

**SO 350**  
**Soil Fertility and Fertilizers**  
**3 Credits**

Instructor: Ryan Pearce  
Phone: 780 853 8585  
Original Developer: Mel Mathison, Munawar Chaudhry  
Current Developer: Ryan Pearce  
Reviewer: Cassandra Gnyra  
Created: 01/06/1992  
Revised: 05/12/2017  
Approval: 06/12/2017

The Implementation Date for this Outline is 01/01/2018

Copyright©LAKELAND COLLEGE. Email: [admissions@lakelandcollege.ca](mailto:admissions@lakelandcollege.ca)  
2602 - 59 Avenue, Lloydminster, Alberta, Canada T9V 3N7. Ph: 780 871 5700  
5707 College Drive, Vermilion, Alberta, Canada T9X 1K5. Ph: 780 853 8400  
Toll-free in Canada: 1 800 661 6490



## SO 350 Version: 17



# Soil Fertility and Fertilizers

## Calendar Description

This course is a study of soil as a medium of growth. The fertility status of soils and plant/soil relationships are discussed in depth. Major topics include the function and mode of uptake of essential nutrients by plants, the forms and transformations of nutrients in soils, and the influence of soil chemical and physical characteristics. The impact of fertilizer chemistry, application method, and timing of application on soil fertility status is also reviewed.

## Rationale

This is a required course for Environmental Conservation and Reclamation students. A strong understanding of soil fertility is essential to the successful growth of vegetation in agricultural cropping, and is equally important to establishment and maintenance of vegetation in industrial or commercial sites, or in land reclamation. This course covers the factors affecting plant growth, balanced nutrient requirements, the chemical reactions that occur in the soil when different fertilizer types are applied, the forms of nutrients taken up by plants, and ways to reduce or prevent the loss of nutrients from the soil once fertilizers are applied. Calculating the amount of different fertilizers to blend together to supply nutrients in the required amounts is determined. This is commonly required for small applications.

## Prerequisites

SO 210

## Co-Requisites

None

## Course Learning Outcomes

Upon successful completion of this course, students will be able to

1. implement proper soil sampling techniques.
2. evaluate soil test reports.
3. design a fertility program for the establishment and maintenance of plant growth on industrial sites, reclamation sites, or for agricultural crop production.

4. determine and recommend optimal fertility programs, including choice of fertilizers, application rates, timing and methods of application.
5. predict the chemical reactions that occur in the soil related to nutrient availability, nutrient uptake and potential losses of nutrients from the soil.
6. assess the relationship of soil fertility and fertilizers to other essential plant growth factors.

## Essential Employability Skills

Essential employability skills are critical for workplace success and lifelong learning. Lakeland College prepares its graduates for the workplace and lifelong learning by integrating and promoting essential employability skills development in its curricula. Each credit course offered at Lakeland College emphasizes one or more of the following five essential employability skills:

- A. **Communication Skills** that enable individuals to listen, interpret, express, and convey knowledge and ideas so that they are received and understood.
- B. **Teamwork Skills** that enable individuals to respect the thoughts and opinions of others as they work together to plan activities, meet deadlines, complete projects, and contribute to an organization's goals.
- C. **Critical Thinking Skills** that enable individuals to conceptualize and analyze issues from various perspectives while rationally evaluating the strengths and limitations of each perspective and deciding what action to take.
- D. **Adaptability Skills** that enable individuals to respond quickly, willingly, and positively to new conditions and changing times.
- E. **Positive Attitude and Behavioural Skills** that enable individuals to be confident about themselves and to deal with people, problems, and situations with honesty, integrity, and personal ethics.

Please refer to the Knowledge/Skills Matrix of this course outline to review the essential employability skills emphasized in this course.

## Resource Materials

Brady, N.C., and R.R. Weil. 1999. The nature and property of soils. 12th ed.  
Prentice Hall, New Jersey.

J. Havlin, S. Tisdale, W. Nelson, and J. Beaton. 2014. Soil Fertility and Fertilizers: An Introduction to Nutrient Management (eighth ed.). Pearson. ISBN-13: 978-0-13-503373-9.

## Conduct of Course

The course is approximately 42 hours of lecture and 28 hours of lab-related study. Classroom instruction is in a lecture-style, with use of overheads. Questions and discussion occur during the classroom instruction to insure the material is understood.

Lab work emphasizes plant nutrient analysis of soil samples and evaluation of soil test reports. Assignments are given relating to the development of a fertility program using nutrient analysis, blending of fertilizers, economics, application rates, application timing, and application techniques.

