BOOK 3

Agricultural Science

A course for secondary schools in the Caribbean

SAMPLE CHAPTER

THIRD EDITION

Ian Elliot ▪ Orville Wolsey ▪ Amrith Barran
Augustine Vesprey ▪ Edmund Berahzer
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Boost

HODDER EDUCATION

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Chapter 1
Soil fertility and land capability classification

Figure 1.1 Fertile soil newly prepared for planting

At the end of this chapter you will be able to:

- Understand the processes involved in soil formation
- Describe the major components of the soil (organic and inorganic components, water and air)
- Understand what is meant by a soil profile
- Know how to manage the soil to keep it fertile
- Understand the effects of using organic versus inorganic fertilisers
- Know how land is classified according to its potential use

Why learn about soil?

Land-use planners classify lands to determine the most suitable use for each area. These are called **land capability classifications**. For a farmer, knowledge of the soil, its fertility and land capability are essential references for practising good agriculture.

In this chapter, we will learn how the soil, its formation and its composition are related to soil fertility and land classification.

Consider this

Have you ever wondered what makes soils fertile?

In agriculture, we often hear about the importance of fertile soils for growing healthy plants. Soil fertility refers to the nutrient content of the soil.

We also know that some land areas are more capable of growing crops than others.

What do you think would happen if farmers attempted to grow food in soil that was not fit for that purpose?

Career corner

Land-use planner

Do you like …

- gathering information and data for interpretation
- the thought of studying urban planning?

Can you see yourself …

- working with government officials, farmers, developers and environmental organisations to make decisions about land use
- making decisions based on existing policies that will affect activities in the future?

Then maybe you should be a land-use planner. You will …

- organise and design plans for the best use of land, including for agriculture, in your country
- consider population growth, economic, environmental and ethical factors as you determine how best to use land for food production, housing developments, etc.

Figure 1.2 Considering a career as a land-use planner

Soil formation

Soil fertility is influenced, in part, by how the soil is formed. Soil is formed from the interaction of factors that have led to the breakdown of rocks. Dead animals, plants and plant parts contribute to the organic matter found in soils.

The five main factors that contribute to soil formation are listed below.

PARENT MATERIAL

To form soil, hard and stony surface rock must first be broken down into smaller pieces. This surface rock is called the **parent material**. Parent material is broken down by the forces of weather, such as rain, wind, heat and cold, over time. For example, when the nights are cool and the days are hot, small cracks in rocks can expand and contract. This movement eventually causes the rocks to break apart. This breakdown process is known as **weathering**.

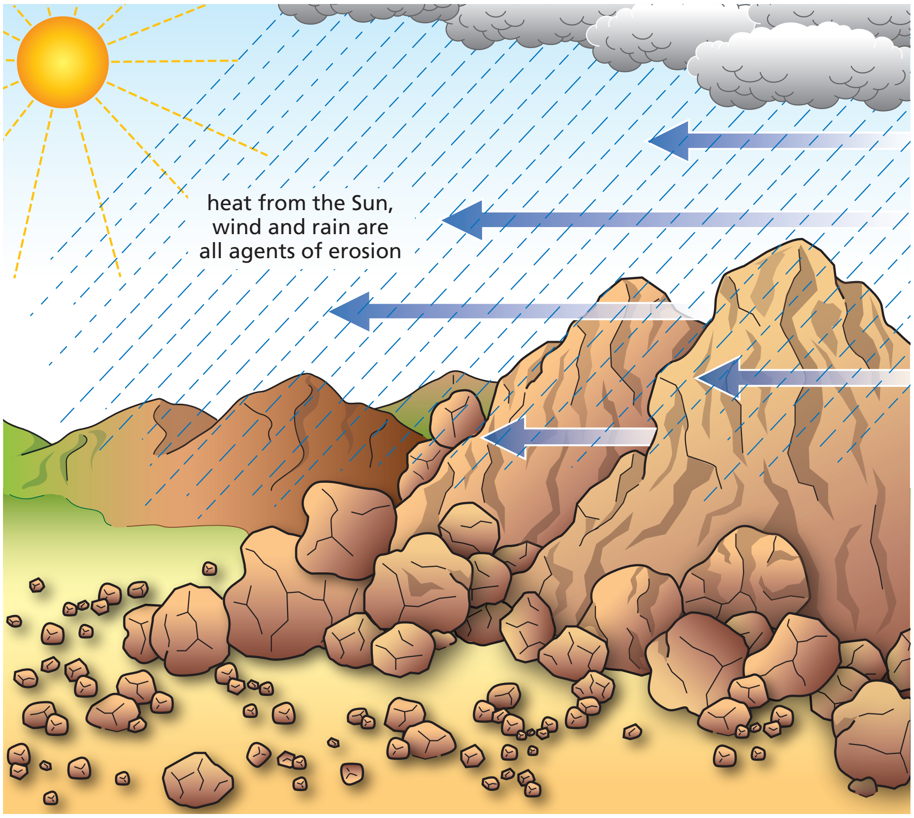

Figure 1.3 Rocks are weathered to form small particles that become part of the soil

CLIMATE

Climate influences the rate of weathering and therefore the rate at which soil is formed. If there is high temperature, high rainfall or very windy conditions, there is more breakdown of rock and movement of sediment. Cold weather slows down the decay of dead plant and animal matter. This is why there is faster soil formation in warm, humid climates than in colder areas.

