SOILS COURSE CURRICULUM

for Dr. Ritz
OTED 785

by
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Dabney S. Lancaster Community College
November 15, 2001

CURRICULUM FOUNDATIONS

DEFINITION AND PHILOSOPHY FOR SOILS COURSE

Soil science is the study of the soil as a component of natural and man-made systems. The Soils course is used to develop the skills required by the student to complete required class and lab work in one of the required courses toward attainment of a Career Studies or Certificate degree in Landscape/Turfgrass Management at Dabney S. Lancaster Community College. This course will give the student the basic knowledge of the role of soil in the environment, focusing on the physical, biological, chemical, and morphological properties. The aim of the curriculum is to develop knowledge in soil chemistry, plant nutrition, soil physics, soil microbiology, soil and water conservation, and soil classification through study of soils in the classroom, lab and outside research. An additional aim of the course is to provide the student with the recognition that soils are one of our most important natural resources, in that they provide the food, fiber, and foundation of our existence.

RATIONALE FOR SOILS COURSE

The Soils course focuses on the need for productive soils in plant growth, prevention of soil degradation, bio-remediation, pollution transport processes, waste treatment, wetland issues, and control of water pollution by soil-borne contaminants. This course provides students with a foundation of skills they will need in landscaping and turfgrass management, and prepares students with knowledge and abilities needed in similar fields such as production agriculture, conservation, research, extension, and natural resource management.

Research and analysis of institutions in Virginia and elsewhere offering programs in the landscape/turfgrass management and related areas, reveal the inclusion of the basic soils science course as a requisite for program completion. These institutions and programs include Tidewater Community College's (VA) Turfgrass Management Program, Virginia Tech's (School of Agriculture) two-year turf management program, Penn State's Turfgrass Management Certificate Program, Michigan State's two-year Golf Turfgrass Management Certificate Program, and Rochester Community College (MN) landscape, golf course, grounds maintenance diploma. The northern states' programs were included in the review as the college location is in both lower and higher mountain elevations of western Virginia, and thus deals with both "northern" and "southern" turfgrass areas.

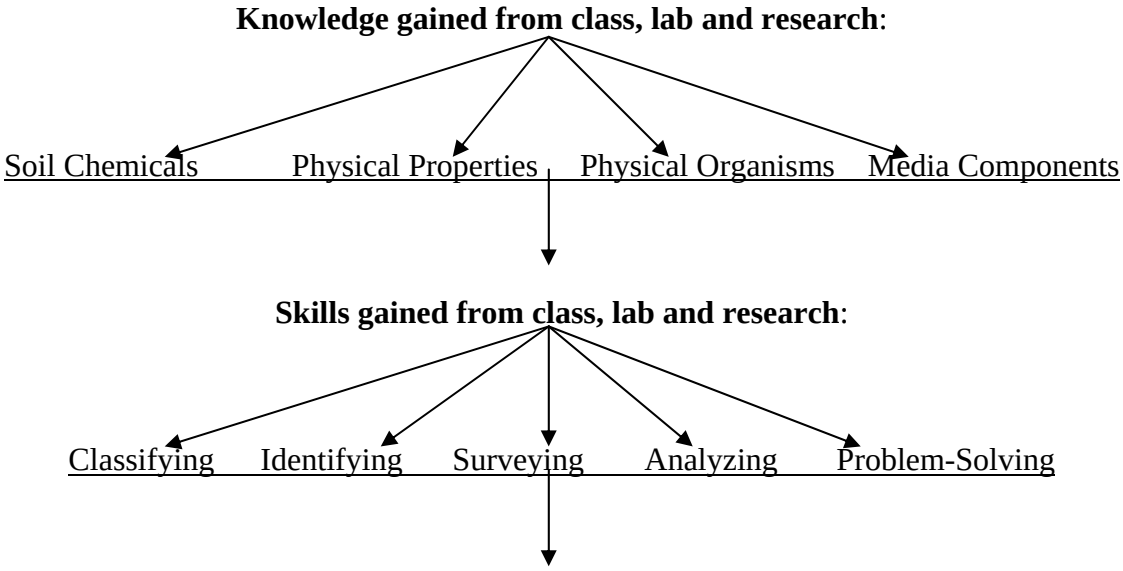
The college's advisory committee for the Landscape/Turfgrass Management Programs approved the inclusion of the Soils course as a required course for both the Career Studies and Certificate programs.

