Organic Matter and Compost Training

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ALTERNATIVE LIVELIHOODS PROGRAM—EASTERN REGION ALP/E

Soil Organic Matter Content

There is a two-way relationship between soil activities and plant physiology, where soil organic matter content plays an important role.

Organic matter has an effect on:

-Plant nutrition

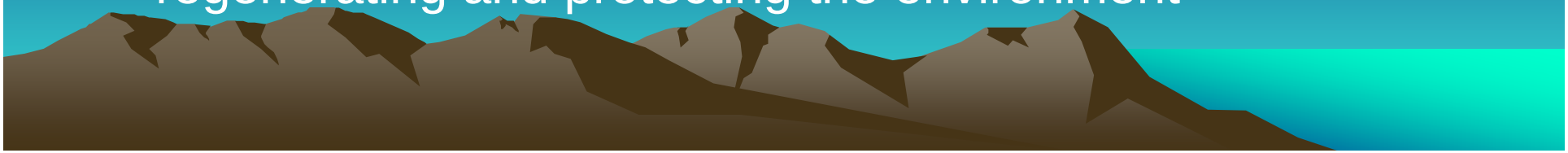
-Soil and Plant health

-Soil physical, chemical and biological properties

Soil Organic Matter Content

How organic matter in soil influences the soil-plant relationship?

- Decomposed organic matter provides nutrients for plant growth (Mineralization)
- It determines the soil's temperature, air ventilation, structure and water management
- It contains bioregulators, which affects plant growth (enzymes, hormones, etc.)
- Its carbon and energy content is the soil's energy battery for future use
- It determines the soil's capacity to compensating, regenerating and protecting the environment



Soil Organic Matter Content

- The most important part of the soil organic matter is called: humus, which is the ultimate product of decomposition.
- Humus is continuously removed from the soil (Humus loss)
- Humus is continuously added into the soil (Humus addition)

Soil Organic Matter Content

- Humus loss:

  $$\text{H loss} = \frac{\text{N requirement x N covered from mineralization}}{\text{N content in humus}}$$

- Expressed in MT/MT
- N content in humus: 50Kg/MT (5%)
- N covered from mineralization:
  - Phabaceae 20%
  - Other crops 30%

Soil Organic Matter Content

- Humus addition:

$$\text{H add} = \frac{N_{OM} \text{ content} \times \text{Humus index}}{\text{N content in humus}}$$

- Expressed in MT/MT
- N content in humus: 50Kg/MT (5%)
- Humus index :
  - Phabaceae 30%
  - Roots 18%
  - Roots + N added (fertilizer) 30%

Soil Organic Matter Content

- Way to increase Humus content:
  - Legumes and other Phabaceae species
  - Animal manure and compost application
  - Green manure and plant waste incorporation
  - N addition (Fertilizers) to organic matter
  - Microbiologic products addition to organic matter

Humus addition vs. Humus loss = Balance

(Humus balance remain the same during 2 years after the production of legumes)

Soil Organic Matter Content

- Soil contains nutrient in two forms:
  - Free (Available immediately)
  - Fixed (Before mineralization)
- Plant mainly acquires nutrients provided by micro-organisms, which decompose the organic matter
- Free and fixed nutrient content is in balance inside the soil
- Optimal balance is when the intensity of transformation from fixed to free nutrient is equal to the plant's nutrient uptake intensity

Soil Organic Matter Content

- The highest nutrient balance in soil will be if the added nutrients are:
  - Fixed nutrients
  - The applied fertilizer added into the soil together with organic carbon sources (organic matter)
- The farmer should practice soil husbandry instead of plant feeding

Compost

- The composting process is implemented by micro-organisms
- The available N for plant is equal to the excess of N, which remains after than the micro-organisms need for N is satisfied
- Quality manure and compost has a balanced Carbon-Nitrogen balance
- High C/N ration causes pentozan effect (Microorganisms use all available N for its reproduction and cell body build up)

Compost

- Different kinds of material can be used for compost-making, e.g. animal manure, urine, dry and green plant waste or grass, kitchen ash, bone meal and animal excreta.
- The decomposition process needs water
- Compost-making requires aerobic conditions, and so ventilation inside the heap is very important; it helps regulate the inside temperature of the heap and ensures the quality of the compost.
- In anaerobic conditions, organisms that cause disease flourish, and the decomposition process then generates materials toxic to the plant, with a reduction in nutrients and the volatilization of nitrogen, sulphur and phosphorus

