> *“Amino acid pathways are critical to the plant’s immune system.”*

Varietal differences revealed

Technical
Pushing performance

It’s no secret the industry is still learning about how to get the best out of biostimulants. *CPM* interrogates the latest data from trials carried out by NIAB to find out more about the responsiveness of different wheat varieties to Bridgeway application.

By Lucy de la Pasture

The subject of biostimulants is one that divides opinion. Inconsistent and unpredictable results in independent trials, particularly in wheat, have raised question marks as to whether they really have a role to play or not.

The data from Interagro’s own trials over the past three seasons (2017-2019) in cereals has thrown up wildly different yield responses, ranging from -0.3t/ha to +3.0t/ha, with the best results achieved in the stressful growing periods of 2017 and 2018, says Stuart Sutherland, technical manager at Interagro.

The question is why? In an effort to better understand what may be happening, Interagro enlisted the help of NIAB in 2020 to delve deeper and look at winter wheat variety responses to the application of its amino acid biostimulant, Bridgeway.

“Apart from defence pathways regulated by the typical stress hormones, certain amino acid pathways are also critical to the plant’s immune system. NIAB proposed that any host-defence trigger response enhanced by biostimulant application is likely to be most effective in moderately to highly disease-resistant varieties, with more disease-prone varieties unlikely to show any host-defence mechanisms,” explains Stuart.

Trial series

So to test this, a trial series was designed to investigate the effects of Bridgeway on three winter wheat varieties that show a wide range of responsiveness to fungicide inputs — with RGT Gravity selected as a high-input variety; Gleam as a medium-input variety and KWS Extase as a low-input variety, with the expectation Extase would respond the most to Bridgeway application.

“To have the maximum effect on host-defence mechanisms, biostimulants should be applied in advance of any disease, so this means conventional fungicide timings are unlikely to be the most effective. In the trial series, earlier applications of Bridgeway were investigated at the pre-T0 and T0 timings in addition to the more conventional timing at T1,” he says.

NIAB hypothesised that in the more disease-resistant varieties, KWS Extase and Gleam, it’s possible that the fungicide requirement could be partly replaced by Bridgeway. The trials also set out to test if this held true by including a reduced rate fungicide treatment where Bridgeway was applied at the pre-T0 and T0 timings.

Disease monitoring in the trials didn’t throw up any surprises, with KWS Extase performing as expected. With good resistance to yellow rust and one of the highest ratings for septoria, disease in the trial was negligible. As a result, the yields were pretty flat with no significant differences seen. ▸

In the NIAB work KWS Extase was less responsive to biostimulant and fungicides, whereas Gravity was very responsive to Bridgeway application – which wasn’t as expected, explains Bill Clark.

Does Bridgeway pay back?

Biostimulants are an additional input cost for growers rather than a replacement cost, so whether the costs stack up is a very pertinent and important question. Stuart believes these results show the potential of Bridgeway to enhance grower margins.

"With profitability implications it's important to recognise that used in the right situation, biostimulants offer the potential for considerable profit gains. The research conducted here showed that every Bridgeway treatment more than paid for itself when used on the high input variety Gravity — ranging from an additional £37.30/ha up to £150/ha. In fact where only fungicide was used, there was a loss of £93.10.

"In the medium input variety Gleam, profit margins were also increased where Bridgeway had made significant differences to the yield — in all but two treatments — up to £184.50/ha extra margin was generated.

"Bridgeway use in Extase didn't pay back, but neither did fungicide use. With the potential for such considerable profit gains to be had, pushing productivity using biostimulant Bridgeway has to be worth considering."

NIAB trial protocol

Tr	Pre T0 (13th March)	T0 GS30 (9th April)	T1 GS31 (29th April)	T2 GS39 (20th May)
1	Untreated	Untreated	Untreated	Untreated
2	Bridgeway 2L	Bridgeway 2L	Bridgeway 2L	Ascra XPRO 1.125L
3	Bridgeway 2L	Bridgeway 2L	Ascra XPRO 0.75L	Ascra XPRO 1.125L
4	Bridgeway 2L	Bridgeway 2L	Ascra XPRO 0.5L	Ascra XPRO 0.75L
5	Untreated	Bridgeway 2L	Ascra XPRO 0.75L	Ascra XPRO 1.125L
6	Bridgeway 2L	Untreated	Ascra XPRO 0.75L	Ascra XPRO 1.125L
7	Untreated	Untreated	Ascra XPRO 0.75L	Ascra XPRO 1.125L

Source: NIAB, 2020.

▸ Gleam, representing the middle ground in terms of disease resistance, showed very little septoria present but yellow rust came into the trial, with 19.7% recorded on leaf 1 in the untreated on 29 June. On leaf 2 it was 17.4%, 12.9% on leaf 3 and 6.8% on leaf 4, notes Stuart.

