



Maxi-Phi
the natural growth catalyst

The Soil First Farming Guide to Magnesium nutrition – are your crops getting enough?

A specialist guide to Magnesium nutrition by
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An introduction to Magnesium and its role in crops

In this guide I hope to pass on to you as much of the information I have gleaned and important facts I have discovered over many years of investigating and studying the fascinating subject of crop nutrition.

Magnesium is a crucial component in the production process of yield in any crop. It forms the centre of the chlorophyll molecule that literally puts the spark into making plant growth happen. In this report the complex conditions that affect Magnesium and its availability to your crops are covered, and solutions discussed to correct possible deficiencies. So to find out how to get your crops firing like a well tuned engine read on!

If any of the following situations apply to any of your fields:

1. High calcium levels
2. High pH
3. High potash levels or you apply potash to your crops
4. High magnesium levels

Or

5. Low magnesium levels

You owe it to your crops and bank balance to read on...!

As I am sure you are aware every mineral element is important in crop nutrition so for this guide I will assume the other elements are properly taken care of as if your crop nutrition programme was written by us at *Soil First Farming*.



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Because...

Magnesium is central to the formation of the chlorophyll molecule - this means magnesium determines how much of this critical photosynthetic material is produced by your crops. You can't buy or apply it, (chlorophyll that is) your plants have to make it for themselves. Not enough chlorophyll will have a direct impact on your crop yield potential.

Which means...

Magnesium = chlorophyll = photosynthesis = yield = profit

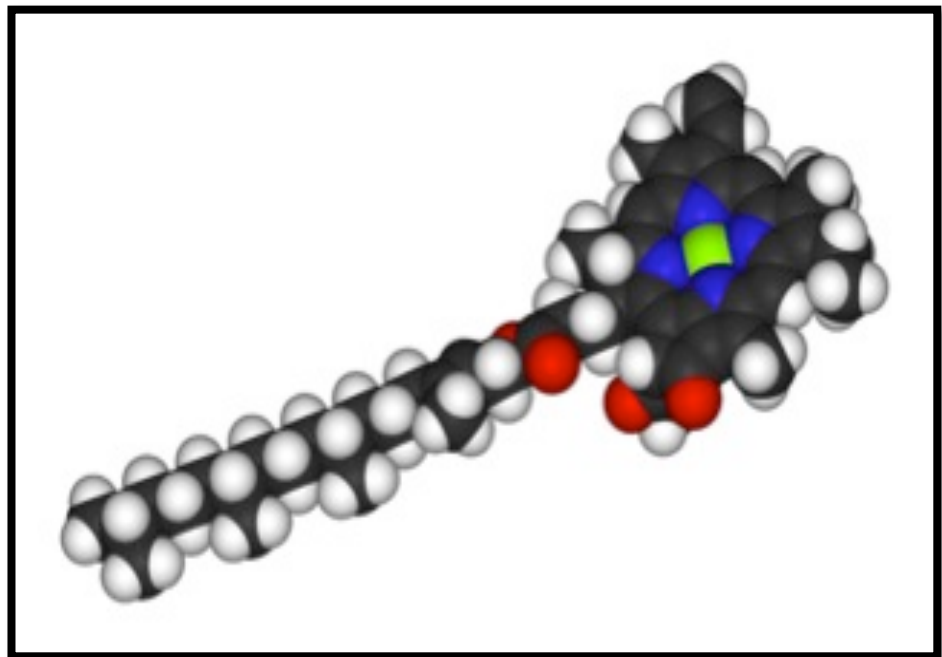


Figure 1 Chlorophyll a.

Also...

As you can see in figure 1 above the makeup of a chlorophyll molecule has one Magnesium atom (coloured green) in its centre. Holding it in place are four nitrogen atoms (coloured blue). This is the elegant ring that allows light to shift electrons that fuel the reaction that creates the building blocks that plants use for growth. This is obviously important for efficient nitrogen use as well!

Note:

There are two types of chlorophyll type 'a' and type 'b' - importantly both having a magnesium atom at their centre with

four nitrogen atoms around it.

Magnesium is also important for oil production, the movement of phosphate inside crops and many other important enzyme activities as well.

This guide will concentrate on how certain field situations (outlined on page 1) could falsely lead you to believe your crops are getting enough of this critical element from the soil and so avoiding the inevitable loss of valuable yield and profits.

So...?

What does magnesium deficiency look like?

Intervenial chlorosis is how Magnesium deficiency is classically described though figure 2 shows it better than I can describe it to you. Notice the loss of colour in the stripes running up and down the length of the 3 leaves in the centre of this picture.



