



Feed the hidden hunger

Technical Research Briefing

The benefits of applying micronutrients through foliar applications are well established, but what about when the crop is too small to take it up? *CPM* assesses the value of a micronutrient coating applied to granular fertiliser.

By Tom Allen-Stevens

Chances are, if you have crops in the ground, they're getting a bit hungry. And that won't just be for nitrogen and other major nutrients — there are around seven micronutrients considered essential for healthy crops, and attention to these are unlikely even to get a look-in until you get the sprayer out.

“Relying solely on foliar applications to give a crop what it requires simply isn't good enough”

“The agricultural supply industry has created a dichotomy around crop nutrition whereby macro-nutrients are delivered in solid and liquid fertilisers and micronutrients are generally supplied as foliar within the crop protection programme,” notes technical director at Origin Fertilisers Peter Scott.

“This dichotomous approach makes proper, integrated nutrient management planning difficult.”

Right balance

R&D development manager at Agrii Jim Carswell has similar concerns. “Relying solely on foliar applications to give a crop what it requires simply isn't good enough,” he says. “The crop needs the right balance to get established and to get up and away. All too often the approach to nutrition centres around a philosophy of addressing nutrient deficiencies through curative treatments, by which time the crop's yield potential has already been compromised.”

A better approach is to bridge what's referred to as ‘the hunger gap’ or a crop's

‘hidden hunger’, he suggests. This is the period between establishment and when foliar feeds can be applied during which plants will be searching for nutrients, but won't necessarily show deficiency symptoms if they can't find them. “To optimise field performance the crop needs access to all the essential nutrients throughout the season,” Jim points out.

The issue is particularly acute this year, he notes. “There are some very sorry-looking crops, and soil samples are indicating low levels of N in the soil.

My advice would be to get an NPK fertiliser on as soon as possible. But the crop needs access to micronutrients to assimilate macro-nutrients during growth. Crops established late that haven't tillered won't have a sufficient root system to find these, and they won't have enough leaf for an early foliar application either.”

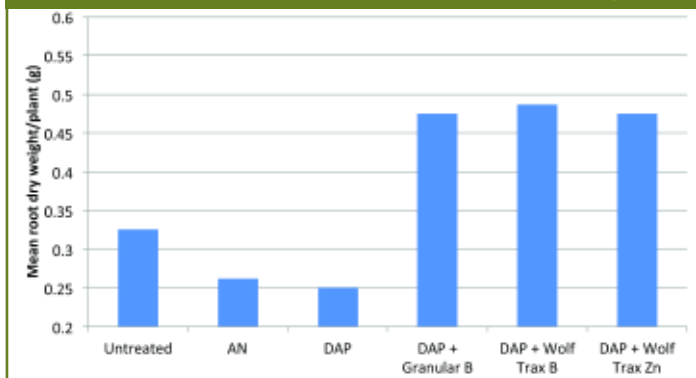
Jim says there's a similar issue with spring crops, but this can be addressed at the time of drilling. “You have to get the plant going from day one, so it must be able to access the nutrients to do so. This is further compounded by the likelihood that conditions will turn too cold, too wet or too dry at establishment and put the seedlings under stress.”

Early P is the essential element here, but he believes you can't rely on soil reserves to supply this, and even freshly applied TSP needs a helping hand. “We know that P helps rooting, but it effectively doesn't move in the soil, so the nutrient needs to be close to the seed to feed it and thereby stimulate the roots to develop. P also needs nutritional interaction ▶



Jim Carswell feels that addressing nutrient deficiencies purely through curative treatments compromises a crop's yield potential.