LIVING ORGANISMS

Living organisms (plants and animals) also help to create soil. When plants and animals die, their bodies decay to form organic matter. Micro-organisms, such as bacteria and fungi, help with the process of decay. Larger animals, such as moles and earthworms, tunnel through the soil. These actions cause the mixing of organic material with weathered parent material to promote soil formation.

TOPOGRAPHY

The shape of the land or the amount of slope or flatness is called the **topography**. The sides of mountains are called slopes. Steep slopes have thinner soils because they are more affected by wind and rain. Rain and wind can carry away small rocks and mineral nutrients. This process is called **soil erosion**. On sloping land, the south-facing side tends to be warmer than sides that face north because it is exposed to more sunlight. Because of this, soils on south-facing slopes will tend to be more weathered and drier.

TIME

It can take thousands of years for parent rocks to be weathered into finer material that eventually becomes soil.

Soil components

Soil is made up of an extensive variety of substances and rocks. Although soils can be very different from one location to another, the different substances that make up soil, also called **soil components**, can be placed into four main groups:

- the organic component
- the inorganic component
- water
- air.

An ideal soil is composed of 5 percent organic matter, 45 percent inorganic matter, 25 percent water and 25 percent air. Soil is therefore made up of a mixture of rocks, minerals, and rotted or decayed plant and animal matter.

When there is an imbalance of one or more of the soil components, the fertility of the soil is affected.

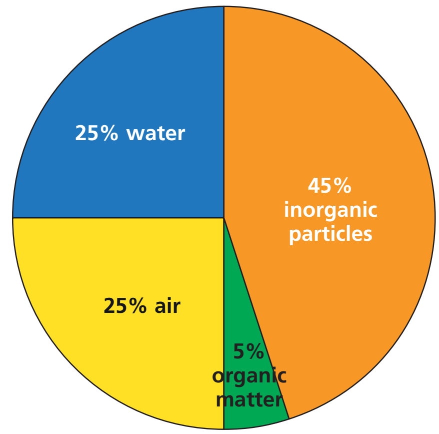

Figure 1.4 Components of an ideal soil

THE ORGANIC COMPONENT

The organic part of the soil is made up of partially decayed and fully decomposed dead matter from plants and animals, as well as non-decayed plant and animal litter (such as leaves and roots and living soil organisms). This organic matter goes through various stages of change over time to form **humus**, which is known as stabilised organic matter. Humus is a brown or black organic substance consisting of partially or wholly decayed vegetable or animal matter that provides nutrients for plants and increases the ability of soil to retain water. It gives the soil a dark colour and can remain in the soil for a long time.

Organic matter makes up only a small fraction (5%) of the total components of soil, but it is extremely important for the following reasons.

- **It is essential for nutrient recycling**: when soil organisms decompose organic matter, essential nutrients within the organic matter are released back to the soil and plants can then take them up.
- **It improves soil water content**: organic matter on the soil surface helps protect the soil from the erosive effect of rainfall and wind. It also protects the soil from becoming dried out by the Sun.
- **It improves soil structure**: the structure of a soil depends on how the soil particles cling together due to the presence of humus. Organic matter clumps the soil particles together to make room for air and water.
- **It improves plant growth**: organic matter is the chief source of nitrogen, phosphorus and potassium for plants. High levels of organic matter in the soil mean there will be more nutrients available for plants to take up.

Soil organisms

These are responsible for decomposing organic matter into humus and inorganic nutrients (which are taken up by plants).

Soil organisms are essential for plant growth. They can be divided into macro-organisms, such as earthworms, insects, rats and moles, and micro-organisms, such as bacteria, nematodes and fungi. Nematodes are microscopic, eel-like organisms that live in soil. Fungi in the soil can be both macroscopic and microscopic. Micro-organisms feed on the remains of dead plants and animals, causing them to decompose. This releases plant nutrients into the soil. The plants then take up these nutrients as they take in water.

The waste from some soil organisms, such as earthworms, helps to bind soil particles into small clumps, enhancing soil structure. Earthworms also tunnel through the soil, leaving spaces through which air and water can enter. This makes soil loose and crumbly.

Not all soil organisms benefit plants. There are also soil micro-organisms that cause diseases in plants. Certain types of bacteria, viruses and fungi can infect plants and cause serious loss of crops. Other beneficial soil micro-organisms help to control the populations of these harmful soil organisms.

