Theme 1: Forage production and pasture management

SOIL FERTILITY MANAGEMENT

Level 1 – Part I

Topic	Training & information Content
1.1	Planning of fodder/feed requirements for the dry season
1.2.1	Integrated soil fertility management I
1.2.2	Integrated soil fertility management II
1.3	Use of natural resources, compost making, farmyard manure, manure storage and use
1.4	Growing maize and sorghum for fodder and estimating time of harvest and yield
1.5	Brachiaria, Panicum, & Napier (cut and carry) grass management
1.6	Growing fodder trees and use of feed
1.7	Estimating of dry matter content, feeding value and yield of various fodder crops
1.8	Guidelines for Tropical pasture management and grazing management
1.9	Scaled mechanization of forage production and pasture management (harvesting practices)
1.10	Operating farm equipment and self-propelled tractors
1.11	Mechanization of feeding management
1.12	Economics of forage and pasture production

Soil Fertility Management (Level 1 – Part I)

Learning Activities - You will learn about:

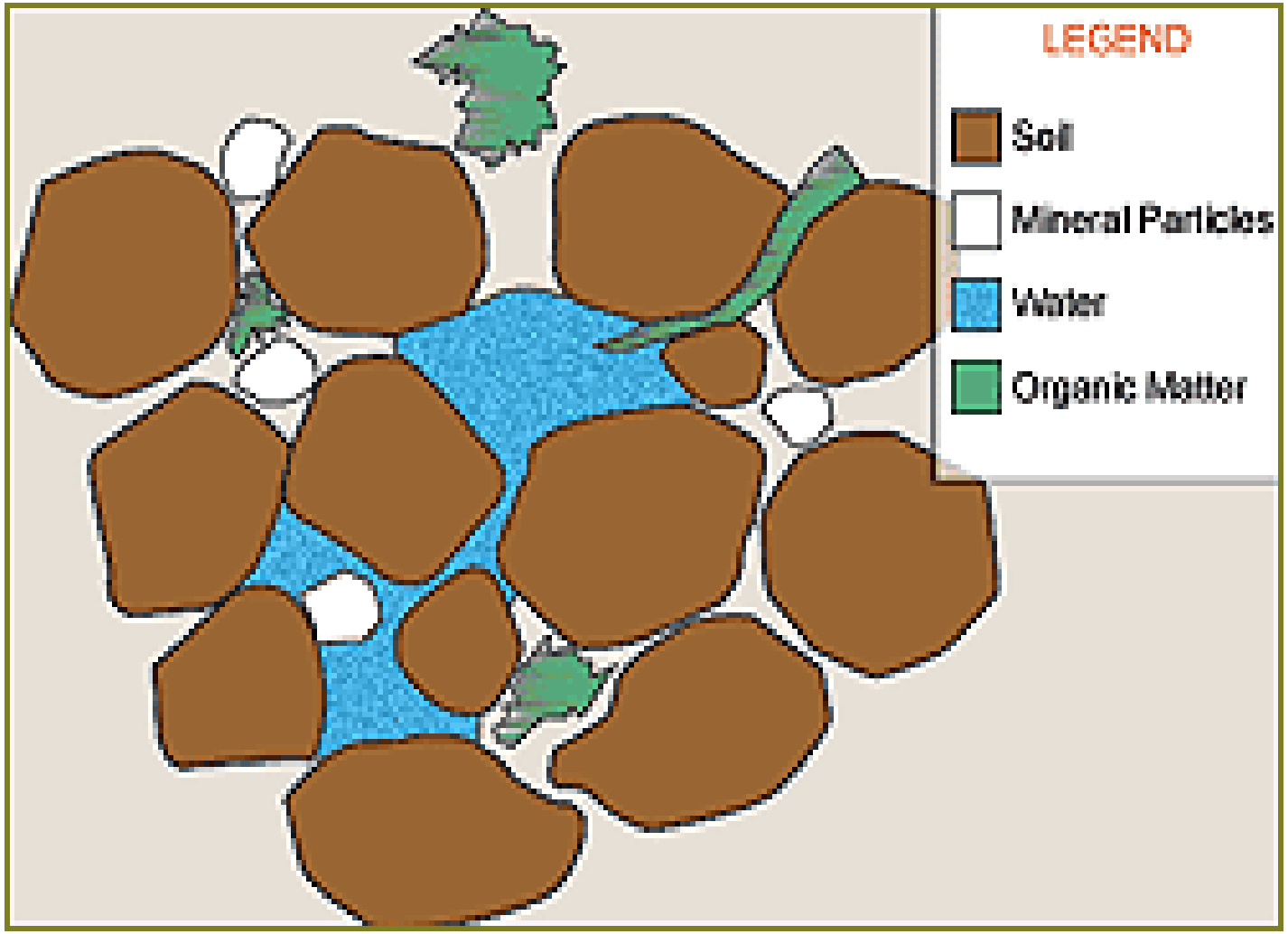
- Key characteristics of Soil
- Soil organic matter, its benefits and sources
- Soil sample collection for analysis
- Plant nutrients

Soil Fertility Management (Level 1 – Part I)

Introduction

- Soil can be living or dead. A living/healthy soil has:
  - Minerals (Sand, Silt and Clay)
  - Organic matter
  - Water
  - Oxygen

- Only a healthy soil is viable for crop farming.