"Where Bridgeway was applied (treatments 2-6), the yellow rust infection was significantly lower than the untreated. Yellow rust infection was only present on leaf 1 at inspection on 29 June (17.9%) where just Ascra Xpro (bixafen+ fluopyram+ prothioconazole) was applied at T1 and T2 (treatment 7)."

In the trial, disease control and green leaf area were only significantly better than the untreated control where Bridgeway was included in the programme. Where Ascra was used alone there was no significant difference in both metrics.

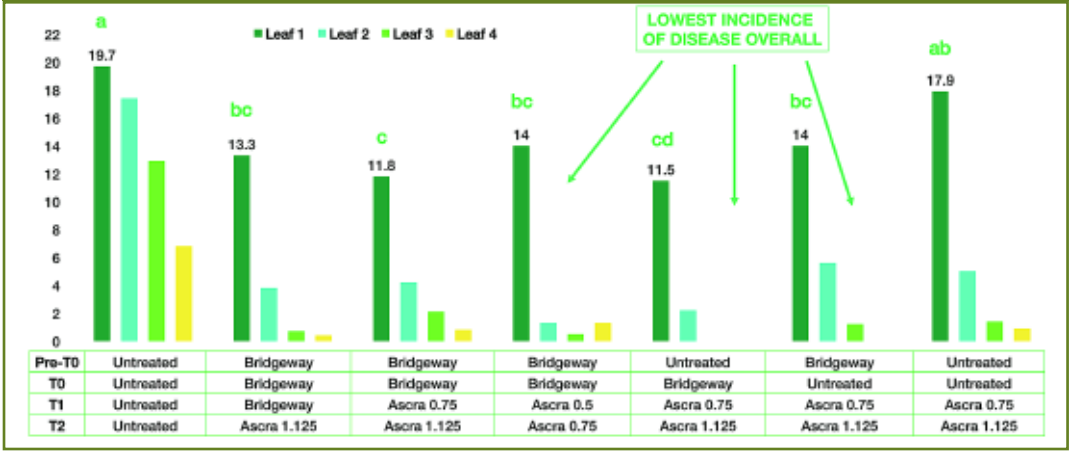
Lowest incidence

Treatments 4 (Bridgeway pre-T0 + T0) , 5 (Bridgeway T0) and 6 (Bridgeway pre-T0), all showed the lowest incidence of yellow rust across all four leaves which resulted in the highest yields, with a +0.26 to +0.94 t/ha yield benefit over Ascra alone.

Key learnings

- Bridgeway ahead of the T1 and T2 fungicide improved the overall level of disease control that was achieved.
- The best yields were achieved where Bridgeway was included pre-T0 and at T0.
- In KWS Extase, Bridgeway delivered statistically significant increases in yield over both the untreated control and fungicide-only treatments.
- In Gleam, where Bridgeway was applied pre-T0 and T0, reducing the rate of fungicide made a positive and statistically significant difference to the yield response and was better than using fungicide at typical field rates.
- The biggest responses were seen in disease-susceptible variety, RGT Gravity.

Gleam yellow rust infection (%)



Source: NIAB, 2020; assessed 29 June.

"The highest of these was achieved where Bridgeway was applied pre-T0 and the lower yield benefit was where Bridgeway was applied at T0 instead. Applying Bridgeway at both of these timings (pre-T0 + T0) and following with a reduced rate of Ascra (0.5 l/ha), delivered a benefit of +0.3t/ha," comments Stuart.

In RGT Gravity, the disease levels were relatively low, with very little septoria recorded. Yellow rust infection was present, with 13% on Leaf 1 and 6.7% on Leaf 2 when inspected on 29 June.

"While there was no significant difference in disease levels between treatments, applying Bridgeway ahead of the T1 and T2 fungicide improved the overall level of disease control that was achieved," he notes.

"The results show that a pre-T0 only application (treatment 6) was better than a T0 only application (treatment 5) in terms of reducing the incidence of the disease, but the best overall disease control was achieved where Bridgeway was included pre-T0 + T0 (treatments 3 & 4). This also corresponds with the yield results — the best yields were achieved where Bridgeway ▸

▸ was included pre-T0 and at T0."