Did you know?

- There are more micro-organisms in a handful of soil than there are people on Earth.
- It takes 500 years to produce just under 2.5 centimetres of topsoil.
- Approximately 10% of the world's carbon dioxide emissions are stored in soil.
- Soil acts as a filter for underground water, filtering out pollutants.

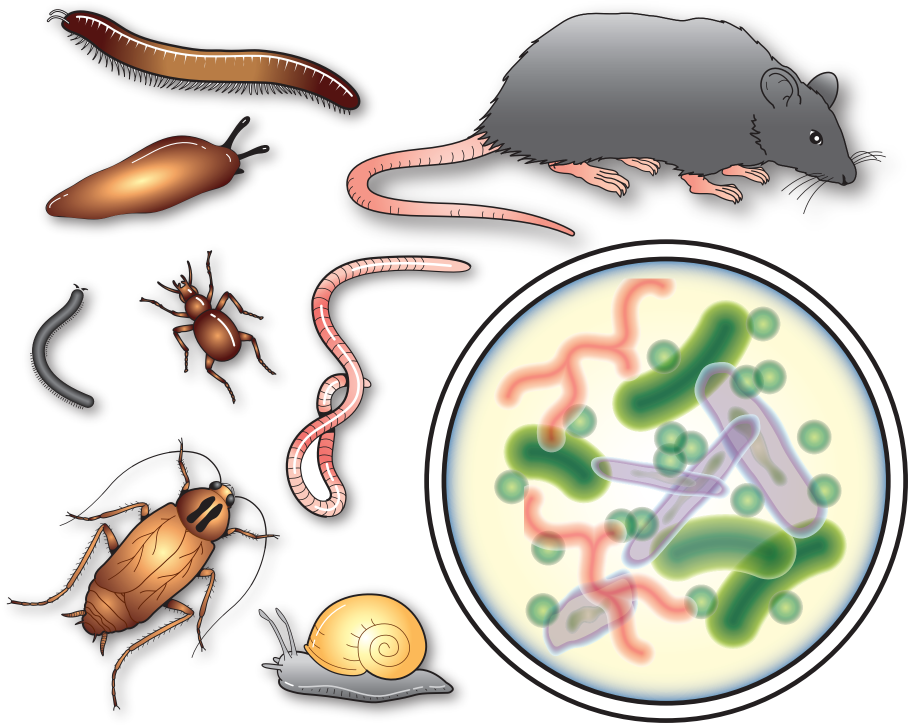

Figure 1.5 A range of common soil macro- and micro-organisms (micro-organisms have been encircled and magnified)

THE INORGANIC COMPONENT

The inorganic component of soil consists of weathered rocks of variable sizes, which are present as sand, silt and clay (as well as all the mineral elements needed by plants for growth). The inorganic materials found in soils account for almost half of the total mass of most soils (as shown in Figure 1.4).

Table 1.1 Classifying the inorganic components of soil

MATERIAL	SAND	SILT	CLAY
Size of particles	This is the largest type of soil particle Ranges from 0.05–2 mm in diameter	Between sand and clay in size Ranges from 0.002–0.05 mm in diameter	Smallest of the particles Typically less than 0.002 mm in diameter
Description	Feels rough Has sharp edges Does not hold many nutrients	Feels smooth and powdery when dry Feels smooth when wet, but not sticky	Feels smooth when dry and sticky when wet It is a heavy component in soil Holds nutrients Water and air do not pass through easily because there are few spaces between the particles

Macro- and micronutrients

The sand, silt and clay compounds contain mineral elements, which are essential for plant growth. Since 2016 the Earth was confirmed to be comprised of 118 elements. Of these, 20 elements essential for plant growth and development are found in the soil as minerals. Those needed in larger amounts are called **macronutrients** while those needed in small amounts are called **micronutrients**.

Table 1.2 Macro- and micronutrients present in soils (chemical symbols in brackets next to each element)

MACRONUTRIENTS	MICRONUTRIENTS
Calcium (Ca)	Boron (B)
Magnesium (Mg)	Manganese (Mn)
Potassium (K)	Copper (Cu)
Nitrogen (N)	Zinc (Zn)
Phosphorus (P)	Chlorine (Cl)
Sulphur (S)	Iron (Fe)
	Molybdenum (Mo)

Subject link

This topic is covered in more detail in biology and chemistry.

The total amount of these nutrient elements contained in the soil depends on the following:

- The **nature** of the original parent material from which the soil was formed. For example, soils formed from limestone parent material contain more calcium.
- The amount of **leaching** of dissolved minerals into the soil from the surface of the soil. When water moves downwards into the soil, it can dissolve as well as wash out some of the minerals. The dissolving of substances from the soil is called leaching.
- The **age** of the soil. Older soils have fewer mineral elements because they have been weathered and eroded for longer.