Soil Fertility Management (Level 1 – Part I)

Characteristics of Soil

i. Physical Characteristics

Soil Texture

- Soil texture varies, hence we have Sand, Silt and Clay.

Sandy soil

Loam

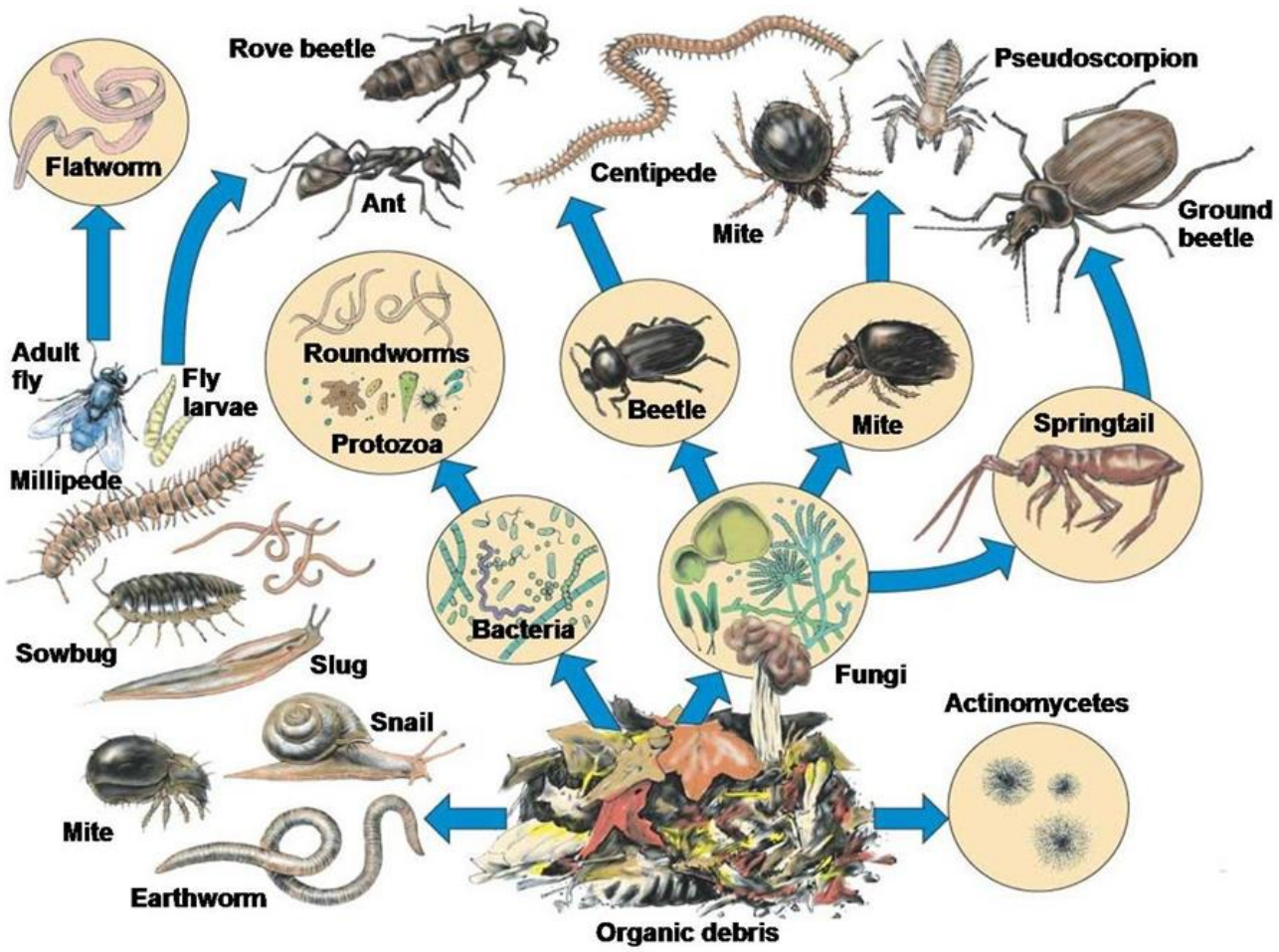
Clay

Soil Fertility Management (Level 1 – Part I)

ii. Biological Characteristics

Soil Organisms

- Soil rich in organic matter is a good environment for living organisms.
- The organisms benefits the soil; keep plants well supplied with nutrients.
- If soil organisms aren't present and active, more fertilizers will be needed to supply plant nutrients.



