

## Matt's Guides –Plant Nutrients

Plants need three main macronutrients, the elements nitrogen (N), phosphorous (P), and potassium (K). Other macro and micronutrients are needed, with more specific functions. There are 90 or more plant nutrients, 14 of which are commonly listed as essential (ignoring hydrogen and oxygen from water, and carbon):

- The macronutrients are nitrogen (N), phosphorus (P), potassium (K), calcium (Ca), magnesium (Mg) and sulphur (S). NPK are required in the largest quantities.
- The micronutrients are Manganese (Mn), Boron (B), Copper (Cu), Iron (Fe), Zinc (Zn), Nickel (Ni), Molybdenum (Mo) and Chlorine (Cl).
- In fertilisers the composition of NPK is listed, with these elements typically provided by the compounds ammoniacal nitrogen, phosphorous pentoxide, potassium oxide. The elements are more useful to the plant than the compound. Fertiliser labels therefore list both the element and the compound as percentages, eg Potassium Oxide: 7% (K 5.8%) - it is the usable 5.8% K that is really relevant to the plant.
- Plants can only use water soluble compounds/minerals. This is why liquid feeds work faster. Solid organic feeds such as blood, fish and bone need to be broken down in the soil before the plant can use them. Also, if it is very dry the plant cannot get the nutrients it needs (as well as the water)!

| Primary Macronutrients          | Purpose                                                                                                      | Deficiency                                                                                                                    | Remedy                                                                                                  | Other notes                                                                                                                                                                   |
|---------------------------------|--------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Nitrogen (N)                    | Chlorophyll production for photosynthesis (shoots/growth)                                                    | Yellowing or stunted leaves; spindly plants                                                                                   | Short term: poultry manure; high N fertilisers. Longer term: mulch with organic matter, compost/manure. | Nitrate easily washed out of soil (common deficiency in spring after wet winter)                                                                                              |
| Phosphorous (P)                 | Root development (roots)                                                                                     | Slow growth, dull foliage                                                                                                     | Bone meal; mulch with organic matter                                                                    | Usually rare. Possible in heavy clay soil, or after very high rainfall.                                                                                                       |
| Potassium (K)                   | Reproduction related (fruits/flowers)                                                                        | Yellow or purple leaf tints, browning at edges.<br>Poor flowering or fruiting                                                 | Sulphate of potash; tomato feed; organic source from beetroot processing.                               | If too much potassium applied it will be taken up in preference to magnesium (too much K can lead to a deficiency of Mg)                                                      |
| <b>Secondary Macronutrients</b> |                                                                                                              |                                                                                                                               |                                                                                                         |                                                                                                                                                                               |
| Calcium (Ca)                    | Cell structure (strength and rigidity) and processes within plant cells such as transportation of nutrients. | Poor root growth. Curling leaves, stunted growth, discolouration<br>In fruit and veg: bottom end rot, water core, bitter pit. | Avoid soil drying out. Also avoid overfeeding potassium and nitrogen                                    | Mainly affects fruit and tomatoes. Rare that soils are deficient, normally a problem from dry soil/compost or high humidity (poor transport of water containing the calcium). |
| Magnesium (Mg)                  | Healthy leaves and photosynthesis. Part of chlorophyll pigment.                                              | Yellowing or stunted leaves, particularly between leaf veins; early leaf fall.                                                | Magnesium sulphate (epsom salts) on the leaves, or limestone at the roots.                              | More common on light, sandy soils.<br>Overuse of K fertiliser, as K uptake is in preference to Mg                                                                             |
| Sulphur (S)                     | Photosynthesis and support of nitrogen metabolism.                                                           | Similar to nitrogen deficiency – yellowing leaves, but appearing on younger leaves first.                                     | Ammonium sulphate                                                                                       | Plants may also be spindly, as for nitrogen deficiency.                                                                                                                       |

## Matt's Guides –Plant Nutrients

| Micronutrients  | Purpose                                                                                                       | Deficiency                                                                                            | Remedy                                                                                                                                                       | Other notes                                                                                                                                                                         |
|-----------------|---------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Manganese (Mn)  | Used in photosynthesis and nitrogen metabolism.                                                               | Yellowing between the leaf veins with browning of leaf edges on acid-loving plants.                   | Manganese sulphate – foliar spray or directly at roots.                                                                                                      | May affect young leaves more.<br>More common in high pH soils, so needed by ericaceous plants.                                                                                      |
| Boron (B)       | Cell wall formation, providing strength to the plant.<br>Transport of sugars. Pollen tube growth/pollination. | Stunted growth, yellowing of leaves, poor flower development. Fruit mis-shapen, cracked or undersized | Borate ions in soil, or as foliar spray - addition of boric acid, or sodium borate (borax). Availability of boron decreases in alkaline soils.               | Often affects youngest leaves and growing points first.                                                                                                                             |
| Copper (Cu)     | Photosynthesis and metabolism; lignin synthesis; disease resistance                                           | Pale leaves, curling of leaf margin, stunted growth.<br>Reduced fruit/flower formation.               | Addition of copper sulphate or chelated copper.                                                                                                              | Copper deficiency can be caused by acidic soil, soil compaction or high levels of other nutrients (iron, zinc, phosphorous)                                                         |
| Iron (Fe)       | Chlorophyll synthesis, enzyme function, energy production.                                                    | Yellowing leaves (interveinal chlorosis – yellowing between the veins); stunted growth.               | Lower soil pH – add elemental sulphur (converted to sulphuric acid), or ammonium sulphate.<br>Add iron sulphate, iron oxide, or chelated iron foliar sprays. | Deficiency more common in alkaline soils. Can also remedy by increasing organic matter to lower soil pH. Copper and Iron need to be in balance to optimise cell metabolic activity. |
| Zinc (Zn)       | Enzyme activation, protein synthesis                                                                          | Chlorosis, often interveinal. Stunted plants; smaller or malformed leaves.                            | Add zinc sulphide or zinc oxide. May also need to lower soil pH (as for Iron).                                                                               | More common in sandy/alkaline, compacted soils, and those low in organic matter.                                                                                                    |
| Nickel (Ni)     | Nitrogen metabolism (uptake), seed germination and stress response                                            | Distortion/browning at leaf margins; seed germination poor; root development poor.                    | Apply nickel sulphate to the soil or as a foliar spray                                                                                                       | Required in small amounts, but has a disproportionately large impact on plant physiological processes.                                                                              |
| Molybdenum (Mo) | Nitrogen fixation                                                                                             | Pale leaves with intraveinal yellowing.                                                               | Raise the soil pH; apply Mo fertiliser (sodium molybdate) to soil or as foliar spray                                                                         | Mo deficiency causes a build up of nitrate. More common in acid, sandy soils                                                                                                        |
| Chlorine (Cl)   | Osmotic and ionic balance – essentially helps balance water content.                                          | Wilting; reduced growth rate (compromised photosynthesis); susceptibility to disease.                 | Chlorine containing fertiliser.                                                                                                                              | Rare - chlorine commonly found in water and fertilisers. Excess chlorine is more common.                                                                                            |

As micronutrients are needed in much smaller quantities deficiencies are rare, relative to the macro nutrients.

General purpose plant feeds/fertilisers contain some micronutrients, but analysis of the label is needed to determine which for each product.