Theme 1: Forage production and pasture management

USE OF NATURAL RESOURCES, COMPOST MAKING, FARM YARD MANURE, MANURE STORAGE AND USE (Level 3)

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

1. You will learn about (learning objectives):

- ❑ Important of conserving natural resources.
- ❑ Ways of conserving natural resources.
- ❑ Recycling waste in a dairy farm.

2. Introduction

- Dairy farming depends on many natural resources from the environment.
- All these resources should be well managed to ensure productivity and longevity.
- Poor management contributes to wastage of natural resources through pollution.
- Adoption of climate-smart farming systems helps conserve natural resources.

3. Why conserve natural resources?

- Sustainable livestock production without negatively impacting future production systems can be practised through:
    i. Improving productivity without affecting natural resources and environment at large.
    ii. Minimizing waste through recycling i.e. compost making.
- Sustainable livestock production and management of natural resources helps reduce production of greenhouse gases e.g. methane.
- Methane is a major greenhouse gas that contributes to global warming.

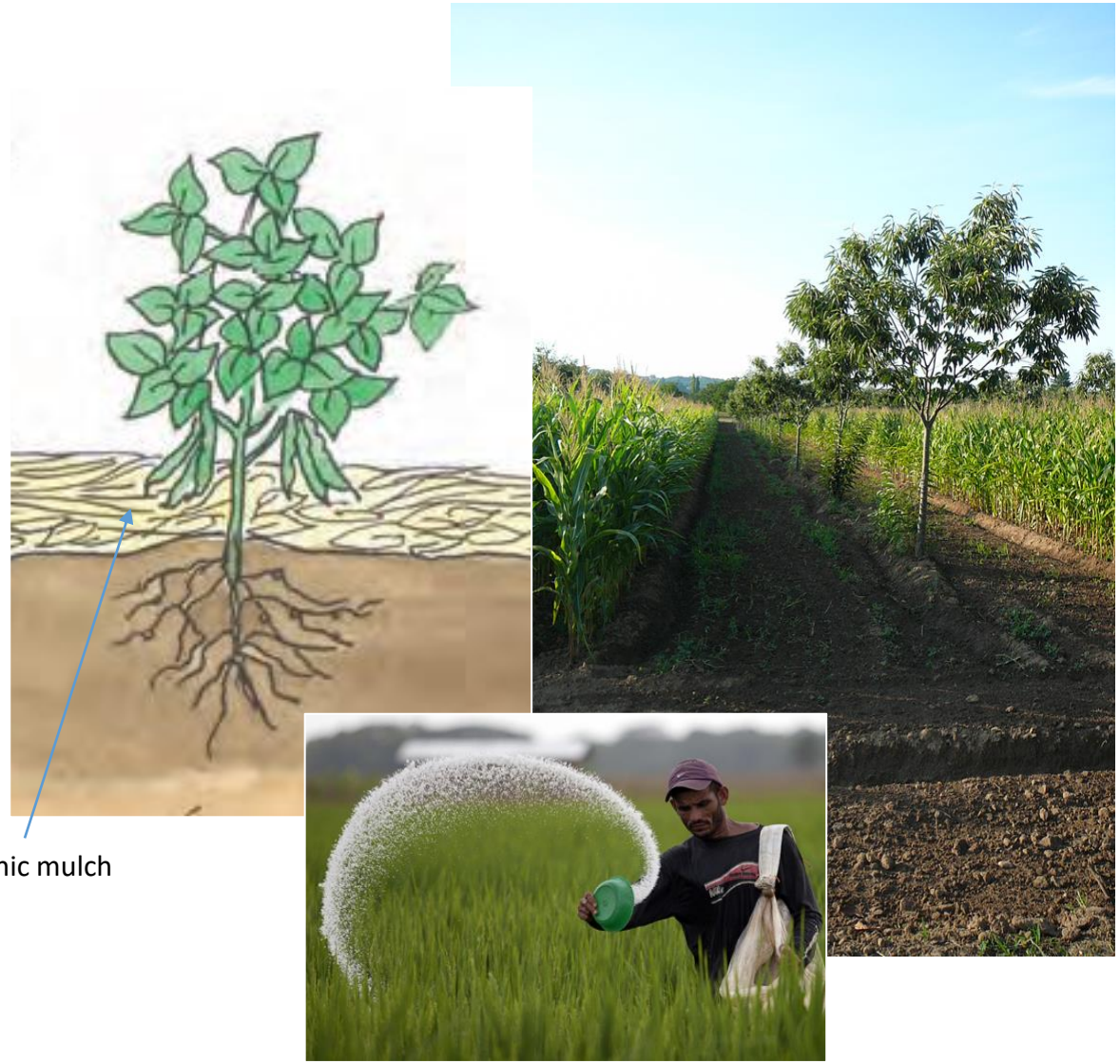
4. How to conserve natural resources

- This is achieved by;