Soil Fertility Management (Level 1 – Part I)

Soil fertility: Soil Organic matter (SOM)

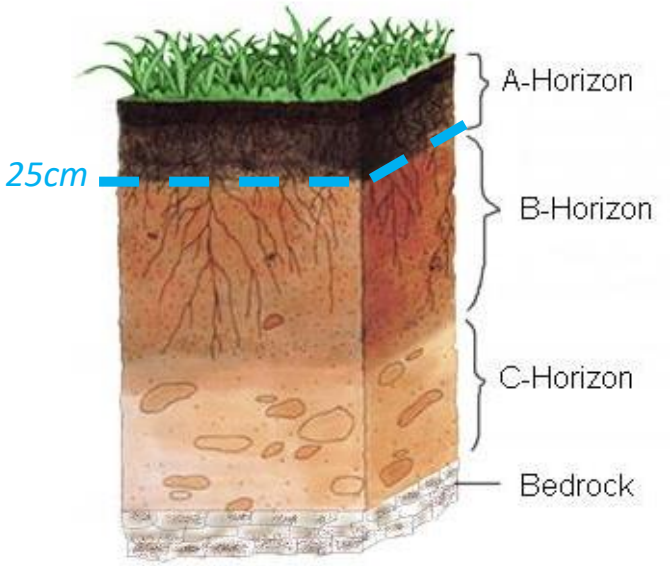
Benefits of Soil Organic Matter (SOM)

- Soil organic matter gives an indication of the measure of a soil's ability to supply nutrients for plant growth

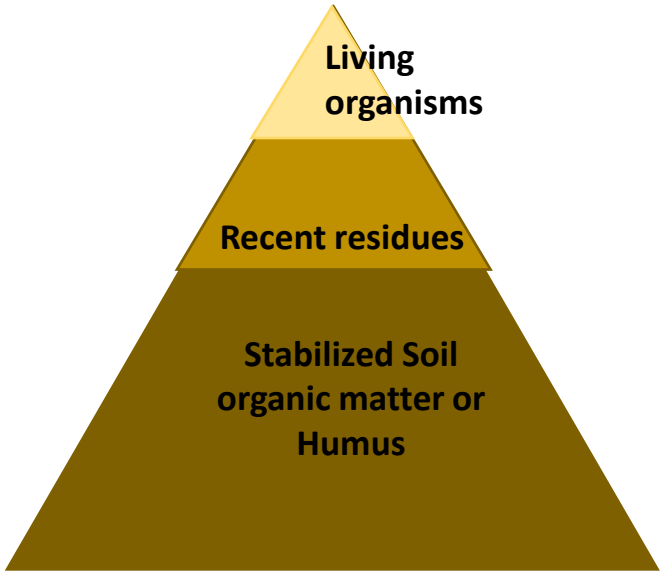
Important: *Enhance soil organic mater and soil organisms.*

Soil Fertility Management (Level 1 – Part I)

- Organic Matter is especially critical for soil functions and quality in horizon A



- A fertile soil has organic matter that: -
  - improves soil structure
  - improves soil moisture retention/holds moisture and nutrients
  - regulates soil pH, which determines the ability of nutrients to being soluble and available to plants.



Source: *Adapted from Magdoff and Weil 2003*

Soil Fertility Management (Level 1 – Part I)

Sources of organic matter

- Add to the soil:
  - Living organisms (small worms, bacteria)
  - Green/Farm yard manure
  - Green (cut) plant material
  - Mulch
  - Planting leguminous trees
  - Dead animals
  - Dead material (Crop residues of last harvest)
  - Compost

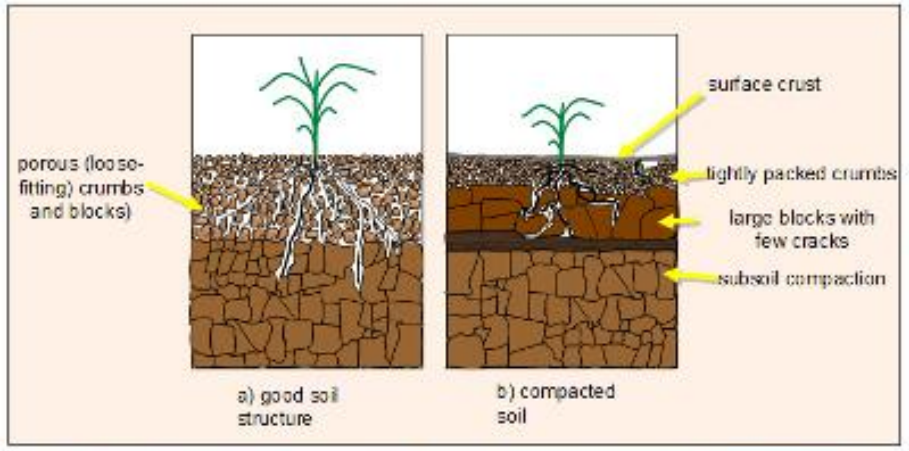
Farm yard manure

Soil Fertility Management (Level 1 – Part I)

