

# Making efficient use of nutrients



*“One of the most significant things we can do is to focus on nitrogen use efficiency.”*

PETER SCOTT

New innovative developments in crop nutrition promise to deliver lower carbon farming and reduced input use, but are these claims founded and is there a preferential approach for their use? *CPM* speaks to experts for their views.

By Janine Adamson

**I**norganic nitrogen fertilisers are the single largest component of the carbon footprint of crop production, reminds Origin Soil Nutrition’s technical director, Peter Scott. Therefore, any attempt to decarbonise food production has to address this, he adds.

It might be a strong and rather direct statement, but it’s indeed fact. “In a typical combinable crop, 50% of its carbon footprint is related to the production of the fertiliser in the first place, with the other 50% due to in-field emissions.

“But, around half of human dietary protein consumed globally is directly

related to the use of inorganic nitrogen and in the West, this would be much more. The issue of nitrogen use goes to the very heart of sustainable food production.”

It’s undoubtedly a critical issue which will involve collaboration across the entire sector to rectify, but are there areas to target first – lower hanging fruit? To start, Peter believes one solution could be the use of green ammonia, where the hydrogen element of ammonia comes from water rather than gas. “This could play an important role in the future with regard to reducing the carbon footprint of manufacture, but we



## Carbon footprint concerns

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## Taking it to trial

### Reviewing the results from endophyte trials

**A**grii has been looking at the potential benefits of endophytes in its R&D programme for several years and not only are the benefits becoming clear, so too are the conditions and management factors which can have an impact, says technical manager, Jodie Littleford.

“Our main focus is on endophytes and their ability to improve nutrient use efficiency. When endophytes are used as seed treatments, positive results have been observed in pulses during work conducted in conjunction with Swaythorpe Growers in Yorkshire, where use of Nuello iN from Syngenta – an endophyte combined with a probiotic treatment – produced improvements in pea yields and quality.

“In fact, just 18 days after drilling an increase of more than 10% in shoot length and 20% in root length was seen in the treated crop [peas] with visible difference clearly apparent in the field.”

According to Jodie, this advantage continued throughout the growing season with increased nodulation and improved levels in seven out of 11 nutrients in the treated crop, 56 days after drilling.

“At harvest, the treated crop delivered a freshweight yield of 11.29t/ha compared with 8.06t/ha for farm practice, resulting in a frozen yield of 8.99t/ha compared with 6.57t/ha – a 2.42t/ha improvement. Levels of key nutrients in the treated peas were much higher too.”

Foliar treatments in cereals have also highlighted endophytes’ ability to improve NUE in other arable crops too, she adds. “Agrii trials have shown *Methylobacterium symbioticum* – an endophyte that takes nitrogen from the air and converts it to nitrate within the plant’s leaves – can effectively compensate for 30kgN/ha less inorganic N applied with an ROI of nearly £90/ha.

“Furthermore, when 212kgN/ha was applied as farm practice in trials at Bishop Burton College in Yorkshire, an average winter wheat yield of 13.08 t/ha was achieved. This increased to 13.67t/ha when the endophyte was used in addition – a 0.6t/ha uplift.

“But, a 30kg reduction in N with the endophyte gave a yield of 13.03t/ha – which is practically identical to the farm standard. At £200/t for wheat, that delivered an ROI of £87.11/ha,” she explains.

Other Agrii trials at a range of UK sites have also shown endophytes’ supporting plants to make better use of N while assimilating other key nutrients into the crop more effectively, but it’s far from a simple science, stresses Jodie.

“It’s not a technology you can take shortcuts with; we’ve seen a broad range of results. This points to the fact that you really have to work with your agronomist to establish how and when to use endophytes to get the best results.”



### Benefits in pulses

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All in all, Agrii R&D insights suggest there’s much to be gained from endophytes, but their use has to be tailored to the individual growing situation, comments Jodie. “The more factors you have working in your favour, the better the results you’re likely to see.

“A healthy, well-nourished crop is more likely to benefit from endophytes than one that’s struggling. In such cases, increases in NUE will largely result from the higher yields achieved diluting the nitrogen required for each tonne of production.

“Agrii’s R&D is pointing towards endophytes working more effectively as an addition to full rate programmes rather than as a consistently effective way to reduce N inputs,” she concludes.

▶ must also address in-field emissions.”

This is because from a very practical sense, the pH of soil together with its organic matter content and structure plus other considerations such as drainage, all impact emissions, he says. “Consequently, better management is essential in the future.

“One of the most significant things we can do – and one of the most important benchmarks for delivering future sustainability full stop – is to focus on nitrogen use efficiency (NUE). The higher the NUE, the lower the N loss, but you have to measure it to manage it,” stresses Peter.

“NUE changes from season to season, field to field and crop by crop, so it’s

no good using default average values or national levels. We have to get local and encourage all growers to do this.”

