

# Testing times for plant health

“Once you see deficiency symptoms in the crop, you’ve already lost half the battle.”

## Technical Nutrient Nurture

**In-season tissue testing combined with targeted nutrition offers an effective way of improving crop resilience and maximising yield potential. CPM discovers how.**

*By Paul Spackman*

Prevention is better than cure for many aspects of crop husbandry, none more so than nutrition. Keeping crops well-nourished from sowing right through the growing season is fundamental to promoting strong, healthy growth, yet knowing exactly what a crop needs at each stage of the season requires an extra level of detail.

“Soil testing provides a good snapshot of soil nutrient status, but it doesn’t tell you whether plants are accessing those nutrients,” says FMC commercial technical manager, Chris Bond.

“That’s where tissue testing offers a really valuable tool for understanding what is happening in the crop at a specific point in the season and what the plant is actually able to access.”

This information helps fine-tune nutritional strategies to individual situations and can prevent crops becoming deficient in any of the 17 essential elements plants need.

Testing data shows many crops, even some of the best, can suffer nutrient deficiencies, which may be restricting yield potential.

### Nutrient deficiencies

Grain testing within the Yield Enhancement Network (YEN) between 2016 and 2018, for example, found almost three-quarters of samples were deficient in one or more of 12 nutrients tested. FMC’s analysis of 1500 leaf tissue samples received between 2018 and 2020 found similarly significant results.

In cereals, the biggest issues appear to be for magnesium and zinc, where more than 60% of FMC’s samples were below the optimum level, according to Chris.

“For magnesium, the situation seems to

have got slightly worse each year, as 68% of samples were below optimum in 2018, increasing to 70% in 2019 and 74% last season. There may be a seasonal effect, as magnesium is the most leachable of the large cations and we’ve seen wet weather during these years which could have reduced the amount available to crops within the rooting zone.

Other factors could also be at play, so it’s worth looking at closely, given how important magnesium is to crops.”

Further analysis of the data for magnesium across all three seasons and all crops suggests deficiencies can be present throughout the year, he adds. This is illustrated in the chart on p49, which shows the percentage of samples that were sub-optimal for magnesium at the four main fungicide timings. This reinforces the fact that deficiency is present at the traditional timing, but a significant amount may be being overlooked at T0 and T1, so should be addressed along with other issues such as manganese, Chris suggests.

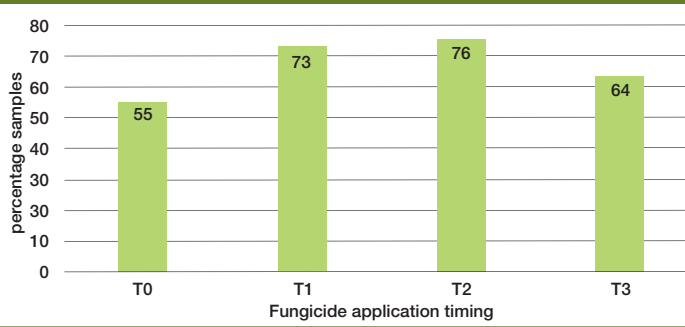
“Magnesium is traditionally applied later in the spring, around the T2 or T3 fungicide timing given its importance for boosting grain quality. However it’s needed for many other functions through the season, including photosynthesis, so growers cannot just focus on latertimings.”

More than 60% of samples analysed by FMC came in below optimum for zinc. Chris suggests there may be a seasonal effect as zinc can become locked up in cold, damp conditions early in the season, or it may be that levels need supplementing. Either way, growers should monitor it closely given zinc’s important role in photosynthesis, cell structure and



*Tissue testing offers a valuable tool for understanding what is happening in the crop at a specific point in the season, says Chris Bond.*

## Leaf tissue samples below the optimum magnesium level



Source: FMC; 1500 samples taken 2018–2020.

hormone production.

Chris points out that manganese levels were generally satisfactory in samples analysed by FMC,

which may reflect the fact many crops receive this micronutrient as routine in autumn and at T1. “Our results show this is a worthwhile decision, especially

considering how important manganese is for chlorophyll production, photosynthesis and ensuring an efficient, green crop.”

