

“ We’re using biostimulants as a blunderbuss at the moment. ”

## Technical Biostimulants

# Much still to learn

The end of year report for amino acid biostimulants reads ‘could do better’. CPM finds out where the independent evidence suggests we’ve got to on the learning curve.

By Lucy de la Pasture

**The buzz around biostimulants has reduced to more of a whisper. And that’s hardly surprising in a difficult year where inputs will be carefully considered with a watchful eye on their probable contribution to the bottom line. Independent research is indicating that biostimulant effects are anything but certain.**

In 2017, ADAS conducted a review of the biostimulants market on behalf of AHDB and the overwhelming conclusion was that there’s a distinct lack of field evidence in the UK to properly assess the contribution this upcoming class of products may make to yields, explains ADAS crop physiologist, Dr Kate Storer.

Interestingly, the review found the lowest evidence-base was for one of the classes of biostimulants that’s been gaining the most momentum on farm, amino acids. Researchers found the published data was principally from glasshouse pot experiments and there was little or no independent data for amino acid use in cereal or oilseed rape crops.

In an effort to explore the potential of these often well-promoted products, particularly for maintaining crop momentum, one of the YEN Farmer Innovation Groups (FIGs) set up tramline trials on their farms during the 2018 and 2019 seasons, funded by the agricultural European Innovation Partnership (EIP-AGRI).

### Yield effects

“The aim was to assess the yield effects of amino acids applied in the autumn and/or spring in tramline trials which took place in Lincolnshire, Staffordshire and The Wash. We had seven sites in 2018 with timings in the autumn and/or the spring, targeting tillering and stem extension.

“In 2019 there were five sites, of which three were taken to completion, and the application timings were T1 and T2 or in response to drought stress,” explains Kate.

“The idea was to see if the amino acids would increase above ground biomass and stress tolerance, which are associated with higher yields in YEN and increased grains per unit area.”

The results from both years were disappointingly underwhelming, with some trial sites showing a small positive response and others a small negative response, but no clear effects from amino acids on yields, describes Kate.

In 2018, yield effects from spring-applied amino acids ranged from -0.26t/ha to +0.5t/ha. The only statistically significant result was the 0.5t/ha yield increase. At four of the sites, amino acids were also applied in the autumn, with yield effects ranging from -0.71t/ha to +0.27t/ha. The reduction in yield of 0.71t/ha was the only statistically

significant result. In 2019, the range of yield effects was -0.47t/ha to +0.18t/ha, with no significant differences.

“The two significant results in 2018 were from an un-replicated trial site, and may have been confounded by underlying variation,” says Kate.

Dr Bob Bulmer is also involved with the YEN FIGs looking at amino acid and other biostimulant products on participating farms. With two years data on amino acids and 2019 data on other approaches now analysed, he agrees the results haven’t been much to get excited about.

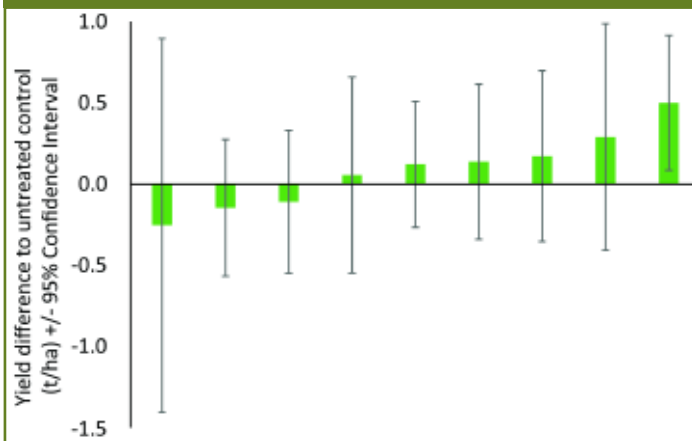
But Bob says the things that the group has learned on the journey have been really useful. One of the main areas of learning has been trial design, with problems encountered in 2018 that led to better design in 2019 and a more robust set of data, he explains.

“The trials have shown us that the more you find out, the more you have to think about things. Biostimulants are a very interesting area with much potential but



There were no clear effects from amino acids on yields in two years of YEN Farmer Innovation Group trials, says Kate Storer.

## YEN amino acid FIG cross-site analysis



Applications spring and T1. Mean weighted yield effect 0.11t/ha across nine sites. SE: 0.086t/ha; 95% CI: 0.17t/ha.

Source: ADAS, 2020

in terms of understanding just how to get the best out of products, it's an emerging technology and there's still a lot to learn," he says.

