Remedy required for lost N

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Technical
Take Control

A cold, wet winter has left crops in urgent need of repair and soils starved of available nutrients. *CPM* seeks the emergency measures that will put growers back in charge.

By Tom Allen-Stevens

Just at the point where you feel you've got an element of control over your cropping system, Nature comes along and gives it a good kicking to remind you who's in charge.

So as spring unfolds, and after one of the wettest winters on record, Yara's Mark Tucker urges growers to re-exert their authority. "The reality is that, since last harvest, the weather has been in control of the UK's arable cropping and left us in a sorry state. Now is the time to assess the condition of your crop and decide the management action needed to repair it."

For many crops across the UK, it'll be more a case of rescuing the biomass than feeding the potential. But careful nurture this spring can turn around even the most withered and sorry-looking wheats, he says. "Don't be too quick to write crops off. We've had trials we've very nearly aborted in the past that have gone on to demonstrate some of the best responses to a carefully tailored nutrition programme."

And that's what he advocates — decades of proprietary trials, along with recent experience gained through Yara's association with YEN (Yield Enhancement Network), back up advice for the current season that Mark believes will help growers pull a decent potential from their wheats. It boils down to a focus on three key areas — the soil, the leaf and the grain. Early spring is when the soil comes under scrutiny.

Water-logged soils

"Many crops will be sitting in water-logged soils and there's no doubt tiller number and size will be compromised as a result — that puts a dent in that first tier of building biomass, which is essential for yield. But trials suggest you can still get 82-96% of your yield potential," he says.

Yara agronomist Natalie Wood takes up the story. "Cold wet soils are not a good environment for arable crops. Processes in the soil and the plant itself shut down and that has consequences," she explains.

"The young crop relies on mineralised N at this time of year to start its spring growth. But there won't be much available in the anaerobic conditions. What's more, the heavy rain will have encouraged denitrification, so any available N will have been used up by the soil itself or washed away from the shallow plant roots, resulting in a double hit."

Wheat plants will begin to turn on themselves and cannibalise their own reserves, characterised by a worrying yellowing of leaves that will already be looking frail. "These crops need emergency treatment, and a dose of N as soon as you can travel is the best remedy — around 70kgN/ha should be applied early. Where there's a reasonable leaf area this can be applied in one dose. But in many cases, it's best to split this, returning in mid to late Feb," she advises.

But is it right to apply extra nitrogen following a winter that may have washed soil reserves down the drain? "Soil nitrogen losses are not necessarily leached. Nitrification is a natural process, governed by bacteria in the soil. During periods of anaerobic conditions, the soil micro-organisms don't get enough oxygen, and that's when they draw on its nitrogen reserves," explains Natalie.

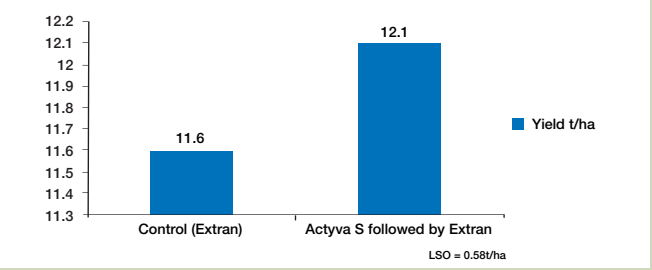
Replenishing these reserves is best supplied with ammonium nitrate, she continues, as this source is readily available to plants. Urea needs to be processed by soil bacteria into an available form, which may take some time in the cold soils. "Bear in mind you're replacing what's lost from the soil, rather than feeding the crop, so the amount of total N you apply early shouldn't be adjusted for crop potential," she continues.

Natalie believes taking soil and leaf

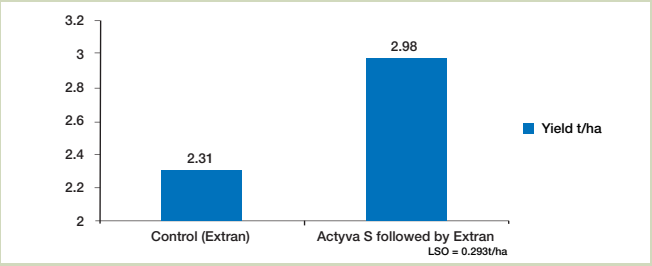
Mark Tucker urges growers to assess the condition of their crop and decide the management action needed to repair it.