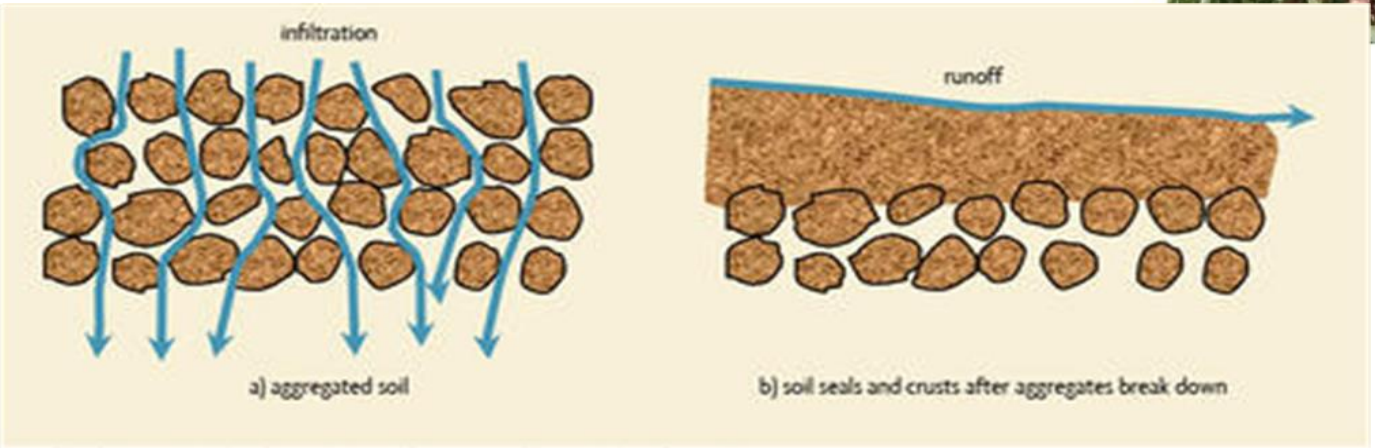
Soil Organic Matter: Compaction

- Soil compaction occurs when soil particles are pressed together. Organic matter in the soil benefits the structure of the soil.

Important: *Avoid soil compaction*



Source: *https://www.waldeneffect.org/20150226soilcompaction.jpg*



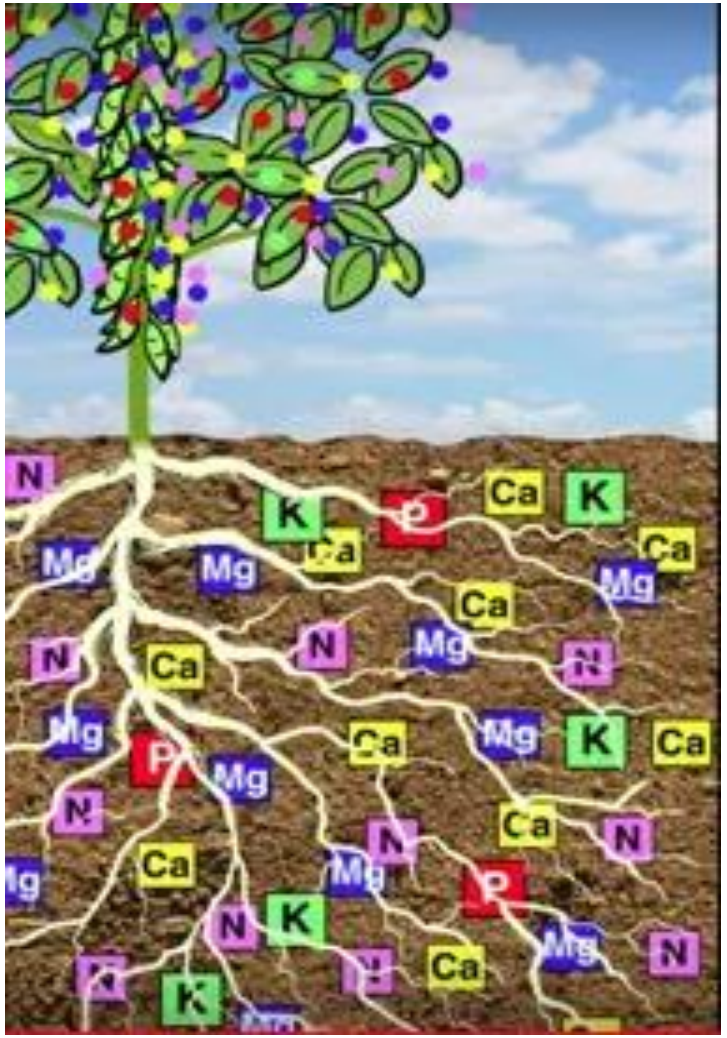
Soil Fertility Management (Level 1 – Part I)

iii. Chemical Characteristics

1. Nutrients

- A fertile soil contains all the major nutrients for basic plant nutrition as those needed in smaller quantities

- Many soils lack all the necessary plant nutrients, in the amounts needed by the plants. Soil sampling and analysis helps identify lacking nutrients in soils



Source: *Plants – and the crops they grow – get their nutrients from the soil they grow in. Crops grown in nutrient-rich soil have higher nutrient content. Illustrator: J. Toomey*

Soil Fertility Management (Level 1 – Part I)

Soil Sampling: How to assess soil fertility

- You will need the following equipment:
  1. Sample bags
  2. Auger or shovel
  3. Bucket
  4. Sample submission forms
  5. Field logbook
  6. Labels or marker pens
  7. Tape measure and;
  8. Mobile testing kit (for soil screening)

Source:
http://t2.gstatic.com/images?q=tbn:ANd9GcQxFNfo5VjNZ7eUukOX0joX9kLlxYKozEMMv9hzXqk3ooK7UazTdyRUAsumQmPLLNREp0GRIw27pplTypRXiAE

