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‘We have to enable the innovations available today’

POINT OF VIEW

Many liken the progression of global crop yields during the past six decades to a miracle. Despite the widespread pessimism of the late 1950s which predicted worldwide food shortages, malnutrition and hunger are at historic lows today. Of course, this wasn’t a miracle.

Public and private investment in innovation underpinned agriculture’s success, enabling the industry to increase productivity. In the UK, research organisations have directly contributed to this boom and since Niab’s foundation in 1919, UK wheat yields have increased almost fourfold to an average 9t/ha.

Supported by advances such as gene editing, speed breeding and artificial intelligence, agricultural science should seize the opportunity for continuous progress. Access to new varieties, optimised farming systems, and improved pathogen management can sustainably feed future generations while curbing agricultural emissions and restoring biodiversity.

However in recent years, progress has stalled with national average crop yields flat-lined.

Restrictive policies coupled with insufficient long-term investment in applied research pose the biggest barrier to harnessing and exploiting these new technologies. While advanced genetics have boosted yields and reduced pesticide use in the US and Canada, European farmers can’t access them.

Take insect-resistant crops such as Bt maize – genetic engineering enables Bt maize to produce toxins which target certain insect pests using a bacterium known as *Bacillus thuringiensis*. Plant protection products have used these toxins for decades and as a result, Bt maize reduces spraying by up to 35%. Yet in the EU, regulations applied to GM organisms effectively block access to this technology. So EU farmers use more insecticides and more land to produce the same yields.

Steve Reed MP, Defra secretary, recently announced that the secondary legislation required to implement the Genetic Technology (Precision Breeding) Act will be introduced to Parliament in March – this is welcome news.

Timely, proportionate regulation is crucial to incentivise investment in and enable the use of all available scientific solutions. Developers are ready to bring forward exciting precision-bred traits once this Act is fully implemented and the government appears to accept we shouldn’t delay any further.

We have to enable the innovations available today to ensure we’re prepared for the challenges ahead. The recent report of glyphosate resistance in UK Italian ryegrass exemplifies this. It stresses the need to build resilience to address expected challenges and be prepared for the unknown.

Let’s make use of all tools at our disposal so we can continue to feed future generations, sustainably.

By Professor Mario Caccamo
With more than 20 years’ experience in life science research and big data, Mario is Niab’s chief executive.

CPM CROP PRODUCTION MAGAZINE

Christmas is long over, it's time to get back at it as crops start waking up.

February 2025

COVER STORY

OPINION

AGRONOMY

The man who knows his SUs P.40.

Unlocking 'killer' genes P.20.

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About Crop Production Magazine

Crop Production Magazine is the leading specialist journal for UK arable farmers and agronomists.

The magazine operates within a controlled circulation with a readership including farm managers, agronomists, machinery dealers and other arable supply industry professionals.

CPM is also distributed to agricultural universities, colleges and research institutes, examined by some of the leading researchers in their field as well as the next generation of crop specialists.

Above all, the magazine is read by UK farm business owners – decision makers. Articles are mostly in-depth and analytical, exploring the issues behind a current problem while aiming to present new ways of thinking.

The magazine doesn't seek to prescribe solutions, rather inspire, stimulate and inform.

CPM is proud to represent some of the most experienced agronomic, technical and machinery journalists, many of whom have received British Guild of Agricultural Journalist awards for their contributions.

The team works closely with companies that support *CPM* to gather inside knowledge on the technical issues that affect farmers and the wider food chain. Although small, *CPM* is managed by a driven team, responsible for delivering the sharpest insight and most relevant information across both print and digital formats.

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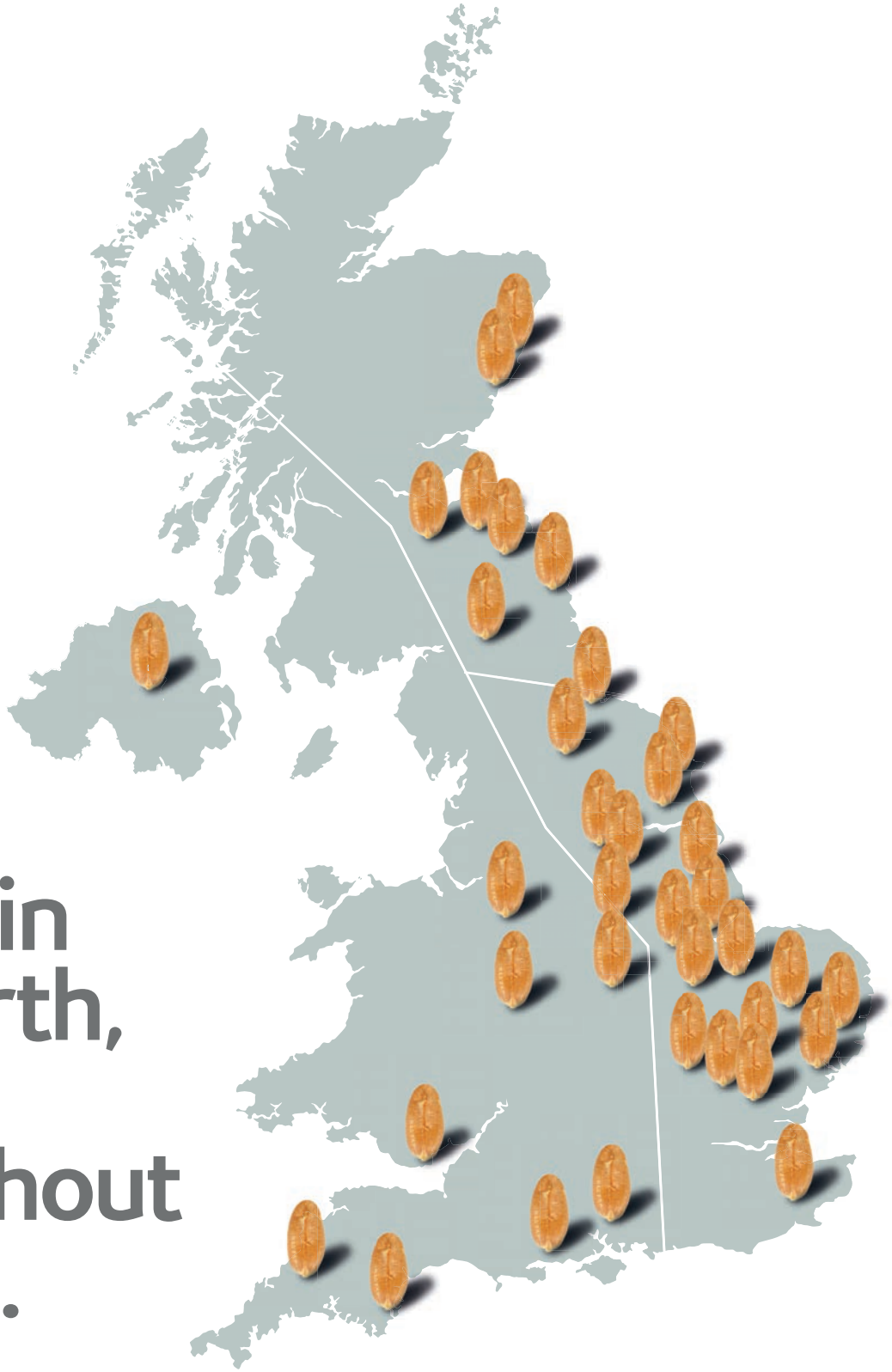

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COVER STORY

A chink in glyphosate's armour

The first incidence of glyphosate-resistant Italian ryegrass in the UK has now been confirmed and although concerning, experts stress their continued confidence in the active's efficacy. *CPM* reports.

By Janine Adamson

The importance of glyphosate to UK farmers is so significant, that when the news of a resistant population of Italian ryegrass was announced last month by the Weed Resistance Action Group (WRAG), it was even reported by broadsheet newspapers.

Agricultural weeds and herbicide use rarely make national headlines for something so technical, rather the usual route being to question the credentials of modern crop production methods. However this time, the potential gravity of the situation appears to be more widely acknowledged.

But is this amplification really necessary? According to ADAS' John Cussans, the arable sector is right to be concerned, but equally, there has to be some perspective. "It's resistance in one weed species on one farm in Kent and not a widespread problem. For context, during 2018-2023 we collated data for samples of Italian ryegrass which were submitted for standard resistance tests.

"They were screened with glyphosate and there's not been a single resistant sample. This one case does, however, serve as a firm reminder of the importance of stewardship otherwise we're likely to see more cases," he says.

Although globally there are several instances of glyphosate resistance in annual ryegrass (Lolium rigidum) and Italian ryegrass (Lolium multiflorum), John's keen to stress the case in Kent is the first confirmed in the UK. That said, three further suspect populations of Italian ryegrass are currently under investigation with results expected later this year.

In terms of other species, extensive blackgrass testing and a 2023 survey of 166 brome samples have found no populations of concern.

According to John this is unsurprising, because experience from around the world suggests ryegrass species are particularly high-risk with regard to glyphosate resistance. "But other weeds can develop resistance, so glyphosate stewardship concerns every farmer not just those managing Italian ryegrass."

Work conducted by UK scientists also indicates the risky nature of the weed, he points out. "We're seeing shifts in herbicide sensitivity. There's a five-fold difference between the least and most glyphosate-sensitive populations of Italian ryegrass tested. In comparison, for blackgrass, this is around 1.7 times."

Given official screening suggests an otherwise clear run for glyphosate, how was the resistant Kent population identified? John reveals it was through an agronomist who noted Italian ryegrass survivors post glyphosate application in ▶

Industry-wide effort

Glyphosate stewardship concerns every farmer not just those managing Italian ryegrass, stresses ADAS' John Cussans.

preparation for spring crop establishment.

The plants in question were recovered, sent to NIAB, grown on in a glasshouse and tested, confirming a cause for concern. He says what makes this the first true field case of glyphosate resistance is that follow-up seed samples from the summer were also shown to be resistant to glyphosate.

"Neither a 540g (1.5 l/ha) or a 1440g (4.0 l/ha) of glyphosate were sufficient to control this population," adds John.

A similar process will be undertaken for future suspect cases, with ADAS offering initial rapid resistance testing this spring to identify any other populations with cause for concern. Growers are asked to first instigate a discussion with their agronomist before completing a questionnaire regarding agronomic and farm practice.

Whole, live weeds are to then be dug up and sent to ADAS. "Early intervention is vital to minimise the risk of more cases of resistance, don't just apply more glyphosate," emphasises John.

"The vast majority of cases of sub-optimal control will have nothing to do with resistance. They could be due to the application rate, timing or conditions. Spring 2024 is a good case in point, many farmers suffered from poor control for one or more of these reasons.

"We've taken glyphosate for granted and we mustn't do that any longer. Stewardship is hugely important," he stresses.

Bayer's Roger Bradbury agrees that although true field resistance to glyphosate is quite rare and therefore should be manageable, growers must engage with guidelines for weed management at a field level, including those issued by WRAG.

Application timing

According to Bayer's Roger Bradbury, it's imperative to remember that glyphosate shouldn't be applied to a weed during rapid stem extension.

"It's not new information but requires greater awareness, so in many ways, this is a plea to growers and agronomists to engage with the stewardship guidelines to mitigate the risk of further resistance cases."

Roger adds that in some instances this risk will be higher, depending on the farming system. "Those who operate no-till or within regenerative types of approaches and therefore rely heavily on the use of glyphosate, will require additional scrutiny and attention on a per-field basis.

"But the overall aim is to use integrated weed management techniques to drive down numbers and prevent survivors, this can include strategic use of cultivations and non-chemical methods as well as sequencing herbicide programmes with alternative modes of action.

"Then it's about maximising the efficacy of glyphosate through correct dose rate and application timings," he adds.

According to Roger, it's imperative to remember that glyphosate shouldn't be applied during rapid stem extension. "From GS30 is when it becomes difficult for glyphosate to function properly as the active will be translocated to the weed's growing tip rather than its root zone, risking potential regrowth.

"However, weeds should be actively growing and not under stress from environmental conditions such as waterlogging or drought."

He also emphases the importance of application quality – including correct water volume, nozzle choice, lowering the speed of the sprayer and considering the use of a water conditioner – to ensure the chemistry reaches its target.

"Don't forget to monitor success, remove survivors and if appropriate, have the seed tested. A small number of weeds often survive a herbicide application but in all likelihood, this isn't due to resistance but because of other external factors."

Roger says WRAG is proactively working with other sectors beyond arable given the widespread reliance on glyphosate. "Perennial cropping for one as well as the applications within the amenity sector; there must be adherence to stewardship in those instances too," he concludes.

Reducing glyphosate resistance risk

Guidelines issued by WRAG promote four key points which all growers and agronomists should adhere to:

1 **Prevent survivors: Repeat application to surviving plants presents the highest risk especially where those surviving repeat applications are allowed to set seed**

2 **Maximise efficacy: Use the right dose for the hardest target weed species and growth stage on actively growing plants; reduced rates increase risk of reduced efficacy**

3 **Use alternatives: Use cultivation or other non-chemical control when practical; use effective herbicides in the crop in sequence (or mixture only, if recommended)**

4 **Monitor success: Consult your agronomist or supplier; remove survivors to prevent spread; test seed samples of survivors**

Stewardship guidelines

WRAG reminds of guidelines previously issued for the use of glyphosate.

WHAT'S WRAG?

The Weed Resistance Action Group (WRAG) is an independent and cross-industry body supported by AHDB. It involves CropLife UK member companies, representatives from the agrochemical industry (AIC), a range of independent organisations including public-sector research institutes and AICC, and the Chemicals Regulation Directorate (CRD).

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Further reactions

AICC annual technical conference discusses glyphosate challenges

Just days after the news of the first confirmed case of UK glyphosate resistance was shared, the Association of Independent Crop Consultants (AICC) dedicated a conference session to the future of the chemistry and how it might be protected.

The content was based on Rothamsted Research's impact assessment of life without glyphosate – conducted by Helen Metcalfe in 2024. The results were presented at the conference by the institute's ecologist, Dr David Comont.

The project modelled a simple cereal and oilseed rotation across ten growing seasons, estimating weed abundance, crop yields, total food production and profitability. The model included glyphosate pre-drilling as well as the pre- and post-emergence herbicides available in each crop.

Hundreds of simulations were then run with different weed communities and in different weather scenarios to achieve a 'business-as-usual' baseline, explained David.

He said the model was then re-run without glyphosate to quantify the impact of losing the active, and also with a range of cultural practices to evaluate their usefulness in mitigating its loss. These included increasing the frequency of grass leys and spring cropping in the rotation, delaying drilling of winter crops, and finally, substituting ploughing for glyphosate use.

David shared that the only scenario which achieved total weed control was where glyphosate was included and, in all scenarios where glyphosate was excluded, weed control suffered. However, the one practice which stood out in helping to reduce the overall weed burden in the absence of glyphosate was ploughing.

Furthermore, in some years, the simulations showed very large weed outbreaks threatening crop viability and aside from glyphosate use, the only scenarios that aided prevention were where the plough was used.

David commented that yields were generally lower where glyphosate wasn't used although this varied considerably between crops, largely driven by availability of pre- and post-emergence herbicide options.

Equally, overall food production and profitability across the 10-year rotation without glyphosate decreased, but not by as much as expected. "We're still producing food and making a profit in these systems where we have a higher abundance of weeds, but quite clearly nothing is performing better than the 'business as usual' system," explained David.

The study also scrutinised the trade-offs of deploying alternative practices instead of glyphosate, with increased frequency of grass leys providing competition for weeds and with correct management, depleting seedbanks.

However, there was a dip in food production and profitability where a proportion of cash crops were taken out of the rotation, said David.

The effectiveness of delayed drilling fell without glyphosate to create a stale seedbed, and when combined with the increased risk of potential crop failures in a poor autumn, it becomes a less attractive weed control measure.

He highlighted that spring crops in the absence of glyphosate still helped to reduce the number of pernicious weeds while providing an environmental benefit by allowing over-winter stubbles or cover crops to provide food and habitat for farmland birds.

Finally, David noted ploughing was clearly beneficial for weed control in a glyphosate-free scenario, burying weed seeds, reducing their viability over time and physically destroying weed seedlings.

"But of course, we know there are trade-offs with using these types of tillage practices which disrupt soil structure, soil biodiversity and change the greenhouse gas fluxes from the soil. All of these strategies can be important for weed control but there are a range of positive and negative consequences that should be kept in mind," he said.

David added that the modelling emphasises the urgent demand for a diverse range of strategies in a future with or without glyphosate, following the discovery in Kent. "Resistance management strategies are always most effective and financially viable when we start to impose them early before we see any issues in the field."

After 50 years of use, the case of resistance in Kent didn't come as a surprise to Lincolnshire agronomist Sean Sparling, who believes sub-optimal application is a key cause and urges users to sharpen up practices to protect its effective life.

He said the very low cost and almost bulletproof reliability of glyphosate has arguably fostered a blasé attitude, with sprays applied when conditions aren't right for other plant protection inputs.

"The simplest possible message I could give is to treat glyphosate like you would a flag leaf fungicide spray in winter wheat. It might not be costing you as much, but it probably gives you a greater benefit.

"If resistance evolves and glyphosate is lost because it's not treated with respect, you might not have a flag leaf to treat anyway," he warned.

Impact assessment of life without glyphosate
Dr David Comont presented Rothamsted Research's modelling work at the recent AICC conference.

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[1] Based on BASF and external field trial results, alongside interpretation of AHDB fungicide performance curves on key T1 target diseases, as indicated by Kynetec field data (Septoria, Brown rust, Yellow rust and Eyespot).

[2] Based on the AHDB fungicide performance data for product performance against Brown rust in 2024.

[3] Based on 31 BASF and external field trials targeting Septoria at typically applied field rates as indicated by manufacturer recommendations and Kynetec field data (Revystar® XE 0.75l/ha, Ascra® Xpro 1l/ha).

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Rust: a cautionary tale

Inability to travel plus cool, damp conditions last spring meant a distinct lack of T0s and therefore in many cases, yellow rust seized the opportunity to thrive. *CPM* looks at the importance of this spray timing in combatting the disease.

By Janine Adamson and Rob Jones

Each season there's a cereal crop disease of the moment depending on a range of external factors, namely weather conditions. Last year it was rusts – both yellow and brown – which thrived in the cool wet spring following a mild winter.

With growers unable to travel and apply critical fungicide sprays, for those in high yellow risk regions, a lack of usual T0s meant the disease was able to repeatedly cycle and romp away. While for those on the fence, the consequences experienced by others may have proved a cautionary tale for the future.

According to Agrii agronomist, Phoebe Foster, it was evident which growers had succeeded with a T0 last spring and who hadn't. "Subsequently we were chasing our tails on rust control, the disease was cycling so fast it was hard to keep on top of.

"I suspect growers and agronomists will be very wary as a result, and if they weren't already considering a T0, be more open to it if the weather allows," she says.

VARIETY RATINGS

Phoebe highlights that of the wheat varieties on the current Recommended List, there appears to be a significant quantity which are susceptible to rust. "With so many traits to consider, it's easy to be caught out especially with brown rust, which had a terrible year last season.

"If you're choosing a variety with lower rust scores, and/or are in a high pressure area, it's best to mitigate early and go with a T0. It's perceived as an additional spend but going for azole-based chemistry like Sakura (bromuconazole+ tebuconazole) is relatively cost-effective and means you can save the more expensive options for later in the fungicide programme," she explains.

Sakura, marketed by Sumitomo, offers the power of two azoles in one product, highlights the firm's Simon Leak. He adds that although the ▶

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(1) Mildew = powdery mildew (2) Reduction of eyespot

Hampered plans

According to Agrii agronomist, Phoebe Foster, it was evident which growers had succeeded with a T0 last spring and who hadn't.

chemistry is older than newer actives on the market, when looking to devise a robust programme, Sakura is a solid option for T0 and combatting rust.

"There's also a benefit in septoria control – admittedly tebuconazole won't be the first port of call for this, but what Sakura does do is offer a level of support for resistance management. That's because there's a case for using different azoles to target the different strains of septoria, which will also relieve some of the selection pressure on prothioconazole," he says.

Despite this added bonus, Simon's keen to stress that the main target of the product is yellow rust, a disease which is prevalent most years. "With Sakura you're targeting this key disease at T0 but gaining an opportunity to add further diversity into the programme. This then reserves the 'bigger' chemistry for T1."

He also recognises a threat looming on the horizon: "We have to be realistic that at some point, tebuconazole may disappear from the armory. For that reason, we're in the process of registering straight bromuconazole as we believe that has a strong chance of retaining its regulatory status."

If this does come to fruition, Phoebe points out that trial work has shown bromuconazole's activity can equal that of prothioconazole when it comes to targeting eyespot, another tricky wheat disease. Whereas Simon highlights that used together (bromuconazole plus prothioconazole), the duo could prove a cost-effective mix for T3, helping to control fusarium.

ON-FARM PERSPECTIVE

South Cambridgeshire grower, Sam Kiddy, is already on board with using azoles at T0. Given last year's high yellow rust pressure situation, he's taking a preventative approach across the 1200ha farm.

And despite scoring an 8 for yellow rust on the RL, it was a crop of Crusoe which was hardest hit, he says. "We're growing the variety again this season but have halved the area to 200ha, plus we'll be implementing a robust yellow rust programme with a mix of azoles," he explains.

Sam adds that this is the farm's second year of using Sakura at T0, although septoria is usually the disease of primary concern. "We'll target septoria from T1 onwards," he comments.

PIPELINE SOLUTIONS

But with tebuconazole's future looking uncertain, what impact might this have on fungicide programmes? Simon suggests a solution could be a new fungicide technology.

"Sumitomo is in the process of securing registration for a new active ingredient technology known as Indiflin (inpyrfluxam), which will be targeted at the T1 and T2 timings. An SDHI, it's already on the market globally, targeting diseases like soybean rust.

"If successful, it should also offer some activity on septoria, however, perhaps unsurprisingly, its main use will in combatting both rusts – yellow and brown – against which it's achieved excellent control in UK trials, including the severe brown rust experienced last season," he concludes. ●

Brown rust

2024 proved a particularly bad year for not only yellow rust, but also brown rust (pictured).

Two azoles in one

Not only does Sakura target yellow rust at T0, but it helps to add further diversity into the overall fungicide programme, suggests Sumitomo's Simon Leak.

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Disease control post-CTL

Have grower concerns been founded five years on?

Higher fungicide programme costs, an increased risk of resistance and lower overall control of key cereal diseases, were often cited as potential outcomes of a loss of chlorothalonil (CTL).

Fast forward five seasons and only one of those concerns appears to have come to fruition – higher programme costs, albeit with some caveats. The risks of resistance and reduced efficacy, although not realised, do remain.

It could be perceived that the loss of the mainstay multi-site active substance has been mitigated in ways by the emergence of new single-site options – mefentrifluconazole, fenpicoxamid, isoflucypram and pydiflumetofen.

However, at a higher cost these can hike fungicide programme expenditure alongside other factors such as inflationary pressures on manufacturing. In addition, replacement multi-site options such as folpet, sulphur and elicitor laminarin also have higher price tags than CTL.

> *"It comes down to cost – growers have the mindset that CTL was only £5/ha while the new options are more."*

One of CTL's key strengths was ramularia control especially in spring barley, states Neil Havis, plant pathologist at SRUC. "Up until 2020, most growers would rely on CTL as part of T2 sprays. Afterwards, we were left with mefentrifluconazole which has a latest application date of GS45-49 if you were aiming for malting quality. If you missed that, you'd had it."

Other options have since emerged, he points out. "Pydiflumetofen looks to be a useful active for ramularia – it's ahead of mefentrifluconazole. We've also seen good trials results from two applications of folpet at T1 and T2 which isn't too far behind a single shot of mefentrifluconazole at T2," says Neil.

Both pydiflumetofen and mefentrifluconazole have single-site modes of action, but with azole- and SDHI-resistant strains of ramularia already detected, both require protecting, warns UPL's Stuart Jackson. He stresses the danger, particularly when looking at pydiflumetofen's performance, is that it adds to selection pressure.

Furthermore, AHDB fungicide performance curves for ramularia suggest a gradual decline in performance of mefentrifluconazole during the past five years, suggests Neil. "It's not a massive change but a slow drift, as we've seen against septoria with azoles during the years as the number of mutations increase in the population."

That's where multi-sites such as folpet play an important role in helping to protect those actives, he says. "A classic resistance strategy is to partner products of equal strength although that's difficult with something as strong as pydiflumetofen. Prothioconazole will give you something, but you better have enough multi-site in there as well."

Despite this, market data from Kynetec indicates a stark drop in multi-site use since the loss of CTL. In 2019, almost the entire UK winter wheat area received a multi-site at T0, T1 and T2 whereas in 2024, this dropped to 3% at T0, 23% at T1 and 6% at T2.

