MAGNESIUM – THE FORGOTTEN ELEMENT?

Magnesium (Mg) is essential to plants. It is strongly involved in photosynthesis and transporting carbohydrates from leaves to roots, which is particularly important for tuber development. Yet, it may be overlooked within fertiliser programs focused on N, P and K.

Even if plants appear in good condition above ground, root systems are likely to be stunted if Mg levels are low. High levels of available potassium and heavy applications of calcium (e.g. gypsum, lime) can reduce uptake of Mg by the plant.

As Mg can be slowly leached, highly weathered soils are the most likely to be low in Mg. Magnesium helps to protect plants from aluminium toxicity which is more likely in acidic soils. This means that if weathered soils are low in pH, the issue is further compounded.

Getting Mg right is important to maximise yield, firmness and starch content of potatoes. Increases in starch accumulation improve specific gravity, which has direct financial benefits to processing growers. Ware growers may benefit from reductions in bruising and discolouration during transport[1].

THE POTATOLINK MG MINI-TRIAL

PotatoLinks' Marc Hinderager recently conducted a small trial on magnesium at the Canowindra demo site. The test paddock has fairly light soil (CEC approx. 8) and is under pivot irrigation.

"We applied 130 units of potassium (SOP) pre-plant and got the seed into the ground on 19 October," said Marc. "A week later I put on the first application of magnesium sulphate (Epsom salt) at a rate of 200kg/ha. This effectively added 20 units of magnesium plus 25 units of sulphur to our two 20m experimental plots".

The treatment was repeated a month later (23 November) when the potatoes were at tuber initiation

Figure 1. There were no obvious differences in growth between Mg treated and control plots (left) at tuber initiation (right)

