



**Centurion**  
**UNIVERSITY**

*Shaping Lives...  
Empowering Communities...*

## **Lecture -21, 22 & 23**

**Organic nutrient resources  
and its fortification and  
Restrictions to nutrient use  
in organic farming**



Centurion  
UNIVERSITY

Shaping Lives...  
Empowering Communities...

## Organic manures

- Manures are plant and animal wastes that are used as sources of plant nutrients. They release nutrients after their decomposition.
- ***Bulky Organic manures-*** FYM, Compost and Green manure
- ***Concentrated Organic manures-*** Oil seed cakes



Centurion  
UNIVERSITY

Shaping Lives...  
Empowering Communities...

## Advantages of Bulky organic manures

1. They supply plant nutrients including micronutrients,
2. They improve soil physical properties like structure, water holding capacity etc.,
3. They increase the availability of nutrients,
4. Carbon dioxide released during decomposition acts as a CO<sub>2</sub> fertilizer, and
5. Plant parasitic nematodes and fungi are controlled to some extent by altering the balance of Microorganisms in the soil.



Centurion  
UNIVERSITY

Shaping Lives...  
Empowering Communities...

## Farmyard Manure (FYM)

- The decomposed mixture of dung and urine of farm animals along with litter and left over material from roughages or fodder fed to the cattle.
- FYM Contains 0.5% N, 0.2% P<sub>2</sub>O<sub>5</sub> and 0.5% K<sub>2</sub>O.
- Urine contains 1.0% N and 1.35% K<sub>2</sub>O.



**Centurion**  
**UNIVERSITY**

*Shaping Lives...  
Empowering Communities...*

# Factors affecting quality and composition of FYM:

1. kind of animal
2. Age and condition and individual animal
3. Quality and quantity of feed consumed
4. Kind of litter used
5. Collection of manure
  - a. **Byre methods**
  - b. **Dry earth**



**Centurion**  
**UNIVERSITY**  
*Shaping Lives...  
Empowering Communities...*

## 6. Storage of manure

- a. Pit method
  - b. Heap method
  - c. Covered pit method
- Trench method of preparing FYM



**Centurion**  
**UNIVERSITY**  
*Shaping Lives...  
Empowering Communities...*

## Sheep and Goat Manure

- The dropping of sheep and goats contain higher nutrients than farm yard manure and compost. On an average, the manure contains 3% N, 1% P<sub>2</sub>O<sub>5</sub> and 2% K<sub>2</sub>O. It is applied to the field in two ways. The sweeping of sheep or goat sheds are placed in pits for decomposition and it is applied later to the field. The nutrients present in the urine are wasted in this method. The second method is sheep penning, wherein sheep and goats are allowed to stay overnight in the field and urine and fecal matter is added to the soil which is incorporated to a shallow depth by running blade harrow or cultivator.



**Centurion**  
**UNIVERSITY**  
*Shaping Lives...  
Empowering Communities...*

## Poultry Manure

- The excreta of birds ferments very quickly. If left exposed, 50% of its nitrogen is lost within 30 days.
- The average nutrient content is 3.03% N, 2.63% P<sub>2</sub>O<sub>5</sub> and 1.4% K<sub>2</sub>O.



**Centurion**  
**UNIVERSITY**

*Shaping Lives...  
Empowering Communities...*

- **Compost**
- A mass of rotted organic matter made from waste is called compost.
- **Farm compost** – farm wastes and residues
- **Town compost** – garbage sewage and sludge



Centurion  
UNIVERSITY  
*Shaping Lives...  
Empowering Communities...*

# Methods of composting

- In **Coimbatore method**, composting is done in pits of different sizes depending on the waste material available. A layer of waste materials is first laid in the pit. It is moistened with a suspension of 5-10 kg cow dung in 2.5 to 5.0 l of water and 0.5 to 1.0 kg fine bone meal sprinkled over it uniformly. Similar layers are laid one over the other till the material rises 0.75 m above the ground level. It is finally plastered with wet mud and left undisturbed for 8 to 10 weeks. Plaster is then removed, material moistened with water, given a turning and made into a rectangular heap under a shade. It is left undisturbed till its use.



Centurion  
UNIVERSITY

Shaping Lives...  
Empowering Communities...

- In the **Indore method** of composting, organic wastes are spread in the cattle shed to serve as bedding. Urine soaked material along with dung is removed every day and formed into a layer of about 15 cm thick at suitable sites. Urine soaked earth, scraped from cattle sheds is mixed with water and sprinkled over the layer of wastes twice or thrice a day. Layering process continued for about a fortnight. A thin layer of well decomposed compost is sprinkled over top and the heap given a turning and reformed. Old compost acts as inoculum for decomposing the material. The heap is left undisturbed for about a month. The compost is ready for application in another month.



