

# Understanding and Identifying Healthy Soils



# OVERVIEW

## LEARNING OBJECTIVE

Gardeners will understand the importance of healthy, living soils and learn a series of simple steps to test a soil's health.

## MATERIALS NEEDED

- Flipcharts and markers
- Spades and hoes
- String or tape measure
- Notebooks and pens for gardeners





## DURATION



## KEY CONCEPTS

- A healthy, living soil is key to growing healthy plants. If our soil is not healthy, our plants will be stunted and will not yield well.
- We can easily test our soils to see if they are healthy or not.

## TRAINING AGENDA

1	Introduction and warm-up	 DISCUSSION	10 mins
2	Why is a healthy soil so important?	 DISCUSSION	1 hour
3	How can you tell if a soil is healthy? Simple soil testing techniques	 PRACTICAL ACTIVITY	1.5 hour
4	Closing discussion	 DISCUSSION	10 mins

# 1. Introduction and warm-up

Welcome gardeners to the training. Do a brief introduction to today’s topic and review the training agenda. You may want to outline the training agenda on your flipchart or board so gardeners can see it when they arrive.

Conduct a warm-up exercise or ice-breaker to make sure all gardeners feel welcome and are ready to fully participate. Suggested warm-up and ice-breaker activities can be found in the Facilitator’s Guide: Encouraging Learning through Participant Engagement.

# 2. Why is a healthy soil so important?

## INTERACTIVE DISCUSSION

**GOAL OF DISCUSSION:** Participants will reflect on the importance of healthy soil and relate it to their own experiences with staying healthy.

**MATERIALS NEEDED:** Flipchart and markers

1. Ask participants to silently reflect on what the words ‘soil health’ mean to them—abundant crops or lots of earthworms for example.
2. Have participants discuss in pairs why a healthy soil is so important. Ask participants to share their reflections with the larger group and note the answers on a flipchart.
3. Using the pairs that worked together on the last question, put two pairs together so that they are now small groups of four. Ask the group to think about:
  - How healthy people can become sick but can also get better by eating nutritious food. Does the same apply to our soils?
  - If so, what can we give soils that are ‘sick’ so that they can get better?
  - How can we maintain our soils’ health by feeding it nutritious food?
4. Ask participants to share their reflections. Note them on a flipchart.

## KEY MESSAGES

- A healthy soil is a living soil. Healthy soil is crawling with earthworms, beetles, ants, and many other organisms. Some organisms, called microbes or microorganisms, are too small for humans to see, but you know they are there if you see decomposing leaves or roots. Many microbes and other forms of soil life live in dark, loamy soils.
- A healthy soil is key to growing healthy plants with lots of nutrients. If our soil lacks nutrients, then our crops will be stunted and will not yield well.
- We can improve degraded soils by ensuring they are always covered by either dead or living mulch and continuously feeding our soil with lots of organic matter, such as well-rotted manure. It takes many seasons of work to improve the health of a degraded soil, but improvements in yield can be seen right away.



# 3. How can you tell if a soil is healthy? Simple soil testing techniques\*

## PRACTICAL ACTIVITY

**GOAL OF ACTIVITY:** Gardeners will learn simple, no-cost soil testing techniques to help them distinguish healthy and non-healthy soils. They will be able to apply these techniques easily in their home gardens and fields. Through the testing process they will understand the components of a healthy soil and start to understand how to build and maintain healthy soils.

**FACILITATOR PREPARATION:** Identify a suitable garden site where gardeners can gather. Before the training, identify a site where gardeners can test two patches of soil: one that is covered in organic matter and relatively healthy and one that is exposed to the sun and is degraded. This activity can be done any time of the day, however the soil temperature test is most effective once the sun is up and has warmed the soil.

