

# Organic Matter

Any substance of either plant animal or microbial origin produced with in the soil or added to the soil in order to improve soil properties and supply essential plant nutrients is known as organic matter.

## Composition:

All the sources of organic matter contain.

(i) Water      (II) Mineral matter      (III) Organic compound

### (I)-Water:

Water content of organic matter ranges from 20-90% on fresh weight bases depending upon nature of the plant, plant organs and plant age.

### (II)-Mineral Matter:

It ranges from 1-10% on dry weight bases and it includes Nitrogen, Phosphorous, Calcium, Potassium, Magnesium, Sulphur, Copper, Iron, Zinc etc.

### (III)-Organic Compound:

These are comprised of

(I) Carbohydrates (1-5%) (Sugar, Starch, Pectin and Hemicelluloses)

(II) Lignin (Woody material 10-60%)

(III) Nitrogenous compound (Proteins, amino acid, nucleic acid, (1-15%))

### **Decomposition of organic matter:**

Decomposition of organic matter takes place in 3 overlapping phases.

**Phase I:** Break down of large pieces of plant residues into smaller fragments by soil fauna (earth worms, mice)

**Phase II:** Enzymatic break down of complex molecules into simpler one i.e. Proteins are converted into amino acids.

Molecules are decomposed in following sequence.

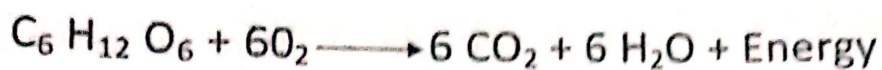
- I) Sugar, Starch, Simple protein
- II) Crude, Protein, Carbohydrates
- III) Hemi cellulose
- IV) Cellulose
- V) Fats and Waxes



## VI) Lignin

**Phase III:** A final stage of microbial break down is the oxidation in which  $\text{CO}_2$  is produced and energy is released.

O compound + Oxygen  $\longrightarrow$   $\text{CO}_2$  + Water + Energy



At the same time.

## Green Manuring:

### Definition:

A growing crop that is ploughed under and mixed with the soil to enrich it with organic matter is called green manure while the practice of turning into soil, the undecomposed green plant tissues is referred to as green manuring (Rotavator is used).

If Carbon-Nitrogen (C N Ratio) is narrow then decomposition is fast. To make the CN ratio narrow nitrogen source (used) is applied.

### Characteristics of Crops:

Following characteristics of the crop determines its suitability as green manure.

- (i) Crop should be growing rapidly.
- (ii) It should produce an abundant biomass in a short period.

(III) Growth habit of crop should encourage ground cover soon after its establishment.

(IV) It should have the ability to grow on poor soils (Leguminous crops need very low Nitrogen).

(V) Plant material should have narrow CN ratio.

(VI) Crops which can enrich the soil with nutrients should be preferred (Legume ).

(VII) It should not a wide climate and soil adaptation.

Most crops used as green manuring are alfalfa (Lucern), red clover (shaftal), Soyabean, Janter, (Susbinea), Guara, Berseem.

### **Farm Yard Manure:**

Farm yard manure consists of excreta and feed wastage.

#### **Excreta:**

It is the combination of feces and urine.

Farm yard manure may be fresh or at various stages of decomposition. It is mostly partially decomposed.

#### **Composition of Farm Yard Manure:**

It is quiet variable as it is a mixture of feces and urine along with bedding and feed wastages. Moisture content of fresh manure is highly variable ranging from 65-85%.



### Humus:

Compounds very resistant to microbial action and formed either through modification of compounds in original organic material or synthesized by micro-organisms.

### Factors effecting the quantity of Manure and Composition:

- I) Kinds and age of animal
- II) Kind and amount of feed they consume.
- III) Condition of animal.
- IV) The milk produced or work performed by animal.

### Manure:

Any natural material added to soil to improve plant growth and soil health.

### Manuring:

Practice of adding manure to soil is known as manuring.

### Types:

- I) <sup>green</sup> Manuring
- II) Composting

### Benefits of Manuring:

- I) Manuring improves soil fertility, nutrient availability and supply to plants.
- II) It improves physical properties of soil like structure, aeration and water holding capacity as well as chemical properties of soil such as CEC and buffering capacity.
- III) It helps in the reclamation and management of salt-affected soils.
- IV) It reduces soil erosion and improves soil productivity.
- V) It enhances the micro-organism activity in soil.

### Composting:

It is a controlled biological process which results in partial decomposition of organic/waste material. The product of composting is known as compost.

