

Getting to know your soil

TEACHING OBJECTIVES: WHY DO THIS?

- Show learners how their senses can help them understand their soil.
- Explain and demonstrate steps to improve the soil for crop production.
- Guide learners to observe the soil to help identify soil problems and values.
- Visit fields and discuss to help learners understand a field can vary and affect crop growth.

BEST LOCATION

 Best if you can go to a garden or crop field where you can dig a pit to look at soil layers.

BEST TIME OF YEAR

- These activities can be done anytime or a few days after a rain when there are puddles in the spring or summer.
- Each time soil evaluation is done it is best to do it the same time of year.

LEARNING OBJECTIVES: WHAT CAN PARTICIPANTS LEARN?

- Identify soil layers and texture.
- Assess a field for values and challenges to grow vegetables.
- Consider how the soil can affect plant growth (negative and positive).
- Consider how the weather can impact the soil.
- Evaluate soil texture (sand, silt, clay) and discuss how it affects plant growth, due to water drainage. and loss of nutrients from erosion.







Getting to know your soil

IMPORTANCE FOR BEGINNING FARMERS

You may be familiar with a soil test. Besides testing the soil, this step described here can be done before taking a soil test. It is about getting to know the soil using observations and all of your senses. The goal is to gain an understanding of how the soil can vary across the field and impact plant growth. This can be done by looking at differences and similarities above and below ground.

All of the activities included will encourage the learners to look at the soil, and see how it varies across the field, especially after a heavy rain or as the snow melts. Soil color, drainage, weeds, soil texture, and crop growth all can vary in a single field due to the soil texture which is made of a mixture of clay, loam, and sand. Soil texture cannot be changed but there are ways to manage it to maximize the soil's ability to grow crops. This module offers activities to enhance the learners' awareness and skills to understand their soils, below ground seeing soil aggregates to above ground as cover crops are grown. Observation skills will be useful to understand why crops grow unevenly or why some soils are more difficult to till.

UNIQUE ASPECTS OF THE CURRICULUM

This module will guide you through activities that demonstrate various aspects the add to soil health. Learners will be encouraged to explore differences in a field soil colors, water drainage after rains, and possible hard-pans. Digging a pit is a good way to see what is IN the soil such as worms, insects, spiders, and different soil colors (soil textures). The activities will help beginning farmers to use their senses seeing, and discuss in groups to understand how to improve the soil conditions and improve crop health.





Facilitator Planning & Preparation

Activity Name	Est. Instructional Time
Primary Activity 1 : Digging a Soil Pit	1-2 hours
Primary Activity 2: Detecting Hard Pans In the Field	30 minutes
Primary Activity 3: What Is the Soil's Texture?	Overnight or min of 3 hours to allow soil to settle so you can identify distinct layers
Primary Activity 4: Identifying Type Using a Soil Triangle	30 minutes
Primary Activity 5: Where is the organic matter? Looking at soil aggregates	1.5 hours including collecting soil.



Technical Content

KEY WORDS:

Soil texture	Texture is how the soil feels. There are three soils that make up the texture: sand, silt and clay. Soil texture cannot be changed but is important to know so you can better manage drainage and the water in the soil.
Soil drainage	How quickly water drains from the soil surface depends on the soil texture (sand, silt and clay). Texture can be improved by adding compost and growing cover crops with deep roots. Also important, is not to till the soil right after a heavy rain or early spring after snow melts.
Soil hard-pan	If soil is tilled or plowed at the same depth repeatedly then a hardened surface can form, keeping water from draining well and making it difficult for roots to go beyond that depth.
Soil erosion	Soil can be moved by wind and water, known as erosion. Nutrients are lost in soil that is easily eroded. Improving organic matter and keeping the soil covered with cover crops will reduce erosion. Losing top soil reduces crop health. Note that it takes 1000s of years to replace eroded soil.
Cover crops	Cover crops are plants grown specifically to improve the soil . Their roots and above ground are good for the soil to break it up when there is clay and to hold it when it is sandy. There are many types of cover crops and each type can contribute to different soil goals.



Technical Content

KEY WORDS (cont.):

Organic matter	This is from something that was once living, biological matter like manure, compost, or fish leftovers. It adds nutrients like nitrogen and improves the soil health. It feeds soil organisms that release nutrients for the crops as they digest this food.
Soil Aggregates	Soil Aggregates are clumps of soil that protect organic matter. Soil microbes feed on compost etc, make a sticky substance while feeding and this helps soil stick to the organic matter. Careful tillage and feeding microbes help increase soil aggregates.
Soil health	Soil health refers to how much organic matter is in the soil and how well is supports plants to grow. It is dependent on soil chemistry, physical properties and soil biology.



