



“The direction that farming is going is all about being prepared to look at things in a new way.”

Strategies for spring success

Better biostimulation

With spring nutrition plans now underway, Frontier’s BioPlan programme looks into how incorporating biostimulant solutions could help growers to maximise their inputs this season. CPM finds out more.

By Charlotte Cunningham

As the evenings begin to draw out and the ground starts to slowly warm up, it’s all eyes on maximising spring growth in the hope of a prosperous harvest.

Unlike the past two years, the fair weather over the autumn/winter of 2021 has meant that many winter cereals have entered the spring in good form, and the conditions for sowing spring crops are similarly so far looking promising.

Of course, in good old British weather fashion, growers will be all too aware that this could change drastically at the drop of a hat — as has been the case in recent years, with farmers left to deal with the aftermath of everything from early droughts to unusually cold spring months.

So how can growers best prepare for the unknown, while realising the potential of crops this spring?

Dr Paul Fogg, Frontier Agriculture’s crop production technical lead, says the starting point is understanding exactly what’s happening within the plant during the spring months. “From March onwards, it’s all about trying to keep a plant fully functioning. Here, we’re thinking about respiration and nitrogen assimilation.”

Plant growth

“At this stage of the growth cycle, we want to maximise green leaf area to boost photosynthesis and clearly we want to make sure that we’re assimilating as much nitrogen and soluble nutrition as possible so that the plant can produce amino acids, convert them into protein, and essentially, growth.”

Jim Stotzka, lead on sustainability at Frontier, jumps in and explains further. As photosynthesis starts, the plant begins to make energy in the form of adenosine triphosphate (ATP) which enables it to start growing. “In the event of stress, these two basic functions essentially start to fail as the plant stops growing and focuses solely on respiration as that’s a more essential function than growth.”

The good news, however, is that growers can support these functions

by intervening ahead of the event with biostimulant solutions like pidolic acid. But what exactly is pidolic acid, and how does it work?

Essentially, pidolic acid is a signalling compound in nitrogen metabolism, explains Jim. “It causes two main responses in plants, firstly, it increases nitrogen assimilation ability and subsequent amino acid synthesis and



The key to getting the best growth from crops this spring starts with a sound understanding of the primary plant functions at this time, says Paul Fogg.

New product expands offerings

Although the market has undoubtedly been flooded with products in recent years, a novel product for 2022 offers something new to growers, believes Mark.

"We're launching a new biostimulant this spring called Status, which contains 320 g/l of pidolic acid and 2 g/l of MTU (1-(2-Methoxyethyl)-3-1,2,3-Thiadiazol-5-yl Urea).

"MTU is a unique and patented molecule which works by stimulating photosynthesis and does this by increasing the phytochrome activity within the plant."

Essentially, this phytochrome system can be described as a biological light switch and, when stimulated, makes the plant more sensitive to light in the red and far-red region. "What that means is that we get more chlorophyll in photosystem two and one (PS II and PS I) —

both of which are essential in photosynthesis," explains Mark.

"Increasing the activity of PS I is unique, as far as we're aware, as most biostimulants don't appear to have an effect on PS I. So this is quite exciting. Being able to manipulate this means it's possible to increase the output of nicotinamide adenine dinucleotide phosphate hydrogen (NADPH), which is a co-enzyme in many essential biochemical processes in the plant, for example nitrogen assimilation and cell growth."

A healthier plant also means a greener plant that can assimilate more carbon. And under stress conditions — such as drought and heat — MTU really comes into its own as it primes the plant for recovery and speeds up this process, he notes.

"We've found this enables plants to adapt better in a stress situation and treated plants have shown a bigger root system. This results in partitioning of more carbohydrates to the root as it reacts to being under drought conditions. Treated plants have lower levels of the drought stress hormone abscisic acid (ABA)."

Another function of MTU is the ability to activate cytokinin receptors in the root system, otherwise known as the AHK3 gene. "This effectively means we get more lateral root production.

"It's a novel molecule and it's quite exciting," concludes Mark. "We've also just won an award with the US Department of Agriculture for nutrient-use efficiency with this molecule, so we're really pleased with it."

protein production.

"And secondly, it helps prepare plants to recover better from stress situations, once limiting factors — like drought or heat — are addressed. This is important because, as mentioned earlier, when a plant comes under stress, it prioritises respiration over its growth and essentially stops the nitrogen assimilation cycle at a crucial point.

"This reverses the cycle and subsequently glutamic acid is then converted into alpha-ketoglutarate, which results in a build-up of toxic ammonia and causes subsequent plant yellowing."

Jim goes on to explain that if a plant is supplemented with pidolic acid prior to this, so it doesn't have to synthesise the signalling molecule itself, it can kick start the cycle back into action to help

Pidolic acid can help prime plants to recover better from stress events, explains Jim Stotzka.

compensate against those negative effects.

What it doesn't do, however, is stop the stressful event, he emphasises. "If we're in a drought situation and we don't get rain, it doesn't have magic powers to stop the effect of this on a plant. But what it can do is better prime the plant's recovery. Almost in the same way a person may use a protein drink to help aid the recovery from intense exercise.

"In a non-stress situation, by incorporating pidolic acid into the programme, we're simply adding a tool to support and maximise plant growth through nitrogen assimilation."

Paul emphasises this: "Pidolic acid ►



Revisiting R100

The last instalment of Better biostimulation (CPM, October 2021) looked at R-100 and the advantages from its use in the autumn, however, benefits from application could still be realised in the spring, reckons Paul.