The effect of starter fertiliser on oilseed rape



Source: Agrii Bishop Burton Technology Centre; cv Quartz, drilled 02/09/13, assessed 08/11/13; Nitram applied at 87kg/ha; DAP – 167kg/ha; Granular B – 10kg/ha; Wolf Trax B and Zn – 167g/ha

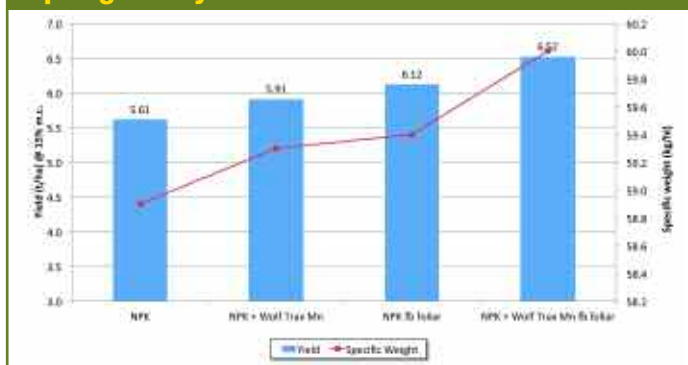
▶ with other nutrients to aid take-up.”

It's why ammonium phosphate is a favoured solution, best applied down the spout at drilling, in Jim's view, or at least directly after, spread on the seedbed. But what about the other

micronutrients?

This is the quandary that's led him to carry out a number of trials on Wolf Trax, a range of micronutrients formulated as a dry dispersible powder (DDP), which are designed to be coated onto granular fertiliser or mixed

The effect of starter fertiliser and foliar Mn on spring barley



Source: Agrii trials at Northcliffe, E Yorks; cv – KWS Irina, drilled 11/04/16; NPK (10:15:21) applied at 375kg/ha to seedbed; Wolf Trax Mn – 400g/ha; foliar – 2x Mantrac, 1 l/ha, applied 11/05/16 and 06/06/16; Yield – P value = 0.0542, LSD = ns, cv = 7.5%; Specific weight – P value = 0.5078, LSD = ns, cv = 7.57%.

into liquid fertiliser (see panel below).

“We investigated it first in oilseed rape in autumn 2013. We wanted to explore any differences in crop nutritional status for OSR established with

starter fertiliser compared with using Wolf Trax boron and zinc to see if the product was getting into the plant. We concluded it was.”

A range of different establishment treatments were

What are Wolf Trax DDP innovative nutrients?

The technology behind the nutritional coatings was originally patented by Canadian firm Wolf Trax in 2004. The products first came to Europe in 2009, and then to the UK a couple of years later. The product line was bought for US\$85M (£65M) in 2014 by Kansas-based multibillion-dollar concern Compass Minerals.

“Traditionally micronutrients are available as minerals or chelates,” explains Michael Lassen, European sales manager for Compass' plant nutrition lines. “But take-up by the plant and lock-up by the soil always cause problems, so Wolf Trax DDP are formulated with adjuvants, pH adjusters, sticking and wetting agents to aid nutrient take-up.

“The key challenge comes in the early part of the year when the soil is too cold for the plant to take up the nutrient required for healthy growth. That's why Wolf Trax developed a way to make micronutrients available to emerging and young seedlings.”

The nutrients are formulated into a dry dispersible powder (DDP) that attaches itself to the individual granular fertiliser. This can be applied combination-drilled with the seed, or spread soon after drilling or to a

young crop in early spring as growth starts.

Using the fertiliser as a carrier means very low rates of micronutrients can be effectively blanket-applied to the soil. “Fertiliser granules for most blended compounds and nitrogen prills would be just 2-3cm apart. But if you were to apply granular micronutrients the application points would be at least 50cm apart,” he notes.

This puts the right amount of micronutrients within easy reach of young roots, he maintains, and the formulation is optimised for root uptake with minimal lock-up. “Dual-Action availability means each DDP nutrient is formulated with at least two forms of the mineral, providing immediate nutrient uptake by the plants, as well as continuous feeding over time,” he adds.

So why not apply it to the seed? “We have formulations especially suited to seed coatings,” explains Michael. “The limitation there is the amount you can apply to the seed — it doesn't take you all the way to that first foliar spray.