That's worrying, states Stuart, who believes this could compromise resistance management. "It comes down to cost – growers have the mindset that CTL was only £5/ha while the new options are more; there's a suggestion that you're better off buying a higher dose of the single-site."

There's also a perception that current multi-sites aren't as effective as CTL, he adds. "But trials demonstrate that performance is as good, you just require a higher dose, which is why there are extra costs."

In wheat, there are three potential multi-site options – folpet, laminarin and sulphur. Plant defence response elicitor, laminarin, helps to fill the gap at T0 where CTL had been a

popular choice, highlights Stuart. "It tricks the plant into thinking it's under attack from septoria therefore should be applied around T0 or even before, for example, with a sulfonylurea grassweed herbicide."

Thiopron (sulphur) and folpet have a place through the programme, but particularly at T1 and T2, he suggests. "Using 2.0 l/ha of Thiopron is equivalent to 1.0 l/ha of folpet in terms of septoria performance with the added benefit of mildew control. Equally, folpet provides the benefit of some control of rusts."

Neil agrees that multi-site products should be used throughout wheat programmes. "Our trials demonstrate their efficacy and yes they do cost more, but they're there for a reason. It's false economy to save money on a multi-site to spend more on a single-site. In the long term you're not going to win by not protecting the single-site actives."

There could be a divide between use of multi-sites regionally with higher septoria pressure areas such as the West and North of England and Scotland using more, while the East of England is more reluctant, suggests Stuart.

"There isn't the same perception of disease pressure in the East but when we get a year like last season, it reminds you why you should be using a multi-site and keeping to key fungicide timings."

Another change, albeit difficult to quantify, is that the loss of CTL could have accelerated the use of more resistant varieties, he adds. "CTL going was one of the drivers for growers to look more at resistant traits," he says.

But variety choice remains market dependent, counters Neil. "In Scotland, variety choice is limited by market both in wheat and especially barley. In barley, it's the tail wagging the dog – what the maltsters want is what'll be grown, no matter the cost to keep it clean."

Therefore resistance ratings of eight or nine are required to drive changes in fungicide inputs, he believes. "Some of the work we've looked at in barley suggests it has to be that before you start seeing a significant difference in inputs and managing the crop differently."

Making cuts
According to SRUC's Neil Havis, it's false economy to save money on a multi-site to spend more on a single-site.

'Killer' gene has potential to thrill

Scientists have identified a gene which could protect against fungal threats and harnessing its potential may offer a new way to keep wheat diseases in check. *CPM* reports.

By Mike Saull

From a pool of more than 14,000 gene candidates, scientists have identified one which plays a role in driving forward pathogen development within wheat. Consequently, new products designed to block this gene's action could revolutionise the way in which disease is controlled.

One of the key pathogens boosted by the newly identified gene is Septoria tritici, which even with current fungicide use, causes estimated annual yield losses in the UK of £110-£220M.

While further work is required and researchers stress it's some way off being commercialised, creating a product which prevents this gene's activity of encouraging disease development in wheat could help to bolster current fungicide options through offering a new mode of action.

The project, led by Rothamsted Research in partnership with the University of Bath and the University of Exeter, used combined pathogen host modelling to map cereal disease interaction for the first time.

This work focused on identifying the genes which are active during infection and traced them to the proteins that help disease to build-up in wheat tissue. One gene stood out – identified as synthesising a protein known as Knr4 that boosts the virulence of some fungal pathogens – a driver of infection for fusarium and septoria.

Knr4 was originally explored by other scientists in the model yeast fungus Saccharomyces cerevisiae where it's known as 'killer nine resistant'. This is because overexpression of Knr4 in this yeast species was found to be associated with resistance to the killer nine toxin produced by another yeast type.

According to the bioinformatics scientist leading the project, Dr Erika Kroll, the Knr4 gene is activated at the earliest stages of infection suggesting it's a key gene required for the fungus to invade wheat. "Remove or disable the gene and the disease is less able to spread," she says.

"We'd not looked at Knr4 and its effects in pathogens of agricultural significance before, but in this instance, it came up as highly important in gene expression in host colonisation and is clearly critical in enabling the fungus to cause pathogenicity.

"Knr4 is involved in regulating growth rate and sensitivity to stress and appears to be necessary for full fusarium virulence," she adds. "Knocking the gene out in fusarium saw a complete inability of the pathogen to spread in the wheat spike and a similar deletion also resulted in a drop in virulence of septoria (see photograph).

"Most importantly, this protein is only found in fungi, not in plants or animals meaning if we target Knr4, we may be able to reduce the infectivity of pathogenic fungi without harming the wheat crop, ourselves, or other animals. This could be a game-changer," she suggests.

While further research is required, Erika adds it's likely that controlling this gene's activity could play a role in cutting the development of other key cereal crop diseases too.

"This completely new method of disease control would use a mode of action currently not utilised in agricultural fungicides and so would be a different approach to back the different modes of action and resistances of current products.

The gene in question

Knr4 is involved in regulating growth rate and sensitivity to stress, explains Dr Erika Kroll of Rothamsted Research.

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Knr4 in action

L-R: Wheat ears (2) inoculated with a mutant strain lacking Knr4, ears (2) inoculated with mutant strains with restored Knr4, and an unmodified wild-type strain showing normal disease levels.

▶ "Hopefully if we can develop a chemical to target the Knr4 gene we can control fusarium head blight, septoria and other diseases."

Erika suggests this gene discovery approach is akin to exploring a city map where roads connect key locations like houses, workplaces and recreational areas. In a similar way, in a biological network, the connections represent interactions between genes.

"Just as some intersections in a city are critical for traffic flow, certain genes serve as 'hubs' in the fungal network. If one of these essential genes is disrupted, such as Knr4, the network collapses, halting the fungus' ability to survive and spread," she says.

With mounting challenges in fungal control and increasing restrictions on fungicide use due to environmental concerns, there's a growing demand for innovative control strategies, believes Erika. She says this could be achieved through the development of chemical fungicides that disrupt the protein's function or through the application of RNA interference techniques that would reduce fungal gene expression.

"Stricter regulation of fungicides is contributing to growing pathogen resistance as fewer chemicals can be used; there's a pressing demand to identify new target sites for control.

"This research not only advances our understanding of mechanisms required for full fungal virulence, but also offers a promising direction for the development of effective strategies for disease control."

Rothamsted has now approached agrochemical manufacturers and while a marketable product could be years away, Erika believes the discovery offers hope.

Reflecting on the work, Agrovista's Mark Hemmant agrees. "Anything that could help with cultural disease control is to be welcomed.

"Even our less susceptible varieties have struggled in the last two wet seasons. We're having to mix fungicides to cope and while some newer products are better than we've had in the past, they're disease specific and mixing actives means the costs of key T1 and T2s are considerably more than they used to be."

According to Mark, disease-related problems are being exacerbated by earlier sowing. "We now have to combine several approaches to protect our best wheat genetics as provided by the breeder.

"Therefore, any new method of control that works and can be used alongside other ways of minimising disease risks will be much appreciated," he concludes. ●

Making efficient use of nutrients

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

Inorganic 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
In a typical combinable crop, 50% of its carbon footprint is related to the production of fertiliser with the other 50% due to in-field emissions, says Peter Scott of Origin Soil Nutrition.

Taking it to trial

Reviewing the results from endophyte trials

Agrii 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
When endophytes are used as seed treatments, positive results have been observed in pulses, highlights Agrii's Jodie Littleford.

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 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.

Accessing reserves
Soil reserves should always be the first port of call in terms of nutrition for optimum NUE, suggests Agrii's Tim Horton.

Climate resilient cropping

With 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.**

Key considerations for nutrition this spring

"Unless you've measured the plant and had it analysed via a lab, you can't second guess nutrition."

DICK NEALE

With spring just around the corner, *CPM* seeks advice on nutrient planning to counteract deficiencies and optimise crop production this season.

By Charlotte Cunningham

As the spring tentatively rears its head, thoughts for many growers turn to nutrition plans. With nutrient management not only impacting crop yields but also the environmental sustainability of arable operations and economic profitability, getting it right is key.

But to plan efficiently for what the crop requires, it's vital to know your starting point, explains Hutchinsons' Dick Neale. "Pre-Christmas, crops were generally looking pretty good and had continued to grow well over the autumn and winter. Since then, we've had quite a lot of rain and there are damp fields out there now.

"That said, crops still look pretty good overall with signs of continued growth. At this point (mid-January), I can't say I've seen any vast areas of nutrient deficiency. Lots of crops are still nice and green.

"Having said that, at this time of year, I always get asked questions about what growers should or shouldn't be applying, but the answer is – I don't know. The reason for that being unless you've measured the plant and had it analysed via a lab, then you can't second guess it. So I would say that should be a priority this spring rather than just applying nutrition based on a standard plan."

Looking more generally at what Hutchinsons' crop monitoring has shown, Dick says while every farm is different, one nutrient in particular to hone in on during analysis is magnesium. "Based on our seven years of monitoring, it's likely to be one of the biggest shortcomings in crops this year.

"Something important to remember about magnesium is that it's a secondary macronutrient – not a trace element. Historically, it tends to be bundled in with a product that's a mixture of manganese, zinc etc. This means you're applying maybe 20/30/40g/ha of magnesium to a crop that's looking for 30-50kg."

While crops access magnesium quite readily from the soil, extreme weather patterns during recent years have hampered availability, notes Dick. "We've been going through these extreme weather events in the

Measure to manage

Starting with tissue testing in the spring is a vital first step before applying any nutrition, recommends Hutchinsons' Dick Neale.

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Magnesium deficiencies

Crop monitoring carried out by Hutchinsons has showed that magnesium could be revealed as a significant deficiency this spring.

UK – it's either very wet or tends to go very dry for a period of time.

"When this happens, the two things – from a nutritional perspective – that will run out of steam first when it goes very dry, are potassium and magnesium. So while you may have enough magnesium in your soil, it's important to consider whether the plant can access it at the right time.

"This of course is in the spring when the plant really starts to grow. If we do go into an 8-10 week dry period, the crop isn't likely to access the magnesium as freely as it wants. So if you're inputting magnesium, it's important to think about the product you're using because something with 20g/ha just doesn't cut it."

As the crop grows larger in terms of its canopy, it's also important to adjust the magnesium content in turn, adds Dick. "While a lot of the foliar, bottled products will suffice at GS30, they're not enough at GS37-39, so that's worth bearing in mind too as the season progresses."

In terms of other nutrients, Dick says phosphate isn't likely to be short, with the exception of those fields with poor indices, high calcium levels or high pH. "Look at your pH and consider how that might affect your P levels. However, P doesn't wash down through the soil like other nutrients do – it's locked away fairly well.

"Whereas potassium over winter will be one to watch, particularly where it's been wet because it can be lost down the soil profile. Nitrogen is obviously another significant consideration nutrition-wise.

"This is because it's been relatively warm over winter so soil microbiology will have converted some ammonium to nitrate. Ammonium won't leach out – it's positively charged – but nitrate is negatively charged so moves down the soil profile freely."

SOIL TYPE INFLUENCE

While Dick says manganese isn't generally a major concern, based on his monitoring, some regions and soils will be more prone to deficiencies than others. "We have a range of soils that have natural manganese deficiency, these are typically the sands that tend to go acid, the Fens and the light sands across Norfolk, for example," he highlights. "But I think some farmers outside of these areas might be seeing more manganese deficiencies lately, largely due to more cultivations off the back of the 2023 season.

"The theory was that this would let more water through the soil. However, the challenge is soils become slightly open and fluffy making for a loose seedbed which can then lead to a manganese deficiency. Otherwise, general monitoring of manganese suggests that it's not deficient in most circumstances."

For growers who are hampered by manganese deficiencies, ensuring applied sources are readily available to the crop is vital, says Robert Hawkin of Fielder Nutrition. "It's something we're seeing more of."

As a solution, he suggests the firm's Mn350 product – based on a sulphate-nitrate mix – can deliver litre-for-litre 2.5x more manganese to the crop, making it an option for growers experiencing deficiencies this spring. "By treating plants with a high dose of readily-available manganese, farmers

Don't overlook the micros

Playing a considerable role in crop production

While it's macronutrients like nitrogen which usually grab attention, not losing sight of the value of micronutrition is equally as important, says Origin Soil Nutrition's Peter Scott.

"Micronutrients are fundamentally important. The only difference between a macronutrient such as nitrogen, and a micronutrient such as molybdenum, is that the word macro means it's required in larger amounts and micro in smaller quantities.

"That doesn't mean that it's any less important than nitrogen, however, there seems to be a tendency to not apply the same level of detail and rigor to managing molybdenum as we do nitrogen."

Peter believes this approach could be to the detriment of crop production, with an important synergy between molybdenum and nitrogen in particular becoming apparent in the latest research.

"Molybdenum is used by bacteria and enzymes as a catalyst to stimulate the transformation of nitrogen in the soil into forms of nitrate that the plant can take up," explains Peter. "It's also then a key catalyst in breaking that nitrate down into a protein which the plant can use to build dry matter and yield."

Peter says as increasing nitrogen use efficiency is a trending topic at the moment, it's important to identify what the limiting factors potentially are, and his experience has shown that this can sometimes come down to suboptimal micronutrient levels – particularly molybdenum.

"We've undertaken trial work in winter wheat, winter barley and oilseed rape, which saw us investigate the impact on crops when molybdenum was coated onto the nitrogen fertiliser.

"As a result, we saw significant increases in the amount of nitrogen that the crop took up which drove increases in yields and protein levels."

Peter says while the landscape is beginning to change, up until now many fertiliser manufacturers have focused on macronutrients while agronomy and crop protection

Breaking new ground

Origin Soil Nutrition is undertaking new research looking at the largely untapped area of the synergy between molybdenum and nitrogen, explains the firm's Peter Scott.

sectors have focused on micronutrients. "If we can apply micronutrients as part of the macronutrient package then there's the potential to bridge a hunger gap between soil-applied and foliar-applied nutrition, which will have a huge benefit on crop production."

This – particularly the role molybdenum plays in stimulating crop uptake of nitrogen and assimilation into protein – is new ground for the industry as there's no data to show critical levels of molybdenum to specifically stimulate soil bacteria and plant enzymes, believes Peter.

As such, it's something the firm is going to study in greater detail during the coming years in a new, environment-controlled glasshouse. Origin also has plans to develop micronutrient catalysts to stimulate increased nitrogen fixation in both field and glasshouse trials

"There's a limitation to the work that we can do in field trials because it's expensive and you only get a view of that particular geography and soil type, for example," explains Peter. "In our field trials, we've verified proof of concept with the relationship between molybdenum and nitrogen, but what we now have to understand is exactly how much molybdenum is required to make that difference."

The new greenhouse testing facilities mean it'll be possible for researchers to control temperature, light intensity, shading and moisture, among other variables to produce detailed work on a relatively quick basis, he adds.

"Efficient use of micronutrients will help us to get more nitrogen from what's applied to the crop, which benefits the farmer and is an economic win. Additionally, in doing so, there's less at risk of being leached or lost to the environment too.

"It's a win-win, scenario, and I think that's the most exciting, innovative part of it," concludes Peter.

can correct any deficiencies quickly and easily before impacting crop yield."

Dick continues by highlighting one of the major nutrients – one often overlooked – which is likely to impact crop performance this year – sulphur. "When we monitor crops either through grain, soil or tissue analysis, sulphur repeatedly comes up short," he comments.

"This is for a number of reasons. Firstly, the atmospheric deposition isn't there anymore, but sulphur is also a negatively charged anion, so it's always sloshing around in a soil solution.

"This means as soils wet up and you start to get movement within the profile, sulphur will be taken down through the soil and away from the rooting zone. For this reason, I advise applying it every year; there's just no argument."

With the incredibly wet season just passed, Dick says sulphur was one of the biggest deficiencies he saw last year which resulted in poor nitrogen performance too. "Without sulphur, nitrogen won't function.

"Unfortunately, sulphur deficiency is demonstrated by the crop going yellow and without an educated set of eyes looking at it, growers can presume this is down to a nitrogen shortage and apply more, which actually makes the situation even worse. You don't require much sulphur – 30-50kg in cereals, slightly more in oilseed rape – but it's really important." More about the current state of play for sulphur losses and the impact of this on crops can be found on page 31.

TISSUE ANALYSIS

In terms of next steps, Dick advises carrying out tissue analysis as soon as crops get moving again. "But it's important to not test too early, though. At the moment, the crops look fine because they don't need an awful lot of nutrition, and there's clearly enough nutrition out there.

"So if we take a tissue analysis in February because we're not busy and have the time to do it, we can see a false reading which can lead to underapplication. As soon as that crop starts to accelerate away – between GS30 and GS31 – it demands a lot more nutrition and that's where the deficiencies start to appear because the availability can't keep up with the growth of the plant.

Shrinking sulphur

Tissue and grain testing has revealed rapidly declining levels of sulphur in crops which could be negatively impacting nitrogen use efficiency.

"I'd generally recommend taking a tissue analysis at around GS30 at the earliest, and then another at GS31 just before you spray to ensure you have time to plan and make an adjustment if required."

Shrinking sulphur: the silent threat to crops and soils

Despite being a key component in crop nutrition, the latest data suggests that sulphur levels in crops are declining rapidly. *CPM* explores the current outlook and asks the experts how growers can rectify this.

By Charlotte Cunningham

While both environmental protection and public health have undoubtedly benefitted from a national directive to lower emissions across the board in recent years, something that's been negatively impacted is sulphur levels in agriculture.

Sulphur is an essential nutrient for crop growth, playing a critical role in the synthesis of amino acids, enzymes, and proteins. Historically, sulphur deficiency was rarely a concern in the UK due to ample deposition from industrial emissions.

This atmospheric deposition – primarily in the form of sulphate – has long served as a natural source of plant-available sulphur, however, during the past few decades, stringent environmental regulations aimed at reducing air pollution have led to a significant decline in atmospheric sulphur deposition.

Yield penalties

Omex's David Booty fears rapidly declining sulphur levels could be constricting crop yields in a way they never have before.

In fact, according to statistics from the UK Centre for Ecology and Hydrology (UKCEH), sulphur emissions have decreased by more than 90% since the 1970s, following the introduction of the Clean Air legislation which brought about a move to low-sulphur fuels.

The UK's sulphur deposition levels, which once averaged 50–60kg/ha/year in the 1970s, have now fallen below 5kg/ha/year in many regions. While this has significantly improved air quality and environmental health, it's left UK farmers reliant on alternative sources to meet crop sulphur demands.

Where deficiencies are present, it can lead to a host of challenges for crops – largely due to sulphur's role in nitrogen use efficiency – including reduced yields, poor soil health and nutrient cycling, and a deterioration in crop quality.

Exacerbating an already declining level of sulphur, extreme weather patterns during the past few seasons – namely, high levels of rainfall – have left soils susceptible to leaching of this highly soluble nutrient.

The impact of this is very low availability in soils, suggests Omex's David Booty. "Sulphate resources can deplete very quickly – just like nitrogen. During the past two years particularly, many growers have experienced heavy, excess winter rainfall. The result of this is very depleted soils."

Despite this outlook, David says application rates of sulphur have fallen too, with data from the British Survey of Fertiliser Practice indicating application rates on arable land have decreased from an average 35kg/ha in 2018/19, to 28kg/ha in 2022/23. "I think this partly comes down to financial pressures as we're seeing application rates of phosphate and potash fall as well," he notes.

"But also, there's been more straight imported urea used during the past year, mainly because it was a cheap option, however, there probably wasn't an option to have sulphur with it. If we look at our own nitrogen products, about 95% of what we sell is a blend of nitrogen and sulphur.

"If you just use straight nitrogen to save money – without buying sulphur from somewhere else – then you're missing a trick."

Now, the worry is that this could be constraining yield in a way it hasn't done before, warns David. "The important thing to remember with sulphur is that even if the correct levels of other nutrients are applied, they're not going to work in the absence of this key nutrient, largely due to its role in nitrogen use efficiency."

> *"If you just use straight nitrogen to save money – without buying sulphur from somewhere else – then you're missing a trick."*

INDEPENDENT TRIALS

Delving deeper into just how impactful the absence of sulphur can be on crop yields, independent trials carried out at Omex's research site at Heckington in Lincolnshire last year (2024) revealed some stark results (see graph).

"The trials compared the use of straight nitrogen applied at 210kg/ha, with a nitrogen-sulphur blend. In terms of how they were applied, we did a standard three-split application because that's what growers would typically do, but we also looked at a two-split application. This is because in our experience, you can often achieve the same results in feed wheat using two equal splits as you would do with three."

Looking at the results, David says they saw grain yield responses ranging 1.25-2.0t/ha from the inclusion of sulphur, with the same rate of nitrogen. "Personally, I've never seen responses as significant as that before."

Independent laboratory NRM – a division of Cawood Scientific – has also been looking at declining sulphur levels via tissue analysis through its CropCheck programme. "The programme involves growers sending us their samples from February onwards – essentially when crops are actively growing – and we do a dry weight analysis to assess what's happening in terms of crop nutrition," explains the firm's Dr Sajjad Awan.

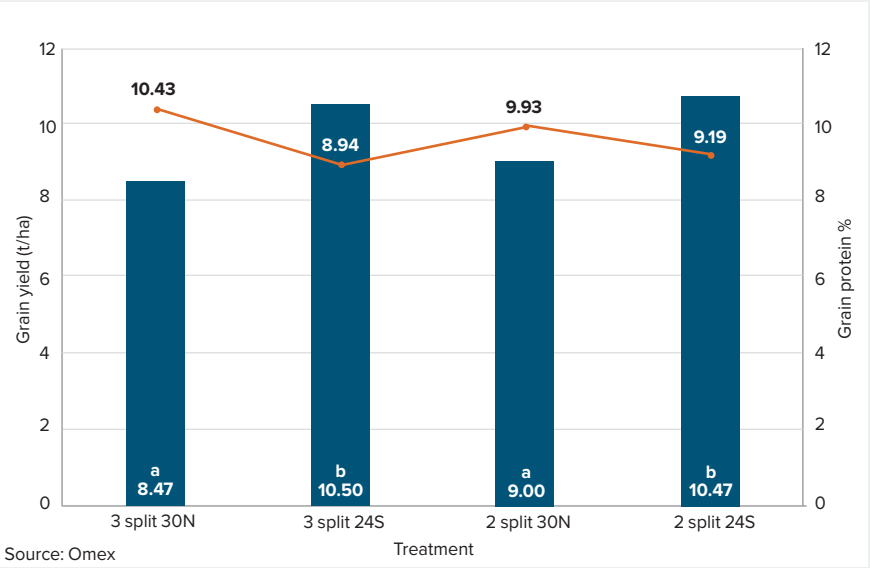
Plotting the data for around 1200 samples from winter wheat collected GS32-37 between 2021 and 2023, Sajjad says there was a high concentration of sulphur deficient samples collected in 2021 particularly.

"In 2022, you can see on the graph (see graph 'CropCheck winter wheat tissue analysis sulphur levels GS32-37 (2021-2023)') that the curve isn't overlapping and shifted more towards the right side compared with 2021 or 2023, which means more of the samples had sufficient sulphur levels during this year," he explains.

"When you compare this against yield – based on statistics from Defra – they show the highest yield was achieved during 2022."

Sajjad adds that a similar pattern emerged through the nitrogen analysis of the same tissue samples, as such, he set about trying to prove the importance of sulphur as both a standalone nutrient and its role in improving nutrient use efficiency, particularly nitrogen. "The next question I asked myself is what else can be done

Sulphur trials results: Heckington, Lincolnshire



Source: Omex

to find out why it's so important and that it's sulphur which is playing the main role in improving crop yield?"

As a result, he created correlation matrix graphs. "These graphs show both positive and negative correlations amongst different nutrients with the plant tissue."

Sajjad says this exercise revealed the strongest correlations were between nitrogen and sulphur. "But it doesn't stop there, there were also strong positive correlations between sulphur and phosphorous, as well as potassium, magnesium, zinc and boron.

"What we can say based on this data is that sulphur is the most important nutrient to help the uptake of others, and we can state that with moderate confidence now as we have the data to back it up."

Contextualising this with the fall in atmospheric sulphur and climate change-related leaching from soils, Sajjad says it's a concerning time for arable crops and as such, it's important to take action. "I believe we've reached that tipping point.

"A lot of us talk about the cliff edge, but we've been moving towards the edge of the cliff for the past few years and have now fallen off. That's why I believe sulphur needs a higher priority – among other nutrients – to ensure it's present when the crop is actively growing and that growers are optimising sources of sulphur which are readily available."

With this symbiotic relationship very apparent, he carried out what he coins a 'grain test postmortem', to provide further analysis on how well crop nutrient management plans have – or haven't – worked. "Your grain tells you how much nutrients have been taken up and essentially check how well balanced your nutrient management plan is," explains Sajjad.