**Centurion**  
**UNIVERSITY**  
*Shaping Lives...  
Empowering Communities...*

- In the **Bangalore method** of composting, dry waste material of 25 cm thick is spread in a pit and a thick suspension of cow dung in water is sprinkled over for moistening. A thin layer of dry waste is laid over the moistened layer. The pit is filled alternately with dry layers of material and cow dung suspension till it rises 0.5 m above ground level. It is left exposed without covering for 15 days. It is given a turning, plastered with wet mud and left undisturbed for about 5 months or till required.



**Centurion**  
**UNIVERSITY**

*Shaping Lives...  
Empowering Communities...*

# NADEP method of composting

Raw materials required for filling NADEP tank:

- Agricultural waste (Dry & green) – 1350-1400 kgs.
- Cattledung or biogas slurry – 98 – 100 kgs.
- Fine sieved soil – 1675 kgs.
- Water – 1350-1400 litres.



**Centurion**  
**UNIVERSITY**  
*Shaping Lives...  
Empowering Communities...*

## **Sub-layer-1**

- 4 to 6 inches thick layer of fine sticks, stems, (To facilitate aeration) followed by 4 to 6 inches layer of dry and green biomass.

## **Sub-layer-2**

- 4 kgs. Cow dung is mixed with 100 litres of water and sprinkled thoroughly on the agricultural waste to facilitate microbial activity.



Centurion  
UNIVERSITY

Shaping Lives...  
Empowering Communities...

## Sub-layer-3

- 60 kgs. of fine dry soil is spread uniformly over the soaked biomass for moisture retention and acts as a buffer during biodegradation. Thus the proportion of organic materials for each layer is 100 kgs. organic biomass: 4kgs. cowdung + 100 litres water+60 kgs soil. In this way, approximately 10 -12 layers are filled in each tank. After filling the tank, biomass is covered with 3// thick layer of soil and sealed with cow dung +mud plaster.



**Centurion**  
**UNIVERSITY**  
*Shaping Lives...  
Empowering Communities...*

# Advantages of Composting

- Volume reduction of waste.
- Final weight of compost is very less.
- Composting temperature kill pathogen, weed seeds and seeds.
- Matured compost comes into equilibrium with the soil.
- During composting number of wastes from several sources are blended together.
- Excellent soil conditioner
- Saleable product
- Improves manure handling



**Centurion**  
**UNIVERSITY**  
*Shaping Lives...  
Empowering Communities...*

- **Vermicompost** is the use of earthworms for composting organic residues. Earthworms can consume practically all kinds of organic matter. Earthworms have the capacity to eat as much matter as their own weight and produce the same amount of manure per day in the form of castings.
- **Vermiwash**
- Liquid fertilizer collected over passage of water through a column of worms in action useful as foliar spray.
- Collection of excretory products and mucus secretion of earthworms along with micro nutrients from solid organic molecules.



Centurion  
UNIVERSITY

Shaping Lives...  
Empowering Communities...

# Advantages

- Reduction of noxious qualities of a wide variety of organic waste, elimination of smell, reduction of harmful microorganisms
- Production of marketable organic fertilizer
- Production of aqua life, birds and animal food or even human food by drying earthworms
- Additional benefit to the farmers
- Increases soil fertility and bacterial activity in the soil
- Increases micro grains in the soil and enhances water absorption capacity
- Helps the plant root get air easily.



**Centurion**  
**UNIVERSITY**  
*Shaping Lives...  
Empowering Communities...*

## Green Manuring

It is a practice of ploughing in the green plant tissues grown in the field or adding green plants with tender twigs or leaves from outside and incorporating them into the soil for improving the physical structure as well as fertility of the soil. It can be defined as a practice of ploughing or turning into the soil, undecomposed green plant tissues for the purpose of improving the soil fertility.

### Types

1. Green manuring
2. Green leaf manuring



**Centurion**  
**UNIVERSITY**  
*Shaping Lives...  
Empowering Communities...*

## • **Desirable characters of green manuring:**

- Multipurpose use, short duration, fast growing, high nutrient accumulation ability.
- Wide ecological adaptability, tolerance to shade, flood, drought and adverse temperatures and efficient in use of water.
- Early onset of biological N-fixation, high N accumulation rates, timely release of nutrients and high N sinks in underground plant parts
- Photoperiod insensitivity, high seed production, high seed viability.



**Centurion**  
**UNIVERSITY**  
*Shaping Lives...  
Empowering Communities...*

- Biofertilizers are defined as preparations containing living cells or latent cells of efficient strains of microorganisms that help crop plants' uptake of nutrients by their interactions in the rhizosphere when applied through seed or soil. They accelerate certain microbial processes in the soil which augment the extent of availability of nutrients in a form easily assimilated by plants.



