

Magnesium



FUNDAMENTALS:

- Elemental Form: Magnesium (Mg)
- Plant Nutrient Form: elemental magnesium (Mg)
- Plant Uptake Form: magnesium cation (Mg²⁺)

IMPORTANCE AND ROLES IN PLANTS:

Magnesium, along with sulphur and calcium, is one of the secondary plant nutrients. These are required by plants in generous amounts, although not nearly in such volumes as the three macro-nutrients nitrogen, phosphorus and potassium. Most people know that magnesium is the heart of the chlorophyll molecule, upon which photosynthesis depends. It is also involved in respiration and energy metabolism of plants.

Deficiency Symptoms:

Magnesium is mobile within plants, moving into areas of new growth. Therefore, deficiency symptoms are apparent mostly on older leaves. It usually manifests as interveinal chlorosis, and in corn yellow or whitish stripes can be seen running along the length of the leaves parallel to the leaf veins (Diagram 1). Broadleaf crops may exhibit a bronze or orange-yellow colouration, yet with green veins. Highbush blueberries also develop interveinal chlorosis, with leaf edges turning red or brown (Diagram 2).

As for other nutrients, the best way to determine whether a deficiency exists is by lab test. Bring soil or tissue samples to the Plant Science Lab at our Abbotsford location at 464 Riverside Road. One of our agronomists can assist you and provide recommendations. A major

deficiency can be best corrected by a granular supplement such as potassium magnesium sulphate; this is typically the least expensive method. An application can be done at any time of year including the fall. In mid-season, you can apply a foliar or drip magnesium product to correct a small or urgent deficiency.



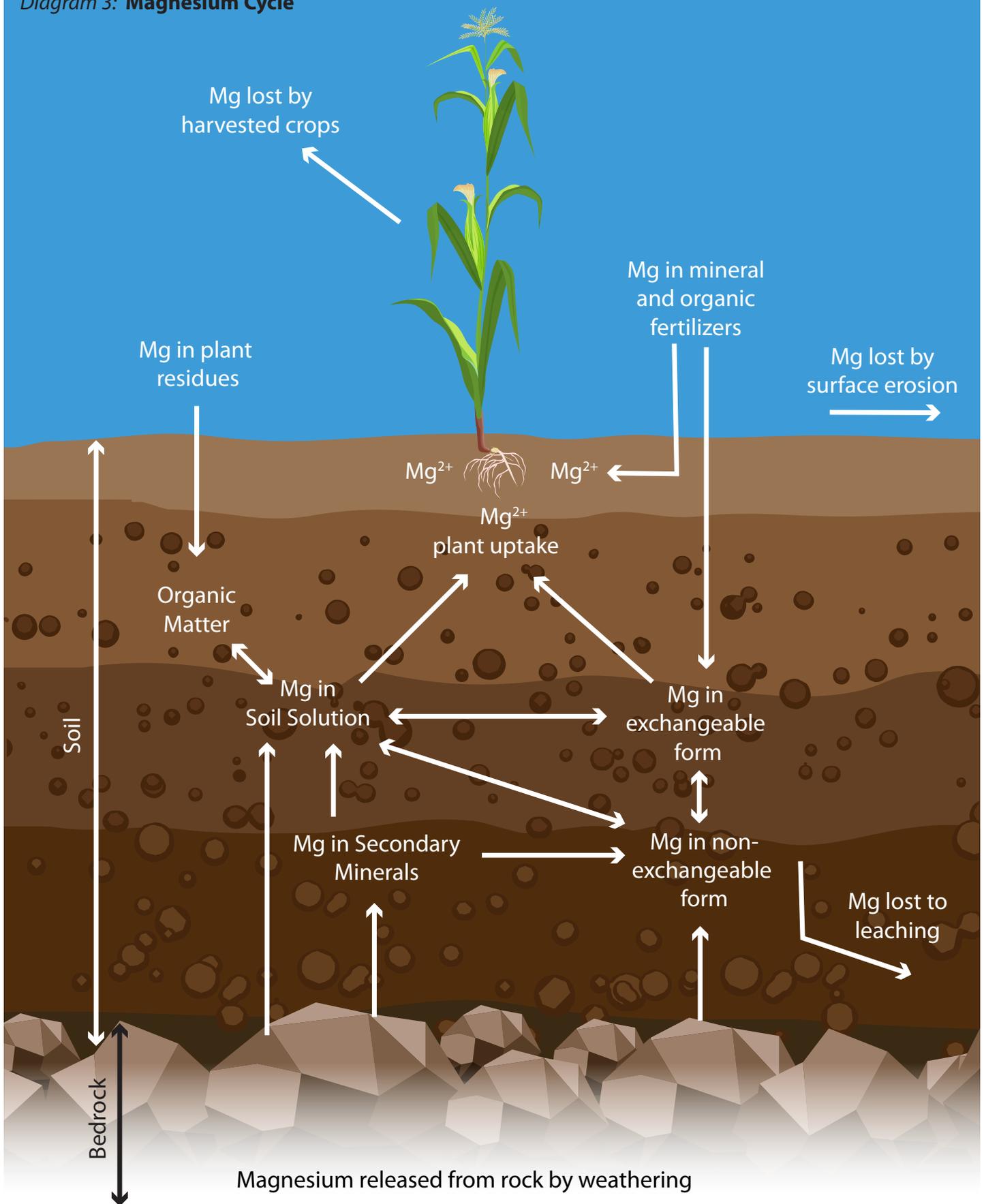
Diagram 2: Magnesium deficiency in blueberry leaf