FACILITATOR BACKGROUND INFORMATION:

How observations can be used to improve the crops:

- All soils have their + and -. Making observations in each field will guide the farmer to selecting the best land or part of the field for more productive farming.
- Improvement of soil can be measured by organic matter % (OM). It takes several years to raise it even 1%. So it is important to continuously work to improve the soil soil by adding organic matter with compost, manure, cover crops and keeping the soil covered with plant material.
- Since every soil is different, it is up to the farmer to decide the best action plan to improve the soil. It depends on soil texture, what to add, when to till and best crops and cover crops to grow. Getting advice along with a soil test will help too.
- Compost, manure and fertilizers are needed for crop growth but how much and when depends on the soil's needs and the farm goals. Making good observations using teach of these activities will help identify the key challenges of the soil and guide the selection and use of inputs.
- Tillage is an important tool to manage weeds and turn in compost and crop residue but needs to be done only when needed. Tillage too often, or tillage when the soil is wet can form a hard pan and leave large soil clods. and destroy soil aggregates. In poor soil management, organic matter is lost, thus reducing soil quality or soil health. Both practices will reduce the plant's ability to sprout, grow roots deep in the soil and get the needed to get water and nutrients to grow well.



How organic matter is made



This diagram shows the decomposition (organic matter breakdown that feeds soil microbes) process to make of organic matter, starting with a plant or leaves. You can see that there are many players that help break down organic matter (once living stuff) to improve the soil. This can happen naturally such in the fall when leaves drop from the trees or by making compost. Natural helpers include animals rabbits, worms, insects, and fungi (mushrooms). They eat the leaves and other types of organic matter and start the break down process that eventually (~6 months) releases nutrients for plants to use.

Can use as a slide or handout. this is the above diagram https://www.biopassionate.net/biologyimportanttopicsclass12/decomposition-process



KWL Process

Know, Want to Know, Learn



- Ask each learner to identify any key soil challenges they have experienced while farming (drains too quickly, soil crusting, standing water, erosion, steep slope, soil texture, excess weeds).
 Which aspect(s) would each learner like to learn more about?
- How do you (or want to) prepare the soil for growing crops?
- What do your crops need so they grow well, based on your experiences?
- How can the soil be improved for drainage, for nutrients, for weed management?
- Which resources do you find useful that you can share with your colleagues?

Suggested prompting questions to find out what participants want to learn:

- How would you describe an ideal soil for a farm?
- Given you have limited time in the season when farming, how would you determine which improvements are most important or useful?
- What are issues with your soil you would like to address this year and several year to come. Share some examples of what you can do to address the issues.



Primary Activities

Overview of the main activities in this module

Activity 1

Digging a Soil Pit

A soil pit allows a view from where the roots live. Dig a pit about 18 inches deep and wide enough to drop in there to see the sides. Here learners can look at soil colors (horizons), insects and holes from them, worms and roots. A hand magnifying lens will let you see smaller things with more details. One pit can be shared with a few learners and then they discuss what they see.

Activity 2

Detecting Hard Pans in the Field

If you have a lot of clay in the soil or the field has been plowed for many years this is a good and easy way to check if there is a hard pan using just a metal stake like a marker flag. Insert the stake into the ground and note how deep it goes in each spot. When the stake will not go into the ground as deep, then you have found a hard pan (or rock so double check by moinvg flag to left a bit from st place.

Activity 3

What is the Soil's Texture? (Mason Jar Activity)

This is a fun way to identify the soil texture; how much sand, silt and clay you have in the soil. It is a great tool to compare two different fields too. Compare the soil textures and discussing how each will be different to grow crops. With this you just need jar with a good lid, a soil sample from the crop field or garden, water and a little dish soap. Then shake jar with soil and let it settle to measure the layers of sand, silt and clay.



Primary Activities (cont.)

Overview of the main activities in this module

Activity 4

Identifying Soil Type (texture)

If you have done the Mason jar activity then you may like this activity to identify the name of your soil based on the percentages of sand, silt, and clay. The soil triangle can be printed out to see all the types of soil which is based on the % [percent of sand, silt and clay that are in the soil sample. If you want the name of soil then you can use this triangle: <u>https://www.pinterest.fr/pin/soil-texture-chart--723812971400712236/</u>

Activity 5

Where is the organic matter? Let's look at soil aggregates

After hearing all about organic matter and how it is so important you can now take a look. Compare different soils for aggreages and you have an a soil health evaluation. The process just needs a solid clump of soil from the field, a screen mesh and a jar of water.



1. Digging a Soil Pit

OVERVIEW

Digging a soil pit may sound like a lot of work but the information is offers outweighs the shovel. do this as a team and it will go fast. Discuss each of your experiences with digging holes to plant trees, double dig a garden or even digging holes for fence posts. Try to dig a hole when soil is moist or moisten it before.

Once the hole is dug use flashlights and magnifying glasses to get a closer look and see if you see:

- worms
- worm holes
- beetles
- centipedes
- roots
- different color soil layers
- rocks
- heavy clay

MATERIALS NEEDED

- Shovel
- Digging bar
- Bucket to remove soil
- Hand lens
- Screwdriver
- Trowel for looking at area within pit
- Camera to take interesting photos

FACILITATOR BACKGROUND INFORMATION

Digging this hole will show where the hidden parts of the plants go, into the soil. Help the learners look at the soil texture as detected by different soil colors. Allow them to dig a little in the sides to follow a hole to see if they see any of the items listed on left.