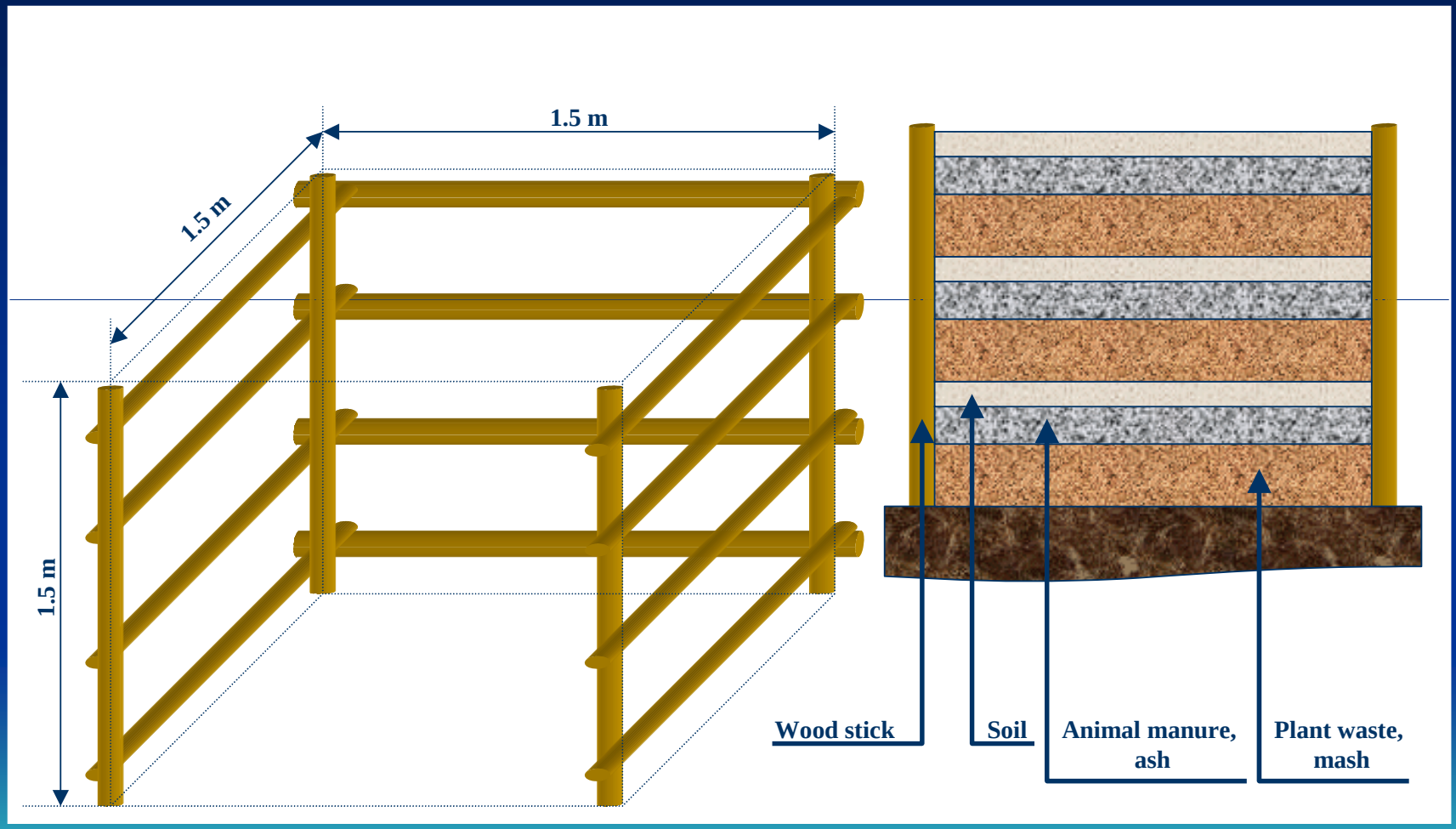
Compost

- Compost-making process depends on the following conditions:
  - Aeration at 10-20% by volume
  - Humidity at 50% of the weight
  - Micro-organisms
  - Raw materials at the C/N ratio of 25-35 : 1
  - Temperature of 55-60º C

