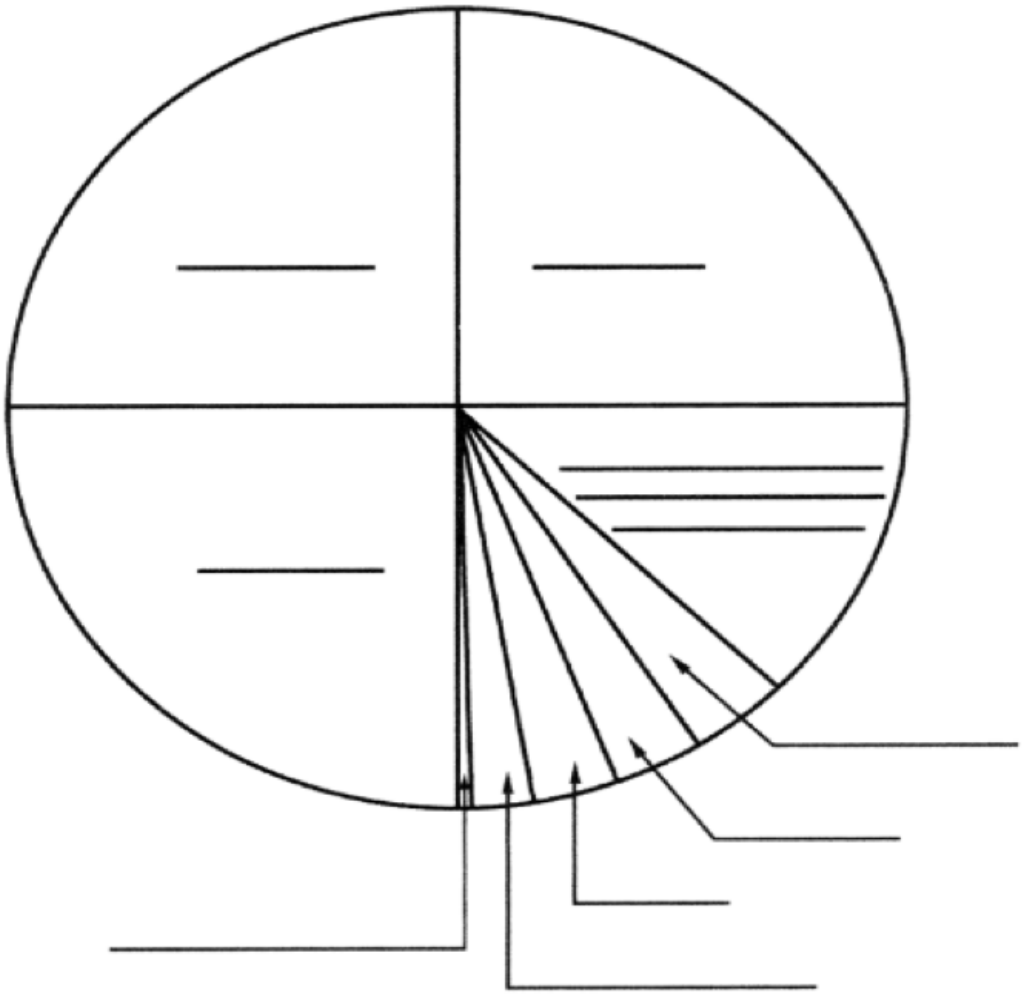
Earth's valuable soil

Directions

Label the following
3/4 of the Earth covered with water
1/8 of the Earth that is desert, swamp, mountains or polar regions
1/32 of the Earth that is too rocky for growing crops
1/32 of the Earth that is too hot to grow crops
1/32 of the Earth that is too wet to grow crops
1/32 of the Earth where crops can be grown
Tiny fraction that represents soil of that cropland



This project presented by Alaska Agriculture in the Classroom through funding from the Alaska Division of Agriculture and the Alaska Farm Bureau. For more information, visit www.agclassroom.org/ak

Name _____ Date _____

Nutrients for Plants and Animals

List five nutrients you believe are essential for humans

1.

2.

3.

4.

5.

List five nutrients you believe are essential for plants

1.

2.

3.

4.

5.

Write a definition for what an "essential nutrient" is.

