# STUDY ON MANURES AND FERTILIZERS

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## Manures

Manures may also be called as 'Organic manure'. Some of the organic wastes or by-products (extracts of animals and birds, litter, crop refuses, and other by-products) either decomposed or treated or fresh are used to enrich soil fertility. These are called manures.

Manures may be bulky (nutrient contents are very low per unit area) such as farm yard manures (FYM), and compost or concentrated (containing a higher per cent of nutrients) such as oilcakes, meals of blood, meat, bone, fish, horns and hooves.

## Fertilizers

Broadly, a fertilizer may be defined as any substance (chemical, organic and microbial) that is added to the soil supply element (s) required for the nutrition of plants (BARC, 2024).

In a specific sense, fertilizers are chemicals that occur naturally or are produced in the factory and when added to the soil, supply nutrient elements required for better plant growth.

## Differences between manures and fertilizer

| Sl. No. | Manures | Fertilizers |
|---|---|---|
| 1. | Naturally occurring substance. | Artificially made. |
| 2. | Generally bulky in nature. i.e. concentration of plant nutrient is low. | Concentration of plant nutrient is high. |
| 3. | Obtaining from organic sources. | Obtaining from inorganic sources. |
| 4. | Easy to prepare. | Preparation is complex. |
| 5. | Excess application is not harmful to soil. | Excess application may cause harmful effect to soil. |
| 6. | Release plant nutrient in available form slowly. | Release plant nutrient in available forms quickly. |
| 7. | Residual effect is high. | Residual effect is low. |
| 9. | Improves the physical properties of soil. | Does not improve the physical properties of soil, but sometimes it may cause negative effect on soil properties. |
| 10. | Cost of preparation is low. | Cost of production is high. |
| 11 | They have no definite chemical formula. | They have definite chemical formula. |

## List of manures

The followings are some important organic manures

a. Cowdung
b. Farm yard manures
c. Compost
d. Poultry manures
e. Oil cakes
f. Blood meal
g. Meat meal
h. Fish meal
i. Green manures etc.
j. Vermicompost

**List of fertilizers**

**Nitrogenous fertilizer:** Sodium nitrate, Calcium nitrate, Ammonium chloride, Ammonium sulphate, Anhydrous ammonia, Ammonium nitrate, calcium ammonium nitrate (CAN), Ammonium sulphate nitrate (ASN), Urea, Calcium cyanamide

**Phosphatic fertilizer:** Single super phosphate (SSP), Triple super phosphate (TSP), Ammonium phosphate, Dicalcium phosphate, Basic slag, Rock phosphate. Tricalcium phosphates

**Potassic fertilizer:** Muriate of potash (MOP), Potassium sulphate, Potassium nitrate, Potassium magnesium nitrate

# Properties of some manures and fertilizers

**A. Properties of manures**

| Name of the manures | Physical properties | | | Nutrient content |
|---|---|---|---|---|
| | Colour | Solubility | State | |
| *Cowdung* | Blackish | Water soluble | Solid | % N = 0.5-1.5<br>% $P_2O_5$ = 0.4-0.8<br>% $K_2O$ = 0.5-1.9 |
| *Compost* | Blackish | Water soluble | Solid | % N = 0.4-0.8<br>% $P_2O_5$ = 0.3-0.6<br>% $K_2O$ = 0.7-1.0 |
| *Farm yard manure (FYM)* | Light green or blackish | Water soluble | Solid | % N = 0.5-1.5<br>% $P_2O_5$ = 0.4-0.8<br>% $K_2O$ = 0.5-1.9 |
| *Mustard oil cake (MOC)* | Brownish | Water soluble | Solid | % N = 5.1-5.2<br>% $P_2O_5$ = 1.8-1.9<br>% $K_2O$ = 1.1-1.3 |
| *Til oil cake* | Blackish | Water soluble | Solid | % N = 6.2-6.3<br>% $P_2O_5$ = 2.0-2.1<br>% $K_2O$ = 1.2-1.3 |
| *Wood ash* | Blakish or grayish | Water soluble | Solid | % N = Trace<br>% $P_2O_5$ = 2.0<br>% $K_2O$ = 2.3-12 |