Bob believes the ADAS agronomics is a real breakthrough because it brings statistical analysis to tramline trials, which makes them more meaningful. "It's a new methodology that enables growers to look at agronomy approaches on their own farm, and that's appropriate for anyone who can produce a yield map.

"Small plot trials are essential

to capture the more sophisticated details, but tramline trials allow for soil variation, which we know is a huge factor at a field level. We know biostimulant products can be variable in their effects and influenced by the year, the crop and timing of application. Field studies can help us determine when is the appropriate time to use them," he comments.

One of the growers participating in the YEN group looking at amino acid products was David Hoyles of Monmouth farm in South Lincs. He's not at all disparaging about amino

acids but after four years of looking at them on various crops on the farm, he's unconvinced they have much to offer on his particular soil type.

"I believe biostimulants products have a place, but possibly not on our silty, nutrient-rich soils where there's probably less potential for them to have an effect," he says.

David has looked at amino acids on cereals, potato, sugar beet and beetroot and having invested a significant sum in biostimulants each year, he hasn't found a benefit that justifies continuing to apply them.

"We've had two bad years after the drought in 2018 and the wet harvest in 2019. This year cash flow is going to be even tighter for obvious reasons and we'll be reigning back on costs. That means we won't be looking at biostimulants until either the market contracts or more independent work is done on them," he says.

Dr Syed Shah has been researching biostimulants for the past six years, initially in his role at Agrii and more recently at NIAB, where he is a researcher and TAG Consulting agronomist. On the basis of



*Bob Bulmer believes biostimulants are a part of maintaining crop momentum but aren't the foundation for yield.*

the work he's done to date, Syed isn't yet comfortable to recommend applying any biostimulants products on the farms he advises.

But he has been helping his clients to try biostimulant products in several replicated tramline trials in order to understand them and their interaction with soil type and growing season. Each season is different and one biostimulant product might work on certain soil types but not on others, he notes.

"Currently there is still a lack of independent evidence to support the benefits claimed by manufacturers and farmers need to realise a margin over input cost. It's always really ▶

## Research continues to further understanding

After three years of fieldwork, it's clear biostimulant benefits in cereals don't always translate into yield, says Interagro marketing manager, Sarah Ferrie.

"In a crop with a good root system, with good availability to moisture and nutrients, is it really realistic to expect a yield benefit and does the crop even require a biostimulant boost? Probably not, and that's what we've found in our field work after three very different years of testing."

She believes the opposite is probably true in a crop with a poor root system, restricted access to moisture and nutrients, or a stressed crop. "In this case, the crop does benefit from a biostimulant and the biggest benefits in yield and margin come when the biostimulant application has preceded a stress situation."

And this is where the problem lies — managing expectation and getting back to basics, she highlights. "Remember that a crop can

produce all the amino acids and peptides it needs in ideal conditions. It's only when the raw materials to produce them or the crop is stressed that their production slows or stops.

"A biostimulant acts like a supplement until the crop can start production again. Oversupplying may push potential but then you get into the realms of Liebig's Law — the law of limitations where other elements restrict yield gains," she explains.

"Our advice for 2020 is to tailor any amino acid biostimulant applications in cereals and oilseed rape to the field situation, rather than prescribing a standard programme. Ideally the applications should be applied just before the stress period in order to supplement amino acid and peptides as crop production slows.

"We know that peptides can aid recovery and therefore if they haven't been applied before a stress event, applications should be made

immediately after. None of us have a crystal ball so it's hard to know when the crop is stressed and when to make the application," she says. "It's a similar conundrum to a low/high input fungicide or PGR programme — do you take the insurance route or minimise the investment? They don't always, but sometimes they really do. In root crops and veg, payback can be even bigger.

"We're on a journey in terms of understanding the behaviour of biostimulants in certain varieties, soil types, timings (going much earlier for example) — and we don't have all the answers yet, but we are working extensively in this area to deepen our knowledge.

"YEN is a great initiative to help growers push yield and it's great that biostimulants are part of this research initiative. The question is — in the trials so far, how close is the grower already to achieving the potential of the crop as opposed to getting poor performing fields to yield better?"



Syed Shah says each season is different and one biostimulant product might work on certain soil types but not on others.

► important to question the data when it's presented to you to find out whether any yield effects are statistically significant," he says.

Syed believes that replicated small plot work using a randomised block design trial system has an important role because it enables researchers to isolate the variable and outliers that are causing any effect on the yield.

