

## Soil Fertility

### *Soil Fertility*

Is the ability of a soil to provide growing plants with their nutritional requirements in adequate proportions.

### *Essential Elements*

Are nutrient elements which plants obtain from the atmosphere, water and mostly from the soil.

These elements are divided into two main groups.

#### (a) *Macro-nutrients*

These are elements which are absorbed by plants in relatively large quantities. They include carbon, hydrogen, oxygen (from air and water) and nitrogen, phosphorus, potassium, calcium, magnesium and sulphur (from soil). Plants require these elements mainly for respiration, photosynthesis, growth and development of roots, stems, fruits and seeds.

Deficiency symptoms of these elements are manifested in a variety of ways including colour changes on leaves and stems (e.g. chlorosis), stunted growth and eventual death of plants.

#### (b) *Micro-nutrients*

Are plant nutrient elements which are absorbed in very minute quantities. They are also called trace or rare elements because plants require them in small amounts. However, if these

elements are not adequately supplied, plants start to show deficiency symptoms. They are therefore, equally essential as the macro-elements. These elements include iron, manganese, copper, zinc, boron, chlorine, and molybdenum.

### *Ways in which Soil Fertility is Lost*

- (a) Leaching.
- (b) Soil erosion.
- (c) Bad farming methods e.g. monocropping, continuous cropping and burning the fields.
- (d) Change of soil pH.
- (e) Accumulation of salts that fix other elements in the soil.

### *Soil Sampling and Testing*

Soil sampling is the obtaining of a small quantity (sample) of soil that is representative, in all aspects, of the entire field being sampled.

Soil testing is the analysing of the sample to determine certain qualities of the soil. The objectives of soil sampling and testing are:

- (a) To determine the pH value of the soil hence find out right crop to grow.
- (b) To determine soil fertility level hence find out type of fertiliser to apply.
- (c) To determine whether it is necessary to modify soil pH for a crop.

## Fertilisers

A fertiliser is any material or substance which when applied to the soil improves or increases its ability to sustain plant growth. Application of fertilisers is one of the principal ways of improving and maintaining soil productivity.

### Types of Fertilisers

#### Organic Fertilisers

These are essentially decomposed plant and animal remains and are known as organic manures. They include:

- (a) farmyard manure,
- (b) compost manure,
- (c) green manure,
- (d) organic mulches.

#### Role of Organic Fertilisers in the Soil

- (a) Improve soil aeration.
- (b) Improve water infiltration and hence good drainage.
- (c) Improve soil structure by acting as a cementing agent.
- (d) Add nutrient to the soil when decomposed.
- (e) Encourage microbial activity in the soil.

#### Inorganic Fertilisers

These are artificially processed commercial products. They contain high nutrient concentration per unit volume.

Inorganic fertilisers are formulated and classified on the basis of the primary macronutrients namely nitrogen, phosphorus and potassium. They are also classified as:

- (a) Straight or single fertilisers: These have only one of the primary macronutrient. These include nitrogenous fertiliser.
- (b) Compound or mixed fertilisers: These have more than one primary macronutrient, e.g. Di-ammonium phosphate. They are normally designated as 10:20:0; 23:23:0; 18:47:0; 20:30:10; etc. representing the percentage ratio of each element.

### Methods of Applying Inorganic Fertilisers

Fertilisers may be applied using one or more of the following methods:

- (a) Drilling together with seeds during planting time.
- (b) Broadcasting either by hand or by use of machine broadcasters e.g. in pastures.
- (c) Dibbling i.e. placing handfuls of fertiliser in planting holes.
- (d) Side dressing and top dressing.
- (e) Foliar spraying in solution on to the foliage of perennial crops. e.g. tea or coffee.

### Lime and Liming

Liming refers to the application of the element calcium in form of limestone ( $\text{CaCO}_3$ ) and hydrated lime ( $\text{Ca(OH)}_2$ ).

Importance of lime:

- (a) It improves soil structure through flocculation of soil particles.
- (b) It lowers soil acidity.
- (c) Hastens decomposition of organic matter.
- (d) It makes nitrogen and phosphorus to be in available or absorbable forms.
- (e) It improves legume nodulation and hence nitrogen-fixation in roots.

### Carbon and Nitrogen Cycles

#### (a) Carbon Cycle

- (i) Carbon dioxide is taken by plants through photosynthesis.
- (ii) Decay or burning releases carbon dioxide to the air.
- (iii) Animals feeding on plants obtain carbon compounds.
- (iv) They give out carbon dioxide by expiration or decay.

#### (b) Nitrogen cycle

- (i) Atmospheric nitrogen is converted to nitrates by rhizobium bacteria in the nodules or fixation by lightning.

- (ii) Nitrates are taken up by plants.
- (iii) Nitrogen compounds form plant tissues.
- (iv) Plants are eaten by animals or die and decay.
- (v) Ammonium compounds are converted into nitrates by bacteria.
- (vi) Animals release nitrogen compounds through urine and dung.

**WORK TO DO**

1. (a) What is soil fertility?  
(b) List six nutrients which are taken by plants in large amounts.
2. (a) Name ways in which soil can lose its fertility.  
(b) What are the symptoms or signs of nitrogen deficiency that can be observed in growing plants?
3. (a) What are the reasons for collecting soil samples for testing?  
(b) Outline the procedure followed when collecting soil samples for testing.
4. (a) What is a fertiliser?  
(b) Name four types of organic fertilisers.  
(c) What are the functions of organic fertilisers in the soil?
5. Name three types of inorganic or artificial fertilisers.
6. Differentiate between a straight fertiliser and a compound fertiliser.
7. Name the different methods that are commonly employed in applying fertilisers to crops.
8. (a) What is liming?  
(b) Name five advantages of liming.
9. With the help of diagrams, describe the carbon and nitrogen cycles.
10. (a) Why are phosphatic fertilisers applied during planting of crops?  
(b) State five advantages of the inorganic fertilisers compared to the organic ones.  
(c) What determines the quality of organic manure.