Soil types

Soils are grouped into types based on how much sand, silt and clay they contain. There are three main types of soil: sand, clay and loam. Sandy soils have large particles. Clay soils have small particles. Other soils have a mixture of large and small particles and these are known as loams.

Soil texture

The inorganic soil components give the soil its texture. The term **soil texture** describes the proportions of sand and clay particles in a soil. In other words, the texture of a soil depends on the size of the particles in it. A soil with a lot of sand has a coarse texture (the particles are large). A soil with a lot of clay has a fine texture (many small particles). Knowing the texture of the soil can give clues as to how stable the soil is and how good the drainage is. These are important characteristics to know about for the classification of land for farming and construction.

SOIL WATER AND SOIL AIR

Air and water are essential for the growth of plants. The spaces in between the organic and inorganic soil components are filled with air and water. In fact, water and air make up half of the components of soil (see Figure 1.4). The amounts of air and water vary with location and climate. In swamps and other wetlands there is more water and less air than in drier soils. During the drier times of the year we find less water in the soil. Every time that water enters the soil, air is displaced. Therefore there is always a changing balance between the water and air content of the soil.

Did you know?

The topsoil is very important to farmers. Without topsoil, neither crop plants nor pasture grasses will grow properly, meaning that grazing animals would not be able to graze. If topsoil is lost, no farming can be done in that area again.

The soil profile

If you have ever looked at a pit being dug, you will notice that the soil does not look the same all the way down; it often appears to be in layers. These layers make up the **soil horizons**. Each horizon will look slightly different and will have varying amounts of the soil components. If you take a vertical section of the soil, from the surface down to the parent rock, you will see the layers. This type of section is called the **soil profile**. Most soils have several horizons but for now we will only look at O, A, B, C and D.

- **Horizon O**: this is the uppermost layer of soil, nearest the surface. This layer is rich in fresh organic material such as leaves and other plant litter, as well as partially decayed or fully decayed organic matter, called humus.
- **Horizon A**: this layer is also known as the **topsoil**. It is usually found in the upper 5–30 cm of the soil profile. In this layer, humus and other organic matter are mixed with mineral particles and there is an abundance of plant roots and soil organisms. Plants take up all the nutrients needed for growth from this layer, which is usually fertile. A good topsoil has a good crumb structure and is well drained and well aerated.
- **Horizon B**: this is the middle soil layer, also called the **subsoil**. It lies below the topsoil. The subsoil is lighter in colour than the topsoil and has very little humus. Plants do not grow well in soils from this horizon because there are fewer living organisms and less organic matter than in both horizon A and horizon O. However, deep-rooted plants can get water and some nutrients from the subsoil. The subsoil is often poorly drained and poorly aerated.
- **Horizon C**: consists of partially weathered parent material. In this layer there is less living matter, and the rock material is not as weathered as in the upper horizons.
- **Horizon D**: this is made up of the parent rock or bedrock.

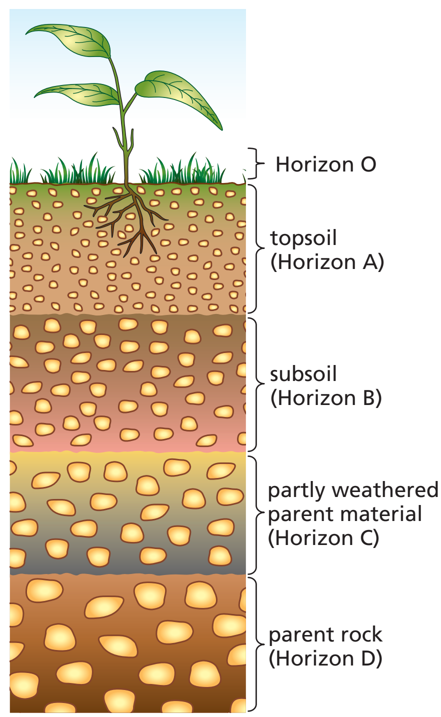

Figure 1.6 A typical soil profile showing the major horizons

Soil fertility: improvement and maintenance

The amount of nutrients in the soil determines how fertile it is. How the soil is formed and what the soil is made up of determines its nutrient content.

Some soils, such as desert soils, have low fertility. Desert soils have too much sand and not enough clay and organic matter to keep the nutrients in. The constant growing of crops, as well as flooding and drought, may also deplete nutrients from the soil over time.

To keep soils fertile, farmers should:

- carry out good cultural practices (such as crop rotation) to reduce or prevent the loss of soil nutrients
- increase soil nutrients (some soils need additives in the form of fertilisers to make them fertile)
- ensure that plant nutrients and organic matter are added back to the soil from time to time.

Fertile soils should have:

- all the necessary nutrients that plants need to grow
- a good structure, good water-holding capacity and good drainage
- the ability to support soil micro-organisms
- a good texture to support the plant and its root system
- a soil pH suitable for a good range of crops (between pH 6.0 and 7.0).