SOILS COURSE CONTENT SOURCE

The content of the course comes from the science of soils. It includes: soil genesis, morphology and classification; soil fertility, fertilizers and plant nutrition; soil chemistry; soil physics; soil management and conservation; agricultural meteorology and climatology; soil salinity; soil mineralogy; and soil microbiology.

SOILS COURSE CONTENT STRUCTURE

Soil Science



Evaluation of Knowledge and Skills

SOILS COURSE AIM AND GOALS

The program aim of the Soils course is to give the student the basic knowledge and skills needed to complete the course and program requirements successfully. The student will gain knowledge in the various areas of soil science and develop analytical skills in evaluating soils and soil conditions, and prescribing remedies.

The curriculum will provide instruction and practice that will:

1. Develop a working knowledge of soils for preparation as a landscape/turfgrass professional.

2. Identify the properties and factors of soils.

3. Analyze soil properties, structures and textures.
4. Apply knowledge of soils to practical use through lab practice and research.
5. Analyze experimental data using lab results.
6. Apply soil management solutions to workplace problems.

CURRICULUM CONTENT

SOILS COURSE SCOPE AND SEQUENCE

Week/Unit #	Topics	Lecture Hours	Lab Hours
1	Course introduction, What is soil?	3	0
2	Soil constituents ▪ Rocks and soil ▪ Rocks to soil (weathering)	2	2
3	Soil forming factors ▪ Pedon and soil forming processes ▪ Climate and biotic factors ▪ Topography factors ▪ Time ▪ Parent materials	2	2
4	Soil horizons ▪ Soil color and structure ▪ Soil horizon nomenclature	2	2
5	Classifying soils using soil taxonomy ▪ Epipedons and subsurface horizons ▪ Soil orders	2	2
6	Soil survey ▪ Soil survey ▪ Soil mapping ▪ Land classification	2	2
7	Soil texture ▪ Texture and mechanical analysis ▪ Texture by feel ▪ Texture profiles	2	2
8	Soil bulk density ▪ Soil bulk density determination ▪ Bulk density significance ▪ Compaction and porosity	2	2

9	Soil water ▪ Water molecule/capillarity ▪ Water potential ▪ Soil water classification ▪ Drainage and irrigation ▪ Wetlands and soil moisture	2	2
10	Soil organisms and the N cycle ▪ Soil organisms ▪ Nitrogen cycle	2	2
11	Soil OM, peat lands, and erosion ▪ Soil organic matter ▪ Peatlands ▪ Soil erosion	2	2
12	Soil pH ▪ Calcareous, saline and sodic soils ▪ Significance of soil pH ▪ Changing soil pH	2	2
13	Cation exchange, clay minerals ▪ Cation exchange and CEC ▪ Clay minerals	2	2
14	Fertilizers and fertility ▪ Fertilizer terminology ▪ Nitrogen fertilizer ▪ Phosphorous fertilizer ▪ Potassium fertilizer ▪ Fertilizer application ▪ Determining nutrient needs	2	2
15	Macronutrients, micronutrients Final course review ▪ Macronutrients ▪ Micronutrients ▪ Final exam content areas	2	2
16	Final Exam	N/A	N/A

UNIT ONE
INTRODUCTION – WHAT IS SOIL?
(One week – 3 hours)

Goals:

1. Explain the field of basic soil science.
2. Outline the course description including an overview of the units to be covered, methods of instruction and learning, course structure, assignments, and resources.
3. Summarize how the course will relate to their overall program, and how it will relate to job knowledge and skills.

Rationale for Unit:

"What is Soil?" is an introductory unit that lays the foundation for the Soils course. The introductory unit provides students with the rationale for the importance of learning about the aspects of soils to the entire Landscape/Turfgrass Management Program. This unit also builds the foundation for the entire course by giving students the course requirements and other information they will need to successfully learn the course competencies and complete the course.

Objectives for Unit:

1. Explore the topics covered in the course.
2. Explain complete information on the course description, competencies, requirements and schedule.
3. Discuss the overview of the study of soils, including the functions of soils, soil constituents, and history of the use and study of soils.
4. List the goals and purpose for studying soils.

Possible Activities:

1. Introduction and brief backgrounds of instructor and students.
2. Review handouts and discussion of syllabus and course schedule.
3. Participate in the PowerPoint viewing of slides and discussion covering such topics as the definition of soil, the science of the study of soils, goals for studying soils, various functions of soils, and the history of studying soils.
4. Examine and identify general different types of soils.

References:

Foth, H. 1991. Fundamentals of soil science. John Wiley & Sons.
Brady, N, Weil, R. 2001. The nature and property of soils, thirteenth edition. Prentice Hall.