This hole may not represent the whole field but it gives a good overview of the role the soil plays for plant growth:

- · Roots to get nutrients and water
- Roots to hold plant up as it fruits or as there are winds and rain
- Soil organisms live there where they break down organic matter to feed plant and themselves
- Water travels through the soil to provide roots water but it also drains to plants do not sit in water.

Note the different colors of soil indicating different textures. Gray areas are often layers of clay creating a hardpan naturally.





1. Digging a Soil Pit

PROCEDURE

- 1. Dig a pit about 3 feet deep by 18 inches widewide. It does not have to be even all the way around but large enough to get in and see the sides of the pit.
- 2. Use a flashlight to look for signs of life; roots, worms, insects.
- 3. Notice color changes in layers of the pit, these indicate different soil textures or soil types (see diagram)
- 4. Use a magnifying glass to attempt to describe what you see. Draw what you see on your notepad to discuss and perhaps ID back in the class.
- 5. Discuss with class mates of how different textures affect root growth.

Now the fun part:

- Look all over in the pit at each side, at bottom and top.
- Touch the soil and rocks.
- See everything possible, perhaps with a flashlight and hand lens
- Watch living creatures
- Probe with shovel or screwdriver to get a clearer view of roots
- Record (write, draw, record on phone) what you see
- Discuss with your co-learners. Try to identify what you are seeking. It is ok to guess, explore and later look up.



This is a soil pit. Notice the soil layers are different colors. This typically means they are each different textures, combinations of sand, silt and clay.



1. Digging a Soil Pit

Digging a soil pit can help explain a lot about the soil. You can do this as a group or individually.

KEY TERMS

Soil Horizons

Soil is formed over millions of years by different events; wind, heat, floods, rains, glacial movement. Each action impacts soil movement and how it is arranged in layers. These form the soil horizons typically of different soil textures (% clay, sand, silt)

Soil Texture

Each layer is of a different color and made up of different sized particles. from different textures. Note that you cannot change the soil texture but you can improve it by adding inputs that have organic material like compost, manure and grow cover crops.

Soil Pit

Once the pit is dug into a field then you and maybe one other can climb in and observe what is on the sides of the pit; such as roots, worms, insects, rocks, lines of sand, and clumps of clay. All living creatures give you a clue how well the soil can support plant growth and water movement.





1. Digging a Soil Pit

DIVE DEEPER

This activity can be used before buying land to give you an overall idea of what the soil's texture (how it feels), the horizons (layers) and if there is a hardpan as descried in this key words. This information will help you understand the soil's ability to drain and support plant growth (root development.) If the soil is all clay or has many hard pans (gray, sticky layers) you may not be able to grow crops on it.



If soil is healthy and there are no hardpans you should see roots growing deep and wide as in the photo

VARIATIONS

Watch this very nice YouTube of life in the soil to see what could be seen in a pit or your compost

 <u>https://youtu.be/q8p-lqOjlaw?</u> <u>si=N5V73zDvEsykAgWi</u>

CONNECTIONS

Understanding the soil is a very important part of land access when planning if land is suitable to farm.

This information is relevant to the Land Access Module.





2. Detecting hard-pans in a field

With a metal marker flag or thin stake you can identify location(s) of hardpans

OVERVIEW

If a farmer knows where the hard pans are in the soil then action can take place to try to break them up. This can be done by:

- Growing a cover crop with a large tap root (daikon radish)
- Tilling at different depths each year
- Not tilling too often
- Not tilling when soil is wet
- Keep the soil covered by growing cover crops
 - In the winter-rye can be grown
 - In the summer-buckwheat can be grown

MATERIALS NEEDED

- Metal staked flag
- A crop field where you can walk through or between rows
- Good sense of resistance, when the flag stake will not enter the soil anymore

Alternate Supplies (instead of falag)

- Soil penetrometer (probe to measure soil surface pressure).
- Long nail (12 inches or more)

FACILITATOR BACKGROUND INFORMATION

A hard pan can be caused by plowing or tillage at the same depth repeatedly OR it can be a natural part of the soil. A hard pan is when there is a hardened layer of the soil at a depth where roots want to grow. It typically does not allow roots or water to easily pass through.

A hard pan makes it difficult for plants to get enough nutrients as their roots cannot go deep enough. Also if there is a heavy rain or fast melting snow the water is very slow to drain which may cause flooding. Areas with hardpans will take the soil longer to dry out in the spring, delaying soil preparation.

Note you never want to till, plow or turnover the soil when it is wet. This action will cause large clods of soil to form and make a poor surface for seeds to sprout and for plants to grow.