The Process of composting consists of rapid decomposition and self heating followed by a cooler, slower decay of remaining organic residues. All the three major groups of soil micro-organisms include Bacteria, Fungi and Actinomycetes are involved in this process.

### Conditions for optimum composting:

- I) Availability of organic matter in bulk.



## Compost:

Composting is a natural biological process in which soil-inhabiting organisms break down various organic materials, such as leaves, grass-clippings, and food wastes. When decomposition is complete, a dark, brown, powdery material called humus has been produced.

## Benefits of Compost:

Composting is a viable means of transforming various organic wastes into products that can be used safely and beneficially as biofertilizer and soil conditioners. A number of problems associated with the use of raw and unstable organic wastes as soil amendments can be resolved through composting, such as malodors, human pathogens and undesirable physical and chemical properties. During the composting process, organic wastes are decomposed. Hence, **plant nutrients are mineralized into plant available forms, pathogens are destroyed, and malodors are abated.** Besides improving the physical structure of the soil, compost has other benefits listed as under:

- I. Utilizes rainfall or irrigation water more efficiently, because less moisture is lost due to evaporation and runoff by permitting better water absorption.
- II. Modifies temperature extremes in the soil, keeping it cooler in the summer and warmer in winter.
- III. Adds a bank of biological activity to the soil, which contributes to more efficient nutrient uptake and tying up of certain ions.
- IV. A buffering capacity (resist change in pH) is added to the soil with the addition of compost.
- V. Because of its tremendous cation-holding capacity, the addition of compost to the soil would allow for the holding of plant nutrients for a longer period of time.

## Composting Materials:

- a. Most **yard wastes** can be composted, including **leaves, grass clippings, plant stalks, vines, weeds; twigs and branches.** Compostable **food wastes** include **fruit and vegetable scraps, coffee grounds, eggshells and nutshells.** Other compostable materials **straw, livestock manure, bone meal and blood meal.**
- b. Materials should **not be composted** if they promote disease, bad odors and attract pests. These include **meat, fish, poultry, dairy products, foods containing animal fats and plants infected with or highly susceptible to diseases.**
- c. Materials that should be composted only in limited amounts include **wood ashes** (a source of lime) and **sawdust** (requires extra nitrogen).

### Various Methods of Compost Production:

Composting practice has been used for centuries by the farmers to convert organic wastes into useful biofertilizers and soil amendments. More specifically, composting is a microbiological process that depends on the growth and activity of mixed population of bacteria, actinomycetes and fungi that are indigenous to the wastes being composted. Composting can be conducted by either aerobic or anaerobic methods. However, the aerobic mode is generally preferred. Basically there are two acceptable systems for compost production;

#### 1) Cool System

This is simply a pile of leaves, grass clippings, eggshells, pea pods, etc., which slowly decompose into humus. Because of the low temperature associated with this type of compost production, weed seeds and plant diseases are not killed. Such a system takes four to six months to produce compost; hence nutrient leaching (especially nitrogen) could take place.

#### 2) Hot System

The purpose of this system is to accelerate the decomposition process resulting in killing of most weed seeds and plant pathogens. In this high-temperature, bacterially active system, it is best to turn the composting material every three to four days. Once activated, the temperature is expected to range between 120-160°F (49-71°C). The decomposition will go faster in summer (as short as three to four weeks) and take more time in the spring and fall. The average finished compost can be expected to have the following principal constituents available for plant growth:

Water	10-15%
Organic matter	10-20%
Nitrogen	0.8%
Phosphorus	0.45%
Potassium	1.45%
Lime	1.25%
Magnesium	0.3%

#### ✓ Farmyard Manure:

Farmyard manure and household waste are major sources of nutrients for food crops in many parts of the tropics. Cattle dung is also a potential source of plant nutrients. The use of farmyard manure or compost as a nutrient source for food crop production depends largely on the prevailing farming system. In some areas, where crop and livestock production are somewhat integrated, farmyard manure could become a major nutrient source for food crops and reduce the need for fertilizer.



**Green Manure Crops:**

Timely applications of organic materials with a low C/N ratio, such as green manure could bring into line nutrient release with plant demand and minimize the amount of inorganic fertilizer needed to sustain high crop yields for short-cycle crops such as maize, rice, and soybean, all of which have a high nutrient demand. Leguminous green manures and cover crops are able to:

- i. Enrich the soil with biologically fixed N
- ii. Conserve and recycle soil mineral nutrients
- iii. Provide ground cover to minimize soil erosion
- iv. Require little or no cash input.