UNIT TWO
SOIL CONSTITUENTS
(One week – 4 hours)

Goals:

1. Explore the concepts soil sources and uses.
2. Recognize the physical weathering processes of the soil constituents.

Rationale for Unit:

Unit Two provides students with a basic foundation of the make-up and formation of soils. This information lays the groundwork for understanding soil as a medium for plant growth. This unit also introduces the students to the basic formation of soils' parent material, and the weathering of rocks.

Objectives for Unit:

1. Explain and discuss the definition and uses of soil.
2. Classify different types of rocks as basic soil elements.
3. Identify the four soil constituents.
4. Compare the physical and chemical weathering processes of rocks.

Possible Activities:

1. Participate in the PowerPoint viewing of slides and discussion covering the topics of soil uses, types of rocks and soil elements, and physical and chemical weathering processes of rocks.
2. Examine and identify different types of rocks.
3. Record rock identification in lab book.

References:

Foth, H. 1991. Fundamentals of soil science. John Wiley & Sons.
Brady, N, Weil, R. 2001. The nature and property of soils, thirteenth edition. Prentice Hall.
Palmer, R and F. Troeh. 1995. Introductory soil science lab manual, 3rd edition. Oxford.
USDA Natural Resource and Conservation Service (www.nrcs.usda.gov)

UNIT THREE
SOIL FORMING FACTORS
(One week – 4 hours)

Goals:

1. Differentiate between soil forming processes and soil forming factors.
2. Recognize the soil forming processes that form horizons.

Rationale for Unit:

Students need to know how general processes form layers in the soil parent material, or horizons, in order to understand soil classification and texture that is introduced later in the course. Learning the five soil forming factors is important in relation to soil development, so that students can understand why soils differ, why their productivity is different from place to place, how different soils will affect the environment, and how soils may be properly used to better manage our most limited resource, the soil.

Objectives for Unit:

1. Explore the methods of soil forming processes that act on soil to form soil horizons.
2. Describe the five soil forming factors of climate, organisms, topography, time and parent material.
3. Explain and illustrate by examples, each of the five soil forming factors.
4. Relate the climate in Virginia to its impact on the weathering of rocks and minerals in the soil.
5. Discuss the impact of organisms on the mixing of the soil.
6. Relate Virginia's topography to soil formation in different parts of the state.

Possible Activities:

1. Participate in the PowerPoint viewing of slides and discussion covering the topics of soil forming processes, soil horizons, and soil forming factors.
2. Review measurements of soil horizons.
3. Discuss how the passage of time relates to soil horizon development.
4. Compare residual and transported parent materials.
5. Produce illustrations (drawings or pictures) of the soil forming factors, and record in the lab book.

References:

Foth, H. 1991. Fundamentals of soil science. John Wiley & Sons.
Brady, N, Weil, R. 2001. The nature and property of soils, thirteenth edition. Prentice Hall.
Palmer, R and F. Troeh. 1995. Introductory soil science lab manual, 3rd edition. Oxford.

UNIT FOUR
SOIL HORIZONS
(One week – 4 hours)

Goals:

1. Explain the development of soil horizons through pedogenesis.
2. Classify soil horizon nomenclature by the soil profile description.

Rationale for Unit:

Unit Four provides the student with an understanding of how soil undergoes various changes over time. This unit will look at how the soil develops different horizons during the formation, and how the horizons are named, as well as how soil characteristics of color and structure are used to identify soil horizons. The ability to write a soil profile description will be a valuable skill and will determine the student's understanding of soils and how they develop. In order to accurately describe a soil profile, understanding how the horizons are named is an important first step.

Objectives for Unit:

1. Differentiate between soil structure and soil texture.
2. Identify types of soil structure.
3. Determine how soil color attributes provide information on soil characteristics.
4. Label soil horizons by identifying the morphological clues (color, texture, structure, etc.).

Possible Activities:

1. Participate in the PowerPoint viewing of slides and discussion covering such topics as soil structure, soil texture, soil color, and soil horizon nomenclature.
2. Examine the samples of different soil structures.
3. View illustrations of soil colors to determine the type of soil horizon
4. Write a soil profile description using the soil morphological clues.

References:

Foth, H. 1991. Fundamentals of soil science. John Wiley & Sons.
Brady, N, Weil, R. 2001. The nature and property of soils, thirteenth edition. Prentice Hall.
Palmer, R and F. Troeh. 1995. Introductory soil science lab manual, 3rd edition. Oxford.

