

Nutrients and fertilisers

Essential elements

To grow healthily and in good yield, plants need an adequate supply of several elements. They are not used in their elemental form, instead their compounds are used.

These elements are often grouped according to the quantities required: primary, secondary and micronutrients.

| Primary nutrients | Secondary nutrients | Micronutrients |
|--------------------------|-------------------------|------------------------|
| 100s kg / hectare needed | 10s kg / hectare needed | 1s kg / hectare needed |
| Nitrogen, N | Calcium, Ca | Boron, B |
| Phosphorous, P | Magnesium, Mg | Copper, Cu |
| Potassium, K | Sulfur, S | Iron, Fe |
| | | Manganese, Mn |
| | | Molybdenum, Mo |
| | | Zinc, Zn |

Note: 1 hectare (ha) = 0.01 square kilometres (km²)

All these elements are found in soil naturally. They are present as inorganic compounds, which are ionic compounds with giant lattices. There are two exceptions, ammonia and boric acid. These are covalent compounds present in soil as molecules.

Fertilisers

Soil does not always have sufficient of the nutrients required by plants. This is when fertilisers are used, to supply the deficient nutrients. There are two main types:

Organic fertilisers are made from rotting and decaying organic matter such as plants and animals. They consist of large organic molecules that need to be broken down by organisms in the soil. This tends to make them slow acting. Fish blood and bone, bone meal, poultry manure pellets and seaweed are examples of organic fertilisers. Urea is an organic compound that is used as a fertiliser, but it is manufactured from inorganic compounds.



Figure 1 A manure heap ready for spreading on farm land. Steam is rising from it because the chemical processes of decay are exothermic.

Inorganic fertilisers are made from naturally occurring minerals or manufactured inorganic compounds. These contain higher concentrations of nutrients than organic fertilisers and are faster acting.

Straight fertilisers, which are usually inorganic, contain a single nutrient. Ammonium nitrate is an example.



Figure 2 Ammonium nitrate is manufactured on a large scale. Granules are bagged up and distributed to growers. The bag shows the percentage of nitrogen in the fertiliser. Typically it is 34.5%.

Multi-nutrient fertilisers

Multi-nutrient fertilisers contain at least two primary nutrients and are often referred using the chemical symbols primary nutrient elements, e.g. NPK and NP.

There are three types of multi-nutrient fertiliser.

- Complex fertilisers are made by chemical reaction. They are single chemical compounds such as ammonium dihydrogen phosphate(V), $\text{NH}_4\text{H}_2\text{PO}_4$, and diammonium hydrogen phosphate(V), $(\text{NH}_4)_2\text{HPO}_4$.
- Compound fertilisers are made by chemical reaction, blending or a combination of both.
- Blended fertilisers are made by mixing two or more dry substances. No chemical reaction is involved.

Labelling fertiliser bags

By law, labels on fertiliser bags must include:

- The prescribed name of the product content, such as 'NPK Fertiliser';
- The primary nutrient contents, nitrogen (N), phosphorus (P) and potassium (K);
- Forms in which the nitrogen content is present;
- Solubility of the phosphorus content: P and K are usually expressed as their oxide content (P_2O_5 and K_2O respectively), followed in brackets by the content of the element;
- Levels of secondary nutrients and micronutrients present;
- Any pesticide content and a statutory declaration to comply with pesticide legislation;
- An EC product declaration, if the product is EC approved.

Quantities of nutrients

Packaging used for fertilisers shows the ratio of primary nutrients.

The one on the right has a ratio of 20:10:20.

However, this is not the ratio of the masses of these elements.

Instead, it is the ratio of the masses of nitrogen, N, phosphorus pentoxide, P_2O_5 , and potassium oxide, K_2O .

Therefore, sometimes two figures appear on the label. The label might have, for example:

'Potassium oxide soluble in water: 10% (8.3% K)'

Growmore has a ratio of 7:7:7. This means the percentages by mass are equivalent to: 7 N:7 P_2O_5 :7 K_2O , which means these percentages by mass of the elements: 7 N:3.1 P:5.8 K.

Finding out

How does the composition of fertilisers formulated for specific plants such as roses, tomatoes and grass (lawns) vary?

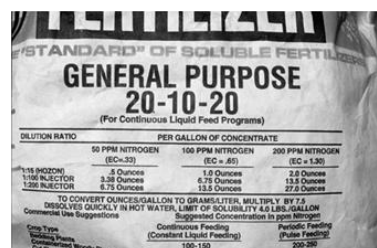


Figure 3 A label usually shows the ratio of primary nutrients present. The proportions are always shown in the order N:P:K.