Between the 2021-2023, the data showed 42% of samples were below target range for nitrogen, 43% for phosphorous, 11% for potassium and 41% for sulphur. "This further proves the deficiency challenge currently facing growers and is evidence that something has to be done to protect the sustainability of both crops and soils," he stresses.

RB209 GUIDANCE

According to AHDB Nutrient Management Guide (RB209), if a deficiency is suspected, tissue and grain analysis can help confirm it. If diagnosed, the deficiency should be treated accordingly. More advice on correcting deficiencies can be found on page 26.

With the relationship between sulphur and nitrogen fundamental in crop growth, as growers head in anticipation towards the spring, David advocates carrying out a soil mineral nitrogen test as soon as possible. "Before planning what you're going to do, you have to know what you already have. This is particularly important where there's high uncertainty, and by that, I mean where growers aren't sure what their losses from winter rainfall might be, or where they've changed farming system, for example.

Importance of sulphur

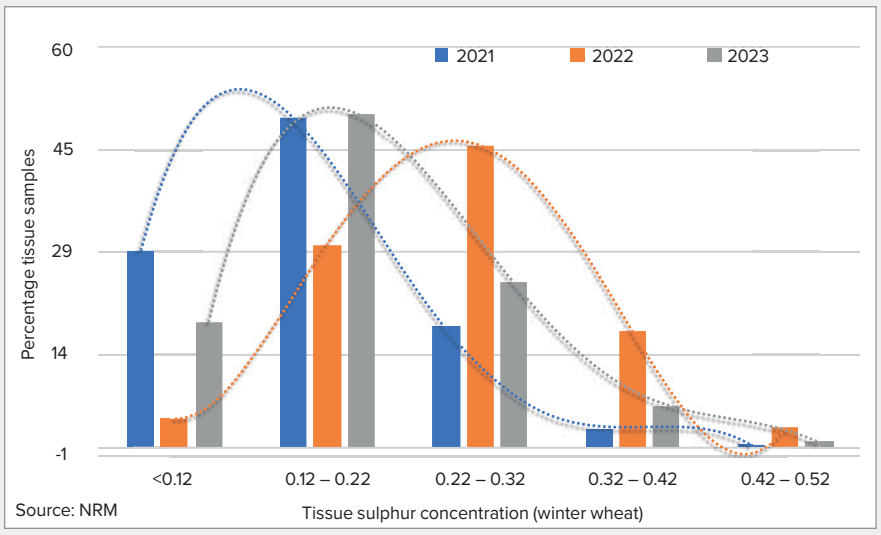
NRM's Dr Sajjad Awan says tissue analysis work looking at response correlations between nutrients has shown that sulphur is the most important nutrient to help the uptake of others.

"There are a lot of people going down the regen route now but it's not always known what effect this is having on the soil unless it's being measured. If ever there was a year to measure properly and know where you stand nutritionally, then this is it."

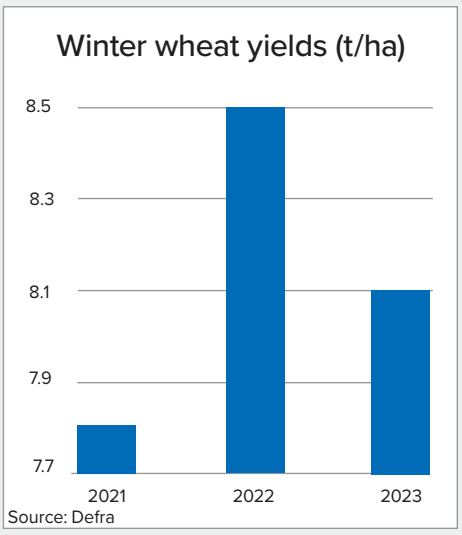
David adds that a lot of focus is now on soil health and keeping its microbiome working, but that requires a certain amount of nitrogen to flourish. "If we under-fertilise crops they'll tend to mine the soil for nutrients.

"If there is less leftover year-on-year, that's going to negatively impact both yields and the soil microbiome for years to come," he concludes.

CropCheck winter wheat tissue analysis sulphur levels GS32-37 (2021-2023) compared with Defra winter wheat average yields (2021-2023)



Source: NRM



Source: Defra

Smith's SOAPBOX

From Whitehall to Washington

WITH GUY SMITH

In the spring of 2017, I had the good fortune of being in Washington DC just as the new Trump administration was starting to flex its muscles. The mood on Capitol Hill could be described as 'antsy' as the world waited to see how the Trump rhetoric would ground itself in the real world.

I was in the American capital visiting the USDA and the Farm Bureau to get an insight into what impact the new broom in the Whitehouse might have on the UK and world agriculture. Eight years later, there's a strong sense of déjà vu but with a key difference – this time the Trump presidency has past form which may help to predict the next four years.

The attitude of US farmers to Trump is a curious one. Electorally, they're overwhelmingly supportive with an estimated 85-90% voting for him in 2024. In the US, farmers are traditionally Republican and with Trump in charge this support of the Grand Old Party is heightened.

Instinctively farmers readily warm to his 'bonfire of red-tape' promises and the way he sticks two fingers up at the green movement and the environmental regulations it demands. But two other key elements of the Trump programme are far more problematic – namely trade and immigration.

A rather unpalatable fact for the Trump-voting farming community is that up to 50% of the paid labour on farms is estimated to be 'undocumented'. In other words, Trump seems to be determined to send most of the people that provide the paid labour on US farms back to the foreign lands they came from.

Then, when it comes to trade, it has to be remembered the US is a major agricultural exporter – it produces 40% more food than it consumes. Arable crops in particular are heavily in surplus with 60% of the mighty 120M tonne US soy harvest being exported.

China is a key importer of soya so Trump's determination to readjust the trade balance between the US and China has significant repercussions when it comes to the prices US farmers get for their soy. In 2018, when China introduced retaliatory tariffs in response to Trump's imposition of tariffs on Chinese goods, soya prices dropped 20% overnight.

The USDA released a study showing an eye-watering $27Bn in losses for US agriculture and, of that amount, soya accounted for 71%. The importance of this for UK arable farmers is that when US trade gets disrupted, the redirected exports can end up on our shores. With feed wheat at £170/t, many of us can't afford US policy changes that further depress that price.

And while Washington wrestles with its trade imbalance with the likes of China, another key driver for farm profitability is the free trade agreement between the US, Mexico and Canada. This agreement is now up for review and Trump has made no bones as to how much he dislikes it.

As for the pro-oil mantra – 'drill baby drill' – and Trump's apparent scorn for measures to combat climate change, the big question is where that leaves the US bioethanol programme which absorbs a third of US corn production.

During his first term in office, Trump's response to any negative repercussions for the US farmer from his trade policy, was to throw treasury money at them in the form of emergency relief as part of the more general support that comes from the multi-billion dollar Farm Bill. Whether the same largesse will be shown in his second term remains to be seen. Trump has promised to slash state spending and the Farm Bill is struggling to escape the purgatory of short-term extensions rather than being given a firm four year footing.

One thing is for sure, now the UK has left the EU it'll be more vulnerable to the winds of change that blow across the Atlantic. British farmers would do well to keep an eye on Washington as well as Whitehall. ●

YOUR CORRESPONDANT

Guy Smith grows 500ha of combinable crops on the north east Essex coast, namely St. Osyth Marsh – officially the driest spot in the British Isles. Despite spurious claims from others that their farms are actually drier, he points out that his farm is in the Guinness Book of Records, whereas others aren't. End of. @essexpeasant

Powering sustainable growth

As farmers seek to incorporate all available options to improve the resilience of their crops, *CPM* looks at how and where biostimulants fit into the picture.

By Charlotte Cunningham

Biostimulants have come a long way in recent years, going from what was perceived as 'muck and mystery' to now more formally proven and scientifically backed products which can – in the right circumstances – add value to crops through improved tolerance to stress and better rooting, to name just a few benefits.

But has this changed uptake on farm? According to a recent survey undertaken by *CPM* and Interagro, 75% of participants revealed they're currently using biostimulants on farm – with a further 8% stating they'll be trying them for the first time this year. Of these participants, the majority (91%) are applying to winter crops, with a foliar spray being the product of choice for 75%.

"Biostimulants are definitely becoming more popular and I think there's a greater degree of professionalism in the market as a whole – with regard to both products and how farmers are using them," believes Interagro's Alan East. "That said, I think there's still a degree of hesitancy as I don't believe they're fully understood yet.

"There are a lot of different biostimulants out there claiming to do all sorts of different things. So I think before deciding to use a biostimulant – and a specific product – it's vitally important to understand the nuts and bolts of exactly what's in it."

Agrii agronomist, Josh Styche, concurs and says he's also noticed a shift in uptake during recent years. Josh is based in East Yorkshire, walking 4450ha annually, and says the past five years specifically have been important for the biostimulant market. "I personally didn't go into using biostimulants in a big way until quite recently. Now – compared with five years ago – the product choice is better and inclusion in the programme can be tailored quite specifically to the individual requirements of the farm."

He adds that typically, his clients are using foliar sprays with key target timings in late autumn and early spring. "I've used them in all sorts of ways, for example, on struggling oilseed rape crops to increase the canopy size pre-winter. Similarly with cereal crops in the autumn – particularly on heavier land – to help increase root mass. In the spring, applying a biostimulant pre-T0 helps wake up crops and encourage earlier growth."

In terms of the benefits of biostimulants, the survey revealed a myriad of advantages, with growers seeing improvements to stress tolerance (51%), rooting (45%), nutrient uptake/nutrient use efficiency (37%) and tillering (33%).

As a result, plant health is perceived as greatly improved, with 69% noting positive changes in crop health as a result of the use of biostimulants. "I've definitely seen all of these benefits with biostimulants, particularly the ability to improve rooting," explains Josh. "An area I think they're really important for is helping to improve the plant's defence mechanism against disease in the spring. Going forward, as our fungicide portfolio becomes increasingly reduced, I think products which enable this are ones that farmers should really be considering."

Josh points out Zonda from Interagro as a product he's seen to be particularly effective. Zonda is an amino acid biostimulant designed to help crops ▶

Enhanced professionalism
Interagro's Alan East believes biostimulants are becoming more popular thanks to a greater degree of professionalism in the market as a whole.

to reach their genetic yield potential and reduce the impact of abiotic stress by improving plant health. Containing essential amino acids for building protein, Alan says Zonda-treated crops have been proven in trials to be more likely to reach their potential.

Turning focus to the business end of the season, almost half of respondents (45%) have observed a moderate increase in crop yields since using a biostimulant. In contrast, 33% said they've seen no change – so why such a difference? "It's often very difficult to see a yield increase across the field without a direct comparison," notes Alan.

"It also depends on the growing season," he continues. "If it's been a season with minimal stress points it's likely growers won't see such a significant result compared with untreated crops. This comes back to the point of using the right product in the right situation."

Josh agrees and says unless farmers are specifically measuring for yield differences in comparable fields it can be quite hard to quantify yield benefits – although many of his clients report very obvious visual differences where Zonda has been used. "That said, the inclusion of a biostimulant needs to give a positive return on investment, and it has done exactly that in Agrii and independent trails across a range of scenarios – particularly where we are trying to overcome crop stress".

When it comes to quality improvements, the benefits are less apparent, with 61% of participants stating they've seen no specific improvements where biostimulants have been used. Alan suggests this could come down to how quality is being measured, whereas Josh says this is something he'd like to see studied further in official and farmer trials as improvements to quality can also help to justify return on investment.

FURTHER BENEFITS

Growers also had indifferent views about the impact of biostimulants on microbial activity and nutrient cycling. "All of these benefits are possible, however, quantifying them depends on how they're measured," notes Alan. "For example, microbial activity is something we'd be seeing in the spring but you have to be doing the soil samples at this time to see a difference. We know that isn't always possible during busy periods."

Looking at how benefits are monitored at both a plant and soil level, the majority of growers (60%) said they opt simply for a visual inspection, while others are also carrying out monitoring via SAP tissue testing and NDVI.

"There's a lot of merit in carrying out more sophisticated testing, particularly SAP testing," believes Alan. "From a sustainability perspective, if you're looking at alternative options like biostimulants to improve plant health then it's imperative to monitor the crop closely to see exactly what benefits you're receiving for the investment you're making."

While Josh agrees, he says this type

Biostimulant beginnings

Farming 970ha in Wiltshire, John Hayward is just beginning his biostimulant journey

"Interestingly, one of my agronomists is quite anti-biostimulants and is unsure they give value for money, however, my own research has shown that's not always the case."

John says it's a move to later drilling that's particularly driven his interest in biostimulants – specifically, him wanting to apply something to help boost early growth. "It wasn't too long ago that I used to begin drilling on 14 September and be done by the end of the month.

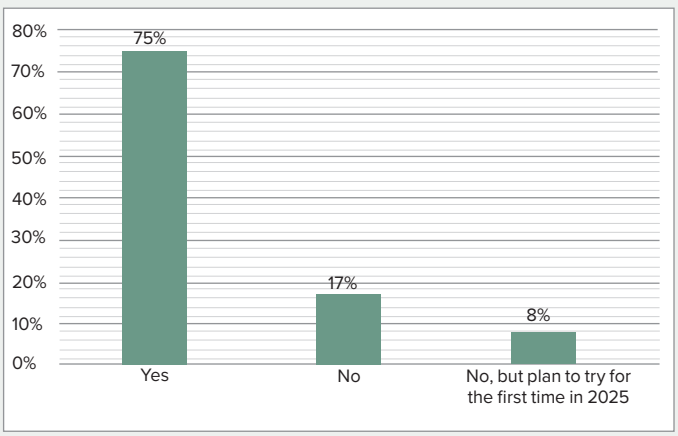
"But now we're starting at the end of the month [September] if we can, and planting way into October which isn't great on our ground, but something we've had to do for weed control. As a result, I think crops often require some help with rooting in the autumn which is what's led me down the biostimulant route."

John adds he's particularly interested in using Interagro's Newton seed treatment alongside Bridgeway. "I hate single purpose dressings, I think they slow germination down which is why I tried a biostimulant seed treatment instead this autumn.

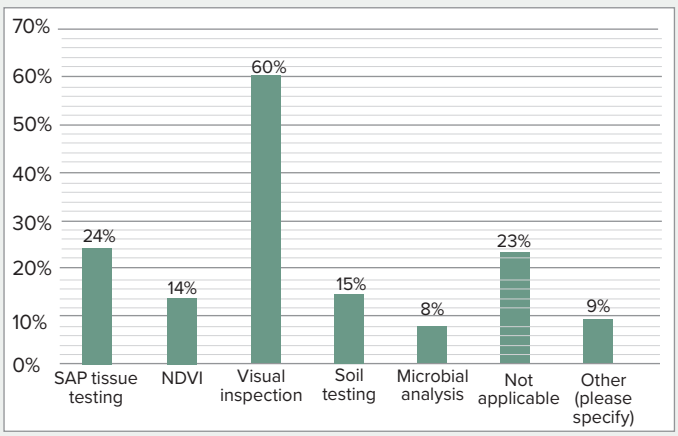
"I've also looked at Bridgeway which is on my radar too. We're not geared up to conduct our own trials here but I know there are a lot of trials that have been done on the product."

John points out Bridgeway's proven benefits on rooting and stress tolerance as what he's most interested in. "We get real extremes of weather here – we go from flooding to drought – there doesn't seem to be anything in between or nice gentle patterns of weather. So anything we can do to help prepare the crops for this has got to be beneficial," he concludes.

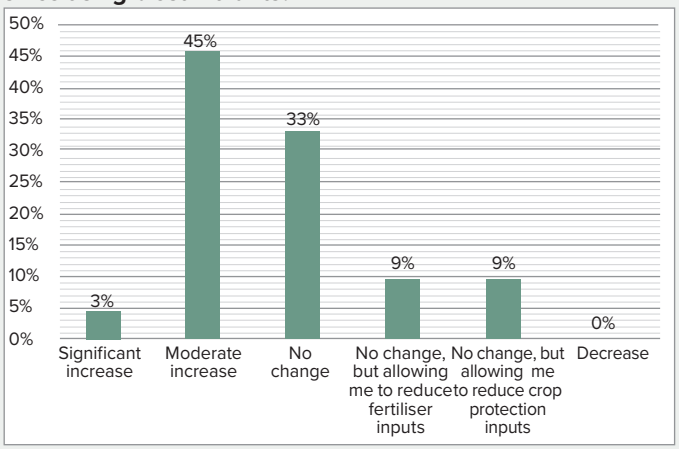
Are you currently using biostimulants on your farm?



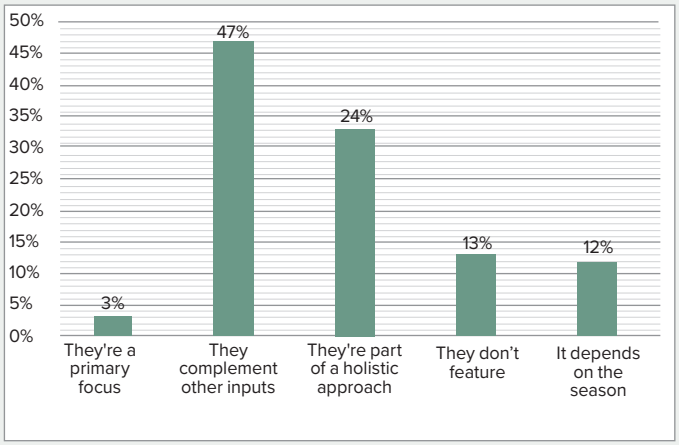
How do you monitor the impact of biostimulants on plant/soil health?



Have you observed noticeable improvement in crop yield since using biostimulants?



How do biostimulants fit into your overall crop management plan?



of testing often falls at busy pinch points of the year, meaning it's not always realistic for farmers to undertake.

In terms of specific products, perhaps interestingly, the majority of growers said they're quite flexible when it comes to product choice, with 73% revealing they don't have a specific brand or formulation preference.

Looking at the Interagro stable of products, Bridgeway and Zonda are two of the most popular options. Derived from vegetal amino acids, Bridgeway promotes healthier crops by stimulating rooting and subsequent crop growth, optimising resource use efficiency.

It increases recovery and immunity against stressful growing conditions, which is something that's becoming increasingly vital to growers, believes Alan. "We've invested a huge amount into both field trials and laboratory work to prove the efficacy, which has consistently proven that these biostimulants can really add value to crops."

Josh says it's the ability to tank-mix easily that makes the Interagro products first choice for him. "The tank-mix list is very wide and I've never had any issues when including them within programmes."

APPLICATION TIMING

As well as choosing the right product for the job, Alan says a lot of the potential efficacy of a biostimulant comes down to applying it at the optimum time. "It's a little like ourselves as humans – if we wait until we're sick to take vitamins, it's likely to have little impact. So, with biostimulants, it's vital to get them on before the plants show any signs of stress symptoms so they're fully primed to be resilient against these stress factors. Only then can you use a biostimulant post-stressor to enhance recovery too."

In terms of where they fit into the strategy, both Alan and Josh say biostimulants have a complementary role alongside other inputs – a view that 47% of survey respondents agreed with.

While there's the opportunity to potentially look to reduce chemical inputs with well-placed biostimulants, this depends greatly on the season, notes Alan. "The job of our biostimulants is to make plants more resilient and with greater resilience comes an opportunity to look at reducing chemistry in a low-pressure season. However, in a high-pressure disease year, we absolutely still require those fungicides."

Looking to the coming season, with the likelihood of extreme weather patterns high, incorporating a biostimulant into the plan could help to better prime plants before what's ahead, suggests Alan. "Before Christmas, a lot of crops were looking quite well. While we know that's not necessarily still the case for some, focus will likely be on protecting the remaining potential. This is where a biostimulant can fit in quite nicely and help to put the crops in the best position against whatever the season throws at them."

Josh adds: "A lot of crops in my area are currently (mid-January) sat very saturated, which is going to leave them incredibly stressed. So, my plan coming into spring is to assess fields on a field-by-field basis as to whether they require a biostimulant in early March – which could be an application of Zonda – as early as I can, in the hope that this is going to offset that stress as much as possible."

Alternative options

Agrii's Josh Styche says with a reducing fungicide portfolio, products like biostimulants which enhance plant resilience are ones that farmers should really be considering.

Winner announcement

Congratulations to prize winner John Hayward from Wiltshire who responded to the *CPM*/Interagro survey and provided insight using biostimulants. John has won an Apple iPhone 16 worth £799.

He answered the tie-breaker question of: "To get the most value from using biostimulants, it's important to...?" With: "help the plants look after their own health by improving rooting". As such, John was asked to give further insight on his opinions of biostimulants for this article.

To engage with future surveys, visit the *CPM* website and sign up to the newsletter.

Shedding the snake oil rep of biostimulants

> *"Nutrigenomics provides the scientific foundation to understand and refine how biostimulants work at a genetic level."*
>
> JOHN HAYWOOD

In a bid to overcome the 'snake oil' descriptors of the past, one biostimulant manufacturer has turned to genomics to elevate the credibility of its innovations. *CPM* breaks down the science to understand what it means in the field.

By Janine Adamson

When launching a new product segment to a market of inherently sceptical individuals, it could be said there's only really one opportunity to get the messaging right and successfully land on target, otherwise, there's a lot of back-peddling to do.

Furthermore, when the science behind such innovations is still in the process of being understood, it's even more critical that information provided is fact-based and robust, believes Unium Bioscience's John Haywood.

"Historically, the biostimulant sector has faced much scepticism often due to overblown claims. While these 'snake oil' reputations aren't entirely unfounded – some products indeed lack rigorous scientific validation – at Unium, we're committed to quashing misconceptions," he says.

Acknowledging the rather shaky start for biostimulants is what led Unium to assess where growers are in terms of product use and what approach could be deployed to instigate a U-turn.

"Abiotic crop stress caused by factors such as temperature extremes, drought, salinity, and waterlogging, is cited as responsible for 60-70% of global yield losses. This significantly overshadows the 15-20% loss attributed to biotic stressors like diseases, weeds and insect pests.

"Despite these stats, just 40% of growers currently consider using biostimulants or biological solutions to address these challenges. While we know this figure is slowly increasing, given the relentless pressure on the synthetic chemical toolbox, we wanted to find a way to scientifically prove the true potential of biostimulants and drive uptake," explains John.

INTRODUCING GENOMICS

Consequently, Unium – through its partnership with Helm AG – invests more than £1M each year in global trials, claims John, the most recent being a programme focussed on genomics. "This cutting-edge research investigates how products influence gene expression in plants, specifically which genetic pathways are upregulated or downregulated when biostimulants are applied," he says.

Up until now, farmers and agronomists have used phenotypic observations such as changes in leaf biomass or green leaf area to assess the effectiveness of biostimulants, suggests John. "While these visible changes are important, they don't explain the underlying mechanisms.

"Through genomics, we now have the tools to connect these phenotype responses to their genotypic causes, offering a more precise understanding of how and why these changes occur."

Taking a more simplistic view, genomics is a field of molecular biology which studies an organism's complete set of DNA, or its 'genome'. In terms of a plant, at the heart of each of its cells lies a nucleus which houses this DNA.

Then, within the DNA are genes which code for specific proteins responsible for root, stem, leaf, flower and fruit formation. Since cells are continually renewing, proteins must be consistently produced to support this cycle, explains John. "Furthermore, the term 'gene expression'

Biostimulant use

Data suggests just 40% of growers currently consider using biostimulants or biological solutions says Unium's John Haywood.

Webinar to explain more

An opportunity to learn how farming practices interact with plant genomics

To learn more about the intriguing world of plant genomics, growers are invited to a free, expert-led webinar taking place on Thursday 27 February.

Co-hosted by Unium Bioscience and the British On-Farm Innovation Network (BOFIN), the online session is entitled 'Genomics: a new frontier in crop production'.

The speaker line-up includes:

Layne Ellen Harris PhD – an outline on how nutrition and bioactive compounds influence gene expression and how this insight helps to optimise plant health and growth.

Tim Eyrich – a delve into the practical application of biological solutions in the field, exploring independent trials conducted by Unium Bioscience which involve extracting plant DNA, analysing genome sequencing to understand plant functions, and evaluating how biological products influence these traits.

Ben Taylor-Davies – insight into biological product use on farm.

Plus, John Haywood and Andrew Cromie of Unium Bioscience.

● To register for the webinar visit: https://tinyurl.com/mpkxrvax

is the process by which cells create the specific proteins they require."

He breaks this science down into three aspects:

1. DNA: Each cell contains the full genetic code but only a fraction of genes are 'switched on' depending on the cell's requirements and external factors such as nutrients or stimuli.

2. Transcription: Activated genes produce messenger RNA (mRNA) – a copy of the DNA code. This process can be upregulated (enhanced) or downregulated (suppressed) depending on nutrient availability and other factors.