Figure 2

A key question...?

What proportion of the leaves in the photograph above are not capturing the available sunlight?



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Crops short of magnesium will have...

- Lower than expected yields
- Poor nitrogen utilisation
- Appear hungry (needing more nitrogen more often)
- Higher susceptibility to disease

So how do the field situations I outlined lead to potential magnesium deficiency?

2. High calcium levels

This situation of high calcium or chalky soils – causes poor availability of Magnesium even though the index level for this element in these types of soils might appear to be ideal i.e. index 2.

You need...

In these situations to take into account the law of the maximum as well as the law of the minimum.

Let me explain...

Most fertiliser programmes and advice in the UK is based on the 'law of the minimum'.

This means...

You test the soil to see what nutrients you don't have enough of to work out what you would need to apply – which typically is the basis of the fertiliser application system outlined in RB209.

You need to consider though...

Working at the same time is the 'law of the maximum'. You test the soil as before but this time to look at what you have too much of in the soil and understand what effect that can have on the availability of some nutrients. The law of the maximum means too much of one element can dominate or tie up another – making it less available than conventional fertiliser practice would suggest. Over liming fields is probably the only situation in the UK where the 'law of the maximum' is generally accepted in practice



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Because...

'Over liming' is known to cause many nutrient lockups due to excessive amounts of calcium being applied.

So...

If you have high calcium or chalk contents in your soil you would be advised to look out for Magnesium deficiency. A word of caution – by the time symptoms are visible you have already lost potential yield.

And what's more...

Magnesium requires high amounts of water to be moved into the plant. High Calcium soils tend to be of a free draining type which means water in the critical top few inches of the soil can be short during the peak Magnesium uptake period of May and early June – slowing down the soil biology and therefore nutrient uptake. You might argue that crops grown on chalky soils have very good access to water during the May & June growing period and should be able to take up all there required Magnesium.

Unfortunately...

This water is taken from depth and not from where the critical biological transfer of nutrients takes place – which is in the top few inches of the soil. Meaning there may not be enough water, in this important part of the soil, for optimum Magnesium uptake.

3. High pH

High pH soils (7.5+) have a shortage of exchangeable Hydrogen (Hydrogen helps with the transfer of soil based nutrients into the plant) generally these soils combine this characteristic with high levels of Calcium (though not always I admit – those situations are quite rare so I am leaving them out of this guide) which dominates the Magnesium, reducing uptake as outlined in the high Calcium section.



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4. High Potash soils

This is an interesting one...!

Potassium has an antagonistic relationship with Magnesium.

Meaning...

When you have too much Potash in the soil - this can tie up or restrict the uptake of Magnesium very much like we discussed in the high calcium or pH situation - where the law of the maximum comes into effect. Those of you who have had or do currently keep livestock are probably well aware about how careful you need to be not to apply too much Potash to early spring grazing fields as too much potash can induce grass staggers or Magnesium deficiency in the stock via the restriction of Magnesium from the soil into the grass induced by the high levels of Potash.

This process affects your crops just as much!

A soil test result to be wary off would look like this:-

pH	P	K	Mg	
6.5	18	350	50	(ppm)

Or - where the potash levels are many times higher than the Magnesium level.

Note:

You can also have a combination of high calcium and high potash in the same soil this restricting magnesium availability even further

Spring applications of potash

If your crops...

Need an application of potash - then the best time to apply this nutrient is in the spring.

For cereals this would be around stem extension (Growth stage 30 -31), which would be fantastic as the most effective Potassium uptake timing. It's in place for when the developing crop needs it most.



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However...

This application would obviously, for a few months, raise the potash levels in your soils which would have a negative effect on Magnesium availability due to the antagonism between these two elements.

Just like in grassland you would have potash induced Magnesium deficiency

So...

To correct this Magnesium lock up foliar applications of Magnesium would be recommended. When to apply and how much is covered later in this guide.

5. High Magnesium soils

You may be wondering why this is included in this guide. Surely if you have plenty of Magnesium in the soil there must be plenty available for the crop.

Strange as it might seem...

In practice this is far from the truth. Magnesium is a fascinating nutrient in so far as it has the ability to lock itself up in the soil therefore reducing its own availability for plant uptake! In affect Magnesium is its own dominant element.

Again...