“Coated to the first fertiliser dressing, however, the minute the

crop begins to take up N, P and K as growth gets underway, it'll access all the micronutrients it needs. This closes the gap until they can be supplied through foliar feeds.”

The coating itself is typically applied at just 1-3kg/t. “Our EvenCoat technology thoroughly coats each and every granule of N, P, K or S in a fertiliser blend. Once applied, the DDP nutrient won't come off during transport or handling, isn't affected by rainfall or humidity and doesn't require operators to wear PPE,” adds Michael.

In the UK, it's applied at Origin's blending sites, explains Peter Scott. “We have special technology and equipment to apply the DDP micronutrient. We use the umbrella brand name Micro-Match to cover any blended compound fertiliser grade that has Wolf Trax applied to it as this fits in with our Nutri-Match concept of prescription nutrients matched specifically to crop and soil need.”

Over 12,000 different products are currently supplied from its plants across Great Britain and Ireland, he says. “There's an infinite range of prescription compounds formulated to match the specific soil and crop



Michael Lassen says the key challenge comes in the early part of the year when the soil is too cold.

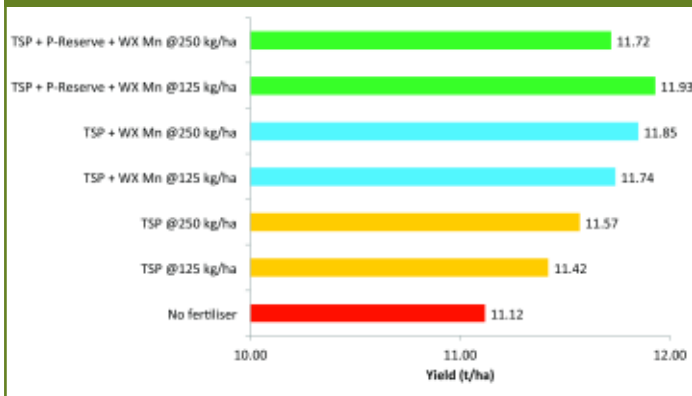
nutrient requirements identified by broad-spectrum soil analyses.”

Alongside N, P, K and S Nutri-Match blends, Origin Fertilisers can apply Wolf Trax nutrients either individually or in any combination up to 1% weight by weight (10kg/t) for cereals, oilseed rape, grass, potatoes, maize, root crops and vegetables.

Micro-Match nutrients available

| | |
|-----------|----------|
| Boron | 18.5% B |
| Calcium | 27% Ca |
| Copper | 57.5% Cu |
| Iron | 47% Fe |
| Magnesium | 30% Mg |
| Manganese | 33% Mn |
| Zinc | 62% Zn |

The effect of starter fertiliser and fertiliser coating on winter wheat



Source: Agrii trials at Bishop Burton iFarm; cv – KWS Kerrin, drilled 27/09/18 in unreplicated strips.

trialled at three sites with root dry weight measured two months after sowing. The trial showed an increase for both Wolf Trax boron (B) and zinc (Zn), when used with diammonium phosphate (DAP) compared with Nitram (34.5% N) or DAP used on its own (see chart on p38). At Stow Longa in Cams,

where the soil analysis revealed a slightly low Zn status, the Zn content of the plant shoots was increased using Wolf Trax, compared with untreated or DAP on its own.

Spurred on by these initial results, Agrii's carried out further work in spring barley, looking at the use of Wolf Trax

manganese (Mn) with and without a foliar follow-up. "The soil analysis showed the site had a very low Mn status. The yield response to Wolf Trax Mn applied with the NPK to the seedbed was generally similar to the results achieved with a foliar follow-up, with nearly 1t/ha yield benefit from using both," reports Jim.

Phosphate lock-up

Most recently, trials on winter wheat have looked at the use of Wolf Trax Mn, with and without P-Reserve, a fertiliser phosphate coating used to optimise phosphate availability (see chart above). Jim's a keen advocate of using P-Reserve to help reduce phosphate lock up in the first weeks after drilling and help maximise the initial boost to growth, while the Wolf Trax puts readily available Mn close to the root zone.

