15
SOIL - OUR LIFE

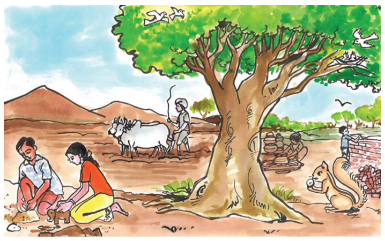


Figure 1

Rafi and Vasanthi were asked by their teacher to make models of some vegetables. They collected some soil from their garden, mixed the soil with water and made some models. They were not satisfied, as sometimes, their models would break when they tried to shape them. The surface of the models was rough and not smooth. Rafi's grandma saw them doing this and said, "To make models, you have to collect soil from the bank of our village pond which is sticky".

- Guess why soil of the garden was not suitable to make models?
- Why was grandma's suggestion useful?
- Are soils different from place to place?
- How is soil useful for us?
- Guess what soil is made up of?

Let us try to find out the answers to some of these questions. For this lets do some activities.

Let us do-1 : Usefulness of soil

Work in groups of 3 to 4 students. Discuss and list out the ways in which soil is useful for us. Compare the list with that of other groups and add any point that you may have missed.

- Can we say soil is one of the most important resources like water and air? Why?

Soil is the uppermost layer of earth's crust. It is formed of rock particles and organic matter called humus. It is one of the most important natural resources. It supports the existence of living organisms. We can use soil for different purposes in our daily life. Almost all things in our surroundings directly or indirectly depend on soil.

Can we say soil is one of the most important resources like water and air?

The soil supports all plants, animals and micro organisms. Almost all the things in our surroundings directly or indirectly depend on soil. For example a pot may be directly made from soil. But a wooden chair is derived from tree which depends on soil.

Let us do-2: Soil in our life

Rafi and Vasu want to make a list of things that are directly or indirectly related to soil. Help them with their list.

S.No.	Things directly related to soil	Things indirectly related to soil
1	Pot	Wooden chair
2		
3		
4		
5		

What do you observe in your findings? This tells that our daily life activities are closely related to soil. In addition to agriculture we depend on soil for construction of house, making utensils, toys etc.

Human beings can't live without air and water. In the same way soil is also an essential component in our lives. Most of our daily life activities are closlely related to soil. We use soil for various purposes.

During festivals like Vinayaka Chavithi people use idols of Ganesh made of plaster of paris and chemical colours which causes severe damage to our environment. Instead of these chemical idols we should use clay idols and celebrate festivals in an ecofriendly way..

Let us do-3: Soil and Life

Go to any area to study about organisms in soil (The suggested sites are: lawn in the school, public parks, near pond, river bank, bank of a canal, a badly eroded field, a good agricultural field). Select any three such site and work in groups. It would be better to visit the place after rain.

Don't forget to carry a hand lens, any hand tool to dig soil, your notebook, pencil, rubber, scale, news paper, soil life chart and any bag.

Soil Life Chart

(Put a tick mark on the options given if you find them in your site, add to the list wherever needed.)

Name of Site: _____

Section 1: Plants

1. In the soil, there are-No roots, few roots, many roots _____
2. Presence of small plants like _____
3. Other signs of plants include: _____

Section 2: Animals

I observed-different kinds of worms. (e.g. earthworms which have no legs,..... .....)
different kinds of larvae of insects. (e.g. thick worm-like creatures,... ....)
different kinds of snails and slugs. (e.g. soft- bodied animals; snails have shells, slugs do not have shells,.....)
different kinds of insects. (e.g. animals with 3 pairs of jointed legs,.....)
different kinds of spiders, mites, ticks.
(e.g. animals with 4 pairs of legs,..... .....)
different kinds of animals with more than 4 pairs of legs. (e.g. centipedes, millipedes, ...)
Other creatures I found are..... .....) After examining and counting, return the living things to the soil.

This is what you need to do at the site:

1. Measure and mark off an area of land approx. 30 cm x 30 cm.
2. Gently sort through the leaf litter, and collect any creatures you find there. Record your findings in the chart given.
3. Dig the soil to a depth of 4-6 cm. observe and record the presence of roots. Are there any?
4. Take out the soil and spread the soil onto a sheet of newspaper.
5. Carefully sort the soil, watch closely for small living things with a hand lens. Watch for worms and other animals. You may also find other signs of animal life such as burrows or eggs of insects which may be single or in masses. Count the different kinds (write in section: other creatures I found)

You may take the help of the given picture for your study.