2. Detecting hard-pans in a field

FACILITATOR BACKGROUND INFORMATION (cont.)

How does a hard pan look and what does it to to crops?

Compare the two blocks of soil. Note how the roots are growing.

On the right is the soil with a hard-pan. It may be hardened soil from repeated tillage at the same depth, a rock layer or hard clay layer. Note the difference in how the roots are growing in each diagram.



www.https:locallygerminated.wordpress/tag/sheet-mulching/



2. Detecting hard-pans in a field

FACILITATOR BACKGROUND INFORMATION (cont.)

Key terms to know:

Hard pan : This is a hardened surface below the top of the soil often at the depth of tillage. A hard pan may also be natural due to bedrock or hard clay layer in the soil. This hardened layer reduces the ability for plant roots to grow beyond this layer It also reduces the plant's roots to take up water and nutrients beyond this point in the soil.

Soil crusting: This is a hardened layer on the surface of the soil that can prevent seeds from germinating, or pushing through the top of the soil to start growing.

Cover crops: Plants that are grown to improve the soil. They add organic matter. The roots feed soil microbes and they hold the soil which helps to reduce erosion. All plants have roots that help the soil. Different plants have different types of roots so each contribute to the soil in a different way, helping to break up hard pans, loosen soil throughout, and add to organic matter, which holds nutrients for plants.

Soil aggregates: These are tiny clumps of soil that have organic matter protected between layers of soil. These are the clumps we are trying to protect by NOT tilling too often or when the soil is wet.





Soil Crusting



2. Detecting hard-pans in a field

PROCEDURE

- 1. Insert stake into ground at random areas across the field. Notice when it becomes too difficult to insert the stake further into the soil than at other locations.
- 2. Do this at several locations in rows and in furrows and headlands (where the tractor turns around).
- 3. Compare the different sites, noting which sites are very difficult to push the stake vs those places that it is easier.
- 4. If it is often difficult to insert the stake more than an inch in the field then there may be a hard pan (hardened soil) or a bed of rocks or hardened clay. This is an important area to grow cover crops and add organic matter like compost. Over time the worms and smart tilling will reduce the hard pan so roots can grow deeper.

Managing soil with a hard-pan:

To reduce or break up hard pans there are several approaches, but it takes time (perhaps several seasons).

- 1. Grow a tap root cover crop like daikon radish in the early fall to help break up the hard pan.
- 2. Till the soil at a deeper depth than the hard pan. This is often why farmers occasionally use a moldboard plow for tillage in a single year. Note this is not a tool to use always, just when absolutely necessary.
- 3. Help to prevent a hard pan by growing different types of cover crops each year, as all plants have different root structures and grow to different depths.

4. Do not till the soil when it is very wet. This can destroy soil aggregates and form giant clods of soil, making an uneven and hard soil and contribute to a hard-pan.
5. If the soil is hard a few inches down, in a larger area then it will be difficult to grow plants there as roots need to get to water and nutrients. Perhaps avoid planting crops in this location.





2. Detecting hard-pans in a field

DIVE DEEPER

The activities in this Soil Health-Module 1 can be complemented by Module 4-Building Healthy Soil-this curriculum is appropriate for those already familiar with the practices described here.



VARIATIONS

If there is no field to visit to do this exercise here is a YouTube that shows an example of vising a field and looking for hard-pans in the field.

This YouTube offers information on hardpan created in (often) heavy clay soil that is too often walked on and is tilled too often. it offers ways to remedy this: https://youtu.be/0qMxSwtXoks? si=r8PKQCR6BH0q65OA

CONNECTIONS TO OTHER MODULES

Curricula within this site: Urban ag The other 3 modules of Soil Health



3. What is the Soil's Texture

Observing soil separated into layers based on the soil texture

OVERVIEW

This is a simple and fun demonstration to show soil texture based on the 3 main ingredients (sand, silt and clay) found in soil layers. The learners measure each layer and calculate the % of each soil type after shaking a jar of a soil from a soil sample.

MATERIALS

- Large glass jar with good fitting lid for each soil sample
- Water (enough to fill jar)
- Dish washing soap
- Tape measure
- Calculator (optional)
- Paper to write down Percentages of each texture (sand, silt, clay)

FACILITATOR BACKGROUND INFORMATION

Soil texture is how the soil feels. It affects how well the soil drains, how it holds water, say after a heavy rain fall or fast snow melt. It is important to know the soil texture but note that is CANNOT be changed, just managed. Sand is the coarsest of the 3 soil textures. Then silt is the next size down and clay is the finest textured soil. A soil's texture is the combination of the 3 and how much of each is what affects the soil's physical properties: drainage, likeliness to erode, and how it tills or cultivates. Sand is a lighter soil (there is more air between soil particles) so it drains quicker and turns easier during cultivation. Clay holds more water and is heavy so it is more difficult to cultivate or plow. This activity will offer a hands on opportunity to identify the soil texture by seeing the soil layers and measuring them to calculate the % of each texture; sand, silt, and clay.