3. Translation: The mRNA is used to create proteins which perform specific biological functions such as growth, reproduction, and photosynthesis. Regulating gene expression allows plants to adapt and thrive in varying conditions, hence becoming a key focus of agricultural innovation.

Taking this to the next stage is nutrigenomics, which when applied to plants, studies how nutrition and bioactive compounds influence gene expression. As such, researchers can observe exactly which genes are upregulated or downregulated under different conditions.

"Pioneering research in nutrigenomics has shown how targeted nutrition and biostimulant use can enhance plant performance. For example, specialised formulations have been developed to improve crop growth and resilience," says John.

"This suggests that just as athletes use supplements like vitamins and minerals to enhance performance, plants can benefit from biostimulants, because biostimulants go beyond basic nutrition by influencing gene expression and by doing so can enhance stress tolerance, improve water use efficiency, and boost yields."

GENETIC UNDERSTANDING

"Nutrigenomics provides the scientific foundation to understand and refine how these compounds work at a genetic level," stresses John.

He adds that utilising this insight means agriculture can move towards a more precise and sustainable approach to crop management, empowering farmers to enhance productivity while maintaining environmental balance and naturally unlocking the full potential of plants.

"The ability to identify and articulate the mode of action for biostimulants represents a groundbreaking and much desired development for the industry. This advancement not only improves product efficacy, but also enhances communication with regulatory bodies, offering clear, scientifically substantiated explanations of a product's impact on plants.

"Furthermore, by understanding how biostimulants influence genetic pathways, growers can predict outcomes with greater certainty – knowing what will happen, why, and when," he explains.

And according to John, looking at global crop yields, growers still have a long way to go to lift averages towards the world record figures, which he believes is where biostimulants can come in.

"We won't be able to lift yields to world record levels everywhere as sometimes the stars have to align with environmental factors. However we can move a considerable way by integrating alternative approaches and technologies with new crop genetics to maximise yields in a sustainable way, without finding more land."

The preliminary results of Unium's genomics trial work will be shared at a webinar on Thursday 27 February (see box). ●

Plant science

Genomics is a field of molecular biology which studies an organism's complete set of DNA, or its 'genome'.

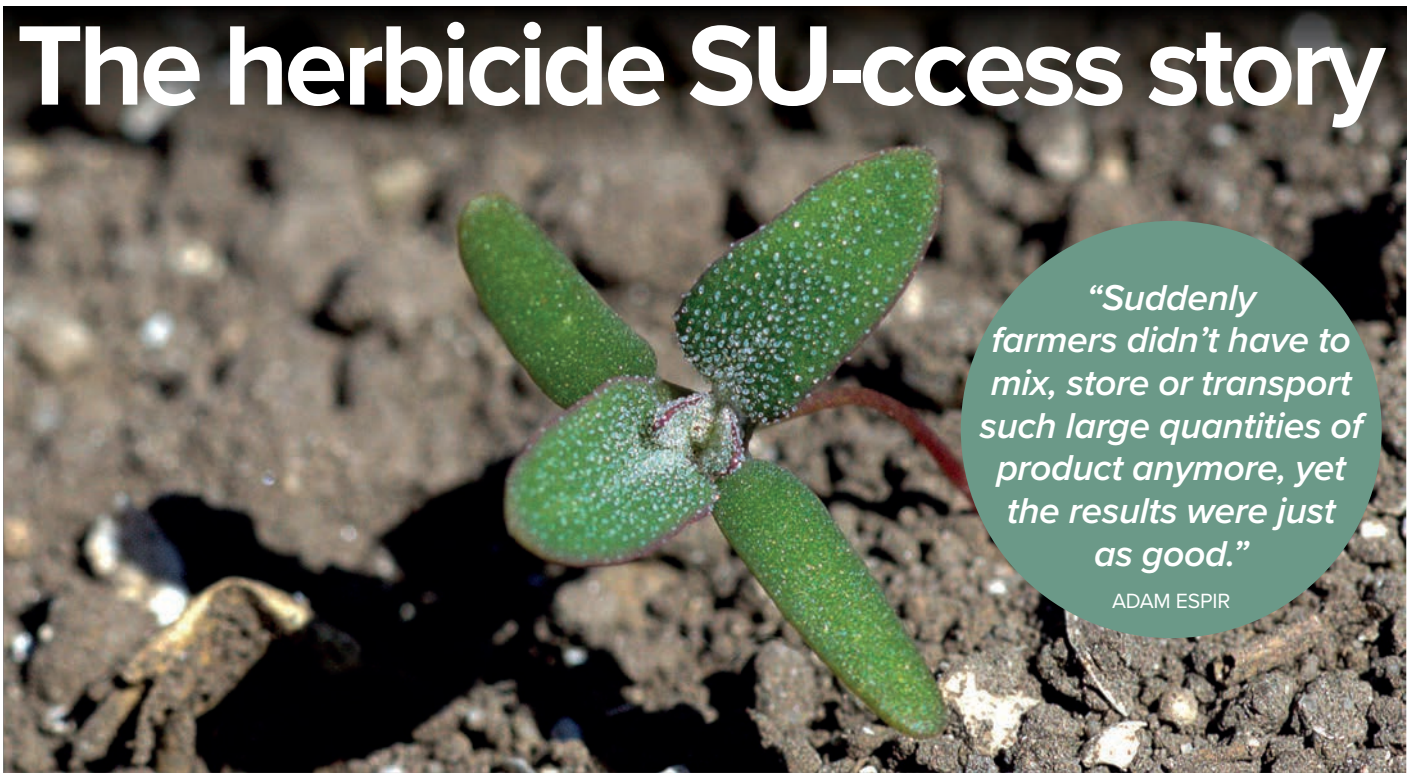
Bioscience in practice

As the chemistry toolbox continues to shrink, an array of new biosolutions are coming to market offering a range of benefits and complementary additions. Evaluating how effective they are and where they're best placed can be tricky, however.

This series of articles opens a window on the science behind these innovations with *CPM* teaming up with Unium BioScience to explore the background, unravel the physiological processes and provide analysis on trial results.

● Learn more by joining the Unium Bioscience technical group https://www.uniumbioscience.com/unium-technical-group

The herbicide SU-ccess story



"Suddenly farmers didn't have to mix, store or transport such large quantities of product anymore, yet the results were just as good."

ADAM ESPIR

Part of the broadleaf weed control armoury for 40 years, what's behind the staying power of spring-applied sulfonylurea herbicides? *CPM* finds out.

By Janine Adamson

Cast minds back to 1985 – Live Aid rocked Wembley Stadium, Boris Becker won Wimbledon, and the British Antarctic Survey discovered the hole in the ozone layer. However, despite being less memorable for the general public, this year proved especially game-changing for British growers – the arrival of spring-applied sulfonylurea (SU) herbicides.

"I recall the launch advert being a rusty old barrel of chemical next to a small pack of SU herbicide – the premise was 'beat the drum'," remembers Adam Espir, former commercial technical manager for FMC.

"Visualising the low dose of SUs in this manner really captured the imagination of farmers. Suddenly they didn't have to mix, store or transport such large quantities of product anymore, yet the results were just as good."

Originally discovered by DuPont, the SU broadleaf herbicide range was transferred to FMC in 2017 following the acquisition of part of DuPont's crop protection business. Active ingredients in the range currently comprise metsulfuron-methyl, tribenuron-methyl and thifensulfuron methyl.

Hampshire grower, Julian Gibbons, has used SUs since before their official launch and agrees the change was memorable. "Through connections with DuPont we were part of the pre-launch trial.

"We were used to lugging 20l cans of product around so having a small container was rather innovative – far less backache was involved," he laughs.

So just how do SUs work? Contact acting, their mode of action means they're classed as ALS-inhibitors – attacking an enzyme required for the biosynthesis of isoleucine, leucine, and valine amino acids. Because these amino acids are critical for cell division, post-application of an SU, weeds stop growing and slowly discolour before eventual mortality.

Adam highlights that as this mode of action was different to other products available at the time of launch, much work was required to educate users on the science. "Farmers had to trust that although it took longer to see symptoms than they were used to, the SUs were efficacious and control of the weeds would follow," he highlights. "It was a new approach and it was different."

Fast-forward to 2025 and Julian says for him, they've stood the test of time, helping to combat key species such as chickweed, mayweed, fat hen and bindweed across the 450ha farm. "The alternative broadleaf options have since disappeared; we've lost a lot of products meaning we only have SUs and hormone-based weed sprays left for spring use.

"Ultimately, SUs do the job across a broad spectrum of weeds. Unlike other growers, we've not experienced problems with resistance – we either catch any broadleaf weeds with our autumn pre-ems or target them when they're small in the spring.

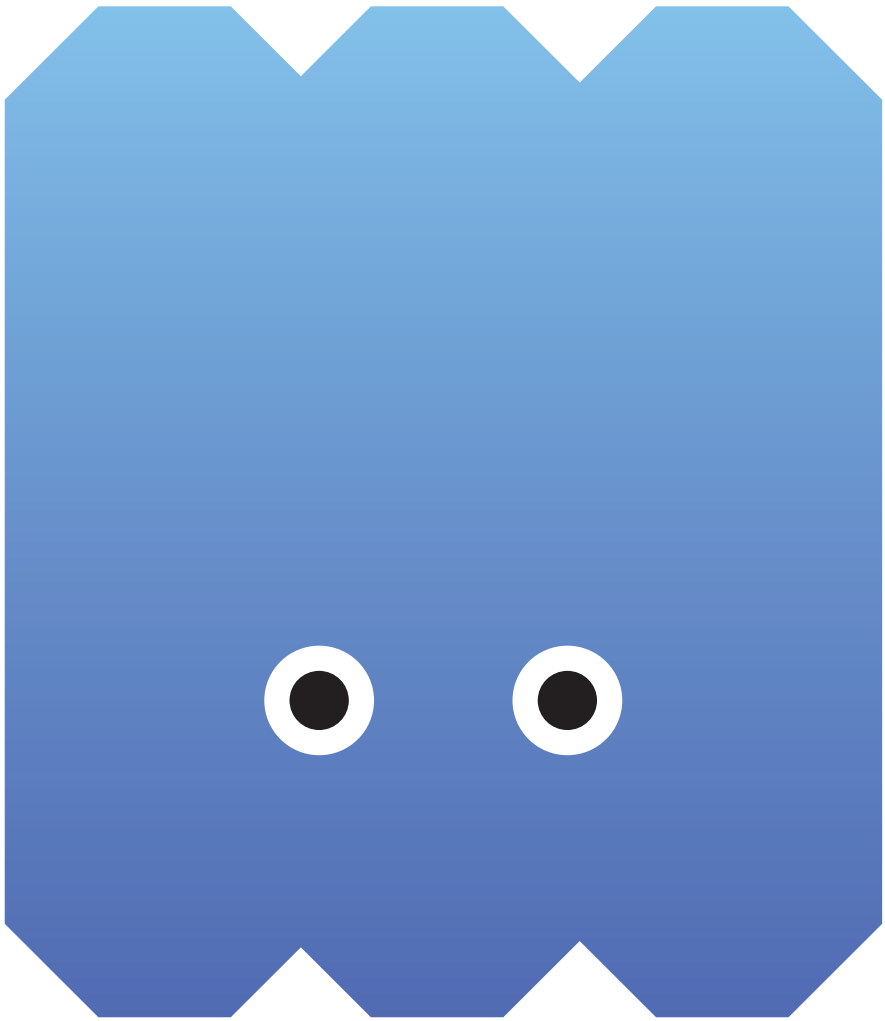
"That said, if any do slip through, the dose rate is flexible depending ▶

Market launch campaign

Former commercial technical manager, Adam Espir, recalls the launch advert for SUs being based on 'beating the drum'.

Iodus

Disease management



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- Control of septoria and reduction of powdery mildew
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NPP Natural Plant Protection by UPL

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on the weed size and the application window is wide," he explains.

ADAS' Dr Sarah Cook points out that known cases of SU herbicide resistance are increasing, primarily in poppy, chickweed and mayweed. "And there are many more species out there that have resistance that we haven't found yet.

"Therefore it's critical to identify resistance rather than brush it under the carpet as a herbicide failure. Rotations can be wide and variable now and situations where resistance can be an issue, particularly in broadleaf species, are relatively rare," she says.

"So it's important to identify when it is indeed herbicide resistance, as broadleaf weed seeds have a long life in the seedbank and will come back in greater numbers in the future, making for a significant problem."

Adam acknowledges the growing threat of resistance, but stresses the pace at which it's developing is much slower than in other classes of active ingredients. "From day one of SUs, the advice has always been to mix or alternate modes of action as part of a proactive anti-resistance strategy.

"The launch of the new, improved SX formulation in 2004 supported this further, enabling greater tank mixing and better solubility," he highlights.

Sarah agrees that stewardship has been and will continue to be key, for the longevity of SUs. "Apply products at the right rate to the correct growth stage and when the weeds are actively growing."

Resistance concerns

ADAS' Dr Sarah Cook points out that known cases of SU herbicide resistance are increasing.

And it's not just the stewardship of conventional SU herbicides that requires attention to detail, she believes. "Another threat on the horizon has to be the introduction of the herbicide-tolerant varieties – Conviso sugar beet and Clearfield oilseed rape. Although they've been excellent for the control of weed beet and brassica weeds respectively, they can facilitate more rapid development of herbicide resistance to SUs. Therefore, use this technology wisely and follow the guidelines stringently."

With new weed threats ever on the horizon, Adam says this is another area where SUs can continue to be the solution. "When growers reported increasing incidences of bur chervil, FMC invested in trials to understand whether SUs could offer control. Another 'new' threat has been in the guise of cover crops, for example – phacelia in subsequent crops of spring barley.

"Providing trial data on whether SUs can control these emerging weeds has been important to keep the products current to the requirements of growers, especially when no new technology has arrived to supersede them. Similar solutions have come along, but there's been little in the way of comparable innovation for the past 40 years," he says.

Despite being based on older technology, FMC's product manager, Hazel Blanshard, believes SUs meet the expectations of modern farming systems where protecting the environment is of key concern. "Not only is the low dose an efficient and convenient delivery mechanism for the grower, but it means SUs pose a lower threat in terms of their ecotoxicological profile.

"SUs are much less soluble than other contemporary actives and this, together with the innate low dose innovation which delivers far less product, offers benefits to the environment particularly watercourse contamination."

Hazel perceives SUs as the stalwart of broadleaf weed control. "It really is a positive story – 40 years on and they remain front of mind," she concludes.

Agronomic perspective

According to Frontier's Paul Fogg, the arrival of spring-applied SU herbicides undoubtedly simplified agronomy in terms of broadleaf weed control

"The SUs came in with a low use rate, were kind to the crop, easy in the tank, and offered a broad spectrum of control.

"The world has since changed though – with the area of autumn-sown crops and therefore quantity of residual chemistry being used much greater, it's somewhat shifted attention away from the role of SUs," he explains.

Paul also reminds of persistency: "If applying later in the season due to drilling date, use of cover crops or other rotational shifts, you have to accept there'll be a high level of crop interception during establishment. For an active like metsulfuron-methyl, this will be quite significant therefore specific SU choice will depend on both its persistency and the weed in question."

As for the alternatives, he perceives a steady evolution is taking place. "Hormone-based options such as MCPA or MCPP do have a role to play but we see them as offering complementary activity to the SUs rather than being the foundation.

"If you've leant on spring barley in your rotation, and therefore relied on SUs and are now seeing resistance issues, it'd be wise to consider introducing MCPA/MCPP. But definitely don't give up on SUs altogether – test for resistance and be smarter – responsible use of all chemistry is essential," he stresses.

Alternative choices

Hormone-based options have a role to play but offer complementary activity to the SUs rather than being the foundation, says Frontier's Paul Fogg.

Northern Ireland: agricultural no-man's land

> *"Bar the relaxed movement of seed potatoes from Scotland into Northern Ireland, nothing has changed or improved since 2020."*
>
> BRUCE STEELE

The impact on trade between Great Britain and Northern Ireland post-Brexit has been so significant, that one County Down agronomist felt he had no choice but to sell his agri-merchant business. *CPM* shares his story.

By Janine Adamson

Four years ago, an independent pesticides regulatory regime was implemented in Great Britain as part of the Brexit transition. In many ways this could be perceived as positive – no longer being governed by the EU means British farmers already reap the benefits of new 'home' plant protection product registrations.

However, there was a sting in the tail. Under the terms of the Withdrawal Agreement and Northern Ireland Protocol (NIP), EU legislation continues to apply in Northern Ireland despite it being part of the UK. This was implemented to avoid a 'hard border' between Northern Ireland and the Republic of Ireland.

The fallout from this was shared at the British Crop Production Council (BCPC)'s annual Congress by Bruce Steele, Northern Ireland representative of the Voluntary Initiative.

And even the most cold-hearted of individuals would find it difficult to not sympathise with his story, because for Bruce, it's meant making the most difficult decision of all – selling his once thriving business. He began by providing context: "The population of Northern Ireland is currently 1.9M which is 3% of the UK, or two thirds of the population of Manchester."

FARMING OUTPUT

"Around 75% of the land is used for agriculture – 1M hectares – with grassland accounting for 80% of the farming area. In 2022, farming output was estimated at just over £3Bn, generated from around 26,000 active farming business at an average size of 40ha."

He reminded that Northern Ireland is predominantly a mixed farming landscape based on grassland with some cereals mostly for home use; the arable sector accounts for just 8% of gross agri output.

In the middle

Bruce Steele shared his personal take on the impact of Brexit on agricultural trade between Great Britain and Northern Ireland.

As for potatoes – a crop historically synonymous with Ireland– the area has reduced substantially to just under 3500ha in recent years due to land availability and the cost of specialised equipment, highlighted ▶

Bruce. Subsequently, Northern Ireland represents just 1.3% of the UK's agro-chemical market.

"Since Brexit, there's a perception that Northern Ireland is in a favourable position to benefit from trading into and from the EU because it remains in the EU's single market for goods. While this is true, the difficulties arise when trading with the rest of the United Kingdom – mainly moving goods from Great Britain to Northern Ireland," he said.

"And the UK Government claims it's fixed many of our day-to-day problems through the Windsor Framework [for smooth trade within the UK internal market], but I can assure you, bar the relaxed movement of seed potatoes from Scotland into Northern Ireland, nothing has changed or improved since 2020."

Bruce highlighted that despite the Northern Ireland Protocol being amended, there's still a border between Northern Ireland and the Republic of Ireland, although it's widely accepted it's much softer than it used to be.

To explain, he reminded that on the island, two currencies are in operation, different laws and tax systems exist, and agriculture as a system, is delivered and funded in a completely different way between the two countries.

"The Republic of Ireland even has its own plant protection product registration and accreditation body, PRCD (Pesticide Registration and Control Divisions). However, greater issues arise as a result of the Irish Sea border."

He said the first of which was access to, and use of, plant protection products. "For one, Northern Ireland has to comply with all current amendments from Brussels yet has no direct representation at the negotiating table, as we're still regarded as part of the UK.

"As such, our position is far weaker when it comes to defending our industry and the nuances of having a western, maritime climate."

Bruce pointed out that consequently, Northern Ireland has diverged away from GB when it comes to MRLs, particularly in fresh produce. "This situation is causing great concern for growers who rely on the shipment of goods into GB, which is also the case in reverse – if product arrives in Belfast carrying an MRL which is not of the EU specification."

According to Bruce, supplying Northern Ireland with product is increasingly perceived as a 'hassle' due to the price of logistics and associated bureaucracy. "We've always relied on product manufacturers to absorb the costs of supplying our relatively small market. But now we're aware of some cereal herbicides and fungicides not being offered to us at all.

"It's especially the case if the timing of EU registration or renewal doesn't coincide with the product coming to the GB market. This could have a significant impact on access to products including certain insecticides, which are critical to those growing niche crops."

QUALITY ASSURANCE

This supply issue has been compounded by the fact that plant protection products registered in the Republic of Ireland can't be used by Northern Irish growers if they wish to comply with UK quality assurance schemes, he added.

"Therefore we don't have the option to obtain specific products from the Republic, despite some EU officials believing that we should."

Another issue for Northern Irish growers is access to cereal seed, which Bruce said was the primary driver for selling his merchant business just over two years ago.

Although growers can purchase seed from the Republic, with no restriction of seed northwards irrespective of dressings applied, most of these varieties aren't featured on the AHDB Recommended Lists. "Northern Irish growers are levy payers, so why shouldn't we benefit from that research and service?" he questioned.

> ***"I've tried to not appear too negative about the situation but it's difficult to remain positive."***

However, he acknowledged that the movement of seed potatoes from Scotland to Northern Ireland successfully resumed in 2023 as a consequence of the Windsor Framework. Otherwise, that industry would have been wiped out, he suggested.

To further explain how complicated the movement of seed has become, Bruce outlined the timescales for pre- and post-Brexit. Before the change, Northern Irish growers could access seed in the same way as any other grower in the UK, working with merchants and referencing the RL.

"The whole ordering process probably took no more than 5-6 days, whereas now, it's a complete disaster," he stressed. "Not only are growers restricted to the few varieties being offered, but they're supplied with one seed dressing only and in one limiting pack size."

Avoiding a 'hard border'

Under the terms of the Withdrawal Agreement and Northern Ireland Protocol (NIP), EU legislation continues to apply in Northern Ireland despite it being part of the UK.

Following the application of various permits, lab testing and obtaining the various certifications required to adhere to the new rules, plus haulage, it can take 5-6 weeks for seed to arrive in a merchant's shed. "For winter cereals, which are sometimes planted within days after harvesting the previous crop, this makes obtaining seed from GB near-on impossible.

"As I said, it's not difficult to see why I ceased trading out of sheer frustration and disappointment at the lack of support. Myself and others have pleaded with Defra and Daera to have some of these rules relaxed, or for a more flexible process to be implemented, but to no avail.

"And, as the so-called grace period expires on 1 January 2026, we can only expect the situation to get even worse."

Bruce commented that Northern Irish merchants now have to gamble on what seed to order, or along with farmers, are storing seed into the next season to guarantee supply.

He claimed that most of the restrictions placed on Northern Irish growers and their businesses have been political with no regard for the impact on the general public, particularly the farming industry.

"It's a relatively small sector, but 50,000 jobs are linked to Northern Irish agriculture so it's a sector which must survive and hopefully thrive. I've tried to not appear too negative about the situation but it's difficult to remain positive.

"We very much look forward to a day when the ability to trade with other parts of our country returns to a level of normality," he concluded.

Impossible dream: Self-fertilising cereal crops?

Is it possible to create cereal crops that provide their own nutrition? In a bid to find out, *CPM* talks to researchers attempting to transfer the nitrogen-fixing abilities of legumes into cereals.

By Mike Abram

Researchers are attempting to do what would seem unlikely, if not impossible: transfer the ability to fix nitrogen in legumes into a much broader range of crops including cereals.

And while the reality of cereal crops that don't require any or much less additional fertilisation is still at least 10-20 years away commercially, the past two decades of research provides optimism that it isn't just a pipe dream.

Much of the research since 2013 has been through a multi-national project, Enabling Nutrient Symbioses in Agriculture (ENSA), led by Prof Simona Radutoiu from Aarhus University. The main purpose of the project, which is currently grant funded from Bill and Melinda Gates Agricultural Innovations, is to make global agriculture more sustainable and equitable, explains researcher Dr Sebastian Schornack, a senior group leader based at the Sainsbury Laboratory at the University of Cambridge.

"To achieve that, we want to expand the use of beneficial microorganisms for the delivery of nutrients essential for crop production."

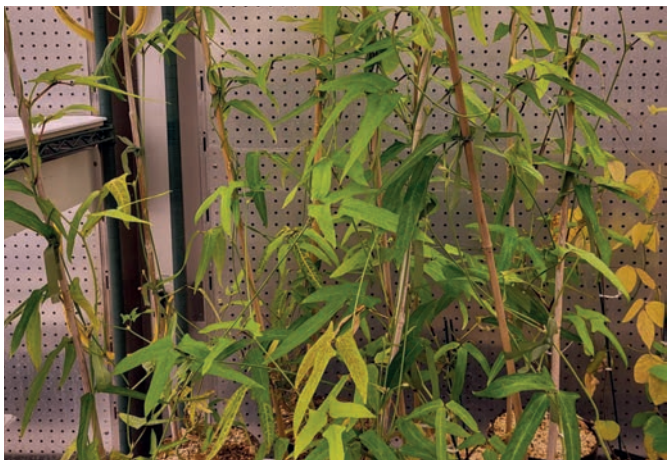
As is becoming increasingly obvious to farmers across the world, symbiotic relationships between plants and microorganisms can be very helpful, including for supplying key nutrients for plant growth. But taking advantage of those interactions is less necessary when growing crops in fertiliser-rich environments, suggests Sebastian.