Fig. 2

- Which area has a maximum of animal life?
- Does the amount of animal life and the burrows the animals make have any relation to the condition of the soil?
- "Soil is a good habitat". Explain the statement.

Soil is a good habitat. We depend on it for agricultural and construction purposes, making utensils, toys etc. We have already learnt that plants depend on soil for nutrients like mineral salts and water from the soil in the chapter "Nutrition in Plants."

Do you know?

Making pots by using soil is called pottery. This is an ancient creative occupation. During Harappan civilization, different varieties of designer pots and clay utensils were used. Pottery is a cottage industry in our country. Potters make pots by using clay soil on a pottery wheel.

Fig. 3

Know more about your soil

Now we have come to know that soil is a good habitat of organisms. We have also studied its different uses. Now let us study some other properties of soil.

Let us do-4: Is the soil from different places same?

For our study, we require soils collected from different places. Examples of some of these locations are given below:

fields, lakeside, open meadows, river banks, gardens, forests, roadside, fallow land

You can change the list, adding or subtracting names, to suit your convenience. But you should make sure that you get different types of soil from different places. It would be even better if the soils are of different colours.

Collect the soil samples while you are on your way to school from home. But, first, let your teacher distribute the work of collecting different soil samples among the different groups in the class. The class can decide which group should visit which location and bring back which type of soil samples to school. This work distribution should be done a day before the chapter is begun in the class.

Leave home a little early on that day, go to the location allotted to you, collect about 250 gm of soil for your sample, and bring it to school. You can carry the soil in a bag. Remember to collect the soil only on the day you begin the experiments in class. Don't forget to put a label on your soil sample, stating where you got it from and the date on which you collected it.

First copy the following Table in your Note book and note all your observations in this table. Instructions given after the table will help you to fill it.

S.No.	Activity No.	Properties	Observation
1	4	Shape of particle	
2	4	Colour	
3	4	How it feels	
4	4	Smell	
5	4	How it looks under a microscope	
6	4	Organisms presents	
7	4	Remains of organisms	
8	6	Type of soil	
9	7	Moisture content %	
10	8	Water retention (ml) Percolation rate (ml per minute)	
11	7	Acidic/alkaline	

Let us do-5: Examining The Soil After Returning To School

Examine the different soil samples brought to class and see whether you can identify various properties of soil as given in the table. Some points to study the properties are given below.

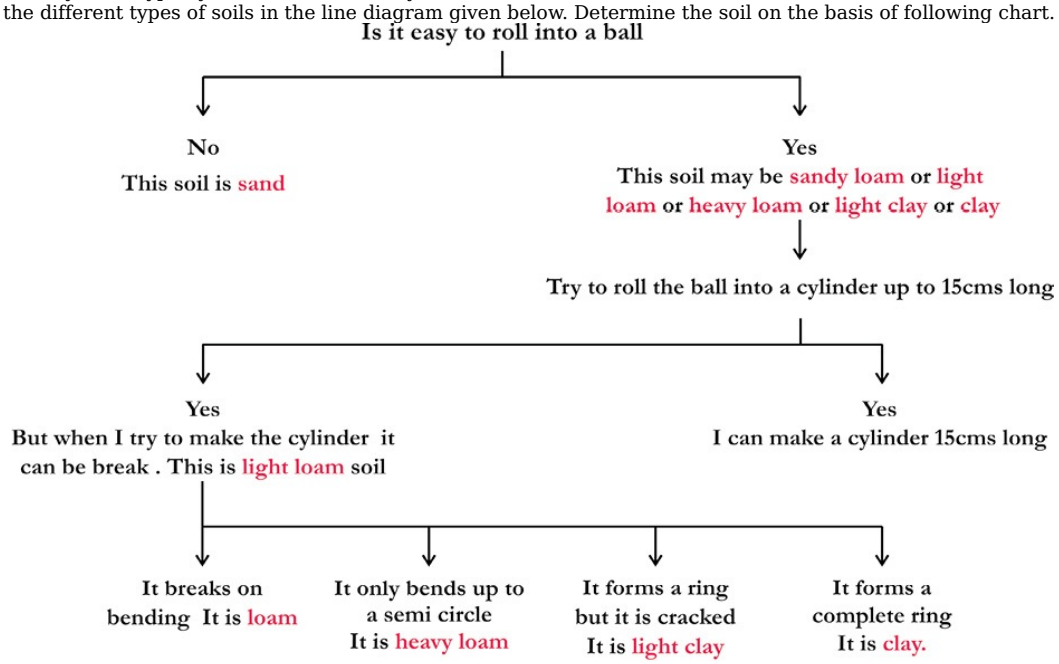
1. How does the soil look? Is it like fine powder or granular?
2. What is its colour? Is it black, brown or any other colour?