    i. Reducing soil erosion.
    ii. Avoiding pollution of water and soil.
    iii. Reducing deforestation.
    iv. Encouraging biodiversity.
    v. Reducing global warming.
    vi. Managing energy sources.

5. Sustainable farming practices

- Adopting pasture management & sustainable grazing practices to prevent overgrazing.
- Using organic manure and mulch to add nutrients to soil.
- Where inorganic fertilizers are used, they should be applied at recommended rates (soil test results of land).
- Improving water management during farming operations and encourage recycling.
- Minimum tillage to avoid excessive use of soil implements causing hard pans.
- Intercropping and crop rotation, preferably with leguminous crops/trees.



Organic mulch

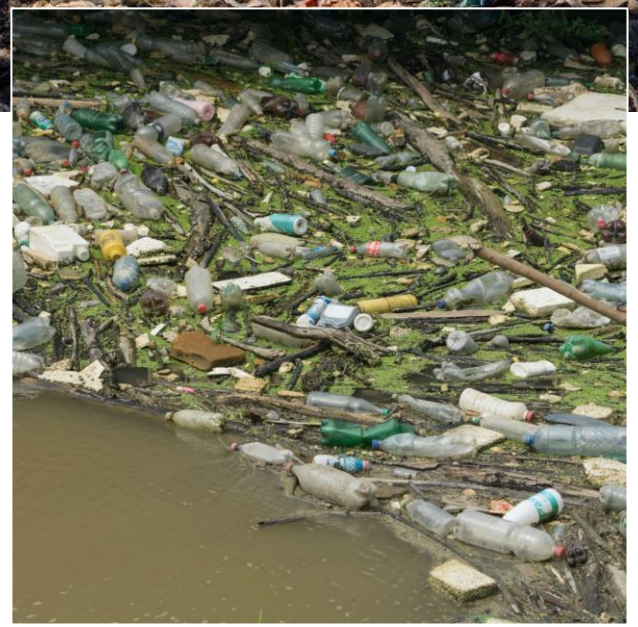
Apply inorganic fertilizers at recommended rates

6. Soil erosion

- Unsustainable farming practices results to soil erosion hence nutrient depletion.
- Erosion in the arid and semi-arid regions is mostly caused by overgrazing, a result of overstocking.
- Overstocking in the long run leads to slow re-growth of pastures due to increased soil compaction.
- Grazing during regrowth of pastures impacts plant growth and yield in the long term.
- Reduction in soil cover also exposes the soil to massive erosion.
- Soil degradation can be slowed by better management of natural resources through adoption of sustainable production practices.

7. Water and Soil pollution

- Decrease in land and water potential over time (water-shed degradation) is influenced by overexploitation of natural resources and increased human activities.
- Other common causes of water & soil pollution include:
  - Careless waste disposal
  - Poor & unregulated fertilizer application.
  - Poor farming activities.
- All these factors exposes water & soil to pollution.



8. Impact of water & soil pollution

- Polluting water and soil have a counteractive effect on farming practices as we depend on them for production activities e.g.;
  - Food safety of farm products i.e. pesticide residue in food.
  - Health concerns that can cause disease to both human and animals alike disrupting reproduction and productivity.
  - Disruptions of fishing activities.

9. Deforestation

- Deforestation of most forests in Uganda is caused by;
  - Unregulated harvesting of forest products i.e. tree logging.
  - Charcoal burning for fuel.
  - Agricultural production.
- Activities such as extensive cattle production activities (ranching), pushes livestock production to forest areas.
- Deforestation releases a great percentage of carbon-dioxide into the atmosphere contributing to global warming.
- Deforestation can lead to desertification in the long run.