Did you know?

Soil pH is a measurement of the alkalinity or acidity of soil. pH is measured on a scale of 1–14, with 7 as the neutral mark. Anything below 7 is considered acidic soil and anything above 7 is considered alkaline soil.

Using cultivation practices to maintain soil fertility

CROP ROTATION

Crop rotation is the practice of changing the type of crop grown in a field from one growing season to the next, so that the same crop is not grown in the same field year after year.

Some advantages of crop rotation are as follows.

- It prevents depletion of soil nutrients and maintains or increases soil fertility.
- It reduces soil erosion. If a field is always covered with plants, there is less chance of the soil being washed away or eroded.
- It reduces the build-up of pests and diseases. When the same crops are planted in the same field every year, pests and diseases begin to concentrate within the area. Rotating the crops makes it harder for the pests to find them and prevents the build-up of disease-causing organisms. This reduces the chance of losing crops due to pest and disease infestation.
- It reduces reliance on agrochemicals. There is less need to apply insecticides and other agrochemicals if the soil fertility is preserved.
- It helps control weeds. When the field is always in cultivation, there is no chance for weeds to take over.

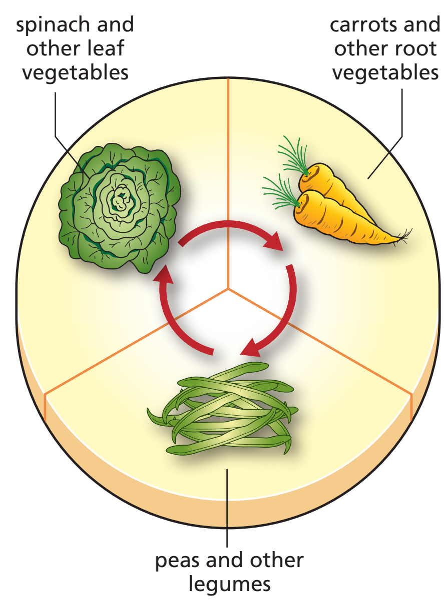

Figure 1.7 A three-course crop rotation for vegetables

EROSION CONTROL

Erosion control is the prevention and control of soil loss. It can be achieved by using a range of cultivation practices. If soil is left unprotected, agents of erosion such as water and wind can cause soil loss.

You will learn more about these practices in Chapter 7.

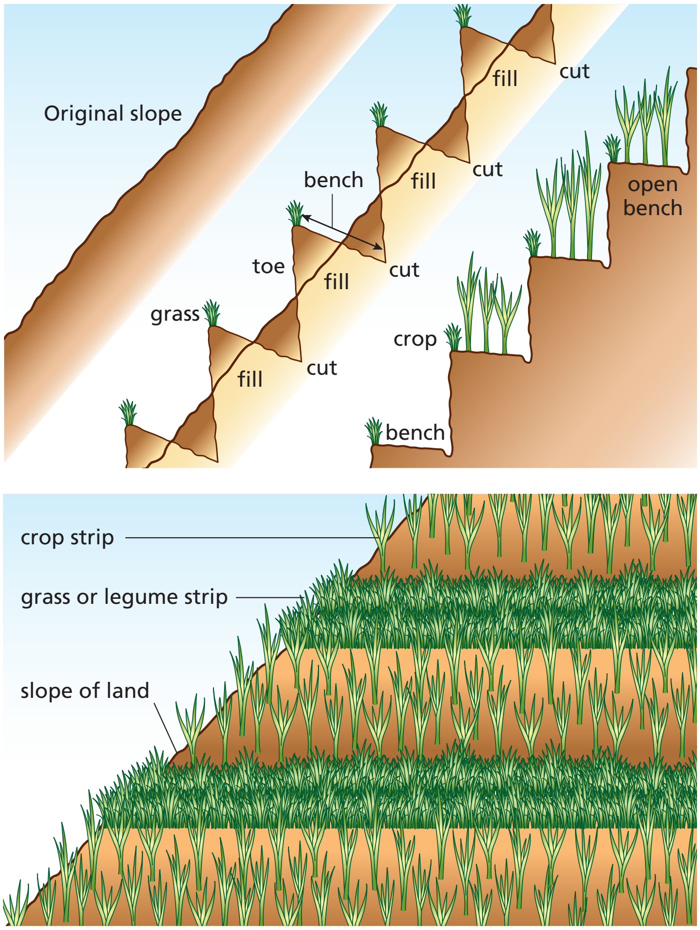

Figure 1.8 Construction of bench terraces (top); strip cropping along the contour lines (bottom)

Using fertilisers to maintain soil fertility

When we think about improving soil fertility, the first thing that comes to mind is the use of fertilisers. Fertilisers are substances added to the soil to enhance or replace its fertility. Fertilisers contain all the nutrients needed by plants to grow, especially nitrogen, phosphorus and potassium, which are the nutrients needed in the greatest quantities.