REDUCING THE SYNTHETICS

Rising societal pressure on the use of nitrogen fertiliser amid awareness of the environmental damage its excessive use can cause, plus an acknowledgement of the high energy and emissions costs of making such products, means reducing synthetic fertiliser is now a key target for many growers.

In addition, there are many parts of the world where farmers don't have ready access to fertilisers because of cost or distribution limitations, or there are nutrient-poor soils, adds Sebastian. "We require alternatives to synthetic fertilisers and one solution is to improve the way crops engage with microorganisms for fertilisation." ▶

ENSA project purpose
Researcher Dr Sebastian Schornack says a significant part of the ENSA project is to expand the use of beneficial microorganisms for the delivery of nutrients essential for crop production.



Cowpea trials
Cowpea, as in black-eyed pea, has been used as a target crop for the research.

The ENSA project is exploring a number of different routes to achieve this, including whether it's possible to transfer nitrogen-fixing root nodules found in legume plants to other crops, particularly cereals.

Understanding how nitrogen fixation happens in legumes is crucial to that longer-term goal, with it also helping researchers to understand how to improve the process in legume crops as well. "We know from research and the natural variation found in plants, that it is possible for this to work better than it does currently," comments Sebastian.

One reason is that root nodule symbiosis hasn't been a trait that breeders have actively tried to improve through plant breeding in legume crops, he suggests. "So there's a lot of potential for improvement in our existing crops."

Sebastian's research group has already discovered in a model legume crop, Medicago truncatula or barrel clover – that by switching off a single gene using gene editing techniques the plants go into overdrive and fix more nitrogen.

In that model crop, nitrogen fixing activity is increased by 25-30% by deactivating this single gene, which could also be achieved through traditional mutagenesis breeding, while shoot biomass increases by 10-15% when grown on nutrient-poor soil under experimental conditions.

GENE SWITCH OFF

The next step is to switch off identified candidate genes in the target crops of soybean and cowpea (as in black-eyed pea). Finding those genes in cowpea was more complicated than in soybean, notes Sebastian. "In soybean, because it's such an important crop globally, you can benefit from existing knowledge. However with cowpea, because it's much less well understood, we had to do more groundwork."

That included growing cowpeas to find out which genes were active when root nodules were present – a step that was already known with soybeans, as well as the model crop. "We're hopeful, although we still have to test this, that turning off identified genes in our target crops will lead to more protein in each seed and therefore higher value legumes," says Sebastian.

Other legume crops could also benefit from this approach, he says. "Barrel clover is very closely related to peas, fava beans and clover – more so than soybean or cowpea – so

it would be perhaps more straightforward to implement such a trait in these crops."

Progress is also being made on the longer term aim of transferring nitrogen fixing nodules into cereal crops. "The nodules are an elaborate home for the bacteria," highlights Sebastian.

He says that's required because of what's known as the oxygen paradox: a common feature of all microbial nitrogenase enzymes that fix nitrogen is they are broken down in the presence of oxygen, yet a lot of energy is required to break the stable triple bonds between nitrogen atoms to fix nitrogen into ammonia. This presents a conundrum – how can aerobic respiration be maintained to produce the energy required to fix nitrogen while protecting the nitrogenase from oxygen?

But, leguminous plants have come up with an ingenious solution to remove oxygen in their nodules so the bacteria can do their job, says Sebastian.

Within the nodules, rhizobia colonise the cells in the centre and become encapsulated by a plant membrane. They're further protected from free oxygen diffusing into this area by a zone of densely packed tissue.

TRANSPORTING OXYGEN

An oxygen carrier, leghaemoglobin, which gives the nodules their pink colour, then transports oxygen to the bacteria so they can respire and produce the energy required to fix nitrogen without it encountering the nitrogenase enzyme.

Understanding all the processes involved in forming these nodules, including how legumes recognise nitrogen-fixing rhizobia bacteria in the first place, how those rhizobia infect legume roots, what triggers the nodules to develop, as well as creating that perfect environment for nitrogen fixation will be crucial for transferring the ability to cereals, stresses Sebastian.

An initial key discovery made by ENSA researchers is that cereal crops have inherited processes involved in forming relationships with arbuscular mycorrhizal fungi – evolutionary the earliest beneficial microbial association in plants. "This means cereal crops can recognise beneficial microbes, but what they don't have is the genetic trigger to produce the actual nodule," he adds.

"So one of the major challenges for ENSA researchers now is to transfer from legumes the ability to build nodules in cereals."

The researchers can potentially take advantage of genetics already present. "For example, ENSA research has shown that the ability to build nodules shares some of the same triggers with producing lateral roots," continues Sebastian.

That means it could be possible to either transfer the relevant genes from legume crops into cereals using a GM approach, or use gene editing to modify the trigger to produce lateral roots in cereals to instead produce nodules, he suggests.

But that would just be one step in creating a self- ▶

Root nodules

Leguminous plants have an 'ingenious' solution to remove oxygen in their nodules so the bacteria can do their job.

fertilising plant. "You would still require the nodules to be colonised by the bacteria at the right time and create an environment that allows them to efficiently fix nitrogen. "It's a multi-step process that requires input from various research groups. It's like a big building project."

Another strand of the ENSA project is looking at how plants obtain phosphorus, water and micronutrients through the association with arbuscular mycorrhizae fungi. These associations can form in most crop plants but few crops fully benefit, says Sebastian.

"It's not just nutrients the plant can gain from this symbiosis, but also resilience to pathogens both in their roots and sometimes in their shoots."

But applying phosphate fertilisers suppresses these associations and with it the beneficial effects, so researchers in ENSA have modified barley plants to support mycorrhizal association even when nutrient fertiliser is applied.

"The plants might not necessarily benefit from the symbiosis by getting nutrients from it, but they might be fortified from diseases, and if nutrient availability varies across the field, it could also buffer that as well," he concludes.

Can free-living bacteria supply nitrogen?

Evidence could suggest otherwise

Evidence that inoculating cereal crops with free-living or endophytic bacteria strains will result in agriculturally significant amounts of nitrogen being fixed from the atmosphere is lacking, according to a new research paper authored by scientists from Wageningen University, the James Hutton Institute and two Australian universities.

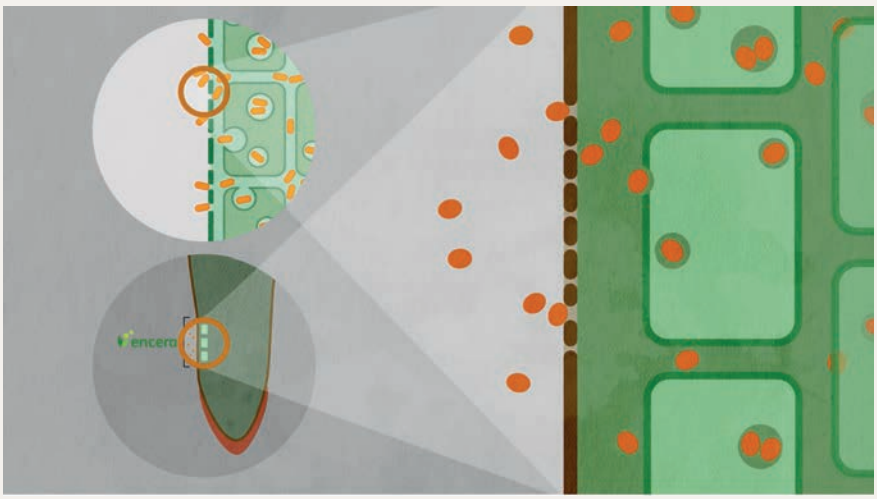
A plethora of bacterial products claiming to increase growth and yields in cereals and other crops through stimulating nitrogen fixation are now available, but simply demonstrating the bacteria are present on roots or inside a non-legume plant doesn't provide evidence for significant nitrogen fixation, suggest the paper's authors, led by Ken Giller from Wageningen University.

Among the bacterial inoculants reviewed in the paper are Methylobacterium symbioticum marketed as BlueN by Corteva and Gluconacetobacter diazotophicum (Gd), sold as Encera in the UK and Europe by Azotic Technologies.

Claims about the nitrogen-fixing ability of both, according to the paper's authors, don't stack up. This is because genome sequencing of the Methylobacterium strains suggests that while there are some that have the capability to make a functional nitrogenase enzyme to fix nitrogen, the ones used within BlueN don't have these genes and therefore lack the capacity to fix nitrogen, the paper claims.

The authors also pull apart research around the Gd bacteria in Encera, suggesting a paucity of field data indicating colonisation of plant cells by Gd in target crops even after inoculation, and a lack of supportive evidence for claims of yield responses due to nitrogen fixation.

In the authors' opinion, 50 years of research more broadly suggests that responses to microbial inoculants are due to plant promotion effects other than nitrogen fixation, such as producing plant hormones or through the stimulation of root growth leading to improved efficiency of nutrient uptake.



Colonising plant tissue

According to Azotic Technologies, the strain of Gd in the firm's products colonises live plant tissues and promotes plant growth via nitrogen fixation by the bacteria.

Not surprisingly, both Corteva and Azotic Technologies reject the claims around their products. A Corteva spokesperson told *CPM*: "Corteva has conducted multiple studies confirming that Methylobacterium symbioticum SB23 – the bacteria on which Utrisha N/Blue N is based – is capable of fixing nitrogen and improving nitrogen use efficiency, yield and quality in colonised crops.

"Further, since its launch in 2021, Utrisha N/Blue N has been well received by farmers with demonstrated success in improving quality and yield performance on row crops and specialty crops."

Azotic Technologies R&D Director Adriana Botes pointed to recent peer-reviewed papers, including one by Phil Hill from the University of Nottingham, which she says proves the strain of Gd in Azotic products colonises live plant tissues and promotes plant growth via nitrogen fixation by the bacteria.

The firm has also conducted experiments comparing strains of Gd modified so that it can't fix nitrogen versus the Gd strain used in Azotic products, which show benefits from using the strain can't be purely hormonal plant promotion effects and must also come from nitrogen fixation by the bacteria.

Field trials also back up the claims that nitrogen is being fixed and contributing to yield responses, says global trials manager Tom Harries. "Multiple trials on different crops, where nitrogen rates are reduced and Gd applied, show yield responses above where Gd isn't used.

"When you look at the trials and in the lab when we knock out the nitrogen fixing part of Gd, it's providing strong weight of evidence that nitrogen is being fixed and contributing to yield," he says.

The rise of quinoa: a superfood revolution

Questionable in terms of pronunciation, but quinoa is the small-in-size superfood that's packing a punch for UK growers in terms of reward. *CPM* finds out more.

By Charlotte Cunningham

"Is it 'keen-wah'? or 'quin-oa'?" – the most important first question when penning an article about the nutty little grain which has soared in popularity during recent years.

Stephen Jones, director of the British Quinoa Company, laughs: "I use them interchangeably, depending on if I'm talking to farmers or consumers. Typically, with farmers I pronounce it 'quin-oa' as this is more akin to what they associate with quinoa in bird food mixes, for example."

But however you pronounce it, from salads in M&S counters to a staple ingredient in nourish bowls in swanky health cafes, quinoa – for human consumption – is the protein-packed superfood that's been sweeping the UK during recent times. "The declaration of the International Year of Quinoa in 2013 was pivotal for the surge in popularity of the grain, and since then, it's gradually increased in uplift year on year," explains Stephen.

While it's now found favour in UK arable fields, quinoa's journey to market in this country has been a long one as the grain was originally grown exclusively in the Andean mountains. This made it unsuitable for growth in the UK climate – a challenge Stephen has had to overcome on his journey to become the leading-grower of quinoa grains in the UK.

UNIVERSITY PROJECT

"In terms of my background, I farm in North Shropshire with my parents and we're completely arable. It was when I was at university at Harper Adams that I first had the idea of growing quinoa on the farm and essentially, wanted to see if we could produce it as an alternative crop.

"Very luckily, Harper allowed me to do a project on it which gave me the time to have a really deep dive into quinoa, to try and learn as much as I could. This was fundamental in developing the crop and working out exactly how we could produce it in this country."

With the crop typically suited to the warmer climates of South America, Stephen says one of the biggest challenges was breeding a seed which was adapted to the cooler, wetter maritime climate. "The first thing to note, variety-wise, is that if you plant quinoa which you've bought off the shelf in the supermarket, it won't grow here. Likewise, if you plant the varieties we typically use for bird food, while that will grow, the seed isn't edible for humans."

With the limitations of these two types of quinoa in mind, Stephen partnered ▶

Specialist interests

Director of the British Quinoa Company, Stephen Jones, says his interest in specialist crops drove him to explore the potential of growing quinoa in the UK.

with a university in the Netherlands which majors on breeding specialist crops. "They were interested in quinoa, so we essentially told them what we were looking for and then they did the genetic work to breed those different traits in. As you can imagine, it's a very slow process and took years to get an end result."

BITTER SAPONINS

The biggest challenges with producing a UK-friendly variety were tweaking the germination characteristics and removing saponins from the crop, which are typically found in the bird food-type quinoa varieties, he explains.

"Sandoval quinoa is what's typically grown for bird food mixes and is very bitter due to the saponins – natural chemical compounds found in the outer coating of quinoa seeds. They have a bitter taste because they serve as a defence mechanism against pests and microbes. While the latter is beneficial, obviously from a taste perspective, we had to breed something which didn't have the saponins, but still grew well."

Reflecting on some of the early varieties, Stephen says maturation date was also a continuous challenge. "Even if everything else worked well, maturity was always an issue – the crop wouldn't be ready until the end of September, sometimes early October. It just wasn't acceptable for us to have that sort of harvest date."

In the second generation of varieties, the genetics were manipulated to pull forward the harvest date by two weeks, which Stephen says was the turning point in being able to get commercially-viable varieties in the field. "Even then though, if you get a normal distribution of harvest dates, some will be around early September, but some of the later planted crops don't mature until the end of the month. So it still wasn't ideal."

Today, Stephen and his network of 30 contracted farms are now growing 'third-generation' varieties, which can be harvested from the last two weeks of August.

Looking at the typical production cycle for quinoa, planting begins in April with flowering in early summer – usually June – so the crop is then ready for harvesting during August/September.

As such, it fits well within most places in a typical rotation and can be grown every four years, he explains. "The caveat to that would be that I'd avoid growing it following oilseed rape as the volunteers can be so vigorous."

Despite the small seed size, no specialist equipment is required for

Superfood revolution

The International Year of Quinoa in 2013 has been credited for the sharp rise in popularity of the small, nutty superfood grain.

Plenty of potential on Mersea Island

Farming 730ha off the Essex coast on Mersea Island, quinoa has found favour in David Sunnuck's arable rotation. "We all enjoy growing different crops and working with people, rather than large corporate bodies," he begins.

David has been growing 68ha of quinoa for The British Quinoa Company for the past two years, which fits alongside his typical cropping plan of first wheats, oilseed rape, peas and Canary seed. "I can't really remember how I came to start growing it now," he laughs.

"But we were presented with the opportunity and as I say, it's nice to grow for end users and end markets, and I'm always interested in growing something different. It's not an enormous cropping area, but it's a very specific crop and most certainly wouldn't suit everyone."

Expanding on this, David says that to be profitable in quinoa growing, having a good drying and cleaning system in place is imperative. "I think just drying it wouldn't be enough – you have to be able to clean it as well. By that I only mean giving it a basic clean, obviously it's not going to be to spec, but you have to be able to do that."

In terms of how he manages weed control, avoiding dirty fields is a key part of the strategy. "Then the other thing I'm planning to do is not to grow it on any headlands, because we've found if we've historically had bird or game covers on the edge of fields, it affects the quinoa crop.

"We discovered this a couple of years ago when we first planted it in a field that had game covers in about 25 years beforehand – you could literally see a line in the crop where they'd been. We then started getting broadleaf weeds which swamp the quinoa.

"Instead we're going to do 24m around every headland – usually into spring oats – and then sow just the middle of the fields with quinoa. The hope is this way it'll be a cleaner crop."

Looking at the typical return, David says it's a high risk, but high reward crop. "It certainly has the potential to be profitable, but it's also high risk. In the two years we've grown it, it's been one of the best margins on the farm but equally, I know there'll be a year when it won't do as well.

"I'm also going into the low input SFI scheme (AHW10) with it this year which is another incentive. If you're interested in doing something a little bit different, then quinoa is definitely the way to go," he concludes.

planting or harvesting, provided drills are geared up for planting smaller seeds, explains Stephen. “They’re small but not tiny; they’re actually only slightly smaller than spring OSR. So as long as you can drill small seeds, you’ll be able to drill quinoa.

“What is critical though, is using a drill that can sow to a precise depth, as this is really important for germination, and of course, going into warm and moist conditions.”

In terms of crop nutrition, quinoa is a nitrogen hungry plant, says Stephen. “That would typically be the biggest crop cost. It may require a little P and K too, as well as applications of micronutrients, but this is very typical with what you’d expect for a traditional arable crop.”

With no herbicides approved for use on quinoa in the UK yet, using alternative methods of weed control during the production cycle are vital for yield. “The varieties we grow now are more vigorous which definitely helps, but we do rely on cultural methods like stale seed beds and avoiding growing quinoa on land which is heavily burdened with weeds,” explains Stephen.

DRYING PROCESS

After harvesting, the drying and storage of the crop is arguably one of the most important parts of the process. “Quinoa deteriorates quite quickly if it’s not dried rapidly, so it has to be dried as soon as it comes in off the field. It always has to be dried, there are no situations where it shouldn’t be, really.

“Once this is complete, it has to be put into store with air going through it, and then it’s just a case of awaiting collection to go for processing.”

As for marketing the crop, while the price per tonne varies year-on-year, Stephen says growers can expect in the region of £700/t for this superfood grain. He’s also received recent confirmation from the RPA that the crop can fit into two SFI schemes – AHW10 (low input harvested cereal crop) and CIPM4 (no use of insecticide on arable crops and permanent crops) – offering another opportunity to capitalise on growing quinoa.

“The rewards for growing quinoa are far better than traditional crops, if you can get it right. But there is that level of risk – so if you’re interested in growing it, I think you have to understand you may have a great harvest one year and a poor one the next, but it does average itself out. It’s a crop with great potential.”

Fitting into the rotation

Despite its small seed size, quinoa doesn’t require any specialist kit for planting or harvesting, meaning it can fit quite seamlessly into existing arable rotations.

Making maize pay

With 2024 proving a poor year for UK maize thanks to below optimum starch, protein and dry matter levels, are there steps growers can take to help the crop pay its way? *CPM* attended this year's maize forum to find out the answer.

By Janine Adamson

Spring last year will long remain etched on the memories of many. The relentless inclement weather meant planting and therefore rotations were thrown up in the air and in some cases, the result was growing a completely different crop entirely, if drilling a crop at all.

Among the options cast under the spotlight was maize thanks to its later drilling date, multiple end uses and viability as a cereal break. However, with wet conditions continuing throughout spring followed by a cooler than average summer, Harvest 2024 results were far from groundbreaking.

With fingers burnt a little, will this prove enough to undo maize's improving status with farmers, particularly those in the arable sector? Acknowledging the reputational risk of last harvest and how to overcome it was the theme of this year's online maize forum – a venture involving Eurofins, Origin Soil Nutrition and Limagrain.

Opening up the discussion was Eurofins' Bob Fabri who shared thoughts on why maize silage tests have revealed starch and dry matter levels have hit a five-year low.

"Reviewing maize samples analysed by Eurofins in 2020-2024, we see that although ME (metabolisable energy) levels are relatively stable, there's been a decline in average starch levels, an increase in NDF (neutral detergent fibre) with fluctuating sugar levels and TFAs (see table)."

QUESTIONING WHY

"Looking at starch specifically, this means a poorer quality product, although this isn't reflected through the ME. Why are we seeing this?" questioned Bob.

He referred to a similar scenario in the Netherlands which had been attributed to a dry summer and as such, Bob shared the UK's cumulative rainfall levels for the past five years.

"Looking at a conventional maize plant, it uses most water June-August. Unlike in the Netherlands when that period was very dry, in the UK, there was a steep increase in cumulative rainfall during all years, therefore this can't be the reason for the decline in starch."

Then, Bob reminded that maize is a C4 plant, in that it 'supercharges' its photosynthesis in hot, dry environments. "Maize thrives in conditions with a lot of sunlight and requires high temperatures to mature effectively, the ideal being 25-30°C during the day.

"Looking at the UK's average monthly temperatures, in July 2024 it was cold and average sunlight hours per month were

Changing conditions

Eurofins' Bob Fabri said it's clear climatic conditions are hugely impactful on the quality of maize.

	ME MJ/kg DM	Starch gr/kg DM	Digestible OM (%)	NDF g/kg DM	Sugar gr/kg DM	TFA gr/kg DM
2024	11.2	265	74.1	447	17	69
2023	11.2	296	74.5	432	15	63
2022	11.6	303	76.5	408	18	70
2021	11.3	310	74.9	415	15	66
2020	11.5	299	75.7	412	17	71

also down meaning conditions weren't optimum for photosynthesis and therefore crop growth. Although in August there was an increase in both temperature and sunlight hours, it wasn't enough to boost the starch levels," he explained.

To add a further layer of complexity, Bob pointed out that in 2022 average temperatures were high during the summer months with good sunlight hours but starch levels still weren't outstanding. He said this was likely due to a lack of rainfall at an earlier stage in the crop's growth cycle.

"You have to combine all factors so it's hard to pinpoint one primary influencer behind the crop's performance. However, it's clear climatic conditions are hugely impactful on the quality of maize.

"Overall, the UK is seeing a shift in temperature with warmer conditions earlier in the season and less sunlight later in the year. This reaffirms the importance of varietal selection and whether those chosen remain appropriate for the UK given the changing conditions," said Bob.

Another key influencer of maize performance is crop nutrition, particularly in young plants, stressed Guillaume Franklin from Origin Soil Nutrition. He began by referring to RB209, highlighting that nitrogen recommendations for the crop are lower than wheat and barley, whereas phosphate can be a little higher and potash is mostly supplied via FYM and organic sources.

Then, he reiterated the role of soil pH. "If the basics aren't correct, the crop will be limited because below pH 6.0, a lot of the key nutrients won't be available to the plant. In fact below 6.5 and phosphate starts to become unavailable.

"However, the Potash Development Association (PDA) recommends a pH between 5.8 and 7.0 for maize and fields should be limed if the pH is 6.0 or lower."

Returning to the role of phosphate – in a practical on-farm sense, it's important for early establishment and to ensure a good rooting system, explained Guillaume. "In dry years, a larger root mass for a maize crop not only helps it to access deeper soil moisture, but also allows it to find more nutrients. Phosphate boosts the growing tips of plants whereas a deficiency exhibits as a purple or reddish tinge on leaves."

He added that phosphate is in fact relatively immobile in soil. "This means it doesn't leach easily, which could contradict other messaging within the industry. But once it's in the soil, it doesn't move around much which can make it hard for the crop to take up, there's also the risk of lock-up particularly if pH isn't correct."

PHOSPHATE LOCK-UP TRIALS

Guillaume shared trial data from Harper Adams University which investigates the relationship between phosphate lock-up and maize yields (dry). The work – conducted across four sites – demonstrates that 62kg/ha of DAP plus OEP (Origin Enhanced-P) yields an average of +2.3t/ha more than a standard application of 125kg/ha DAP.

"OEP is a liquid polymer fertiliser enhancer designed to protect DAP from being fixed into unavailable forms, stopping elements such as iron, aluminium, calcium and magnesium from locking onto P fertiliser," he said.

Guillaume also highlighted zinc which assists early maize crops and can help to bring harvest date forward, whereas sulphur is just as important as nitrogen.

"Sulphur improves nitrogen use efficiency to ensure the investment the farmer is making is being used effectively. It also boosts protein content in maize while increasing digestibility to result in optimum silage quality, which is critical for feed markets.

"However, heavy rainfall increases sulphur deficiency as it's very mobile in the soil so that's something to be wary of following the recent wet autumn. Furthermore, due to a sustained reduction in UK sulphur emissions, the PDA recommends that sulphur is included in all fertiliser programmes for 2025."

The role of sulphur

Sulphur helps to boost protein content in maize while increasing digestibility for optimum silage quality, said Guillaume Franklin from Origin Soil Nutrition.

From Limagrain's Tim Richmond's perspective, 2024's poor maize performance should be mostly attributed to either weather conditions or the crop being sown too late. "Our main challenge in the UK is we have difficult and variable weather – the seasons are becoming more changeable.

"Essentially what happened last year was the rainfall in May – which is the conventional timing for planting maize – was quite high so growers had difficulty accessing land. Consequently crops were sown 2-3 weeks later than usual which cut the growing period down considerably during a summer which was the coolest since 2015.

"However, those who did plant at a conventional timing, did achieve a reasonable crop," he said.

To overcome this, Tim stressed the importance of matching a variety's maturity to site potential and that there are online tools to assist. "Limagrain has a Maturity Manager which is a post code-based app that helps to calculate how many heat units are available in your area; some locations are unsuitable for maize at all due to insufficient heat units through the season," he said.