3. How does it feel when you touch or press it? Hard, soft, elastic, dry, sticky etc?
4. How does it smell? Is it aromatic, foul smelling or without a scent?
5. Can you find anything new when you examine the soil under a microscope?
6. Can you see any living creatures or plants in the soil?
7. Can you see any remains of dead creatures or plants?
8. Are all the particles in the same sample of soil similar?

If you have a problem in answering these questions, do the following activities and then try to answer them.
(To observe properties No 6 and 7, you will have to grind the soil to a fine powder, Spread it out and examine the particles through a hand lens.)

Let us do-6: What type of soil is it?

Take 20 gm to 25 gm of soil from your soil sample. Remove the pebbles, grass and other organic matter from it. Add water to the soil, drop by drop, kneading the soil while doing so. Pour enough water so you can make small balls of soil, without the soil sticking to your palms. Make a 2.5 cm diameter ball of soil. Put this ball on a flat surface and try and roll it into a 15-cm-long rod. If you can bend the rod without breaking it, then bend it into a ring.
You can identify a soil type by the extent to which you can mould it.
Identify the different types of soils in the line diagram given below. Determine the soil on the basis of following chart.



If the proportion of larger sized particles is more, we call the soil sandy. If the proportion of fine particles is more, the soil is clay. If large and fine particles are present in equal proportions, the soil is called loam.

Let us do-7: The Moisture Content of Soil

There are many ways of finding out the moisture content of different soils. We shall use a simple method. Grind the soil you wish to find the moisture content of, into a fine powder. Weigh 100 gm of soil from this pile.
Spread it on a newspaper and dry it for about two hours in the sun. While drying the soil, the sky must be clear and the heat of the sun intense. Keep turning the soil over while you are drying it. Be careful that the soil does not spill out of the newspaper. Weigh the soil again after it has completely dried. The difference in the two weights will tell you how much water 100 gm of the soil contained. This quantity is known as the percent moisture content of the soil.
Let all the groups do the experiment with different soil samples.

- Write the percent moisture content of the soil samples in the table.
- Are the figures of the percent moisture content of all the soil samples the same?
- Compare your findings with those of the other groups.

Let us do-8: The Percolation Rate of Soil

Take soil samples which were collected for the previous activity. Take a plastic funnel and place a filter paper in it as shown in figure. Weigh 50 gm of dry soil and pour it into the funnel. Take 100ml of water in a measuring cylinder. Then pour the water on the soil drop by drop.
Do not let all the water fall at one spot. Pour water all over the surface of the soil until it starts dripping out of the funnel. Observe how fast water passes down the soil. Measure the amount of water collected in the beaker.
Calculate the difference between amounts of water. Record the time taken for water to pass through the sample. Fill the following table.

S.No.	Type of Soil	Initial amount of water taken	Final amount of water in the beaker	Difference D in ml.	Time taken for water to pass down (T in sec)	Percolation rate D/T
1						
2						
3						
4						
5						

- Which type of soil retains the highest amount of water?
- Which type of soil took least time to pass down water?

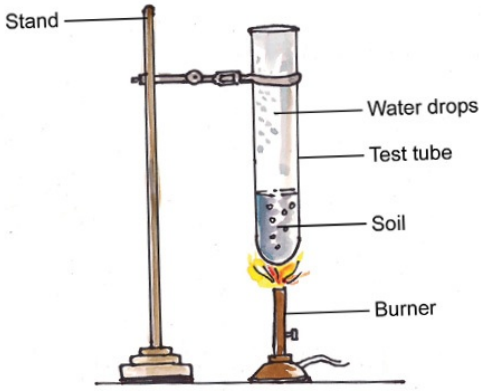
- Which type of soil took maximum time to pass down water?
- Which type of soil retains least amount of water?

Water passing down through the soil particles is called percolation.

- Why does sand soil not retain water for a long time?
- Is there any relation between percolation rate and water holding capacity of soil? Write your observations?

Activity 9: Substances present in Soil

Fill a beaker half full with soil. Pour some rainwater or distilled water over the soil. You should pour enough water to fill the beaker three-fourths. Stir the soil and water with a twig. Then let the solution stand for some time. Once the soil settles down, drain out the water carefully. Fill a boiling tube half full with this drained water. Heat the boiling tube over a candle flame. Continue heating till only a fourth of the water remains. Then answer the questions given below.



- What is the colour of the water?
- Use blue and red litmus to test whether the water is acidic or basic. Note the result in the table.

