Theme 1: Forage production and pasture management

SOIL FERTILITY MANAGEMENT

Level 3 – Part II

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 3 – Part II)

Learning Activities - You will learn about:

- ❑ Soil fertility management: Preparing and maintaining the soil such that it supplies adequate nutrients, water and air to support growth of crops

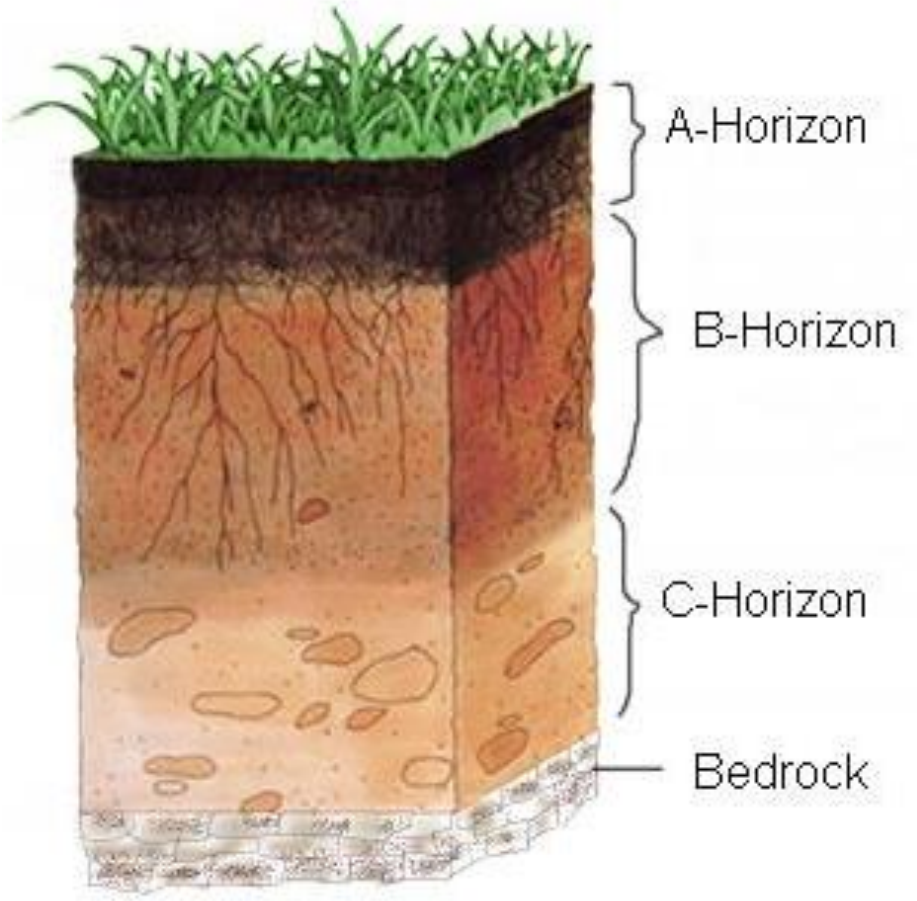
  - Agronomic practices for good Soil fertility management
  - Fertilizer application to plants/crops

Soil Fertility Management (Level 3 – Part II)

Soil tillage to improve grassland

It is important that:

- Soil used for growing grasses has a texture which enables deep rooting
- The land is well drained because quality grasses do not like wet “feet”
- There is enough water for the plant during growing season, whereas under dry and warm conditions, irrigation may be needed



Soil Fertility Management (Level 3 – Part II)

Source: *https://www.agromaster.com/galeri/buyuk/Chisel_Plough_Agromaster%20(1).jpg*

- Soil cultivation is done under dry conditions
- Heavy soils can best be ploughed in dry seasons, light soils with a bit of moisture in the soil
- Chisel plough (ripping the soil) is preferable over disc ploughs
- A ploughing depth of 25-30 cm is sufficient.

