*This activity is from* [*Properties of Soils*](http://minnesota.agclassroom.org/matrix/lessonplan.cfm?lpid=227&grade=6&author_state=0&search_term_lp=soil) *lesson plan developed by Nutrients for Life Foundation.*

# Dry Soil Investigation

## Procedure

**Step 1.** Place 1 teaspoon (tsp) of Soil A in the center circle of one copy of the

graphic organizer and 1 tsp of Soil B in the center circle of the other copy of

the graphic organizer.

**Step 2.** Use a hand lens and a pencil to sort the soil components into the categories

listed on the [graphic organizer.](http://minnesota.agclassroom.org/matrix/lessonplan.cfm?lpid=227&grade=6&author_state=0&search_term_lp=soil)

**Step 3.** Once both soil samples have been separated into their components, compare

the results for the two types of soils.

## Discussion Questions

1. In what ways are the two soil types similar? How are they different?

2. Can you tell by visual inspection how well a soil will support plant growth? Why or why not?

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**Soil and Air Space Investigation**

**Procedure**

**Step 1.** Label three 50-milliliter (mL) test tubes Soil A, Soil B, Soil C

**Step 2.** Place soil into tube so that the tube is 1/3 full.

**Step 3.** Use a ruler to measure the height of the soil in the test tube. Make a mark near

the top of the test tube at a position twice the height of the soil.

**Step 4.** Slowly add 10 mL of water to the tube containing the potting soil. Record your

observations in the table. Repeat, adding 10 mL of water to the tubes

containing local soil and sand.

## Discussion Questions

**1.** Why did the final water level differ among the three types of soil?

## 2. Why is it important for plant growth that soils contain air space?

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**Soil and Water Investigation**

**Procedure**

**Step 1.** Label three 50-milliliter (mL) test tubes Soil A, Soil B, Soil C.

**Step 2.** Place soil into tube so that the tube is 1/2 full.

**Step 3.** Use a ruler to measure the height of the soil in the test tube. Make a mark near

the top of the test tube at a position twice the height of the soil.

**Step 4.** Slowly add 10 mL of water to the tube containing the potting soil. Record your

observations in the table. Repeat, adding 10 mL of water to the tubes

containing local soil and sand.

## Discussion Questions

**1.** Infiltration refers to the ability of soil to accept water. Which of the soils you tested

accepted the most water?

**2.** Percolation refers to the ability of soil to transmit water throughout its depth. Which

of the soils you tested allowed for the fastest water movement? Which allowed water to reach the greatest depth?

*This activity adapted from* [*Minnesota School Garden Guide lesson, It All Begins with Soil.*](http://minnesota.agclassroom.org/educator/garden.cfm)

**Soil Texture Activity**

**Procedure**

**Step 1.** Place 2 cups of soil in a quart jar and fill the jar with water.

**Step 2**. Place the lid on tightly and shake the jar.

**Step 3.** Place the jar on a flat surface and allow the soil to settle completely. The water will be clear when the total sample has settled.

**Step 4.** The soil particles have settled according to size with the largest and heaviest (sand) on the bottom and the smallest and lightest on the top (clay). The middle layer is silt. Using a ruler, measure the total height of the three layers and record this number to the nearest millimeter.

Total height of the three layers= \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Step 5.** Calculate the percentage of the sample that is sand and silt and clay.

Sand= measure of the bottom layer to the nearest mm x 100 = \_\_\_\_\_\_\_ % of sand

Total height of three layers to the nearest mm

Silt= measure of the middle layer to the nearest mm x 100= \_\_\_\_\_% of silt

Total height of three layers to the nearest mm

Clay= measure of the top layer to the nearest mm x 100= \_\_\_\_\_% of clay

Total height of three layers to the nearest mm

**Step 6.** Use the Soil Type Triangle attached to determine the name for this type of soil sample.

**Step 7.** Look over the handout about properties of soil types.

## Discussion Question:

1. Would this soil type be desirable or not desirable for a sports field? Why or why not?

# Importance of soil physical properties

The amount of water, air and nutrients available for plant growth is affected by the soil physical properties and turf management practices that include watering, mowing, and aerifying and how much the fields are used.  Determining the physical properties of your soils will ultimately help you determine how to manage them effectively.

**Soil texture** is based on the relative proportion of sand, silt and clay the soil contains and is used to name the soil, for example a sandy loam soil.

Coarse-textured soils (sands, loamy sands, sandy loams) have a large particle size and do not have great water and nutrient holding capacity. They tend to be well drained, dry out faster, and are less likely to compact.

Fine-textured soils (clays, sandy clays, silty clays) have a small particle size. They can hold water and nutrients, take time to dry out, can be easily compacted when wet and often are associated with poor drainage that limits the use of the fields during wet weather.