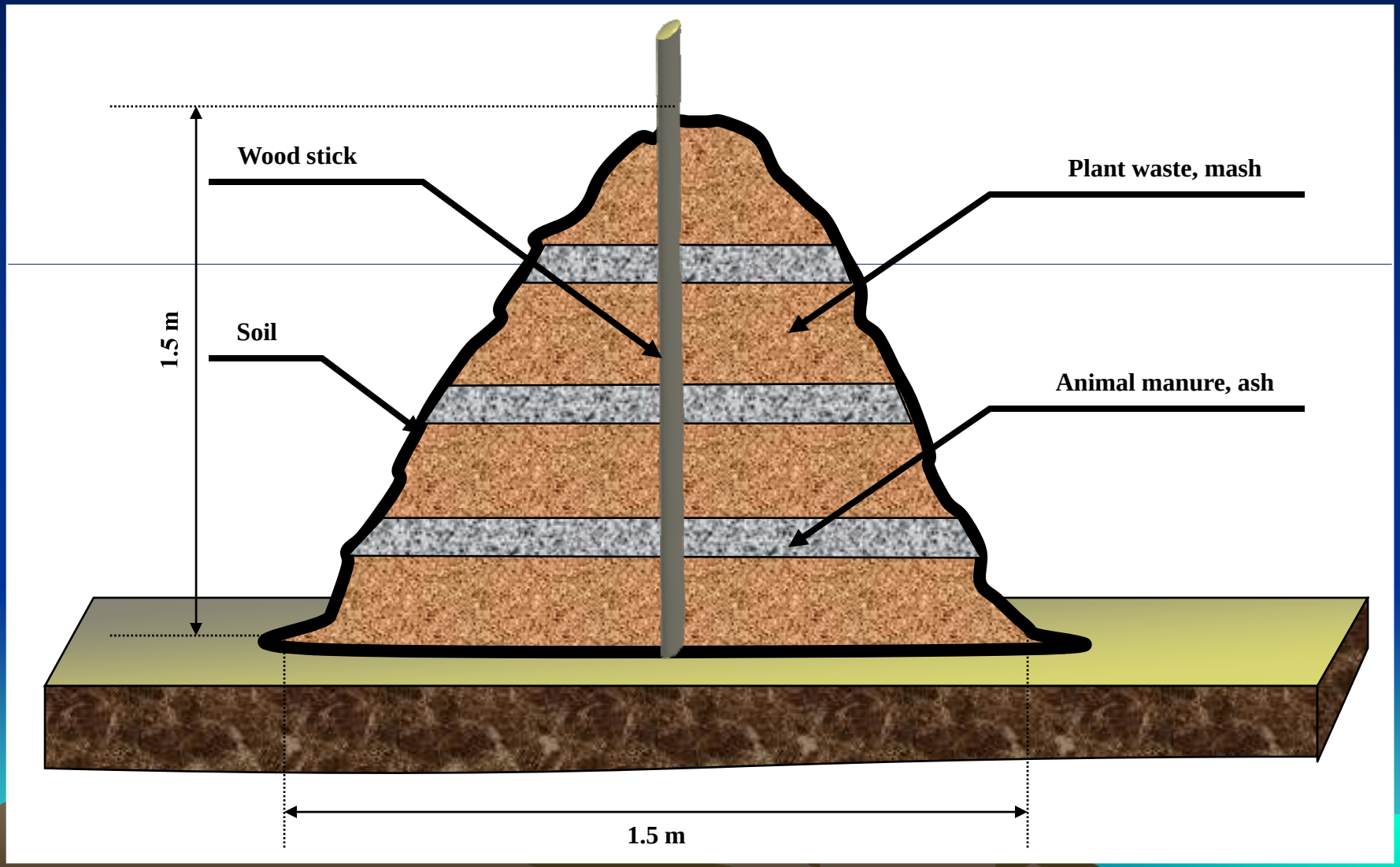
Compost

- Four Phases in Process
  - **Mesophilic Period**
    Micro-organisms, bacteria and fungi invade the heap and start to multiply. The temperature rises
  - **Thermophilic Period**
    The temperature reaches its highest level. This high temperature will kill the fungi. Bacteria achieve their highest growth level and the decomposition process is at its fastest
  - **Cooling Period**
    Micro-organisms die off and the temperature of the heap drops. The decomposition process is almost finished and the fungi content is re-established
  - **Maturing Period**
    The temperature of the heap and its micro-organism content become normal. The compost material is ready to be applied.