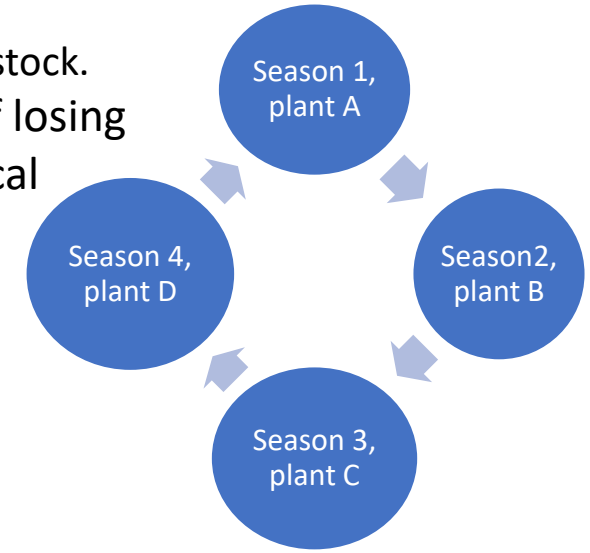
9.1 Deforestation Cont'd…

- Trees are considered carbon sinks due to their ability to absorb carbon from the atmosphere than it releases.
- Trees absorb CO_2 from the atmosphere through photosynthesis and deposit it as biomass to branches, leaves etc.
- Forests and trees in general should be greatly conserved by the farming community.
- Prevention against deforestation should be taken seriously, as forest recovery is quite expensive in that it takes a long time to regenerate.

10. Enhancing biodiversity

- Biodiversity in farming can be encouraged by promoting a variety of practices such as:
  - Encouraging crop rotation (mixed farming) with the aim of reducing overreliance on fertilizers and managing pest & diseases.
  - Encouraging use of integrated pest management practices.
  - Search for alternative sources of feed i.e. indigenous plants & trees.
  - Considerations in genetic selection for livestock.
- Managing crossbreeding reduces impact of losing local breeds that are adapted to diverse local climatic conditions.

Genetic selection of bulls for crossbreeding



Crop rotation

11. Global warming

- Global warming is caused by human activities that lead to burning up of fossil fuel.
- This leads to rise of global temperatures due to increase in the concentration of greenhouse gases (CO_2 and other air pollutants) in the atmosphere.
- Methane expulsion by livestock as a result of fermentation in the gut contribute to the total greenhouse gases.

11.1 Global warming Cont'd…

- Contribution of livestock towards global warming varies upon various factors.
- Beef animals are said to produce more CO_2 compared to dairy animals.
- This is influenced by various factors such as fermentation, feeding and manure production & management.
- Products of fermentation greatly contributes to CO_2 emissions.
- Forest regeneration goes a long way to lower the risk of climate change.

12. Management of Energy sources

- Energy sources in dairy farming can be managed and utilized efficiently through;
  - Adoption of forage crops that are also a source of fuel.
  - Use of bio-digesters in farms to produce energy, resulting from partial confinement hence waste collection is also made easy.
  - Adopting energy plantations of selected species of shrubs and trees that are a source of fuel & foliage. This energy plantation also aids in nitrogen fixation i.e. Leucaena & Gliricidia.