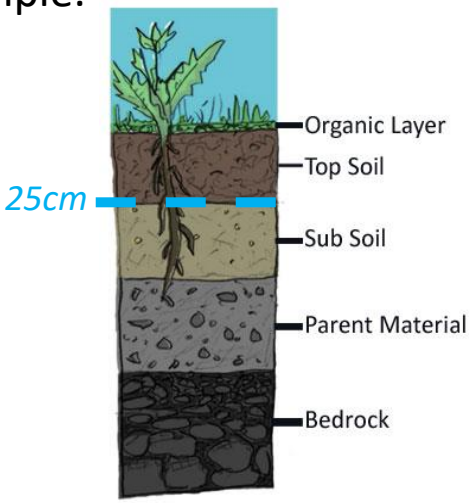
Soil Fertility Management (Level 1 – Part I)

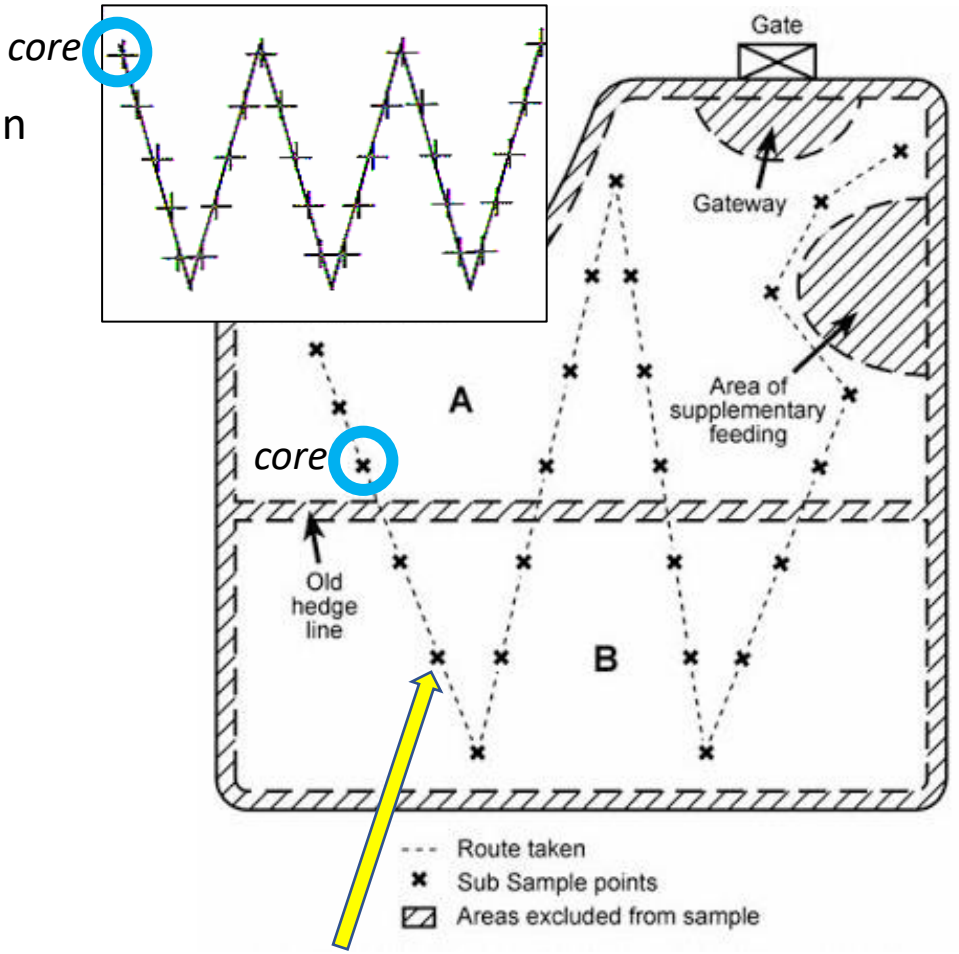
Procedure for Soil sampling

1. One sample should consist of between 20-30 cores taken from the set area of sampling. Take cores from the area in a zigzag pattern as shown in the field alongside
2. Remove surface litter and crop residues. Sample the whole core from the true soil surface to 25 cm depth
3. Place each core in a bucket and mix them thoroughly once you have taken all the cores
4. Fill the soil sample bag half full (**500g**) from this mixed representative sample.

Sampling depth

- 0-25 cm





Zig-zag sampling helps sample each soil type equally (ensures homogeneity). X or + shows number of cores

Soil Fertility Management (Level 1 – Part I)

Sample analyses

- Send the collected sample for analyses. Obtain results and follow the recommendations in the report.