Soil Fertility Management (Level 3 – Part II)

Soil Fertility Management

- Soil fertility management is more than just addition of fertilisers or achieving high crop yields alone. It is about what you do to have a rich, stable and living soil

- Soil fertility management is done to naturally enrich the soil, minimize application of fertilizers, soil amendments and irrigation water. This can be achieved through these approaches:
  a) Conserving the soil, organic matter and water from loss
  b) Improving soil organic matter content
  c) Supplementing nutrient requirements and improving the growing conditions

Source: *https://blog.ciat.cgiar.org/how-can-we-measure-the-health-of-soil-simply-and-cheaply/*

Soil Fertility Management (Level 3 – Part II)

From healthy (living) soils to poor (dead) soils

- Some of the causes of poor soil fertility (dying soils) include:
  - Overgrazing which leads to loss of vegetation
  - Erosion: Bare soils encourage high evaporation of soil water as well as water and wind erosion
  - Frequent water application which results in salinity
  - Deforestation that exposes the soil to erosion
  - Monocropping that causes exhaustion of nutrients and soil compaction
  - Burning of crop residues that destroys soil organic matter

Soil Fertility Management (Level 3 – Part II)

Agronomic practices for good Soil fertility management

Good agronomic practices allow the soil to develop characteristics of good health such as:

- Increased soil organic matter
- good soil structure
- deeper water infiltration encouraged by deep rooting grasses
- protection against soil erosion
- efficient nutrient use and improved biological activity.

Soil Fertility Management (Level 3 – Part II)

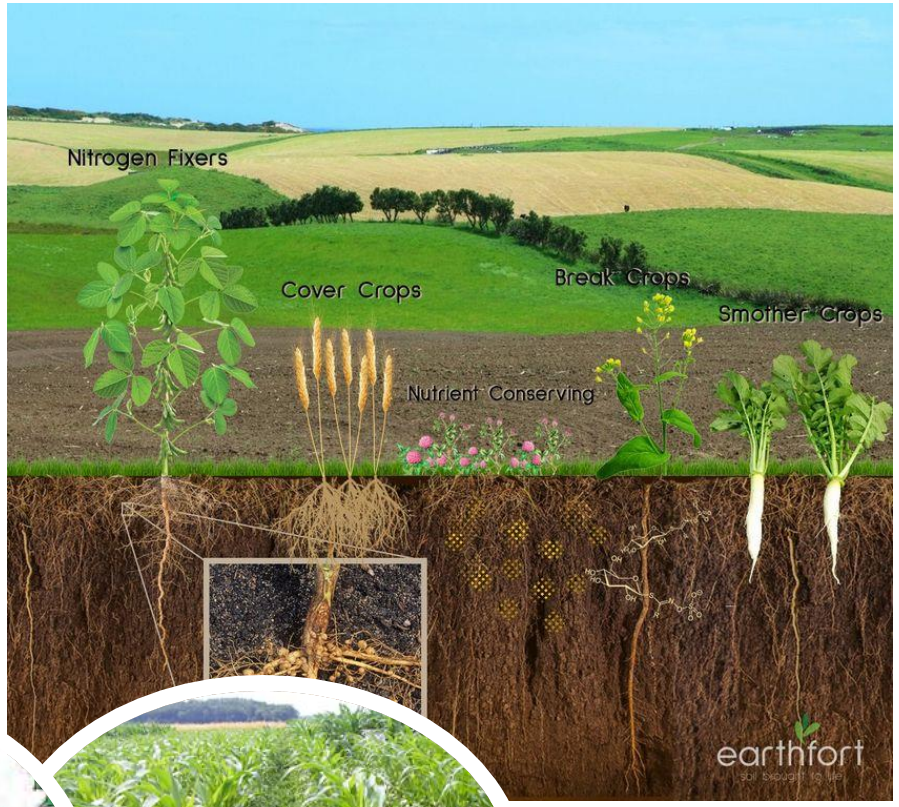
Good Agronomic methods for Improving and efficiently managing soil fertility

- Soil fertility management aims at maximizing the efficiency of nutrients use and improving crop productivity. This can be achieved through:

1. Planting cover crops

- The easiest way to protect the soil from being eroded by wind or water is to keep it covered with living plants called cover crops. Their presence also reduce evaporation of water present in soil.