3. What is the Soil's Texture

FACILITATOR BACKGROUND INFORMATION (cont.)

KEY WORDS

- Sand: this is the largest sized of the soil types. It drains well but also does not hold water and nutrients well
- **Silt**: This texture is in the middle, providing the values of clay and sand, holding water and draining well.
- **Clay**: This is the finest of the soil textures thus holds water very well and sometimes too well taking a long time to drain, thus the soil can be wet for a long time.



3. What is the Soil's Texture

PROCEDURE

- Place ~ 1 cup of soil in each jar that has a good fitting lid for each soil sample
- Fill each jar 3/4 full with water. this is a good activity to compare different soils from different fields.
- Add 2 drops of liquid detergent to each jar. Place lid on jars (tightly) and shake hard to mix the soil for about 5 minutes.
- Allow jars to remain undisturbed for 2-3 hours (start on another topic or have lunch and discussions).
- After soil in jars has settled (2-3 hours) carefully move jars so all can see the layers and talk about the order, sandy is lightest so it is.... on the top layer.
- Silt is the middle weight champion so it is in the middle and clay is the heaviest so it is on the bottom of the jar.
- Take tape measure and measure each layer carefully, Record numbers.

Calculate the % of each texture: Total height of soil = Total height of sand = Total height of clay =

Now: The height of each texture divided by total soil height and x 100 = % Ex: total height = 10 in:. Sand=2, Silt =4 Clay = 4 Math: $2/10=.2 \times 100 = 20\%$, $4/10=.4 \times 100 = 40\%$, $.4/10=.4 \times 100$ SO 20% sand, 40% silt, 40% Clay



3. What is the Soil's Texture

PROCEDURE (cont.)

Step 1: Record heights of each in inches

Total height = Sand = Silt = Clay =

Step 2:

Sand height Divided by Tot X 100% = % of the soil that is Sand.

Silt height Divided by Tot X 100% = % of the soil that is Silt.

Clay height Divided by Tot X 100% = % of the soil that is Clay.

Record each of the % to use when looking up soil type on the soil triangle (next activity)



Jars on left: Each jar has soil from a different field. Compare the differences in textures as detected by height of each layer.





3. What is the Soil's Texture

PROCEDURE (cont.)

What were your observations?

What is the primary texture of your soil? Sand? Silt? or Clay? (which texture takes up the largest space in the jar?)

Each texture is different in size so impacts how the soil holds water and nutrients

A very sandy soil will lose water and nutrients (leeching)

A soil high in clay will hold water and nutrients and prone to flooding or puddling

Soil with no to very little "life" (worms, beetles, rolly-poliles) indicates a lack of organic matter

What are some actions you can take to improve the soil. Note building organic matter takes several years for us to see but you are improving the soil life, little by little.



Sand - the largest of the soil particles



Silt - size of particles are in-between the two other soil textures



Clay - the smallest of them



3. What is the Soil's Texture

DIVE DEEPER

All activities within the Soil Health Curriculum build on knowledge to better understand what is a healthy soil that is essential to grow good crops and ways to improve the soil. Choose activities that the learners are most interested in doing. Also offer to use the Soil Health Score Card to end the soil health chapter to see if there are questions and for learners to share their knowledge from experiences and gained in the program. **The soil health progress report link is included in additional**

<u>resources</u>. https:// www.canr.msu.edu/soil_health/ uploads/ Mich%20SH%20Progress%20Report% 20Card.pdf



VARIATIONS

If there is no field to visit to do this exercise here is a YouTube that shows an example of visiting a field and looking for hard-pans in the field.

This YouTube offers information how hardpans are created in (often) heavy clay soil due to too much traffic or soil that is tilled too often.

it offers ways to remedy this: https://youtu.be/0qMxSwtXoks? si=r8PKQCR6BH0q650A

CONNECTIONS TO OTHER MODULES

Curricula within this site: Urban ag The other 3 modules of Soil Health



4. Identifying Soil Type Using a Soil Triangle

OVERVIEW

The soil triangle is a tool to help you ID the soil type based on soil texture. It is used after you complete a soil texture determination such as the Mason Jar Activity.

MATERIALS NEEDED

Soil texture triangle (link below)

Soil texture % of sand silt and clay.

Calculation of % of Sand, Silt, Clay from soil sample (previous activity)..

Alternate Supplies

Lab Soil analysis can provide the soil texture of sample. (see module 2 to learn how to take a soil sample.)