Soil texture will influence watering and fertilizing management practices on sports fields.

# General Properties of Different Soil Textures

|  |  |  |  |
| --- | --- | --- | --- |
| **Soil texture** | **Drainage** | **Potential for compaction** | **Water & nutrient-holding capacity** |
| sand | excellent | little to none | limited |
| loamy sand | excellent | limited | limited |
| sandy loam | good | limited to moderate | moderate |
| loam | good to fair | moderate | moderated – High |
| silt loam | fair to poor | High | High |
| clay loam | fair to poor | High | High |
| Clay | poor | High | High |

*This activity adapted from* [*Minnesota School Garden Guide lesson, Plant Doctor: Challenges with Growing Plants.*](Importance%20of%20soil%20physical%20properties)

**Plant Doctor: Challenge Growing a Natural Grass Field**

**Procedure**

**Step 1.** Review Plant Doctor Grass Field Guide.

**Step 2.** Read each scenario on the and as a team discuss and figure out what happened that led to this plant problem.

# Plant Doctor: Challenges with Growing Natural Grass Fields

|  |  |
| --- | --- |
| Scenario 1  It’s the beginning of baseball season and the Jacksonville Jumbo Shrimp field manager wants to make sure the baseball field looks pristine for the first game of the season. At the beginning of the week, he mows the field, paints the lines, makes sure the irrigation system is working and puts out the new signage for the season. A couple of days later the field where he mowed is brown. What happened? | Scenario 4 As you are walking your fields to make sure everything looks good, you notice some dry spots. You check the irrigation system and all the sprinkler heads are working, there are no leaks in the system. What is the problem? |
| Scenario 2 Its preseason in Green Bay. The NFL field safety consultant has come to test the hardness of the football field. Unfortunately, the field fails the hardness test. Lambeau Field is deemed too hard and unsafe for players. The first game against the Minnesota Vikings will have to be forfeited and steps will need to be taken to fix the hardness of the field. What is wrong with the field that makes it too hard to play on? | Scenario 5  Your football team travels to another school for the first game of the season. You notice their field is a yellow green instead of the deep green you are used to seeing at your school. Why is the field not a deep green? |
| Scenario 3  This year has been especially hot, it has rained a lot and very humid. You arrive at the field early one morning and see has what looks like spider webs on top of the grass. What is going on? |  |

# Natural Grass Field Guide

The challenge for sports turf managers is to provide safe, functional and aesthetically pleasing fields.

If you irrigate, use the system as needed for infrequent but deep (4"-5") irrigation when the root zone is first dry. Water in cycles, if necessary, to get the best percolation and efficiency for your irrigation dollar yet still have deep wetting. Deep wetting improves rooting depth, and roots are what sustain the turf during periods of high wear.

Soil fertility is step number one and something you can control. Athletic fields should be fertilized at least 4 times per season. Have your soil tested by a professional lab. Follow what the soil testing lab recommends for Phosphorus or Potassium. Nitrogen should be applied to the fields 4-5 times per growing season. Potassium helps to improve a grass’s ability to withstand drought conditions and colder temperatures. Phosphorus is important to root development of the grass. Not enough phosphorus can cause grass to stop growing vigorously. Nitrogen is important to producing chlorophyll, the green pigment that is utlized in photosynthesis.  
  
Mowing should be done properly. For most grass mowing to 1 to 1.5 inch height is best sustainability, but hybrids must be cut lower. Because of the 1/3 rule of cut (never remove more than the top third), shorter-cut turf requires more frequent mowings (shorter interval between mowings). Always try to mow when your turf has grown back 50% from its cutting height. This will minimize mowing stress from causing turf to brown and die.  
  
Watch for pest problems, and remember they are most easily controlled if caught early. That is especially true of weeds. With early attention, you may get by with using the less high-tech materials and equipment for adequate control. When hot, wet condition occur, be on the lookout for fungual issue that can look like spider webs on top of the grass and other abnormalities.

Be sure to include managing thatch in your maintenance plan. Thatch occurs when organic matter ( living and dead grass roots, crown of the grass plant and grass clippings) builds up at the soil surface. If it builds up, faster than it can decompose it forms a barrier that makes it difficult for water to reach the soil.

# Plant Doctor Scenarios Explanations

|  |  |
| --- | --- |
| Scenario 1  The grass was mowed too short. This can stress the grass and cause it turn brown and die. | Scenario 4 The dry areas likely have thatched. |
| Scenario 2 Soil compaction is the cause of natural grass field being too hard. Compaction can happen from overuse, lack of preventative maintenance tasks and overly wet soils being played on. | Scenario 5  This is a rare occurrence but would be due to a lack of nitrogen fertilizer. |
| Scenario 3  This is evidence of a fungus issue that must be taken care of quickly or it can wipe out and entire field. |  |