Status Low - *To correct*

Status Adequate - *Just right*

Status High - *Avoid increasing*

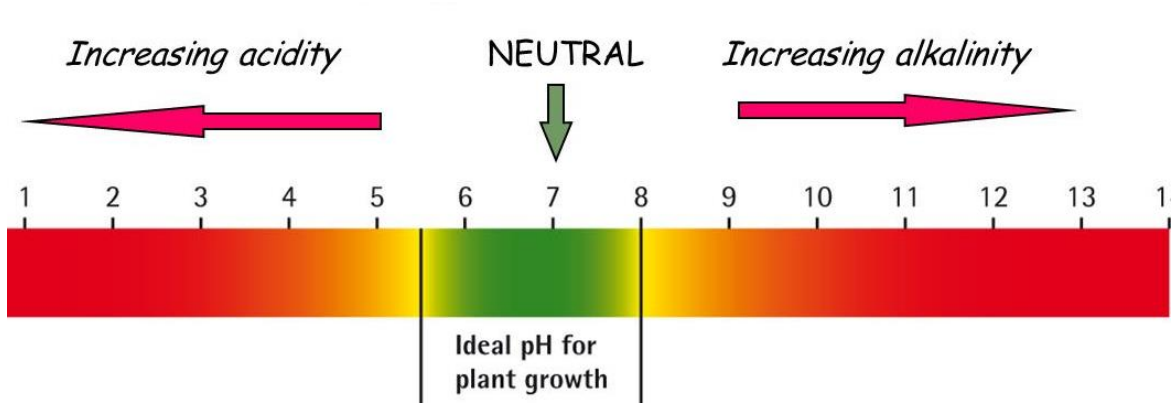
Soil Status

Parameter	Unit	Analysis Result	Range Low	Range High	Low	Adequate	High
pH (KCl)	pH Value	4,4	4,90	6,40	■		
Organic Carbon	g/kg	12,7	20,00	50,00	■		
Total Nitrogen	g/kg	1,1	1,00	2,00		■	
Total Phosphorus	g/kg	0,7	0,20	0,60			■
Total Sulfur	g/kg	0,2	0,30	0,50	■		
Potassium (exch.)	mmol+/kg	8,7	1,50	3,00			■
Calcium (exch.)	mmol+/kg	33,9	15,00	25,00			■
Magnesium (exch.)	mmol+/kg	23,3	4,50	10,00			■
Zinc (M3)	mg/kg	3,9	2,50	4,00		■	
Copper (M3)	mg/kg	4,5	1,00	2,00			■
Cation Exchange Capacity	mmol+/kg	88,7	75,00	200,00		■	
Clay	%	36,8	25,00	50,00		■	
Sand	%	42,5	35,00	55,00		■	
Total Aluminium	g/kg	80,4	56,00	91,00		■	
Total Potassium	g/kg	11,1	9,80	22,00		■	
Total Silicium	g/kg	282,7	250,00	330,00		■	
Total Iron	g/kg	53,4	27,00	72,00		■	
Phosphorus (M3)	mg P/kg	49,1	20,00	40,00			■
Total Manganese	g/kg	689	610,00	2300,00		■	

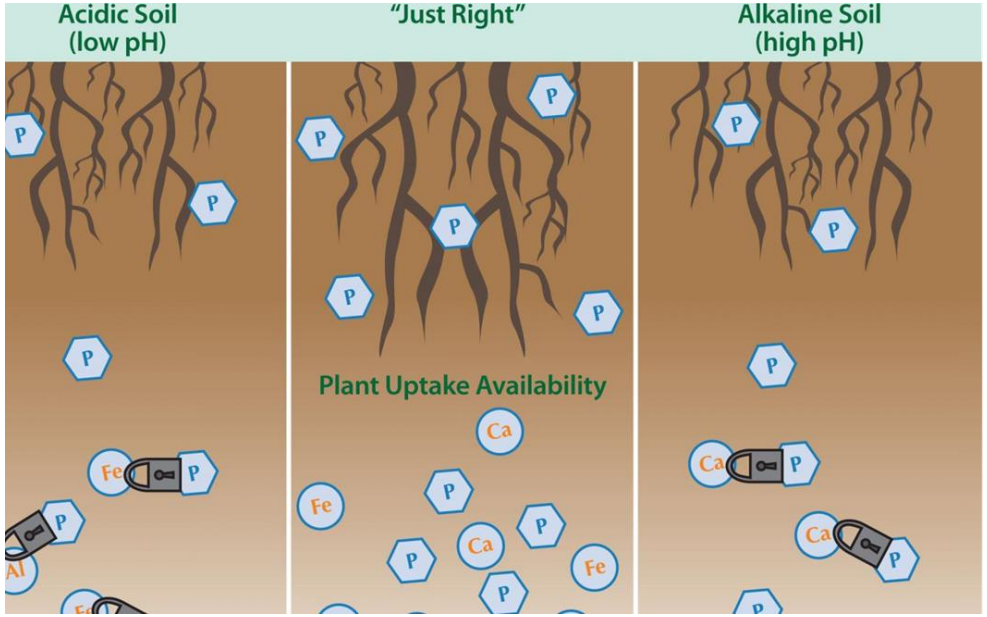
Soil Fertility Management (Level 1 – Part I)