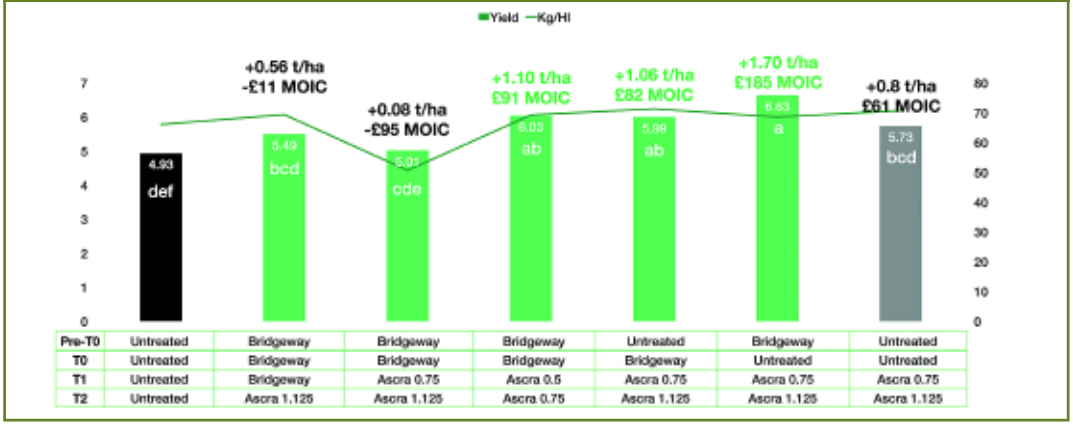
The highest yield in Gravity was achieved where Bridgeway was applied at pre-T0 and T0, followed by a lower dose of Ascra (0.5 l/ha) at T1 and 0.75 l/ha at T2. This gave a 1.47t/ha yield benefit (treatment 4).

"Substituting Ascra at T1 with Bridgeway was not as effective at reducing yellow rust infection, but the difference was not significant. What this treatment (Tr2) lacked in disease control was made up for in the yield, with a 1.26t/ha yield increase over fungicide applied at both T1 and T2," says Stuart

In fact, all treatments where Bridgeway was applied to the crop increased grain yield, with the benefit ranging from 0.78 to 1.47 t/ha over fungicide alone. The only treatment where yield was lower than the untreated was where no Bridgeway was applied to the crop, only the Ascra fungicide applied at T1 and T2 — whilst this was not significantly different to the untreated, there was a decline of 0.16 t/ha.

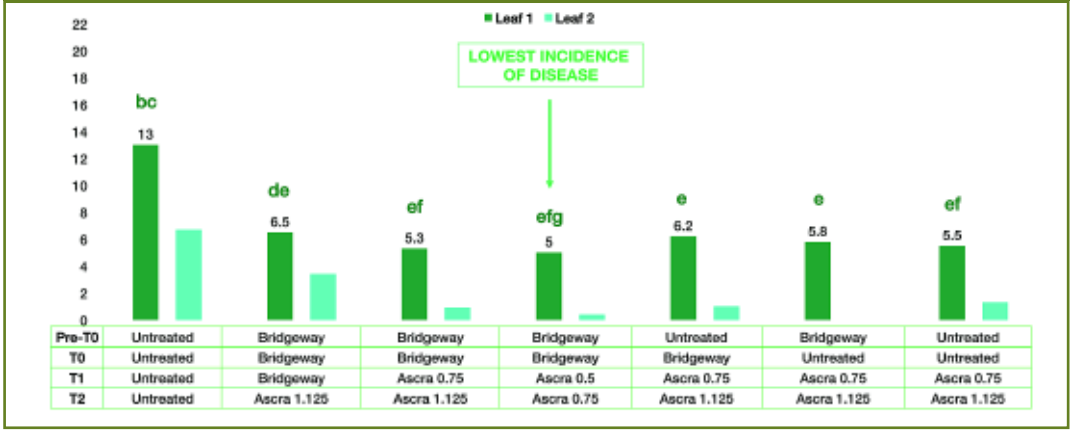
So what can be deduced from this work? Stuart believes the results clearly demonstrate that varieties vary in their response to Bridgeway.

Gleam yield and specific weight



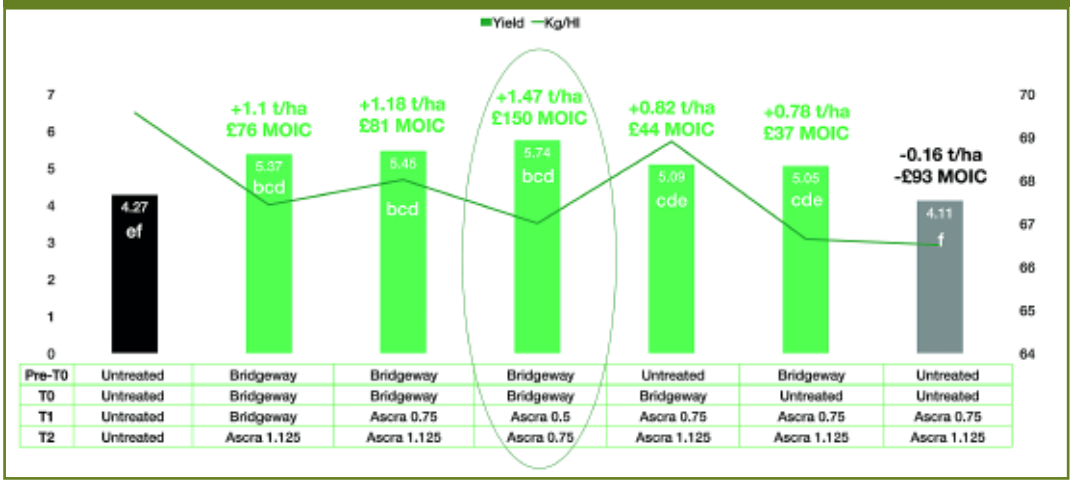
Source: NIAB, 2020.