Leucaena

Biodigester feeder

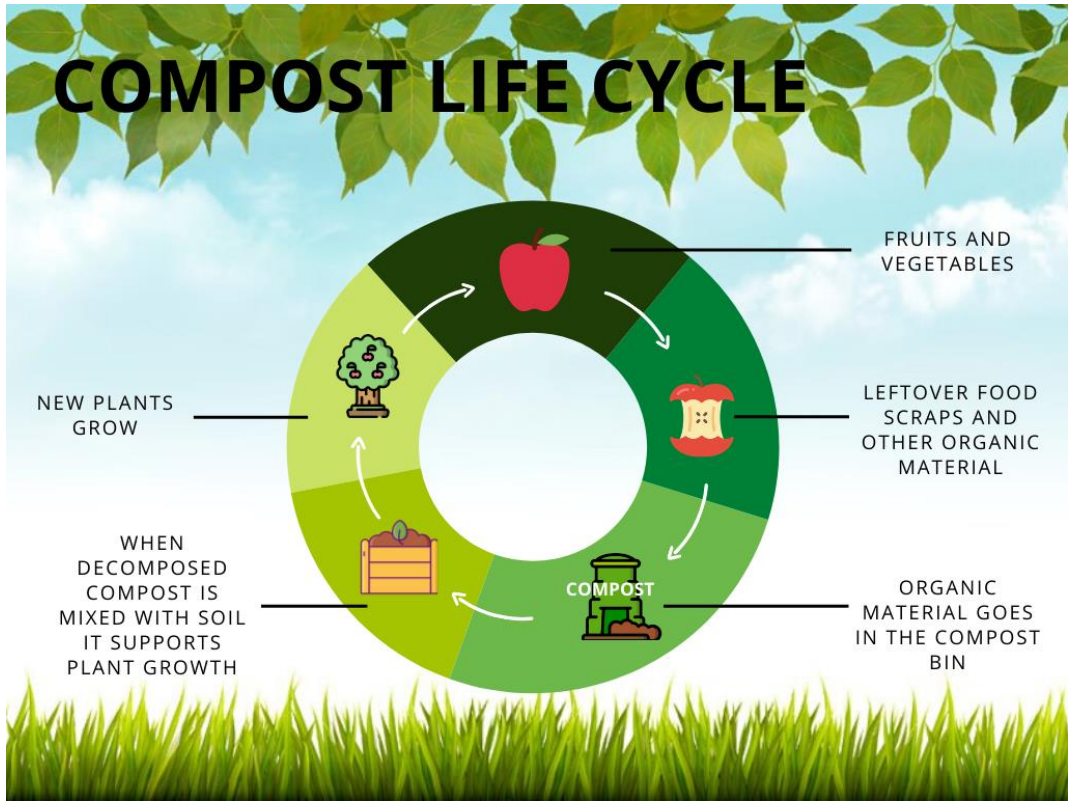
13. Recycling resources in dairy

- **T**he ultimate way that dairy farmers can effectively manage their resources sustainably is by adopting recycling.
- The number one recyclers in a dairy farm are cows as they convert feeds that humans cannot utilize to a form fit for humans.
- Farmers can practice recycling by:
  - Recycling dung to farmyard manure.
  - Using methane digesters to convert waste to energy.
  - Recycling or treating water from cow sheds for irrigation.
  - Compost making.
- Natural resources are key components for waste recycling processes i.e. compost making.

Compost making

13.1 Advantages of Waste recycling

- Cheap source of nutrients to plants and animals. Food waste (mainly vegetables) are a source of feed to animals.
- Reduces waste accumulation.
- Wastes can be raw materials for creating a more stable form/product.
- Improves soil fertility when returned to the soil.
- Offers alternative source of energy e.g. bio-digester.



14. Recycling water

- A lot of water is used in dairy farms for various production purposes and as drinking water.
- Water harvesting and recycling are key water handling and management practices.
- Proper storage ensures water is not contaminated before use.
- Water recycling involves re-distributing already used water to aid in other purposes instead of disposing it.
- Example involves reusing water from milking area to irrigate fields as long as it has no detergents.

15. Biodigester (Biogas)

- Biodigesters store farm waste (manure). This is mixed with water and after the solution ferments, it gives end products.
- Organic fertilizer and methane is produced.
- Gas produced is directed to produce fuel for cooking and heating water. Organic fertilizer produced is used in place of chemical fertilizers.
- Biodigesters also generate mechanical electricity that can be used to run large machines.
- Adoption of biodigesters reduces use of solid fuel.

16. Farm yard manure (FYM)

- Farmyard manure (FYM) is quite an important and great source of organic fertilizer.
- It basically involves storing together the bedding material, dung and urine collected from animal housing.
- It is the cheapest source of fertilizer.
- FYM takes time but the longer it stays the better the quality due to good decomposition.