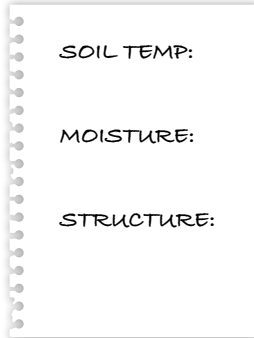
**MATERIALS NEEDED:**

- Spades and hoes
- String or tape measure
- Notebooks and pens for gardeners

Exposed Soil



Covered Soil



**STEP 1.** Gather participants at the designated area. Explain to participants that they are going to go through some simple soil testing steps they can use at home to help them evaluate if a soil is healthy or not.

**STEP 2.** Mark out two equally sized squares on the ground, one on the exposed soil and one on the covered soil. The squares should be around 50 cm on all sides. Explain to gardeners that you are going to compare the characteristics of the exposed soil to the characteristics of the covered soil.

**STEP 3.** Before digging, take the soil’s temperature in each square. Ask participants first to put their hand or wrist on the exposed soil – what is the temperature? Then ask them to feel the temperature of the covered soil and compare.

**STEP 4.** Split participants up into two groups and assign them to a square. Have the groups carefully remove the soil from the square until there is a 30 cm deep hole. This is the upper part of the root zone. Try as much as possible to carefully lift the soil out of the hole to preserve its structure. Keep the soil off to one side.

*\*Adapted from the Permaculture Association UK Soil Test Handbook*

**STEP 5.** Have the participants gather information about the soil's smell, structure, texture, moisture content, the presence of soil organisms such as earthworms and other animals and depth of topsoil in their square. Each group should assign a notetaker to record the information found by the group.

### **Soil temperature**

Record if the soil surface was cool, warm, or hot.

### **Smell test**

Ask participants to grab a handful of soil and smell it. Record if the soil has no smell, an earthy or sweet smell, or a bad smell.

### **Structure test**

Remove a large clump of soil and examine it to see if it has any air pockets or pores running through it. Break large clumps apart to observe the structure of the soil inside. Note how common it is to find large clumps with lots of easy-to-see pores running through them. Pull out a few examples to compare to the other soil from the other square later.

### **Texture test**

Ask participants to examine the texture of the soil by taking a handful of soil and squeezing it in their hand. Does it fall apart as soon as you open your hand or does it hold its shape? Does it crumble if you poke it lightly or does it still stick together?

### **Moisture test**

Ask participants to take another handful of soil and squeeze it. Does the soil have little moisture, no moisture or a lot of moisture?

### **Soil life test**

Ask participants to sift through the soil they excavated from the hole and record any signs of soil life. It would be best if they count and record the number of different soil organisms, such as earthworms or other animals, they find to compare to the other group.

### **Depth of topsoil**

After participants have sifted through the first 30 cm of soil in their square, ask them to measure the depth of the topsoil using a string or tape measure and record it. The topsoil depth could be very shallow (<1 cm) or very deep (>30 cm). A gardener will recognize when the soil starts to look and feel different. The subsoil will be more compact and probably a different color than the topsoil.

**STEP 6.** Gather participants together at one square and have that group report their findings. Switch groups so that both groups can see the soil excavated from each square.

**STEP 7.** Move away from the squares to a place where participants can sit. Discuss each concept with participants:

### **Soil temperature**

- What happens when the soil is too hot? Compare with a child with fever.
- What can we do to ensure the soil does not get too hot?

### **Soil smell**

- What is the smell of a healthy soil?
- What does it mean if there is no smell?
- What can you do if there is no smell?
- What does it mean if the soil smells bad?
- What can we do about it if the soil smells bad?

### **Soil structure**

- What is the structure of a healthy soil?
- How does stepping on wet soil affect a soil's structure?
- What soil structure is best for growing plants? Why?

### **Soil texture**

- What is the texture of a healthy soil?
- What soil texture is best for growing plants? Why?

### **Soil moisture**

- Why is soil moisture important?
- How would soil moisture differ if soil is covered or exposed?

### **Soil life**

- Why is soil life important?
- Why do some soils have a lot of soil life and others have very little?
- What can we do to encourage more soil life?

### **Depth of topsoil**

- Why is the depth of topsoil important?
- Is there anything we can do to build more topsoil?