He then reminded that harvesting early, thus having a shorter growing period, also incurs incentives from varying sources whether that be grants from water companies or the ability to plant cover crops and sign up to SFI actions.

"Our trials show that selecting specialist early varieties can improve UK crop performance, including feed quality, while providing a more flexible harvest. The shorter growing season mitigates against late sowing and poor harvest conditions," he concluded.

Delivering the digital dream

Combining the resilience and intellectual capability of farming with new technology has the potential to achieve great things, was the take-home message at a recent conference. *CPM* joined delegates to find out more.

By Janine Adamson

Whereas in the past there may have been a reluctance to adopt digital tools in farm management, the results of a recent survey suggest those days are long gone – farmers are backing digital technology to help run their businesses now and will continue to do so in the future.

This statement was revealed at Hutchinsons' connected farming conference, where details of the company's latest research were shared for the first time. The independent survey involved qualitative 1-2-1 interviews with around 200 arable and mixed farmers from across England and Scotland, with the aim being to better understand where participants are on their digital journey.

To delve into the detail, agri-data expert, Julian Gairdner, shared the key stats. "Half of participants said digital technology is increasing in importance which rises to two thirds among the largest farms surveyed.

"The most popular precision agriculture tools being used were cited as MyJohnDeere followed by Trimble, SOYL and Omnia. Weather forecasting and What3Words were noted as the most used smart phone apps," he explained.

For farming operations where digital tools are being used, three quarters said this involved autosteer whereas 40% use variable rate technology for fertiliser or seed, he continued. As for the drivers behind using such technology, 78% reported this was with the aim of saving money followed by gaining yield improvements and achieving efficiencies.

"When we looked at the specific farming activities which digital technology can improve, half of participants said meeting the requirements of auditing or compliance for agricultural schemes," said Julian.

BARRIERS TO PROGRESSION

On the other side of the coin, the survey also explored what's preventing growers from progressing their use of digital solutions. Julian highlighted that 70% of respondents said it was due to cost and return on investment concerns, which he said was of no great surprise.

Rounding up the findings, Julian summarised confidence levels. "So how confident to do you feel using this stuff? Three quarters ranked themselves as being a five or more – with 0 being not confident through to 10 being super confident.

"The survey also highlighted that nearly 20% of participants saw data ownership and security as a barrier to uptake, suggesting this is a critical issue," he said.

One farmer who's already embracing technology is Long Sutton-based David Hoyles who shared his experience with the audience. He said it all started in 2007 when the farm introduced GPS steering to the business.

"However, we didn't start collecting data from this until 2010 and it took another few years to make that useful. In fact, we're still learning how to make that rewarding," he commented.

Hyperspectral imaging

George Marangos-Gilks said his firm Messium is offering a precision solution for fertiliser that farmers could only dream of a decade ago.

Farm Data Principles

The Intellectual Property Office has now approved the farm data safe certification mark as ready for use, said Dr Susannah Bolton of Farm Data Principles.

David said in 2010 the farm started to use MyJohnDeere for yield mapping and telematics, Omnia in 2015 for variable rate seed and now nutrition, and in 2020, Bayer's FieldView was introduced.

"We also use technology for water management to address legislative issues and to ensure quality, plus to help understand the performance of our renewable energy," he added. "It's all about being more efficient."

With that in mind, Messium's George Marangos-Gilks pitched his company's concept for precision nitrogen applications, based on hyperspectral imaging. George explained this is the only satellite technology capable of detecting the specific infrared wavelengths required for remote crop nitrogen analysis.

"Every chemical or nutrient has its own spectral signature, and hyperspectral can 'see' nitrogen wavelengths to understand the plant's nutritional status. Excitingly, hyperspectral satellites have just become commercially available," he said.

Compared with legacy solutions, George suggested although effective, laboratory tests are time consuming and expensive whereas former NDVI-based satellites can only assess biomass and struggle to pick up nitrogen in plants.

"Hyperspectral drones have potential but are very expensive and have limited battery life. Finally, tractor sensors – these are limited in accuracy, don't factor in weather and have timing issues," he pointed out.

In contrast, Messium's offer involves weekly, highly detailed insight into crop nitrogen, centred around hyperspectral satellite imaging. "It's a precision solution for fertiliser that farmers could only dream of a decade ago," he proposed.

In addition to the hyperspectral imaging, George explained that the firm also measures crop biomass, rainfall, sunlight hours, soil moisture and soil organic mineralisation, to build a complete picture for the farmer.

"That way we can calculate how far above or below optimum nitrogen level a crop actually is, in real-time," he said.

Then, to reflect on the previously raised point of data ownership, Dr Susannah Bolton shared an update on the Farm Data Principles initiative – a not-for-profit organisation first formed in 2023, chaired by Tina Barsby OBE.

POWER STATEMENT

Susannah began by reminding the room: "Your data is your data and that's really important because the first question we should all be asking is, will I be realising the value from that information?

"To achieve that, we require good data governance so its value can be unleashed without concerns of something being amiss or that someone might use our data in ways we hadn't agreed to in the first place."

She added that at the moment, there remains significant fragmentation and a lack of standardisation. As such, a group of independent industry individuals have come together to form Farm Data Principles, with the aim of meeting the demand for data governance without creating barriers.

And now, the organisation's farm data safe certification mark has been approved by the government's Intellectual Property Office (IPO, also known as the Patents Office), she highlighted.

"The business is up and running so you all have the potential to ask those with whom you share your data with, whether they're adhering to the principles of farm data governance. It's important to enable this process so we can accelerate the digitisation of the industry and achieve our potential."

Susannah pointed out that having heard how data and digital technology can enhance the performance of farm businesses, it's now crucial that those who utilise data to develop solutions such as Omnia are recognised for signing up to the principles of good data governance and championing fair and equitable data use.

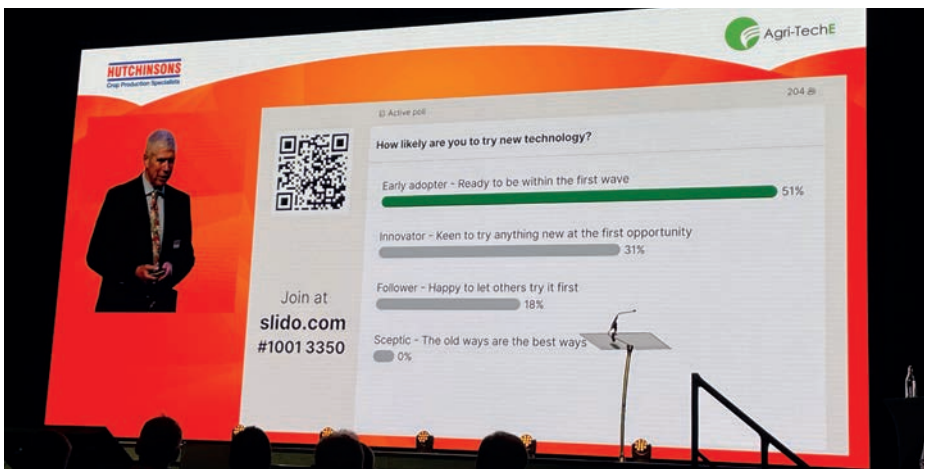
This is because by doing so, organisations agree to adhere to four statements: your data is your data (1), our organisation makes data easy (2), our organisation keeps your data safe (3), and our organisation is clear about value and benefit of data sharing (4).

She said that once a business has signed up to the scheme, they are then open to public scrutiny and if the principles aren't adhered to, there are clear dispute procedures.

"As for the value of certification to farmers – it should help you to understand what type of data the handler is asking for and storing on your behalf. It makes it clear that you retain the right to the data set and that the handler's use of it is for what you originally signed up for.

"Finally, your data is stored safely and you'll be supported correctly to share your data should you want to. We hope you'll champion this scheme and ask those whom you share data with if they're certified and if not, why not?"

A range of organisations have already signed up to the initiative including Hutchinsons, Map of Ag, Red Tractor, Yagro and Sainsbury's, with others in the pipeline, concluded Susannah. Hutchinsons' Omnia is certified under both ISO27001 for data security and the Farm Data Principles scheme for farm data governance.



Independent survey results

Hutchinsons conducted a survey with around 200 arable and mixed farmers to better understand where participants are on their digital journey.

Nature NATTERS

WITH MARTIN LINES

From resistance to change

We started the year with news headlines that glyphosate resistance has officially been found in Italian ryegrass in the UK. For some time, farmers have noticed the efficacy of glyphosate decreasing, but now it's been verified by scientists from ADAS who screened seed samples from a farm in Kent. With resistance also being found in other countries, nature is slowly getting the upper hand on this product.

Like many other products in the past, not using full application rates or ignoring best practices eventually supports the plant in building resistance to the product. With much of our farming system being built around the availability of an effective product for killing green cover, this news may mean big problems for the future.

The UK government has committed to reducing pesticide use, and we'll know more details about the specifics when the UK National Action Plan (NAP) – a five-year plan to reduce the risks of pesticides on human health and the environment – is published later this year. In addition, the license for glyphosate will be up for renewal, so there'll be increased focus on its relative risks and benefits.

More and more, the general public and health and environmental organisations are raising concerns about the dangers of glyphosate to human health, which include gastrointestinal, metabolic, and developmental problems – and even cancer.

In contrast, many farmers believe glyphosate is essential to their system and for successful yields; the debate is going to become increasingly lively. I'm often told by farmers that we couldn't farm without it, but I just point out the many thousands of organic farmers who are already successfully farming without it.

Their farming systems are very different, yes, but we shouldn't fear change. Like many, I can see the benefits of having the product available to kill cover cops and weeds in fields. But I believe we'd have a stronger argument for its continued use if we stopped applying it to products going into the human food chain, as so many of the general public are strongly against eating food that has been treated with and may contain glyphosate.

We farmers are also receiving pressure from water companies, who are finding high levels of it in the water courses, well above the legal limits they must abide by.

Building any farming system reliant on one product or method is highly risky. History shows us that nature will always eventually work around what we impose upon it, whether that's chemical resistance, changes to weed varieties or failing varieties, we have to adapt continually.

Rather than fight nature, why don't we work with it? One of the strongest ways to avoid these problems is by having a robust integrated pest management (IPM) plan. Careful varietal selection, inter-cropping, beetle banks and flowering margins are all free tools at our disposal to reduce the impacts of weeds and pests while minimising the chances of pesticide resistance with reduced use.

Could you farm without glyphosate?

As regenerative methods such as IPM grow in popularity, there's an increased focus on reduced tillage and direct drilling. But employing some cultivation to terminate weeds in place of chemicals may become increasingly important.

As I've heard it said before: 'It's not the plough, it's the how'. We're farming in a climate of change; we require an increased focus on trials which explore the best methods for building soil health through reducing tillage while reducing pesticides and still delivering good yields.

There's less pressure to succeed if we begin trialling adapted methods now while the products are still available, than if we wait until they've been banned or are no longer effective with increasing resistance – whichever comes first.

The range of machinery we'll require in the future may change. We'll likely need a cultivator that can move soil at a shallow depth to terminate roots without disturbing the soil's intricate microbiome and mycorrhizal network – also integral for pest resistance.

An increasing amount of reliable information is becoming available on how to remove weeds in a growing crop; looking at some of the robotic/autonomous machinery being developed, individual treatment may be possible soon without using chemicals. We're only at the beginning of this research area as we transition.

Whether we embrace these changes now or attempt to resist them, they are coming. Putting all our eggs in one basket is becoming increasingly risky. What would your farming system look like without glyphosate? ●

YOUR CORRESPONDANT

Martin Lines is an arable farmer and contractor in South Cambridgeshire with more than 500ha of arable land in his care. His special interest is in farm conservation management and demonstrating that farmers can profitably produce food in harmony with nature and the environment. He's also chair of the Nature Friendly Farming Network UK.
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Walking the world, not just fields

Ever wanted to work with space technology, design precision farming tools, help revolution plant breeding or develop innovative growing techniques? A career in agronomy could be the answer. *CPM* investigates.

By Melanie Jenkins

The days when a career in agronomy would largely mean crop walking are fast becoming a thing of the past. Instead, it's evolved into a career that could head in any number of directions, be that in precision technology, education or even to different places around the world.

As aspects of farming and agriculture such as integrated pest management, sustainability, and the environment become ever more prevalent, the role of the traditional agronomist has expanded exponentially, but the fields in which they can walk have too, says BASIS' Andy Brooks. "The range of careers available now aren't just tied to being a field-walking agronomist."

While the straight BASIS and FACTS qualifications are the only route into becoming a fully qualified agronomist, points out Andy, there are many career options to embark on in agronomy. "There are a lot of other routes into becoming an agronomist; you could take a university course, enter as a graduate trainee, through foundation courses or ▶

Career options

BASIS' Andy Brooks points out there are many career options to embark on in agronomy.

even via organisations such as FWAG and water companies. It's possible to do Levels 4 through 6 with BASIS and FACTS and then attend Harper Adams University as a graduate in agronomy and environmental management."

Those looking to obtain their BASIS certification are likely going to have to apply 6-9 months – around 300 hours – of learning to achieving this, he explains. "It sounds like a lot but during that period it's not that scary. Just ensure you find a trainer that works for you because this is important."

The role of the agronomist is still evolving and is likely to change more in the coming years, with the content of the BASIS qualification continuing to reflect this, explains Andy. "There's a lot more emphasis on the environmental impacts of farming now and we've seen a massive reduction in the use of chemicals."

The University of Reading has a well-established agriculture department which offers numerous courses, including in crop protection. Associate professor, Dr Paola Tosi, is also seeing the programmes she teaches adapting. "There's a real push towards regenerative agriculture and sustainable farming, and the importance of low input systems."

MISCONCEPTIONS

Hutchinsons' Alice Cannon points out that many new starters might feel that without a farming background, the industry isn't accessible. "This is a misconception and so long as you have a genuine interest and a passion for the industry then there are opportunities for you."

From Paola's experience, students in agronomy now come from a wide variety of backgrounds, not just farming. "We have individuals from insurance companies and banks who have to understand agronomy to ensure return on investment for the products they're selling. Only around one third to a half

A role with AHDB

How technology can open the door to agronomy

Although AHDB's Craig Patrick grew up on a small family farm in North Yorkshire, his mind wasn't set on joining the business. While studying physical geography at university, part of his course focused on glaciology and volcanology which taught him about satellite software and GIS mapping. "I picked up skills from this and wondered how I could use them in the real world," he explains.

When he then came across precision agriculture, he saw a meeting of two worlds: farming and technology. This led to his first job with Precision Decisions which was working to advance GPS equipment and soil sampling tools. "Because of the nature of producing soil and variable rate fertiliser maps, the business put me through my FACTS qualification within five months of starting the role. This opened up a new world of what agronomy really looked like, and the depths and levels to it. It was an intense qualification, but it allowed me to push on with the job."

Two years later Craig took his BASIS qualification and although he doesn't see himself as an agronomist, his training has allowed him to apply practical knowledge to precision technology. "I've been involved with more conventional identification projects with cameras and drones, to more elaborate things such as the traceability of the supply chain in China and testing the Mars Rover on a barren field in England."

After eight years with Precision Decisions, Craig moved into knowledge exchange with AHDB. "In my current role I'm able to bring innovative ideas, new science and promote the latest research to UK farmers, helping them capitalise on existing and emerging opportunities to ensure their business remains strong and resilient for years to come."

Project work
AHDB's Craig Patrick's career has seen him involved with projects on the traceability of the supply chain in China and testing the Mars Rover on a barren field in England.

40 years of experience

From supporting farmers to the wider industry

Continuous learning
Taking BASIS and FACTS qualifications is really just the start; continuous learning is vital because of the new technologies and crops constantly being introduced to agriculture, says AIC's Hazel Doonan.

The AIC's Hazel Doonan has 40 years of experience in agronomy, which has involved working in distribution, sulfonylureas and in product development, before she joined the AIC as head of crop protection and agronomy.

Hazel grew up on a dairy farm on the west coast of Ireland before studying zoology at undergraduate level and crop protection as a post-graduate. "I knew I wanted an outdoor job and have worked with all sorts of different crops and characters, which makes life interesting."

Hazel believes that the days when people stick with a single job for their entire career are long gone. "There are so many different opportunities now and it's about taking these rather than having set goals for yourself."

Of the various types of training Hazel has received throughout her career, these have ranged from business management to presenting and even involved taking a course on using forklifts and in advanced driving. "Taking your BASIS and FACTS are really just the start, it's vital to keep learning because there are constantly new technologies and crops being introduced to agriculture – the more you know, the more you find out you don't know."

of our students come from a farming background and we're increasingly seeing new entrants showing an interest in working in the wider industry."

Andy encourages those new to the industry to find practical on-farm experience. "Get your hands dirty, drive tractors, gain an understanding of machines, crops and soils. Contact local agronomists, show initiative and try to find some experience shadowing them."

According to AHDB's Craig Patrick, one of the best things new starters in the industry can do is to surround themselves with the right people. "There are a lot of innovative figures in the industry who you can connect with by joining consortiums, projects and meetings. Build a network around you because I think this will make it easier to develop your career rather than going at it independently."

So just where could a career in agronomy lead? According to James Trett of JP Trett, agricultural recruiter, there are opportunities in scientific institutions, sales and commercial enterprises, vertical farms, with precision agriculture developers and carbon reduction organisations, among many more.

"We've worked with overseas companies that want Western-educated agronomists, placing candidates in the Middle East, Africa and Romania to name just a few. A career in agronomy can lead to almost anything, with language unlikely to be an obstacle as English is often the main language spoken.

"And if you haven't taken your BASIS or FACTS yet, this isn't necessarily a barrier because lots of firms will put their employees through these qualifications," explains James. "We're seeing a shortage of agronomy skills across a lot of industries, so organisations are looking to access and support the right candidates to overcome this."

NICHE SPECIALISMS

For those either just embarking on their career, or already established, the Agricultural Industry Confederation's (AIC) Hazel Doonan points out there're opportunities to focus on specific crops, the environment, fertilisers, sustainability, regenerative agriculture or product development.

> *"The more you know, the more you find out you don't know."*

"It's a wonderful way of life where you're outdoors meeting interesting people. You might decide to work with trade associations, retailers, food processors, or you might find you want to farm."

Paola highlights there are opportunities in the academic world for agronomists too, but that the career could head in any number of directions. "Agronomy could be relevant to a career with Defra, PGRO, LEAF, ADAS and even machinery manufacturers. There are so many possibilities and a spectrum of jobs available that are incredibly diverse."

As to how the future of the career of an agronomist looks, Hazel believes ▶

Diversity of roles

According to James Trett of JP Trett, there are opportunities for agronomists in scientific institutions, sales and commercial enterprises, vertical farms and more.

A digital skills application

Exploring the potential of precision

After completing a degree in agriculture, Lewis McKerrow wasn't sure which direction he wanted his career to head in, but he knew he wanted it to involve agriculture. Although having grown up on a dairy farm, he felt his future didn't lie in milking cows, so instead he headed to Australia to gain wider experience.

Upon his return, he spent six years working on a farm, gaining practical experience which led to a focus on growing crops and the technical aspects of fertilisers. "This made me want to explore a career as an agronomist, so I secured a job as a trainee with Agrovista," he says. "Within the first year I took my BASIS qualification which was hard and intense but because I did it while at an agronomy firm, it meant I had support."

He then took his FACTS which he describes as harder than BASIS, and from here moved on to creating a customer base as a practising agronomist. An opportunity then came about to be involved with the precision farming and soil analysis side of the business. "I was helping the development team to expand the software side of things such as apps and digital solutions."

Lewis then joined Hutchinsons and became involved with Omnia to further his interest in precision technology. "This is an area that's always evolving and changing, with new innovations providing solutions to make people's lives easier and more efficient.

"My agronomy experience was really useful in my role on the digital side because I could see the practicalities and potential usefulness of products to the end user. It's so rewarding to take a concept or idea, speak to farmers and bring solutions to their challenges to market."

Transferable skills

Practical experience in agronomy was really useful for Hutchinsons' Lewis McKerrow when he took on a role in digital agriculture, because he could see the potential usefulness of products to the end user.

Advancing the next generation

Forging a career as a trainer

A lifelong passion for agriculture has resulted in Hutchinsons' Alice Cannon coming full circle and she now imparts this love to trainee agronomists at the firm. Having worked on farms during her A-Levels, she went on to study agriculture at university, specialising in crop protection. "I secured a job with Hutchinsons before finishing my degree and so went straight into training to become an agronomist, further specialising in cover crops and soil health, which had both been fascinations of mine."

Alice quickly embraced new challenges, becoming the first regional technical manager in North Lincolnshire and then in the East Midlands, looking after 45 agronomists as well as her own portfolio. "This opened a lot of doors for me and allowed me to pursue my passion for cover crops by coming Hutchinsons' lead in this, as well as heading up the PGRs team. It meant I presented at a lot of farm meetings and attended open and promotional days, in-house and externally."

The past five years have seen Alice arranging trials events, collecting data and collating key messages, but after 10 years in the business she was ready for a new challenge. "During this time, I'd often had trainees with me because it's a career that involves learning on the job. This was something I'd really enjoyed, feeling a great level of satisfaction from seeing trainees develop and grow."

So as of this year, Alice is now the technical training manager for Hutchinsons, as well as continuing her role heading up cover crops for the firm, and she still has a handful of agronomy clients. "I never saw myself as doing agronomy full-time for my whole career, so it's been fascinating to explore the many different elements of agriculture. My career might have moved a bit faster than I anticipated but that's been driven by a company that supports me."

Personal growth
Alice Cannon of Hutchinsons says she's felt a great level of satisfaction from seeing trainees under her care develop and grow.

The agronomist's position

Adapting, evolving and learning

Growing up on a farm in Suffolk, Agrovista's Hollie Hunter knew she wanted to pursue an outdoorsy career which led to her studying agriculture and crop management at Harper Adams University. "The course was quite hands on and involved time outdoors, creating an open door to a vocation in agronomy," says Hollie. "I applied for a job at Agrovista and my career has evolved from there."

During her first year at the company she undertook BASIS in Lincoln, followed by FACTS the next winter. "My studies at university provided me with a foundation and backbone to the knowledge I then gained by taking both of these qualifications."

Hollie has now built up a base of agronomy clients and is looking forward to expanding on this in the future. "I'm finding the role really interesting and it's great to continue learning in such an interactive way. It's so rewarding when you start growing crops and see them reach harvest – being able to assess what you've done well and where improvements can be made."

The requirement to continually learn and adapt as an agronomist is something Hollie says she's well aware of, especially as the agricultural landscape evolves. "It's such an interesting time for farming at the moment, whether that's new innovations coming through the pipeline or adapting to changing government policies. For agronomists, it'll likely mean our position will change and become even more important as we lose further crop inputs in the coming years."

Adapting to new challenges
The requirement to continually learn and adapt as an agronomist is something Agrovista's Hollie Hunter says she's well aware of, especially as the agricultural landscape evolves.

it to be an exciting space. "There are so many new developments which will change the role of the agronomist, I believe this will be in terms of quantity of data and interpretation. But it's important to recognise that your role as an agronomist is really critical for food production in the UK."

DIGITISATION

Agronomy is an area that's going to become more integrated with remote sensing, drone use and artificial intelligence, says Andy. "We're already at a point where we can automatically detect disease levels and identify multiple issues and this will only increase in the coming years."

Alice feels the industry is going through a phase of serious development. "When I joined Hutchinsons 10 years ago, we didn't have an environmental team but now there are 15 of us involved in this."

Advances in technology are likely to open up more opportunities for agronomists, says Craig. "I think agri-tech is the greatest area of opportunity out there. Having skills in both agronomy and technology is really valuable because most people in technology don't understand farmers.

"And while I think agri-tech businesses have become a lot more visible to the industry, the communication between the industry and those with the right skills to work in this sector are still lacking." ●

Launches, milestones, politics and celebrities

"At a time like this it's absolutely crucial that we stand united."
TOM BRADSHAW

The halls of the NEC were once again packed with machines, farmers, contractors, and all manner of specialists and experts for LAMMA 2025. *CPM* went along to see the releases and hear the latest buzz.

By Melanie Jenkins

The UK's main machinery event saw record numbers descend upon Birmingham's NEC in January. LAMMA played host to impassioned speakers, new machinery launches, notable milestones for some manufacturers and even Amazon Prime's camera crew as it tailed Jeremy Clarkson and Kaleb Cooper.

Although the seminars might not be the main reason most visitors attend LAMMA, the opening session drew in the crowds to hear NFU president, Tom Bradshaw, as he reiterated the tribulations the sector has faced since the Autumn Budget and highlighted the importance of sending a unified message.