Based on your definition, in the box below, draw a picture of what a plant might look like if it were not getting the essential nutrients needed.

Name _____ Date _____

Dry Soil Investigation

Procedure

1. Place 1 tsp. of potting soil in the square of the "Potting Soil Separation Sheet" and one tsp. of local soil in the square of the "Local Soil Separation Sheet."

2. Using a hand lens and pencil, sort the soil components into four different categories: "Animal Materials," "Plant Materials," "Rock Particles," and "Unknown Particles."

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?

2. Can you tell by looking at these soil samples if either would support plant growth? How were you able to make that conclusion?

Potting Soil Separation Sheet

Students can tape, glue, or simply lay their samples into the boxes below.

Particles that could be from animals (organic)	Particles that could be from animals (organic)
Particles that could be from rocks (inorganic)	Particles remaining uncertain

Place Soil Sample Here

Local Soil Separation Sheet

Students can tape, glue, or simply lay their samples into the boxes below.

Particles that could be from animals	Particles that could be from animals
Particles that could be from rocks	Particles remaining uncertain

Place Soil Sample Here

Name _____ Date _____

Dry Soil Mystery Recording Sheet

Soil Characteristics	A	B	C
What color is the soil?			
Does the sample have an odor?			
Does the soil feel gritty or smooth?			
Are there any visible particles or grains?			
Add 20 mL of water. How does the soil react?			
Does the soil sample seem to be mostly clay, sand, or silt?			
Take a handful of soil and ball it up in your fist. How well does it compact (poor, well, very well)?			
Rank the soils 1 to 3 (1 being best) for which would be the best to grow corn.			

Name _____ Date _____

Soil and Air Space Investigation

Procedure

1. Label three 50 mL test tubes “Potting Soil”, “Local Soil”, and “Sand”.
2. Place 20 mL of the appropriate soil into each test tube.
3. Use a ruler to measure the height of the soil in the test tubes. Make a mark near the top of the test tube at a position twice the height of the soil.
4. Slowly add 20 mL of water to the test containing the potting soil. Record your observations in the table below.
5. Repeat, adding 20 mL of water to the test tubes containing local soil and sand.

Soil Type	*Observations*
Potting Soil	
Local Soil	
Sand	

Discussion Questions

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

2. Why is this important for plant grow?

Name _____ Date _____

Soil and Water Worksheet

Problem: What type of soil will retain the most amount of water?

Observe the three samples of soil. In the circles below, draw what you see and write a description on the lines underneath.

Potting Soil	*Local Soil*	*Sand*
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

Hypothesis:

_____

_____

_____

_____

Procedure

1. Label your three graduated cylinders using the post-its. Make sure that the post-its don't cover the numbers where you will be measuring.
2. Place one coffee filter into a funnel and place the funnel into the graduated cylinder.
3. Add one cup of soil into the coffee filter.
4. Tip 120 mL of water onto the soil. Make sure to pour in the center of the soil as to not spill any water outside the funnel. Wait 4 minutes. Record the amount of water poured in the chart provided.
5. Look into the graduated cylinder and record how much water was not retained by the soil.
6. Record on the table provided.
7. Calculate the amount of water retained by each soil sample by subtracting the total amount collected in the graduated cylinder from the amount of water poured over the soil.
8. Repeat this process for the other two types of soil.

Soil Sample	Amount of water poured over soil (mL)	Amount of water collected in cylinder (mL)	Amount of water retained by soil (mL)
Potting Soil			
Local Soil			
Sand			

What soil retained the most amount of water? _____

Why do you think this was a result? _____

_____

What soil retained the least amount of water? _____

Why do you think this was a result? _____

_____

Was your hypothesis correct or incorrect? Why? _____

_____

If you had to you must choose to do something differently! (Be specific): _____

_____

Name _____ Date _____

Soil and MudWatts

Using page 2 of the MudWatt booklet, please write a short summary of how a MudWatt works below.

_____

_____

_____

_____

Problem: Does soil type impact how much power your MudWatt produces?

