AGRI 60 Course Outline as of Fall 2009

CATALOG INFORMATION

Dept and Nbr: AGRI 60 Title: SOIL & PLANT NUTRITION
Full Title: Soil & Plant Nutrition
Last Reviewed: 4/22/2024

Units		Course Hours per Week		Nbr of Weeks	Course Hours Total	
Maximum	3.00	Lecture Scheduled	2.00	17.5	Lecture Scheduled	35.00
Minimum	3.00	Lab Scheduled	3.00	17.5	Lab Scheduled	52.50
		Contact DHR	0		Contact DHR	0
		Contact Total	5.00		Contact Total	87.50
		Non-contact DHR	0		Non-contact DHR	0

Total Out of Class Hours: 70.00 Total Student Learning Hours: 157.50

Title 5 Category:	AA Degree Applicable
Grading:	Grade Only
Repeatability:	00 - Two Repeats if Grade was D, F, NC, or NP
Also Listed As:	
Formerly:	AG 53

Catalog Description:
Presents the study of soil as a growth medium for plants and a valuable natural resource. Includes physical, chemical and biological properties of soil; soil-water relationships; organisms, organic matter decomposition and soil ecosystem principles; soil reaction, cation exchange and essential nutrients; synthetic and organic fertilizers; soil conservation and land management principles. Students perform laboratory analyses on their own soil samples. Math calculations include land areas, fertilizer costs, formulations and application rates, percentages, and unit conversions; field trips and soil survey report required.

Prerequisites/Corequisites:

Recommended Preparation:
Eligibility for ENGL 100 or ESL 100

Limits on Enrollment:

Schedule of Classes Information:
Description: Presents the study of soil as a growth medium for plants and a valuable natural resource. Includes physical, chemical and biological properties of soil; soil-water relationships;

organisms, organic matter decomposition and soil ecosystem principles; soil reaction, cation exchange and essential nutrients; synthetic and organic fertilizers; soil conservation and land management principles. Students perform laboratory analyses on their own soil samples. Math calculations include land areas, fertilizer costs, formulations and application rates, percentages, and unit conversions; field trips and soil survey report required. (Grade Only)
Prerequisites/Corequisites:
Recommended: Eligibility for ENGL 100 or ESL 100
Limits on Enrollment:
Transfer Credit: CSU;UC.
Repeatability: Two Repeats if Grade was D, F, NC, or NP

ARTICULATION, MAJOR, and CERTIFICATION INFORMATION:

AS Degree:	**Area**		Effective:	Inactive:
	C	Natural Sciences	Fall 2025	
	L5	Physical and Biological Sciences		
	C	Natural Sciences	Fall 2019	Fall 2025
CSU GE:	**Transfer Area**		Effective:	Inactive:
	B1	Physical Science	Fall 2019	
	B3	Laboratory Activity		
IGETC:	**Transfer Area**		Effective:	Inactive:

CSU Transfer:	Transferable	Effective:	Fall 1981	Inactive:
UC Transfer:	Transferable	Effective:	Fall 2025	Inactive:

CID:
CID Descriptor: AG - PS 128L Introduction to Soil Science
SRJC Equivalent Course(s): AGRI30

Certificate/Major Applicable:
Both Certificate and Major Applicable

COURSE CONTENT

Outcomes and Objectives:
Upon completion of this course the student will be able to:
1. Collect, prepare, and test a representative soil sample for a variety of crop and forest environments and landscape situations.
2. Measure parcels using a variety of common units of distance measurement and calculate land areas in acres and hectares.
3. Compare USDA Soil Survey maps and data with actual soil conditions encountered in field observations.
4. Define and cite examples of the five soil-forming factors: parent material, climate, topography, living organisms and time.
5. Identify examples of the three classes of soil-forming rocks: igneous, sedimentary and metamorphic.
6. Evaluate soil productivity based on Land Capability Classification and Storie Index ratings.
7. Compare the functions of the four physical components of soil: air,