Taking livestock as an example, grass grown on high Magnesium soils does leave the livestock very venerable to grass staggers or Hypomagnesaemia during rapid grass growth when the grasses demand for Magnesium out strips the supply form the soil. This situation gives credence to my statement about high levels of Magnesium tying itself up in the soil.

This process affects your crops in the spring just as much!



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The wheat crop in figure 2 was taken from a field with high Magnesium levels.

An example of a soil test result to be wary of!

pH	P	K	Mg
6.5	2-	2	5

Or - where the soil has a high Magnesium level (over index 3+)
Another characteristic of a high Magnesium soil is expressed by the crops themselves, especially cereals, appearing hungry or short of Nitrogen, certainly 10 – 14 days after the last Nitrogen application looking like the crop could do with some more or had a lower than planned dose last time. If your crops display this tendency, when Nitrogen is applied, then suspect Magnesium deficiency.

6. Low Magnesium soils

This is obvious isn't it?

I am sure reading this you must be wondering why this is included.

Surely...

Farming low Magnesium soils would encourage anyone to apply Magnesium to their crops as in these situations there is bound to be a shortage for the crop?

I am sure you are right though this situation requires an answer to the following three questions.

1. Is what you are using correcting this deficiency?
2. How much are you using?
3. And when are you applying it?

First question first...

You basically have two choices to correct Magnesium deficiency in crops grown on low Magnesium soils:



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1. Apply a bulk fertiliser to the soil i.e dolomitic lime or kieserite

Or...

2. Apply a foliar mineral feed to the growing crop

Which is best...?

Balancing the soil to have the correct levels of each mineral element is very difficult and potentially very expensive. Using dolomitic lime to increase Magnesium levels should not be done just looking at the Magnesium in this product in isolation. By its nature this form of lime contains high levels of Calcium, which could in combination with the Calcium already present in the soil lock up the Magnesium you've applied and not achieve the desired increase in Magnesium availability.

Note:

You are advised to be very careful not to overdo soil applied Magnesium because as is the case with high Magnesium soils, Magnesium has been shown to have a detrimental effect on soil structure and that is the last thing I suggest you would want. Excess Magnesium in soil can reduce tilth / workability, make soils "stickier" when wet and blocky / very hard when dry.

Kieserite is seen as a better option on some farms - though is expensive compared to foliar applications and in my experience does not deal with Magnesium deficiencies in crops every year.

Why...?

Because soil types that at first glance look like they would benefit from kieserite applications tend to be soils that are free draining (sandy or chalky) and as outlined earlier, Magnesium requires a lot of soil water to move it into the plant - these soil types struggle to meet the water demand needed to move the Magnesium from the soil into the plant at the peak uptake period which is May/early June.

To answer the second two questions the use of foliar applications of mineral nutrition needs to be discussed

I hope you are using some form of foliar Magnesium especially on



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low Magnesium soils. If not then I recommend that in the future on some of the situations I have described you try it.

If you are...

Then to answer the last two questions - how much and when?

You must consider the following...

Much research has been done showing the peak demand for Magnesium coincides with the bulk of the spring growth when the other yield promoting nutrients, Nitrogen, Potassium and Sulphur are required. Commonly foliar applications of Magnesium sulphate are applied at the ear emergence timing (T3). This is good practice though I would suggest that at least 6 kgs/ha of these products should be used at this time for the best effect. If you are using this rate then great.

And if you are not...?

Using this rate of 6 kgs/ha then can I recommend that you use this higher amount in the future! Your crops will thank you for it, and possibly your bank manager.

What's more...

In future combine this application, with extra similar doses at T1 & T2 (stem extension GS 30-31 and flag leaf emergence GS 37-39).

This will ensure...

Magnesium supply is kept in line with demand - which will be greatest at these three (T1, T2, & T3) timings.

The chart below (figure 3) shows Soil First Farming trials data from our own foliar Magnesium product. The chart shows the importance of Magnesium and how the correct timings of three applications (T1, T2 & T3) are cost effective in terms of delivering increased yield. The chart below shows trials data from our own Magnesium products. Our trials data indicate that for every £1 invested in foliar Magnesium applications then a return of £2 is realised.