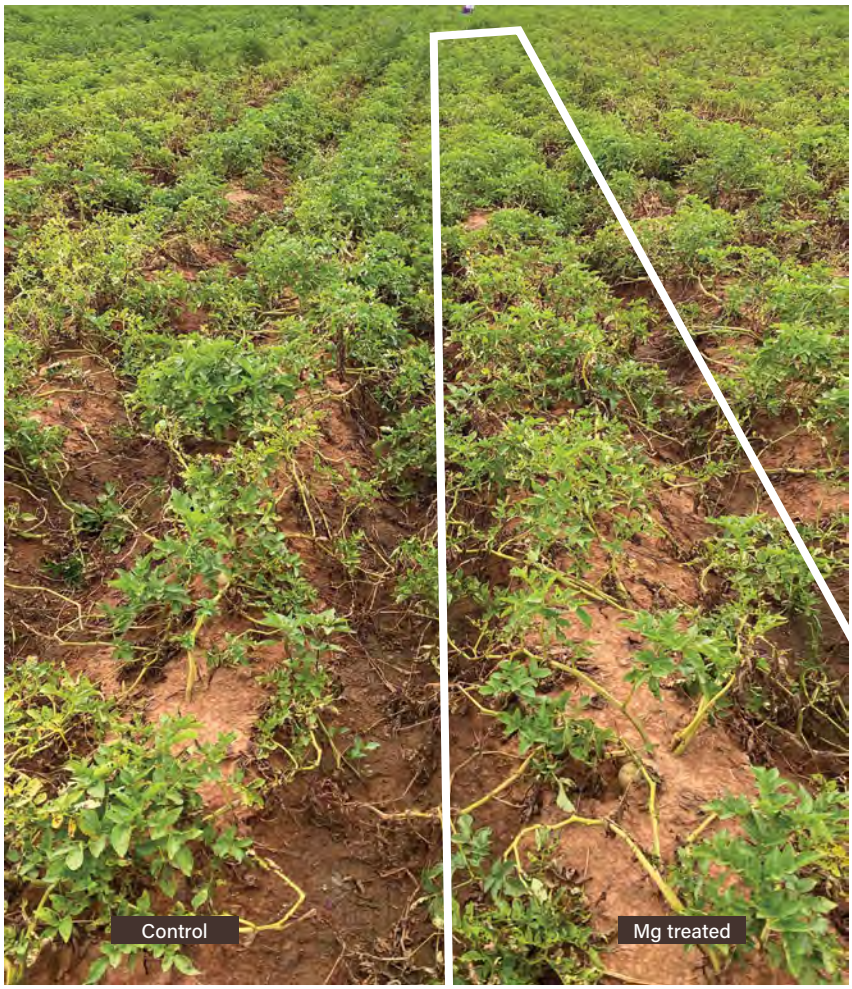
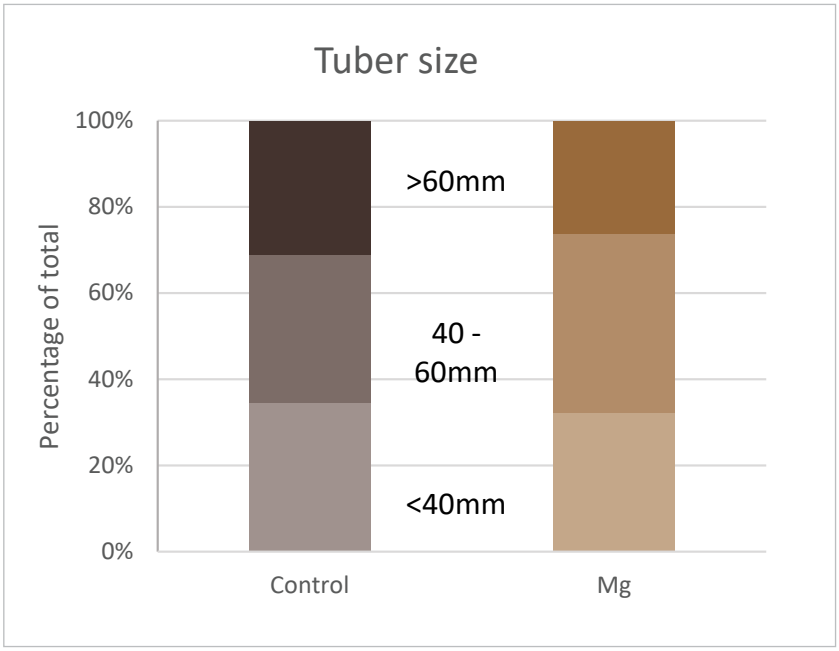


Figure 2. There were still no obvious differences between Mg treated and control plots one week before harvest



stage. This was a mid-morning foliar application with 1,500 L/ha water. While the application did not cause any foliar burn, it should be noted the weather was unseasonably cool (max 25°C).

"We harvested from our two test plots plus untreated adjacent rows on 24 January, 97 days after planting. Even though the tops had looked the same throughout (Figure 1, Figure 2), we found some really interesting differences in the tubers" commented Marc.

The total number of tubers, and the percentage of tubers within each size range, was about the same for the treated and untreated rows (Figure 3). However, reduced water rot of tubers (possibly *Pythium* or *Phytophthora*, with secondary bacterial infections) in the rows treated with Mg meant that yield was effectively increased (Figure 4).

Increased levels of Mg have previously been associated with reductions in both fungal and bacterial diseases of potatoes. Mg fertilisation has been demonstrated to improve plant tissue resistance to the pectolytic enzymes produced by bacteria, while improved transport of nutrients around the plant may enhance resistance to fungal pathogens[2].

"As you know, it's been a really challenging season with well above average rainfall" says Marc, "so the reduction in disease was great to see. Obviously, we need to repeat this on a larger scale, but still a very positive outcome."