UNIT FIVE
CLASSIFYING SOILS USING SOIL TAXONOMY
(One week – 4 hours)

Goals:

1. Understand the diagnostic epipedons and subsurface horizons.
2. Become familiar with the soil orders of the earth.

Rationale for Unit:

Soil covers the earth's surface as a continuum, except on bare rock, perpetual frost or deep water, or on the bare ice of glaciers. Soil in this text is a natural body comprised of solids, liquid, and gases that occur on the land surface and is made up of layers (horizons). This unit provides the students with a universal language of soils that enhances communication among users of soils around the world.

Objectives for Unit:

1. Identify the eight epipedons (surface soil) and their characteristics that help determine the soil category.
2. Identify the subsoil characteristic, or horizon that helps determines the soil category.
3. Describe the twelve orders and their locations on the earth.

Possible Activities:

1. Participate in the PowerPoint viewing of slides and discussion covering such topics as epipedons, subsoils, and soil orders.
2. Examine different soils samples to determine the epipedon and subsoil horizon in each sample.
3. Locate different soil orders on a US soils map, and global soil region map.

References:

Foth, H. 1991. Fundamentals of soil science. John Wiley & Sons.
Brady, N, Weil, R. 2001. The nature and property of soils, thirteenth edition. Prentice Hall.
Palmer, R and F. Troeh. 1995. Introductory soil science lab manual, 3rd edition. Oxford.

UNIT SIX
SOIL SURVEY
(One week – 4 hours)

Goals:

1. Become familiar with the information contained in a soil survey.
2. Understand soil-mapping units.

Rationale for Unit:

Use of the modern soil survey is one of the most important tools that any soil specialist has for determining the characteristics of a parcel of land. In previous units students will have looked at a number of different soil profiles. These profiles show a small segment of the tremendous diversity of soils. Making detailed soil maps of where these soils are located provides further knowledge about soil characteristics and soil interactions with other factors. It is the job of the soil mapper to differentiate the various landscapes into the landform components.

Objectives for Unit:

1. Define the three main elements in a soil survey.
2. Explain the uses of different map scales and the scale order used for soil surveys.
3. Recite the historical significance of soil surveying.
4. Explain how soil maps are made and their potential uses.
5. Describe the two major systems of legal land descriptions.
6. Describe how tracts of land are classified in Virginia.
7. Identify the eight land capability classes in terms of cropland soil suitability.

Possible Activities:

1. Participate in the PowerPoint viewing of slides and discussion covering such topics as soil surveying, map scales, soil maps, legal land descriptions, land tract classification, and cropland soil suitability.
2. Analyze the data in the soil survey for Appomattox County, Virginia (http://www.mo14.nc.nrcs.usda.gov/Publishd%20Soil%20Surveys/appom-cd.pdf).

References:

Foth, H. 1991. Fundamentals of soil science. John Wiley & Sons.
Brady, N, Weil, R. 2001. The nature and property of soils, thirteenth edition. Prentice Hall.
Palmer, R and F. Troeh. 1995. Introductory soil science lab manual, 3rd edition. Oxford.
USDA Natural Resource and Conservation Service (www.nrcs.usda.gov)

UNIT SEVEN
SOIL TEXTURE
(One week – 4 hours)

Goal:

1. Recognize the nature and significance of soil texture.

Rationale for Unit:

Soil texture is perhaps the single most important physical property of the soil. The texture of the soil will influence how the soil can be used and the quality of the soil for that use. It is related to several soil properties such as soil structure, aeration, water holding capacity, nutrient storage, water movement and bearing strength. Although determining soil texture is not difficult, it yields a great amount of information about the soil.

Objectives for Unit:

1. Describe soil texture components by different particle sizes.
2. Determine soil texture by particle size.
3. Illustrate the mechanical analysis of soil texture by using "Stokes Law".
2. Describe the use of the textural triangle in determining soil texture.
3. Describe the use of the feel method in determining soil texture.
4. Identify the uses of soil texture profiles.

Possible Activities:

1. Participate in the PowerPoint viewing of slides and discussion covering such topics as soil texture components, mechanical analysis of soil texture, feel method, and soil texture profiles.
2. Separate soil particles using a sieve to separate the gravel from the soil, and to determine soil constituents.
3. Perform a lab experiment using "Stokes Law" to analyze soil sedimentation. Calculate the findings of the experiment by percents of sand, silt and clay.
4. Use the textural triangle to determine the textural class name of the soil.
5. Practice using the feel method with different soil textures.

