Nutrition needs come under fresh scrutiny

Evidence is emerging that fertiliser applications may not be keeping pace with the needs of today's high-yielding root crops. *CPM* assesses industry views.

By Andrew Blake

More attention to the needs of potatoes for potash (K_2O) and magnesium (Mg) could help growers boost returns. That's the view of Jerry McHoul of K+S following a recent Potato Council review (ref R443) of potassium use on the crop and new advice on magnesium within The Fertiliser Manual (RB209).

The 2011 review came against the background of British Survey of Fertiliser Practice (BSFP) and DEFRA figures showing a growing gap since 2007 between the amount of K_2O applied to the crop and the amount it removed, he notes. In 2011, that amounted to a deficit of about 70kg K_2O/ha.

Meanwhile, fertiliser costs, including potash, have been rising, and as Alex Sinclair of SAC notes, most yield response trials were done some time ago. "The responses then were incredibly flat, but we know that today's newer varieties and bigger crops are removing more potash."

The latest RB209 emphasises the importance of maintaining soil potash and phosphorus target indices and replacing off-take in harvested crops. It has also slightly raised the so-called 'build-up' applications required below Index 2.

"Potash has a strong role in water relations in plants and any deficiency increases drought susceptibility," warns Ecopt's Ian Richards.

Although potash has no environmental issues, its incorrect use can lead to inefficient use of nitrogen and water, adds Omex's Andy Eccles. "It generally increases yield by increasing tuber size and, applied at high rates, can reduce the risk of internal bruising."

The widely agreed 5.8kg K_2O/t of tubers removed by potatoes must be replaced to ensure the soil potash status remains adequate for subsequent crops in the rotation, urges Jerry McHoul.

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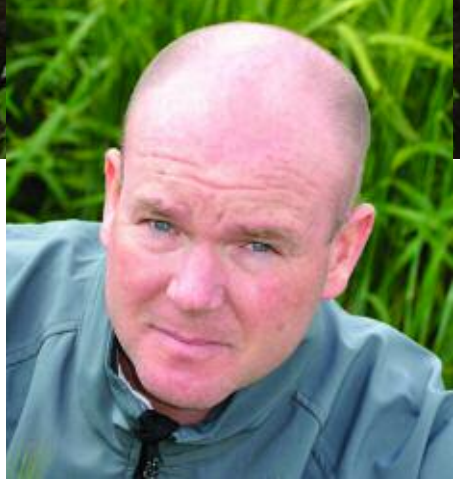

There's a growing gap between potash applied to the crop and the amount it removes, notes Jerry McHoul.

SAC Technical Note TN633 notes that fertiliser potash increases potatoes' susceptibility to cracking, splitting and scuffing, so recommended rates should be exceeded only if internal bruising is a more persistent problem than external damage.

However, for Denis Buckley of Shrops-based Highfield Lodge Agronomy, when it comes to potash for potatoes, "more is good", despite the additional cost.

"RB209 levels are the barest minimum. McCain did the industry a favour in the mid-1990s by advising higher rates than RB209 then recommended. It focussed people's attention more."

With many cereal growers trying to economise on base nutrients, soils with low potash indices are increasingly common, he believes. "Below Index 2, potatoes are more susceptible to bruising, irrespective of how much potash you throw at them."

Yield expectation, based on the 5.8kg/t removal figure, should be the driver for applications, he advises. "But it must be the total, not graded, yield.

"The biggest risks from applying too little potash are lower yield, exceptionally high dry matter and bruising.

"Potatoes are shallow rooting, and potash leaches more than many people think on light soils. So on sands and very light soil, don't apply any before the New Year and don't plough it down. If you are ploughing, use a compound afterwards and top up as necessary with MOP (muriate of potash)."

The more expensive potassium sulphate (SOP) is often recommended for improved tuber dry matter, but the trial evidence is inconsistent, says Ian Richards.

Magnesium recommendation

Magnesium is essential for photosynthesis, and low levels reduce tuber starch content and the protein levels that affect the taste of cooked potatoes, notes Yara's Mark Tucker.

The latest (2010) edition of RB209 includes a new recommendation of 40kg MgO/ha for potatoes grown on soils at index 2, notes Jerry McHoul.

"There was previously no recommendation on those soils and the change doesn't seem to have been fully noticed or implemented." Kieserite and Epsom salts are specifically mentioned as suitable fertilisers for efficiently supplying fast acting magnesium, he adds.

"Kieserite should be used as a magnesium source for potatoes since it's the only commonly used Mg fertiliser

which is water-soluble and available to the crop. This is particularly important for a crop such as potatoes, which has a relatively short growing season and needs to access large quantities of water-soluble nutrients in an uptake period lasting only 3-4 months."

Seven K+S trials from 2005-2008, comparing pre-planting applications of 100kg MgO/ha in various forms, showed magnesium sulphate (kieserite) produced on average 3.3t/ha higher tuber yield, he notes.

"For a product cost of around £150/ha this represents sound economic sense. It also supplies the complete sulphur requirement and maintains the magnesium index for the rest of the crops in the rotation.