Another interesting result was a small but potentially significant increase in specific gravity in the Mg treated

Figure 3. Effect of two applications of mag-sulphate on tuber size, incidence of soft rot, and specific gravity

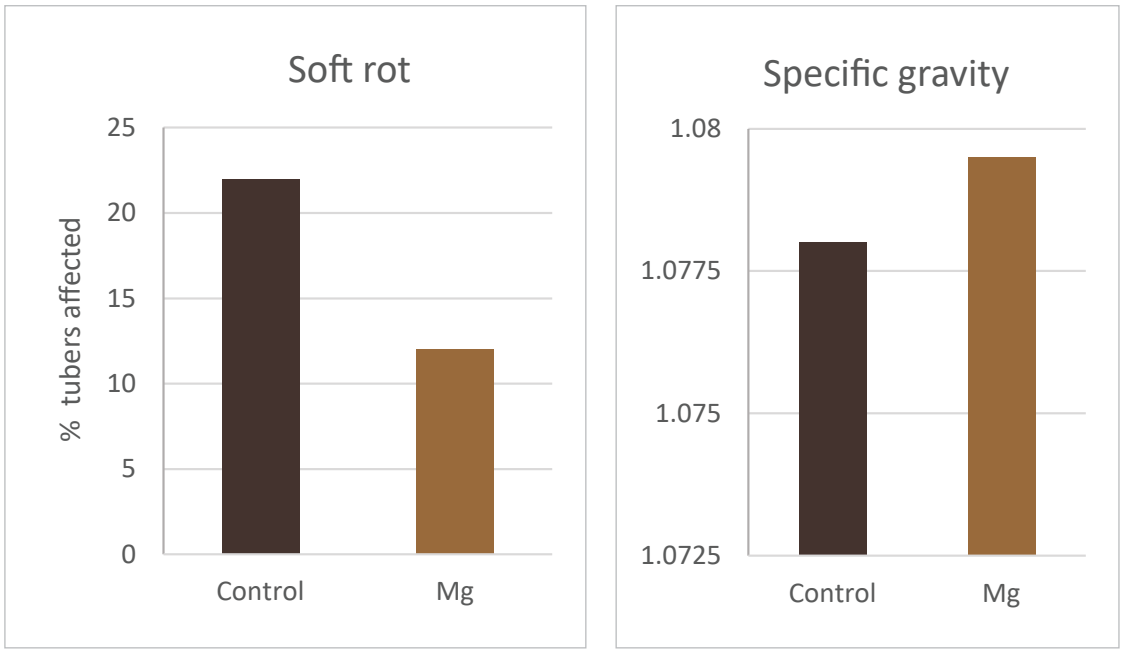


Figure 4. Effect of two applications of mag-sulphate on tuber size, incidence of soft rot, and specific gravity

rows (Figure 4). While there was a fair degree of variability between the different plots, this is consistent with published data and seems worthy of further examination.

"Mag sulphate, applied at the 400kg/ha rate we used in our demo, costs over $400/hectare, so we need to consider costs and benefits before rushing in," suggests Marc. "Depending on soil properties, other magnesium products such as calcium magnesium (dolomite), Sul-Po-Mag/K-Mag, and magnesium nitrate could be considered. However, mag sulphate is definitely the best option for foliar application."

Application of Mg is also complicated by the fact that the solubility of Mg fertilisers varies widely as does release in different soil types and bio-availability to plant roots. For example, Kieserite (magnesium sulphate monohydrate) is more bioavailable to potatoes than calcined magnesite (magnesium oxide).

In UK trials, Kieserite consistently increased both yield and % dry matter, even at sites where leaf analysis indicated Mg was within the recommended range (>0.25%). In contrast, cal-mag often had little effect, even though both products were applied at 60 kg/ha[3].

One thing that is clear is that magnesium should not be forgotten.

Rather, magnesium is essential to both yield and quality of potato crops.

REFERENCES

1 Senbayram M et al. 2015. Role of magnesium fertilisers in agriculture: plant–soil continuum. Crop and Pasture Sci. 66:1219-1229.

2 Huber DM, Jones JB. 2012. The role of magnesium in plant disease. Plant Soil DOI 10.1007/s11104-012-1476-0.

3 Orlovius K, McHoul J. 2015. Effect of two magnesium fertilisers on leaf magnesium concentration, yield and quality of potato and sugar beet. J. Plant Nutrition 38: 2044-2054.