Note: *Always keep the soil covered as much as possible*



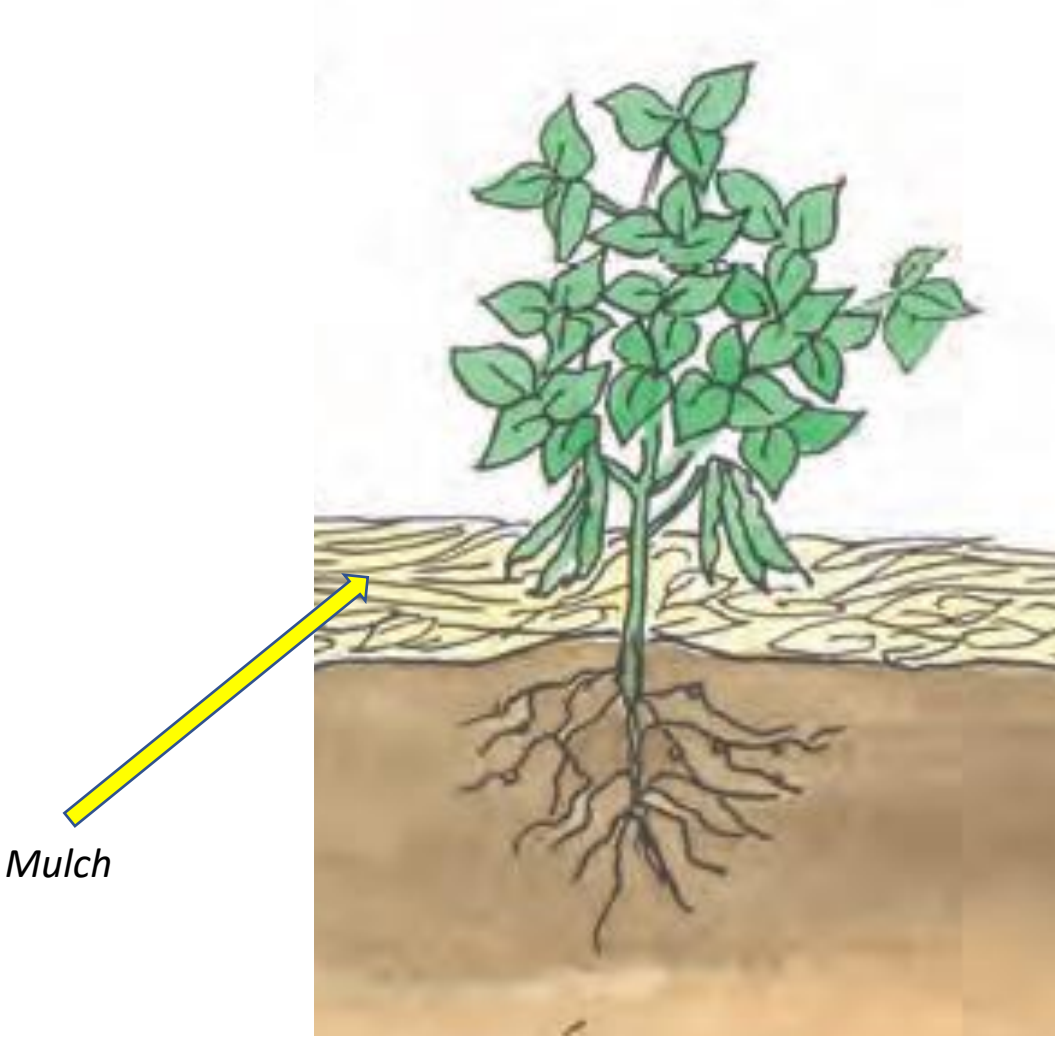
Cover crops

Soil Fertility Management (Level 3 – Part II)

2. Mulching

- Apart from cover crops, you can use dry plant materials such as prunned material from trees, cuttings from hedges, weeds, crop residues and wastes from agricultural and forestry processing to cover the soil

- Mulching helps prevent erosion, keeps the soil humid (reduces evaporation) and thus also enhances soil biological activity.



