Crop Science Investigation Workshop Series Lesson Plans

Subject: Introduction to Crop/Plant Science Production **Grade Level(s):** 4th – 12th grades
Lesson Title: Why is soil nutrition important in crop production?
Time period: 1-3 hours (depending on activities conducted)
This lesson can easily be adapted to address as few as one learning objective or all. Objectives and corresponding learning activities are numbered accordingly.

These lessons can be adapted for youth of any age depending on level of technical content taught. When working with youth of varying ages, it is suggested to have older youth help the younger ones.

Lesson Objectives:

1. Explain the role soil has in plant production.
2. Discuss how all soils have varying levels of nutrients.
3. Determine soil nutrients required for crop production.
4. Brainstorm ways soil nutrient content can be improved for better crop yields.
5. Identify careers related to soil science.

Materials, audio-visual aids:	**Resources Used & Handouts**
Different soil samples (could be from yard, field, garden, construction site, etc.) Teaspoon Sticky notes or notecards with tape Markers Poster Board for each youth Scissors Glue Magazines with farm pictures (soil) Optional: Soil testing kits such as a AccuGrow Soil test Kit (pH, nitrate, Phosphate, and Potassium) for about $10 Distilled water Suggested: Whiteboard, flipchart, something to write on so all youth can see or to illustrate any points Computer(s) to play soil games	- Example Soils Poster handout -State Soils Information which can be found at http://soils.usda.gov/gallery/state_soils/ -Teacher Resource Information (includes interesting soil facts) can be found at http://www.envirothon.org/pdf/CG/Why_Soil_is_Important.pdf -*Optional*: Soil macronutrient hangman game at: http://www.proprofs.com/games/word-games/hangman/plant-macronutrients-hangman/ *Optional*: Soil testing guides found at http://www.extension.unl.edu/web/cropwatch-youth/soil_lessons -Soil Careers at http://soils.usda.gov/education/facts/careers.html -Soil Career Word Scramble at http://www.proprofs.com/games/word-games/word-scramble/soil-careers/#share -Green & Growing, 4-H Crop Projects Manual, #2, Iowa State University, pgs. 23-29

Solving the Problem	
Interest Approach *Hold up a spoon with soil on it. Ask, "how many living organisms are on this teaspoon?"*	By the end of this lesson, you should be able to answer the following problem statement and more.

There are more living individual organisms in a tablespoon of soil than there are people on the earth. *Then, ask, "What industry is the only essential industry on earth?"* Agriculture is the only essential industry on earth.	*Discuss interest approach with youth. Could have them write answers on sticky notes & place answers on flipchart paper with questions written on it for a longer activity.*
Problem statement Why is soil nutrition important in crop production? 1. **Objective 1**: Explain the role soil has in plant production.	**Discussion** 1.1 What role does soil have with plant production? Anchors the roots, serves as a medium for plants Stores water Hold nutrients Habitat for soil organisms Recycler of raw materials Soil is the basic start of life. Without soil, plants wouldn't grow and we wouldn't have food. Animals wouldn't have food and we wouldn't have animals for protein.
2. **Objective 2:** Discuss how all soils have varying levels of nutrients.	2.1 Do all soils have the same levels of nutrients? No, why not? Soil properties differ based on their physical, chemical, and biological properties. Physical properties that vary include: Topsoil depth, Texture & aggregation, aeration & infiltration, surface cover and compaction Chemical properties include: Organic matter content, salinity-electrical conductivity, acidity-alkalinity (pH), & Nitrate nitrogen Biological factors include: Soil respiration (CO_2), microbial activity/biomass, earthworm counts, plant vigor

	Major factors which lead to reductions in soil quality, land degradation, and soil erosion: • **Mismanagement:** Lands that are improperly managed (e.g., improper tillage) lose their topsoil. Either in large chunks during extreme erosive events, or little by little over an extended period of time, the soil disappears from the land resulting in reduced productivity and a degraded condition. • **Salinization:** Results from the accumulation of salts in improperly irrigated soils, most frequently in arid regions. • **Overharvesting:** Occurs on cultivated soils when repeated harvests are made from land without returning organic residues and mineral nutrients to the soil. • **Contamination:** Exposure of soil to toxic substances, as a result of industrial processes or chemical spills, can severely damage the ability of a soil to perform its ecosystem function.
3. **Objective 3**: Determine soil nutrients required for crop production.	3.1 What nutrients are required for high yielding crop production? ACTIVITY: Ask: What do you need to survive? *(Show/draw the food pyramid to show food groups we need in varying amounts.)* We can think of these as macronutrients and micronutrients. <u>Macronutrients</u> are needed in larger amounts. <u>Micronutrients</u> are needed in small amounts. There are 13 <u>mineral nutrients</u> that plants receive from soil and are dissolved in water and absorbed through a plant's roots. All soils don't naturally have all of these nutrients in the amounts plants need, therefore farmers/gardeners must add those nutrients to the soil. Within macronutrients, there are primary and secondary nutrients. <u>Primary nutrients</u> are lacking from the soil first because plants use large amounts for their growth and survival. With <u>secondary nutrients</u>, there are usually enough of these nutrients in the soil so fertilization is not always needed.

ACTIVITY:
If a computer(s) are available, have youth guess the six macronutrients playing the macronutrient "hangman game" found at http://www.proprofs.com/games/word-games/hangman/plant-macronutrients-hangman/

Primary nutrients are nitrogen (N), phosphorus (P), and potassium (K).
Secondary nutrients are calcium (Ca), magnesium (Mg), and sulfur (S).
Large amounts of Calcium and Magnesium are added when lime is applied to acidic soils. Sulfur is usually found in sufficient amounts from the slow decomposition of soil organic matter, an important reason for not throwing out grass clippings and leaves.

