Course	Agricultural Science II
Unit	Introduction to Grassland Management
Subunit	Soil Management
Lesson	Soil Tests
Estimated Time	Two 50-minute blocks

Student Outcome

Interpret soil test information.

Learning Objectives

1. Determine what information is included on a soil test report.
2. Describe how the interpretation of the current soil analysis affects the nutrient requirements for a selected cropping option.
3. Describe how the probability of yield response to fertilizer application is determined.
4. Describe how the amount of lime needed per acre is determined.

Grade Level Expectations

SC/ME/1/B/09-11/b

Resources, Supplies & Equipment, and Supplemental Information

Resources

1. Activity Sheets
   - AS 1 – Word Search
   - AS 2 – Taking a Soil Sample
2. *Introduction to Grassland Management* (Student Reference). University of Missouri-Columbia: Instructional Materials Laboratory, 1997.
3. *Introduction to Grassland Management Curriculum Enhancement,* "Unit II – Soil Management."University of Missouri-Columbia: Instructional Materials Laboratory, 2003.

Supplies & Equipment

- ❑ Soil samples and test results for samples taken previously, if possible
- ❑ See AS 2 for materials and equipment needed to complete the Activity Sheet.

Supplemental Information

1. Internet Sites
   - ❑ Buchholz, D. D., J. R. Brown, and R. G. Hanson. *Using Your Soil Test Results* (Catalog #G9111). Columbia: University of Missouri Extension, 1993. Accessed February 11, 2008, from http://extension.missouri.edu/explore/agguides/soils/g09111.htm.
   - ❑ Lory, J. A., P. Scharf, and M. V. Nathan. *Interpreting Missouri Soil Test Reports* (Catalog #G9112). Columbia: University of Missouri Extension, 1998. Accessed February 11, 2008, from http://extension.missouri.edu/explore/agguides/soils/g09112.htm.
   - ❑ Scharf, P. C. *Liming Missouri Soils* (Catalog #G9102). Columbia: University of Missouri Extension, 2000. Accessed February 11, 2008, from http://extension.missouri.edu/explore/agguides/soils/g09102.htm.
   - ❑ Soil and Plant Testing Laboratory. University of Missouri Extension. Accessed February 11, 2008, from http://soilplantlab.missouri.edu/soil.
   - ❑ Soil Testing. Department of Agriculture and Consumer Services, North Carolina. Accessed February 11, 2008, from http://www.agr.state.nc.us/cyber/kidswrld/plant/soiltest.htm.
2. Print
   - ❑ *Soil Science* (Catalog #10-5050-I: Instructor). University of Missouri-Columbia: Instructional Materials Laboratory, 1995.

Interest Approach

Demonstrate how to take a soil sample. If possible, show students soil test results for samples taken earlier from the same area. Have students take soil samples using AS 2.

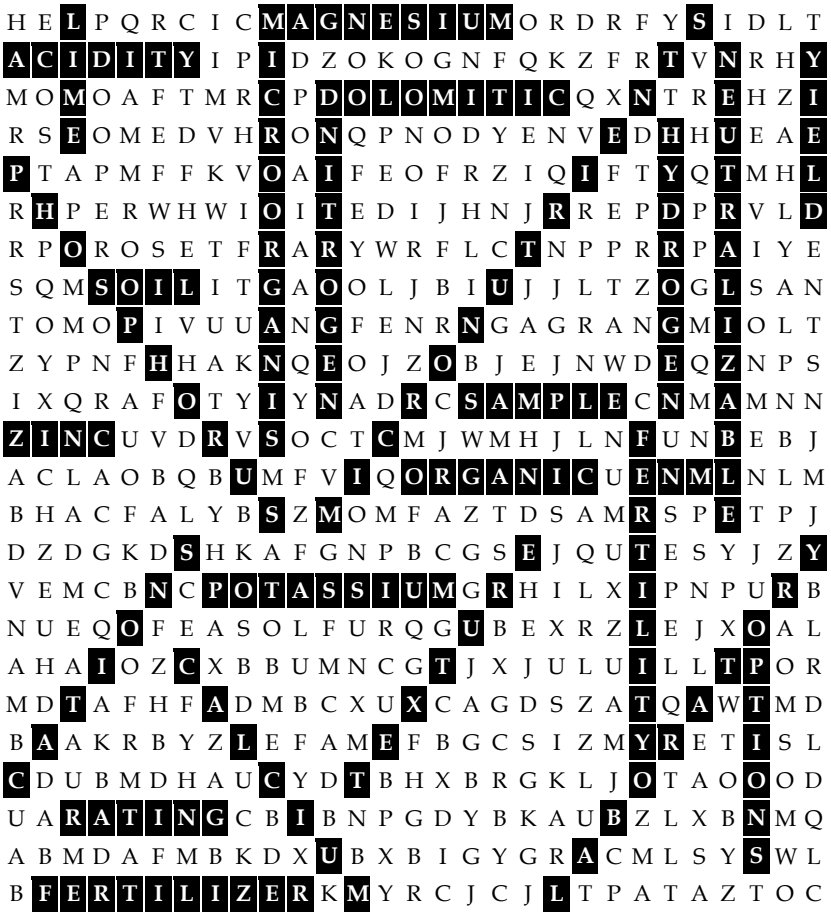
Communicate the Learning Objectives

1. Determine what information is included on a soil test report.
2. Describe how the interpretation of the current soil analysis affects the nutrient requirements for a selected cropping option.
3. Describe how the probability of yield response to fertilizer application is determined.
4. Describe how the amount of lime needed per acre is determined.