To recap, R100 is a biostimulant technology which can be described as a nutrient transport mechanism, explains Jim. "It contains two components — diphenylurea (DPU) and gamma polyglutamic acid (gamma-PGA) — and its role is to increase the uptake and utilisation of cationic nutrients and stimulate cytokinin production, which encourages plant growth. It does this by binding to cations and transporting them into the plant where they

are released and utilised.

"It also encourages magnesium assimilation, which is critical for photosynthesis — a key process in the spring."

Paul adds that the improved uptake of magnesium afforded from R100 is particularly valuable this spring. "It's a key macronutrient in terms of chlorophyll production and ultimately green leaf retention, which means it complements traditional fungicides and biostimulants really well."

Frontier has a range of products containing R100, including RapidMan (manganese nitrate), Proleaf manganese sulphate S-R100, Magistrate, Program and Cearum.

Alongside this, there's a high value to be realised in tissue testing and later in the season, grain analysis," adds Paul. "Understanding where the crop is at and how you can support its growth will enable farmers to better target exactly what should or shouldn't be applied.

"Obviously, biostimulants come with a cost, so if growers are able to justify an investment it can only be a good thing.

"As we get to the end of the season, don't overlook the value of grain analysis. It's an increasing area of interest and can help growers understand how effective — or not — they've been with their crop management and nutrient programming."



IntraCrop is launching a new biostimulant this spring called Status which contains 320 g/l of pidolic acid and 2 g/l of MTU, explains Mark Palmer.

▶ shouldn't be seen as a miracle cure to make stressed plants better, but instead, as a stress mitigation tool. We also know from in-vitro trials work with the University of Nottingham, that pre-loading the plant ahead of stressful periods is the best strategy here.

"I think this is why the 'snake-oil' tag is thrown around a lot when it comes to biostimulants," he adds. "But the conversation has moved on significantly from putting a bit of product on an exhausted plant and hoping for the best, to pushing high performance crops to deliver their full potential using a programmed approach of biostimulants alongside sound agronomy, good macro/

micronutrition and diligence across all aspects of crop production."

Putting the potential of pidolic acid into context for this season, Paul reckons Frontier's pidolic acid-containing product, Program, may be even more beneficial in light of the current challenges with fertiliser supply. "Program is uniquely placed to help maximise nitrogen-use efficiency, so if you are using reduced or sub-optimal rates this season, then something like pidolic acid will help to ensure you're extracting the maximum value from the nitrogen you do have available."

Phosphite opportunity

Also from the Frontier stable is Nutrino Pro — a foliar nitrogen product containing pidolic acid and R100. "Again, we're not saying you can replace 40kg/ha of bagged nitrogen with a foliar source. However, it does provide an option to top up your soil applied programmes."

Turning focus to other available sources to boost crop production this spring, Paul says there's still an opportunity to use phosphite products pre-stem extension. "Phosphite could be particularly beneficial on later sown crops as it was such a kind autumn, and not forgetting spring cropping — in particular, spring barley," explains Paul. "Spring barley has a lot to do in a very short growing period, so giving it as much help as possible can only be a good thing.

"Phosphite can help to ensure crops get the best possible root structure and foundations in place. Sod's law will be

that we get another dry spring again, so having a greater root mass to scavenge moisture and soluble nutrients is key for optimum production.

"Our advice around application is that a sequence is always better — so 0.5 l/ha of Gro-Plan P in the autumn and then going again in the spring before stem extension. But if, for whatever reason, growers missed out in the autumn, it's still worthwhile applying now on perhaps more backward or spring crops."

IntraCrop's Mark Palmer also advocates the early use of phosphite. "We know that phosphite increases root mass, but it also increases nitrate reductase activity. Work conducted by the University of Kiel (Germany) has shown there's the potential of a 10% increase in nitrate reductase activity in wheat when phosphite is applied early. As Paul has explained, this essentially creates a bigger, better root system to scavenge for nutrients — around 30-40% bigger in our trials."

Looking to the future, Paul reckons biostimulants are a key part of the plan in a new era of farming. "The direction farming is going is all about being prepared to look at things in a new way. There's lots of conversation about the rise of conservation agriculture approaches and moving towards a more 'hybrid' model of farming — pulling in all sorts of technologies and tactics to make the best out of the land that's in front of us.

"We believe biostimulants have an important role to play in this, which is why we're investing in research and trying to prove exactly how growers can get the best from these more novel crop production technologies." ■

BioPlan product line up for spring programmes

Product	Biostimulant	What does it do?
Prosper ST	Phosphite	A phosphite-based seed treatment designed to speed up establishment and increase root biomass.
Gro-Plan P	Foliar phosphite	Simulates nitrate reductase and increases root mass by 30%. Suitable for use on a range of crops, Gro-Plan P can be used alone, or in a tank mix with Cearum (R100).
Program	Pidolic acid and R100	Contains a blend of biostimulants with different functions and a balanced, broad spectrum nutrient combination to increase yield and quality.
Nutrino Pro	Pidolic acid and R100	A low-scorch nitrogen formulation containing magnesium and sulphur as well as two complementary biostimulants. It provides a controlled-release nutrient supply, with variable length chain polymers releasing their nitrogen over 6-8 weeks.
Status	MTU and Pidolic acid	Pure plant biostimulant increases photosynthesis and nitrogen assimilation. Reduces abiotic stress.

Better biostimulation

As biostimulants are set to play an increasing role in crop production, it's important to separate the good from the not so effective.

This is what Frontier aims to do through its BioPlan programme. The Better biostimulation series will explore in more detail both the fundamentals of biostimulants and how to get the best from the Frontier range in the field.

CPM would like to thank Frontier for sponsoring the series and allowing privileged access to its staff and materials to put it together.

BioPlan®