"We all know what happened in the Budget and the impacts and concerns that's caused for the farming industry. We know many businesses will be directly impacted by the changes to business property relief and for those that aren't directly impacted, if farming sneezes the whole sector will catch a cold – there's a real risk of it having a ripple effect right through our supply industry.

"At a time like this it's absolutely crucial that we stand united – we have to educate the government, no matter how difficult this is or boring it may be, MPs are the key route through this," he stressed.

Elsewhere in the show, the shadow of political influence was less prevalent, with manufacturers indicating a more positive outlook for the coming years despite the evident tightening of belts that many have undertaken recently.

Dominating Case IH's stand, the AF10 combine made its first UK appearance. Its 20,000-litre grain tank is the joint largest in the industry and it has a 210 l/sec unloading rate. The new 762mm diameter AFXL rotor is the longest available, at 3.67m, helping to boost crop flow, fuel efficiency and straw quality, while minimising grain damage and maximising separation.

In the cab, a revised interior features a comprehensive suite of precision technologies including dual Pro 1200 screens with customisable displays, plus Case IH's Harvest Command ▶

combine automation and Row Guide Pro. Further in-cab control features include remote feeder and rotor reverse procedures, rotor gear selection, chopper speed selection, unloading speed choice and chopper knife engagement/disengagement.

Over on Claydon's stand, its new addition consisted of seed tanks fitted to its Straw Harrow to meet the increasing demands of cover cropping.

"In a Claydon system we always advocate using a stubble rake to get some form of tilth, germinate weed seeds, help eliminate slugs and improve soil biota, and to aid in this we've added a NutriSeeder to the Straw Harrow to allow users to establish cover crops cheaply and efficiently," explained the firm's David Furber.

Claydon will offer two versions of the NutriSeeder for its 7.5m Straw Harrow, a single 200-litre hopper with a single metering mechanism, or twin-hopper design with dual metering systems. The latter, which allows two types of seed to be applied at the same time and mixed in the distribution head, provides higher seed capacity, more accurate metering and avoids seed separation in the hopper.

"The idea with the dual metering system is that it can be metered into the same Venturi airflow system, providing either greater capacity or an option for alternative seedings that can be applied at different rates and calibrations," explained David.

Both NutriSeeder models incorporate a hydraulic fan and electronic control with forward speed rate mechanism. On headlands, the NutriSeeder is started and stopped by the operator via a hydraulic cylinder, as best practice is to leave the Straw Harrow down so to not release weed seeds or drop clumps of straw. Fitting different metering wheels/sections enables seed rates to be adjusted up to 30kg/ha for wheat, 15kg/ha for grass and 25kg/ha for cover crop mixes, at a forward speed of 15kp/h.

Uniting the crowd

Farmers were called to unite and lobby their MPs by NFU president Tom Bradshaw.

SEED DISTRIBUTION

Eight spreader plates at the front of the Straw Harrow distribute seed evenly in front of the implement's standard 14mm or optional 16mm-diameter tines which create a shallow tilth of up to 30mm deep, to ensure good seed-to-soil contact.

Of several new additions displayed on Grange Machinery's stand, the main attraction was its Tine-Drill Toolbar, available from 3-6m. The new drill has been in development for the past five years, starting out life as a predominantly bean seed drill and a winter wheat and barley seeding drill second.

"When you look at the regulations we have in farming, the weather and how farming methods have changed radically during the past five years, a major issue is actually weight," explained Grange's Rhun Jones. "We're now more soil conscious than we've ever been, so by offering a split system or front tank and rear bar, we're taking a lot of weight off the ground and only require relatively low horsepower in all conditions, good or bad."

However, he highlighted that this isn't a wet weather drill but is a direct seeding drill that has the ability to work directly into stubbles, cover crops, min-till or conventional systems.

Featuring Bourgault coulters, the drill is designed to work with a variety of different front tanks. Other attributes include ground contour technology with an oscillating and pivoting wing, hydraulic seed depth control, the option of a hydraulic levelling board system and a rear double harrow, and by this spring, the drill will come with the option of a front tank.

On JCB's stand, a raft of new machines were on display with two standing out in particular: the 542-100 telehandler and 435S loader.

The new Loadall 542-100 is built with fresh chassis and boom designs enabling a maximum load capacity of 4.2t and 9.8m lift height, both increased on the current 536-95 model but with no increase in overall size.

"JCB's Loadall 536-95 handler is a popular choice for large farms and straw contractors but with the heavier-lifting, higher-reaching Loadall 542-100 we now offer a premium high-lift machine. This is especially the case with the AGRI Pro version with its greater engine power and faster travel speed, raising all-round productivity to new levels," said the firm's John Smith.

Key features of the 542-100 include a new chassis and boom design, high-capacity hydraulics with a 160 l/min flow-on-demand pump, and the Sway Control system on the AGRI Xtra and AGRI Pro models, which ensures boom stability on uneven ground. The machine can lift up to 1.8t at full height with a maximum capacity of 4.2t at 5.8m and 3t at 7.8m.

Equipped with JCB's DualTech VT transmission, the 542-100 switches from hydrostatic drive for precise control to direct-drive powershift at higher speeds to optimise fuel efficiency.

Case IH's AF10

The combine, which made its first UK appearance at LAMMA, has a 20,000-litre grain tank.

Grange's Tine-Drill Toolbar

Featuring ground contour technology with an oscillating and pivoting wing, plus hydraulic seed depth control.


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The AGRI Pro version delivers 129kW (173hp) and 690Nm, with a 50kp/h transmission, making it suitable for large farms and contractors.

Second of the two, the 435S wheeled loader, JCB's self-proclaimed 'king of the clamp', has been given a performance and productivity boost to bring more appeal to contractors and large farm enterprises for high-capacity silage and manure handling.

The new machine boasts increased engine power and torque complemented by uprated driveline components. "The JCB 435S is already the machine of choice for contractors and large farm businesses filling silage clamps and loading big manure spreaders, and now we're keeping the machine at the head of its class with significant enhancements that deliver even greater productivity," said John.

The new model features a 12% increase in engine power – from 188kW (252hp) to 210kW (282hp) – improving its power-to-weight ratio from 12kW per tonne to 14kW per tonne. The engine also delivers more torque across a broader range, providing 1200Nm at all engine speeds, improving performance under load.

FLEXIBILITY

The Cummins 6.7-litre engine provides two power settings: a default 171kW (230hp) for lighter tasks and a Dynamic mode for full 210kW (282hp) output. The updated transmission control software offers flexibility in programming torque lock-up for efficiency, and the axles now feature four epicyclic gears instead of three for greater durability.

Additional updates include LED headlights, a new composite rear grille, and optional IntelliWeigh system for precise material handling. The IntelliWeigh system, compatible with JCB's AGRI attachments, allows operators to track material volumes and produce accurate reports using a 7-inch touch screen. A new steering option, the Lever Steer, reduces operator fatigue during repetitive tasks by enabling fingertip control.

On Knight's stand, its new Smart-Inject technology won the Gold Medal for Innovation at the show. The firm's new system aims to inject secondary products closer to where they're applied to the crop to avoid contamination of the main system and reduce chemical use.

While a normal sprayer will allow users to patch spray by switching individual nozzles on and off, the Smart-Inject system means users can patch spray with both individual nozzles and with a selective chemical as well. Added at the nozzle, before application, the secondary product is circulated in its own system.

While the main product is added and circulated using the firm's MAXimiserPro circulatory system, a second system will circulate another chemical around a parallel loop. "This is a partly diluted chemical rather than a neat one," pointed out the firm's Brian Knight. "But it's a separate product that operators want to apply on a patch spraying basis."

Where the two chemicals are combined at the nozzle, this will only be done selectively using pulse-width modulation (PWM), and the secondary product is handled in its own pumping chamber.

One of the key points of the system

Cover crop establishment

Claydon's Straw Harrow is fitted with a NutriSeeder to allow easier establishment of cover crops, says David Furber.

is that it can be fitted to any sprayer, not just Knight's own offering and can easily be retrofitted to existing machines with its ISOBUS compatibility. "The trouble with traditional chemical injection is that you end up having to change the sprayer in its entirety to make it work which can leave it unusable for other applications, whereas this allows specialist products to be applied without affecting the main line of the sprayer.

"This system allows operators to apply two chemicals independently of each other at different rates. It also means that products you wouldn't have wanted to contaminate the machine can now be used because they're in an isolated unit and won't affect the main line."

The product is still in its development stage, but Knight aims to have it ready and running on farm later in 2025.

Of key note for visitors to Kubota's stand was the firm's new pivot-steer telehandler, RT305T-2, offering a 1.2t lift capacity and a maximum lift height of 4.3m, plus a maximum horizontal reach of 3m can be achieved with a 750kg load thanks to its centrally mounted two-stage telescopic boom.

For those seeking additional stability, the RT's 4t operating weight can be increased by 200kg through the use of a bolt-on, additional counterweight.

Power for the range-topping handler comes from an EU Stage V compliant, four-cylinder turbocharged Kubota diesel engine producing 66hp. Like other models in the RT range, the driveline is hydrostatic.

A Bosch Rexroth hydraulic motor drives both Carraro axles through mechanical driveshafts and offers two speed ranges: 0-15km/h and 0-30km/h. The powertrain affords multi-disc brakes and with permanent 4WD, there's the option of selectable differential locks on both axles, to further boost traction.

Manoeuvrability is provided by a maintenance-free centre-pivot joint with 45° of steering articulation, creating an outside turning radius of 3.15m. The machine has 4° of joint oscillation which contributes to keeping all four wheels on the ground when negotiating uneven terrain.

Hydraulic performance extends to 70 l/min through an auxiliary circuit, with the option of up to three double-acting

JCB's 542-100 Loadall
Built with new chassis and boom designs enabling a max load of 4.2t and 9.8m lift.

services for powered attachments. The telescopic loader features a proportional joystick with two double acting hydraulic services, and a hydraulic locking headstock is fitted as standard.

New Holland returned to LAMMA to showcase a line-up of its machinery, ▶

including the first UK appearance of the new T5 Dual Command tractor. But centre stage on the stand was the firm's 2M tractor which came off the production line at its Basildon facility. Adorned in a metallic blue, it drew the eye and the crowds.

The new T5 Dual Command is part of the T5 series, which comprises five models from 80-117hp all powered by FPT F36 3.6-litre four-cylinder engines. The tractor has been given a revamped look and a series of updates designed to improve productivity and operator comfort.

Alongside fresh styling, the T5 Dual Command tractors benefit from mechanical Comfort Ride cab suspension, wet disc front PTO and a rear lift capacity boost of 7% to 4700kg. The range can now be equipped with telematics previously only available on higher power models including auto guidance, the IntelliView 12 touchscreen terminal and ISOBUS Class 2 implement connection.

The new T7 Long Wheelbase series was also exhibited on the stand. This tractor showcases the Horizon Ultra Cab, designed to maximise operator comfort with advanced sound insulation and ergonomic controls. With its PLM Intelligence, the T7 Long Wheelbase provides an integrated digital farming experience, bringing precision agriculture to the forefront.

Unveiled at the show, Weaving Machinery introduced its redesigned tine combination drill, offering improved efficiency and adaptability for farmers using conventional cropping systems. Available in 3m, 4m and 6m working widths, the redesigned drill incorporates improvements aimed at increasing productivity and ease of use.

One of the key features added is the hydraulic depth control, enabling precise adjustments directly from the cab, coupled with an enlarged hopper capacity.

The drill's electrically driven metering unit and hydraulic fan ensure a consistent and accurate seed rate, while its robust design includes three rows of auto-reset tines and a double following harrow for effective seed placement and coverage.

"Recent years of wet autumns have created significant challenges for farmers, increasing the demand for tine drills capable of handling challenging conditions," said the firm's Simon Weaving.

"With this redesigned combi drill, we've not only improved performance but also introduced a multi-fit system. This feature allows the headstock to accommodate a range of power harrows whether they're manufactured by Weaving or Kuhn, providing greater flexibility for operators."

Weaving's tine combination drill the TC3000M

Unveiled at LAMMA 2025, Weaving Machinery introduced its redesigned tine combination drill, offering improved efficiency and adaptability.

Perfecting mechanical cover crop destruction

Glyphosate has often been the primary tool for destroying cover crops ahead of spring cultivations, but mechanical destruction is gaining traction. *CPM* explores why and what options are available.

By Melanie Jenkins

The push to plant cover crops isn't new, but achieving the best results from their destruction is something the industry is still learning about. In addition, with increasing pressures to reduce glyphosate use, incorporating more mechanical means of destruction could provide an effective option.

In the past, growers might have sprayed off their autumn cover crops in November and December to ensure that plants were completely dead ahead of spring drilling, but because of new SFI obligations, destruction might be left until February, says Amazone's Oliver Watson. "It could be that late January is the earliest growers are allowed to destroy crops and during this period you can't guarantee a suitable spray window."

One of the main reasons growers might opt for mechanical destruction is to cut out or reduce the use of glyphosate, says Horsch's Gareth Burgess. "It's about bringing the environmental thought process around to reducing chemical use."

AVOIDING RELIANCE

Oliver is in agreement, noting that it's important to manage glyphosate use because of pressures on the chemistry. "We don't want to be solely reliant on it and instead should be using a hybrid system of cultural and agronomic controls so they work hand-in-hand.

"We wouldn't ever tell a grower that a knife roller will replace glyphosate, but it must become part of their system – the days of the bag and the bottle alone have gone. And with weather conditions becoming increasingly diverse, it's invaluable to have tools in your armoury that you can use when you can't spray off a crop in time ahead of pre-drilling."

The alternative option is to look at different means of incorporating destroyed cover crops into cultivations, he says. "Because over-wintered cover crops might have created a tight profile within soils, it's likely you'll want to go in with some type of light cultivation to bring air back into the soil and get the drying process started as fast as possible.

"With our Cobra tine cultivator, we can fit a knife roller at the front to provide mechanical cover crop destruction and spring cultivation in a single pass. With any knife rollers, the sharpness of the knives is important, but where soil conditions are softer, it's more likely the cover crop stems will be crimped than cut. Because the crop is being lain down in the direction of travel, it means there isn't a matted effect where the crop is dragged along," says Oliver.

"And where crops are crimped and bruised, this will assist them breaking down, especially following a frost which ▶

will help to burst cells and aids with incorporation later on," he adds.

This season has seen back-to-back frost which has been ideal for cover crop destruction, highlights Gareth. "If you go into a cover crop after a frost, the plants will be brittle and crimper rollers will have a better effect."

Additionally, it might be unsuitable to apply glyphosate after a frost, says Horsch's Will Flittner. "If you're looking to destroy a cover crop early ahead of planting a cash crop, mechanical destruction allows greater flexibility than chemicals do."

KNIFE ROLLER

A knife roller can be fitted to Horsch's Joker RT range to serve this purpose. "It's effectively a 300mm diameter Horsch Cultro cylinder with six knives mounted at the front of the RT cultivation discs.

When considering whether or not to fit this on a Joker, it comes down to if you're trying to achieve the best of both worlds: encouraging a chit of weeds after the combine and then in spring going in after a frost to crimp cover crops and simultaneously incorporate it with the discs. Because of its versatility, it potentially allows growers to purchase a single machine instead of two."

Amazone's Cobra can also have a knife roller fitted as well as 220mm points which work with it to cut through roots and further destroy cover crops, explains Oliver. "This means you could destroy the winter cover crop and sow a spring cover crop all in one pass. This could also be done if moving from a spring to summer cover crop, but an application of glyphosate might be required pre-drilling.

"However, rather than using glyphosate three times per year, you've only used it once, plus you've cut your input costs significantly.

"This machine can be used as a primary cultivator in stubbles behind the combine and for secondary cultivations ahead of spring cereals and finer seed crops such as sugar beet and maize."

Alternatively, Horsch's Cultro is targeted solely at destruction and consists of two cylinders with six knives on each which are configured to counter rotate and cross as the machine is driven forwards, explains Gareth. "This mulches, crimps and crushes the crop to destroy it and works at a very shallow level in terms of soil contact.

"Growers can opt to have a rear or front mounted Cultro, with the latter allowing them to mount a secondary tool such a cultivator at the rear to achieve more in a single pass."

For those operating disc cultivators such as the Catros, they also work well with knife rollers on, says Oliver. "It'll knock over and crimp the stems of the cover crop and then incorporate it ensuring it's laid down in the direction of travel, working especially well with woodier material.

"Although I believe tine cultivators to be more versatile when it comes to both primary and secondary cultivations, you can't beat a disc cultivator for creating a stale seedbed or for seedbed preparation, especially ahead of cereals," he adds.

Cover crop height can also dictate how it's mechanically destroyed, explains Kuhn's Rupert Greest. "If you were to go in with Kuhn's Optimer disc cultivator, anything under 15cm can be destroyed and incorporated with the discs alone. But, in situations where a standing cover crop is above this height, we're able to fit a cross cutter front roller that operates ahead of the two rows of discs to lay down the cover crop, lacerate it and break it down."

ONE-PASS APPROACH

For those who are potentially looking to go straight into a standing cover crop to create a one-pass system, Grange Machinery launched its Front Mounted Disc Bar at LAMMA in January. "This machine allows growers to go into a cover crop, chop residues, ease trash flow and create a fine tilth ahead of a cultivator or seeder on the rear of the tractor – it's about turning three or four passes into two, or even one in some cases," says the firm's Rhun Jones.

"From our perspective, we aren't necessarily looking at taking the cover crop out – because all the time its roots are active

Amazone Catros+ 3003

For those operating disc cultivators such as Amazone's Catros, they also work well with knife rollers on.

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it's helping to dissipate water – but are instead aiding the movement of the following through these crops.

"We're all aware that weather windows are becoming tighter so this is about providing peace of mind that the work is done alongside optimising efficiency," he adds.

Where knife rollers are fitted to drills, such as Amazone's Cirrus, Oliver advises going in with min-till discs to cut a straight slot before each coulter and sow seeds. "You can go into a standing cover crop this way with minimum soil disturbance to avoid stimulating weeds, with 16.6cm rows to ensure the volume of material can get through the drill."

If cover crops are becoming an increasing aspect of farming systems, what demand has there been for cultural destruction? "I think around 95% of those growing cover crops are still using glyphosate," highlights Oliver. "But more growers are asking us about fitting knife rollers to machines, be they tine or disc cultivators, and they're easy to retrofit."

The team at Kuhn has noticed increasing interest around cover crop establishment and surmise this will likely lead to more focus on destruction methods. "We've seen more customers enquire about establishment especially, but due to evolving government focus, targets and policy, it's currently a learning curve for manufacturers and customers alike," says Rupert.

Rhun agrees that although the concept of using cover crops has been around for a while, it remains fairly new territory. "We're still determining which blends

Horsch Cultro 5TC front mounted

Horsch's Cultro is targeted solely at destruction and consists of two cylinders with six knives on each which are configured to counter rotate and cross as the machine is driven forwards.

Grange Front Mounted Disc Bar

This allows growers to go into a cover crop, chop residues, ease trash flow and create a fine tilth ahead of a cultivator or seeder on the rear of the tractor.

work best and where, how these perform in different soils and the impact of crop height."

Gareth points out that selecting a cover crop is down to the advantages the individual plants can provide, but this won't impact when the cover crop is destroyed. "The Cultro can handle pretty much anything, but the lusher, greener and more brittle a cover crop is, the more effective mechanical destruction is.

"If you were to use mechanical destruction in conjunction with glyphosate, it'll work better head of spraying the crop off than afterwards. If you were to spray a field with glyphosate and then were unable to access it for a fortnight due to the weather, the dying stalks of the plant won't crush and crimp as well as when they were still alive."

He adds that growers should be wary of any cover crops which may have gone to seed when using mechanical destruction. "You don't want to be spreading cover crop seed and then end up with an infestation in your cash crop, so timeliness is key."

Kuhn Optimer XL 5000

A cross cutter front roller can be fitted to Kuhn's Optimer disc cultivator to destroy cover crops above 15cm in height.

Achieving more by doing less

One way to overcome the challenge of shortening weather windows is to build an armoury ready to tackle any opportunity. *CPM* speaks to one farmer whose tactical machinery purchases have allowed him to do just this, all while reducing inputs and maintaining output.

By Melanie Jenkins

A shift in approach at Porters Somerton Farms near Lincoln has seen Michael Porter, alongside his brother James and father Graham, prioritise soil health which they've propagated through investment in machinery.

Having previously run a high-intensity, high-horsepower operation, the farm has shifted its approach to focus on soil health and organic matter during the past two years. "We used to run deeper rippers at 36cm but when driving the sprayer across the fields we found ruts and realised the deep inversion was creating more damage," explains Michael.

Soil management now involves a lot less cultivation to allow the clay soils to work themselves. "But it's taking us years to bring structure back to the soil. The Väderstad TopDown we've had on farm works really well with this approach despite the harsher weather patterns we've experienced."

And while the TopDown has been a faithful on the farm for a decade, Michael took the decision to introduce a new cultivator and change his drill to open up his working windows and reduce input costs. "During the spring of 2024, a demo of Väderstad's Inspire was brought to the farm and I fell in love with it right away, to the point that the demo never left the farm.

"Then in the summer Väderstad's Ed Hutchinson supplied a demo of the Carrier XL 925 with CrossCutter Discs which produced a nice seedbed in front of the drill, with both working really well in partnership."

Although Michael will keep his TopDown to use on around a quarter of his primary cultivations and still has a Sumo Quatro on farm, he's been impressed with the build quality and durability of the Carrier XL 925. "Its output sits at 16ha per hour meaning it stays ahead of the drill nicely."

The Inspire is a 12m disc drill which ▶

The team
Making changes to the farm has helped Michael Porter (centre) continue to support his full-time staff, Ken Newton (left) and Justin Newton (right).

A LONG WAY TOGETHER

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works best in cultivated land, he explains. “It’s the first 12m drill we’ve had on the farm which now runs on the same wheelings as the sprayer, helping to protect our soils more. Compaction is an issue that’s very much on my mind and ideally, I don’t want to compact soils at all because it’s so costly.”

In addition to prioritising soil health, the change in approach has also tied in with efforts to lower input costs without reducing the farm’s output. “With the cost of labour having increased as much as inputs, managing this has also been important to us. When my brother and I were younger, we were affordable labour, but now, if we were to subsoil, run the combine, cart corn, undertake primary cultivations, spread muck, and more besides, the labour costs just don’t add up.

Depth precision

The 12m Väderstad Inspire requires around 200hp to pull and has Hydraulic Adaptive coulter pressure to ensure precise depth-keeping on uneven ground.

“As it is, the farm still supports my father, brother, and me, plus we have three permanent operators and seasonal workers. So, it’s really been a good time to look at different methods in how we operate without jeopardising our yields.”

Michael has noticed that the different approach has opened up the farm’s drilling window by about two weeks. “We’ve been able to drill into October confidently whereas with the previous drill, if the ground became wet and sticky, we’d have to sit and wait, hoping the conditions would dry up. But with the weather behaving as it has during the past few years we just can’t take this risk any longer.”

YIELD RESTRICTIONS

The farm previously ran an 8m Väderstad Rapid – a drill which has packing wheels at the rear. “This is a cultivating drill and during the wet autumn of 2023 we found the headlands were heavily compacted and there was poor establishment, resulting in some of our winter wheat only yielding 3t/ha on our heavy clay headlands which just wasn’t good enough.

“With the new setup, we’re now able to achieve a good chit of blackgrass, spray this off, and go in with the Inspire. And because it isn’t a cultivating drill, we aren’t disturbing the soil as much as we were in the past so the headlands are looking great and we’re really happy with the results.”

Michael adds that because it’s working on 12.5cm row spacings, it allows a thick canopy to establish which competes with grassweeds. “Compared with

Improved working results

The new three row version of Väderstad's Carrier XL was designed to improve working results, with more mixing and crumbling of soils. ▶

the autumn of 2023, establishment has been great which proved it was the right call to look for a drill like the Inspire. It went into tricky conditions but it's proved itself, allowing us to drill later than we ever have without feeling any repercussions or doubts, and it's been immediately obvious that there's no serious compaction from using it.

"On top of this, our output is now around 14ha per hour, which means we can confidently cover 100ha per day which is better than what we've achieved in the past."

When deciding which drill to purchase, he'd also looked at a 12m Horsch Avatar, but it was the coulter spacings on the Inspire that really sealed the deal. "I want to look out at the fields and see a thick canopy with a high green area index. The Inspire's 1.5m sections mean the seed saving is brilliant whereas on the Avatar these are two 6m, meaning we might have double drilled or run over the crop."

During the coming season, Michael aims to focus even more on soil compaction. "We've changed our machinery a lot during this past year but the aim has been to bring more technology to the farm. Previously, most of the pulling work was done by a Claas Xerion but we've replaced this with a John Deere 8R with a central tyre inflation system (CTIS) and a tracked 8RX, to see what advantages can be gained.