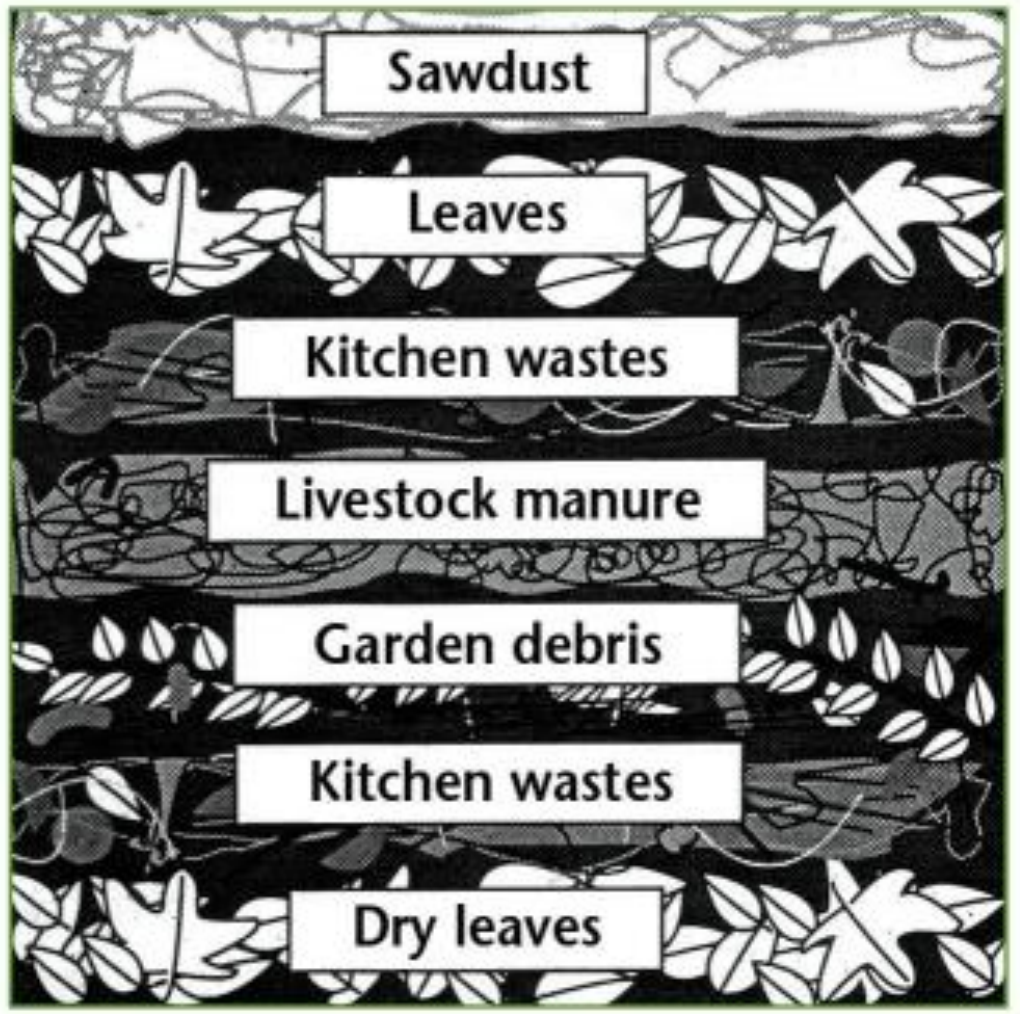
17. Compost making

Ingredients for a good compost

- **Plant materials** - any plant materials including weeds and grasses.
  - Dry (brown) plant material i.e. plant straws (wheat)
  - Wet (green) plant material i.e. vegetable leftovers
- **Animal waste** i.e. cow dung, chicken droppings (rich in Nitrogen).
- **Water** - to maintain decomposition without causing anaerobic conditions. Can also be urine.
- **Air** (oxygen) - to oxidize the carbon.
- **Carbon** - source of energy for living organisms in the pit.
- **Nitrogen** - grows and reproduces more organisms to oxidize the carbon.

18. Making compost manure

- Select site for the pit and clear the ground around, best if near the farm.
  - Site should be well drained to prevent water logging.
  - Site should be accessible for easy loading and offloading.
  - Consider direct of wind.
- Dig a pit about 1 meter deep, height should not be too high to avoid materials being compressed by its weight.
- Place organic material in layers with most fibrous plants at the bottom to facilitate drainage.



19. Compost pits for large farms

Designing an open compost windrow

- Mostly used for production in large volumes by farms/industries.
  - Shred the raw materials .
  - Mix all raw materials and manure on the ground.
  - Pile organic material and biodegradable waste (manure and plant residues) in rows.
- Windrows are turned regularly for air distribution within the compost.

20. Factors to consider when designing a compost pile

- Aerobic compost piles should be loosely stacked to allow space for flow of air.
- Avoid making the pile too low as heat will be lost fast affecting decomposition.
- Small piles loose moisture excessively.
- Size of the pile/windrow can be adjusted to fit climatic conditions of the region:
    - Cold weather: size can be increased to offer higher temperatures.
    - Hot weather: size can be reduced to reduce temperature from being too high.