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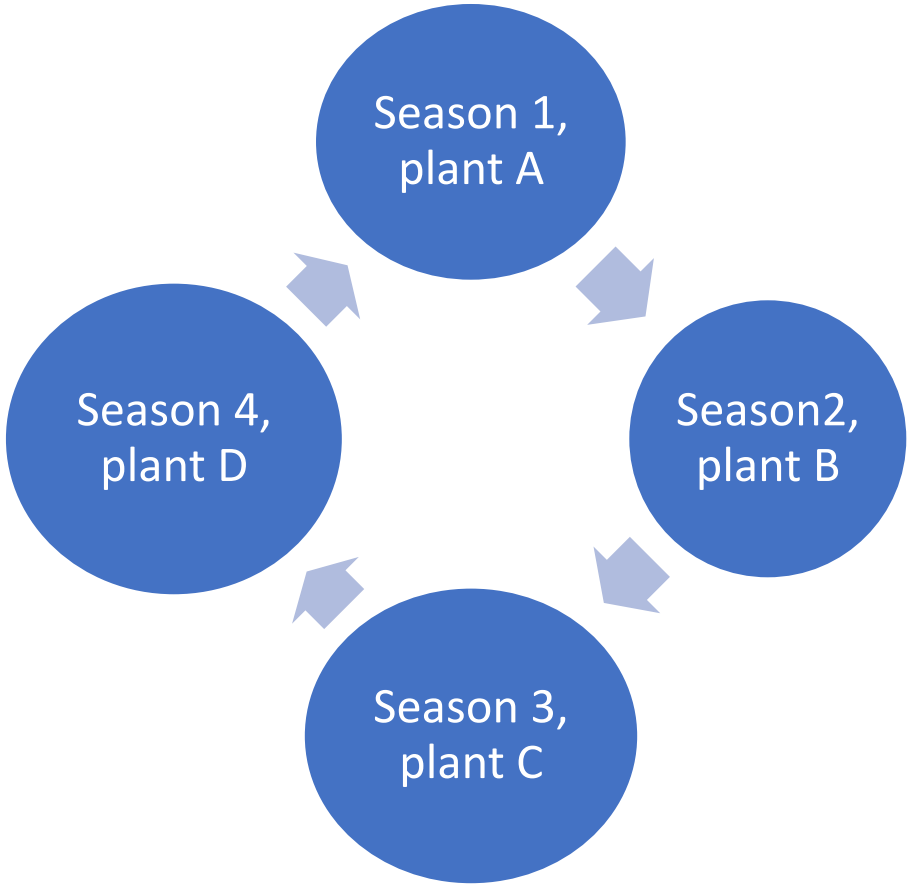
2. Crop rotation

- Involves planting of different crops on the same piece of land in a sequence. This avoids over utilization of soil nutrients by a particular crop.

Note: *Crop rotation keeps the soil fertile and rich of nutrients*



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4. Planting crop as green manure

- It involves the use of for example a leguminous crop that is ploughed into the soil to provide nutrients to the soil.

Soil Fertility Management (Level 3 – Part II)

5. Leave the Land fallow

- This is where a piece of land is made to rest without cultivating any crop on it after some period of time so as to make the soil regain fertility.

Soil Fertility Management (Level 3 – Part II)

6. Application of Fertilizers

- Fertilizers can be used on land to supply nutrients to the soil.

