Sources and Forms of Fertilizer

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Fertilizer is any material of natural or synthetic origin added to the soil to supply one or more plant nutrients.

**CLASSIFICATION OF FERTILIZERS**

- **Straight Fertilizers**
- **Complex Fertilizers**
- **Mixed fertilizers**
**Sources and Forms of Fertilizer**

1. **Straight fertilizers**
   Straight fertilizers are those which supply only one primary plant nutrient, namely nitrogen or phosphorus or potassium. E.g. Urea, ammonium sulphate, potassium chloride and potassium sulphate.

2. **Complex fertilizers**
   Complex fertilizers contain two or three primary plant nutrients of which two primary nutrients are in chemical combination. These fertilizers are usually produced in granular form e.g. Diammonium phosphate, nitrophosphates and ammonium phosphate.

3. **Mixed fertilizers:**
   Physical mixtures are straight fertilizers. They contain two or three primary plant nutrients.
   Mixed fertilizers are made by thoroughly mixing the ingredients either mechanically or manually.
Sources and Forms of Fertilizer

Fertilizers can also be classified based on physical form

- Solid fertilizers
- Liquid fertilizers
Solid fertilizers are in several forms:
• Powder (single superphosphate)
• Crystals (ammonium sulphate)
• Prills (urea, diammonium phosphate, superphosphate)
• Granules (Holland granules)
• Supergranules (urea supergranules)
• Briquettes (urea briquettes).
Liquid fertilizers

Liquid form fertilizers are applied with irrigation water or for application. Ease of handling, less labour requirement and possibility of mixing with herbicides has made the liquid fertilizers more acceptable to farmers.

TYPES OF FERTILIZERS

- Nitrogenous Fertilizers
- Phosphatic Fertilizers
- Potassic Fertilizers
- Complex Fertilizers
A. Nitrogenous fertilizers

More than 80 per cent of the fertilizers used in this country are made up of nitrogenous fertilizers, particularly urea.

<table>
<thead>
<tr>
<th>Ammoniacal</th>
<th>Nitrate</th>
<th>Ammoniacal and Nitrate</th>
<th>Amide fertilizer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ammoniumm</td>
<td>Sodium Nitrate</td>
<td>Ammonium Nitrate</td>
<td>Urea</td>
</tr>
<tr>
<td>Sulphate</td>
<td>Calcium Nitrate</td>
<td>Calcium Ammonium Nitrate</td>
<td>Calcium Cynamide</td>
</tr>
<tr>
<td>Ammonium chloride</td>
<td>Potassium Nitrate</td>
<td>Ammonium Sulphate Nitrate</td>
<td></td>
</tr>
<tr>
<td>Anhydrous ammonia</td>
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</table>
The nitrogenous fertilizers can be further classified into:

Ammoniac fertilizers:

- Ammoniac fertilizers contain the nutrient nitrogen in the form of ammonium or ammonia.
- Except rice, all crops absorb nitrogen in nitrate form. These fertilizers are resistant to leaching loss, as the ammonium ions get readily absorbed on the colloidal complex of the soil.
Sources and Forms of Fertilizer

a) Ammonium sulphate [(NH₄)₂SO₄]

- It is a white salt completely soluble in water containing 20.6 per cent of nitrogen and 24.0 per cent of sulphur.

- It is used advantageously in rice and jute cultivation.

- It is easy to handle and it stores well under dry conditions. But during rainy season, it sometimes forms lumps.

- It can be applied before sowing, at the time of sowing or as a top-dressing to the growing crop.
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b) Ammonium chloride (NH4Cl)

- It is a white salt contains 26.0 per cent of nitrogen.
- It is usually not recommended for tomato, tobacco and such other crops as may be injured by chlorine.
2. Nitrate Fertilizers

- Nitrate fertilizers contain the nitrogen in the form of NO3

- These ions are easily lost by leaching because of the greater mobility of nitrate ions in the soil.

- Continuous use of these fertilizers may reduce the soil acidity as these nitrogenous fertilizers are basic in their residual effect on soils.
b) Potassium nitrate (KN03)

The purified salt contains 13.0 per cent nitrogen and 36.4 per cent potassium.

The nitrogen of the potassium nitrate has the same properties and value as that of the sodium nitrate.