FACILITATOR BACKGROUND INFORMATION:

KEY WORDS:

- Soil texture: This is the portion of each texture; SAND, SILT and CLAY. Knowing this identification of your soil can help when seeking advice about your farm and soil practices.
- Sand: This is the largest sized of the soil types. It drains well but also does not hold water or nutrients well
- **Silt**: This texture is in the middle, providing the values of clay and sand, holding water and draining well.
- **Clay**: This is the finest of the soil textures thus holds water very well and sometimes too well taking a long time to drain, thus the soil can be wet for a long time when you cannot till or plow.
- Leeching: This is when nutrients and water drain through the soil and are lost, often into the ground water. This is common in sandy soil or when too much fertilizer is used.
- **Compaction:** Often an issue when soil is high in clay. Air spaces between soil particles are pushed out of soil aggregates (particles) and create a hard layer in the soil. Compacted soil is difficult for water, roots and nutrients to pass through.



4. Identifying Soil Type Using a Soil Triangle

PROCEDURE

- You will need the results of the soil texture check (shaking the jar).
- Take your note with the percent numbers form your soil sample and go to the soil triangle and follow it for each texture.
- Note where is says "Percent sand" use that side of the triangle to find the **Percent sand** that is in your sample.
- Then go that to the side of the triangle that says "**Percent silt**" and find the % of silt that is in your sample.
- Now do the same for clay. Go to the side of the triangle that says
 "Percent clay" and find the percent from your soil sample.
- Note where all 3 textures intersect. That is your soil texture type.

Use the soil texture triangle to identify the soil type.

Soil type is based on the proportion (%) of sand, silt and clay in the soil.

Look at the Soil Triangle and refer to the Percent of Sand Silt, and Clay in your soil sample

Follow the lines on the triangle for each texture and note that where the 3 lines intersect. This identifies the soil type of your soil sample.



Watch <u>this video</u> to help you use the soil triangle with your soil sample texture results:





4. Identifying Soil Type Using a Soil Triangle

DIVE DEEPER

You can watch a video that guides you to determine soil texture using the soil triangle. If a lab soil analysis was already completed then the soil texture may be included in the results.But if not, you now can do it yourself, and learn a lot and its free!



VARIATIONS

This can be an inside or outside activity. It is quick and could be done as a wrap up exercise of the soil health curriculum. This would be an easy take-home activity following a day in the classroom looking at the soil in the field then identifying texture by shaking in a jar (Activity 3)

CONNECTIONS

Knowing the soil texture is critical before selecting a field where to grow plants. This approach combined with the soil texture in a jar (previous activity) could be done prior to a farmer selecting (renting, borrowing or buying land. Soil texture cannot be changed and impacts water movement and plant root growth.



4. Identifying Soil Type Using a Soil Triangle

REVIEW QUESTIONS:

Based on your findings of the soil texture what do you think this means about the soil?

- Is the soil texture what you expected? Share why you say this
- How would you describe your soil texture? (consider how it feels and looks)
- How could the soil texture impact crop production? (consider drainage and water holding ability)
- What could you do to improve the soil to help crops overcome the challenges with the soil texture. (Remember you can never change the soil texture but you can improve the soil health)

Discuss your observations and how the soil texture may impact:

- Your farm practices and observations. Tillage, drainage, leaching, erosion?
- What do you choose to grow? Crops that need really good drainage, crops that don't mind more wet conditions (not so susceptible to damping off disease).
- How and when you weed and till? Why does how wet the soil matter?
- If you irrigate: How fast does the water pass through the soil? How well does it hold water?

RESOURCES FOR ADDITIONAL LEARNING

- YouTube on How to do this? Here is a link that demonstrates this activity: <u>https://growitbuildit.com/mason-jar-soil-test-clay-sand-silt/ry</u>
- Soil Health Triangle: Look at this to see name of your soil type based on its texture. <u>https://www.youtube.com/watch?v=SXp8Lg0SFPQ</u>



5. Where is the organic matter? Let's look at soil aggregates

This demonstration can show how different tillage practices from different farms impact soil organic matter. Use soils from different farms and compare

OVERVIEW

Soil aggregates (as mentioned earlier in this module) hold organic matter and this activity is a good way to evaluate a soil. When aggregates are present in the soil, management practices are going well. Organic matter will let plants get nutrients easier. Learning what destroys soil aggregates (organic matter) and how to minimize its loss will benefit the soil and crop production. Here is a great demonstration to compare soils from different fields.

MATERIALS NEEDED

Soil Aggregate test materials

- Mason Jar or other glass jar filled with water for each soil sample
- 1/4 inch mesh bent to hold soil lump and fit into jar
- Soil Samples-a whole soil ump not crumbled

FACILITATOR BACKGROUND INFORMATION

Soil aggregation (the making of soil aggregates is how well soil particles that protect organic matter are held together through sticky substances from soil microbes and soil fungi threads. Aggregate stability is the measured ability of a soil to hold together and keep aggregates whole despite disturbance such as raindrops; wind erosion, shrinking and swelling conditions of soil from water, and of course tillage. For detailed description of soil aggregates and how they impact soil health visit: Soil Health Nexus <u>https://soilhealthnexus.org/</u> <u>resources/soil-properties/soil-physical-properties/</u> <u>aggregate-stability-and-aggregation</u>).