References:

Foth, H. 1991. Fundamentals of soil science. John Wiley & Sons.
Brady, N, Weil, R. 2001. The nature and property of soils, thirteenth edition. Prentice Hall.
Palmer, R and F. Troeh. 1995. Introductory soil science lab manual, 3rd edition. Oxford.

UNIT EIGHT
SOIL BULK DENSITY
(One week – 4 hours)

Goals:

1. Understand the nature and significance of weight, pore space and air relationships.
2. Determine the methods and calculations for soil bulk density (BD).
3. Explain the different uses for bulk density calculations.

Rationale for Unit:

Determination of soil bulk density yields information about the soil that is significant in determining if the soil has the physical characteristics for plant growth, building foundations, or other uses. The weight of the soil is important if it is to be lifted or hauled long distances. In addition, determining soil density is used for erosion comparison purposes.

Objectives for Unit:

1. Calculate bulk density of soil by using the clod method, the cylinder method, and the core method.
2. Calculate soil erosion based on the bulk density.
3. Identify the terms used to describe soil consistence.
4. Explain the significance of soil compaction or pore space.
5. Define the C.O.L.E. measurement of the shrink-swell potential.
6. Explain the significance of soil porosity and how it can be changed.

Possible Activities:

1. Participate in the PowerPoint viewing of slides and discussion covering such topics as soil bulk density, methods for calculating bulk methods, soil consistence, soil compaction and pore space, C.O.L.E. measurement of the shrink-swell potential, and soil porosity.
2. Obtain soil cores using a cylinder probe and calculate the bulk density.

References:

Foth, H. 1991. Fundamentals of soil science. John Wiley & Sons.
Brady, N, Weil, R. 2001. The nature and property of soils, thirteenth edition. Prentice Hall.
Palmer, R and F. Troeh. 1995. Introductory soil science lab manual, 3rd edition. Oxford.

UNIT NINE
SOIL WATER
(One week – 4 hours)

Goal:

1. Determine the energy relationships between soil and water and how they influence plant growth.

Rationale for Unit:
Soil water is of great importance because of the many biological activities and chemical reactions that require water, and also because of soil erosion by water. For example, the amount of water that exists in soils during the growing season has a tremendous impact on crop yields.

Objectives for Unit:

1. Explain how adhesion and cohesion of water molecules affect the capillary action of water in soils.
2. Define water molecule/capillary action.
3. Describe the gravitational potential of the total water potential.
4. Label the soil water classifications according to how "tightly" the water is being held in the soil.
5. Infer what conditions are appropriate for drainage (too much water) or irrigation (not enough water).
6. Identify four types of irrigation and their uses.
7. Define "wetlands" and a "hydric soil" and their benefits to the environment.
8. Identify the four soil moisture regimes.

Possible Activities:

1. Participate in the PowerPoint viewing of slides and discussion covering such topics as molecular adhesion and cohesion, molecule/capillary action, gravitational potential, soil water classifications, drainage, irrigation, wetlands, hydric soil, and soil moisture regimes.
2. Measure soil water potential in the field by using a vacuum gauge tension meter, to determine when to irrigate soils.
3. Research examples of drainage and irrigation types used in Virginia.
4. Calculate the amount of water in the soil given the various water potentials.

References:

Foth, H. 1991. Fundamentals of soil science. John Wiley & Sons.
Brady, N, Weil, R. 2001. The nature and property of soils, thirteenth edition. Prentice Hall.
Palmer, R and F. Troeh. 1995. Introductory soil science lab manual, 3rd edition. Oxford.

UNIT TEN
SOIL ORGANISMS AND THE N CYCLE
(One week – 4 hours)

Goals:

1. Explain the role of soil organisms in the soil.
2. Describe the role soil bacteria have in providing nitrogen for plant growth.

Rationale for Unit:
Students will learn what soil organisms do for us by living in and on the soil. In studying soil organisms, students will find that many of the most significant are too small to be seen without a microscope. Healthy soil teems with an immense community of living organisms. Although they make up only about 5% of soil organic matter, these organisms are vital to many soil processes. Through their roles in the decomposition cycle, they regulate the flow of energy through the soil, the cycling of nutrients, and the productivity of agroecosystems.

Objectives for Unit:

1. Discuss how earthworms are like "miniature topsoil factories".
2. Explain how roots in the soil play an important role in the activity of microorganisms.
3. Discuss the negative influence nematodes have on plant roots.
4. Explain the positive and negative roles of fungi to organic materials and to other living organisms.
5. Explain the functions bacteria play in the soil and groundwater.
6. Explain the role soil bacteria play in providing nitrogen for plant growth.
7. Diagram the N cycle and explain each of four steps in the N cycle.