water, mineral solids, organic matter.
8. Distinguish the attributes of the typical horizons within a soil profile.
9. Relate water holding capacity, aeration, permeability to plant roots, and drainage characteristics to sand, silt and clay content of soils.
10. Analyze soil texture using "feel" method and classify soils by percent sand, silt and clay content using the soil textural triangle.
11. Explain the natural processes that result in the cementing of sand, silt and clay particles into secondary aggregates and recommend practices that enhance or maintain good soil structure.
12. Relate soil moisture tension terminology to field and nursery container soil conditions.
13. Predict water movement in soils with non-uniform textural and structural characteristics.
14. Summarize the cation exchange process in relation to plant nutrient availability.
15. Describe how soils become acidic naturally and through soil management practices.
16. Describe harmful effects of pH imbalances and recommend materials and methods for adjusting soil pH.
17. Categorize the major groups of soil microflora and microfauna in the soil ecosystem.
18. Explain the beneficial significance of nitrogen-fixing bacteria and mycorrhizal fungi.
19. Select organic amendments according to carbon:nitrogen ratio characteristics.
20. Select materials and recommend management practices for rapid composting.
21. Compare and contrast artificial soil media such as peat moss, perlite, vermiculite, scoria, and ground fir bark for nursery container culture.
22. List and describe plant uses and deficiency symptoms of the essential mineral nutrients.
23. Interpret a fertilizer label and predict crop response to the use of a nitrogen fertilizer.
24. Analyze the attributes of synthetic and organic fertilizer materials.
25. Recommend fertilizer application methods appropriate for various crop and landscape scenarios.
26. Evaluate various cover crops for perennial and annual cropping systems.
27. Define accelerated erosion by wind and water and describe control methods.
28. Explain how the Natural Resource Conservation Service (NRCS) and Resource Conservation Districts (RCDs) assist landowners in implementing soil conservation practices.

Topics and Scope:

I. Soil formation
    A. Classes of common soil-forming rocks
        1. Igneous
        2. Sedimentary
        3. Metamorphic

- B. The 5 soil-forming factors
  1. Parent material
  2. Living organisms
  3. Climate
  4. Topography
  5. Time
- C. Weathering processes
  1. Physical
  2. Chemical
  3. Biological
- D. Basic soil components: 50% solid particles, 50% pore space
  1. Mineral particles 45%
  2. Organic matter (O.M.) particles 5%
  3. Air +/- 25%
  4. Water +/- 25%
- E. Soil profile development and typical horizons
  1. O, A, B, C, R horizons
  2. Temperate and arid region soil profiles
  3. Profiles in various landforms and environments

II. Soil physical properties
- A. Texture
  1. Sand, silt and clay particles as primary soil separates
  2. Textural classification system and soil textural triangle
- B. Structure
  1. Types of aggregates and aggregate formation
  2. Beneficial effects of good soil structure (aggregation)
  3. Maintaining and improving soil structure
  4. Problems of compaction and subsurface impermeable layers
  5. Role of organic matter in aggregate formation
  6. Soil tilth and proper tillage practices
  7. Mulches
- C. Color
  1. Abundance of certain minerals
  2. Organic matter content
  3. Seasonal waterlogging and gleying
- D. Temperature
  1. Moderation effects of soil on air temperature extremes
  2. Daily and seasonal variation
  3. Moist vs. dry soil effects on temperature
  4. Effects of aspect (north vs. south facing slope)
  5. Effects on seed germination and root growth
  6. Mulched or vegetated cover vs. bare soil
- E. Bulk density and porosity
  1. Effects on aeration and drainage, permeability to roots
  2. Inverse relationship of BD [bulk density] and porosity
  3. Desirable BD values and factors affecting BD

III. Soil-Water relations and water holding capacity (WHC)
- A. Soil moisture tension conditions

1. Saturation
2. Field capacity
3. Permanent wilting point (or wilting point)
4. Available vs. unavailable water

B. Forces affecting water movement in soil
1. Properties of the water molecule
2. Saturated flow and gravitational force
3. Unsaturated flow and capillary forces
4. Osmotic (dissolved salts) potential differences

C. Soil physical conditions affecting water movement and WHC
1. Relationship of particle size and total surface area to water holding capacity
2. Movement across layers of non-uniform texture/structure
3. Depth and consistency of profile and horizons
4. Perched water tables in soil profile and in growing containers; shallow vs. deep containers
5. Texture and structure influences on infiltration, percolation

D. Moisture-sensing devices
1. Gypsum block
2. Tensiometer
3. Neutron probe
4. Other conductivity meters and commercial products

IV. Soil chemical and colloidal properties
A. Structure and properties of clay colloids
B. Humus and organic colloids
C. Negative charges of clay and humus micelles
D. Principle soil cations and anions
E. Cations and significance of cation exchange
1. Adsorption of nutrient cations on micelles
2. Leaching potential of mineral anions
3. Cation exchange capacity related to soil texture and organic matter content
4. Role of cation exchange in soil fertility