3. Ammoniacal and nitrate fertilizers

These fertilizers contain nitrogen in both ammonium and nitrate forms. The nitrates are useful for rapid utilization by crops and the ammonical is gradually available.
a) Calcium nitrate [Ca (NO3)2]

It is a white crystalline hygroscopic solid soluble in water containing 15.5 per cent nitrogen and 19.5 per cent calcium. The calcium is useful for maintaining a desirable soil pH.
b) Calcium ammonium nitrate (CAN)

- Calcium ammonium nitrate is a fine free-flowing, light brown or grey granular fertilizer, containing 26 per cent of nitrogen.

- It is almost neutral and can be safely applied even to acid soils.

- 50% of its total nitrogen is in the ammoniacal form and another 50% is in nitrate form.
a) **Ammonium nitrate (NH4N03)**

- Contain 35 per cent nitrogen half as nitrate nitrogen and half in the ammonium form.

- In the ammonium form, it cannot be easily leached from the soil.

- This fertilizer is quick-acting, but highly hygroscopic and not fit for storage.

- It has an acidulating effect on the soil
C) Ammonium sulphate nitrate [(NH4)2S04 NH4NO3]

- It contains 26 per cent nitrogen, three fourths of it in the ammoniacal form and the rest (6.5 per cent) as nitrate nitrogen.
- It is a mixture of ammonium nitrate and ammonium sulphate.
- It absorbs moisture from the atmosphere and has to be kept in moisture proof containers.
- It is readily converted to ammoniacal and nitrate forms in the soil.

The nitrogen in urea is readily fixed in the soil in an ammoniacal form and is not lost in drainage.

Urea sprays are readily absorbed by plants.

It may be applied at sowing or as, a top-dressing.

It is suitable for most crops and can be applied to all soils.
b) Calcium cyanamide (CaCN2)
- Calcium cyanamide or nitrolime contains 20.6 per cent of nitrogen.
- It is a greyish white powdery material that decomposed in moist soil giving rise to ammonia.

B. Phosphatic fertilizers
Phosphatic fertilizers are chemical substances that contain the nutrient phosphorus in absorbable form (Phosphate anions) or that yield after conversion in the soil.
4. Amide fertilizers
Amide fertilizers are readily soluble in water and easily decomposable in the soil.

a) Urea [CO (NH2)2]
It is the most concentrated solid nitrogenous fertilizer, containing 46 per cent nitrogen.

It is a white crystalline substance readily soluble in water.
Super phosphate [Ca (H2PO4)2]

This is the most important phosphatic fertilizer in use.

It contains 16 Per cent P2O5 in available form.

It is a grey ash like powder with good keeping or storage qualities.

Phosphatic fertilizer hardly moves in the soil and hence they are placed in the root zone.
**Triple super phosphate:**

The concentrated super phosphate is called as Triple super phosphate and it contains 46 per cent P2O5.

This fertilizer is suitable for all crops and all soils.

In acid soils, it should be used in conjunction with organic manure.

It can be applied before or at sowing or transplanting.
C. Potassic fertilizers

There are a limited number of fertilizer materials that can be used to supply K when needed.

### Common fertilizer sources of K

<table>
<thead>
<tr>
<th>Material</th>
<th>Chemical Formula</th>
<th>K₂O Contend(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Potassium chloride</td>
<td>KCl</td>
<td>60</td>
</tr>
<tr>
<td>Potassium-magnesium sulfate</td>
<td>K₂SO₄-2MgSO₄</td>
<td>20</td>
</tr>
<tr>
<td>Potassium nitrate</td>
<td>KNO₃</td>
<td>44</td>
</tr>
<tr>
<td>Potassium sulfate</td>
<td>K₂SO₄</td>
<td>50</td>
</tr>
</tbody>
</table>
a) **Potassium chloride (KCl)**

- Potassium chloride or muriate of potash is a white or red, crystal containing 60.0 per cent K2O.

- It is completely soluble in water and therefore readily available to the crops.

- It is not lost from the soil, as it is absorbed on the colloidal surfaces.

- It can be applied at sowing or before or after sowing.
b) Potassium sulphate (K2SO4)

- Potassium sulphate or sulphate of potash is a white salt and contains 48 per cent K2O.
- It is soluble in water and therefore readily available to the crop.
- It does not produce any acidity or alkalinity in the soil.
- It is preferred for fertilization of crops like tobacco, potato etc.
E. Secondary major-nutrient fertilizers

a. Magnesium fertilizers

These are chemical substances containing the nutrient magnesium in the form of magnesium cations (Mg$^{2+}$).

