



MAGNESIUM

MAGNESIUM IN SOILS

Magnesium (Mg) is one of the six macronutrients that, along with nitrogen (N), phosphorus (P), potassium (K), sulfur (S) and calcium (Ca), are taken up in largest quantity by plants from the soil.

Most of the magnesium in the 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 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 top-soil 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 clay soils. Once the magnesium percentage of exchangeable cations exceeds 20%, 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. Such soils are friable, have better internal drainage, and are easier to cultivate than soils high in magnesium.

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, 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^+) and 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 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 contains 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 sulfate

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

As the magnesium in potassium magnesium sulfate is present in the soluble sulfate form, it can be used where a quick response to magnesium is required, e.g. at planting on soils low

on magnesium. Potassium magnesium sulfate 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 sulfate

Magnesium sulfate is available in two 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.

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