Instructor Directions	Content Outline
Objective 1 *Ask students if they have ever seen a soil test report. Discuss the information included on a soil test report.*	**Determine what information is included on a soil test report.** 1. Field information: contains information provided by the producer to identify the field and summarize previous management 2. Soil test information: b. Provides the results of the soil tests performed on the sample a. Provides the necessary data to develop nitrogen, phosphate, potash, and agricultural lime recommendations for the intended cropping option 3. Rating: provides a rating for the salt pH and nutrients tested 4. Nutrient requirements: contains three parts – cropping options, yield goal, and fertilizer recommendations 5. Cropping options: lists cropping plans or crops for which fertilizer recommendations were requested 6. Yield goal: shows the level of production selected for the crops listed in the cropping options section 7. Pounds per acre: a. Lists the fertilizer recommendations for the crops and yield goals listed in pounds of N (nitrogen), P_2O_5 (phosphate), and K_2O (potash) b. Designed to provide an agronomic recommendation of the nutrients needed to meet the yield goal and improve soil fertility over time

Instructor Directions	Content Outline
	8. Limestone suggestions: a. Gives the suggested amount of limestone to raise soil salt pH to an optimal level for the cropping options listed b. Given for the cropping option requiring the highest salt pH range c. Reported as pounds of effective neutralizing material (ENM) per acre 9. Special notes: helps the producer interpret and use the results and recommendations
Objective 2 *Understanding how to interpret the results of the soil analysis will help students to comprehend why treatments are needed to improve the soil. Ask students why it is important to provide the soil test laboratory with different cropping options. Point out that the treatments provided are crop specific for the best growth, optimum yields, and lowest economic cost.*	**Describe how the interpretation of the current soil analysis affects the nutrient requirements for a selected cropping option.** 1. Basic soil test results a. pH_S (salt pH) – Indicates the relative level of soil acidity – Improves root development and provides a good environment for soil microorganisms b. Phosphorus (P) – Measured in terms of its relative availability for plant growth, not the total amount in the soil – Range from very low to very high c. Potassium (K) – Measured by the amount available for plant growth and not by the amount in the soil – Used with the cation exchange capacity (CEC) to determine the additional amount of potassium needed d. Calcium (Ca) – Used to calculate CEC – Based on the soil pH e. Magnesium (Mg) – Only added if levels are very low to medium – Can be applied with lime in dolomitic limestone, which contains calcium and magnesium

Instructor Directions	Content Outline
	f. Organic matter (O.M.) – Refers to the decayed plant material, or humus, in the soil – Used in estimating the potential nitrogen available to a crop during the growing season g. Neutralizable acidity – Measures exchangeable hydrogen – Aids in calculating liming requirements for the soil h. Cation exchange capacity (CEC): measures the ability of the soil to hold positively charged nutrients called cations (calcium, magnesium, potassium, and hydrogen) 2. Routine fertilizer recommendations a. Nitrogen (N): determined by cropping option, soil texture, and organic matter b. Phosphorus and potassium: added to the fertilizer mix based upon the soil test and the desired yield of a particular crop
Objective 3 *Have students explain how ratings on the soil report relate to the probable yield response caused by fertilizer application.*	**Describe how the probability of yield response to fertilizer application is determined.** 1. The soil test rating provides information on the probability that the application of a particular fertilizer will increase crop yield. 2. The probability of an increase in yields from fertilizer drops as the soil test rating rises.
Objective 4 *Ask students if they have ever helped lime a field. If they have, ask them how the tons of lime needed per acre was determined. Have students complete AS 1.* AS 1 – Word Search	**Describe how the amount of lime needed per acre is determined.** Calculate the amount of lime required per acre by dividing the effective neutralizing material (ENM) value from the soil test by the ENM of the limestone. ENM indicates the ability to reduce soil acidity. $\frac{\text{ENM required by the soil test}}{\text{ENM of agricultural limestone}}$ = tons of limestone/acre

Instructor Directions	Content Outline
Application AS 1 – Word Search	Answers to AS 1  Other activities Take a soil sample from a school-owned planting area. Use the results to determine what amendments would provide increased yields or improve plant growth in that area. This activity would be most beneficial as an ongoing project, so students could see how the soil has changed from year to year. If this is to be done, be sure to keep the soil test reports and the treatments for each year.
Closure/Summary	Soil tests are helpful in reaching production yield goals. They report the current status of the soil and provide suggestions to improve the soil and increase crop yields.

Instructor Directions	Content Outline
Evaluation: Quiz	Answers: 1. b 2. d 3. a 4. a 5. d 6. 1.9 tons/acre 7. The soil test rating provides information on the probability that the application of a particular fertilizer will increase crop yield. The probability of an increase in yields from fertilizer drops as the soil test rating rises. 8. The data can be used to develop recommendations for nitrogen, phosphate, potash, and agricultural lime.