Soil Fertility Management (Level 3 – Part II)

Sources of Plant/soil Nutrients

i. Organic fertilizers

- The are nutrients from natural sources such as plants and animals.
    - Examples of the sources are green manure, farm animal droppings, compost, treated human excrete

Soil Fertility Management (Level 3 – Part II)

ii. Inorganic fertilizers

- These are nutrients synthesized artificially in the factory using chemical substances. These substances are then applied as fertilizer to soil to supply it with adequate nutrients needed for plant growth

Soil Fertility Management (Level 3 – Part II)

Types of Inorganic fertilizers

- Single Fertilizers: fertilizers consisting of only one of the major nutrients. That nutrient may be Nitrogen (N) or Phosphorus (P) or Potassium (K)
  - E.g. Urea (N) Triple phosphate (P) Muriate of Potash (K)

- Compound Fertilizers: fertilizers that are made up of two or more major nutrients present in their appropriate percentages.
  - E.g. NPK 20:20:20 (means 20% Nitrogen, 20% Phosphorus, 20% Potassium)

Soil Fertility Management (Level 3 – Part II)

Nutrients in fertilizers/manures

- Some examples of fertilizers that can be used and their nutrient components are listed below:
  - DAP is Di-Ammonium Phosphate which contains 18% N and 48% P
  - CAN is Calcium Ammonium Nitrate which contains 26% or 27% N
  - SSP is Single Super Phosphate which contains 7-9% P and 18-21% Ca and 11-12% S
  - Lime is Calcium Carbonate which contains $CaCO_3$
  - Rock phosphate contains 30% P and 38% CaO

N=Nitrogen; P=Phosphorus; K=Potassium; Ca=Calcium; S=Sulphur

Soil Fertility Management (Level 3 – Part II)

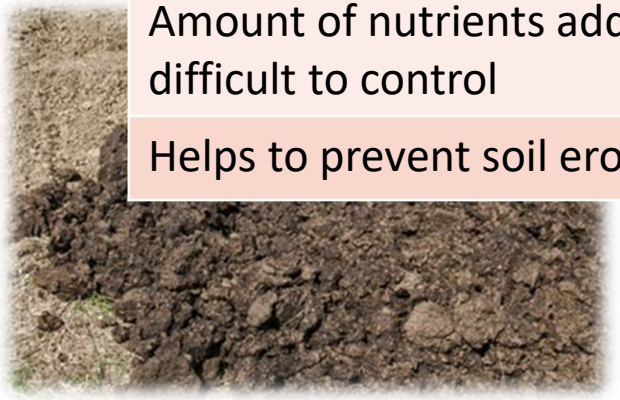
- Cow manure on the other hand contains 12.7% Dry matter (as % of Dry matter) 3.9% N and 0.7% P and 2.6% K

N=Nitrogen; P=Phosphorus; K=Potassium; Ca=Calcium; S=Sulphur

Soil Fertility Management (Level 3 – Part II)

Some differences between organic and inorganic fertilizers

Organic fertilizers	Inorganic fertilizers
Cheap	Expensive
Improves soil structure and texture	Does not improve soil, only provides plant nutrients
Absorbs and holds water	Does not absorb or hold water
Amount of nutrients added to the soil difficult to control	Amount of nutrients added to the soil easy to control
Helps to prevent soil erosion	Does not help against soil erosion



Soil Fertility Management (Level 3 – Part II)

Methods of applying fertilizers

- Broadcasting: is the application of fertilizer uniformly over a piece of land by either hand or by a machine

- Drilling: is the application of fertilizer into holes close to seeds

Soil Fertility Management (Level 3 – Part II)

- Ringing: fertilizers are placed in a circular way around a plant so that it is equidistant from the plant

- Spraying: applying fertilizers in which liquid fertilizers are dispersed on the leaves of crops using a sprayer fertilizer


Ringing

Soil Fertility Management (Level 3 – Part II)

- <u>Side dressing</u>

How to apply fertilizers using side-dressing method:

