

It has high percentage of nitrogen.

Time of Application of the fertilizer in the field by seed <sup>Basal dressing</sup> <sup>is the application of the fertilizer at the time of sowing.</sup>  
(i) During planting: phosphates and compound fertilizers

They are called Planting fertilizers.

(ii) During Active growth of the crop: (Also are called Top-dressing fertilizers:  
Mainly are nitrogenous or potassic fertilizers.  
<sub>Application of the fertilizer in the field after seed germination</sub>

### Compound fertilizers.

These ~~are~~ contain two or more of the primary macronutrients. They are made by mixing two or more straight fertilizers eg. diammonium phosphate (DAP).

⇒ A complete fertilizer contains all the three primary macronutrients. eg. DAP, Monoammonium phosphate (MAP).

### (c) Effects on soil PH

A fertilizer can either be acidic or neutral. Almost all other fertilizers are acidic except calcium ammonium nitrate (CAN).

## FERTILIZER ANALYSIS AND FERTILIZER RATIO

The nutrient content of a compound fertilizer is determined by fertilizer analysis (grade) or by fertilizer ratio.

Fertilizer analysis or grade refers to the percentage amount of each primary macronutrient in a fertilizer.

$$\text{Percentage of Nutrient} = \frac{\text{weight of nutrient}}{\text{Total weight of fertilizer}} \times 100\%$$

The fertilizer grade is usually indicated on the fertilizer bag as NPK. where P and K are normally taken as  $P_2O_5$  and  $K_2O$  respectively.

Examples;

Calculate the percent of nitrogen in each of the following fertilizers  $KNO_3$  and  $Ca(NO_3)_2$ .

Soln.

$$\% N \text{ in } KNO_3 = \frac{14}{39 + 14 + 48} \times 100\% = 14\%$$

$$\% N \text{ in } Ca(NO_3)_2 = \frac{28}{40 + 28 + 96} \times 100\% = 16\%$$

Fertilizer ratio refers to the simple ratio of the nutrients relative to each other. For example: A fertilizer grade 20:20:20 has a 1:1:1 ratio of N,  $P_2O_5$ ,  $K_2O$  (NPK)

Determination of the Amount of fertilizer to be applied.

Fertilizer grade and fertilizer ratio are used in determining the amounts of fertilizers to be applied on a piece of land

- The amount of fertilizer to apply per hectare depends on the amount of nutrient required and the fertilizer grade available.

$$\text{Amount of Fertilizer to supply in (kg) per ha} = \frac{100}{A} \times \text{mass of fertilizer (or nutrient)}$$



## Examples:

1 A maize farm needs 60kg N, 30kg P<sub>2</sub>O<sub>5</sub> and 30kg K<sub>2</sub>O. The fertilizer available from a supplier are 100kg (NH<sub>4</sub>)<sub>2</sub>SO<sub>4</sub> (21% N), K<sub>2</sub>SO<sub>4</sub> (40% K<sub>2</sub>O) and (NH<sub>4</sub>)<sub>2</sub>H<sub>2</sub>PO<sub>4</sub> (23% P<sub>2</sub>O<sub>5</sub>). Calculate the amount of each fertilizer needed to be supplied per hectare.

Soln.

• Amount of (NH<sub>4</sub>)<sub>2</sub>SO<sub>4</sub> needed  

$$\frac{100}{21} \times 60 \text{ kg} = 285.71 \text{ kg/hectare} = 285 \text{ kg/ha}$$

• Amount of K<sub>2</sub>SO<sub>4</sub> needed  

$$\frac{100}{40} \times 30 \text{ kg} = 75 \text{ kg/hectare} = 75 \text{ kg/ha}$$

• Amount of DAP needed  

$$\frac{100}{23} \times 30 \text{ kg} = 130.43 \text{ kg/ha.}$$

2 Rusa require 120kg of nitrogen, what weight of urea fertilizer (80% by CO(NH<sub>2</sub>)<sub>2</sub>) needs to be applied to the soil to meet this demand?

Soln.

$$A\% = \frac{28}{12 + 16 + 28 + 4} \times 100\% = 46.67\%$$

Amount of fertilizer needed =  $\frac{100}{A} \times \text{mass of nutrient}$

$$= \frac{100}{46.67} \times 120 \text{ kg} \quad \begin{array}{l} 100\% \rightarrow 46.67\% \\ 80\% \rightarrow ? \end{array}$$

$$= 257.1 \text{ kg/ha} \quad = 37.336\%$$

$$\begin{array}{l} 257.1 \text{ kg} \rightarrow 80\% \\ x \rightarrow 100\% \\ x = 321.4 \text{ kg} \end{array} \quad \begin{array}{l} F_w = 120 \text{ kg} \times 100 \\ 37.336 \\ = 321.419 \end{array}$$

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$$= 257.1 \text{ kg/ha} \quad = 37.336\%$$

$$257.1 \text{ kg} \rightarrow 80\% \quad \text{Fw} = \frac{120 \text{ kg} \times 100}{37.336}$$

$$x \rightarrow 100\% \quad = 321.419$$

$$x = 321.4 \text{ kg}$$

3 A farmer discovered a state of poor growth for his plants. He was advised to supply 160kg of N for the improvement of the plant growth. What weight of 80% ~~nitrate~~ by weight  $\text{Ca}(\text{NO}_3)_2$  did he have to buy to meet the requirements?

Soln

$$\% A = \frac{28}{168} \times 100\% = 17.07\%$$

$$\begin{aligned} \text{Amount of fertilizer needed} &= \frac{100}{A} \times \text{mass of nutrient} \\ &= \frac{100}{17.07} \times 160 \text{ kg} \\ &= 937.143 \text{ kg} \end{aligned}$$

$$\begin{array}{l} 937.143 \text{ kg } \text{Ca}(\text{NO}_3)_2 = 80\% \\ x = 100\% \end{array}$$

1171.43 kg is needed to meet the demand.

