In a new series of technical articles **Jerry McHoul**, technical manager of Potash Ltd, will look at crop nutrition topics that are often misunderstood and seldom discussed. In this issue he begins a three-part examination of the importance of magnesium in agriculture and discusses ways of ensuring it is managed correctly for maximum returns

Magnesium – the forgotten nutrient

Magnesium (Mg) is often referred to as a "secondary" plant nutrient, simply because less magnesium is required than N, P or K.

In fact, magnesium is required in relatively large quantities and in many crops the requirements for phosphate and magnesium are similar.

Secondary in terms of importance to crops it certainly isn't – magnesium is present at the core of the chlorophyll molecule, without which there would be no photosynthesis.

Magnesium is also required for many other important processes in plants, including protein synthesis, cell wall formation, osmotic balance and in many enzyme driven biochemical reactions. It also has a particularly strong interaction with potash and nitrogen.

MAGNESIUM AS A NUTRIENT

In the UK, magnesium is measured in soils by extraction with ammonium nitrate to give an indication of the exchangeable quantity of magnesium easily available for plant uptake.

The results are expressed in mg/l which are then, in turn, banded for easy management into the following indices which are not in a linear scale (see table, right).

The standard method of declaring magnesium content in fertilisers is to express the level in terms of magnesium oxide equivalent (MgO). The product in the bag may be a completely different form but would need to be expressed in terms of the oxide. To convert from Mg to MgO, multiply by 1.67 or 0.6 vice versa.

The minimum content required for declaration is 2% MgO or 1.2% Mg.

MAGNESIUM IN THE UK

The magnesium status of the agricultural soils in England and Wales varies considerably by region. The map (right) highlights the main trends by county and was compiled using 45,000 sets of analysis results.

This map is thought to reflect differences in parent rock type, rather than differences in fertilisation practice, and to some extent, the heavy use of dolomitic lime in some areas for pH correction.

It is difficult to predict whether magnesium levels are rising in agricultural soils as there is little historical data on the subject, but clearly a very different approach is required in different parts of the country.

MAGNESIUM IN THE SOIL

The magnesium naturally present in soil is usually derived from granite, dolomite (magnesian limestone) and various types of silicate rocks, and although the total level of magnesium in UK soils is often quite high (as much as 1%), only a small percentage is typically present in a form suitable for plant uptake.

The magnesium can be categorised as:

- That contained in parent rock material, largely insoluble and largely unavailable to plants.
- That held loosely in the soil (exchangeable magnesium is present in the soil as the positively charged cation (Mg^{2+}) and as such capable of being held in the soil by the negative charges present on the clay-humus complex).
- That which is present in the soil solution for immediate plant uptake.

These pools are similar to the soil sinks for potassium, although there are some important differences.

Unlike potassium, magnesium does not move between non-exchangeable sources into the exchangeable pool easily and this process is chiefly driven by pH (the more acid the conditions, the faster the mobilisation).

The electrical charge on magnesium is also weaker and is therefore more easily leached or lost to lower soil zones than potash, particularly on sandy or acid soils. A shortfall in exchangeable magnesium will thus generally not be provided from weathering processes and needs to be redressed with applied magnesium.

Soils with a high CEC (cation exchange capacity) have the potential to fix more magnesium than those with a low CEC. The latter tend to need fertilising more often with cationic nutrients (K, Mg, Ca etc) in a little-and-often approach, as is the standard advice for potash fertilisation.

CEC values can be improved by the addition of organic matter and some calcium, although sandy soil types will inherently have a lower CEC value than clay based or organic types.

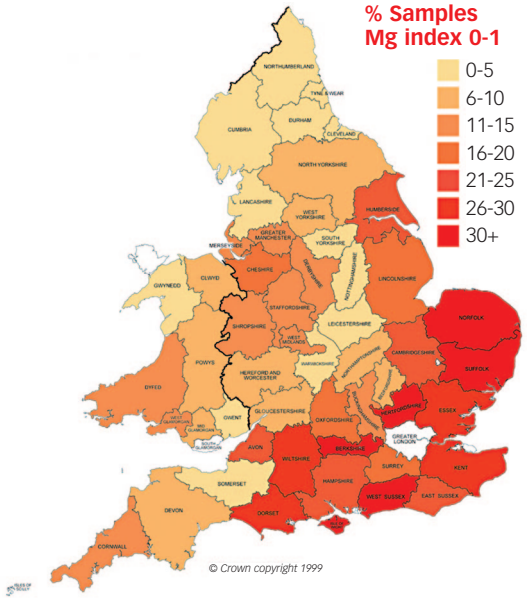
The magnesium content measured from soil analysis provides a useful indicator of the magnesium that is available to plants. It is, however, important to take into account the concentration of other cationic nutrients, as all will 'compete' in the soil solution and for holding sites on the soil particles.

Based on an average of different values put forward by various authors, the K:Mg ratio in soils should be between 0.5:1 and something around 5:1 to avoid antagonism between the two.

- *Next issue: Magnesium management.* A

Mg index

Index	mg Mg/l
0	0 – 25
1	26 – 50
2	51 – 100
3	101 – 175
4	176 – 250
5	251 – 350
6	351 – 600
7	601 – 1,000
8	1,001 – 1,500
9	>1,500



Map showing magnesium status of soils in England and Wales