## Evaluation Procedures

Exam	30%
Lab Reports (4-5 @ 3-5% each)	15%
Assignments (3 @ 5% each)	15%
Quizzes	5%
Final Exam	<u>35%</u>
Total	100%

## Knowledge/Skills Matrix

**Students apply and demonstrate their knowledge and skills to use**

### A. Communication Skills

<b>A1. by listening, reading, interpreting information, and communicating effectively</b>	
	Evaluation(s)/Goal(s): Midterm/Goals 4, 5, 6; Assignments/Goals 3, 4; Lab Reports/Goals 1, 2, 6; Final/Goals 1, 2, 3, 4, 5, 6
<b>A2. by using written, spoken, and/or visual formats and media to communicate and meet needs of each particular audience</b>	
	Evaluation(s)/Goal(s): Lab Reports/Goals 1, 2, 6; Assignments/Goals 3, 4
<b>A3. by using libraries, Internet, technical publications, journals and other sources to find pertinent information</b>	
	Evaluation(s)/Goal(s): Lab Reports/Goals 1, 2, 6; Assignments/Goals 3, 4

### B. Teamwork Skills

<b>B1. by using interpersonal skills to create an atmosphere that maximizes the strengths of group members to accomplish tasks</b>	
	Evaluation(s)/Goal(s): Lab Reports/Goals 1, 2, 6
<b>B2. by using interpersonal skills to resolve conflict, relate to others, and assist others</b>	
	Evaluation(s)/Goal(s): Lab Reports/Goals 1, 2, 6
<b>B3. by contributing and listening to others as group determines realistic objectives, prioritizes tasks, and identifies resources and timelines</b>	
	Evaluation(s)/Goal(s): Lab Reports/Goals 1, 2, 6
<b>B4. by treating other members of the group open-mindedly and fairly</b>	
	Evaluation(s)/Goal(s): Lab Reports/Goals 1, 2, 6
<b>B5. by developing tactics/strategies to accomplish tasks</b>	
	Evaluation(s)/Goal(s): Lab Reports/Goals 1, 2, 6

**C. Critical Thinking Skills**

<b>C1. by seeing critical thinking as a lifelong process of self-assessment</b>	
	<b>Evaluation(s)/Goal(s):</b> Midterm/Goals 4, 5, 6; Assignments/Goals 3, 4; Lab Reports/Goals 1, 2, 6; Final/Goals 1, 2, 3, 4, 5, 6
<b>C2. by examining problems closely</b>	
	<b>Evaluation(s)/Goal(s):</b> Midterm/Goals 4, 5, 6; Assignments/Goals 3, 4; Lab Reports/Goals 1, 2, 6; Final/Goals 1, 2, 3, 4, 5, 6
<b>C3. by examining beliefs, assumptions, and opinions, and weigh them against the facts</b>	
	<b>Evaluation(s)/Goal(s):</b> N/A
<b>C4. by seeking out the truth</b>	
	<b>Evaluation(s)/Goal(s):</b> N/A
<b>C5. by finding solutions; make decisions</b>	
	<b>Evaluation(s)/Goal(s):</b> Lab Reports/Goals 1, 2, 6; Assignments/Goals 3, 4
<b>C6. by incorporating new ideas that may not necessarily agree with previous thought on the topic</b>	
	<b>Evaluation(s)/Goal(s):</b> Lab Reports/Goals 1, 2, 6; Assignments/Goals 3, 4
<b>C7. by seeing connections between topics and use knowledge from other disciplines to enhance reading and learning experiences</b>	
	<b>Evaluation(s)/Goal(s):</b> Lab Reports/Goals 1, 2, 6; Assignments/Goals 3, 4

**D. Adaptability Skills**

<b>D1. by working independently or as part of team</b>	
	<b>Evaluation(s)/Goal(s):</b> Midterm/Goals 4, 5, 6; Assignments/Goals 3, 4; Lab Reports/Goals 1, 2, 6; Final/Goals 1, 2, 3, 4, 5, 6
<b>D2. by carrying out multiple tasks or projects</b>	
	<b>Evaluation(s)/Goal(s):</b> Lab Reports/Goals 1, 2, 6; Assignments/Goals 3, 4
<b>D3. by being innovative and resourceful: identify and suggest alternative ways to get the job done</b>	
	<b>Evaluation(s)/Goal(s):</b> Lab Reports/Goals 1, 2, 6; Assignments/Goals 3, 4
<b>D4. by being open and respond constructively to change and uncertainty</b>	
	<b>Evaluation(s)/Goal(s):</b> Lab Reports/Goals 1, 2, 6; Assignments/Goals 3, 4