**B. Properties of fertilizers**

| Name of the fertilizers | Properties | | | | | | |
|---|---|---|---|---|---|---|---|
| | Physical properties | | | Chemical properties | | | |
| | Colour | Solubility | Structure | Reaction | Chemical formula | Nutrient content | Available form (s) |
| *Urea* | White | Highly soluble in water | Granular | Acidic | $CO(NH_2)_2$ | N= 46% | $NH_4^+$<br>$NO_3^-$ |
| *Diammonium phosphate* | Brownish | Highly soluble in water | Granular | Alkaline | $(NH_4)_2HPO_4$ | N= 18%<br>$P_2O_5$= 46% | $NH_4^+$<br>$H_2PO_4^-$<br>$HPO_4^{2-}$<br>$PO_4^{3-}$ |
| *SSP* | Grayish | Highly soluble in water | Dust | Neutral | $Ca(H_2PO_4)_2.H_2O.\ CaSO_4$ | $P_2O_5$ = **16**-18%<br>S = 10-14%<br>Ca: 18-21% | $H_2PO_4^-$<br>$HPO_4^{2-}$<br>$PO_4^{3-}$<br>$SO_4^{2-}$ |
| *TSP* | Grayish or blackish | Easily soluble in water | Granular | Neutral | $Ca(H_2PO_4)_2.H_2O$ | $P_2O_5$ = 48%<br>Ca: 15% | $H_2PO_4^-$<br>$HPO_4^{2-}$<br>$PO_4^{3-}$ |
| *MOP* | Brick red | Easily soluble in water | Granular | Acidic | KCl | $K_2O$ = 60% | $K^+$ |
| *Gypsum* | Whitish | Easily soluble in water | Dust | Acidic | $CaSO_4.2H_2O$ | S = 18%<br>Ca = 33% | $SO_4^{2-}$<br>$Ca^{2+}$ |
| *Zinc sulphate* | Whitish | Easily soluble in water | Granular | Acidic | $ZnSO_4$ | Zn = 36%<br>S = 18% | $Zn^{2+}$<br>$SO_4^{2-}$ |

## Calculations on fertilizers and manures

**Problem 1:** Calculate the quantity of urea, single superphosphate (SSP) and muriate of potash (MOP) required for one hectare of rice with the N, $P_2O_5$ and $K_2O$ 100-50-50 kg $ha^{-1}$.

**Solution:**

**Problem 2:** Recommended rate of urea, TSP and MOP for wheat is 120, 60 and 60 kg $ha^{-1}$, respectively. Calculate the amount of N, P and K required for two hectares of land.

**Problem 3:** Calculate the quantity of DAP, urea and MOP required for one hectare of rice to meet the nutrient requirement of N, $P_2O_5$ and $K_2O$ at 100-50-50 kg.

**Problem 4:** Calculate the amount of nutrient from 3-2-1 graded 1 ton fertilizer.

**Problem 5:** Recommended rate of N, $P_2O_5$ and $K_2O$ for wheat is 120, 80 and 70 kg $ha^{-1}$, respectively. If the land (2 ha) is supplemented with 10 tones of farm yard manure (FYM), calculate the amount of urea, TSP and MOP to meet the requirement.

**Useful Chemical Conversion Factors**

$P \times 2.29 = P_2O_5$
$P_2O_5 \times 0.43 = P$
$H_3PO4 \times 0.32 = P$
$K \times 1.20 = K_2O$
$K_2O \times 0.83 = K$
$KCl \times 0.52 = K$
$K_2SO_4 \times 0.45 = K$

**Fertilizer/Nutrient Ratio**
Urea: N = **2.17**: 1
TSP: P = **5.00**: 1
MOP:K = **2.00**: 1
Gypsum:S = **5.56**: 1
$ZnSO_4$:Zn: **2.79**: 1

**Some other useful conversions**

1 acre = 100 decimal = 3.025 *bigha*
1 hectare = 1 ha = 10,000 $m^2$ = 2.47 acre = 7.47 bigha
1 *katha* = 1.67 decimal
1 *bigha* = 20 katha = 33.33 decimal

1 kg = 2.2046 pounds
1 lb = 0.4535 kg

**Suggested Reading:**

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