The benefits of applying fresh P and K in early spring

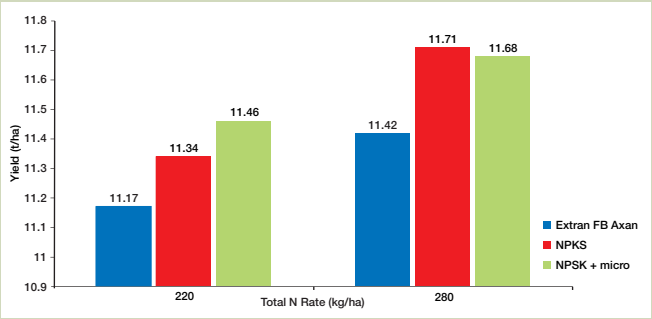
Winter wheat, 2015



Winter oilseed rape, 2015



Winter wheat, 2016



Source: Source: Yara UK trials; 2016 trials were conducted on a high P and K site; ActyvaS – 16:15:15 + 6.5% SO_3; Axan – 27%N + 9% SO_3.

samples to assess soil mineral nitrogen at this time of year has limited value. "Anaerobic soils can give you a misleading result. Leaf tissue analysis is an excellent gauge of nutrient requirements once the crop is growing, but if you take a sample from a water-logged crop, you'll get a spurious result.

Nitrous oxide

"But while it's important to get the N into the crop as early as possible, don't necessarily apply it all at once and don't apply any AN at all to water-logged soils. If it's not readily taken up, some AN will convert to nitrous oxide, a damaging greenhouse gas that's 298 times more polluting than carbon dioxide."

So although you're feeding the soil, the ability of the crop to take up the nutrients is important, to ensure the application is both cost-effective and environmentally responsible. That's where another potential cost of the season comes into play.

"Water-logging also damages root systems and the crop may have suffered dieback of its seminal roots — the first exploratory ones the young plant sends out that travel to depth. As the crop recovers, it will put out shallow roots first — that's good because these will take up the N, provided it's in a readily available form. But the plant needs to restore its damaged root system."

Phosphate is one of the best remedies, but again this won't be readily available in cold ▸

Testing times for nutrient levels

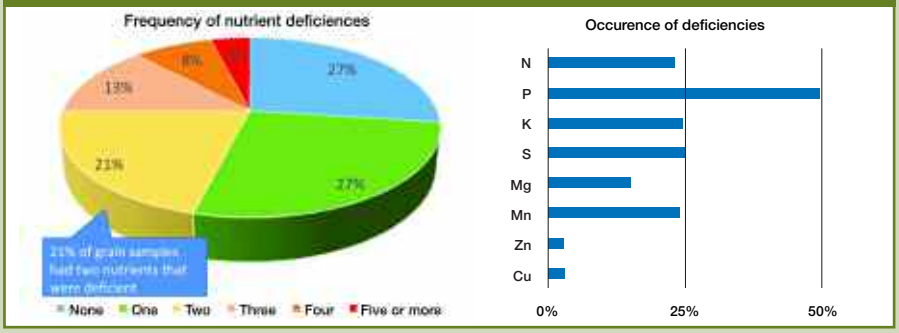
YEN entrants benefited last year from free leaf tissue tests. More than 800 samples were sent into Yara's lab at Pocklington, Yorks, with each grower sending up to four samples at the key timings — GS30, GS31, GS39 and GS59.

Boron, copper and zinc were the trace elements that consistently showed up as deficient in wheat samples, as well as magnesium. 92% of OSR samples were short of Mg.

"Historically, growers would have relied on a single recommendation for trace elements to cover the season, but many are now moving to dynamic guidance, based on tissue testing," notes Mark.

"It can be a very useful tool to benchmark crops and requirements do vary through the season. The guideline for P content of a wheat plant is 0.3%, for example, but this starts the season at 0.4% and peaks at 0.5%, dropping down to 0.2% after the T3 spray timing."

Nutrient deficiencies in grain



Source: Data from the YEN (by NRM) pus the Grain Nutrient Benchmarking pilot supported by ADAS, AHDB and Yara (Lancrop). Samples from 633 YEN crops after harvests 2016, 2017, 2018.

Grain testing is revealing high deficiencies here, even in crops that show no symptoms from soils with reasonable indices (see chart). "YEN tends to attract growers who pay attention to detail, and they put forward their best crops. So the fact that grain analyses show even these crops are suffering high deficiencies, particularly levels of P, points to a challenge growers have nationally to feed optimum nutrition into the ear," says Mark.

▸ soils. "That's why we'd always advocate applying the early dose of N as an NPKS compound. Even where indices indicate a healthy balance of P and K, our trials have shown fresh applications in early spring provide a yield boost (see charts on p41).

This is a year that extra application will come into its own, and we'd recommend around 35kg/ha of P_2O_5 for a soil at Index 2," she says.

A foliar source may serve the crop even better. "The efficiency of solid phosphate is relatively low, so an application such as Magphos K (19.2% P, 6% K, 6% Mg), before the first granular dressing, can spark off growth. Make sure it's quickly followed up, however, as the young plant won't take long to run out of steam."

The double damage of wasting N

It's more important than ever to assess a crop's nutrition requirement and tailor fertiliser applications, according to Prof Keith Goulding, sustainable soils research fellow at Rothamsted Research.