V. Soil acidity
A. Acidity, alkalinity, pH and related terms pH scale
1. Exponential relationship of pH values
2. Desirable pH values for plant growth
3. Effects of undesirable pH on plant growth and soil organisms

B. Buffering and buffering capacity of various soils
C. Adjusting pH
1. Benefits of liming acid soils, various liming materials
2. Acidifying alkaline soils

VI. Soil biology and ecology
A. Principles of diversity and stability of soil organism populations
B. General groupings of macro- and micro-organisms
1. Macro- and micro-fauna
2. Macro- and micro-flora

C. Classification of organisms by feeding habits and

beneficial or harmful effects on plants
D. Symbiotic organisms
1. Rhizobium bacteria and nitrogen fixation on legume roots
2. Mycorrhizal fungi on roots of most plants
E. Rhizosphere characteristics

VII. Organic matter addition and decomposition
A. Types of organic soil amendments
B. Value of cover crops in O.M. management
C. Common groups of aerobic decomposing organisms beneficial to plants
D. Carbon:Nitrogen ratio of organisms and organic matter
1. Effects of C:N ratio on decompositon rate of O.M.
2. Immobilization of N by decomposing microbes
E. Composting methods overview
1. Rapid composting or hot composting
2. Pit composting or other cold composting methods
3. Worm composting
F. Composting fundamentals
1. Green, moist nitrogen materials
2. Brown, dry carbon materials
3. Temperature indications related to decomposition rate
1. Ambient
2. Mesophilic zone
3. Thermophilic zone
4. Moisture levels within 40%-60% for aerobic organisms
5. Aeration through regular turning and mixing of materials

VIII. Essential mineral nutrients
A. Primary nutrients and their functions and deficiency symptoms
1. Nitrogen cycle
2. Available forms of nitrogen for plant uptake
B. Secondary nutrients
C. Micronutrients

IX. Fertilizers
A. The need for and benefits of proper fertilizer use
B. Common synthetic and organic fertilizer materials
C. Speed of availabilty of nutrients in various materials
D. Effects on pH
E. Fertilzer label
F. Complete fertilizers
G. Balanced fertilizers
H. Starter fertilizers
I. Calculating nutrient content, application rates and cost per pound of selected nutrients in fertilizers
J. Methods of application
K. Environmental concerns related to fertilizer use

X. Soil conservation, management and erosion control
A. Comparison of conventional tillage systems and conservation tillage effects on soil erosion
B. Land Capability Classes
C. Storie Index
D. Erosion by wind
F. Erosion by water

1. Slope angle and length
2. Soil texture and structure
3. Surface cover
4. Volume and velocity of flow

G. Erosion control methods
H. Natural Resource Conservation Service (NRCS) and Resource Conservation Districts (RCDs)
I. Global significance of soil erosion

XI. Laboratory tests, calculations and field activities

Assignment:

1. Weekly laboratory procedures and associated homework questions.
2. In-class calculations and exercises.
3. Weekly text reading assignments of approximately 20 pages per week.
4. Soil survey report.
5. Mid-term and final exam.

Methods of Evaluation/Basis of Grade:

Writing: Assessment tools that demonstrate writing skills and/or require students to select, organize and explain ideas in writing.

Written homework	Writing 10 - 30%

Problem Solving: Assessment tools, other than exams, that demonstrate competence in computational or non-computational problem solving skills.

Homework problems, Lab reports	Problem solving 10 - 40%

Skill Demonstrations: All skill-based and physical demonstrations used for assessment purposes including skill performance exams.

Class performances	Skill Demonstrations 5 - 20%

Exams: All forms of formal testing, other than skill performance exams.

Multiple choice, True/false, Matching items, Completion	Exams 30 - 60%

Other: Includes any assessment tools that do not logically fit into the above categories.

Lab participation.	Other Category 10 - 30%

Representative Textbooks and Materials:
Elements of the Nature and Properties of Soils. Brady, N., Weil, R. Prentice Hall, NY, 2003
The Nature and Properties of Soils. Brady, N., Weil, R., 13th ed., Prentice Hall, NY, 2007

Soil Science Simplified. Kohnke, B. 4th Ed. 1995 (Classic).
Soils in Our Environment. Miller, R., Gardner, D. 8th ed. Prentice Hall, NY, 2007