"The increase correlated with improved Mg content of the foliage which kept the level above the critical deficiency threshold of 0.15-0.25%."

Denis Buckley believes in applications of soil-applied magnesium on Index 0 soils. But at higher indices, he believes a regular program of foliar magnesium combined with the blight program is more beneficial.

However, Jerry McHoul considers that the latest RB209 advice, indicating a need for 40kg and 80 kg MgO/ha on Index 2 and index 1 soils respectively, cannot be met in that way.

"Magnesium is certainly not a micronutrient," he stresses. "You need to look after the soil levels first to meet the basic demand. Foliar applications are useful for covering times of peak demand and/or stress, such as during flowering or under drought conditions."

Noting the need for new research, the Potato Council review points out particularly high Mg soil indices may induce potassium shortages. This is estimated to occur over about 13% of the UK's potato-growing area, notably in the north, the review adds. ■

Kieserite (magnesium sulphate) is water-soluble, making it suitable for potatoes.

Options for supplying sulphur to sugar beet

Product	Analysis	Typical rate	Nutrient supplied kg/ha	
		/ha	N	SO3
Ammonium sulphate	21%N:24%S	150 kg	31.5	90
Double Top	27%N:12%S	125 kg	33.75	38
Kieserite	25% MgO: 20% S	200-400 kg	-	100-200
Magnesia-Kainit	27%Na_2O: 11% K_2O: 6% MgO: 10% SO_3	600-1000 kg	-	60-100
Nitroflo XS	20%N: 5%S	142 litres	35	22

Conversion: SO_3 to S x 0.4 & S to SO_3 x 2.5

Growing need for sugar beet sulphur

Sugar beet growers who don't use sulphur in the seedbed, could be risking yield losses, especially on light land, warns Jerry McHoul of K+S.

Relatively recent work at Rothamsted Research led to a revision of advice on sulphur inputs to the crop last year, he notes. The British Beet Research Organisation (BBRO) 2011 Spring Crop Management bulletin urged growers with crops on sandy and sandy loam soils to consider applying sulphur, especially where no S-containing fertilisers or manures had been recently applied.

"I believe this work and new advice is highly significant," says Jerry McHoul. "But it's been little reported or discussed, and it really needs to be brought to more growers' attention."

The results of the Rothamsted trials at six sites from 2003 to 2005, published in 2010, showed that modest applications of sulphur to seedbeds, applied in the sulphate form at up to 40kgS/ha (100kg SO3/ha), raised sugar yields by up to 0.56t/ha.

Similar work in the 1970s and 1980s found no conclusive evidence of a response to applied sulphur fertiliser. One likely reason for the latest trial results is the drastic decline in atmospheric sulphur deposition in sugar beet-growing areas, highlighted by researchers, he explains.

In the mid-1970s, about 70kg/ha of sulphur — enough to supply the needs of most crops — was deposited each year at Woburn, Bedfordshire. By 2009, the annual sulphur deposition rate in most areas used for sugar beet production in the UK had fallen to just 8kg/ha per year, and was expected to fall further.

"The crop uptake for sulphur is around 20-40kgS/ha. So particularly on lighter mineral soils where there is little mineralisation, there is going to be a deficit which needs attention."

In the light of the Rothamsted work and new BBRO advice, Jerry McHoul investigated practices elsewhere in Europe. "It seems that most of the major beet-producing countries — Germany and France in particular — routinely apply S to beet and have also noted responses in recent work."

The extra S applied in the Rothamsted work tended to lower the beet juice's amino N concentrations, although the reductions were always below 10% and never significant, state researchers Keith Jaggard and Fangjie Zhao.

Pam Chambers of Brooms Barn Research Centre agrees that growers on light land should be more aware of the risks of not giving their crops sufficient sulphur. "Although the experiments do not provide evidence of a precise amount of S that needs to be applied, all amounts between 10-40kgS/ha produced the largest sugar yield."

One way to ensure an adequate supply is to use ammonium sulphate fertiliser for the first nitrogen dressing. "Typically 150kg/ha supplies 90kg/ha of SO_3 (36kg/ha of S) as well as 31.5kg/ha of N," she says.

"Another option would be to apply a product such as Double Top, which is often used on oilseed rape. Double Top at 125kg/ha will supply 38kg/ha of SO_3 (15kg/ha of S) as well as 33.75kg/ha of N.

"Growers who wish to combine a post-drilling but pre-emergence herbicide with their fertiliser could consider something like Nitroflo XS." (See table).

Kieserite supplies readily available magnesium for the Mg-responsive crop, but the sulphur it contains is sometimes overlooked, Jerry McHoul believes. "It can be applied as a straight or in a blend and it allows growers flexibility of N source."

Growers should be aware that analysis of soil samples taken in spring is only a poor guide to the need for S fertiliser, warns Pam Chambers. "This is because firstly the sulphate is mineralised from soil organic matter during the growing season, and secondly sulphate leaches readily.

"The best current advice is that it is probably worthwhile to apply some S fertiliser for beet grown on sandy fields, that have not received any S-containing fertilisers or manures recently."

Beet crops on light land could benefit from sulphur applications.