## METHODS OF FERTILIZER APPLICATION

### (i) Broadcasting Methods

This involves the random scattering of fertilizers on the farm. This ~~is~~ is usually done either manually or by use of fertilizer spreads.

### (ii) Placement method

In this method, a fertilizer is put in the planting holes or drills. The fertilizer is then mixed thoroughly with the soil before the placement of seeds. This method is usually used when applying phosphatic fertilizers.



### (iii) Side dressing Application

This is the placement of nitrogenous fertilizers at the side of the crop or around the growing crop. It is mainly used on perennial crops like coffee.

### (iv) Foliar spraying

This is the application of fertilizers in solution form on the leaves of the crops. The fertilizers are directly absorbed by the leaves. This method is used when conditions do not allow the use of soil-applied fertilizer, for example, during a prolonged dry season.

- It is applied to avoid formation of complex compounds which reduce the availability of plant nutrients.

### (v) Drip application

In this method, the fertilizer is dissolved in water and applied to individual plants through pipes or bottles. It is an uneconomical method and is commonly used in horticultural crop fields.

### (vi) Banding

In banding, the fertilizer is placed either below or on the side of the seed or plant, at a distance of 6-9 cm from the seed or plant.

### Advantages of Inorganic (artificial) fertilizers

- (i) They are not bulky and therefore be transported easily.
- (ii) They contain readily available nutrients for plant growth.
- (iii) They are relatively easy to apply compared to manures.

(w) The composition of fertilizers is almost constant

### Disadvantages

- 1 They are expensive to buy.
- 2 Do not encourage the activities of micro-organisms
- 3 They do not improve the physical properties of the soil, such as soil structure.
- 4 Do not assist the conservation and build-up of soil organic matter
- 5 Some inorganic fertilizers have a scorching effect on some crop parts such as leaves and stems.

### Similarities between manure and fertilizer

- 1 Both supply nutrient in the soil
- 2 Both increase the yield of the crops
- 3 Both are applied in the soil by placing in rows or bands.

The fertile soil is not necessarily productive.

- 1 Occurrence of unknown disease or pests on the crops.
- 2 Poor methods of farming which may lead to loss of soil nutrients
- 3 Occurrence of uncontrolled disasters like floods, drought
- 4 Unfavourable weather condition for crop production.
- 5 Dominance of the weeds in the farm.
- 6 Viability of the seed sown
- 7 Suitability of the soil for the type of crop grown.



8 Growing of crops early or too late of the start of season in the field.

Productivity of the soil refers to the amount of yields a farmer can harvest in a small field. It is the output from the agricultural field.

- If ~~farmers~~ It is measured in terms of quantity of yields obtained.

The productivity of the soil can be improved if the farmer can.

- 1 Control the pest and diseases like attack crop plants
- 2 plant crops in the field in the proper time.
- 3 Do weeding on proper time.
- 4 Grow crop plants by following good agronomic plants practices like spacing
- 5 Supplement the soil with fertilizers

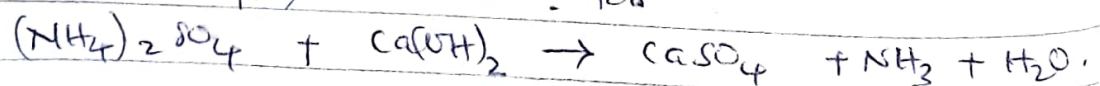
→ On treatment with calcium hydroxide the soil pH was raised from 5 to 7. What can you say about the properties of calcium hydroxide

→ What cations prevail in acid soil?

Hydrogen ions ( $H^+$ ) aluminium ions ( $Al^{3+}$ ).

→ Is it sensible to add lime to a field which has received an application of ammonium sulphate fertilizer? Explain

No, because they will react. too



\* Controlling excess acidity:

When <sup>soil</sup> becomes too acidic, it can be treated with bases like quicklime ( $CaO$ ) and slaked lime ( $Ca(OH)_2$ ). These bases react with the acids in the soil and raise the pH for healthy plant growth.



$$Fw = \frac{Rr \times 100}{Cn}$$

$Rr$  = recommended nutrient rate (kg/ha)

$Fw$  = weight of fertilizer (kg/ha)

$Cn$  = concentration of nutrient in the fertilizer %

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Addition of inorganic fertilizer is not as important as addition of organic manures

- Back staining  
They are less important since they are
- They do not improve the soil structure
  - They are readily leached. They do not stay for a longer duration in the soil and thus do not supply nutrients to the plant for a long period of time as compared to organic manures.
  - They do not support the activity of the microorganisms compared to organic manure.
  - When frequently applied they change the pH of the soil greatly.
  - Some inorganic fertilizers have scorching effect on some crop parts such as leaves & stems.

### Causes of acidity in soil

- 1 Leaching of basic <sup>elements</sup> cations,  $Ca^{2+}$ ,  $Mg^{2+}$ ,  $K^+$ ,  $Na^+$
- 2 Due to heavy rainfall or irrigation
- 3 The use of acid forming fertilizers eg  $(NH_4)_2SO_4$  - Ammonium based fertilizers
- 4 The presence of <sup>some anions</sup>  $SO_4^{2-}$ ,  $NO_3^-$ ,  $Cl^-$  in the soil solution.
- 5 Microbial activities & decomposition of organic matter. - Organic decay produces hydrogen ion ( $H^+$ ) which are responsible for acidity.  $CO_2 + H_2O \rightarrow H_2CO_3$  (aq)
- 6 Acidic parent material