Fertilisers can be separated into two groups: organic (or natural) fertilisers and inorganic (or chemical) fertilisers.

ORGANIC FERTILISERS

As the name implies, organic fertilisers are based on naturally occurring organic matter, such as plant and animal waste. Use of organic fertilisers benefits both the soil and the plants growing there. Organic fertilisers improve the fertility of the soil by adding organic matter, which is rich in nitrogen and other nutrients essential for the growth of plants.

Organic fertilisers also improve the structure of the soil. They increase the capacity of the soil to absorb and store water, and improve soil aeration and soil structure. This is beneficial both to soil organisms and for healthy plant root development.

Organic fertilisers include manure, compost, mulch and legumes.

Manure

The best-known organic fertiliser is manure. Manure has been used for centuries as a fertiliser. Manures are grouped into two classes: animal manure and green manure.

- **Animal manure**: animal manure comes from animal faeces. Some domestic or farm animals from which we get manure are horses, cattle, pigs, sheep and chickens.
- **Green manure**: green manure is a type of **cover crop**. Cover crops are grown to prevent erosion, control weeds and improve soil quality between plantings. Usually the green manure crop is grown for a limited time and then ploughed and mixed into the soil. Apart from improving the fertility of the soil, green manures also help to protect the soil, since they act as a cover. Legume plants are most often used as green manures because they can extract ('fix') nitrogen from the air into a form that can be used by plants.

Did you know?

Manure from different animals may have different qualities, since the diets of the animals are different.

Compost

Compost is decomposed organic matter, which may consist of kitchen scraps, lawn cuttings, dried leaves and even paper or cardboard. Soil micro-organisms are responsible for breaking down the organic matter in compost into carbon dioxide, water and humic substances (these are the residues of decayed organic matter, capable of releasing plant nutrients). Heat energy is also released during the composting process.

Mulch

Any material spread over the soil surface as a cover is called a **mulch**. Applying mulch is like putting a protective blanket over the soil. Covering the soil surface with mulch helps to prevent the loss of soil moisture and the growth of weeds. Mulching also prevents the spread of disease. When the soil is covered, disease-carrying particles cannot be splashed onto the plants. Soil erosion is reduced by mulching because covered soil cannot easily wash away when it rains.

Various materials can be used as mulches, such as wood chips, straw and types of organic material such as compost. Other types of mulch include rocks, black plastic and newspaper. Adding organic mulches has the added benefit of improving soil fertility.

Legumes

Legumes are plants such as beans and peas, peanuts and lentils. They are a good source of fibre and protein in the diet of humans. Apart from being a good food source, legumes are useful for improving soil fertility because they can supply nitrogen to the soil.

INORGANIC FERTILISERS

Inorganic fertilisers are usually manufactured chemicals (such as nitrogen in the form of urea) or mined minerals (potassium and phosphorus). The various elements are often combined in other chemical processes to produce **compound fertilisers**. Compound fertilisers have the three major nutrients – nitrogen, phosphorus and potassium – in varying proportions.

You may have noticed on fertiliser packages symbols such as NPK 10 : 10 : 10. These numbers represent the percentage (by weight) of the three major nutrients required for healthy plant growth: nitrogen (N), phosphorus (P) and potassium (K). These compound fertilisers come in various formulations such as 10 : 10 : 10, 10 : 20 : 10, etc. Farmers can select the different formulations depending on the needs of their soil and crops.

ORGANIC VERSUS INORGANIC FERTILISERS

Plants do not know the difference between organic and inorganic fertilisers, and their roots will absorb the required nutrients wherever they come from. However, there are drawbacks and benefits to the use of either type of fertiliser. These are outlined in Table 1.3.

Table 1.3 Benefits and drawbacks of organic and inorganic fertilisers

ORGANIC	INORGANIC
Obtained from naturally occurring living matter	Must be chemically synthesised or derived from non-living matter
Nutrients are not readily available but must first be broken down by soil organisms to simpler compounds	Nutrients are readily available for uptake by plants
Nutrients are slowly released into the soil so they are available over a longer period of time and are not leached away easily	Nutrients are easily leached out of the soil by rain and irrigation water, so fertilisers need to be re-applied often
Limited chance of 'burning' the plants, once well-decomposed matter is used	Application of too much can 'burn' seedlings and young plants
Improves soil structure, texture and the air- and water-holding capacity of the soil	They are useful for growing plants but do nothing to sustain the soil
Required in large quantities, since the concentrations of nutrients are lower	Concentrations of nutrients are known, so exact plant requirements can be supplied
Little to no risk of toxic build-up of chemicals and salts that can be deadly to plants	Repeated applications may result in a toxic build-up of chemicals in the soil, which can eventually end up in your fruits and vegetables
Organic fertilisers are renewable, biodegradable, **sustainable** and environmentally friendly	Long-term use of chemical fertiliser can change the soil pH

Food for thought

On a visit to your older brother in a rural area in your country, you notice that he always plants the red cowpeas (string beans) and pigeon peas in one part of his farm and the yams and sweet potatoes in another. On a closer look you realise that the red cowpeas and pigeon peas are doing well but the yams and sweet potatoes are not flourishing as they should.