"Putting surplus N on your crops is not only a waste of money, it's a major cause of environmental pollution," he notes. "We have plenty of data that shows leaching is directly related to surplus N applied. With a draft Environment Bill set to pass through the Houses of Parliament against the backdrop of the Government's 25-year Environment Plan, expect legislation to tighten up in this area."

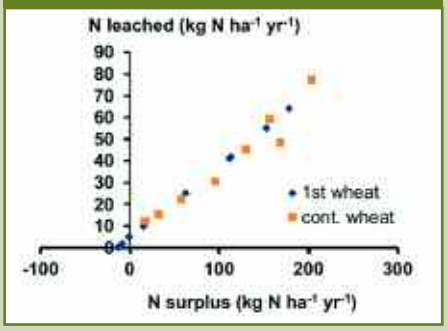
Keith points to data from Rothamsted's Broadbalk experiment, that's been running for over 170 years and shows a very clear correlation between surplus and leached N. This is supported by on-farm data from the Netherlands. "Broadbalk shows us consistently that optimum use of all crop inputs brings best results."

These should be applied according to the "4Rs of nutrient stewardship" — from the Right source, applied at the Right rate at the Right time and in the Right place. "There are now many ways to get a good accurate prediction of crop yield and apply nutrients precisely. This spring, although there will be little N left in soils, they will still be wet. There will be a high risk of leaching, so growers should tailor applications carefully to field conditions, taking account of forecast rain," he notes.

Guidance is available through AHDB's tools, such as the Nutrient Management Guide (RB209) and data on excess winter rainfall. Natalie also points to new services to help growers tailor nutrition requirements to canopy growth. The Yaralrix app is free to download and delivers N recommendations straight to your phone based on photos you upload of crop canopy. Atfarm, is a satellite-based service, with crop growth monitoring provided free to growers. You can purchase variable-rate nitrogen-application maps, generated using the same algorithms the N-Sensor uses to determine optimum N.

"This year will be the season when all the N-testing kit will really come into its own to ensure optimum nutrients are applied at the right time," she notes. "But for now, the focus is on repairing a damaged crop and replenishing starved soils, so small blanket applications of carefully chosen products will be the best remedy."

N leached from Broadbalk experiment



Source: Rothamsted Research Broadbalk experiment.

Keith Goulding warns that putting surplus N on your crops wastes money and is a major cause of environmental pollution.

Feb-drilled winter wheats don't have to be held back

For those still drilling, or hoping to drill, their winter wheat, treat it as you would a spring crop, advises Natalie, at least until well after it's first established.

"Many winter varieties can be sown in Feb. If it was a true spring variety, typically you'd apply 180kgN/ha, split 60% on the seedbed with the rest applied as soon as the crop's emerged. But that may be sub-optimal for a winter type that could take 40kgN/ha more if growth and conditions go favourably."

Aim to get the crop off to the best start, and nurture it through the early growth stages, she advises. "Monitor the crop biomass closely and apply a later top-up of N that's matched to canopy growth and the crop's potential."

Struggling crops need emergency treatment, says Natalie Wood, and a dose of N as soon as you can travel is the best remedy.

Once growth has been triggered, it's important to keep crop momentum. Experience through YEN has shown the best way to build early biomass is to ensure the crop wants for nothing as it puts on leaves. Wheat plants this year will start the season with some catching up to do, so Natalie feels it'll be more important than ever that every nutrient is available at the right time.

"Sulphur is another key requirement, and it behaves much like N in terms of its availability from the soil. A wheat crop needs a little S every time it takes up some N, with a total requirement of around 50kg/ha SO_3. So it's best to apply an NPKS compound fertiliser first, following up with NS products."

Oilseed rape requires a higher total dose of sulphur — around 75kg/ha SO_3 — and Natalie advises treating crops much the same as wheat, starting applications as soon as you can travel, preferably with a compound fertiliser.

"The concern with OSR is gauging whether it will be a crop worth investing in, so it's a good idea to split the early N. While you'll want around 70-80KgN/ha early on, you may want to start with just 40-50kgN/ha, then coming back a couple of weeks later, before applying the main dose in March." ■

Take Control

As Britain exits the EU, the move will create unprecedented uncertainty and change for farmers. While much of the change is beyond the control of the average arable business, it highlights the importance of those elements that can be managed.

Few aspects of crop production are more critical than a plant's nutrition, which is why *CPM* has teamed up with Yara in a series of articles that brings in some of the latest understanding to build on established knowledge. The aim is to take control of how a plant draws in and assimilates nutrients to optimise every aspect of crop and field erformance.

With decades of evidence-based knowledge, Yara continues to be at the forefront of crop macro and micronutrient advice. Investment in technology hasresulted in world-leading products that support in-field decision-making and precision nitrogen application.