

MAGNESIUM

MAGNESIUM IN SOILS

Magnesium (Mg) is one of the six macronutrients that, along with nitrogen (N), phosphorus (P), potassium (K), sulphur (S) and calcium (Ca), are taken up in largest quantity by plants from the soil. Most of the magnesium in soil exists in forms that are not directly available to plants. About 5% of the total is present in exchangeable forms. This consists of magnesium held on clay and organic particles in the soil, and any magnesium in water-soluble forms.

Exchangeable magnesium levels are likely to be relatively lower on well drained sandy soils in areas of high rainfall where magnesium and other cations, e.g. calcium, have been leached from the topsoil. Soils that are low in calcium and magnesium tend to be acid, i.e. they have a low pH.

Magnesium concentrations often increase with depth. In annual crops grown on soils where magnesium is low in the topsoil and higher in the sub-soil, magnesium deficiency may be temporary and only apparent early in the growing season.

Magnesium also has an influence on the structure of soils. Once the magnesium percentage of exchangeable cations exceeds 25%, especially on heavier soils, the soil will become increasingly difficult to work. Magnesium causes clay particles to disperse, whereas in soils dominated by calcium, clay platelets will aggregate together to form crumbs or peds. On lighter soils, the calcium to magnesium ratio (Ca:Mg Ratio) can be a better indicator. On these soil as the Ca:Mg ratio falls below 2, but especially around 1, or less – the same dispersive & hard-setting soil characteristics become more prevalent. More friable soils, have better internal drainage, and are easier to cultivate than soils high in magnesium and/or have low Ca:Mg ratios.

MAGNESIUM IN PLANTS

Magnesium is taken up by plants as magnesium ions (Mg^{2+}). It plays a key role in the photosynthetic process, being an important constituent of chlorophyll, which is the green pigment in leaves and stems. The presence of other positively charged ions (cations) in the soil, or their application in fertilisers, may depress plant uptake of magnesium (Mg^{2+}), e.g. calcium (Ca^{2+}), potassium (K^+), sodium (Na^+), aluminium (Al^{3+}) and to a lesser extent ammonium (NH_4^+).

As an example, the application of high rates of potassium (K) at planting on light sandy soil can induce magnesium deficiency (orange freckle) in sugarcane. In pasture, the use of potassium fertiliser may increase the incidence of grass tetany (magnesium deficiency) in grazing animals. Such effects are more pronounced at low soil pH, and also in fast growing short season horticultural crops.

Once absorbed, magnesium is quite mobile within the plant. It is readily relocated from old to young plant tissue.

DEFICIENCY SYMPTOMS

Deficiency symptoms generally appear during the latter part of the growing season. However, it may be induced earlier, e.g. following the application of potassium at planting. As magnesium is mobile in plants, deficiency first appears in the older leaves and then moves to the younger leaves as the deficiency becomes more severe.

Early symptoms of magnesium deficiency include the loss of healthy green colour between veins. This is usually followed by yellowing (chlorosis), which starts at the leaf tips and margins and progresses inward until the entire leaf is chlorotic, curling of the leaf margins, death of these areas and premature defoliation. Brilliant colours develop in some plants, e.g. bright orange, red and purple tints in strawberries.

MAGNESIUM FERTILISERS

Magnesite

Magnesite is magnesium carbonate (MgCO_3). In its pure form magnesite contains 27% Mg. Magnesite is not commonly used on its own. Soils low in magnesium are usually low in calcium as well and are acid. Hence magnesium is normally applied as dolomite, or in combination with lime (calcium carbonate).

Dolomite

Dolomite is calcium magnesium carbonate [$\text{CaMg}(\text{CO}_3)_2$]. In its pure form it contains 20.8% Ca and 12.5% Mg. Commercial grades of dolomite typically contain from 8 – 12.5% Mg. Dolomite, and related products, are used to supply calcium and magnesium, and raise the soil pH.

Liming materials such as magnesite, dolomite and lime are insoluble and are slow to react in the soil. To be effective, they must be finely ground, i.e. have a fine particle size. In annual crops, they should be applied several months before planting, and be incorporated into the soil.

Magnesium oxide

Magnesium Oxide (MgO) is the most concentrated magnesium fertiliser available. It contains 55% Mg. Magnesium oxide, like the magnesium carbonates (magnesite and dolomite) is insoluble and slow to react in the soil. In annual crops, it is best applied pre-plant. It should not be used where a quick response to magnesium is required.

Potassium magnesium sulphate

Potassium magnesium sulphate ($\text{K}_2\text{SO}_4 \cdot 2\text{MgSO}_4$), sold under the names of Sul-Po-Mag and K-Mag, contains around 18% K, 22% S and 10.5% Mg. Incitec Pivot does not market either of these products.

As the magnesium in potassium magnesium sulphate is present in the soluble sulphate form, it can be used where a quick response to magnesium is required, e.g. at planting on soils low on magnesium. Potassium magnesium sulphate is only suited to dry application to the soil. While it is soluble, it dissolves too slowly to be used in the preparation of fertiliser solutions.

Magnesium sulphate

Magnesium sulphate is available in three forms:

- **Epsom Salts** ($\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$) contains 9.6% Mg. It is used where there is a need to dissolve magnesium and apply it in solution, e.g. through fertigation systems or as a foliar spray.
- **Kieserite** ($\text{MgSO}_4 \cdot \text{H}_2\text{O}$) contains 15% Mg. It is used where there is a need to apply a soluble magnesium fertiliser dry to the soil.
- **Easy Mg-SUL** (MgSO_4) contains 6.3% Mg. It is used where there is a need to apply a liquid magnesium fertiliser in solution (i.e. foliar, soil injection or in fertigation systems).

SAFETY DIRECTIONS

Refer to the Safety Data Sheet (SDS) for more detailed safety advice. Before use, read the Product Label and the SDS. Use safe work practices and avoid contact with the eyes and skin. Avoid ingestion and inhaling dust. Protective clothing, eyewear and dust masks should always be used when dealing with this product. Observe good personal hygiene, including washing hands after use. Avoid loss of fertiliser to waterways.

WARNING

This document contains information of a general nature. Before using fertiliser seek independent agronomic advice. Fertiliser programs may need to be varied depending on the plants being grown, climatic and soil conditions, application methods, irrigation, agricultural and livestock management practices, the soil's fertility, and cultural practices. ('Unforeseen Elements')

Fertiliser may burn and/or damage crop roots or foliage. Foliar burn to the leaves, fruit or other plant parts is most likely to occur when fertilisers are foliar applied at high concentrations and/or on a regular basis, different products are mixed and sprayed together at cumulatively high rates, the water is of poor quality, or the spray is applied under hot dry conditions, e.g. in the heat of the day.

Fertiliser and supplements may affect animal health. Seek independent advice before using any supplements in livestock rations.

DISCLAIMER

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