21. Balancing factors inside the compost pit

- Excess water - Causes bad smell as a result of materials rotting in the pit.
- Excess air and limited water - Materials in the pit dry up and do not decompose to be compost.
  How to correct: Add water to the pit.
- Excess water and inadequate air - Nitrogen is converted into ammonia making the pit to smell.
  How to correct: Add dry plant material and turn materials in the pit.
- Balanced moisture - Rate of decomposition in the pit is best facilitated.
- Turn materials in the pit for aeration purposes using a long stick.

22. Carbon, Nitrogen ratio balance (C:N)

- The C:N ratio should be balanced with considerations that more carbon is required for the process than Nitrogen.
- It is desirable to keep the C:N ratio above 30 (30:1) when composting animal waste (droppings/feaces and urine).
- Decomposition of organic matter is facilitated by living organisms that use carbon as energy source and nitrogen for building their cell structure.
- However excess carbon causes decomposition to decrease when nitrogen is used up, making some living organisms to die.

Table 2. Average Carbon: Nitrogen Ratios		
Food scraps	15:1	Green
Grass clippings	19:1	
Coffee grounds	20:1	
Rotted manure	25:1	
	30:1	Ideal
Corn stalks	60:1	Brown
Leaves	40-80:1	
Straw	80:1	
Paper	170:1	
Sawdust, wood chips	500:1	
Actual content may vary.		

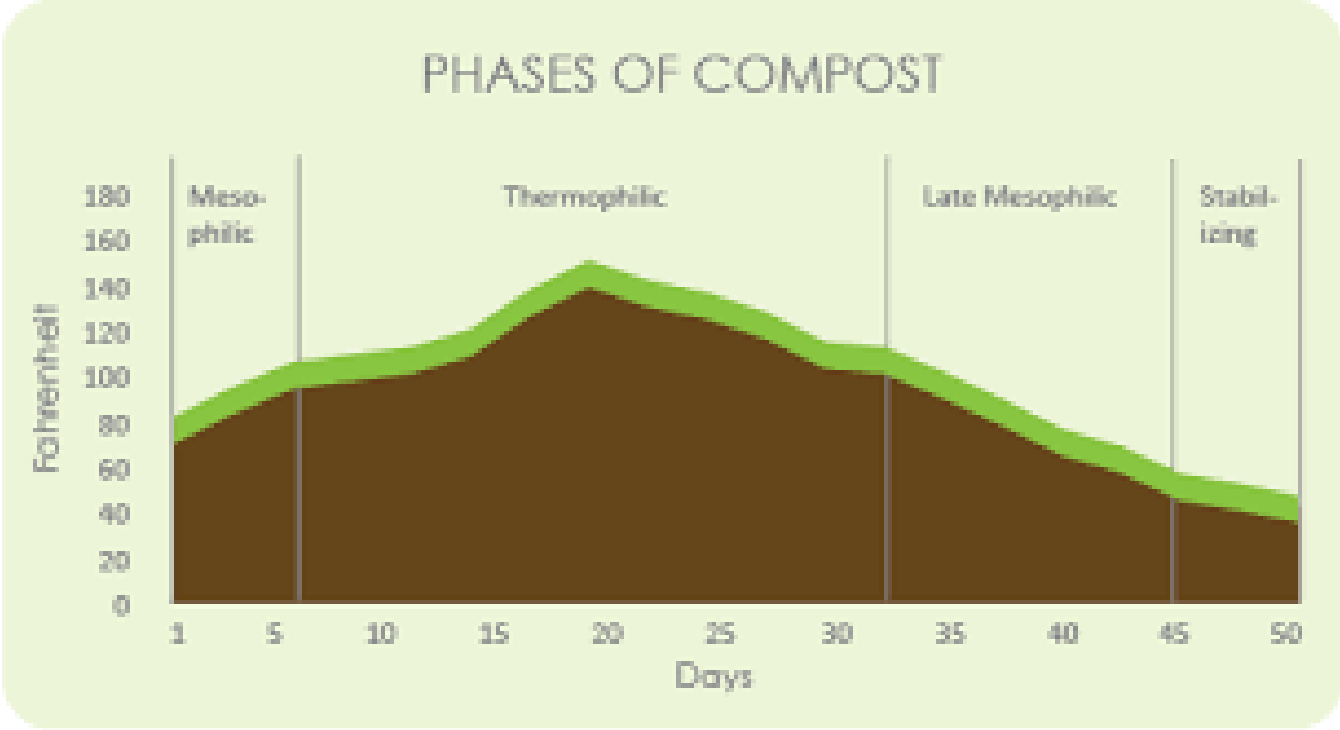
22.1 Carbon, Nitrogen ratio balance (C:N) Cont'd…

- Bacteria robbing nitrogen as a results of utilizing available carbon from the soil may result in nitrogen deficiency.
- Nitrogen robbing causes delayed availability of nitrogen as nutrient to plants in later seasons.
- Excess Nitrogen/nitrogen-rich material causes overheating and conversion to ammonia, causing release of bad smell from the pit. This can be corrected by adding materials rich in carbon especially brown plant materials (dry leaves and stalks) or sawdust.

