JUST AGRICULTURE
multidisciplinary e-Newsletter

Nitrogenous Fertilizers and their Characteristics

[1]Kavita, [2]Harender and [2]Kavinder

[1]Department of Soil Science, CCS Haryana Agricultural University, Hisar

[2]Department of Agronomy, CCS Haryana Agricultural University, Hisar

ARTICLE ID: 009

Introduction:

General properties of nitrogenous fertilizers

Ammonium sulphate [$(NH_4)_2SO_4$]

1. It is a white crystalline salt having good keeping quality in dry conditions.
2. It contains 20.6 to 21 per cent nitrogen and 24 per cent sulphur.
3. It is readily soluble in water and is non hygroscopic, however under humid condition (rainy season) it forms lumps (caking).
4. It is much more resistant to loss by leaching, because ammonium ion is readily absorbed on the colloidal complex of soil. Ions, so fixed, are not readily lost by leaching.
5. Thus it is very suitable for wetland crops such as paddy and jute.
6. It has excellent physical properties and can be mixed with phosphate and potassic fertilizer.
7. It is acid forming fertilizer and suitable for salt affected and sulphur deficient soils.

Uses: Ammonium sulphate is a useful fertilizer for all crops and for a wide variety of soil. It can be applied either at sowing or as top dressing i.e. during the growing period of the crop. But it should not be applied with seed and lime. It is advisable to use this fertilizer in conjuction with bulky organic manure like compost and FYM. Paddy takes up nitrogen in ammonical form in early stage and nitrate form in later stage. So ammonium sulphate is best suited for basal dressing and top dressing of paddy field.

JUST AGRICULTURE
multidisciplinary e-Newsletter

Sodium nitrate

Sodium nitrate is also known as 'Chilean Nitrate'. It is the oldest and best-known nitrate fertilizer. It is obtained as neutral product, Saltpeter, from salt bed in Chile and in India it is imported mainly from Chile. Sodium nitrate occurs in natural impure deposits in Chile and also known as Caliche. It has impurities like common salt (NaCl), Glauber's salt (Na2SO4), gypsum, iodates, borates and earth.

General properties of Sodium nitrate

1. Sodium nitrate is a white salt, highly soluble in water and highly hygroscopic results in difficulty in storing. It should be stored in dry warehouse.
2. It causes fire hazard and highly soluble in water and quickly leached out from soil.
3. It contains about 16 per cent nitrogen in nitrate form and 27 per cent sodium.
4. It is a basic fertilizer and its basicity is 29 i.e. 100 kg of sodium nitrate reduces the acidity equivalent to 29 kg of calcium carbonate.
5. It is particularly useful for acidic soils.
6. Chilean nitrate contains also traces of micronutrients such as Mn, B, Cu, and Zn.

Uses: It is a good fertilizer for wheat, maize, barley, cotton and sugarcane. It is also good for top and side dressing. It is not suitable fertilizer for waterlogged conditions because under such condition, large portion of fertilizer is lost by leaching. Sodium nitrate may damage the structure of soil by reducing flocculation if applied in large quantities. It should not be applied in sodic soils.

Calcium Ammonium Nitrate [$CaNH_4(NO_3)_3$ or $CaCO_3.NH_4NO_3$]

Calcium ammonium nitrate is a mixture of calcium carbonate and ammonium nitrate. Thus, for the manufacture of this fertilizer ammonium nitrate solution is first produced. Then pulverized limestone ($CaCO_3$) is mixed with concentrated solution of ammonium nitrate.

General properties of Calcium Ammonium Nitrate

1. Calcium Ammonium Nitrate is a fine, free flowing, light brown or grey granular fertilizer.
2. It contains 25 per cent nitrogen, half in ammonium form and half in nitrate form.
3. It is readily soluble in water, but it is resistant to leaching.

JUST AGRICULTURE
multidisciplinary e-Newsletter

4. It is very hygroscopic. So it needs special care during handling.
5. It is almost neutral and can be safely applied even to acid soils.
6. It can be mixed with phosphatic and potassic fertilizers for dry home mixing but the mixture must be used immediately after mixing otherwise the calcium present in CAN forms water insoluble calcium phosphate and reduce the phosphate availability to plants.

Uses: Calcium ammonium nitrate is a suitable fertilizer for all crops and for a wide variety of soils. It is best fertilizer for basal application and it is also useful for top dressing except for wetland rice. In waterlogged soils losses due to denitrification are likely to be higher than ammonium sulphate. Heavy irrigation after application of CAN should be avoided as it contains 12.5 per cent nitrate nitrogen which may be lost due to leaching.

Ammonium Sulphate Nitrate [$(NH_4)_2SO_4.NH_4NO_3$]

Ammonium Sulphate Nitrate is a double salt of Ammonium sulphate and ammonium nitrate. Thus, this fertilizer is produced by mixing ammonium sulphate and ammonium nitrate.