Agrii’s fertiliser technical manager, Tom Land, agrees that it should all start with measurement. “If we contextualise this with the current season, there’s a very mixed bag of winter cereals out there depending on the drilling date.”

### SEASONAL IMPACT

“This, combined with higher soil temperatures, means more mineralisation of N and crops looking better than what might have been expected thanks to the conditions. However, winter isn’t over yet so there’s potential to lose further N, plus crop

demand could be above average.

“This is why it’s critical to have an understanding of the soil nitrogen supply and residual levels by conducting timely soil testing.”

Reflecting back to Peter’s statement regarding better soil and crop management to mitigate agricultural emissions, what comes next from an agronomic perspective? Despite fully championing new innovations within fertiliser technology, Tom believes it’s back to the basics.

“You have to get the crop into a solid, responsive state before considering anything like biostimulants, endophytes or alike. So what’s tissue testing telling you about the health of the crop?”

Are there any nutrient deficiencies such as molybdenum or iron?

“As for sulphur, this can’t be ignored across all crops – conditions the past few seasons mean we’re seeing many crops deficient in this key nutrient. Then, once any deficiencies are rectified, we can begin to look at alternative technologies,” he says.

As such, Tim Horton, Agrii’s technical manager for combinables, suggests a product worth considering early doors is Agrii-Start Release – a soil phosphorus activator. “Agrii-Start Release works in the soil to prevent lock-up and in turn, increases the release of phosphate and other crop nutrients for uptake through plant roots.

“Soil reserves should always be the first port of call in terms of nutrition for optimum NUE, and Agrii-Start Release helps the crop to access those reserves in a more efficient way.”

In regard to its sustainability credentials, Tim highlights that Agrii-Start Release reduces the use of finite rock phosphate, which can be replaced with lower cost, citrate-soluble phosphate options like manures and digestate.

Then, something most growers are now familiar with, is biostimulants. “Here, we’re mostly looking at an early application to get crops moving to hopefully compensate for poor autumn conditions,” explains Tim.

“Biostimulants are a proven way to support and make conventional crop health/production products more

effective while unlocking a crop’s potential. Plus, boosting rooting helps to improve nutrient absorption which contributes to NUE.”

However, Tom stresses with so many options now available on the market, an end goal has to be identified first. “Understand what you actually want it to do, for example, is that target stimulating nutrient translocation in the plant?”

“There are many formulations available which offer an array of benefits including overcoming stress, and we know stress reduces a plant’s ability to take up and utilise nutrients. Biostimulants play an important role but my advice is to be mindful of spend versus key nutrient input costs,” he stresses.

But according to Tim, whether it’s down to price or environmental concerns, grower attention is moving away from conventionally produced fertiliser. “We’re seeing increasing interest in biofertiliser technologies such as endophytes, which are based on bacteria which fix atmospheric nitrogen.”

## CROP COLONISATION

“The bacteria, often applied in cereals as a foliar spray, colonise the crop to improve their nutrient use, which in turn can increase yield and quality,” he explains.

Tom adds that the ideal time to apply endophytes is when the bacteria has the best chance of survival. “The bacteria require adequate air temperature in the spring – which is around April time – for optimum growth and multiplication. The temperature of the water in the tank which they’re applied from also has an impact.

“But, this timing should work well because it gives growers an opportunity to build the right foundations first, so the crop’s ready to receive the endophyte once it’s applied,” he says.

Tom stresses that although endophytes are an obvious solution in



### Accessing reserves

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the quest to improve NUE, the purpose of their use shouldn’t be to cut back on N. “It’s more about enhancing what’s applied and the subsequent gains in NUE and environmental sustainability.”

Although the aforementioned solutions are relatively proven in the field, fertiliser technology is a fast-paced area of the market, states Tim. “Yes farmers are interested in these options as a way of reducing their carbon footprint, but they have to reliably deliver, which is where Agrii trials come in.

“We have a comprehensive trials programme in the field, and this is about to be supplemented with a new glasshouse facility for ‘fast fail’ screening. This investment has been made because we want to help farmers to understand what these products are actually doing and what they could achieve on farm, while speeding up the availability of innovation,” he concludes. ●



### Back to basics

According to Agrii’s Tom Land, getting a crop into a solid, responsive state before considering anything like biostimulants, endophytes or alike is essential.

## Climate resilient cropping

**W**ith weather extremes becoming more frequent, and challenging conditions now perceived as the norm, what can growers do to improve the resilience of their cropping approaches?

This series of articles, kindly sponsored by Agrii, aims to explore some of the different approaches to de-risking crop production – from making better use of nutrients and boosting NUE, to getting the most from plant genetics.

CPM would like to thank Agrii for providing expert insight into these topics, and for the privileged access to the individuals involved.