Magnesium Fertilizers:

TerraLink Horticulture offers magnesium in a variety of forms. Fraser Valley soils are low in this element, and so it is a common ingredient in standard and custom agricultural granular fertilizer blends. A common magnesium-bearing "simple" is granular langbeinite, commonly known as sulphate of potash magnesia (0-0-22+22(S)+11Mg). When this product is mined, crushed, sized and cleaned, it qualifies as an organic magnesium supplement.

Soluble magnesium fertilizers at TerraLink include hydroponic grade Epsom Salts

Diagram 3: Magnesium Cycle



(9.8% Mg), Magnesium Nitrate (10.7-0-0+9.3Mg), Magnesium EDTA (6% Mg) and Potassium Magnesium Sulphate Solution Grade (0-0-22+22(S)+11%Mg). We also offer a premium foliar magnesium product in TigerClaw chelated Magnesium (3% Mg).

Dolomite and Dolopril lime are also sources of magnesium. Unlike regular limestone, dolomite is comprised of about half calcium carbonate and half magnesium carbonate.

Behaviour in the Soil:

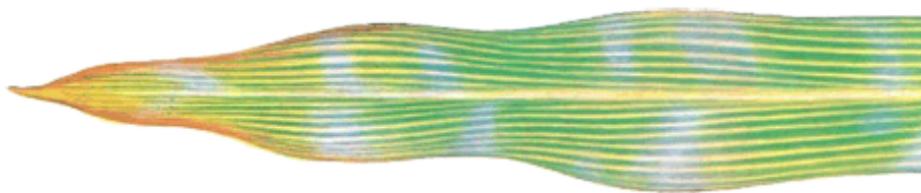
Magnesium is plant-available in the soil as the cation Mg^{2+} (positively charged ion) (Diagram 3). It is fairly immobile in the soil, so make sure to apply granular or liquid magnesium fertilizer into or over the root zone. Magnesium cations Mg^{2+} exists in soil solution, a thin film of moisture that normally coats and permeates solid soil particles of clay, silt and organic matter. Solution Mg^{2+} moves back and forth between exchangeable Mg^{2+} held on cation exchange sites, non-exchangeable Mg^{2+} buried within clays like montmorillonite, vermiculite and chlorite, secondary minerals such as dolomite and magnesite, and organic matter.

The plant-availability of magnesium is affected by soil pH, just like all other plant nutrients. In general, magnesium is most plant-available in the range of pH 5.5 to about pH 8.5. For highbush blueberries, this is an added complication, since this crop does best in soils of a pH range between 4.5 and 5.5. This makes it very important to apply magnesium fertilizer within the drip line of the foliage, as the root zone does not generally extend beyond this zone. Alternatively, make sure to also apply some foliar magnesium, avoiding the soil pH interaction.

Interaction with other Nutrients:

The most common nutrient interactions with magnesium are those involving other cations in the soil, such as K^+ , Ca^{2+} , Na^+ and NH_4^+ . A healthy soil should be comprised of about 80% of these cations or bases; (the other 20% being the acidic cations aluminum and hydrogen).

Diagram 1: Magnesium deficiency in corn



When base saturation is too low, the soil tends to cling to cations such as potassium and magnesium. Magnesium competes for cation exchange sites with the other cations. When we recommend supplementing the soil bank of nutrients with fertilizers, we strive to raise the base saturation to 80%; aiming for about 15% of it in magnesium, 70% of it in calcium and about 5% in potassium – this ratio thought of as an ideal relationship between these three nutrients. Too much potassium can reduce plant uptake of magnesium, so these ratios should be taken seriously.

Magnesium Cycling:

The element magnesium originates from magnesium-bearing minerals found in rock in the Earth's crust (see *Diagram 3*) such as olivine, amphibole, pyroxene and mica. Bound up in these rocky minerals, magnesium is inaccessible to plants. Just as for other minerals of similar chemistry, magnesium becomes released in geologic time by "weathering", a process of erosion. Long-term weathering results in magnesium-bearing secondary minerals, such as dolomite and magnesite. Further weathering results in magnesium-containing clays such as montmorillonite and vermiculite. Mg^{2+} moves back and forth between the secondary minerals, non-exchangeable form within clays, exchangeable form on cation exchange sites, and solution form Mg^{2+} .

Magnesium can be lost from the soil via leaching, surface erosion and removal in harvested produce. Besides long-term weathering of subsurface bedrock, magnesium can also be added to the soil by applications of fertilizer or in plant material such as cover crops.

References:

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