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Manures , Fertilizers and Soil Fertility Management

01. Manures

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01.1

The term "manure" originally meant that which was "worked by hand" (Fr. *manoeuvre*), but gradually came to apply to any process by which the soil could be improved

➤ Soil organic carbon play a key role in nutrient cycling of soil and also valuable for attaining the sustainability.

➤ Throughout the world, agricultural activity has generally involved exploitation of soil organic matter(SOM) reserves as a source of nutrients (Salter and Green **1933**).



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01.2

Advantages of Manures

- Improve soil structure, aeration, infiltration rate and water holding capacity of soil.
- Provide **all essential nutrient elements**, which are available in the soil for longer periods.
- **Regulate the soil temperature in summer as well as in winter.**
- **Promote microbial activity in the soil.**
- Reduce **soil erosion** in sandy soils.
- Can be prepared **locally and eco-friendly**



01.3

Classification of Manures

Manures are classified on the basis of their **N content** and organic matter present on the soil. On the basis of **N content**, manures may be arbitrarily grouped into **Bulky organic manures** and **Concentrated organic manures**

Sources of organic residues:

1. **Cattleshed wastes**: dung, urine, and slurry from a bio gas plant
2. **Human habitation waste**: town refuse, sewage, sludge
3. **Poultry litter, droppings of sheep and goat**
4. **Slaughter house wastes**: bone meal, meat meal, blood meal, horn and hoof meal
5. **Fisheries waste**
6. **By products of agro-industries**: Oil cakes, bagasse and pressmud from sugar industries, wastes from fruit and vegetable processing, tea wastes, cotton wastes and any such vegetable matter
7. **Crop wastes**: sugarcane trash, stubbles,
8. **Water hyacinth and tank silt**
9. **Green manuring crops**



01.4

Source	Nitrogen (N %)	Phosphorus (P₂O₅ %)	Potash (K₂O %)
Bulky organic manures			
Farmyard manure	0.50	0.3	0.50
Compost (urban)	1.0	0.5	1.5
Compost (rural)	0.50	0.15	0.50
Cattle dung	2.41	0.75	0.88
Buffalo dung	1.09	0.82	0.70
Swine dung	2.11	2.41	0.97
Chicken - broilers dung	3.17	3.29	2.41
- pullets dung	3.61	3.33	2.38
- layers	2.85	4.21	2.00
Night soil	5.50	4.00	2.00
Sewage and sludge	1.5-3.5	0.75-4.0	0.3-0.6
Vermicompost	1-1.6	1.2-1.45	0.8-1.1
Phosphocompost	1.2-1.4	2.00-3.50	-



01.5

Concentrated organic manures	Nitrogen (N %)	Phosphorus (P₂O₅ %)	Potash (K₂O %)
Non-edible oil cakes			
Castor cake	4.40	1.80	1.40
Neem cake	5.00	1.10	1.50
Mahua cake	2.50	1.0	1.50
Karanj cake	4.0	1.0	1.0
Edible Oil cakes			
Mustard cake	5.20	1.80	1.20
Sesame cake	6.20	2.10	1.30
Groundnut cake	7.30	1.50	1.30
Linseed cake	5.50	1.10	1.30
Meals from animal wastes			
Bone meal	3.0	20.0	-
Fish meal	7.0	6.0	1.0



01.6

Farmyard Manure

Farmyard manure is a decomposed mixture of cattle dung and urine with straw and litter used as bedding material and residues from the fodder fed to the cattle.

This is the traditional manure and is mostly readily available to the farmers.

Variation in the composition of the manure (FYM)

- **Kind of the animals**
- **Age and individuality**
- **Feed used**
- **Bedding materials**
- **Handling and Storage**



01.7

Characteristics of FYM:

❖ **Moisture Content: 60-75%**

❖ **Low analytical value: N:P:K= 0.5% : 0.25%: 0.5%**

❖ **Some residual effect.**

Nutrients present mostly in the **organic forms** which subsequently would be **converted to inorganic forms** to become available to plants. This takes along time. So if a few cart of FYM is used in a crop it will be helpful for the **succeeding crop** unlike the commercial fertilizers.

❖ **Complete manure:** Number of nutrients are available, (though unbalanced in FYM). So micronutrient deficiencies may be checked.



01.8

Reactions of organic manures in soils

Protein & allied Compound undergoes mineralization in three steps, viz., Aminization, Ammonification, Nitrification

Aminization : (Protein → Protease → Peptone → Peptide → Amino acid compd)

Proteins → R-NH₂ + CO₂ + energy + other products

Ammonification : (R-NH₂ + H₂O → R-OH + NH₃ + E

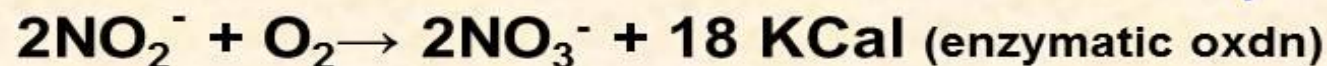
by enzymatic hydrolysis) $\begin{matrix} \text{H}_2\text{O} \\ \downarrow \\ \text{NH}_4^+ + \text{OH}^- \end{matrix}$

The released (NH₄⁺) is subject to following changes:

Nitrification:



Nitrosomonas europae



Nitrobacter winogradskii

(ii) It (NH₄⁺) may be absorbed directly by plants

(iii) It (NH₄⁺) may be fixed by lattice of expanding type clay mineral



01.9

Factors affecting decomposition (FYM):

(i) Temperature:

With increase in Temperature, decomposition becomes faster. Hence, higher the rate of decomposition – higher the loss of Nutrients (Nitrogen).

(ii) Compactness of heap:

In open and light heap, aerobic organisms takes part in the decomposition of manure. In compact heap, the fermentation is slow but regular fermentation is going on mainly due to anaerobic organisms. We **should prefer aerobic decomposition (Light heap)**.

(iii) Moisture :- Some amount of moisture is needed to hasten the microbial decomposition. If moisture level is too high it will retard fermentation

(iv) Constituents :- The decomposition of manure depends on the presence of **soluble nitrogenous matter in the manure**. If urine constituent is higher, decomposition is rapid, because **microbial organism assimilate N from Urine**.



04.8

Storage of FYM:

Chemical preservatives are added to farm yard manure **to decrease nitrogen losses.**

To be most effective the preservatives are added in the cattle shade to **permit direct contact with the liquid portion of excreta or urine.** This has to be done because the loss of N from urine starts immediately.

The commonly used chemical preservatives are **gypsum & Super phosphate.**

The reaction of **Gypsum with $(\text{NH}_4)_2\text{CO}_3$** [The intermediate product from decomposition of Urea present in Urine] is as follows:



As such under Indian condition use of Gypsum to decrease N-losses does not offer a practical solution.



THANK YOU