Hypothesis: _____

_____

_____

_____

Procedure

1. Use pages 8-11 to setup your MudWatt. If you run into any issues, there is a troubleshooting page on 17, of your booklet. Here is the link to a digital copy if you prefer. http://cdn.teachersource.com/downloads/lesson_pdf/MudWatt_Educational_and_Instructional_Booklet.pdf
2. Prepare your soil. You will need about 3 or 4 handfuls. Make sure that your soil is saturated with water, but not soupy. It is best to add water in small amounts to avoid oversaturation.
3. Make sure to bend your cathode and anode wire to 90 degrees just after the plastic endings.
4. Insert the non-plastic end of the cathode and anode wires into their separate felt pieces. Work to make sure the wire does not poke out of the felt.
5. Pack a layer of mud roughly 1 cm. in depth. Make it as smooth as possible.
6. Place your anode wire and felt into your vessel. Make sure to get out as many air bubbles as possible. You will then want to make sure to have the felt saturated in water.
7. Fill your container with enough mud to make it roughly 5 cm. deep. Make a nice firm push to remove air bubbles. Let your MudWatt sit for 3 minutes and then drain any excess water into a sink or spare container.
8. Place the cathode on top making sure that it is exposed to air.
9. Remove gloves and attach hacket board and place on the lid making sure the wires are coming through the appropriate holes (cathode on the left and anode on the right).

Number of Days	MudWatt Power Output (v)	Power Gain or Decline

Draw or print and paste your MudWatts data graph below:

Using the data collected please answer the following questions:

1. What day did the light begin blinking for your MudWatt?

2. What days did your MudWatt produce the most energy?

3. Compare you graph with other groups. Which type of soil produced the most power? Why do you think that might be?

Please still include the current Soil Sample Guide from current curriculum S4 and S5).

Spectrum Analytic Inc

Soil Sampling Guide

Maximizing productivity is a fact of life in agriculture. The demand for high yields, top quality and environmental stewardship will always be a driving factor. Unfortunately good yields and top quality don't happen automatically. However, there are tools available to guide you toward these goals in a reliable manner. Soil analysis is the first building block in a sound fertility program. *Soil reports should always be used with other information as a guide in arriving at fertilizer and lime recommendations which will help the grower attain their crop yield and quality goals.*

How to Take Soil Samples

Important: Accurate soil analysis with meaningful interpretation requires properly taken samples. Follow all directions carefully and correctly. Sampling technique presents the greatest chance for errors in results. Laboratory analytic work will not improve the accuracy of a sample that does not represent the area.

1. Select the Proper Equipment

Collect samples using chrome plated or stainless steel sampling tubes or augers. A clean spade or shovel can also be used. Avoid galvanized, bronze or brass tools. Use clean, plastic buckets. Do not use galvanized or rubber buckets, as they will contaminate the samples. (Figure 1)

2. When to Take Samples

Sampling can take place during any period of the year. However, it is best to sample a field at about the same time of year. Wait a minimum of thirty days to sample after applications of fertilizer, lime, or sulfur.

3. Sample Area

Samples must be representative of the area you are treating. Most often, sampling by soil color is an acceptable method for dividing large fields into "like" areas. County ASCS aerial photographs can be used as a guide. Areas that differ in slope, drainage, past treatment, etc. should be sampled separately (fig. 2). Sampling across dissimilar soil types is not recommended. And finally, the sample area should be large enough for special lime or fertilizer treatments.

Always remember to remove any surface debris prior to sampling.

Do Not Sample:

- Dead or back furrows.
- Fence rows, old or new.
- Old roadbeds, or near limestone gravel roads.
- Terrace channels.
- Wind breaks or snow fence lines.
- Turn-rows.
- Spill areas.
- Fertilizer bands including Anhydrous N.
- Unusual or abnormal spots.

4. Sample Depth

Refer to Table 1 on page 2 for the correct sampling depth. Sampling depth must remain consistent because many soils are stratified and variation in depth will introduce errors into the analytic results.

To test for soil stratification, sample through the soil profile, separately, 0" to 2", 2" to 4", 4" to 6", and 6" to 8". Remember to take the recommended number of cores per sample. The greater the difference in the analytic data between samples, the greater the degree of stratification.