Soils contain minerals. Most of the minerals found in the soils are salts of sodium, calcium, magnesium and potassium chlorides, sulphates and carbonates. Highly acidic soil retards plant growth by affecting the efficiency with which the plant absorbs nutrients from the soil.

- Can you find out ways to decrease acidity?

HORIZONS OF SOIL

Soil is made up of distinct horizontal layers; these layers are called horizons. They range from rich, organic upper layers (humus and topsoil) to underlying rocky layers (subsoil, regolith and bedrock).

- O Horizon - The top, organic layer of soil, made up mostly of leaf litter and humus (decomposed organic matter).
- A Horizon - The layer called topsoil; it is found below the O horizon and above the E horizon. Seeds germinate and plant roots grow in this dark-coloured layer. It is made up of humus (decomposed organic matter) mixed with mineral particles.
- E Horizon - This eluviation (leaching) layer is light in colour; this layer is beneath the A Horizon and above the B Horizon. It is made up mostly of sand and silt, having lost most of its minerals and clay as water drips through the soil (in the process of eluviation).
- B Horizon - Also called the subsoil - this layer is beneath the E Horizon and above the C Horizon. It contains clay and mineral deposits (like iron, aluminum oxides, and calcium carbonate) that it receives from layers above it when mineralized water drips from the soil above.
- C Horizon - Also called regolith: the layer beneath the B Horizon and above the R Horizon. It consists of slightly broken-up bedrock. Plant roots do not penetrate into this layer; very little organic material is found in this layer.
- R Horizon - The un weathered rock (bedrock) layer that is beneath all the other layers.

- These different layers of soil are called soil profile.

Do you know?

Soil Formation: Soil is formed slowly as rock (the parent material) erodes into tiny pieces near the Earth's surface. Organic matter decays and mixes with inorganic material (rock particles, minerals and water) to form soil. These days farmers test the soil in the field using soil technologies in order to grow suitable crops in the fields. Engineers also test the soil profile before constructing multi- storied buildings, bridges and dams.

Soils in our village:

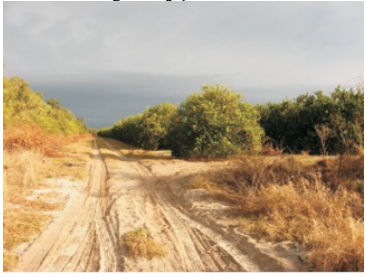
We will see different types of soils in different parts of our state. Most of the places in a district generally have same type of soil. In some cases we can see different types of soil in a district or same type of soil in different areas also. Lets us observe experiences of students from different parts of our state.

I am Madhu. I am living in Veerapanayanipalli village in Kadapa district. We have black soil in our village. We can make a ball by using this soil. But we can make cracked ring only. So it is light clay soil. Farmers grow cotton and Mirchi. If you dig two or three feet we will get lime stone in the soil. We use those stones for different purposes like construction of compound walls etc.

I am Kalesha. I am living in Krishnapuram of Karveti Nagar mandal in Chittoor district. We have red soil in our village. We can make a ball by using this soil. But we can't make a ring by using this soil, because this contains sand too. Farmers grow ground nut and castor and in some places cotton, redgram, tomatoes are also grown. Our people said that this is red sand soil.

I am Sujatha. I am living in Dantaguntla of Kanumolu mandal in Krishna district. We have black soil in our village. We can make any type of model by using this soil. It is sticky in nature. We call it black soil. This soil retains water for a long time. Farmers grow cotton, sugar cane and paddy. I saw the same type of soil in Indukurupeta of Nellore district also.

I am David. I am living in Kanala of Sanjamala mandal in Kurnool district. We can only make cracked rings using the soil in our village. My father said that this soil contains sand also. We grow Jowar, Bengal Gram and Paddy .



I am Ramadevi. I am living in Ramapuram of Vetapalem mandal in Prakasham district. In my village we can see sandy soil. We can't make even a ball by using this soil. Farmers grow flowers like Jasmine

and Kanakambaram only. Most of the farmers practise Aqua culture. Paddy is not grown in my village.

What do you observe in the information given by these children. Write information about soil and crops that are grown in your village in the same way.
I am .....
.....
.....

Soil and crops:
The crops commonly grown in any area depend on many factors. One major factor is the kind of soil available in that area and its properties. We can start with taking paddy as an example to understand the relation between soil and crop production. A paddy crop grows best in a field that remains filled with water for a long time.

- Which type of soil is better suited for growing paddy - one with a high percolation rate or with a low one?