RGT Gravity yellow rust infection (%)



Source: NIAB, 2020; assessed 29 June.

RGT Gravity yield and specific weight



Source: NIAB, 2020.

Less responsive

"KWS Extase was less responsive to biostimulant and fungicides in this instance. On the other hand, Gravity was very responsive to Bridgeway and all applications delivered statistically significant increases in yield over the untreated control and fungicide-only treatment.

"The moderately resistant variety Gleam was also highly responsive where Bridgeway was applied at either the pre-T0 or T0 timings, with the earlier of the two giving the best overall yield response. Where Bridgeway was applied at both timings, reducing the rate of fungicide made a positive and statistically significant difference to the yield response and was better than using the fungicide at typical field rates," comments Stuart.

What was interesting was that the outcome of the trial wasn't as the researchers had expected. It was predicted that the greater response to the Bridgeway application would be seen in the low input variety, Extase, and the least in Gravity, whereas it was found that the opposite was true.

Stuart believes this can be partly explained by the fact that the site was particularly stressed by the weather. "It's possible the stress-busting properties of Bridgeway helped keep the crops healthier and helped trigger host-defence mechanisms in the plant, allowing Gleam and Gravity to respond more quickly to yellow rust infection," he says.

The 2020 season provided more challenges to crops than most, which may be responsible for some anomalies in the data which have been hard to explain, adds Stuart. In

particular, treatments three and four in the KWS Extase produced plants with a good GLA but the resulting yields were depressed.

He believes the results are in all likelihood a trials anomaly for the following reasons. "Firstly, swapping a fungicide for Bridgeway at T1 in treatment two didn't have this issue. Similarly treatments five and six only had one Bridgeway prior to fungicide application, so it doesn't follow that three applications of Bridgeway and one application were fine, but two applications caused a 50% yield reduction."

Bill Clark, technical director at NIAB, describes the Interagro trials as a really interesting piece of work.

"The thing about biostimulants is that their effects are inconsistent and variable, so can be difficult to explain or indeed predict. Because of this, one or two trials rarely give you a clear answer, unlike with fungicide trials. So, inevitably trying to make conclusions from one trial is really difficult.

"We imagined that the most resistant types of varieties, such as KWS Extase, and the moderate input varieties, such as Gleam, would be the ones that would respond best to biostimulants and the 'dirty' types, such as Gravity, wouldn't. In the end, the very resistant variety KWS Extase didn't respond to either biostimulants or fungicides in this trial."

So what is Bill's explanation for this? "In a year where many crops were stressed and yields were down, KWS Extase often didn't respond to fungicides and yield responses were small. We've also seen greening effects in the absence of disease on disease-resistant varieties such as KWS Extase.

"Trying to identify where biostimulants are best placed needs this type of experiment as yield responses may be smaller and less consistent than when applying fungicides, but we have identified that biostimulants can have a part to play, even on disease susceptible varieties.

Encouragingly, Interagro intend to continue to carry out trials to help growers refine their choices when considering biostimulants application, says Stuart. "We hope to continue looking at Bridgeway in this scenario, and we will continue as always to offer our best use guidelines based on our data. 2020 has certainly been a different year," he concludes. ■

Pushing performance

At the heart of good crop production lies careful use of chemistry to protect the plant and maintain performance, right through the season. But optimising the efficacy of plant protection products can be challenging, while increasingly restrictive regulations limit just how far you can go.

This series of articles explores the science behind the use of adjuvant and biostimulant tools to help power both chemistry and crop performance, as well as increase understanding of why they're needed and what they do. We're setting out to empower growers and drive crops to reach their full potential.

CPM would like to thank Interagro for kindly sponsoring this article, and for providing privileged access to staff and material used to help put the article together.

Bridgeway is a stress-busting biostimulant based exclusively on plant-sourced amino acids. It is certified for use on organic crops and can be used in all agricultural and horticultural crops throughout the growing phase to reduce stress, and improve crop health and fitness to protect yield and quality potential.

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