23. Phases of composting

i. Mesophilic phase

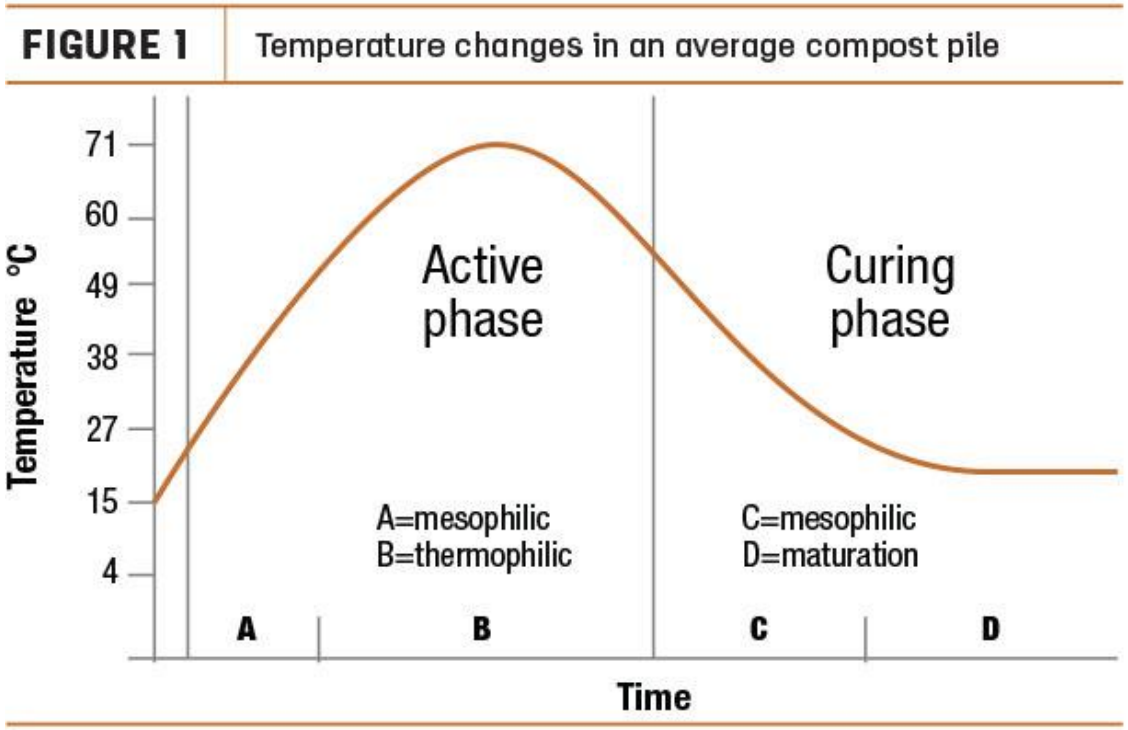
- Process lasts for 2-8 days.
- Temperature rises above 40°C due to metabolic activities.
- Mesophilic microorganisms break down the readily available solid compounds to utilize the nitrogen (N) and carbon (C) in the organic matter.
- pH drops to around 4.3 due to decomposition of soluble compounds (sugar).



23.1 Phases of composting Cont'd...

ii. Thermophilic phase

- Temperature rises above 45°C and introduces thermophilic microorganisms.
- Complex organic matter (cellulose & lignin) carbohydrates, fats and proteins are also broken down by the microorganisms.
- High temperature above 55°C facilitates destruction of plant and human pathogens i.e. weed seeds are destroyed here and any form of disease causing pathogens.
- pH rises as a result of nitrogen conversion to ammonia.