As with magnesium, manganese is needed throughout the plant’s life, especially when cereals are putting on considerable biomass in spring. Deficiency symptoms may not be seen until significant damage has been done to growth and photosynthetic capacity, so identifying potential issues early is vital.

For oilseed rape, insufficient boron is generally the most common issue, with more than half of FMC samples showing



*Magnesium, deficient in this wheat, is the most leachable of the large cations.*

sub-optimal levels. The nutrient is vital for cell division and elongation, along with production of flowers, pollen and seed. ▶

## Berks grower takes precise approach to fertiliser strategy

Tissue testing plays a key part in agronomic decision making at FC Cummins’ Rookery Farm near Newbury, Berks, where Dan Willis farms 600ha of arable crops with his mother Hazel.

Dan is the fifth generation of the family to farm in the area and the business prides itself on continually improving its farming methods. This includes regular investment in machinery and technology, a move to minimal strip tillage cultivation and a concerted focus on enhancing soil health and nutrition.

“Much of the farm is on sandy soil over chalk, which is extremely hungry for macro and micronutrients, so we started using tissue testing in 2018/19 to sharpen our approach to crop nutrition and target fertilisers more closely to when they are needed.”

It’s now used alongside routine soil sampling every three years to assess the nutritional status of cereals and oilseed rape through the growing season, starting in autumn and then at key timings during spring and early summer.

Testing is generally organised around areas

*The main timing for boron, deficient in this OSR, is at stem extension in spring.*



of similar soil type, although it’s used more prominently in the Group 1 milling wheats to maximise chances of crops achieving the required specification, Dan says.

In winter wheat, the focus is on tissue testing 10-14 days before the main T0 to T3 fungicides, allowing time for additional nutrients to be included where needed. The farm follows a “little and often” approach to applications rather than traditional fertiliser timings.

Low sulphur has been one of the main issues highlighted by tissue testing in oilseed rape and wheat, with the deficit appearing to be greater than budgeted, Dan says. This has prompted a move away from the traditional approach of supplying sulphur through granulated ammonium sulphate, towards split doses of a multi-nutrient sulphate fertiliser, containing sulphur, potassium, magnesium and calcium.

“We usually apply a small amount in autumn, followed by two applications in the spring growing season depending on crop need. We aim to build nutrition early in the season and maintain that right through according to what crops need. It’s no use waiting for deficiency symptoms to become visible before doing a tissue test, as the damage has already been done.”

Previously, with ammonium sulphate, Dan says sulphur was being applied at the same time as nitrogen, which wasn’t necessarily when the crop needed it. “Tissue testing shows crops need more sulphur than we thought and before the nitrogen, so splitting applications to better match these crop timings has to be more effective.”

Boron deficiencies in oilseed rape have also been addressed, while tissue testing confirms the farm has been correct in applying manganese regularly, given that deficiencies can be common



*Tissue testing confirms Dan Willis has been correct in applying manganese regularly, given that deficiencies can be common on his light, sandy soils.*

on light, sandy soils.

Dan also believes the tighter focus on nutrition has reduced Septoria and rust incidence early in the season. “I’m not sure we can quite say we’d cut fungicide inputs on the back of it, but it certainly helps reduce the pressure on the chemistry and keep crops clean.”

Looking ahead, the farm will continue moving towards more targeted use of foliar nutritional products. Variable rate P and K have been applied for several years, and this year nitrogen will start to be applied at variable rate. Next year Dan plans to replace the sprayer with a new machine fitted with individual nozzle and rate control, allowing variable rate liquid blends to be used instead of solid forms.

“As part of a precision farming approach, we need to be analysing the growing crop more, and tissue testing is part of that. It’s not always about saving money, but using inputs better to target exactly what the crop needs at the right time.”





Andrew Stilwell notes that high pH can occur in calcareous clay loams and may reduce the availability of some micronutrients.

► “The main timing for boron is at stem extension in spring, but crops are setting yield potential with floret initiation in the autumn, so levels must be sufficient throughout the season,” Chris says.

Tissue testing has been widely adopted among the growers advised by Andrew Stilwell, agronomist and crop nutrition technical manager for Bartholomews in Hants and Wilts.

“Quite often, once you see deficiency symptoms in the crop, you’ve already lost half the battle. Prevention is certainly better than cure, so tissue testing at strategic points through the season provides a very effective snapshot of crop health, that allows nutrition programmes to be adjusted where required.”