"Data quality measured in terms of co-efficient of variation, least significant difference (LSD) and numbers of trials over seasons need to be considered. Over the past 5-6 years, 99% of the biostimulant treatments we've trialled have had no yield effect.

We have seen crop greening and increases in above ground biomass, but farmers are paid on the basis of their yields, not on these other effects," he says.

One of the factors most growers, agronomists and researchers agree on is that more work is necessary on the biochemical pathways involved so that they can gain a better understanding of how biostimulants are working. In spite of a mediocre performance in trials over two very different seasons, there remains a feeling that biostimulants offer potential.

### Yield differences

"There are some development biostimulants we've been looking at NIAB, that have given statistically significant yield differences in trials, but this was just one year's data so we need another year's data from at least two sites before we can draw any real conclusions," he adds.

Bob agrees that better science will help realise the potential biostimulants may offer. "We're using biostimulants as a blunderbuss at the moment, rather than as a sniper's rifle. We will have to understand which substances in the biostimulant 'soup' are affecting which biochemical pathways in the plant to refine the approach and perhaps

isolate and apply only the active principles.

"Seaweed products are a mixture of carbohydrates, amino acids and minerals, often with additional trace elements added by the manufacturer, so what's doing what in the plant? Amino acid products don't contain enough nitrogen to affect plant growth, so is it the amino acids or is it peptides having an effect?" These are some of the unanswered questions which make using biostimulants a bit hit or miss, he believes.

One of the questions Bob believes anyone using or recommending a biostimulant should ask themselves is 'what am I trying to influence?' "This spring my mantra is enhancing roots and conserving tillers, rather than canopy longevity and reduced stress, and that takes me towards certain biostimulants products. Phosphites are known for their effect on roots, so may be useful to help achieve this, as well as ensuring adequate nutrients — for example, phosphate and nitrogen — are available and utilising the effects of PGRs before stem extension and under the right conditions," he explains.

Bob has also been wondering if just applying one biostimulant and expecting it to work is where things may go wrong and this is something the YEN group of growers investigated last year, with mixtures and sequences of products in their trials.

"We've had some success in trials combining seaweed and phosphite products but in the YEN trials sequences performed at a similar level to a single application of a biostimulants product."

Is the failure to reproduce the responses claimed by manufacturers a reason to dismiss biostimulants? Bob believes not.

"It's an emerging area that I'm taking seriously. Products are being better researched now and the biochemical



David Hoyles believes biostimulants offer potential but possibly not on his soil type.

pathways involved are being investigated. The potential rewards are there, and I believe biostimulants can contribute to better crop stability, yield improvements and quality effects.

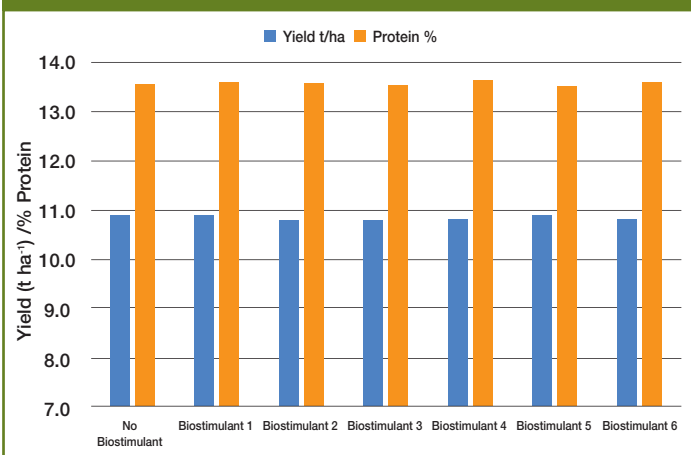
"The national average yield for winter wheat has been stuck at 8t/ha for years so we can't carry on doing the same thing and expect a different result. When you add in public concerns about pesticides and evolving resistance in weeds, pests and diseases, then it's evident we have to develop a more integrated approach that's less dependent on agrochemicals," he comments.

The one thing biostimulants are not is a panacea for poor farming, points out Bob. "Using biostimulants as part of a crop production system is still all about getting the fundamentals in place. Biostimulants are a part of maintaining crop momentum but aren't the foundation for yield." ■



Independent trials have proved inconclusive but researchers still believe biostimulants offer potential.

### Effect of a range of biostimulants at East Malling



Treatments were applied at the manufacturer's recommended rate and effects measured on the grain yield and protein of winter wheat.

Source: NIAB biostimulant trials, 2017-18