5. Number of Cores and Acres per Sample

Various studies have shown that proper sampling requires at least 10 core per sample, and sometimes 15 or more cores, depending on the nature of the soil and the size of the area being sampled. A smaller number can introduce variability into the results from different sampling years. There is no rule for the number of acres to include in a single sample. This must depend on the local situation. However, the University of Illinois has long recommended that a single sample should represent no more than 5 acres. Very small sampling areas, such as residential landscape plants and some small gardens may use fewer cores per sample.

6. Preparing Samples for Shipment

Thoroughly mix the randomly taken core samples in a plastic bucket and remove a separate, well-mixed composite sample (½ to 1 pint) from the mixture. Place it into the lab's sample bag, filling it to the "line." New plastic sandwich bags can be substituted. Make sure to double bag these types of bags. All samples taken for Nitrogen analyses should be immediately air-dried, shipped early in the week, or shipped frozen.

Once the sample is in the bag, fold the top down to exclude air and roll it down to close and fold the tabs.

Write your sample ID designation (include grid sub sample identification where applicable) and your customer's name on the bag where requested.

7. Completing the Information Form

On the Information Form record the same sample, and sub-sample IDs, and the customer name with the address. In the indicated area include your business name and address. Complete all the remaining information as required.

8. Mailing the Sample

Spectrum provides the shipping containers (at a nominal fee) but other boxes may be used. A strong envelope may be used when shipping only a few samples.

Figure 1

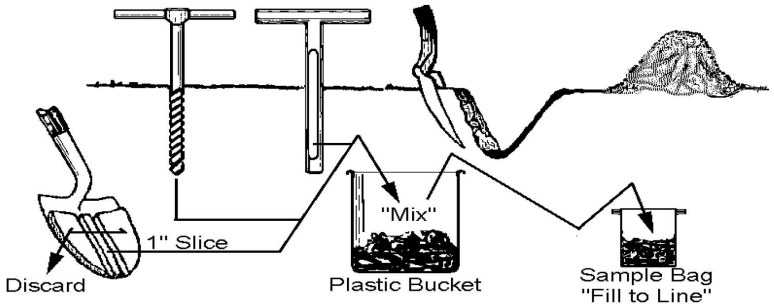


Figure 2

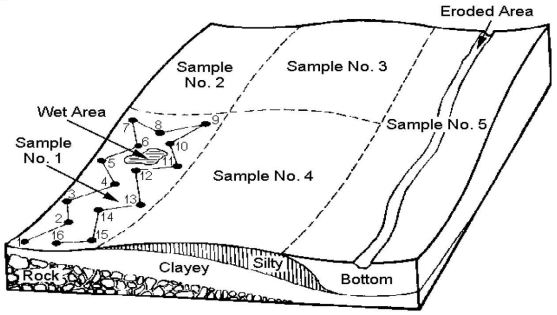


Figure 3: Trees

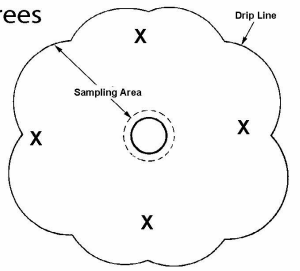


Figure 4: Sampling Fields with Banded Fertilizer

$$S = 8 \times \frac{\text{band spacing (inches)}}{12}$$

Where **S** = number of cores to take outside the band for each core taken in the band.

Table 1: Depth to Sample

Type of Sample	Sample Depth	Misc. Notes
Conventional Tillage	7″	Sampling depth must remain constant.
Strip/Band Fertilization (known)	7″	See Figure 4 for instructions.
Strip/Band Fertilization (unknown)	7″	Take 20+ random samples 90° to band rows.
Reduced Tillage or No-Till	2″ and 7″	2″ sample is for surface pH determinations.
Orchards and other trees	7″	Take samples inside the "drip line" (Figure 3)
Lawn/Turf	4″	Remove the sod piece from each core sample.
Pasture	4″	Remove the sod piece from each core sample.
Special Problem Solving	7″ and 36″	Take 7″ sample and 36″ sample from the "same hole"
Pre Sidedress Nitrogen Test	12″	Take samples when corn is 10″ to 12 ″ tall.
Soil Nitrogen Tests	12″ to 36″	Drier climate soils require the taking of deeper samples.
Soybean Cyst Nematode Samples	7″	Sample near planted row, in fringe of damaged areas.