"I was happy to spend more on the CTIS to look after our soils in the autumn and to run higher horsepower tractors and lower the pressures. We're planning to assess the level of compaction we're leaving behind and at what depths

because this'll help us to dictate how deep we go in with the TopDown. Plus, changing the tractors means we've actually gone down 100hp, so we're actually seeing a reduction in fuel use.

"When running the Xerion with the Rapid, it'd burn through 90 l/hr, but with the John Deeres and Inspire this is just 44 l/hr, or 3.2 l/ha. However, the Xerion was 12 years old which will have had an impact," he adds.

DATA INSIGHTS

Using John Deere's Operations Center, Michael has been able to produce prescription drilling plans for the drill operators across the farm's medium soils, sandy loams, and heavy clays. "The operators used to have to do this themselves but with the ability to send the prescription maps via the Cloud, I can set the kg/ha of seed and the system determines whether to apply more or less, depending on the soil type.

"It's proven to be really interesting for us to work with the soil maps produced from the data. It only takes five minutes to create a job plan for the Inspire or Carrier XL 925 and both work perfectly in sync as a result."

He also plans to look closer at residual nitrogen and pay even more attention to organic matter content. "We've assessed the organic matter for years but only started to inspect residual N in 2023. We use chicken muck on the farm which is tested twice per year, applying it in spring and autumn. It's like rocket fuel especially when used for second wheats and oilseed rape.

"Using it is all part of lowering our input costs and ties into my overall aim of establishing a good working system where we aren't sacrificing yields and are creating a nice profit for the farm."

Väderstad CrossCutter disc
This has ultra-shallow working depths of 2-5cm and is effective at speeds of up to 20km/h.

Väderstad Inspire drill
Designed for customers on larger farms requiring a higher capacity work rate to make the most of weather windows.

Digging into the details

What attributes make the Carrier XL 925 and Inspire an ideal fit?

The CrossCutter Disc Michael Porter has fitted to the Carrier XL at Porters Somerton Farms is a new three-row concept launched in 2024. "Although the standard Carrier XL with CrossCutter Discs has two rows, the new three row version was designed to improve working results with more mixing and crumbling of the soils," explains Väderstad's Tom Wyles.

"This is also useful for better disruption of blackgrass because more of the fine seeds are thrown into the air and dropped into the crumb, creating a better flush that can then be mechanically destroyed or sprayed off. The idea is that this'll help to reduce herbicide use by creating machines that can do more mechanically."

In addition, because there's another set of discs, this means there's 50% more working performance from the machine. The distance between the discs has been decreased with the standard two-row Carrier at 12.5cm spacing and the new three-row at 8.2cm.

The CrossCutter Disc is available in three configurations – the Standard Disc on all three rows which is best for light to medium-heavy soils and works well for cover crop incorporation; the Aggressive Disc option on two rows and the Standard on the final row, which is designed for tough, compacted soils; or, with the Aggressive Disc across all three rows for heavy clays or very hard, compacted soils.

Michael has the second configuration of the Carrier XL to work his soils, says Tom. "The machine has working depths of 1-5cm at recommended speeds of 12-20km/h. Experience with the machine has demonstrated that the higher the speed, the more effective the mixing and crumbling of the soils. Plus, the higher speeds will save time and can help to reduce fuel costs."

Weighing in at 10t, the Carrier 925 requires 300hp or more to pull and has 108 disc arms. "The Carrier 925 is best suited to larger, high-capacity farms who want quick access to their soils to beat short weather windows and works especially well combined with the Inspire to fast seeding," adds Tom.

He says the Inspire came to market around four years ago as a completely different drill option to the Rapid with it having no front tools. It has 96 double disc arms and the combi version has a large capacity tank with a 5000-litre seed hopper and a 2200-litre secondary chamber. "This is a drill designed for customers requiring a higher work rate and due to its lack of cultivation tools, has been available to purchase through various grant schemes."

In terms of the drill's metering ability, it has eight Fenix III motors, which are small and compact, able to sit underneath the hopper. "Because it has eight motors, this has allowed us to provide section control at 1.5m – a unique feature for a 12m seed and fertiliser drill," explains Tom.

Hydraulic Adaptive coulter pressure ensures precise depth-keeping on uneven ground. "Adjustable from the cab, this results in impressive seed placement and even emergence across the entire field," he concludes.

Talking TATIES

Do what you do best, and do it better

WITH ANDREW WILSON

Well, winter landed. We had our share of snow, frost, rain and high winds, but bar a couple of ponded areas, the damage isn't too serious. I had cause to drive through south Lincolnshire recently, somewhere I usually think to be quite dry. It made me realise that I'm not the only one with sad crops sat in wet fields.

I mentioned in December that my cover crops looked dreadful but having walked the fields with my spade, I have to report that for all they still look unimpressive, they've done their job as far as protecting the soil surface and working some magic underground if nothing else.

We managed to pass our ACCS & AP inspections back in December with only a couple of minor tweaks to make – I'm pleased to say that it took significantly less time than the year before too. Does it deliver value? Not really. Does it have a place? As far as differentiating our produce from imports, yes it does, but Red Tractor really does need some practical thinking putting into its overhaul if it's to continue.

Predictably, potato contract prices started to arrive just before Christmas featuring numbers that didn't exactly have me reaching for the champagne. The c.10% increase in ware price is welcome far more than the seed cost increase, which wasn't a surprise.

My calculator has been busy of late but the end result hasn't much changed. Historically, we've always grown potatoes for more than one customer and that will continue. Each customer brings their own idiosyncrasies to the table, but they all have the same thing in common – just enough price increase to keep us planting. Investment in infrastructure can only be justified in those odd really good high yielding years that seem to get ever further apart, but there's nowt new there!

My winter analysis brought few surprises – our lowest risk enterprises include pig keeping, grain drying, hedge cutting, stewardship and roof top solar. Highest risk is root crops as ever, but increasingly winter wheat, particularly that sown later.

Spring barley has replaced second wheat preceding spring oats on heavy land here, mostly to facilitate a double spring crop to enhance blackgrass control but also to reduce high-cost poor-yielding part-flooded wheat. Good wheat is still the cornerstone of arable farming, but we mustn't lose focus of the consequential effect of some constituent parts of the rotation.

Wheat sown after earlier lifted beet here is currently heaven for a flock of Canada geese, and later sown beans seem to be crow paradise – I made the mistake of sowing them a little shallower to get them emerged quicker but said depth seemingly being a smidge less than a crow's beak. Oops!

We snatched a gap in the weather last week to lift another third of our sugar beet and I'm pleased to report sugar and dirt respectively are still the right side of the factory averages. Putting the beet in a shed seems a little unnecessary at times but it does help the returns, as does the late delivery bonus. Said shed is a busy one – it sees wet grain, then dry grain, short-term stored potatoes, then beet, seed potatoes and machinery servicing before harvest comes round again.

My general farming philosophy is that there's always a better way of doing everything so we're continually tweaking, mostly in reaction to the seemingly endless challenges that we face at the moment. Some wise advice given to me 30 years ago was 'Do what you do best, and do it better'. What that translates to is that attention to detail is vital, regardless of the sector.

We have to get fussier; challenge more when things aren't right – be that feed mills having a laugh with deductions, chip factory quality control returns, poor seed or late crop movements. Communication is key along with mutual appreciation for the challenges faced by both parties. People deal with people, and any one-sided relationship will be short lived.

Otherwise, last month we washed and delivered our crisping potatoes, it's the turn of the chippers next. We had a pig batch change a fortnight ago and got some beet up. Machinery servicing is ongoing but making progress alongside some ditching and drain jetting when weather allows.

As February rolls by we have spring seed to clean, seed potatoes to chit, cover crops to desiccate, muck to spread, base fertiliser to apply and with all probability, see if our 'brand new second-hand' fert spreader entertains the neighbours with stripiness as much as its predecessor did when we start spreading urea at the end of the month.

Best crack on, but before we do, next week in this neck of the woods is YAMS – the Yorkshire Agricultural Machinery Show at York. Undoubtedly there'll be a lot of kit there beyond this peasant's pocket, but the grub, banter and 'one day' thoughts will be good, they always are. It doesn't do any harm to have a day off occasionally. ●

> *"Red Tractor really does need some practical thinking putting into its overhaul if it's to continue."*

YOUR CORRESPONDANT

Andrew Wilson is a fourth-generation tenant of the Castle Howard Estate in North Yorkshire. He has a strategic approach to direct drilling on his varied soil types and grows a wide variety of crops. He's passionate about the potato industry and having been utilising cover crops to reduce cultivation and chemical use since 2011, dipped his toe in the water of regenerative potatoes in 2021. @SpudSlingsby

Pricing position strength for potato growers

"I'd suggest growers are in the best position to sit down and negotiate fair and sustainable pricing that I've seen during the past 20-30 years."

ANGUS ARMSTRONG

Optimism towards price negotiations, the role of innovative technology, and new tools for technical challenges were all highlighted during the recent CUPGRA potato conference. *CPM* joined delegates to find out more.

By Mike Abram

Potato growers are currently in a much stronger position to negotiate fair prices, according to Angus Armstrong, former chief executive officer of Greenvale AP.

Speaking at the 35th annual CUPGRA potato conference, he suggested security of supply is a key battleground for packers and processors to secure good, reliable growers for their raw material requirements.

This is because volatile markets during Covid, higher costs largely attributable to the Ukraine war, plus soil damage after wet harvests deterred landlords from renting out for potato production, has seen growers leave the sector.

"Consequently, I'd suggest growers are in the best position to sit down and negotiate fair and sustainable pricing that I've seen in the past 20-30 years," he said. "The crop is in demand and there shouldn't be any over-supply."

To take advantage of the situation, he stressed growers require a solid understanding of their true cost of production including storage costs, associated weight loss, and a realistic margin. "On the back of good accurate costings you don't commit to contracts that aren't viable."

PROFESSIONALISM

Strive to be in the top quartile – or at least the top half – of growers for your main customer, he added. "Every buyer wants to feed off good quality crops grown by professional growers.

"Communication is key; get input from your buyer but be proactive. Set review dates to discuss what's working in your business, their business, how you're aligned and what can be better. Don't leave it to chance," he urged.

James Green, group director of agriculture for G's Growers, provided insights for how potato growers could improve their businesses by drawing on an example from outside the sector. His pointers included investing in infrastructure and technology to improve efficiency and reduce labour costs, especially the use of automation and data-driven systems to optimise yields and reduce waste.

G's has made significant investment in digital agriculture, for example, to improve productivity as costs grew without much increase in selling prices,

Raw material requirements
Security of supply is a key battleground for packers and processors to secure good, reliable growers, suggested Angus Armstrong at the CUPGRA conference.

explained James. In fact, 10 years of development began with an initial question of how to have more crop available for customers to remove some of the peaks and troughs in supply.

Working with Microsoft Research in Cambridge led to G's initially developing its 'Ice CAM' model, using planting date, temperature and sunlight to predict harvest dates for its iceberg lettuces – helping to manage shortages or surpluses for the all-year harvest.

"Part of the forecast isn't just when, but how many, and we soon realised what we thought was in the field, wasn't," said James.

That led to work with Cranfield University counting lettuces with drones. "A 3-4% difference in establishment on 50M iceberg lettuces adds up through the season."

Next came managing size using precision fertilising technology based on a 30x30cm grid. "We can apply per plant fertiliser where we treat only the smaller plants and not the big ones, which has driven up to a 50% saving in nitrogen and created a more uniform crop."

James added that the latest project for G's uses AI and machine learning to understand and manage more factors that affect uniformity and quality. "Data is power. Hang onto yours because it's valuable and if you're not collecting it, start, because the simplest data can be powerful when you see the patterns within it," he said.

New technologies using data are also starting to gain traction directly within the potato industry. Dr Joseph Mhango, a senior lecturer in applied data science at Harper Adams University, highlighted how combinations of machine learning, remote sensing and AI could improve the accuracy of growth models used to predict yields by dynamically adjusting parameters based on real-time data.

For example, ground cover estimates could be improved using AI analysis of drone images to overcome biases in traditional methods which rely on setting thresholds for soil and plants, he explained. ▶

Parallel learnings

G's Growers' James Green provided insights for how potato growers could improve their businesses by drawing on an example from outside the sector.

Seed supply headaches

Tight potato seed supplies are being caused by a complex web of challenges relating to production, market forces, politics and supply chain management, according to speakers in a CUPGRA workshop

Richard Baker, managing director of breeder HZPC UK, outlined calculations suggesting around 205,550t of new seed potatoes are required each season for ware production in GB.

With around 30% of GB seed potato production currently exported predominantly to Egypt, it leaves just enough area to produce that tonnage (see table below), he suggested. "There shouldn't be a shortfall with supply and demand theoretically in balance, although the reality might be different."

Brexit took away much of the flexibility within the supply chain, added Richard. "Until 2021 we could fill shortfalls by importing high grade seed to multiply or direct for ware planting. That's now either impossible or impractical.

"We could also afford to overproduce or produce on an optimistic scenario that a variety would sell because we could export to Europe."

Losing that market has made seed supply less reliable, not helped by three consecutive low yielding seasons, he added. "Equally, we have to be reliable customers for our suppliers, meaning we sell all the seed they produce. We do our planning based on average yield which is the one figure we know we won't have. But, we can't increase area simply based on low yields."

Competition for Scottish seed from export markets is another factor affecting supply with 91,000t exported last year – a figure seed grower and chair of the Seed Potato Organisation, Mike Wilson, expects will continue to grow.

He said simple economics are driving the increase, highlighting that in 2024, export seed potatoes were selling for around £565/t compared with £420/t into GB. "The cheaper crop to grow is for export, so you can see why growers are growing those varieties," he said.

Region	Total potato area (ha)	Ware area (ha)	Seed area (ha)	Region ware production area from new seed (ha)	Tonnage of new seed required @ 2.5t/ha seed rate (t) for ware	Area of seed production to supply @ average yield of 22t/ha (ha)
Scotland	22,000	11,800 (>50% farm saved seed)	10,200	5900	14,750	670
England & Wales	88,000	84,800 (10% farm saved seed)	3,200	76,320	190,800	8672
GB	110,000	96,600	13,400 (9,300 for GB use)	82,220	205,550t	9,341

Ground cover is used as a proxy for light interception within the growth model but could be replaced altogether by AI models that accurately predict absorbed radiation from satellites, he added.

A combination of machine learning and radar is helping to predict 50% emergence dates which is useful for initial yield predictions, estimating chronological age and managing irrigation for scab control, said Joseph.

"Using crop models for deciding harvest dates requires accurate dry matter prediction, but, while most models use a general conversion factor, the range of dry matter concentration in the field is wide enough to create significant errors.

"Whereas we can use machine learning to dynamically predict dry matter concentration to understand how fresh weight develops over time with respect to inputs."

Other techniques such as ground penetrating radar could be used to assess tuber size and distribution without undertaking test digs. That technology might also be useful for precision de-stoning, he said.

It's technology that could be used to help address the challenge of stone content within the Innovate-UK funded Potato-LITE project, noted Mac McWilliam, the project lead from PepsiCo.

The four-year cross-sector project is focusing on how regenerative agricultural practices, particularly lower intensity cultivation, can be implemented in the potato crop. One of the project outputs will be to use the data to create a decision support framework where factors such as end use, movement date and therefore risk of bruising, soil type and stone content perhaps determined by technology, are fed in to guide cultivation strategies, explained Mac.

Another decision support tool was introduced at a CUPGRA conference workshop, which is looking at the latest potato cyst nematode research. With a working title of 'PCN Pro', a model has been developed by PCN Action Scotland to replace AHDB's PCN calculator. Its aim is to incorporate some of the features of successful Dutch tool NemaDecide, such as a large variety database and a cost benefit analysis for different scenarios.

Users input a starting population for each PCN species, potato variety, rotation length, any treatment, region, a start or planting date and an end date for how long to run the model, explained Anglia Ruskin University's Dr Marcus Bellett-Travers.

"What it calculates is the active PCN population for each species in the soil over time as influenced by management practices, and the impact on yield."

DEVELOPMENT PROSPECTS

Currently trained on mostly Scottish data, for both calculations it assumes average weather for the region. Future iterations could allow the use of more location-specific data while the impact of cover crops on control is another factor likely to be added.

Demonstrating the model, Marcus showed how varieties with different tolerance or resistance to Globodera pallida or Globodera rostochiensis affected PCN populations over time, predicted yield impact, and the influence of other management practices.

Earlier in the workshop, James Hutton Institute researcher Dr James Price explained his latest research on the genetic basis of varietal resistance to PCN. "It's more complicated than just being two species – there are also different pathotypes within each."

A pathotype is a population that can interact differently with a host plant, usually exhibiting different virulence, he explained, which is important when considering varietal resistance particularly for G. pallida.

Streamlining processes

Ground cover estimates could be improved by using AI analysis of drone images to overcome biases in traditional methods, believes Harper Adams University's Joseph Mhango.

While typically there's a single score for potato variety resistance, that could vary depending on what pathotypes are present. For example, Lanorma, which has a resistance rating to G. pallida of six, showed good reductions in egg numbers after being grown in a Potato Partnership (TPP) trial in England but had the opposite result in a Scottish PCN Action trial.

The discrepancy in performance was likely due to the presence of different PCN pathotypes with PA2 and PA3 identified in the English trial, while it's suspected that PA1 was present in Scotland, said James. "That six score could be for PA2, PA3 but might only be a two for PA1, for example."

Such inconsistency underscored a necessity to also know the specific pathotypes in a field when selecting a variety for PCN management. To that end, the Hutton Institute is developing simple low-cost PCR tests which could distinguish between different pathotypes, concluded James.

Biostimulation beyond seaweed

Trials indicate bacteria-based Biimore delivers an increase in both tuber quantity and quality

In many cases, biostimulants are applied with the aim of overcoming abiotic stresses such as drought, waterlogging or pest damage. However, by utilising a different mode of action, it's possible to unlock further yield beyond simply offsetting, believes Loïc Della Faille of RovensaNext.

For the potato plant, this means not only a larger quantity of tubers but also improved tuberisation leading to a more homogeneous crop and therefore better marketable yield, he claims. So how's this achieved?

The company, through its subsidiary in Brazil, has developed a new biostimulant using a specific bacterial strain which is fermented and fed with sugarcane molasses, explains Loïc. "By adjusting various parameters, we can stress the bacteria to produce metabolites and exudates which then become a product known as Biimore.

"Although the fermentation process is based on a unique strain of Corynebacterium glutamicum – a non-pathogenic soil bacterium – Biimore itself doesn't contain live bacteria."

According to Loïc, when applied as a foliar spray, Biimore triggers the genes within a plant which improve photosynthesis pathways, translocation and cell division/multiplication, rather than stimulating root activity as per seaweed-based biostimulants. He says this is why the firm is seeing significant results in crops such as potatoes and sugar beet.

> *"The focus is on improving quality and gaining additional yield instead of mitigating the losses experienced through crop stress."*

"The focus is on improving quality and gaining additional yield instead of mitigating the losses experienced through crop stress," he says.

However, application timing is critical, as with all biostimulants.

"Biimore should be applied early in the potato crop's life cycle – 10-15cm (hook stage) – because as the plant grows, its response to light and therefore photosynthesis will trigger tuber initiation and we want to capitalise on that. It should be applied once and can coincide with the first fungicide application.

"Then, since it remains active in the plant for a long time, it'll also support the bulking phase. This is because of the product's ability to improve cell division, as well as efficiently translocating trace elements such as potassium to the tubers which we know helps to deliver a more consistent size," adds Loïc.

To provide suitable evidence of Biimore's in-field performance, independent trials have been underway at Scottish Agronomy, Eurofins and Prime Crop Research. RovensaNext's Bruce Morton highlights that at Scottish Agronomy's site in South Aberdeenshire last year, despite inclement conditions, Biimore delivered a 3.7t/ha yield increase compared with the control while increasing the number of marketable tubers by 11.8%.

"Then, if we look at the average across all trial sites, the yield increase is 4.5t/ha so we know this is delivering consistent results."

Although the company has been focusing on root crops so far, Biimore can be applied to a wide range of options including cereals, oilseed rape, beans and soft fruit, adds Bruce. There are also its sustainability credentials to consider, too.

"The application rate is much lower than many biostimulants on the market because of a concentrated formulation meaning a much smaller bottle – either 50 or 250ml. Translating that to the field, a 250ml bottle will cover around 20ha.

"Not only is that less packaging waste, but it's also more favourable in terms of its haulage carbon footprint. These are all aspects which have to be considered when developing a new innovation," says Bruce.

Admittedly relatively unknown in the UK market, Bruce says RovensaNext has made sustainable innovation its strategic focus. "At our core are biosolutions, with our portfolio featuring bionutrition, adjuvants and biocontrol options.

"We're hopeful that by bringing something different to the UK market with Biimore rather than another seaweed-based biostimulant, we're helping to make a step towards greater understanding of this group of products and maximising their potential," he concludes.

Potato yield uplifts

The focus of Biimore is improving quality and gaining additional yield instead of mitigating the losses experienced through crop stress, explains Loïc Della Faille of RovensaNext.

LASTWORD

WITH JANINE ADAMSON

Change is as good as a rest

Bearing in mind I've been harping on about it for some time now, you may have noticed there have been a few changes taking place at casa *CPM*, all of which have culminated in our new-look style.

I'm careful choosing my words here for a reason, and that's because *CPM's* heart and soul remain the same, we've just undertaken a rather long overdue facelift. Equally, I hope you'll agree that we've not slipped into the dangerous territory of style over substance, or dare I say it, fur coat and no undies!

At times I've felt the gravity of this exercise. Niggly voices in my head have whispered: 'but if it ain't broke, don't fix it'. What gives me the authority to instigate such a change when it's stood the test of time just fine and dandy? Okay, I'm hardly revolutionising agronomy here, but *CPM* is part of the farmhouse furniture.

And from an even more personal level, I find change rather uncomfortable. I thrive on stability, structure and routine; I prefer to know where I stand. Equally, being inherently introverted, I'm the most unlikely leader of anything.

However, and rather importantly, I've been able to ignore the draw of my deeply embedded personality traits because doing a good job is far more important to me. In this case that means ensuring a forward trajectory, because in ways, standing still is in fact travelling backwards.

So it was a year ago when fresh in the hot seat and tinged with green, I naively asked for an updated logo and cover design. Yet quite unexpectedly, the kind folk at our parent company commissioned a full mag makeover. So here we are, all shiny and new.

If we take a step back on this one, dealing with change is tough, isn't it? I think the first word which springs to mind when thinking about change, is panic. I can only assume it's because I take great comfort in a controlled, steadiness of life.

Naturally, change instigated by others which is out of my control is the worst kind to adjust to. An example being, earlier in my career I'd just about found my stride in a role when it was announced the company had been sold and an acquisition would occur.

My former colleagues and I all handled this very differently. For me, I instantly began to grieve my former contentment and of course, went into full force panic mode, second-guessing the outcome and pounding job websites. Others carried on blithely whereas some were quick to see the positives, much to my annoyance at the time.

I've since better understood that it's inevitable things will change and actually, as with many activities in life, it seems the more you have do it, the better you become at handling it.

Although adverse to most change imposed upon me, something I can get onboard with is the changing of the seasons.

A pivotal shift in how I deal with change has been focusing on the knowledge that despite my protests, I always come out at the other side, albeit a little battered! I'm good at finding solutions to problems, so why wouldn't I be able to apply that skill during change?

You could say, trust the process – an over-used groaner, but an appropriate phrase. Then, I think it's focusing on the elements of life which are consistent, taking a more day-to-day approach. It's easy to let change dominate your entire being, but it absolutely doesn't have to.

Of course, I'm not saying blindly ignore what's occurring around you, more the important role of pragmatism.

The bottom line is, more often than not, there's little we can do to stop things shifting in our lives. If we take a 'being present' mentality, if nothing can be done to improve the situation right here and now, is there any point in worrying about it? You know I relish a quote, well here's one: "Don't waste today worrying about tomorrow."

Granted, I'm throwing a stone in a glass house here, because I spend far too many of my precious minutes on this Earth werriting myself half to death. However, I'm fully aware this isn't the most productive approach to living and do my best to take stock.

In some ways, refreshing *CPM* is a brave move but in others, it's an absolute no-brainer. Why wouldn't I want the magazine to be easily navigable and engaging, with improved clarity? For it to walk the walk, talk the talk and now, dress to impress?

We owe it to you and those who contribute to *CPM*, to do our utmost to ensure the magazine has a future. I feel as though I've been handed the keys to a Ferrari, luckily I'm not too shabby at driving. ●

YOUR EDITOR

Janine Adamson began her journalistic career writing obituaries for a local newspaper but fast found her stride within agricultural communications. Now, more than 15 years later, she finds herself at the helm of *CPM*. A proud Staffordshire girl from the Moorlands, Janine takes pride in tackling subjects which although aren't exclusively farming, affect everyone.

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