**Magnesium Sulphate (MgSO$_4$)**

The utilization rate of magnesium fertilizers decreases with increasing potassium supplies.
b. Calcium fertilizers

These are the chemical substances containing the nutrient calcium in absorbable calcium cations ("Ca2+) form.

The raw material of calcium fertilizers is lime found in nature.

**Calcium Chloride (CaCl2 6H2O)**

It contains at least 15 per cent calcium.

It is highly water soluble and can, therefore, be dissolved for application as a foliar nutrient.
D. Micronutrient Fertilizers

The importance of fertilization of crops with micro-nutrients is increasing mainly because of greater removal from the soil, intensive liming of soil, intensive drainage of soil, higher use of nitrogenous, phosphatic and potassic fertilizers etc.

There are seven essential micronutrients required by plants.
These are iron, manganese, zinc, copper, chlorine, boron and molybdenum.
c. Sulphate Fertilizers

These are chemical substances containing the nutrient sulphur in the form of absorbable sulphate anions (SO\(_{4}^{2-}\)).

The sulphur requirements of plants are about two third of their phosphorus requirements.

Substantial sulphur supplies occur as minor constituents of various N, P and K fertilizers.
a. Iron fertilizers

These are generally water soluble substances, predominantly sprayed as foliar nutrients on the crops.

Plants absorb iron in the form of Fe2+.

<table>
<thead>
<tr>
<th>Ferrous sulphate (FeSO4 7H2O)</th>
<th>It is a water soluble fertilizer containing 20 % Fe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fe – Chelates</td>
<td>Suitable for application as foliar nutrients</td>
</tr>
<tr>
<td>Fe-EDTA</td>
<td></td>
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<tr>
<td>Fe-EDDPA</td>
<td></td>
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</tbody>
</table>
### Sources and Forms of Fertilizer

#### b. Manganese fertilizers

The manganese (Mn) fertilizers are as follows:

<table>
<thead>
<tr>
<th>Manganous Sulphate (MnSO₄ 7H₂O)</th>
<th>It is the well known water soluble Mn fertilizer.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>It is pink salt containing 24% Mn.</td>
</tr>
<tr>
<td></td>
<td>It dissolves in water and is suitable for foliar application.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mn – chelates (Mn – DTA)</th>
<th>It contains 13% Mn.</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>It plays an important role in the crop fertilization.</td>
</tr>
</tbody>
</table>
### d. Copper Fertilizers

Copper fertilizers have been used to correct copper (Cu) deficiencies.

- Copper sulphate (CuSO₄ 5H₂O) – 25 % Cu
- Copper sulphate (CuSO₄ H₂O) – 36 % Cu

### e. Boron Fertilizers

<table>
<thead>
<tr>
<th>Borax (Na₂B₄O₇ 10H₂O)</th>
<th>It contains 11 % B</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>It is water soluble white salt</td>
</tr>
<tr>
<td></td>
<td>It can be applied as a soil dressing or foliar application</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Boric acid (H₃BO₃)</th>
<th>It contains 18 % B</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>It is a white crystalline powder</td>
</tr>
<tr>
<td></td>
<td>It is applied as a foliar nutrient</td>
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</tbody>
</table>
### c. Zinc fertilizers

Zinc (Zn) fertilizers play an important role in Zn deficient soils.

<table>
<thead>
<tr>
<th>Source/Material</th>
<th>Properties</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zinc Sulphate (ZnSO₄·7H₂O)</td>
<td>- It is water soluble whitish salt containing 23 % Zn.</td>
</tr>
<tr>
<td></td>
<td>- It is applied as foliar nutrient.</td>
</tr>
<tr>
<td></td>
<td>- Its acidic action causes corrosion damage to plants.</td>
</tr>
<tr>
<td>Zinc-oxide (ZnO)</td>
<td>- It contains 70 % Zn.</td>
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<tr>
<td></td>
<td>- It is slightly soluble in water.</td>
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<td></td>
<td>- It is used as slow acting foliar nutrient.</td>
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</table>
f. Molybdenum Fertilizers

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<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium molybdate</td>
<td>(Na₂MoO₄·2H₂O)</td>
</tr>
<tr>
<td>Ammonium molybdate</td>
<td>(NH₄)₆Mo₇O₄·44H₂O)</td>
</tr>
</tbody>
</table>
Fertilizers are available in both organic as well as inorganic forms. They are classified as straight, complex and mixed fertilizers. They can also be classified into solid and liquid fertilizers. Fertilizers are applied to supply nutrients required by the crop that are taken up from the soil.