The big question

How can your brother use green manure and crop rotation to improve the quality of the soil and crops he produces?

Breaking this down

1 What is the condition of the crops your brother produces now?

2 What evidence from your brother's farm can you use to show him the benefits of green manure and crop rotation?

3 Can you support your arguments with evidence from other countries?

Sharing the information

Do a dramatic presentation with the rest of your group in which you demonstrate how you are able to argue in favour of green manure and crop rotation.

Answering the big question

What are your thoughts about how your brother's crops will improve if he uses both green manure and crop rotation?

Classification of land

Assessing the most suitable use for an area of land is called **land classification**. In agriculture, a knowledge of land classification allows the farmer to make the best use of the land while preserving the soil.

Factors generally used for land classification assessment include:

- **climate** (effect of rainfall, exposure to sun, exposure to wind, temperature changes)
- **topography** (the configuration of the land; how flat or hilly it is)
- **soil** (soil type, texture and structure).

LAND CLASSIFICATION SYSTEMS

One of the best-known land classification systems groups soils into classes, subclasses and units, as shown in Figure 1.9. Table 1.4 shows the classes of soils.

Problem-solving tip

Critical thinking

When faced with a problem it is best to try to understand all its components before attempting to find a solution. Using critical thinking skills often helps to unlock the solution, or at least parts of it.

Critical thinking requires asking the following to get started:

- who?
- what?
- where?
- when?
- why?
- how?

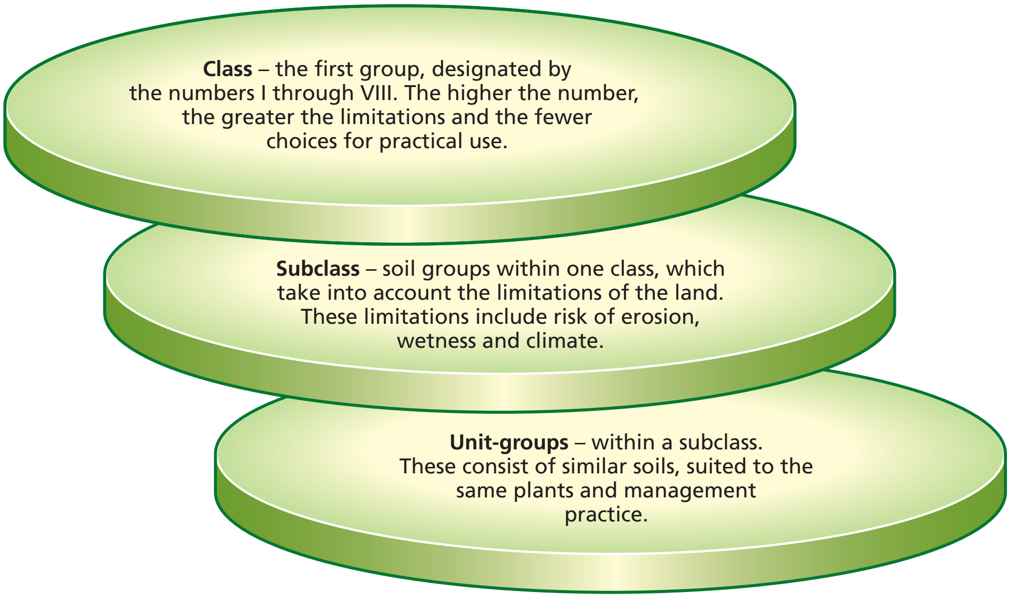

Figure 1.9 Diagram of a land classification system

Table 1.4 The different soil classes

CLASS	DESCRIPTION
Class I	These are the best soils. They have good soil fertility and soil properties. They can be farmed easily and are not susceptible to erosion. Simple management practices are needed to maintain productivity.
Class II	These soils have limitations that reduce the choice of plants or require moderate conservation practices. This soil may have gentle slopes, be moderately prone to erosion and have less than ideal soil properties. More management practices are required to farm these soils.
Class III	These soils have severe limiting factors, leading to reduced choice of crops and cropping system. They are very prone to erosion. These soils may be shallow, with poor moisture-holding capacity and fertility. Farming these soils requires many inputs and conservation practices.
Class IV	These soils have the same limitations as the other classes but they are more severe. Lands with Class IV soil may have very steep slopes. There are greater restrictions for the choice of crops and these may require in-depth management and conservation practices. Steep slopes and their erosion hazards may require the use of terracing.
Class V	These soils are restricted to pastures and woodlands. They are stony and may be susceptible to flooding.
Class VI	Similar to Class IV soil, but generally unsuited to cultivation. Their use is limited largely to pasture, woodland or wildlife food cover. They can be used for some kinds of tree crops if intensive management is practised.
Class VII	These soils are unsuited to cultivation and their use is restricted to grazing, woodland or wildlife. These soils are not suited for cultivation of any of the common crops.
Class VIII	These soils are not used for plant production.