**Centurion**  
**UNIVERSITY**

Shaping Lives...  
Empowering Communities...

| S. No.                                      | Groups                         | Examples   |
|---|--------------------------------|--|
| <b>N<sub>2</sub> fixing Biofertilizers</b>  |                                |  |
| 1.  | Free-living                    | <i>Azotobacter</i> , <i>Beijerinckia</i> , <i>Clostridium</i> , <i>Klebsiella</i> ,<br><i>Anabaena</i> ,<br><i>Nostoc</i> ,              |
| 2.  | Symbiotic                      | <i>Rhizobium</i> , <i>Frankia</i> , <i>Anabaena azollae</i>  |
| 3.  | Associative Symbiotic          | <i>Azospirillum</i>  |
| <b>P Solubilizing Biofertilizers</b>        |                                |  |
| 1.  | Bacteria                       | <i>Bacillus megaterium</i> var. <i>phosphaticum</i> , <i>Bacillus subtilis</i><br><i>Bacillus circulans</i> , <i>Pseudomonas striata</i> |
| 2.  | Fungi                          | <i>Penicillium</i> sp, <i>Aspergillus awamori</i>  |
| <b>P Mobilizing Biofertilizers</b>          |                                |  |
| 1.  | Arbuscular mycorrhiza          | <i>Glomus</i> sp., <i>Gigaspora</i> sp., <i>Acaulospora</i> sp.,<br><i>Scutellospora</i> sp. & <i>Sclerocystis</i> sp.                   |
| 2.  | Ectomycorrhiza                 | <i>Laccaria</i> sp., <i>Pisolithus</i> sp., <i>Boletus</i> sp., <i>Amanita</i> sp.   |
| 3.  | Ericoid mycorrhizae            | <i>Pezizella ericae</i>  |
| 4.  | Orchid mycorrhiza              | <i>Rhizoctonia solani</i>  |
| <b>Biofertilizers for Micro nutrients</b>   |                                |  |
| 1.  | Silicate and Zinc solubilizers | <i>Bacillus</i> sp.  |
| <b>Plant Growth Promoting Rhizobacteria</b> |                                |  |
| 1.  | <i>Pseudomonas</i>             | <i>Pseudomonas fluorescens</i>   |



**Centurion**  
**UNIVERSITY**  
*Shaping Lives...  
Empowering Communities...*

Rhizobium is a soil habitat bacterium, which can able to colonize the legume roots and fixes the atmospheric nitrogen symbiotically. They are the most efficient biofertilizer as per the quantity of nitrogen fixed concerned. They have seven genera and highly specific to form nodule in legumes, referred as cross inoculation group.



Centurion  
UNIVERSITY  
Shaping Lives...  
Empowering Communities...

# ***Azotobacter***

- Of the several species of *Azotobacter*, *A. chroococcum* happens to be the dominant inhabitant in arable soils capable of fixing N<sub>2</sub> (2-15 mg N<sub>2</sub> fixed /g of carbon source) in culture media.
- The bacterium produces abundant slime which helps in soil aggregation. The numbers of *A. chroococcum* in Indian soils rarely exceeds 10<sup>5</sup>/g soil due to lack of organic matter and the presence of antagonistic microorganisms in soil.



Centurion  
UNIVERSITY  
Shaping Lives...  
Empowering Communities...

- **Azospirillum**
- *Azospirillum lipoferum* and *A. brasilense* (*Spirillum lipoferum* in earlier literature) are primary inhabitants of soil, the rhizosphere and intercellular spaces of root cortex of graminaceous plants. They perform the associative symbiotic relation with the graminaceous plants.
- Apart from nitrogen fixation, growth promoting substance production (IAA), disease resistance and drought tolerance are some of the additional benefits due to *Azospirillum* inoculation.



Centurion  
UNIVERSITY

Shaping Lives...  
Empowering Communities...

- **Azolla**
- *Azolla* is a free-floating water fern that floats in water and fixes atmospheric nitrogen in association with nitrogen fixing blue green alga *Anabaena azollae*. *Azolla* fronds consist of sporophyte with a floating rhizome and small overlapping bi-lobed leaves and roots. Rice growing areas in South East Asia and other third World countries have recently been evincing increased interest in the use of the symbiotic N<sub>2</sub> fixing water fern *Azolla* either as an alternate nitrogen sources or as a supplement to commercial nitrogen fertilizers. *Azolla* is used as biofertilizer for wetland rice and it is known to contribute 40-60 kg N/ha per rice crop.



Centurion  
UNIVERSITY

*Shaping Lives...  
Empowering Communities...*

# Constraints in biofertilizer

- Technological constraints
- Infrastructural
- Financial
- Environmental
- Human resource and quality constraints



**Centurion**  
**UNIVERSITY**  
*Shaping Lives...*  
*Empowering Communities...*

**Thank You**