2. Soil pH

- Soil pH is a measure of the acidity and alkalinity in soils



- Soil pH affects availability of plant nutrients e.g phosphorus

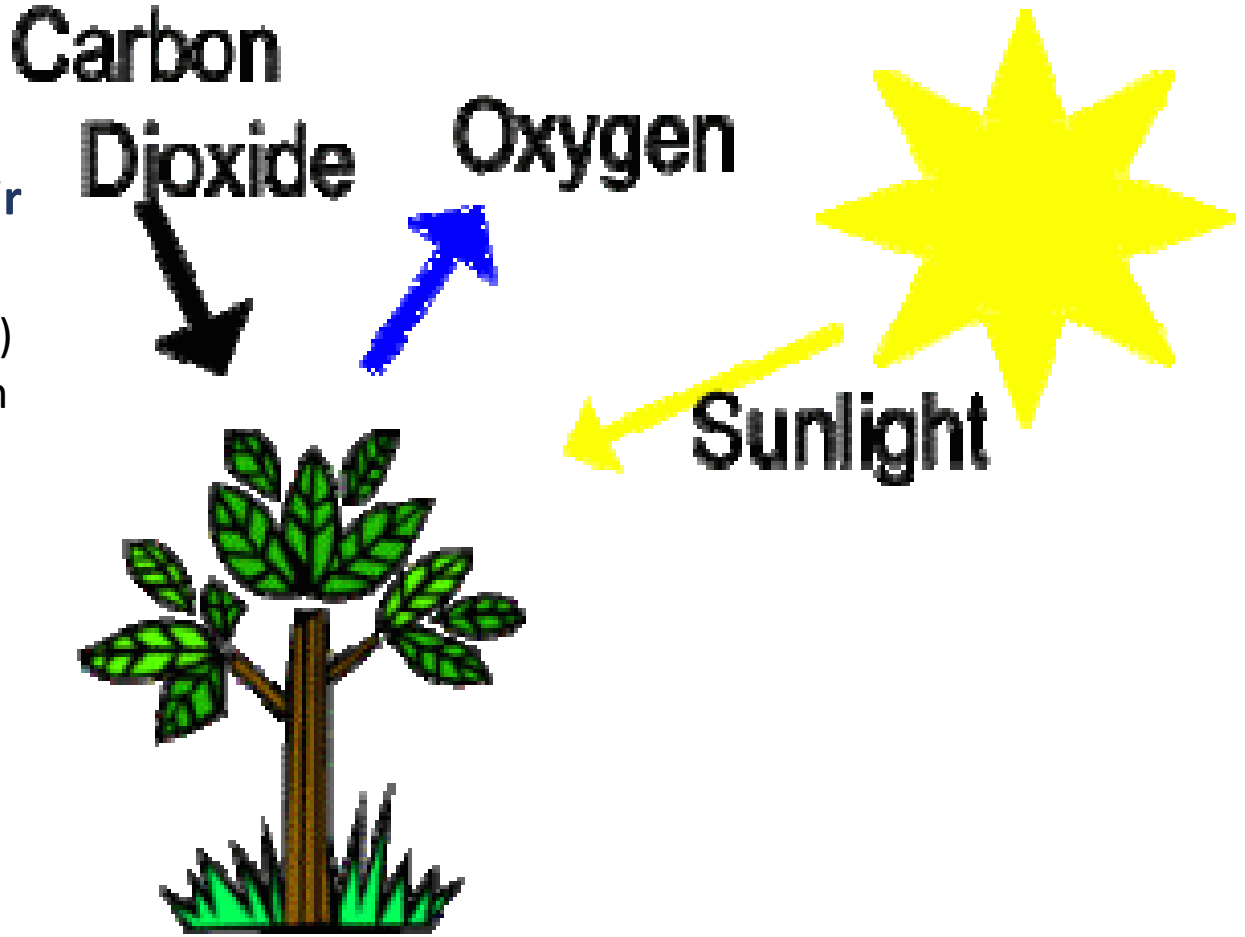


Soil Fertility Management (Level 1 – Part I)

Plant Nutrients

1. Plants can obtain Nutrients from the Air

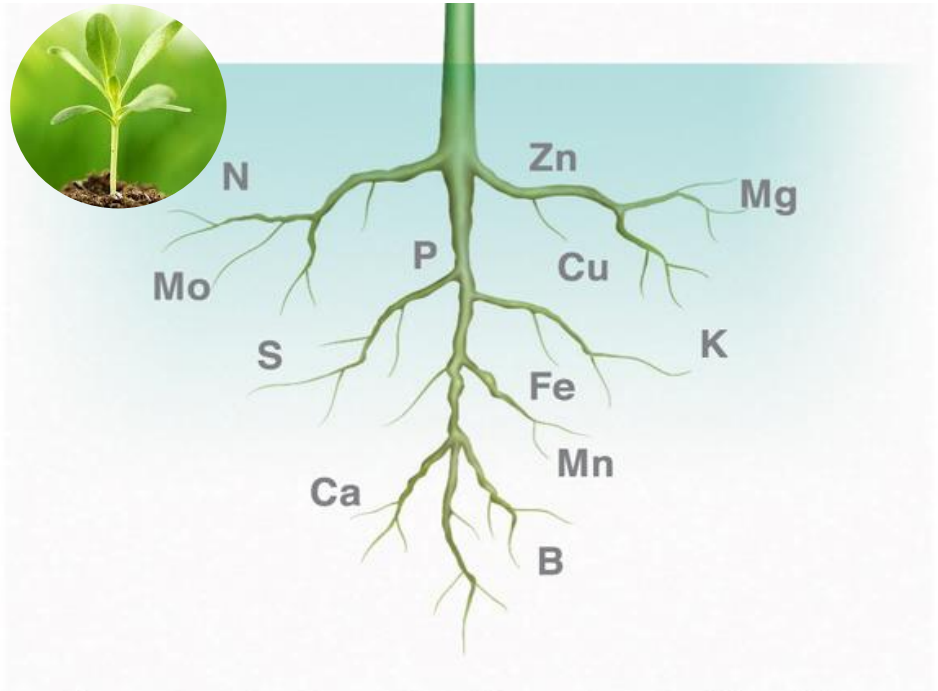
- Plants obtain carbon as carbon dioxide (CO_2) and oxygen partially as oxygen gas (O_2) from the air