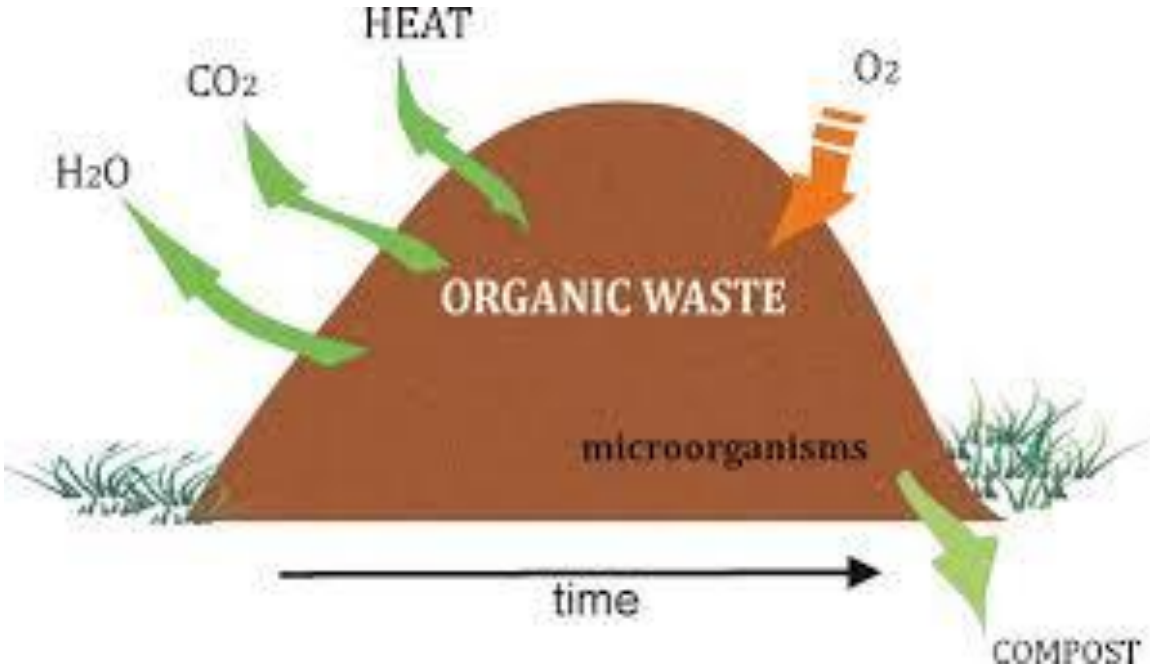
23.2 Phases of composting Cont'd...

iii. Mesophilic phase II (Cooling)

- Takes some few weeks before the last stage of maturation.
- Temperature drops to about 40-45°C introduces mesophilic organisms that proceed with their activities under this favourable conditions.
- pH slightly drops.

iv. Maturation phase

- Temperature drops to below 30 °C.
- Compost is ready after this last stage for use.
- This stage can easily be confused by the Mesophilic phase II.



24. Importance of compost manure

- Source of nutrients to plants.
- Improves soil productivity.
- Controls spread of pest and diseases as well as weeds, due to high temperatures in the pit.
- Improves the soil structure when used.
- Humus improves moisture holding capacity of soil.
- Reduces effects of soil erosion.

25. Commonly used compost making methods

i. Ring-hole method

- Commonly used by farmers growing perennial crops .
- In Uganda, banana plantations use this method.
- Involves creating holes that are ring-like around banana plants.
- Nutrient rich waste and livestock manure are damped in the hole.
- Soil is added on top of the waste products and left there as compost.
- Restores nutrients and moisture of soil at site damped.

ii. In-Situ composting method

- Involves placing nutrient rich waste on top of the soil surface.
- This generally composts on soil surface.
- Wastes (food waste, livestock manure) are left on the surface to decompose in open air.
- Restores soil nutrients and soil moisture.

25.1 Commonly used compost making methods Cont'd…

iii. Pit composting

- This is a common method known by farmers.
- Involves collecting waste in pits.
- This pits contain nutrient-rich materials used by microbes and worms.
- Improves soil nutrients at site/area placed after maturity.

26. Signs of ready manure

- Volume of the manure is low/goes down.
- Manure is light in weight and crumbly when felt between fingers.
- Moisture content of manure is low/not dump/wet.
- Change in smell from rotting to earthy-like smell.
- Becomes dark in colour.

27. Vermicomposting

- Vermicomposting is a method of producing compost using earthworms.
- Is not a common method practised by many farmers despite its use as an organic fertilizer.
- The manure produced improves soil health by introducing living soil organisms to the soil.

- END -