**E. Positive Attitude and Behavioural Skills**

<b>E1. by dealing with people, problems, and situations with honesty, integrity, and personal ethics</b>	
	<b>Evaluation(s)/Goal(s):</b> Lab Reports/Goals 1, 2, 6; Assignments/Goals 3, 4
<b>E2. by showing interest, initiative, and effort</b>	
	<b>Evaluation(s)/Goal(s):</b> Midterm/Goals 4, 5, 6; Assignments/Goals 3, 4; Lab Reports/Goals 1, 2, 6; Final/Goals 1, 2, 3, 4, 5, 6
<b>E3. by affirming the need for positive solutions and encourage positive interaction and feedback</b>	
	<b>Evaluation(s)/Goal(s):</b> Lab Reports/Goals 1, 2, 6; Assignments/Goals 3, 4
<b>E4. by balancing personal and family activities with job-related activities</b>	
	<b>Evaluation(s)/Goal(s):</b> Midterm/Goals 4, 5, 6; Assignments/Goals 3, 4; Lab Reports/Goals 1, 2, 6; Final/Goals 1, 2, 3, 4, 5, 6

## Grade Equivalents and Course Pass Requirements

*A minimum grade of D (50%) (1.00) is required to pass this course.*

Letter	F	D	D+	C-	C	C+	B-	B	B+	A-	A	A+
Percent Range	0-49	50-52	53-56	57-59	60-64	65-69	70-74	75-79	80-84	85-89	90-94	95-100
Points	0.00	1.00	1.30	1.70	2.00	2.30	2.70	3.00	3.30	3.70	4.00	4.00

**Students must maintain a cumulative grade of C (GPA - Grade Point Average of 2.00) in order to qualify to graduate.**

### Attendance

Classroom and laboratory attendance is considered vital to the learning process and as significant to the students' evaluation as examinations and reports, therefore absenteeism is recorded.

- a. Students having a combination of excused and/or unexcused absence of 20 percent or higher for the scheduled course hours can be required to withdraw and would then automatically receive a "RW" (required withdrawal) for the course, regardless of any other evaluation results. (RW is a failing grade).
- b. An excused absence is one that is verified with your instructor. Verification should be prior to the absence or the next class day following the absence. Verification of the absence may take the form of a note from your doctor/College nurse regarding illness, or a note from another instructor regarding a field trip or other activity, or authorization by your instructor following an in-person meeting. Be sure to contact your instructor and ask what they will require from you as verification of each absence. An unexcused absence is anything NOT verified by the instructor prior to the absence or the next class day following the absence.

NOTE: Any exceptions to the above attendance policy (e.g. timetable conflicts, work-related issues) must be approved in writing by the Department Chair prior to the beginning of the course.

It is the students' responsibility to know their own absentee record.

Normal hours are 8:30 a.m. to 6:30 p.m., with potential for evening courses, exams or extended field trips. Students are expected to be available for classes during these times.

## Course Units/Topics

- A. Factors Affecting Plant Growth
  1. Genetic
  2. Environmental
    - light, heat, air, water, nutrients
    - soil factors (pH, E.C., structure, organic matter)
    - biotic factors (weeds, insects, diseases)
  3. Management of genetic and environmental factors to obtain optimum plant growth
- B. Essential Nutrients
  1. Macro and micronutrients
  2. Plant roles, deficiency symptoms, available forms
  3. Effects on growth
- C. Plant and Soil Relationships
  1. Ion exchange
  2. Ion uptake by plants
  3. Soil reaction and soil fertility
  4. Organic Matter and Fertility
- D. Nitrogen as a Nutrient and Fertilizers
  1. Forms in soil
  2. Forms of plant uptake
  3. Nitrogen transformations in the soil
  4. Types of nitrogen fertilizers and application
  5. Side effects of nitrogen fertilizer application
- E. Phosphorous as a Nutrient and Fertilizers
  1. Forms in soil
  2. Factors affecting P availability
  3. Fertilizer types and application
- F. Potassium as a Nutrient and Fertilizers
  1. Forms in soil
  2. K deficient soils
  3. Fertilizer types and application
- G. Sulfur as a Nutrient and Fertilizers
  1. Forms in a soil
  2. Acidification
  3. Fertilizer types and application
- H. Micronutrients
  1. Relationship to pH and availability
  2. Deficient locations
  3. General application methods

- I. Fertilizers and the Environment
  - 1. Nitrate leaching
  - 2. Phosphate pollution
- II. Fertility Management

Lab Content:

The lab exercises performed are not restricted to but may include the following (NOTE: labs are not indicated in chronological order):

Soil sampling, evaluation of soil analysis reports and fertilizer recommendations

Nitrogen fixation by legumes

Nutrient deficiency symptoms

Germination loss with high rates of N application (greenhouse trial)

Calculation of nutrient requirements

Field trip



Copyright©LAKELAND COLLEGE.  
2602 - 59 Avenue, Lloydminster, Alberta, Canada T9V 3N7. Ph: 780 871 5700  
5707 College Drive, Vermilion, Alberta, Canada T9X 1K5. Ph: 780 853 8400  
Toll-free in Canada: 1 800 661 6490 E-mail: [admissions@lakelandcollege.ca](mailto:admissions@lakelandcollege.ca)