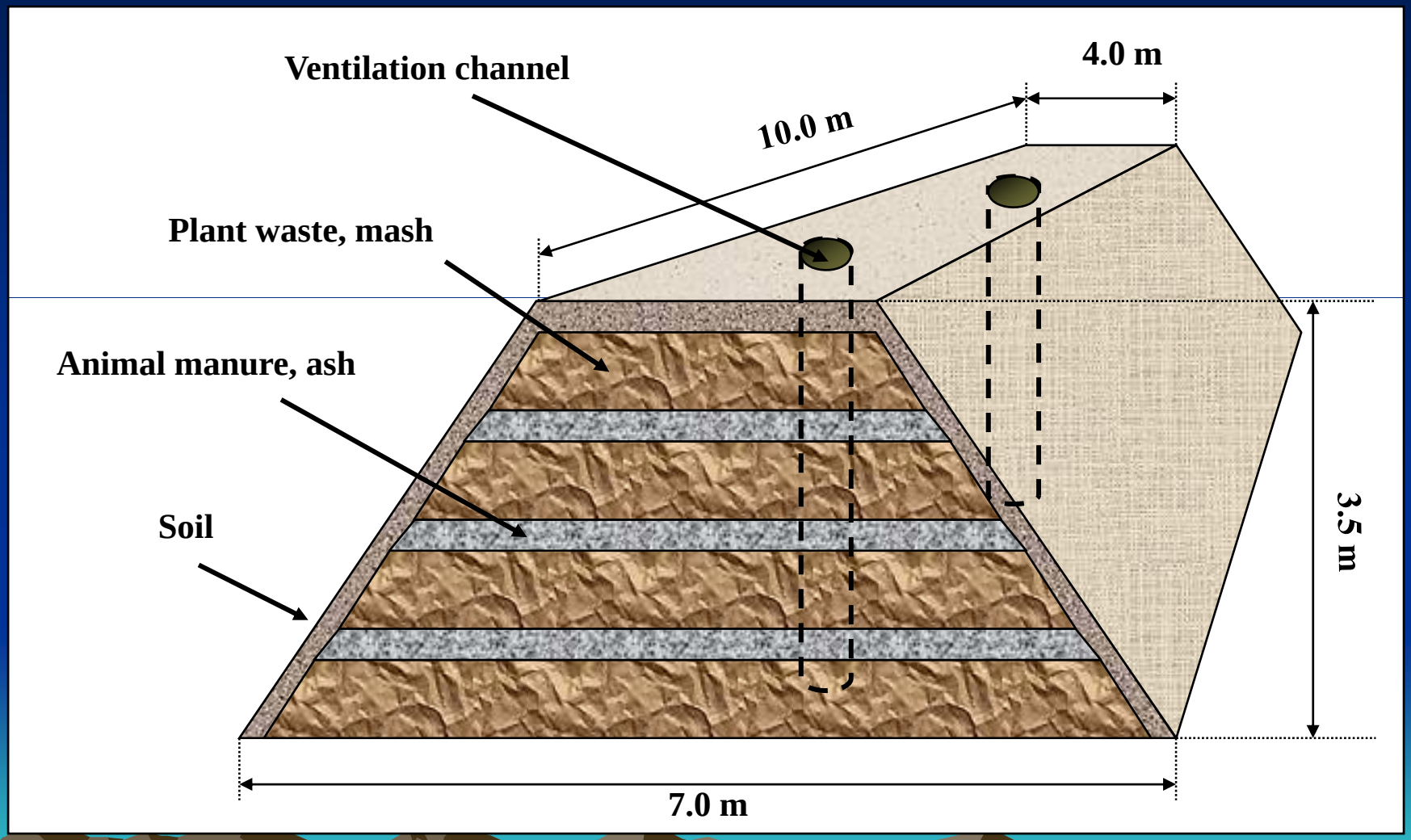
Compost


1.5 m
1.5 m
1.5 m
Wood stick
Soil
Animal manure, ash
Plant waste, mash

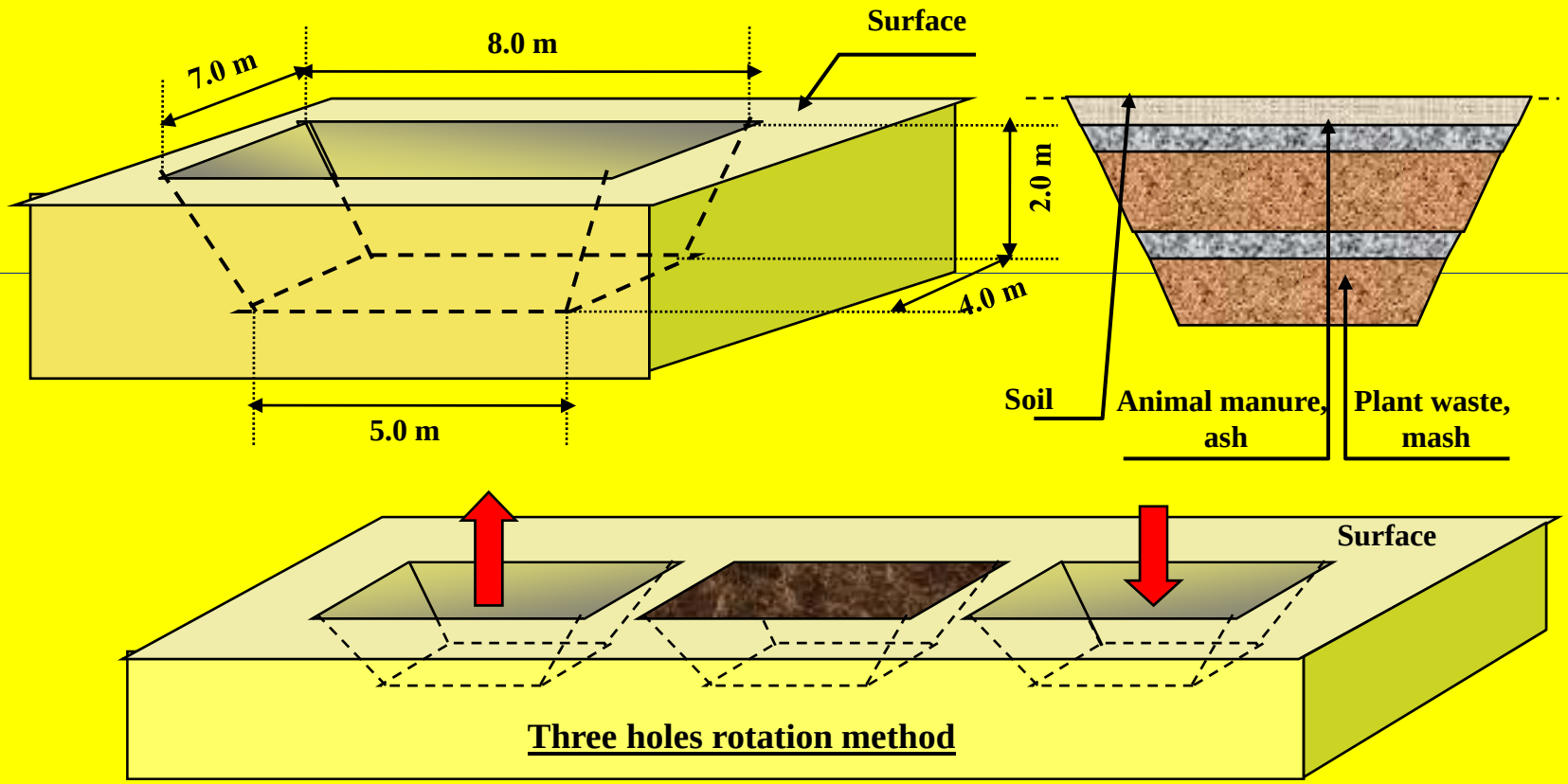
Compost



Compost


Ventilation channel
4.0 m
10.0 m
Plant waste, mash
Animal manure, ash
Soil
3.5 m
7.0 m

Compost


Surface
8.0 m
7.0 m
2.0 m
4.0 m
5.0 m
Soil
Animal manure, ash
Plant waste, mash
Surface
Three holes rotation method
Removing the compost 1st hole
Compost making in Process (the hole Covered with soil) 2nd hole
making new compost 3rd hole

Compost

- Compost provides all macro and micro nutrients which are needed for plant growth
- Compost improves soil structure and texture
- Compost retains moisture in the soil
- Compost reduces erosion risk
- Compost has a long term effect on soil improvement
- Compost increases soil life