Boron (B), copper (Cu), iron(Fe), chloride (Cl), manganese (Mn), molybdenum (Mo) and zinc(Zn) are examples of micronutrients. Recycling organic matter such as crop residue and grass clippings is an excellent way of providing micronutrients (as well as macronutrients) to growing plants.

ACTIVITY:
Provide students a nutrient to research its functions, deficiencies and its sources. This can be done in any method youth want. (Pictures, power points, posters, reports, etc.) This can be done in teams; if you do not have enough youth, pick the macronutrients to discuss.
http://www.ncagr.gov/cyber/kidswrld/plant/nutrient.htm

ACTIVITY:
Using the soil sample(s) you have obtained, have the youth conduct nitrogen, phosphorous, and potassium soil tests to determine if they have enough nutrients for a field/garden.
Follow the directions on the box or use NRCS soil testing guides which can be found at
http://www.extension.unl.edu/web/cropwatch-youth/soil_lessons
Discussion Questions:

- What is the result of the soil tests?
- Why would that soil be adequate/inadequate to grow plants in (or specify corn, etc.)?

4. **Objective 4:** Brainstorm ways soil nutrient content can be improved for better crop yields.	4.1 What are some ways soils can be improved for better crop yields? -Crop rotations -Animal manures -Synthetic or commercial fertilizers -Leaving on crop/plant residues -Cover Crops Have youth brainstorm additional ideas on how to improve soil nutrients. ACTIVITY: Ask youth to create a poster illustrating the importance of soil health and its function in crop/plant production. *See example poster handout with examples to help get youth started.*
5. **Objective 5:** Identify careers related to soil science.	5.1 What careers are related to soil science? ACTIVITY: Have youth unscramble soil science-related careers. http://www.proprofs.com/games/word-games/word-scramble/soil-careers/#share Have youth brainstorm careers related in any way to soil in your local community. (farmer, NRCS, crop consultants, cooperatives, well drillers, landscaping, extension, etc.) Discuss options for careers in soil sciences. Use the following as a guide for discussion. http://soils.usda.gov/education/facts/careers.html

Summary (Closure) – Conclusion to the Problem:

Why is soil nutrition important in crop production?

Review:

1. Explain the role soil has in plant production.
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3. Determine soil nutrients required for crop production.
4. Brainstorm ways soil nutrients can be improved for better crop yields.
5. Identify careers related to soil science.

References:

(n.d.). Retrieved May 1, 2013, from Kids World - Plant Nutrition: http://www.ncagr.gov/cyber/kidswrld/plant/index.htm

Kettler, T. (2013). *Assistant Professor*. Retrieved April 30, 2013, from Plant & Soil Sciences e-Library: http://passel.unl.edu/pages/informationmodule.php?idinformationmodule=1130447033&topicorder=2&maxto=13&minto=1

Schwab, D. L., Levings, J., & Creswell, J. (2004). *Seedy Business, Manual One.* Iowa State University Extension.

Lesson plan by Brandy VanDeWalle, UNL Extension Educator

(**Example** poster) Use your creativity; can be 3-D!

Soil is life!

Could put picture here

Support plants

Could put picture here

Nutrients

Could put picture here

Water storage

Could put picture here

Medium for food

-Illustrate how soil health is important in plant/crop production and the benefits healthy soil provides.

Support life (microscopic & visual)

Could put picture here

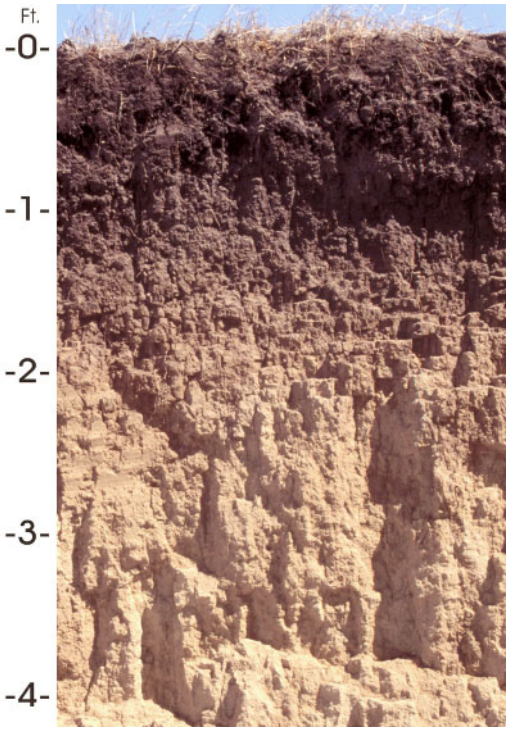
Human Health (antibiotics)

Could put picture here

Humans use to build, change landscape

Could put picture here

Holdrege -- Nebraska State Soil



Holdrege Soil Profile
Surface layer: dark grayish brown silt loam
Subsoil - upper: dark grayish brown silty clay loam
Subsoil - middle: light brownish gray silty clay loam
Subsoil - lower: light gray silt loam

Holdrege soils are extensive, making up about 1.8 million acres in south-central Nebraska. Most areas of these soils are used for crops, pasture, or rangeland. Corn, soybeans, and small grain are the main crops grown under dryland conditions. Many areas are irrigated.

The Holdrege series consists of deep, nearly level to gently sloping, well-drained soils on uplands. These soils formed in silty, calcareous loess. Slopes typically range from 0 to 6 percent, but they are as much as 15 percent in some areas. The average annual precipitation is about 22 inches, and the annual average snowfall is about 22 inches. The average annual air temperature is about 50 degrees.

The Holdrege series was established in Phelps County, Nebraska, in 1917. it is named after a community in the county. It was selected as the Nebraska State soil in 1979.

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