Tillage may be necessary for plant growth depending on your crop, farming practices, or soil conditions. Soil effects from tillage vary depending on the type of tillage used, soil moisture and soil texture. The University of Minnesota has a good website and bulletin that goes through the different tillage methods, <u>https://extension.umn.edu/soil-</u> <u>management-and-health/tillage-implements-</u> <u>purpose-and-ideal-use</u>.

The aggregate demonstration activity can be used to demonstrate differences in soils related to their aggregates from management under different tillage practices.



5. Where is the organic matter? Let's look at soil aggregates

PROCEDURE

Overview:

You can take a clump of soil (about 2 inches) and check for how quickly it "melts" into a jar of water to evaluate the "soil aggregates". If the soil "melts" slowing there are many good soil aggregates. Remember aggregates are important to protect organic matter, the key to soil health.

This is an easy and fun way to assess the soil. This is a great opportunity to compare several soils samples. Following the demonstration consider discussing how the soil is farmed at each location and compare each ways based on the soil aggregate results. Decide which practices are best to protect soil aggregates.

Collecting the soil:

Go to the field and collect a "lump" of soil. If there is not one on the top of the soil, take a shovel, dig for a shovel of soil then turn it over on the ground. Carefully look through this soil for a "soil lump". Be careful not to break up the soil lump as that is what will be used in this demonstration. Here is a link to an excellent You Tube that demonstrates the process: https://youtu.be/KdVA9FKH-FE?si=5BNpq18aS7FKybZ4. There is also a description on the activity sheet if internet is not available.

(To learn more about soil texture go to Soil Health – Determining the Soil Texture (mason jars) activity.

You will need

- a large glass jar
- water
- · a screen that fits just into the top of the water
- clump of soil
- timer if you are comparing more than 1 soil



5. Where is the organic matter? Let's look at soil aggregates

PROCEDURE (cont.)

Note how the screen mesh fits just into top of jar, into the water. Soil clump should be immersed into water when gently placing it into the jar. Then start the timer till it is all dissolved (goes to bottom in tiny pieces)

ACTIVITY 5



Soil aggregate comparison



Comparison of 2 soil samples from different fields. The sample with the least cloudiness shows better soil structure.

Soil aggregates are affected by soil texture AND how the soil is managed. If it is tilled too often it will have poor soil aggregates. If the soil is very sandy it will be difficult to have soil aggregates, but can be done over time. Of course, never till the soil when it is wet. All of your hard work to build soil aggregates will be lost! to build soil aggregates you want to add organic matter and plant cover crops as often as possible.



5. Where is the organic matter? Let's look at soil aggregates

PROCEDURE (cont.)

Soil Aggregation Demonstration offers a way to compare soil aggregation



1. Fill 2 tall jars with water.

2. Collect soil from 2 fields with 2 different tillage types. With a trowel dig straight into soil and with soil collected carefully break off a piece (about 2 inches). Try to keep it as one clump.

3. Place soil clumps on paper towels until soil is dry.

4. Using 2 small holed pieces of fence (hardware screen with 1/2 inch square holes) mold them so they fits into the jar but not drop to the bottom. Fold the wire edges over the jar edges.so they are held and do not sink to the bottom of the jar. Place the wire "box" over the top of the jar and let it reach into the jar just enough so its covered with the water.

5. Now carefully drop the soil samples in the hardware wire, trying not to break them apart. Each sample should be placed in a jar at the same time.

6. Observe the 2 soil clumps over time (5 minutes max). The soils that have low (poor) aggregation will break apart quickly. Visit, https://youtu.be/BJ-zJRkeScA, for an explanation on how to conduct soil aggregate demo. Watch the video for easy to follow instructions and explanations: https://youtu.be/KdVA9FKH-FE?si=5BNpq18aS7FKybZ4 test.

Questions to ponder: Discuss how each tillage system differ from the farms where you collected the soil samples.

Why do you think one soil broke apart faster than the other?

What does that tell you about approaches to tilling the soil?



5. Where is the organic matter? Let's look at soil aggregates

DIVE DEEPER

This demonstration is a good visual representation on how tillage impacts soil health especially during a major rain event. These demonstrations can also be a good entry point for discussions about soil 's ability to withstand weather such as heavy rains, winds and freezing/thawing.



soilhealth.osu.edu

VARIATIONS

If several students have gardens or fields ask each learner to collect a soil ump from their field and allow it to dry.then bring them to class. run the demonstration of each :"lump' side by side and ask each student to share how they till or prepare the soil for planting. Discuss how different tillages and soil textures affect the soil. If there are several jars from different fields use a rating system of 1-5 regarding amount of soil disturbance based on their soil preparation approach.

CONNECTIONS

These demonstrations are a great visual tool that growers can replicate on their own farm then discuss with one another their results they observe.