Soil Fertility Management (Level 1 – Part I)

2. Plants also obtain Nutrients from the Soil

- **Macro Elements** are nutrients in the soil that are required by plants in large quantities
- **Micro Elements** are nutrients found in the soil that are required by plants in tiny quantities. When they are supplied in large quantities it might be detrimental to the plants



Macro Elements	Secondary Elements	Micro Elements
N - Nitrogen	**Ca -** Calcium	**Fe -** Iron
P - Phosphorous	**Mg -** Magnesium	**B -** Boron
K - Potassium	**S -** Sulphur	**Zn -** Zinc
		Cu - Copper
		Mn - Manganese
		Mo - Molybdenum

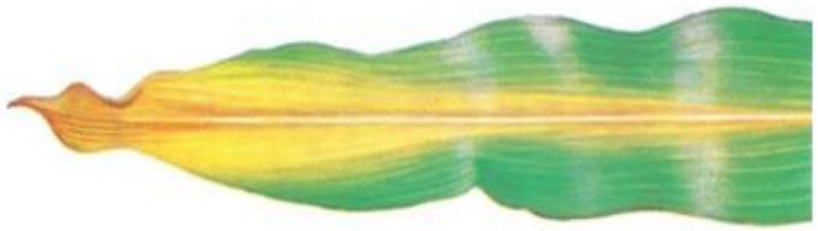
Soil Fertility Management (Level 1 – Part I)

Let's have a quick look at the Macronutrients:

1. Nitrogen (N)

Nitrogen deficiency symptoms

- It produces small, yellow leaves and results in stunted growth. Plants grow poorly.

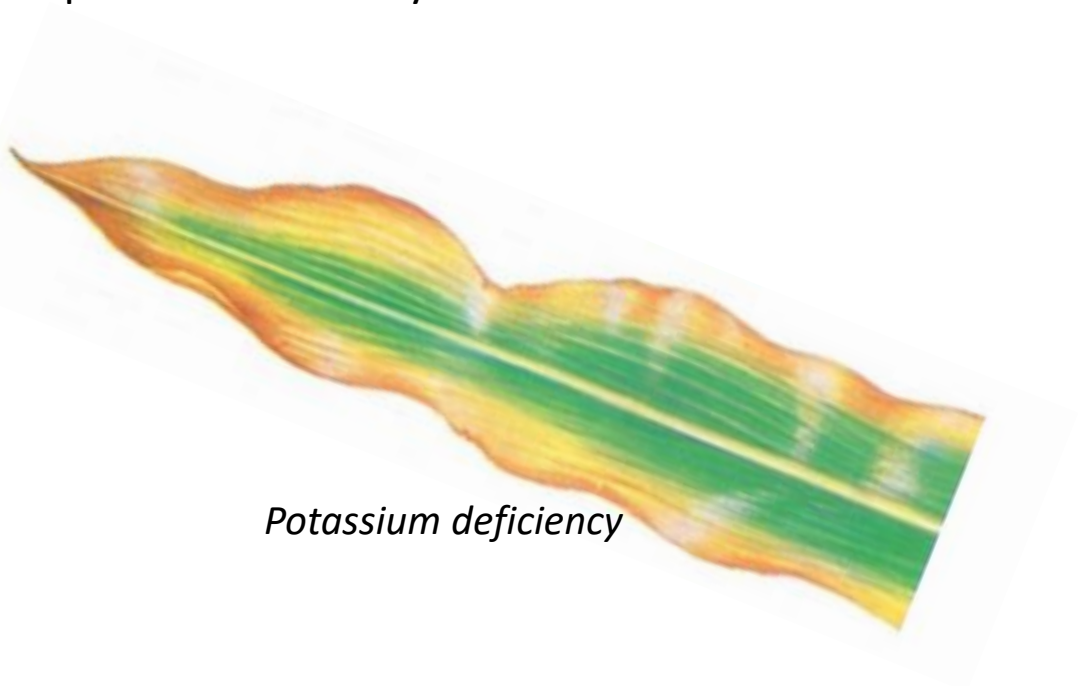


Nitrogen deficiency

2. Potassium (K)

Potassium deficiency symptoms

- Plants die prematurely. Leaf margin or edges of plants tend to be yellowish in colour



Potassium deficiency

Soil Fertility Management (Level 1 – Part I)

3. Phosphorus (P)

Phosphorus deficiency symptoms

- Poor growth and development of plant nob. Poor growth or stunted growth of plants and grass plants tend to have slender/ slim stems

Purple leaf discoloration

Soil Fertility Management (Level 1 – Part I)

Economic effects of nutrient deficiency in crop production

- Low yield of crops
- Poor quality of harvested crops
- Crops are susceptible to diseases and decay
- Loss of market value of crops
- Harvested crops may lack nutrients required for healthy growth when eaten
- Crops may not grow well and may die early without any harvest.