In cereals, he uses tissue testing at three key timings. The first test is usually done two to three weeks before applying early spring fertiliser to gauge the health of crops coming out of winter and allow sufficient time for fertiliser plans to be amended, or foliar nutritional products to be added to the T0 fungicide. Further tissue sampling is usually done before the Growth Stage 31-32 (T1) and GS39 flag leaf (T2) sprays. He also points to magnesium, zinc and manganese as being the most common deficiencies seen in winter cereals, but calcium is sometimes lacking, even on calcareous soils.

While lighter soils with a low cation exchange capacity are more at risk of nutrient deficiencies than medium to strong-bodied soils with higher clay content, Andrew warns the situation is not that simple.

High pH can occur in calcareous clay loams, for example, and may reduce the availability of some micronutrients, while fertile soils sometimes suffer antagonism between nutrients. High potassium for example, can hinder crop

## Nutrient nurture

An appreciation of the importance of crop nutrition and the need to understand its multifaceted nature are essential to optimise crop performance. In this sponsored series, *CPM* has teamed up with FMC to explore the individual elements needed for crop growth and the factors which apply individually to each element.

From functions within the plant to behaviour in the soil, antagonism, synergies, environmental impacts and limiting factors, these articles seek to unlock the answers and facilitate sustainable increases in crop yield and quality.

FMC is an agricultural sciences company that

advances farming through innovative and sustainable crop protection technologies. From our industry-leading discovery pipeline, to unique application systems, to modern biological products, we are passionate about bringing new solutions to growers around the world.

FMC supplies an extensive range of foliar nutrition products, encompassing those containing single elements to more complex multi-element products formulated to meet differing crop demands.



uptake of magnesium.

Foliar-applied nutrients can help bypass potential issues with crop uptake caused by pH, antagonism or lack of soil moisture, Chris says. “Micronutrients are needed in relatively small amounts, so it is fairly easy to supply a significant proportion of crop requirements through the leaf. But even with nutrients that are needed in larger volumes, foliar applications allow you to apply a smaller amount in a more targeted, efficient way.”

## Reasonable investment

Andrew adds: “If you don’t test, you don’t know. At around £30 per sample for a decent tissue test, it’s a reasonable investment, but it provides very valuable information. You don’t have to test every field; testing by a particular crop type or variety can be enough to highlight underlying issues.”

Some growers also like to tissue test early-sown winter crops in the autumn to ensure they are as healthy and resilient as possible going into winter. The first oilseed rape tissue samples, for example, are usually taken before Christmas, while the second sampling period is before the first spring fertiliser application, Andrew says.

“Some crops can be quite lazy rooted, but we can encourage plants to build root mass with early nutrients in combination with other methods. Zinc and calcium are particularly important for autumn rooting.”

Keeping crops well nourished throughout the season can directly benefit their resilience to pests or diseases. It’s a key part of the regenerative agriculture philosophy, but applies equally to any crop protection strategy, says Andrew.

“Rust and mildew for example are parasitic on stress, so if we can prevent a plant becoming stressed that should help reduce the pressure from these diseases.

“Varietal traits also seem to come to the



There may be a seasonal effect with zinc, showing up as deficient here in barley, as it can become locked up in cold, damp conditions early in the season.

fore more strongly in well-nourished crops, allowing growers to maximise natural resistance mechanisms. This helps make more efficient use of crop protection products and potentially allows lower doses to be used in protectant situations.”

Some nutrients are particularly important for building the physical defences of plant tissues, making them better withstand attack, Chris notes. Manganese deficiency, for example, can have an impact on production of waxes on the leaf surface. Research carried out at the University of Copenhagen showed significant reductions of cereal leaf wax occur even before visible manganese deficiency symptoms are apparent.

Experience with potatoes clearly highlights the link between nutrition and disease control, Andrew adds. “We’ve seen how frequent tissue testing in potatoes every two to three weeks through the season can be very beneficial for alternaria control. Alternaria comes in on the back of nutritional deficiency, but a rigorous tissue testing regime combined with applying micronutrients where needed has seen a 25-30% drop in alternaria incidence over the past three to four years.” ■