Possible Activities:

1. Participate in the PowerPoint viewing of slides and discussion covering such topics as the roles of earthworms, microorganisms, nematodes, fungi, bacteria and the N cycle.
2. Draw a diagram of the N cycle, illustrating each of the four steps.
3. Research examples of nitrogen human management – beneficial or detrimental.
4. Identify different organisms from a soil sample using a microscope.

References:

Foth, H. 1991. Fundamentals of soil science. John Wiley & Sons.
Brady, N, Weil, R. 2001. The nature and property of soils, thirteenth edition. Prentice Hall.
Palmer, R and F. Troeh. 1995. Introductory soil science lab manual, 3rd edition. Oxford.

UNIT ELEVEN
SOIL OM, PEATLANDS, AND EROSION
(One week – 4 hours)

Goals:

1. Explore the role of soil organic matter (OM) in soil ecosystems.
2. Recognize soil health as an indicator of environmental health.
3. Describe the formation and use of peatlands.
4. Determine the relevance of soil erosion to the environment and production of food.

Rationale for Unit:

Supplying a ready source of organic matter to the soil is an important management practice for all persons using the soil for plant production. Organic matter provides nutrients, tilth, and makes the soil healthy. Studying the causes of soil erosion is important, as saving the soil is directly related to civilization survival.

Objectives for Unit:

1. Recite the ideal growth conditions for OM decomposition.
2. Explain the importance of the carbon to nitrogen ratio for compost microbe's climate.
3. Describe the influence of precipitation and temperature on organic matter production.
4. Explain the process of peatland development, peatland indigenous plants and their value.
5. Identify the causes and processes of soil erosion.
6. Measure soil erosion using the universal soil loss equation (USLE).

Possible Activities:

1. Participate in the PowerPoint viewing of slides and discussion covering such topics as OM decomposition, carbon to nitrogen ratio, factors affecting organic matter production, peatlands, and soil erosion.
2. Solve composting problems using C:N ratios.
3. Identify peat products from specific peat moss illustrations.
4. Conduct a lab demonstration showing the influence on soil erosion.

References:

Foth, H. 1991. Fundamentals of soil science. John Wiley & Sons.
Brady, N, Weil, R. 2001. The nature and property of soils, thirteenth edition. Prentice Hall.
Palmer, R and F. Troeh. 1995. Introductory soil science lab manual, 3rd edition. Oxford.

UNIT TWELVE
SOIL PH
(One week – 4 hours)

Goals:

1. Distinguish the differences between acidity and alkalinity in soil pH.
2. Compare the attributes of calcareous, saline and sodic soils.
3. Explain the effect of soil pH on plants.
4. Describe methods for changing soil pH.

Rationale for Unit:

Soil pH plays an important role in plant growth. It influences many facets of crop production and soil chemistry, including the availabilities of nutrients and toxic substances, activities and nature of microbial populations, solubility of heavy metals, and activities of certain pesticides. Soil pH measurements provide quick, valuable information that will determine needed corrective procedures.

Objectives for Unit:

1. Define the elements in the soil pH scale.
2. Identify the sources of different pH factors in the soil.
3. Identify methods for determining soil pH.
4. Describe the causes for the high pH in calcareous, saline and sodic soils, and solutions for remedies to these soils.
5. Explain how nutrients can the effect the soil pH factor and used to solve micronutrient deficiencies.
6. Identify the methods, materials, and application procedures for changing the soil pH factor.

Possible Activities:

1. Participate in the PowerPoint viewing of slides and discussion covering such topics as soil pH scale, pH factors, determining soil pH, causes for the high pH, soil nutrients, and changing the soil pH factor.
2. Discover the pH range for most mineral soils found in Virginia.
3. Conduct a lab experiment of measuring soil pH using a solution of distilled water.

References:

Foth, H. 1991. Fundamentals of soil science. John Wiley & Sons.
Brady, N, Weil, R. 2001. The nature and property of soils, thirteenth edition. Prentice Hall.
Palmer, R and F. Troeh. 1995. Introductory soil science lab manual, 3rd edition. Oxford.

UNIT THIRTEEN
CATION EXCHANGE, CLAY MATERIALS
(One week – 4 hours)

Goals:

1. Recognize the importance of cation exchange capacity (CEC) for plant growth.
2. Describe the characteristics of clay minerals.