Activities

Practical work

Observing different soil types

Your teacher will take you on a field trip to observe soils in different areas of the country. To prepare for this trip, make a table in your farm diary to record the following: area visited, use of land, vegetation cover, type of soil, features of soil including size of clumps, colour, presence of organic matter, water content, possible soil class, etc.

Building a compost heap

1. Measure out an area on the ground, 2 metres by 1 metre, for building the compost heap. Mark the corners with sticks knocked into the ground.
2. Lay some twigs or thin branches on the ground. These will allow air to circulate under the heap.
3. Cover the branches with a layer of old compost 10 cm thick. This will contain plenty of bacteria to start rotting down the material that will be put on the heap. Place a stick about 2 metres tall in the centre of the staked-out area. This will enable you to check the temperature of the heap, as described later (see point 8).
4. Add layers of leaves, weeds, crop residues, grass, kitchen waste or any kind of plant remains, up to 30 cm thick. Chicken manure and animal droppings can also go on the heap.
5. Now add a layer of soil 10 cm thick. This holds down the plant material, and the bacteria in the soil will help to promote rotting.
6. Keep on adding a layer of plant material followed by a layer of soil until the heap is about 2 m high.
7. Split open a plastic sack and use it to cover the heap. Weigh it down with stones.
8. Once a week remove the plastic cover and water the heap, as the bacteria responsible for decomposition (rotting) work best in a moist environment. As the decomposition takes place, the temperature of the heap rises. You can check the temperature of the heap by using a thermometer. Remove the 2 m stick and lower a thermometer attached to a string into the hole. Leave it there for a few minutes. Then pull it out again and read off the temperature. After inspecting the heap, replace the plastic cover to keep the moisture in.
9. After 4 weeks you will see that the compost heap seems to be smaller than when you started. You will also observe that the temperature in the heap begins to fall. The outer parts of the heap do not decompose as quickly as the inside. For this reason, to make really good compost, you should do it in two stages:
   a. Stage 1 lasts for 4 weeks. After this time, you should turn the heap. Remove the outer portions of the heap and use them to make the base for the Stage 2 heap.
   b. Stage 2 is shorter because there is less material to ferment. Turn over the rest of the partly-made compost and put it on top of the new base. What follows is a quick temperature rise that falls off in 2 weeks. By turning over the organic matter you allow decomposition to occur more fully.

   The compost is now ready to be used in the garden, or it can be stored in a shady area until needed. The soil and rotted organic matter will have become a brown mixture containing humus and plant nutrients.
10. Draw labelled diagrams of the stages in making compost to remind you how to do it.

Technology-based activity

Your teacher will help you to get the email addresses of some soil-testing laboratories in your country. Send an email to the manager of a lab requesting information on the various soil-testing processes that are carried out at that particular laboratory.

Make an information sheet that you can share with farmers in your community to help them maintain soil fertility on their farms.

What have I learnt?

Multiple choice questions

1 **Soil is a complex mixture of:**
- a an organic component
- b an inorganic component
- c air and water
- d all of the above.

2 **Which of the following does not control soil formation?**
- a Composition of parent material
- b Rainfall and temperature
- c Biological activity
- d Soil horizon

3 **What is a soil horizon?**
- a A factor influencing how soil is formed
- b A layer of soil
- c The inorganic component of the soil
- d The organic component of the soil

4 **Why is organic matter (humus) an important part of soil?**
- a It improves the fertility of the soil.
- b It improves the structure of the soil.
- c It increases the capacity of the soil to absorb and store water.
- d It is important for all of the above.

5 **In which soil layer is humus found?**
- a Horizon A
- b Horizon B
- c Horizon C
- d Horizon D

6 **The practice of changing the type of crop grown in a field from one growing season to the next is called:**
- a cultivation
- b fertilisation
- c crop protection
- d crop rotation.

Short answer questions

1 **Why is soil necessary for plant growth?**

2 **What is soil fertility?**

3 **How can soil fertility be maintained?**

4 **Draw a typical soil profile and name and briefly describe each horizon.**

5 **Compare and contrast the benefits of organic versus inorganic fertilisers.**

6 **Explain soil classification and how it is useful to people involved in agriculture.**

7 **What is meant by soil texture?**

8 **What is meant by soil type?**

AGRICULTURAL SCIENCE

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SAMPLE CHAPTER

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