Let us do-10:
Can you identify any connection between crops and soil? Make group with four or five students study the Atlas and other books in your school library. Make list of soils and crops growing in those soils in our state.

S.No.	Name of the District	Types of Soil	Crops grown
1			
2			
3			
4			
5			

- Which type of soil is generally seen in our state?
- Which type of crops are grown in our state?
- The districts that cultivate paddy in large areas have which type of soil?

Along with seasonal rainfall fertility of soil also influence crop production. Do you know why farmers dump cattle dung in the fields? Farmers always take care of the soil in their fields.

Soil Conservation:
During heavy winds we observe that the surface soil particles are carried away by air. Sometimes during heavy rains, rain water carries away top layers of soil. This is called soil erosion. As a result of storms and floods fertile soil layers are removed and the soil become barren. Our farmers grow big trees around the fields to stop winds. They don't keep the lands vacant. Farmers generally use vacant lands to grow grass and other plants. These grass plant roots hold the soil particles and prevent soil erosion during heavy rains. You will learn more about this in the chapter on Forest.
It is very important to preserve the fertility of soil. Do you know why farmers can't continue the same type of crops in their fields? Continuous cultivation of same agriculture crops reduce the soil fertility.

Let us do-11:
Make a group with four to five students and collect information about crops that grow in a year in your village. Why do they change crops after a period of time? Write your observations in your note book.

- Which crops are grown one after another in your village?
- Why are pulses grown every time?
- Is there any crop that grows continuously in a same field?

Generally, farmers cultivate pulses after completion of paddy. This kind of rotation of crops retains soil fertility and productivity.

Conservation of soil is important factor in agriculture.

Key words

Clay, Humus, Loamy, Sandy, Percolation, Water retention, Soil profile, Soil fertility, Soil erosion, Crop rotation

What we have learnt

- Soil is a mixture of rock particles and humus.
- Clay, loam and sand are types of soil.
- Amount of water that passes through gives us percolation rate. It is highest in the sandy soil and least in the clayey soil.
- Water holding capacity of soil depends on soil type.
- Clay and loam are suitable for growing wheat, gram and paddy. Cotton is grown in sandy loam or black soil.
- Soil profile is a section through different layers of the soil.
- Removal of top soil by wind, water or any other means is known as soil erosion.

Improve your learning:

1. How can you say soil is a precious resource? Give reasons.
2. Which type of soil is suitable for growing cotton?
3. Give reasons for low percolation rate of clay soil as compared to sandy soil.
4. Why is top soil more useful for us?
5. What types of soils are there in your village? Make a list of crops grown on these soils.
6. If a farmer wants to improve water holding capacity of his sandy soil field what will you suggest to him?
7. Do you think rotting vegetation and animal remains are important for the soil? In what way?
8. Roots of grasses hold soil particles. This conserves the .....
9. Which of the following statement is correct? Correct the wrong one.
   - Soil form from sand.
   - Crop rotation protects soil fertility.
   - Clay soil can't hold water for a long time.
   - Upper layers of soil are made of rocks.
10. Collect soil from your school ground. Try to make a ring with that soil. Write down your observations. What type of soil is it?
11. Take a boiling tube. Put two spoons of soil in it. Heat it on a spirit lamp and cover it.
    (a) Do this experiment and write your findings.
    (b) Do you find any moisture in the soil?
    (c) How can you say that?
12. Nazmal's grand mother said "Human beings always depends on soil" is she correct? How do you support her statement
13. "If you sow a seed in the soil it will give birth to a tiny plant which grows bigger and bigger. "It is the wonder of soil" Swetha said. How you express your appreciation of soil like Swetha?
14. Write a dialogue between seed and soil and perform a small play using your own script.
15. If you have a chance to talk with a soil scientist, what questions would you like to ask him about soil?
16. Do you find any relationship between the chapters "Soil" and "Nutrition in plants". What are they?

SOIL SCIENCE

Soil science is the study of soil as a natural resource on the surface of the Earth. This includes Soil formation, Clssification and mapping, physical-chemical-biological and fertility properties of soil.

Some times terms which refer to branches of soil science such as pedology and edaphology are used as if synonymous with soil science. Study of formation, chemistry, morphology and classification of soil is called pedology. Study of influence of soil on organisms, especially on plants is called edaphology. The diversity of names associated with this discipline is related to the verious associations concerned. Indeed engineers, agronomists, chemists, geologists, physical geographers, ecologists, biologists, microbiologists, syliviculturists, archiaiogists all contribute to further knowledge of soil and the advancement of soil science.