on the nutrient needs, input and losses described in Part II and site characteristics described in Part I, suggest a plan for nutrient application. This should include

∙       How much: the amount of nutrients from the fertilizers applied to each area

∙       What form: the type of fertilizer being used

∙       When applied: The timing of the application

∙       How:  the type of placement of the fertilizer

Show/describe your calculations. You also need to include how much your plan will cost.

9.    Suggest ways to improve environmental sustainability. How can you conserve nutrients and tighten the nutrient cycling to include more on-farm resources and to minimize losses of nutrients from the root zone?

**General Project information:**

> Submit written report electronically

The **written report** has to include the above described information. Not all information may be applicable and depending on the “farm” you choose there may be other information relevant to nutrient management not listed. The report has to be typed and submitted using the assignment folder in Moodle. Some elements of the report (e.g. large maps) may be difficult to submit in a digital format and may be provided to the instructor as a printed hard copy

> Include maps and photos where appropriate.

> Use a table format to show nutrient needs, nutrient inputs, nutrient outputs, and application.

>Include a reference section, listing all your sources of information *in citation format* (See handout in your Moodle).

> Due Dates

- The full report is due on **the Wednesday of week 10**.

- Send me an email by **Wednesday of Week 4,** providing the location and size of the area and crops to be grown for your nutrient budget. Also include any questions you have.

 > Oral Presentation

- A five (5) minute ***oral presentation* is presented on the last day of class in week 10** by each student. It should include the  following

∙       Description of the area and crops you are growing

∙       Challenges you faced in preparing the nutrient budget

∙       Major opportunities for improving the nutrient management on your farm/garden

## **Written Report Structure**

**Organize your report with the following headings, subheading, and content: (see detail description above)**

**Part I – General Information and Environmental Assessment**

1.   Description of the farm or garden area

2.    Previous crops and the generally practiced crop rotation

3.    Soil information, including soil survey and soil test results

**Part II - Nutrient Inputs and Outputs**

4.    Nutrient needs

a) Yield goal (either per acre or per your cropping area):

b) N, P, K need to reach the yield goal

c) Other nutrient needed

d) Lime need to correct pH

5.    Nutrient inputs/gains

a) Yearly nitrogen mineralization

b) Nitrogen and other nutrient inputs from other sources such as rainfall

6. Outputs/losses

a) Yearly losses of N,P, K from crop harvest

b) Yearly losses of from leaching, erosion, gaseous losses

7. Nutrient budget in table format for Nitrogen, Phosphorus and Potassium.

**Part III - Nutrient Management**

8.    Plan nutrient application

a) Amount of nutrients applied to each area

b) Type of fertilizer being used

c) Timing of the application

d) Placement of the fertilizer

e) Cost of plan

9. Ways to improve environmental sustainability

## **Project Evaluation - 100 points total**

Part 1:  Introduction 20 Points

Description of the “area” (10)

Soil/site information (10)

Part II - Nutrient Inputs and Outputs             30 Points

Nutrient Needs (7.5)

Nutrient Inputs/gains (7.5)

Outputs/losses (7.5)

Nutrient Budget (7.5)

Part III - Nutrient Management              20 Points

Application Plan (15)

Environmental Sustainability (5)

Written Report format                                   10 points

Oral Presentation - Content                    10 points

Oral Presentation - Presentation  10 points

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                                                          Total: 100 points