Rationale for Unit:

Cation exchange capacity is the ability of the soil to hold onto nutrients and prevent them from leaching beyond the roots. The more cation exchange capacity a soil has, the more likely the soil will have a higher fertility level. When combined with other measure of soil fertility, CEC is a good indicator of soil quality and productivity. Clay minerals are the most important chemical weathering product of the soil and clay has many uses including pottery, ceramics, linings for landfills, computer chips, cosmetics and pharmaceuticals.

Objectives for Unit:

1. Describe the methods of expressing the CEC and weight of common cation elements.
2. Recite the formula for determining the CEC.
3. Identify methods for measuring CEC.
4. Identify the composition and properties of clay.

Possible Activities:

1. Participate in the PowerPoint viewing of slides and discussion covering such topics as cation exchange, cation exchange capacity, and clay minerals.
2. Conduct a test of CEC following specific laboratory procedures.

References:

Foth, H. 1991. Fundamentals of soil science. John Wiley & Sons.
Brady, N, Weil, R. 2001. The nature and property of soils, thirteenth edition. Prentice Hall.
Palmer, R and F. Troeh. 1995. Introductory soil science lab manual, 3rd edition. Oxford.

UNIT FOURTEEN
FERTILIZERS AND FERTILITY
(One week – 4 hours)

Goals:

1. Identify fertilizer terminology.
2. Explain the benefits of nitrogen, phosphorus and potassium fertilizers.
3. Provide rationale for using different methods of fertilizer application.
4. Determine nutrient deficiency and solutions for addressing problems.

Rationale for Unit:

The use of fertilizer has become increasingly indispensable in food and fiber production and the maintenance of horticultural plantings. Manufactured fertilizers have been used for the past 100 years. Its use has increased worldwide to address the world's growing population. However, there is some evidence that excessive fertilizer use may be hazardous to human health and the environment. The justification for future use must be based on an understanding of the benefits of proper use, as well as on an understanding of the ill effects from improper use.

Objectives for Unit:

1. Identify information required for display on commercial fertilizers (including the guaranteed chemical analysis).
2. Explain the process of adding nitrogen to soils and its relationship to the nitrogen cycle.
3. Identify the four forms of nitrogen fertilizer materials.
4. Explain the role of phosphorus to plants and types of phosphorus fertilizers.
5. Describe situations where phosphorous is a pollutant.
6. Explain the role of potassium to plants and sources of potassium fertilizer.
7. Identify and describe five methods of fertilizer application.
8. Identify methods for determining nutrient deficiency.
9. Define "precision agriculture".

Possible Activities:

1. Participate in the PowerPoint viewing of slides and discussion covering such topics as fertilizer terminology, nitrogen, phosphorous, and potassium fertilizers, fertilizer application, and determining nutrient needs.
2. Solve fertilizer problems using the formula for pounds of fertilizer needed.
3. Calculate fertilizer rates for the soil using data from a soil test recommendation.

References:

Foth, H. 1991. Fundamentals of soil science. John Wiley & Sons.
Brady, N, Weil, R. 2001. The nature and property of soils, thirteenth edition. Prentice Hall.
Palmer, R and F. Troeh. 1995. Introductory soil science lab manual, 3rd edition. Oxford.

UNIT FIFTEEN
MACRONUTRIENTS, MICRONUTRIENTS, FINAL REVIEW
(One week – 4 hours)

Goals:

1. Define and recognize the uses for adding macronutrients and micronutrients to soils.
2. Summarize the course goals and objectives.

Rationale for Unit:

Understanding soil tests and remedies for macronutrients and micronutrients incorporates the previous content areas of soil texture, climate conditions, and the soil pH factor into a larger concept the student can use in practical, workplace situations. Review of the course objectives and activities will assist students in understanding how each of their class activities fit into the total picture of soil science. In addition, the review of the final exam content areas will clarify important course elements to retain.

Objectives for Unit:

1. Identify the factors that affect soil macronutrients and micronutrient availability.
2. Explain the recommended soil tests for macronutrients and micronutrients.
3. Review specific course objectives and learning activities.

Possible Activities:

1. Participate in the PowerPoint viewing of slides and discussion covering such topics as macronutrients, micronutrients, course objectives, learning activities and final exam content areas.
2. Identify and calculate secondary macronutrients for commercial turfgrass and cultured sod production.
3. Review handout and discussion of the final exam content areas.

References:

Foth, H. 1991. Fundamentals of soil science. John Wiley & Sons.
Brady, N, Weil, R. 2001. The nature and property of soils, thirteenth edition. Prentice Hall.
Palmer, R and F. Troeh. 1995. Introductory soil science lab manual, 3rd edition. Oxford.