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## KEY MESSAGES

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### Soil temperature

The surface of the soil should not feel too hot or too cold. Below the surface, the soil should feel slightly cool to the touch. Soil that exposed to the hot sun often gets too hot, just like someone with a fever. If the soil gets too hot, it is difficult for young plants to grow. Soil organisms, such as earthworms, leave in search of cooler soil. Covering soil with mulch or keeping living plants growing in the soil is a first step towards preventing soils from becoming too hot.

### Soil smell

Healthy soil should have an earthy, slightly sweet, smell. If the soil smells earthy, sweet, or fresh this indicates a healthy microbe community living in aerobic (plenty of oxygen) conditions. If the soil is sandy and dry, it will have little or no smell at all. This soil needs lots of organic matter added to it. If the soil has a sour or putrid smell, then it is most likely frequently waterlogged and it may be easier to find another spot instead. If the soil has a strong chemical smell, it is best not to use it for a garden site.

### Soil structure

Healthy soil has pores and air pockets running through it. These are created by soil life burrowing through soil. These pores act as water channels, so water can infiltrate into all parts of the soil equally. They also create air pockets so that plant roots can access air, and soils can dry evenly. When soils do not contain enough organic matter, there will be few burrowing soil organisms living in the soil who can create pores and any pores created can easily collapse. Gardeners can also easily destroy pores by applying heavy pressure on the top of soil when walking or driving over soil or by digging in the soil too much.

### Soil texture

Healthy soil holds its shape after you squeeze it and crumbles if you poke it lightly. This soil type is called loam. Loamy soil contains just enough clay and silt to make it stick together but not make it too compact. Loamy soils are good for growing plants because they act as a "sponge" that lightly retains moisture so that plants can easily use it. A soil that sticks together when wet has a lot of clay in it. Both loamy and clay soils are rich in nutrients and contain lots of organic matter. Clay soils will not drain easily, so it is important to have good drainage systems when using these soils so plant roots are not waterlogged. A soil that falls apart as soon as you open your hand is a sandy soil. This soil drains water quickly—sometimes too quickly for plants to use it—and is low in nutrients. It also needs a lot of organic matter dug into it to provide nutrients and improve its "sponge-like" texture.

### Soil moisture

If there is no moisture when you squeeze the soil, and the soil does not stick together, then it is too dry. This soil needs lots of organic matter to retain some moisture in order for plants to grow well. If there is no water coming out when you squeeze the soil, but you can sense moisture and the soil sticks together, then the soil is moist. This is great for growing plants. If you see water coming out when you squeeze the soil, then the soil is wet. Soil that is too wet will cause plant roots to rot and deprive them of air.

### Soil life

A healthy soil should have lots of soil life, not just earthworms but lots of different creepy crawlies, such as termites or ground beetles. These organisms in the soil helps plants decompose so the nutrients in them can be returned to the soil. As insects move through the soil, they move nutrients from the bottom layers of the soil to the top layers, which also replenishes soil nutrient levels. Insects and earthworms also create pores in the soil that facilitate water movement and root growth. It is important not to disturb these pores by walking on freshly dug garden beds!

Even though we cannot see many small organisms when we are gardening, we can be pretty sure that if we see lots of earthworms, our soil will also contain many small organisms. These small organisms (also called microbial organisms or microbes) are enriching our soil with many nutrients and are even helping us fight off many soil diseases. Soil organisms thrive when soil is moist and rich in organic matter.

### Topsoil

Topsoil is the uppermost layer of soil. It was formed by the slow decomposition of the plants that have grown on it. It takes a long time to build topsoil, but very little time for it to disappear once exposed to air, wind, and rain. Some topsoils can be very deep (>30 cm or more), while others very shallow (<1 cm). The deeper the topsoil, the better the plant growth. Although it takes many years to increase the depth of a soil's topsoil, continuous additions of organic material and minimum tilling will slowly improve the topsoil and make it easier for gardeners to grow vegetables.

## 4. Closing discussion

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Invite participants to share what they have learned about soils.