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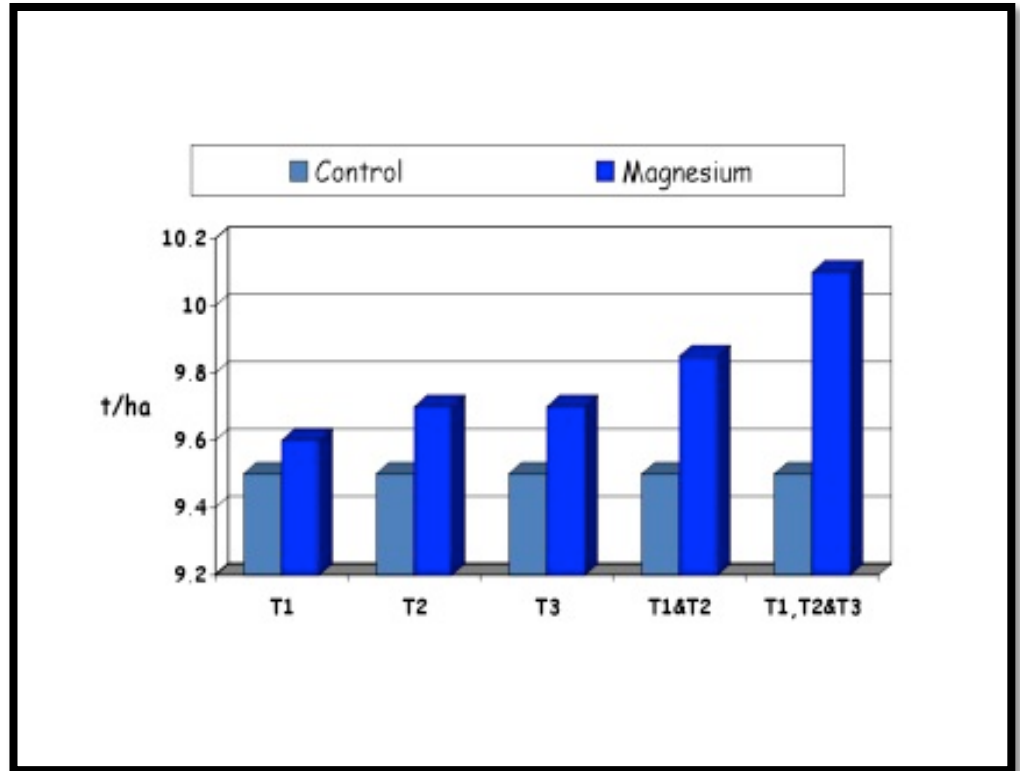


Figure 3

The chart shows that as more Magnesium was supplied more frequently under field conditions the crop utilised it, producing more chlorophyll. The increased utilisation resulted in higher yield.

The advantage of foliar Magnesium is...

In plain terms foliar applied micronutrients have less far to travel. With the correct formulation they are able to cross into the leaf where they are needed bypassing the soil, transport up the stem and movement into position on the leaf.

It's a question of timing...

As the sprayer is passing through wheat crops at the key timings Magnesium can be applied as part of the tank mix just when the crop needs it, without availability being compromised by soil lock up or soil moisture.



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7. To Summarise...

Magnesium is crucial for chlorophyll production in plants. Without it crops can't fully utilise the sun's energy and will therefore produce lower yields.

Understand the impact the 'Law of the Maximum' can have in tying up nutrients. RB209 only tells you half of the story.

So...

Without taking this important 'Law' into account having too much of something in your soil - can be as bad as not having enough of something.

High levels of Calcium (chalk), Potash and Magnesium can all be as bad for Magnesium availability - just as low soil levels of Magnesium can be.

And the answers are...

Spreader applied solutions to Magnesium deficiency are potentially expensive. They deliver additional Magnesium but risk that Magnesium becoming part of the complex interaction that causes deficiency – soil lock up.

Does the timing work...?

Can a spreader based solution get it on at the right timing? Does it conflict with Potash applications? Keiserite and dolomitic lime can add the book (RB209) levels of Magnesium, though how much can be accessed by the crop can vary.

Can you avoid soil lock up...?

Foliar applications of Magnesium give a better opportunity. They are flexible – you can get the timing just right. They can be repeated as often as the crop needs it. They are cost effective compared to spreader based options. You can give the crop what it needs when it needs it where it needs it.



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Availability to the crop is more assured as interaction with the soil is avoided.

Maybe...

Now is the time to look at your soil tests to see what you have too much of?

And ask the question...?

Did any of your crops have stripy leaves like those shown in Fig 2 last spring?

Or...

If like me, until a few years ago, you thought that's the way wheat looks naturally anyway!

If you suspect you have a shortage of Magnesium in your crops then my simple three spray programme (apply the correct dose of a foliar mineral feed at timings T1, T2 & T3) will be the best and most cost effective way to ensure it doesn't appear in your crops.

Remember...

If you see the symptoms you are already too late!