Additional Resources/Activities

Resource 1

Take a look at this short video if you would like to see an approach to garden when you have a hardpan in the soil. Using a raised bed method is demonstrated to build the soil and garden even when you have a hardpan. "Beginning Gardener? Learn About Hard Pan and How to Get Rid of It". <u>https://youtu.be/0qMxSwtXoks?</u> <u>si=0gKRDJfxqPQSMwYU</u>

Resource 2

This fact sheet offers ways to garden even when there is a hardpan in the soil. "GARDEN AND LANDSCAPE PLANTINGS ON HARDPAN SOILS" <u>https://sacmg.ucanr.edu/files/163</u> <u>130.pdf</u>



Notice how the roots stop growing at the hardpan layer.



Additional Resources/Activities (cont.)

Resource 3

The value of knowing the soil texture

For details of the value and why bother with a soil test this extension bulletin provides relevant information for gardeners and beginning farmers.

https://extension.oregonstate.edu/catalo g/pub/ec-628-guide-collecting-soilsamples-farms-gardens.

Resource 4

Example of a soil test results

This is a link to a soil test sheet with results that can be used as a practice sheet if the learners do not have test results to use.

What is my soil test results telling:

https://www.notillfarmer.com/articles/8691-what-is-my-soiltest-report-telling-me.

Resource 5

A visual guide to taking-sending and understanding the soil test results

This video starts with sampling and ends with understanding the results. You can advance the video to the location you want if you do not want to watch the entire process. It is a good video for a beginning farmer that explains terms and shows you how to do it called: Soil Testing Made Easy: Report Explained

https://www.youtube.com/watch?v=np9RbtHX6mA



Additional Resources/Activities (cont.)

Resource 6

Farm production note-taking

Keeping notes of practices and which crops did and did not succeed will pay off for your markets, income, and soil health.

Taking Note! Keep a journal of your garden/farm:

https://www.burpeehomegardens.com/bl og/2016/07/14/take-note-keeping-agarden-journal.html?printerfriendly=true

Resource 7

Crop rotation map for your farm

When making a farm plan you will want to rotate the crops each year, by rotating vegetable families from one row to the next. Use this guide to help you select different families as you build your crop rotation plan.

https://twitter.com/raiseyourgarden/st atus/728392882072129536.



Review and Encouraging Further Learning

Visit a field after a heavy rain and observe:

What do you see? Standing water Plants sitting in water for an extending time Plants not doing well even though the soil is wet

If you can dig up a plant that is sitting in water and not looking healthy, <u>look at the roots:</u>

What color are they? Are there many long and hairy roots or shot and stubby? Is the plant as tall as those in the area of field ot standing in water?

Now let us discuss:

What could be causing this? How do plants get nutrients? How are they able to grow larger/taller?

Keep in mind that it could be more than a hardpan reducing the plant's health. A hardpan prevents roots from getting to water and nutrients deep into the soil but it is also about water being able to drain when there is too much, such as after a heavy rain. Here is is likely there is a hardpan in this area of the field that is flooded. Notice that only a part of the field is flooded (after several days of slow drainage)





Review and Encouraging Further Learning

Module Review Questions:

- How can field observations help you with improve your farming practices?
- What does soil texture have to do with how plants grow? (consider percent of sand, silt and clay and water and plant nutrients)
- What does improving the soil's health mean to <u>you</u>? What do you plan to do?

Activities for Review:

- When looking at 2 different crop fields, describe differences you see and how they can impact crop growth.
- Describe some approaches you can do to improve the soil if the soil is very sandy?
- If the soil has a large amount of clay how would your plans differ?
- How can you increase organic matter? Why is organic matter important?

Next steps?: Choose ones that best fits your needs

- What will you look for when seeking land to farm or garden?
- Given the current conditions of your farm, what are the primary actions you want to take to improve the soil? What is the challenge you are dealing with?
- What practices have you done in the past to improve the soil and what impacts do you see?



Review and Encouraging Further Learning (cont.)

Taking Your Knowledge Back to the Farm:

- Make observations in each field each year (notebook, computer folder, using photos or notes). Compare how the fields have changed and note what management changes you have made. Connect practices to results and determine best approaches. Discuss with other farmers and educators to gain understanding. If you do a soil test compare that to your crop production results.
- Take a soil sample every 3 years and attach the list of practices you did to address the issues identified in the soil test. Keep this in your records. (see "Taking a soil sample and Sending soil to a lab modules)
- Compare your soil tests over the years to see if the nutrients are adequate and not in excess, pH is near neutral (6.5-7) and the organic matter is going up, even a little. Adjust your farm plan according



https://images.app.goo.gl/k7zriquMR3Apw8Vz9







Examples of Challenges & Possible Solutions



If field floods easier than other fields



Grow perennial crops, overwintering cover crops, or even trees to have year around water absorption



Erosion happens from heavy rain, and winds, cutting gullies in the field and washing away topsoil.



Heavy clay soils crust as they dry, making it difficult for seeds to push through the soil



To manage erosion keep soil covered either with a mulch or a cover crop



Grow cover crops yearly to add organic matter from roots and leaves, especially oats