"Having the nutrients available in the soil around the seed encourages the young roots to grow and explore, which in itself provides an additional benefit to the plant."

And he saw this effect in the field. "The effects on rooting were astonishing. We saw a fantastic increase in the root mass of the wheat plants assessed in early March where

the Wolf Trax had been used."

NDVI assessments of above-ground biomass were also made of the crop in autumn and early spring, both revealing Wolf Trax gave the crop a benefit. "We saw an increase in ear numbers that translated into a higher yield," adds Jim. Although the extra cost of the best-performing treatment was £48.75/ha, it brought a return on investment for a field slightly low on Mn of £72.75/ha at a wheat price of £150/t.

Grain nutrient levels from the trial were also assessed with the Mn content higher where the Wolf Trax had been used. "Specific weight and protein also came out higher. This indicates that early rooting boost brings the crop a benefit that lasts right the way through to harvest," Jim surmises.

Manganese, zinc and copper are three trace elements frequently shown up in grain analyses as nutrient deficiencies, he notes. "These are important nutrients — Zn is needed for enzymes and sugar formation while Cu strengthens cell walls and is used during photosynthesis. Mn is the commonest trace deficiency in UK arable crops. All three can be supplied to a crop as Wolf Trax DDP nutrient coating on fertiliser." ■

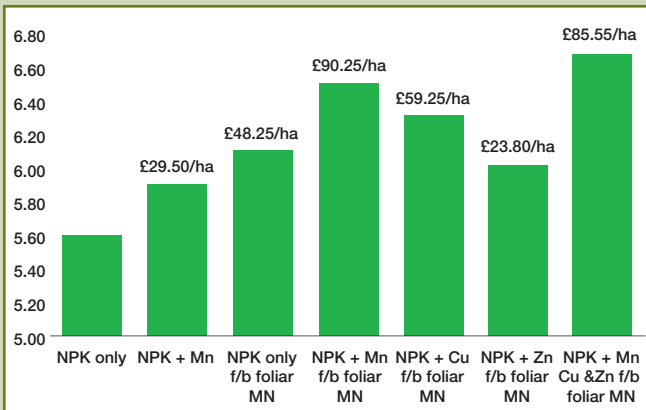
Effect on spring barley yield of Wolf Trax DDP coatings and foliar manganese

A trial carried out by NDSM (now Eurofins) in 2016 in Yorks, aimed to evaluate response of spring barley to soil and foliar micronutrients. Soil analysis showed the level of Mn was very deficient, slightly deficient in Cu and optimal for Zn, but its cation exchange capacity (CEC) was low, indicating the sandy loam has low potential to hold nutrients.

NPK fertiliser with and without Wolf Trax DDP coatings were applied to the seedbed. In five of

the seven treatments, foliar Mn was applied at GS13 and GS30. The greatest benefits from the Wolf Trax treatments came where the level of the nutrient in the soil was lowest, with the highest return on investment coming from soil and foliar-applied Mn.

The highest grain yield was achieved from soil-applied Mn, Cu and Zn together, followed by foliar Mn, indicating there may have been a synergistic yield benefit from the combination of soil-applied micronutrients.



Research Briefing

To help growers get the best out of technology used in the field, manufacturers continue to invest in R&D at every level, from the lab to extensive field trials. CPM Research Briefings provide not only the findings of recent research, but also an insight into the technology, to ensure a full understanding of how to optimise its use.

CPM would like to thank Origin Fertilisers for sponsoring this Research Briefing and for providing privileged access to staff and material used to help bring it together.

Origin Fertilisers is a national manufacturer and distributor of crop nutrition products with 12

production sites throughout the UK. Key to Origin's strategy is its continuous programme of innovation and unique product developments aimed at improving nutrient efficiency and farmer returns on fertiliser. Improving soil health through matching crop requirements to a prescription fertiliser blended with up to 14 nutrients has increased the Nutri-Match range to over 12,000 grades.