- Make furrows along the lines of the grass or forage crop
- Apply fresh manure and cover the furrow with soil
- Repeat this after every crop cut/harvest **OR;**
- Apply DAP fertilizer in the furrows
- Cover the furrow with soil

Note: *One bag (50 kg) DAP is enough for 1 acre*

Fertilizer applied into a furrow along the growing grass/crop

Soil Fertility Management (Level 3 – Part II)

- <u>Tumbukiza</u>

- This techniques is borrowed from smallholders.
- To use their small parcels of land intensively they plant high value food crops such as Bananas and coffee in pits, with in the bottom a heavy dose of farm yard manure.

Soil Fertility Management (Level 3 – Part II)

Good practices for fertilisation of pastures

- Before using fertilizers on crops/pastures:
  - Take soil samples before fertilization. This will inform nutrients deficient in the soil and enable you use correct fertilizers
  - Fertilize adequately
  - Use the correct Nitrogen (N) source

Note: *Forages/pastures like Brachiaria grass can grow on low fertility soils but with lower levels of production. Therefore higher and more frequent fertilizer applications are necessary on low fertility acid soils*

Soil Fertility Management (Level 3 – Part II)

Fertilisation

- For the initial fertilization during planting use a phosphorus dominated fertilizer such as DAP to support root development

Soil Fertility Management (Level 3 – Part II)

- Subsequent applications should be done annually with nitrogenous fertilizer at a rate of 100 kg/ha of calcium ammonium nitrate (CAN)
- Fertilizer application should be done after rains when the soil is wet enough to dissolve the fertilizer; alternatively, use irrigation
- Preferably, application should be after harvesting when the soil is wet, for regrowth.

Fertilizer applied on a wet soil

Soil Fertility Management (Level 3 – Part II)

Factors influencing fertilizer application

- **Soil fertility**: some soils are naturally more fertile than others and have a lower fertilizer requirement
- **Rainfall:** the more water a crop has at its disposal, the higher the yield and the more nutrients will be needed
- **Pasture crop:** the species and cultivar(s) in the pasture play an important role as every species has its own unique characteristics and requirements

Soil Fertility Management (Level 3 – Part II)

- **The type of animal:** it is inefficient to use high quality pastures for animals such as dry cows that can be kept in the required condition with much cheaper rations. Animals such as milk cows, young growing cattle, that are being fattened mostly have a need for better quality grazing and are usually able to use these pastures.

Note: *Poorly fertilized pastures cannot meet the requirements of these high producing animals, hence the fertilizer application rates will partly be determined by the type of animal and the system in which the pasture will be used.*

Soil Fertility Management (Level 3 – Part II)

General rule of thumb for fertilizer application

Based on the three main nutrients for crops (NPK)

- **Nitrogen (N)** application is: 0.2-0.25 kg N fertilizer for every 1 mm rainfall, in other words 100 kg N per hectare for a 500 mm rainfall zone

- **Phosphorus (P):** Phosphate removal from the soil can range from 1 kg/ ton DM produced (poor grazing) to 3 kg / ton DM produced (intensive used pasture). If plant material is cut and removed, P should be replaced.

- **Potassium (K)** removal ranges from 15 kg/ton (poor grazing) to 25 kg/ ton DM produced (intensively used pasture). Where plant material is removed, it would be necessary to replace the removed K.

Picture source: https://5.imimg.com/data5/ML/PF/BW/SELLER-45489165/npk-fertilizer-1kg-500x500.jpg

Note: *More general to maximize Dry Matter yield per acre, annual fertilizer applications of between 250 300 kg/ha of NPK fertilizer are recommended.*

Soil Fertility Management (Level 3 – Part II)

Take Home Message

- When soil is exploited for crop production without fertilisation (restoring the organic matter and nutrient contents as well as maintaining a good soil structure) the nutrient cycles in the soil are broken, soil fertility declines and the balance in the agro-ecosystem is destroyed.

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