CURRICULUM EVALUATION

STUDENT EVALUATION

Sample assessment questions from each unit:

Unit One: Introduction, What is soil?

- Name at least two occupations for which the course will help prepare students.

Unit Two: Soil Constituents

- Name and describe the four soil constituents.

Unit Three: Soil Forming Factors

- Describe how each of the five soil forming factors affects soil.

Unit Four: Soil Horizons

- Evaluate the student's written soil profile description.

Unit Five: Classifying Soils Using Soil Taxonomy

- Give three examples of the twelve soil orders, identifying the diagnostic features and world location of each.

Unit Six: Soil Survey

- Define the three main elements in a soil survey.

Unit Seven: Soil Texture

- Define "Stokes Law", including the K factors.

Unit Eight: Soil Bulk Density Determination

- Identify the formula for determining bulk density.

Unit Nine: Soil Water

- Given the following data, what is the % water by weight at field capacity?

Soil Core Volume = 250 cc (for each soil core below)
Weight of soil core at –1/3 bar (field capacity) = 420 g (July 4, 2001)
Weight of soil core at – 15 bar (wilt point) = 350 g
Weight of soil core at present field condition = 395 g (on July 10, 2001)
Weight of oven dry soil core = 300 g

Unit Ten: Soil Organisms and the N Cycle

- Diagram the N cycle and describe each of the four steps in the N cycle.

Unit Eleven: Soil OM, Peatlands, and Erosion

- Given the following data, what factors would you need to change to reduce the soil erosion?

A field (R=150) has a crop rotation of corn-soybeans, no conservation tillage, K=.24, slope length is 300 feet, with a slope of 2-6% (assume an average of 4%) LS=.64, P=1, C=1

Unit Twelve: Soil pH

- Describe a methodology for measuring soil pH.

Unit Thirteen: Cation Exchange, Clay Materials

- The CEC is important for maintaining adequate quantities of plant available _____ (four common elements needed by plants)

Unit Fourteen: Fertilizers and Fertility

- Identify and describe two of the five methods of fertilizer application.

Unit Fifteen: Macronutrients, Micronutrients, Final Review

- Name four micronutrient minerals.

DOCUMENT VALIDATION

In order for this community college curriculum in soils to achieve validation, a panel of subject matter experts in basic soil science should evaluate it. The panel should consist of soil science professors, the college's advisory committee for the Landscape/Turfgrass Management Programs, practitioners, and community college administrators, who would evaluate the curriculum in terms of appropriate educational levels for students in community colleges. A cover letter and survey should be enclosed with the curriculum program. The experts would be asked to critique the curriculum in terms of cohesiveness of content, aims, goals, objectives, teaching activities and inclusion of current research methodologies, practice and findings.

Cover Letter:

Dabney S. Lancaster Community College
P. O. Box 1000
Clifton Forge, VA 24422

Dr. Daniel E. N. Smith
College of Agriculture
VPI & SU
Blacksburg, VA

Dear Dr. Smith:

I am a curriculum developer who requests your evaluation of the enclosed curriculum course in basic soils science for Dabney S. Lancaster Community College. This soils course is one of the course requirements for the Landscape/Turfgrass certificate program. A survey is also enclosed to facilitate your evaluation in terms of curriculum content and cohesiveness.

Any added comments beyond what is covered in the survey will be appreciated. Your expertise in the soil science field is a benefit toward our goal of implementing a quality curriculum. Please contact me at 540-863-2902 should you have any questions or concerns. Thank-you for your time, knowledge, and cooperation in evaluating the curriculum and completing the survey.

Sincerely,

Christine A. Visscher
Workforce Training Coordinator

Soils Course Curriculum Document Validation Survey:

1. Is the definition of soils science precise and current?

2. Does the rationale for teaching the soils course provide a strong case for offering this curriculum?

3. Is the content source complete with accuracy and necessary information affording a solid knowledge base for learning by community college students?

4. Does the program aim of the curriculum reflect the content source?

5. Do the program goals reflect the direction a basic soils course should follow?

6. Are the program goals congruent with the program aims?

7. Is the scope of the content complete and divided into coherent units?

8. Is the sequence of the content in the most advantageous order for learning?

9. Do all of the unit rationales substantiate the unit goals?

10. Are the suggested activities congruent to the learning of the unit?

11. Are there any units that need to be removed, revised, or added?

12. Do the references provide the curriculum with current and accurate knowledge?