General properties of Ammonium Sulphate Nitrate

1. It is available in a white crystalline form or as granules of a dirty white colour
2. It contains 26 per cent nitrogen, a part of which (19.5 per cent) is in ammonical form and the rest (6.5 percent) in nitrate form. It also contains 12 per cent sulphur.
3. It has good keeping quality. It is not explosive and not as deliquescent as ammonium nitrate.
4. It is readily soluble in water and is readily available to crop as it contains one fourth of nitrogen in nitrate form.
5. It is highly resistant to leaching as it contains three fourth of nitrogen in ammonical form.
6. It is acidic in nature and its acid equivalent is 93 i.e. 93 kg of calcium carbonate is required to neutralize the acidity developed by application of 100 kg ammonium sulphate nitrate.
7. It does not cake easily under normal condition but forms a hard cake when it is stored in moist condition.
8. It is best fertilizer for marginally saline soils having pH up to 8.5.

JUST AGRICULTURE
multidisciplinary e-Newsletter

9. It may be mixed with superphosphate and potassic fertilizers, however fertilizers having free lime like basic slag, calcium cyanamide *etc* should not be mixed with it otherwise ammonia gets lost due to volatilization.

Uses: This fertilizer is used for all crops and is suitable for application to all types of soil. It may be applied prior to sowing, at sowing time or as top dressing. But it should not be applied with the seed. It should be preferably mixed with soil or the application should be followed by light irrigation. The nitrogen recovery and fertilizer use efficiency of this fertilizer is relatively much better.

Urea [$CO(NH_2)_2$]

Urea is an organic fertilizer and is a cheapest source of nitrogen. Urea was first identified in 1773 after isolation in crystalline form from urine. It was synthesized in laboratory in 1828 by Wohler from ammonia and cyanuric acid.

$$NH_3 + HCNO \longrightarrow CO(NH_2)_2$$

However, now-a-days Urea is manufactured by reacting anhydrous ammonia and carbon dioxide gas under very high pressure (200 atmospheric pressure) in the presence of suitable catalyst in a urea reactor maintained at about 185 ^oC. The reaction is represented as under:

$$2NH_3 + CO_2 \rightleftharpoons NH_2CO_2NH_4$$

Ammonium carbamate

This unstable intermediate product (ammonium carbamate) is decomposed and urea is recovered. The urea solution is concentrated to 99 per cent and is sprayed into a chamber where urea crystals are formed.

$$NH_2CO_2NH_4 \rightleftharpoons CO(NH_2)_2 + H_2O$$

Urea

General properties of Urea

1. Urea is a white crystalline product soluble in water, hygroscopic and it has a tendency of caking.
2. It contains 46 per cent nitrogen in amide form and this form is not utilized as such by most of the crops.

JUST AGRICULTURE
multidisciplinary e-Newsletter

3. Urea is a acidic fertilizer but it is less acidic compared to ammonium sulphate.
4. Urea can be mixed with phosphatic and potassic fertilizers, however mixture is used just after preparation because water soluble P converted to water insoluble calcium phosphate.
5. Mixture of urea with murate of potash has a strong tendency to become wet.

Causes of popularity of urea

1. Urea can be used in every soil and for every crop.
2. Urea contains more amount of nitrogen in comparison to other nitrogenous fertilizers. So the cost of transportation and application to the crop is less and saves money in the cultivation of crop.
3. The price per unit nitrogen of urea is less than that of other fertilizers.
4. It is suitable for foliar spray.
5. It is neither explosive nor a fire hazardous.
6. The application of urea by broadcasting is very easy as it is a crystalline fertilizer.
7. Urea can be applied at any time i.e. before sowing, at the time of sowing, top dressing and foliar spray.
8. Urea produces less acidity in soil compared to ammonium sulphate

Uses: Urea is suitable for application to all crops and on all soils. It may be applied either top dressing or at sowing time. When applied at sowing time, it should not be allowed to come into contact with seed. The unhydrolyzed urea is washed out under submerged condition of soil. It also washed out if applied at the time of continuous rain.

Calcium nitrate [$Ca(NO_3)_2$]

Calcium nitrate is a nitrogenous fertilizer and is also known as nitrate of lime.

General properties of Calcium nitrate

1. It is white crystalline salt, very hygroscopic in nature i.e. absorb moisture at storage particularly in humid climate like India.
2. It contains 15.6 to 25.0 per cent nitrogen in nitrate form.
3. It is supporter of combustion (all nitrate form of fertilizer is a supporter of combustion)

JUST AGRICULTURE
multidisciplinary e-Newsletter

4. It is basic in nature and its basic equivalent is 27.

Uses: it is suitable fertilizer for all crops and for a wide variety of soils. But it is not suitable fertilizer for water-logged condition, because large portion of this fertilizer is lost by leaching.